Minimal Access Surgery and Endoscopy for all Gynecologists

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Editors

Prakash Trivedi
MD DGO FCPS DNB
Director
Dr Trivedi's Total Health Care Pvt Ltd and
Aakar IVF Centre, Mumbai
Professor and Head
Department of Obstetrics and Gynecology
Rajawadi Municipal Hospital
Mumbai, Maharashtra, India

Paul Fogarty
MD FRCOG FICOG
Professor and Head
Department of Obstetrics and Gynecology
Penang Medical College
Penang, Malaysia

Juan De Villegas
MD FACOG
Laparoscopic Gynecological Surgery Specialist
Advanced Gynecological Laparoscopy Unit and
Pelvic Pain, Algia
Oval Médica, Pereira, Colombia

Alberto Mattei
MD
Professor
Department of Obstetrics and Gynecology
Minimally Invasive Gynecologic Surgeon
Italy

Megan Wasson
DO FACOG
Professor
Department of Obstetrics and Gynecology
Minimally Invasive Gynecologic Surgeon
Mayo Clinic, Phoenix, Arizona, USA

Forewords

Professor CN Purandare

Shirish S Sheth

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For the FIGO Committee of Minimal Access Surgery

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Jaypee Brothers Medical Publishers (P) Ltd
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Phone: +91-11-43574357
Fax: +91-11-43574314
Email: jaypee@jaypeebrothers.com

Overseas Offices

J.P. Medical Ltd
83 Victoria Street, London
SW1H 0HW (UK)
Phone: +44 20 3170 8910
Fax: +44 (0)20 3008 6180
Email: info@jpmedpub.com

Jaypee-Highlights Medical Publishers Inc
City of Knowledge, Bld. 235, 2nd Floor
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Fax: +1 507-301-0499
Email: cservice@jphmedical.com

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Dedicated to

All those teachers who have relentlessly mastered the art of giving an unselfish donation of time with a flare of expression of their authority. True scientific wisdom of a genius is to upscale knowledge of every reader to implement in clinical practice for the benefit of women's health care.

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Contributors

Alberto Mattei MD
Professor
Department of Obstetrics and Gynecology
Minimally Invasive Gynecologic Surgeon, Italy

Ankita Fatnani MD DNB
Fellow in Endoscopy & MAS
Dr Trivedi's Total Health Care Pvt Ltd and
Aakar IVF Centre
Mumbai, Maharashtra, India

Chetan Kolhatkar MBBS DGO
Fellow in Endoscopy & MAS
Dr Trivedi's Total Health Care Pvt Ltd and
Aakar IVF Centre
Mumbai, Maharashtra, India

Dinesh Bajani MD (Anesthesiology)
Practicing Anesthesiologist
Mumbai, Maharashtra, India

Esha Sharma MD
Consultant
Manchanda's Endoscopic Centre
Pushpawati Singhania Hospital and
Research Institute (PSRI) Hospital
New Delhi, India

Gopinath N Shenoy MD LLM DGO DFP
Medicolegal Consultant
Mumbai, Maharashtra, India

Juan De Villegas MD FACOG
Laparoscopic Gynecological Surgery Specialist
Advanced Gynecological Laparoscopy Unit and
Pelvic Pain, Algia
Oval Médica, Pereira, Colombia

Late Pravin Patel
Consultant and Gynecological Endoscopist
Ahmedabad, Gujarat, India

Mahindra Borse MD (Obstetrics & Gynecology)
Consultant
Gynecologic Endoscopic Surgeon
Deenanath Mangeshkar Hospital and
Research Center
Pune, Maharashtra, India

Megan Wasson DO FACOG
Professor
Department of Obstetrics and Gynecology
Minimally Invasive Gynecologic Surgeon
Mayo Clinic
Phoenix, Arizona, USA

Pallavi Erlekar MBBS DGO ICOG
Fellow in Reproductive Medicine
Dr Trivedi's Total Health Care Pvt Ltd and
Aakar IVF Centre
Mumbai, Maharashtra, India

Pandit Palaskar MD DNB DFP
Gynecological Endoscopic Surgeon and
Infertility Specialist
Endoworld Hospital
Aurangabad, Maharashtra, India

Paul Fogarty MD FRCOG FICOG
Professor and Head
Department of Obstetrics and Gynecology
Penang Medical College
Penang, Malaysia

Prakash Trivedi MD DGO FCPS DNB
Director
Dr Trivedi's Total Health Care Pvt Ltd and
Aakar IVF Centre, Mumbai
Professor and Head
Department of Obstetrics and Gynecology
Rajawadi Municipal Hospital
Mumbai, Maharashtra, India

Rahul Manchanda MD
Director and Head
Manchanda's Endoscopic Centre
Pushpawati Singhania Hospital and
Research Institute (PSRI Hospital)
New Delhi, India

Sandeep Patil DNB FMAS MBBS
Consultant
Gynecologic Endoscopic Surgeon
Yashadaa Hospital
Mumbai, Maharashtra, India

Shyam Desai MD DGO FCPS
Consultant
Gynecologic Endoscopic Surgeon
Mumbai, Maharashtra, India

Soumil Trivedi DNB FMAS MBBS
Specialty Medical Consultant
Gynecological Endoscopic Surgery Department
Rajawadi Municipal Hospital
Mumbai
Co-Director and Consultant Endoscopist
Dr Trivedi's Total Health Care Pvt Ltd and
Aakar IVF Centre
Mumbai, Maharashtra, India

Vinod Bhivsane MD (Obstetrics & Gynecology)
Gynecological Endoscopic Surgeon and
Infertility Specialist
Endoworld Hospital
Aurangabad, Maharashtra, India

Foreword

The important pillars of International Federation of Gynecology and Obstetrics (FIGO) are the committees and special interest groups, which truly strengthen the cause and involve persons globally to spread the skill, knowledge and services.

Minimal Access Surgery (MAS) in gynecology whether vaginal, laparoscopic or hysteroscopic, has been a revolution. Last 25 years have seen an exponential rise in skills and technology by gynecologists to remove pathology, correct problems and visit spaces never explored before.

The FIGO Minimal Access Surgery Endoscopy team has competent and excellent experts committed to service for women's gynecological health care with FIGO's mission and vision.

This unique group of surgeries is equally good for women in developed as well as underdeveloped countries.

Drs Prakash Trivedi, Paul Fogarty, Juan De Villegas, Alberto Mattei, and Megan Wasson from India, Malaysia, Columbia, Italy, USA are active members in the committee. They involve experts from all over the world.

A dedicated handbook on *Minimal Access Surgery and Endoscopy for all Gynecologists* prepared by them covers from basic to few advance skilled surgery well documented. Emphasis is kept on setting up a good MAS center, patient evaluation, safety, credentiality and also managing complications explained in a lucid manner. Important aspects of what to do and what not to do MAS endoscopy along with the medicolegal issues makes the book complete.

It is truly a treat to go through the meticulous contents with adequate photographs to make every FIGO member understand the art of MAS and Endoscopy for women's gynecological problems.

I am happy and feel satisfied with their efforts and also wish them to continue good services to FIGO and spread safe women's health care in the world.

Professor CN Purandare
MD, MA Obst. (IRL), DGO, DFP, DOBST.RCPI (Dublin)
FRCOG (UK) FRCPI (Ireland), FACOG (USA)
FAMS, FICOG, FICMCH, PGD MLS (Law)
President FIGO
Mumbai, Maharashtra, India

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Foreword

I feel privileged and honored to welcome this addition to medical literature, as it deals with some vital as well as enigmatic problems. This book is important in a country bedeviled with poverty, multiparity and women with not-so-strong pelvic tissues. We live in an era of hope kindled by awesome scientific advances and India live with this paradox. I look forward to it becoming a reference work to all strata of readers.

Dr Trivedi leading the team of experts in the field like Fogarty, De Villegas, Mattei, and Wasson, reminds me of the words of Thomas Fuller: "If you have knowledge, let others light their candles by it".

Guidance on the subject is the need of the day, of Endoscopy and Minimal Access Surgery (MAS) indeed, the need of the era, to clear clouded minds of gynecologists bombarded with the sophistication of laparoscopically performed surgery, often by inexperienced gynecologists and/or invading non-gynecologists surgeons. The book also teaches the 'when' and 'why' to all those who know 'how'. This will prevent catastrophes and/or provide guidelines on when and how to utilize the advances. The book will supersaturate the reader with its basic knowledge and fundamentals on the subject.

The International Federation of Gynecology and Obstetrics's (FIGO's) dedication is on women's health by enhancing the health care of women worldwide by addressing important issues. The FIGO MAS Committee has added a feather in its cap, as the book has addressed important conditions like fibroids, adnexal pathology, including endometriosis and even ectopic pregnancy along with prevention of their complications, chapters related to urinary incontinence, cancer, robotic surgery and medicolegal component enrich the text to avoid a plethora of problems and complexities, with flair and dignity.

The insurance industry can pick-and-choose the place of laparoscopic surgery, reduced hospital stay, expenses and advantages that override opening of the abdomen with its consequent hazards. This will definitely revolutionize and smoothen surgical practice.

This book should act as a beacon of light to our colleagues in gynecology and reduce prevalent doubts, fears and perplexities.

Shirish S Sheth
President
FIGO, 2000–2003

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Preface

"A candle never loses its intensity to brighten and spread light till it perishes".

Education and spread of skill enhancement are a passion found only in a few skilled or knowledgeable experts in the art of delivery of medical services particularly for women's health.

International Federation of Gynecology and Obstetrics (FIGO) is perhaps the biggest organization dedicated to various services of women's health dealing with Gynecological, Obstetric, Urogynecological, Minimal Access, Vaginal and Endoscopic Surgeries, Infertility-IVF to Contraception, Safe Abortion and many other aspects of women's health.

We are fortunate to serve in the special interest group and FIGO Minimal Access Endoscopic Surgery Committee. We from the Committee along with other global experts have made a handbook for FIGO Minimal Access Surgery Committee on *Minimal Access Surgery and Endoscopy for all Gynecologists* which covers various aspects meticulously.

To write a comprehensive handbook on *Minimal Access Surgery and Endoscopy for all Gynecologists* which covers from basic setup to advances is no less than a dream of having a monument penned down with traditional wisdom and skill to meet the expectations of many unfulfilled endeavors.

In spite of unsurmountable difficulties, the FIGO MAS Endoscopy Committee has left no stones unturned to stimulate, clarify doubts, add knowledge and skill towards the improved women's health care globally.

Basic setup, advanced energy sources, credentiality, indications, limitations, complications of various Minimal Access Surgery are addressed along with the medicolegal aspects.

We have focused on FIGO's mission and vision of skill enhancement with safe endoscopy for women.

We are indebted to the legends in the respective fields who have actually written their experience over more than two decades from all over the world. Their down to earth simplicity, in spite of being at the academic peak, which we all dream to achieve, is exemplary.

We are honored to have the Forewords by Professor Dr CN Purandare, President, FIGO and Professor Dr Shirish S Sheth, Past President, FIGO.

The book is kept easy to read, yet it is a comprehensive and complete treasure of knowledge for all FIGO members.

"Our success is incomplete if this wealth of material is not spread in every corner of the world to impart benefits to our patients who deserve the most".

Let the women of the world be in safe hands of Gynecologists-Obstetricians and other experts under FIGO.

Long live Women's Health and Safety.

FIGO Minimal Access Surgery Endoscopy Committee.

Prakash Trivedi
Paul Fogarty
Juan De Villegas
Alberto Mattei
Megan Wasson

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Acknowledgments

This book titled *Minimal Access Surgery and Endoscopy for all Gynecologists* was only possible because of active involvement of FIGO MAS Committee members—Paul Fogarty, Juan De Villegas, Alberto Mattei, and Megan Wasson.

We acknowledge our clinical associates and fellows Pallavi Erlekar, Soumil Trivedi, Ankita Fatnani, Prerana Patil and especially Sonali Nikam, our Office Secretary, for their immeasurable hard work to shape this handbook.

The immense faith and support of FIGO President Professor CN Purandare, Past President of FIGO Professor Shirish S Sheth and relentless work by Saskia Dean, Lohan at FIGO.

We would like to thank Shri Jitendar P Vij (Group Chairman), Mr Ankit Vij (Managing Director), Ms Chetna Malhotra Vohra (Associate Director–Content Strategy), and all the staff of M/s Jaypee Brothers Medical Publishers (P) Ltd, New Delhi, India, for their efforts and input enabling timely publication of the book.

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Chapter 1

Impact and Safety of Gynecological Endoscopy on Women's Health

Prakash Trivedi

"Talents hits a target no one else can hit,
Genius hits a target, no one else can see"

INTRODUCTION

Last three decades have seen a meteoric rise in advances in women's health care. The field of endoscopy has visited all spaces and corrected most of the pathology or even anatomical defects. Modern hysteroscopy has truly become a speculum for the uterus with office hysteroscopy. The field of assisted reproduction, sonography, imaging, and urogynecology has taken giant strides.

In the last century, gynecological endoscopy was in search of indications, but today it is an established tool in the treatment of major gynecological pathology, early cervical cancer, uterine cancer, and prolapse.

Laparoscopic surgeries like removal of ectopic pregnancy, ovarian cyst, fibroids, uterus, tubo-ovarian mass, of prolapse in a young patient and vault prolapse, laparoscopic creation of neovagina, unification of uterus, and radical hysterectomy with lymphadenectomy for uterine endometrial and early cervical cancer.

Miniaturization of hysteroscope has made procedures like septal incision, removal of myoma, adhesions, foreign body, intrauterine contraceptive device, and tubal cannulation office procedures.

Resectoscopic surgery has been taken over by bipolar and use of saline for endometrial resection and myoma removal. New hysteroscopic myoma shaver or morcellator dissects fibroid and sucks simultaneously.

Laparoscopic tubal microsurgery with nearly 60% pregnancy rate, 3D camera, and high-definition monitors have made laparoscopy live with best anatomy and layered impeccable view.

Smart electrosurgery units, harmonic, new vessel sealing devices have made surgery fast and efficient with least blood loss.

Complications of laparoscopic or hysteroscopic surgery management have advanced in the hands of expert gynecological endoscopist with excellence in endo suturing.

High-grade anesthesia machine and multiparameter monitors have added safety. Minimal-access surgery, both endoscopic and vaginal, has made abdominal or open surgery limited to few but definite indications. New instrument, morcellation, mesh controversies, and medicolegal issues have also increased.

Credentiality, standardization, excellent skills of gynecological endoscopists, their teams, or technicians, and nurses go a long way in establishing minimal-access surgery for women's health. Safety is a matter of importance.

IS SAFETY AN OPTION OR NECESSITY IN ENDOSCOPIC SURGERY?

Endoscopic surgery came with promises beyond the expectations of the instruments and skills of surgeons especially in gynecology where pathologies are diverse.

In the hands of an expert, endoscopic or vaginal surgery is less invasive than open surgery. Thus, it becomes imperative that safety is a necessity and not an option in gynecological endoscopic and minimal-access surgery.

The pioneers of gynecological endoscopic surgery in the world have spent sufficient unselfish donation of time to enhance their skills, increase their knowledge, and give faster recovery to the patient while promising safety. Simultaneously, the assistants, anesthetists, and operation theater staff also have had to upgrade their standards of understanding new technology, equipment, limitations, and difficulties of each surgery in this group.

"Habits are Safer than Rules you do not have to Watch them or Keep them Either. They Keep You"

The fear of safety and longer duration of advanced endoscopic surgery prevented thousands of skilled gynecologists and surgeons not to venture into a never-ending exciting field of gynecologist endoscopy and minimal-access surgery.

"Be not Afraid of Growing Slowly, be Afraid of Standing Still. Minds are like Parachutes they Work Best when Open"

The biggest groups are fertility-enhancing endoscopic surgery, benign gynecological pathology, myomectomy, hysterectomy, and urinary incontinence surgery.

Universal application of these techniques by poorly trained surgeon or one with inadequate experience always added catastrophic proportion of morbidity or mortality.

Gynecological endoscopy and minimal-access surgery today is poised on the gateway of excellence in the hand of skilled experienced endoscopist with outstanding safety, yet the neoendoscopist trying to cross the gates in hurry to prove the supremacy of success in a short time fell into an equal division of achieving and others complicating.

Your own mastery is to show excellence in even difficult cases or handling crisis. You always wonder why the ghost is not seen, but the moment you affect the safety, morbidity, or mortality of the patient, he makes his appearance felt and that is the lawyer. It is the mind that stimulates

you to do new surgery, it is your hands that develop the skills, it is your heart that is concerned about the safety to the patient, and it is the soul that tells you that you have succeeded in the endeavor finally.

"Ability is what you are Capable of Doing, Motivation Determines what you can do, Attitude Determines how Well you do it, and Courage is Grace Under Pressure"

Finally, for minimal-access surgery in women, we can keep our eyes wide open for acceptance, but not till the brain falls out.

Chapter 2

Setting Up of a Cost-Effective Gynecological Minimal Access Surgery Unit

Prakash Trivedi, Paul Fogarty, Alberto Mattei, Pallavi Erlekar

INTRODUCTION

Operative laparoscopy and hysteroscopy have become an integral part of gynecological surgery. Endoscopic surgery needs a number of equipment such as monitors, camera, insufflators, light source, generator, etc. It also needs extra space for gas cylinders, cables, tubing, and suction irrigation system. Majority of gynecologists perform endoscopic surgeries in their regular gynecological operation theater, which is not designed for endoscopic surgery. Naturally, there is overcrowding of equipment in a chaotic manner. Inappropriate use of these equipment can result in operative inefficiencies and safety problems for both patients and staff. Proper operation theater setup and use of appropriate equipment and techniques can greatly add to patient's safety and satisfaction. The aim of this article is to give a general idea about setting up an operation theater for safe gynecological endoscopic surgery.

Increasing climate of medical negligence and litigation, consent is an important issue. Avoiding potential complications through careful patient selection and counseling.

Significant numbers of adverse outcomes arise at basic laparoscopic procedures, contributing factors:

- High number of procedures performed for pelvic pain and sterilization
- Variable operator skill.

OPERATING THEATER

An organized and well-equipped operating theater is essential for successful laparoscopic surgery. The setup should be designed to optimize efficiency using a team concept.

The operating room should be sufficiently large to accommodate a variety of equipment, preferably 20 × 20 feet. Smaller centers can manage with a 15 × 15 feet room. Ceiling-mounted instrument carts avoid gas tubing and electrical wires on the floor. Modern operation theater (Fig. 2.1) needs false ceiling for installing the operation theater lights, ceiling-mounted instrument carts, and plenum-type air conditioning. So, room height should be at least 12 feet to provide space for the false ceiling.

Operation theater walls and floor should be washable, without joints, and nonpermeable. Epoxy coating is suitable for this purpose. But if the walls have a potential to get wet, epoxy

Fig. 2.1: Theater layout.

coating can bleb or peel off. Steel or aluminum paneling with sealed joints is suitable in these situations. We have used epoxy on the floor, steel paneling of the walls, and roof in one operation theater. Other operation theaters have epoxy floor, polyurethane coating on the walls and steel false-roof. The floor and the wall should not meet at right angles, as this creates an area that is difficult to clean. Rather, the floor should continue seamlessly up the wall for 4–6 inches. The door size is also very important. It should be large enough to allow a patient bed to be brought in. Two-part door with large main door and smaller second door works well because the entry way can be enlarged when needed. Sliding automatic doors are ideal.

Central air conditioning is the most suitable one for operating theater. There should be at least 15 air changes per hour; at least three of these exchanges should be fresh outdoor air. The air supply should be from the ceiling near the center of working area. Fitting high efficiency particulate air (HEPA) filters at the air supply give cleaner air. The return air outlet must be from the floor level. There should be at least two return outlets located as remotely from each other.

There should be enough number of electrical plugs on the walls. Uninterrupted power supply plug sockets should be of different design, so that it is easily identifiable. All endoscopy equipment, anesthesia machine, and monitors (Fig. 2.2) should be supplied by uninterrupted power supply, so that surgery will not be interrupted during generator changeover. The operating theater lights should have independent controls so that some can be turned off during endoscopic surgery.

Anesthesia gases should be brought to the operation theater through pipes. There should be at least two oxygen, one nitrous oxide, two vacuum outlets, and one air outlet available at the head of the table. There are different methods by which gas connections can be brought to the room. The options include wall outlets, fixed columns, or multiservice articulated arms. Carbon dioxide and vacuum outlets should be available on the equipment pendent or trolley. This avoids bringing a carbon dioxide cylinder in the operation theater for the insufflators.

Different types of scrub sinks are available. Knee operated or sensors with timers are available. It can be located between two operation theaters, with proper smoke extraction system.

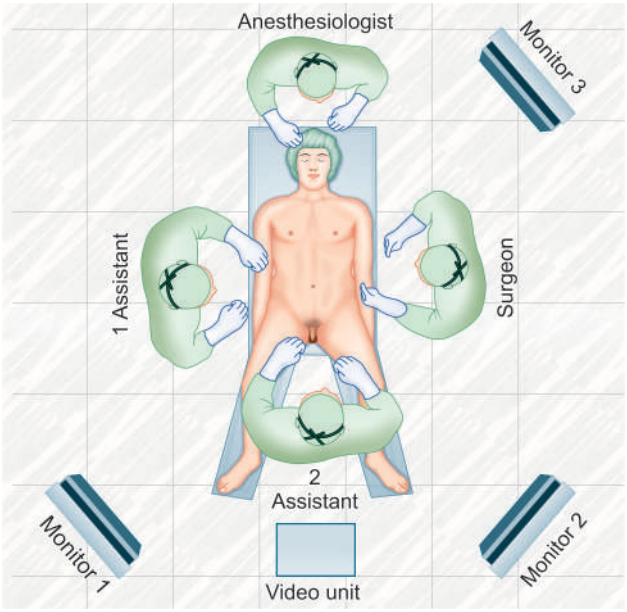


Fig. 2.2: Schematic layout of operation theater, monitors, equipment, and personnel.

Theater Layout

- Gauges need to be visible
- Adjustments need to be made
- Suction needs to be emptied
- Addition of new pieces
- Cable Tangles and to trip over
- Oh, and turn down the lights!

Preparation of Patient in Theater

- Checklist complete
- General anesthetic
- Washed and draped
- Vagina cleaned
- Bladder emptied
- Uterine manipulator.

Storage space is one of the most important requirements for modern operating room. Only few items such as sutures, meshes, and essential disposables are kept in the operation theater. Other sterile items are kept in the adjacent room. Cleaning and disinfection of telescopes and hand instruments are done in the intervening room between two operation theaters. These delicate instruments are not mixed with the open surgery instruments in the regular cleaning area.

POSTANESTHESIA CARE UNIT

This room is kept adjacent to the operation theater because it provides instant access to essential resources and equipment. Moreover, anesthesiologist and surgeon can supervise the operated patients. The number of beds depends on the average number of surgeries performed on a day.

OPERATION THEATER SETUP

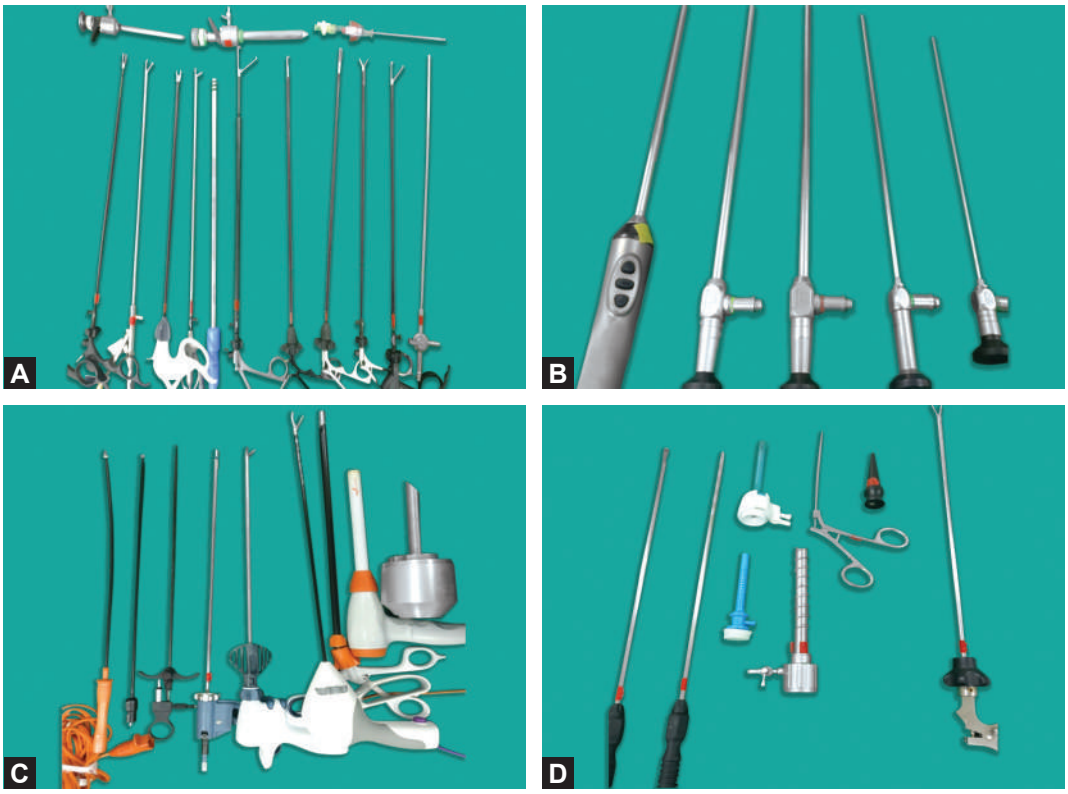
Surgical Team

Surgeon and assistant view the ceiling-mounted high-definition digital monitor placed at the foot end of the table on the right side. The operation theater nurse standing between the legs of the patient views the ceiling-mounted digital monitor at the head end of the patient. One trolley for vaginal instruments is kept at the leg end of the patient and another for laparoscopy instruments.

Instrument Cart

The hardware laparoscopy equipment are usually kept on a mobile cart. Electrical cables, gas, and suction irrigation tubing on the floor make it very difficult to move. The instrument panels should always be visible to the surgeon for safe surgery. The ceiling-mounted instrument cart is very convenient, although costly. Our instrument cart has a dedicated electrosurgical unit, advanced bipolar—vessel sealing device (Fig. 2.3), HD digital camera (Figs. 2.4A to D), video capturing system, morcellator, carbon dioxide insufflators, Xenon light sources, Harmonic generator, and shell control box (SCB) computer for controlling the equipment remotely and pneumatic sequential compression device for deep vein thrombosis (DVT) prevention.

Fig. 2.3: Bipolar, harmonic, and other vessel sealing devices.



Figs. 2.4A to D: (A) Instrument trolley; (B) Optics; (C) Tip of the energy instruments; (D) Knot pusher, clip applicator, port closure.

OPERATION TABLE

The patient is positioned in a semi-lithotomy position. The legs must be properly padded and supported. The legs are positioned in such a way that the thigh makes 160° with the abdomen. This will allow free movement of operating instruments. The modern stirrups such as Allen's Leg Rests allow easy positioning of legs by the surgeon (Fig. 2.5).

The table should have capabilities for at least 45° Trendelenburg and reverse Trendelenburg position (Fig. 2.6), preferably motorized. The height of the table should be in the lowest position so that the patient's abdomen is below the waist of the surgeon. Short surgeons may still need stepping stools to achieve this.

Video Monitors

The quality of the surgery image depends not only on camera but also on monitor. Monitor resolution should be equal to that of the camera for best picture quality. Fourteen and 20-inch size monitors are commonly used. High-definition digital LCD monitors are easier to handle. Digital cameras have digital visual interface (DVI) output and this can be connected to the LCD monitors with DVI/ HDMI cable. LCD televisions (HD or HD ready) are cheaper alternatives to

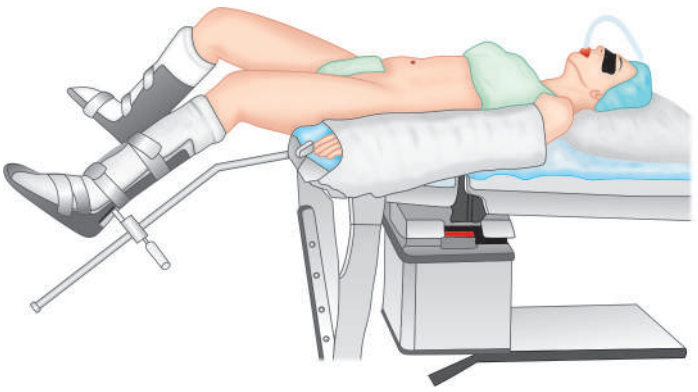


Fig. 2.5: Patient position.

Fig. 2.6: Operation table with double pelvic cut.

medical grade LCD monitors. They have S-Video and HDMI inputs, and depending on the type of camera, any of these connections can be used.

SUCTION IRRIGATION EQUIPMENT

There are different types of pumps to deliver the fluid for irrigation. Some of them pressurize the saline bottle with air to get a jet of fluid. They are usually noisy. We prefer to use a peristaltic pump, which works only when the irrigation is used. This type of pumps allows the saline bottle to remain warm in the fluid warmer. Peristaltic pump can be used for both hysteroscopy and laparoscopy.

ERGONOMICS IN LAPAROSCOPY

There are many ergonomic difficulties experienced during laparoscopic surgeries.

Static Posture

One of the main and basic ergonomic problems during laparoscopy is the surgeon's non-neutral posture during laparoscopy. Surgeons hold postures that are more static during laparoscopic surgery than during open surgery because they move less and hold still longer during laparoscopic surgery. The static postures have been demonstrated to be more disabling and harmful than dynamic postures. The surgeon should be relaxed and take the assistants help when prolonged holding of instruments is required.

Laparoscopic Vision Limited View

The laparoscopic surgeon typically views a two-dimensional video image of the operating field on a video monitor placed at a distance of 5–8 feet. The surgeon has to compensate for the loss of third dimension by experience, as binocular depth cues are lost. Laparoscopic image depends on many factors such as distance of telescope from the tissue, its color, and amount of bleeding. Closer the telescope to the tissue, higher the magnification. This magnification can be used for fine dissection when required. Too close-up view should be avoided when diathermy is used, as it can give a false safety to the surgeon even though the vital structures are very close. A balance of panoramic and close-up view should be used for safe surgery.

Less Efficient Instruments

Laparoscopic instruments are designed to work through small ports 3–10 mm in size. Fixed Ports, Longer Instrument, and Fulcrum Action surgery involves fixed operating ports, and so, port placement is very critical for accessibility to the operating site. The handling of instrument is also different from open surgery, as the instruments are longer and movement is fulcrum type. Only four degrees-of-freedom of movement (rotation, up/down angulations, left/right angulations, in/out movement) are possible. So, planning the port site is very critical when organs are enlarged or there is a history of previous surgery. Instrument exchanges during laparoscopic surgery are laborious and distracting to the surgeon. Using multifunction instruments can circumvent this problem.

Equipment Organization

Unexpected bleeding is difficult to control in laparoscopic surgery. So, instruments for hemostasis such as bipolar forceps and an atraumatic grasper should be kept close at hand. A suction irrigation instrument with properly connected tubing should also be kept ready.

SURGEON'S FATIGUE

Surgeon's fatigue can compromise the safety of the patient. Operation theater setup should aim at improving the comfort of the whole surgical team. The screen should be kept below the eye level of the surgeon. The OT table should be kept low so that the surgeon's elbow touches his body. Short surgeons can stand on a foot step to achieve the same effect. This position will allow the surgeon to make movements at the level of elbow or wrist.

RECORD KEEPING

Record keeping is an essential part of surgical practice. Video recording of the laparoscopic procedure is a standard practice in many endoscopic units. Recording can be done directly by an assistant or using the camera head buttons by the surgeon himself. Still pictures can also be captured from the videos already recorded. The unedited videos are then written on DVDs, named and stored. It should be done on the same day. Delay can result in losing the recorded data. Edited video is given to the patient on request. Still pictures are printed and given to the patient along with discharge summary.

We simultaneously record the surgery on a DVD recorder with a hard disc as a standby. On many occasions when the recorder malfunctions, this can be used. It can store up to 40–50 surgeries depending on the size of hard disc. We simultaneously record the surgery on a DVD recorder with a hard disc as a standby. On many occasions when the recorder malfunctions, this can be used. It can store up to 40–50 surgeries depending on the size of hard disc. The detailed surgical notes are prepared by the assistant immediately after the surgery. Surgeon should verify it for accuracy.

Chapter 3

Endoscopy that every Gynecologist Should do Definitely

Prakash Trivedi, Paul Fogarty

INTRODUCTION

"*Procedures with control tend to have no enthusiasm and procedural reports with enthusiasm have no controls—Is Expertise a cause of over enthusiasm*."

Pillars of modern gynecology are advanced clinical skills, sonography, specific blood reports, and endoscopy. One picture is better than 10,000 words, which emphasize the use of endoscopy. However, with a normal pelvic sonography, blood parameters and good clinical evaluation after appropriate history restrict the role of diagnostic hysterolaparoscopy to a great extent.

However, there is no debate that documentation of a gynecological pathology can be done even by needlescope, office hysteroscope with diameters of less than 2 mm. In many clinical situations, all other modalities assist to confirm the diagnosis, but endoscopy concludes, for example:

- Confirming tubal patency or block or tubal ectopic or tubal adhesion
- Ovarian cyst, endometrioma, dermoid, etc.
- Uterine pathologies such as fibroids, adenomyoma-adenomyosis, endometrial carcinoma, cavitory fibroid, polyp, adhesion, foreign body
- Uterine architectural or congenital anomalies such as septum, bicornuate or unicornuate uterus, rudimentary horn, uterine didelphys and absent uterus.

Thus, hysteroscopy and laparoscopy have a definite place in diagnosis if other modalities do not confirm. But the role of diagnostic hysterolaparoscopy is reduced by the other modalities and it is more often needed for therapeutic treatment.

COMMON LAPAROSCOPIC PROCEDURES

- In infertility for complete diagnosis of tubo-ovarian status
- Laparoscopic tubal sterilization
- Laparoscopy for undiagnosed pelvic pain, adhesiolysis, or tuberculosis
- Laparoscopic ovarian drilling

DEFINITE THERAPEUTIC LAPAROSCOPY

- Laparoscopic treatment for ectopic pregnancy
- Laparoscopic salpingectomy for hydrosalpinx
- Laparoscopic surgery for ovarian cysts such as dermoid, endometrioma, twisted ovarian cyst
- Laparoscopic myomectomy
- Laparoscopic hysterectomy.

COMMON HYSTEROSCOPIC PROCEDURES

- Office or simple hysteroscopy for cavitary pathology or problems
- Postmenopausal bleeding
- Diagnosis of amenorrhea in the presence of uterus
- Suspicion of foreign body or contraceptive device
- Diagnosis of cavitary anomaly such as uterine septum.

THERAPEUTIC HYSTEROSCOPIC SURGERIES

- Incision of uterine septum
- Resection of polyp or submucous myoma
- Lysis of intrauterine adhesions
- Removal of foreign body
- Hysteroscopic cannulation for proximal tubal block
- Targeted endometrial biopsy to rule out malignancy
- Endometrial resection or ablation.

Kindly note that therapeutic laparoscopy and hysteroscopy are covered in other chapters, so we will discuss only those aspects that are left.

DIAGNOSTIC LAPAROSCOPY

Simplified Step-by-Step Procedure

Patient is usually under general anesthesia with endotracheal intubation and occasionally local anesthesia and sedation.

With the patient in lithotomy position, a small incision is taken in the umbilicus, veress needle is inserted vertically, placement checked by a drop of fluid at the hub getting sucked, CO_2 insufflation is done with an intra-abdominal pressure cut-off at 15 mm Hg, till satisfactory pneumoperitoneum is achieved between 2.5 L and 3 L; the umbilical incision is made appropriate to the size of the trocar. Optics of the laparoscope is introduced connected with the light source. Trendelenburg's position is given, and at least one additional port is inserted on the side where the operating surgeon is standing. This port may be at an imaginary McBurneys point or mirror image on the left side; this may be 3/5 mm. Appropriate diagnostic procedure is done with a uterine manipulator in place with bladder emptied before starting the laparoscopy. In case there is a need of tissue biopsy, for example, tuberculosis, endometriosis, etc., a third port can be introduced on the opposite side.

LAPAROSCOPIC TUBAL STERILIZATION

This is probably one of the most common procedure done by gynecologists. The preliminary steps are diagnostic laparoscopy procedures; however, a large number of patients are under local anesthesia and sedation.

Apart from all the other methods, the commonest method is applying silastic band on the fallopian tube 3 cm away from the cornu.

Either a double puncture method or a single puncture method is used. In the double puncture, the method is exactly like diagnostic laparoscopy wherein the diagnostic laparoscope can be of 6.5/5/3 mm, and use of camera is optional. However, for the silastic band application, the second port is usually of 7 mm to allow the 6.5 mm band applicator to be inserted with one or both silastic bands. The most important care that the laparoscopist has to take the band applicator to grasp the tube only at the right spot, while releasing the band, the applicator goes more toward the tube rather than pulling the tube to avoid transection. The ring applicator may have the capacity to load only one band at a time or both with one and two marks to be kept after the first and second band application. Usually, double puncture is considered to be more versatile than single puncture laparoscope.

The single puncture laparoscope is usually around 11–12 mm, as it carries the optics and the band applicator together; the tip of the band applicator is at an angle to be seen by the optics. Although there are equal number of people using single puncture laparoscope under local anesthesia, the limitations are as follows:

- As both optics and band applicator are together, the primary port size is 11–12 mm.
- Again, due to the same reason, it is less versatile than double puncture wherein the applicator comes separately and can be easily visualized by the primary optics.

The most common complication of a band applicator is:

- Improper application of band to other structure such as round ligament, which leads to failure
- Partial application of the band on the tube, which is less than satisfactory for the results
- Transection of the tube and bleeding. This is a serious complication that has to be dealt on the spot. one of the methods is to apply one band each on either side of bleeding that controls the situation. A 5-mm bipolar can be used to achieve hemostasis, but this is possible by using 7 to 5 reducer to avoid gas leak.
- Other complications can be related to laparoscopic procedure such as insufflations and anesthesia, and improper placement of trocar.

Late complications can be:

- Failure that is intrauterine pregnancy
- Ectopic pregnancy.

The other methods of laparoscopic sterilization such as Filshie clip and bipolar cauterization of the tube with or without cutting are not included in the chapter to remain precise.

However, it is important for every gynecologist to know that if we do bipolar coagulation and just cut the tube, then it has 67% chances of ectopic among the failure, because the sperm may pass through the medial end, but fertilized embryo does not return back.

Chapter 4

Operative Laparoscopic Surgery Step by Step

Soumil Trivedi, Pallavi Erlekar

"It's wiser to learn from others mistakes
than to learn by committing themselves"

INTRODUCTION

Operative laparoscopy is a standard procedure almost globally; however, every expert performs this technique with different primary steps. We will be highlighting an accurate stepwise procedure to perform safe operative laparoscopy in this chapter, which is for moderate to advanced surgery such as laparoscopic hysterectomy, myomectomy, ectopic pregnancy, large ovarian cyst, young patient with prolapse, vault prolapse, creating neovagina, etc.

INTERACTION WITH PATIENT AND PROPER CONSENT

As the patient expects only success or miracles from a laparoscopic surgeon, it is important to explain the operative laparoscopic procedure to the patient, close relatives, preferably by properly made photographs or small clips of video, making very clear with them regarding limitations, complications, possibility of open surgery in a subtle but clear fashion, finally, giving a brief idea that such incidences, although rare, if encountered, can be handled safely by laparoscopy or alternative methods. Further, a proper consent should be taken for anesthesia, relative risks, and also elucidating history of any drug allergy or previous problems she had with any type of surgery. The patient and relatives should read the consent forms, though exhaustive, and then sign. In certain high-risk patients, a special informed consent, additionally, is mandatory.

PRIOR TO OPERATION THEATER

The operating surgeon should have a full idea of the clinical, sonographic findings with additional investigative details, keeping the end point desired by patient rather than what the surgeon wants.

We usually prefer to give Exelyte 90 mL in 300 mL of lemon drink on the day prior to surgery, consumed in 45 minutes, which will empty her bowels. Further, 10 mg of Bisacodyl is given on the evening day before surgery. Post lunch, patient can have soft dinner on the day prior and

is fasting on the day of surgery if scheduled in the morning, but if surgery is in the afternoon, she can have a cup of tea or coffee, 6 hours prior to operative procedure.

We have not advised liquid diet for 2 days to any patient, except for laparoscopic radical surgery or extensive endometriomas with bowel adhesions.

Nitrous oxide, which causes bowel distention on prolonged surgery, is best to be avoided and general anesthesia with endotracheal intubation and proper relaxant gives an excellent pelvic field Trendelenburg position, which keeps bowels out of field. In selected centers, laryngeal mask apparatus (LMA) anesthesia have replaced the earlier techniques to avoid throat irritation, etc. due to endotracheal intubation.

OPERATION THEATER SETUP

Before shifting the patients in the operation theater, the following are mandatory:

- A proper laparoscopic instrument trolley having all instruments needed for surgery
- The operating table should have a double pelvic cut to allow good manipulation of uterus. Lithotomy padded rods can be angled at 45° or Allen's leg rests, position of which can be changed during the surgery with sterile clothes covered.

The operation theater table should have padded shoulder rest and side arms to avoid patients from slipping down on head low positions. The left arm of the patient should be kept at the side of the patient, covered with a green sheet, so that the surgeon has ample space and patient does not have any brachial plexus compression. The padded leg rests also avoid peroneal nerve pressure in popliteal fossa. Every time when the patient position is manipulated, the anesthetist is informed to take care of the endotracheal tube, side arms, multiparameter, and ECG attachments remaining intact (Fig. 4.1).

In surgery such as placing obturator sling for stress urinary incontinence, patient passes urine before entering the operation theater, and catheterization is avoided. In others, a Foleys catheter 10–12 Fr is inserted in a sterile fashion.

Equipment should be available in functioning condition, for example, in myomectomy, electronic morcellator should be functioning. Few standby instruments should be kept due to wear and tear at a busy surgical center.

A team of good assistants, OT staff, and anesthetist is the key to a good laparoscopic surgery.

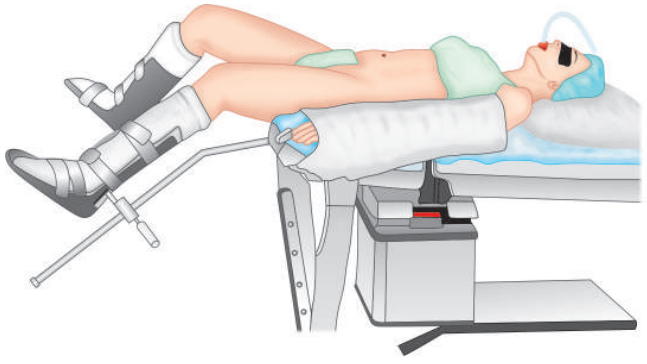


Fig. 4.1: Schematic representation of patient's position in laparoscopy.

THE BEGINNING OF THE SURGERY

Patient is placed in a modified lithotomy position with the upper thigh at 135° from the abdomen for free movement of instruments in lower ports.

In addition, we should have long pocketed drapes to park the common instruments, from where it will be easy to pick up by the surgeon. Position of the monitors, keeping camera, cable, and CO_2 insufflators tubes fixed at the working distance with free movements. The surgeon and assistant should always stand 6 inches away from the table. Patient's abdomen on the operating table should be at the height of the flexed elbow of the surgeon while using an ipsilateral port, and it should be lower for using contralateral port.

The intravenous and irrigation bottles are all suspended from ceiling on a strong chain to avoid any bottle-hanging stands occupying the floor space.

The instrument trolley should have optimum and not excessive instruments. The main assistant and OT staff are versatile to hold camera and give instruments sequentially before asking. All important monitors, equipped with display, should face the surgeon (Fig. 4.2) who subconsciously are aware, without distractions, of the position of footswitches, energy sources setting, and irrigation suction devices.

Although there are few hand-operating instruments such as Harmonic scalpel, bipolar, vessel sealing device, and some morcellator, largely, it is controlled by foot switches, which avoid you to look down every time, yet be sure of not stepping on a wrong paddle. Our foot switches are laid as follows:

- Patient's arms positioned by the side
- Surgeon with ipsilateral ports 6" away from table and drapes with pockets.

Closest to the operation theater table is the harmonic scalpel foot switch, followed by dedicated bipolar, vessel sealing device. The monopolar footswitch is sparingly needed today.

Fig. 4.2: Important equipment in laparoscopy OT.

If morcellator is needed, it replaces one of the footswitch, so that while focusing at the TV monitor, the leg movement is easy. A green sheet is kept below all these footswitches to avoid them to be pushed while using. If CO_2 laser is used, the footswitch is used on the right side.

The group of wires of energy sources, cable, camera wire, CO_2 insufflation tubing, inflow outflow tubing is kept in a fixed position as suitable for the surgeon toward the assistant's side fixed properly.

THE SETTING OF EQUIPMENT

Monopolar current for major surgery is 80–100 W pure cutting and 50–60 W coagulation, bipolar dedicated cautery on 25–30 W with matching company hand piece. If another company's brain unit—then it is to be set at 35–40 W. The settings of Harmonic are minimum between 1 and 3 for hemostasis and maximum at 5 for dissection and cutting (Remember Harmonic scalpel is an excellent dissector but not a vessel sealing device).

The vessel sealing devices are set automatically on insertion of the hand piece, that is, for sealing, cutting, or morcellation. The irrigation suction can be Endomat (Karl Storz) at 300 mL/min flow rate and 200–300 mm Hg by suction pressure; unless there is ectopic rupture with lots of blood or clots, the inflow is at 1 l/min flow and suction pressure of 500 mm Hg.

The gas flow rate of CO_2 is 1–3 l/min on starting with Veress needle at 15 mm Hg pressure, and then after trocar insertion, the flow rate is increased from 7–8 to 20 L/min, but pressure is 15 mm Hg only. The CO_2 pressure is raised to 20–25 mm Hg for insertion of morcellator hand piece and then brought back to 15 mm Hg on insertion. In the absence of Endomat, the same pressure can be set by C-infusor pressure bags with wide bore tubing and normal electronic suction at 0.05/50 mm Hg to 0.3~300 mm Hg to 0.5 mark 500 mm Hg pressure. Adequate quantity of CO_2 cylinders, warm irrigation fluid, etc. is kept. Using heparin with saline/ringer lactate makes little difference.

The body temperature is maintained by a thermal jacket or warmer; patients have the monitoring probe and electrodes fixed at proper place for pO_2, $ETCO_2$, Plethysmograph with ECG, and body temperature. A defibrillator is a must, but respirator or spirometry is optional. Circuit busters with complete voltage transformer are mandatory and UPS/inverter backup is required.

INTRODUCTION OF VERESS NEEDLE AND TROCARS

Many endoscopic surgeons have a direct trocar insertion, which we avoid by creating good pneumoperitoneum through Veress needle. We use Veress needle properly, vertical not oblique, either disposable or reusable (Fig. 4.3). A drop of fluid that gets aspirated if in the negative pressure peritoneal space identifies the confirmation of intraperitoneal space. Next, a syringe with 2–3 mL is attached to the Veress needle to push for clear and no resistance. Around 3–3.5 L of CO_2 is adequate in any Asian women before first trocar insertion.

Insertion of Veress needle, reusable/disposable, and also of primary and other trocar cannula should be vertical with the index finger as a guard (Fig. 4.4), preventing the instrument from sliding on the sheath obliquely.

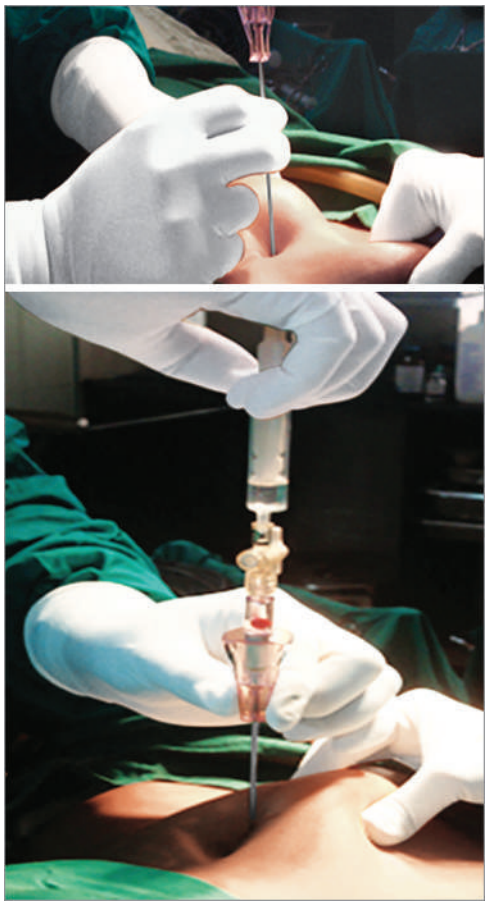


Fig. 4.3: Insertion of Veress needle and a drop at the hub.

Patient still in lithotomy position and not with head low, as it increases the rate of possible injury to iliac vessel. There is no safety trocar optiview, which FDA doctors approve to be safe. However, the blunt tip termanium cannula is good after a pneumoperitoneum; you can introduce the primary trocar with optics visualizing the path.

If there is a previous laparotomy scar, horizontal or vertical, the Veress needle and trocar is introduced 4–5 cm above the uppermost mark of vertical incision or above the umbilicus with a nasogastric tube emptying the stomach.

The Palmer's point on the left upper abdomen below the rib cage can be used to detect adhesions. Open trocar insertion is performed by most of the surgeons, but as a gynecologist, that is not the routine and also you have to take a stitch to avoid gas leak or use special trocars. The primary trocar is frequently the multifunction valve trocar with Pyramidal tip.

The ancillary trocars are usually 5 mm flower-valve trocar on the left and right imaginary Mc Burney's point. The left upper port is in line with the umbilicus little medial to the left lower port again introduced in a vertical fashion under vision. We prefer injecting 2–3 mL of 0.25/0.5

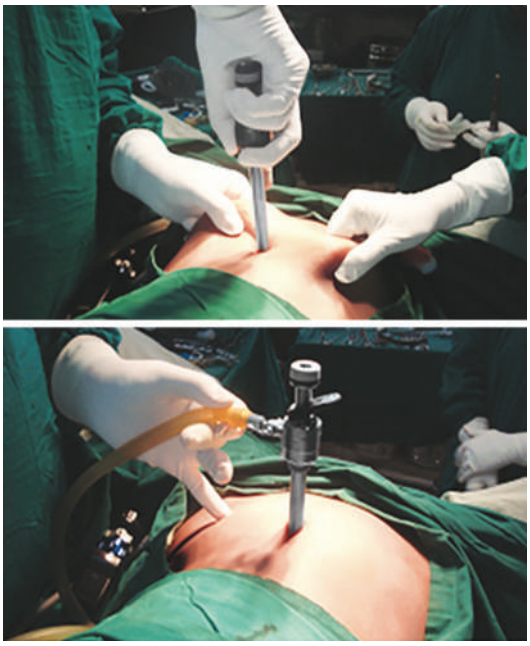


Fig. 4.4: Vertical insertion of primary trocar with counter traction and trocar well placed.

percent sensorcaine before incising the skin to block the pain pathway, reducing the need for postoperative analgesia. The lower trocars are introduced lateral to the inferior epigastric umbilical vessels, avoiding injury to it.

LOCATION OF STANDARD PORT PLACEMENT

The optic can be 10 mm 0° or 30° depending on surgeon's preference or assistant's ease of handling the camera. We have stopped using the suprapubic 5 mm trocar, as it comes in the way of optics and has no advantage over the ipsilateral port placement wherein the surgeon is comfortably not crossing hands over the patient and working like open surgery and the assistant holding the camera and instrument on assistant's side like open surgery (Fig. 4.5).

The placements of trocars shift by 1–3 inches above, if the size of the uterus or fibroid is big. In cases of previous vertical scars, it is also the same. The uterine manipulator is used vaginally, and additionally, in cases of hysterectomy and fibroids more than 8–10 cm, we prefer a 10-mm myoma screw from the right upper port.

NEW ENERGY SOURCES, VESSEL SEALING DEVICES: A BRIEF CLEAR CONCEPT

Although, there are good electrocautery machines including a dedicated bipolar for a laparoscopic surgery, yet there are multiple changes in instruments, that is, bipolar and then to cut with scissors or suturing for hemostasis and cut with scissors. Always there was a need

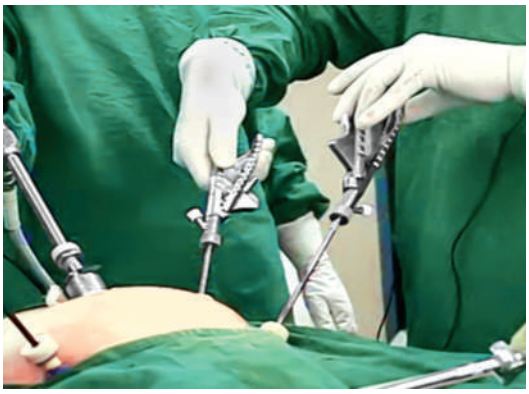


Fig. 4.5: Ipsilateral suturing with two needle holders in trocar.

of instrument that can seal the vessels, cut, and may be dissect tissues. Harmonic scalpel 5 mm Ace, better for gynecologists, came as an excellent dissector due to one blade oscillating 55,000/sec. It is a costly, disposable instrument useful for dissection, cutting, tissue separation, and less for sealing vessels. It is especially useful for tissue dissection in cases of previous cesarean section, adhesions, and big uterus. Setting is kept at 2/5 for moderate hemostasis and cutting, it is disposable.

What is different in a Vessel Sealing Device from a good bipolar? We have to remember that the amount of current delivered is the total of voltage multiplied by amperes, which is the Wattage. In a standard bipolar device, the voltage is high and amperes are low, but in a vessel sealing device, the voltage is low and amperes are high, but wattage remains the same. This gives good desiccation and vessel sealing. However, the lateral spread may depend on the size of the tip and delivery of the wattage from one electrode configuration to the other. Although each company claims to have the least lateral spread, it should be assessed and not blindly go by this claim. Finally, it is good to have a combination of a good vessel sealing device with Harmonic scalpel for excellent dissection and minimum instrument changes, or one can do the same with scissors, bipolar, and suturing main vessels such as uterine arteries.

The following are the vessel sealing devices:

- Ligasure and Atlas from Valley lab
- Martin maxim with Robi grasper
- Biclamp from Erbe
- Gyrus-Plasma kinetic energy transector and 5 mm curved sealer with dissector
- Harmonic Scalpel 5 mm Ace
- Enseal from Johnson and Johnson
- Dedicated bipolar, ligasure is used for cornu and infundibulopelvic ligament, up to the uterine vessels, but beyond this, its use was limited as on the uterosacrals, etc
- Harmonic Scalpel or Ace is an excellent dissector.

In Hysteroscopic Surgery, Versapoint, Plasma Kinetic Gyrus, and bipolar electrodes have their own use but are not necessarily less injurious to the tissue. Further, they have to be used through the operating channel and not continuous flow resectoscopic sheath with better vision. But bipolar resectoscopes are now good and here to stay.

GOLDEN RULES OF EACH PERSON IN ENDOSCOPIC SURGERY

Endoscopic surgery is a team work, hence each person should know their role.

1. *Main surgeon:* The captain should handle the main tissue dissection and suturing and every important plan is captain's job. He/she has to be organized, know limits of assistants, sisters, instrumentation, and should not be temperamental in crisis, should be cool, confident yet swift. They make the atmosphere of the operation theater responsible yet enjoyable at ease, disciplined, and understanding the final mission of surgery.
2. *First main assistant:* To control camera movement, centralization, back up goes close as needed for the surgery. The second hand does supportive movement anticipating primary movement of surgeon.
3. *Nursing staff* should organize instrument trolley, equipment, and should be well acquainted with the surgical steps. They quiet often boost the confidence of a new main assistant.
4. *Anesthetist:* He/she should be composed, not in a hurry, but should give good suggestion in crisis or decision making, and should not distract the surgeon by nonspecific talks.

   Hands-free mobile for surgeon, and usage of mobile phones by others should be restricted.

A good music and some humor make a high turnover work pleasure and not stressful.

DOCUMENTATION AND EXPLAINING PATIENTS AFTER SURGERY

The future of medicine is skilled documentation of all surgery showing relevant part to the relative and the patient. Hard disc storage is very useful for the future presentation, books, DVD, and medicolegal purpose. A serial photograph is an important document of each surgery given to the patient.

After the surgery, all aspects are explained to the relatives, and future plan of action or treatment is also explained.

In moments of crisis such as bleeding or rare injury to bladder, ureter or bowel if identified; an additional support of the surgeon or urologist is useful medicolegally even if you are the best.

Periodic upgradation of operation theater setup and each person involved in surgery is productive.

After the surgery is finished, port closure, analgesic suppository, color of urine, condition of patient's well-being are confirmed with the anesthetist. All fluid discrepancies, blood loss, etc. are well calculated.

Conversion to open surgery is not a defeat; the setup for open surgery should be always kept ready. However, this decision is taken within 2–3 minutes of introducing the laparoscope and not 1–2 hours after struggle.

"A true surgical genius is not born in crisis but they exhibit in crisis."

AFTER THE SURGERY

Transfer of patient from operation theater to the recovery room should not be taken casually. It is compulsory for a nursing staff or a qualified doctor to inform the vital parameters of the patient to the main surgeon and anesthetist, who will check intravenous fluid line, catheter, drainage tube, if any, and condition of the button hole dressing.

Proper entry of surgical procedure and immediate postoperative notes is done by assisting surgeon and checked by the main surgeon.

SUGGESTED READING

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Chapter 5

Laparoscopic Suturing Made Easy

Prakash Trivedi, Juan De Villegas, Soumil Trivedi

INTRODUCTION

Laparoscopic suturing has taken giant strides in last 25 years. Earlier, focus was how laparoscopic suturing should be done to convince that it is possible. Now, it is simple, efficient, and safe so that there are no limitations regarding the location of the suturing site and duration of surgery. It is possible to undertake suturing at any corner of pelvis and upper abdomen. Learning curve was long initially, which is not today. Suturing is the integral part of any surgery or procedure. It has to be easy and effortless to be safe and efficient.

Ipsilateral suturing is more physiological considering the surgeon's posture then contralateral suturing. It is possible to use a long thread and do extensive suturing. Contralateral suturing has advantage of being more precise squaring of the knots. The biggest disadvantage is that you have to cross your hands, leads to strain on the shoulder and increases fatigue, for persons who are used to these techniques either the OT table has to be kept low or a small platform is used by the surgeon. One can follow any of the technique with principles of the surgery, which they are comfortable.

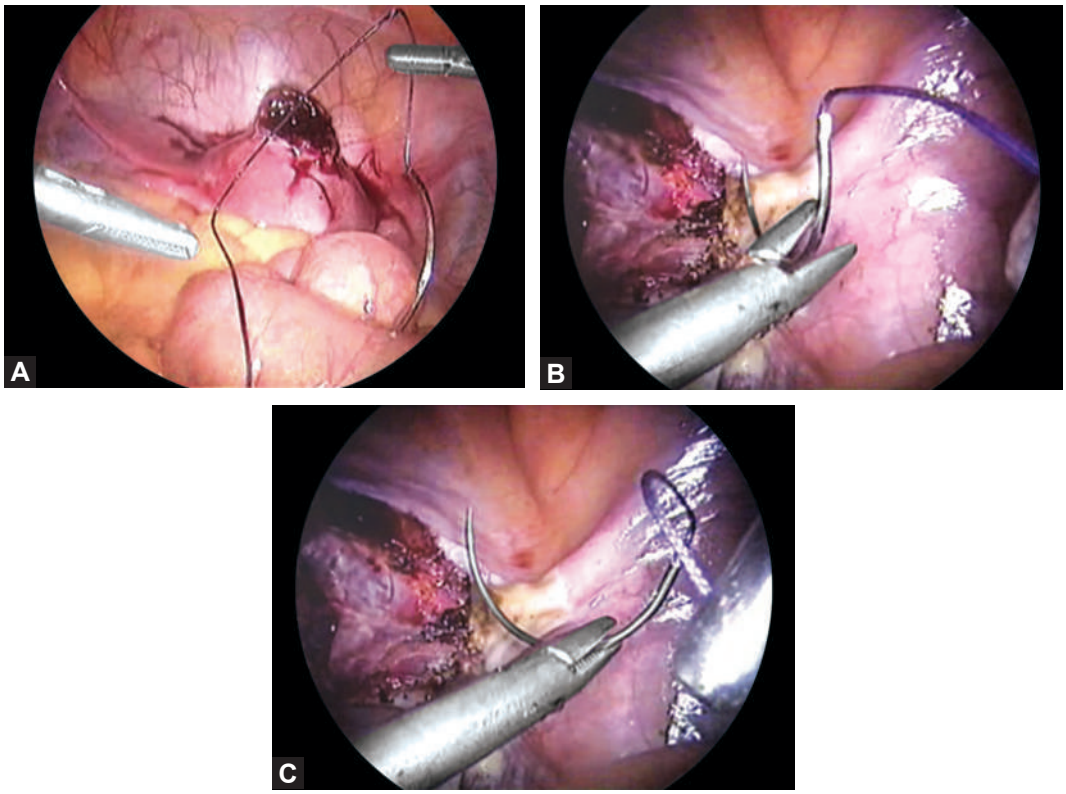
PATIENT'S POSITION

This starts from the proper positioning of the patient. Patient is placed in modified lithotomy position. Allen's stirrups are the ideal things to have but in absence of Allen's stirrups, tilting of the vertical stirrups by 45° can serve the purpose. The principle is to avoid the thigh to obstruct the movements of the surgeon.

INSTRUMENTS

Manipulation of the needle and thread is important. Initially it takes time and demands good surgical sense to master this skill. Right and left, both the hands are to be used for manipulating the needle. Movements involved in laparoscopic suturing are manipulating the needle and the thread, holding the needle in the "position of function" (Figs. 5.1A to C), holding the tissue, traversing the needle through the tissue and tying the knot.

The aim of choosing proper needle holder is to make sure that it grasps the curve needle securely. Inability to hold the needle securely makes inefficient passage of the needle through the tissue.



Figs. 5.1A to C: Ideal position to hold the needle.

A light-weight needle holder with a flat and titanium-coated tip as a dominant needle holder and a curved-assisting needle holder are the ideal instruments for the laparoscopic suturing.

Handles made of titanium reduces the weight of needle holder significantly. There is a wide range of instruments available to choose according to individual needs.

A needle holder with single tooth at the tip can be used to hold and stabilize the tissue like tooth forceps. It has an added advantage that the needle does not slip out while holding in the desired position. The curved needle holder with the tooth is an excellent instrument for handling the tough structures. A word of precaution—never lock the needle holders with tooth when the thread is close to the bowel loops.

A grasper can be used instead of assisting needle holder but there are chances of the thread getting caught in the "joints" which is a disaster at a critical moment. Out of variety of handles the one which is inline with the barrel of the needle holder is more versatile and useful at difficult sites of suturing. The curved handle (Koh's needle holder) is comfortable to use for prolong suturing.

PORT PLACEMENT

The distance between two suturing ports should be at least 10 cm, this is achieved naturally in contralateral technique, while it has to be achieved cautiously during ipsilateral

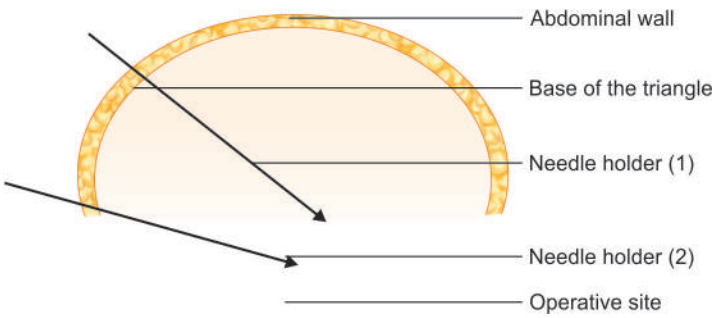


Fig. 5.2: Schematic representation of ipsilateral suturing.

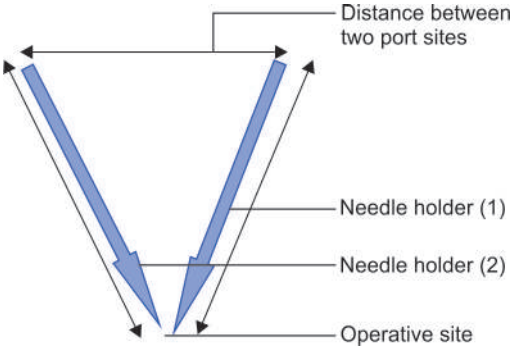


Fig. 5.3: Triangle of success and distance between two suturing instruments.

suturing (Fig. 5.2). Too close port placement makes the instruments to be parallel to each other and cause cluttering. Though it is not impossible to suture with closer ports it takes practice and good learning curve to execute it.

It is explained in terms of "Triangle of success". The line joining two ports forms the base of the triangle and the suturing sight forms the apex where the two instruments meet. The angle between two instruments should be more than 60° (Fig. 5.3), when we are trying to roll the thread on the instrument.

NEEDLE INSERTION

With Reich technique of curved needle insertion it is possible to introduce any type of needle into the peritoneal cavity for extracorporeal suturing. The needle holder pulls the tail of the thread through the cannula and again it is inserted through the cannula which holds the thread close to the swage point and the sequence of appearance in the peritoneal cavity is tip of the needle holder, small length of the thread, the needle and then the cannula which railroads over the needle holder, then the needle is left and the thread is pulled inside vertically down to drop the thread below the port side. When we do not want the push knot it is not necessary to pull the thread through the cannula and the needle can be inserted in the same way as described.

During microsurgery the thread is coiled and pulled into the reducer and then the reducer is inserted in the cannula and suture is released inside the peritoneal cavity.

Once the needle is inside, it is manipulated by holding the thread close to the swage point with the grasper and a light grip of needle holder at the center of the needle. The thread can be pulled or pushed to get the desired position of the needle.

IPSILATERAL SUTURING

The two instruments work from the same side of the patient out of which one is needle holder in the dominant hand and other can be assistant needle holder or a grasper which has tight grip on the thread-like needle holder (Fig. 5.4). Passage of the needle is an art where the depth of the tissue decides the position of the needle holder. If a deep bite through the tissue is required then the needle is held at the center and pierced perpendicular to the surface at adequate depth, the fore arm is supinated to bring the needle tip out and the needle is pushed holding proximal to the previous grip; similarly, it is passed through the other half of the tissue and the knot is tied. The needle should be pushed through the tissue to get adequate length from the tip to grasp it and it is better to push rather than pull it by holding the tip. It is prudent to retain the original sharpness of the tip of the needle till the end of the suturing, it helps to get the anticipated passage of the needle through the tissue.

For all the purposes needle is held at the junction of proximal one-third and distal two-thirds. There are occasions when we have to change the direction of the needle after just insertion into the tissue, which is done by holding the needle with the needle holder and the thread with the grasper.

The length of the thread is 12–20 cm for comfortable suturing but longer thread can be managed during ipsilateral suturing. The standard technique of ipsilateral suturing is to make the "C" on the surgeon's side and roll the thread above or below the assistant needle holder and pull the tail through the loops to tighten the knot. The "strangulation" of the assistant needle holder while tightening the knot can occur if the loops are pulled and tightened prematurely before they come out of the tip of the assistant needle holder (Figs. 5.5A to G). Occasionally, the loop needs to be pushed if the strangulation occurs. The loops slide smoothly on the assistant

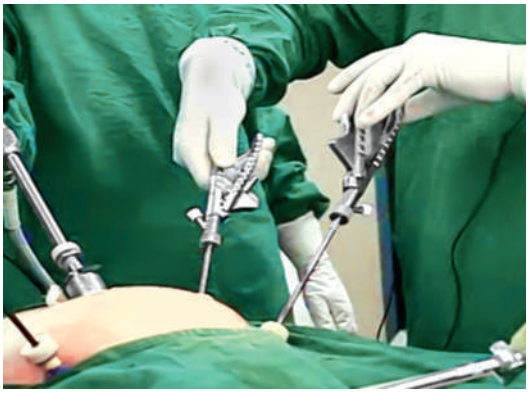
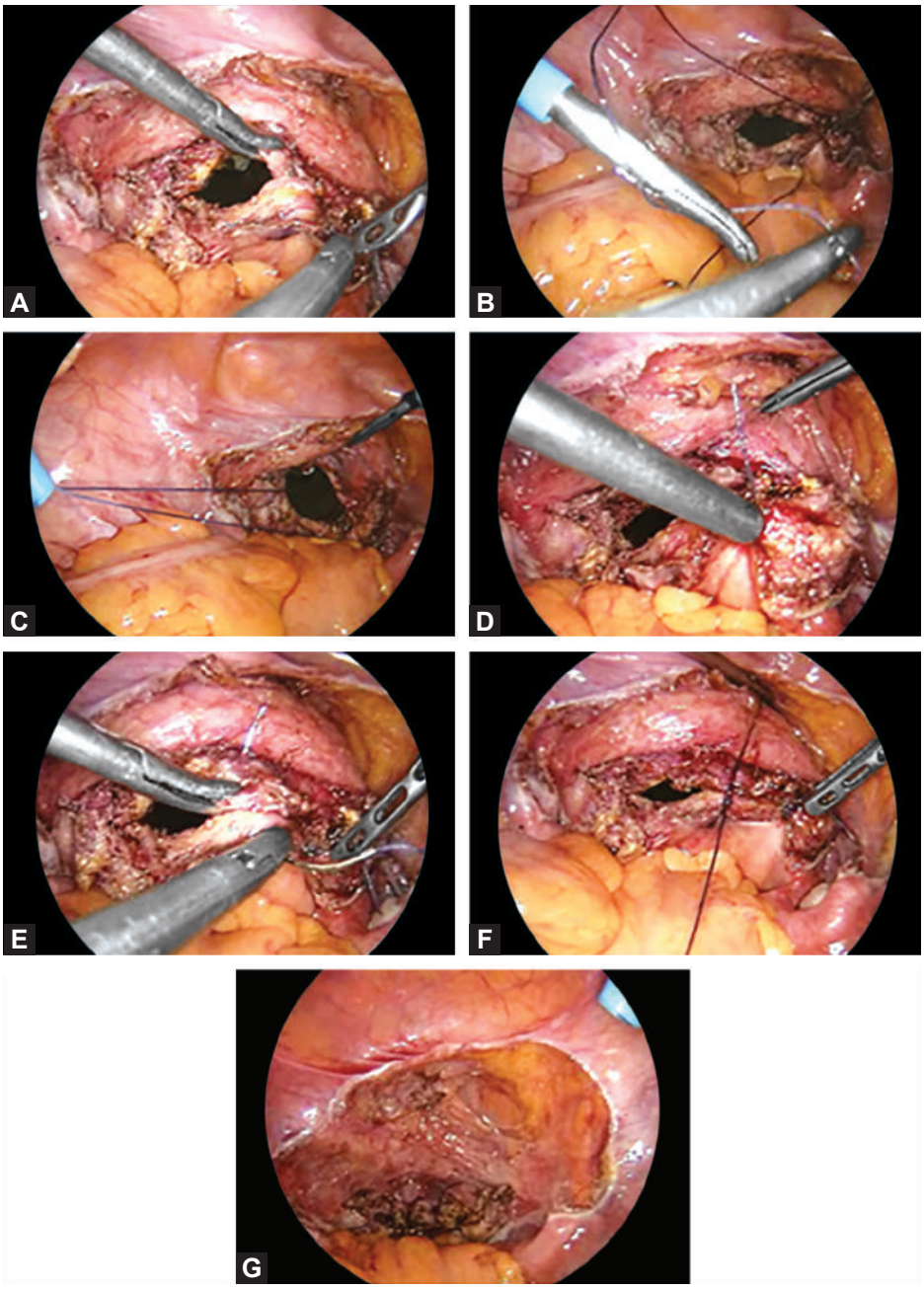


Fig. 5.4: Ideal placement of ports for ipsilateral suturing.



Figs. 5.5A to G: Sequential steps of ipsilateral closure of the vaginal vault.

needle holder as compared to the grasper, which have the joints bulging out when opened. The next loop is on the same side but the rolling of the thread is opposite to the previous one to square the knot.

Tightening in appropriate direction results in a proper surgical knot. Longer length of the thread needs a patient handling in the peritoneal cavity. Once the needle comes out through the tissue it is pulled in upward direction then toward the left upper port (dominant needle holder) and then it is kept in the midline or toward the right side of the peritoneal cavity. This reduces nuisance of the long length of the thread coming in the way of simple suturing.

CONTRALATERAL SUTURING

The laparoscope in the center and both suturing instruments from opposite sides make contralateral suturing resemble conventional suturing technique. Once the needle is passed through the tissue the "C" is formed on one side, then the long thread is handed over to the other instruments. During this, the "C" is automatically formed on the opposite side. The thread is rolled over the two instruments alternately. The direction of tightening the knot is such that it results in a proper surgical knot. There are less chances of "strangulation" of the instruments during contra lateral suturing.

NEEDLE REMOVAL

Once the suturing is complete the needle is removed by holding the thread close to the swage point. First the cannula comes out followed by thread and then the needle.

CAMERA HOLDING

With the advent of high definition camera, monitors, laparoscope, and excellent light source, we get an excellent picture which is illuminated in all the corners and does not need focusing repeatedly. Larger monitors with very sharp pictures avoid the necessity of repeated close-up view.

NEEDLES

A cutting-edge needle can pass through the abdominal wall with ease, it can result into complications, which can go unnoticed. There are chances of laceration of blood vessels, especially vein, with the sharp tip and cutting edge.

The needle can be kept safely on a flat surface or it can be parked in the anterior abdominal wall. Depending on the length of the suture, the needle can be kept above the iliac fossa or more cranial to it, up to the liver. During this, one should always have the inferior epigastric vessels in vision and be aware about the vessels. Minimum or optimum handling of the bowel loops is the best and safest strategy to avoid the complications arising from the needle prick.

Bowel retraction should be complete and the suturing site should be well exposed before we grasp the needle and get ready to pierce the tissue. This helps to reduce the time required to suture. Depending on the depth and consistency of the tissue, 35 mm or 40 mm needles are the most frequently used in gynecological surgeries. Too thick needles or the cutting or reverse cutting edge needles are more prone for postsuture oozing of blood through the stitch bite.

SUTURE MATERIAL

Performance of the surgeon varies depending on the suture material he is using. Polyglycolic acid is the most commonly used suture material, which is suitable to all aspects of laparoscopic suturing. It does not retain its memory; hence, the recoiling is not there, which is the property of prolene or nylon sutures. Besides, the knotting property of polyglycolic acid (Vicryl, Centicryl, etc.) is one of the best. Stiffness and knotting property of the polyglycolic acid vary according to the processing and coating on the suture. It is compared with Prolene because prolene is the next commonly used suture material in gynecology. Properties of polydioxanone (PDS) are very much similar to Prolene.

Catgut has better handling properties than prolene, but not as good as Vicryl. It has significantly less strength as compared to Vicryl or prolene. Silk is rarely used except in accidental bowel injury.

Vicryl is used for all the purposes, e.g. vault suturing, myomectomy, peritoneal closure, extracorporeal suturing for pedicles, uterine vessels, etc.

Prolene is mainly used for the suspension procedures for uterine and vault prolapse. It is used where permanent fixation is desired. Handling Prolene is significantly difficult because of its characteristic of retaining its memory. Stretching of the suture may help for a shorter thread or we should get a suture which is packed as straight one.

Perfect laparoscopic suturing is the pinnacle of laparoscopic surgery skill. Handling properties of the Prolene, PDS, PDO, and barbed suture are the same.

There are occasions when we have to pass a blunt tip needle of the Mersilene tape through tough structures as anterior longitudinal ligament or pectineal ligament. In this case the needle should be held close to the tip at the junction of one-third and two-thirds and inserted at the desired site. Then leave the needle and then rehold at the center of the needle. This makes it easy to change the direction and plane of driving the needle. Then push the needle until it emerges out from the tissue. Once the tip is pushed adequately, it can be pulled along its curvature, by holding proximal to the tip. The Mersilene tape should be pulled with two atraumatic instruments, as it needs strength without causing damage to the tape.

Gore-Tex is one of the best suture material to use for laparoscopic suturing as it glides very smoothly through the tissue and does not have stiffness (memory) as Prolene. It is used for laparoscopic colposuspension.

BARBED SUTURE

It is similar to the fish scale or fence wire which has barbs but soft. The barb does not allow the suture to slide back once it has passed through the tissue.

It is made of PDO, available in two types, one with a single needle and a loop at the other end. Bidirectional system is with needles at both the ends of the suture. It is divided at the center, where the barbs change the direction. Hence, if the suture is pulled through the tissue it meets resistance at the center of the suture. Each barb acts as a lock; as performed during conventional suturing, once passed through the tissue. It stays as it is and there is no need to keep undue traction. This property has eliminated the need of knotting at the end of the suturing.

Barbed sutures can be used at all the occasions, mainly for myomectomy and vaginal vault suturing. Adequate amount of firm tissue is required for the barbs to stay in the tissue. As it makes the laparoscopic suturing easy and convenient, the learning curve has shortened. It helps to reduce the duration of surgery and hemostasis is achieved very fast during myomectomy. Suturing in multiple layers to obliterate the dead space is no more a tedious and time consuming exercise.

Reducing the blood loss and duration of surgery reduces the anesthesia time. Apposition of the tissue is excellent and very pleasant to perform if the stitches are placed at appropriate distance including adequate tissue. Suturing pattern may vary according to personal choice. It can be either continuous from one angle to the other or we can start at the center and then proceed to the angles. The bidirectional system can be used in a crossing fashion to make it a shoe lace pattern. The exposed suture material is less as there are no knots and overall it results in less adhesion formation.

Barbed self-retaining knotless suture has made it possible to do multilayer closure of myoma defects. Additionally they are available with two needles with thread having small spicules going in two different directions. The first layer of a horizontal incision is taken like normal suturing that is outside in and inside out in the deeper layer and as we pull the suture toward the needle end the tissues are automatically approximated without tying a knot. The superficial layer is sutured in a baseball fashion which is going from inside out on one wall of myometrium then the needles direction is reversed to take the other wall also with needle going inside out in a continuous fashion to meticulously close the myometrium, by this method minimum amount of thread is exposed to peritoneal cavity.

Barbed suture is also useful in single port or single incision laparoscopic surgery (SILS). With the conventional sutures, though not impossible, but suturing is definitely very tiring and time consuming. Barbed suture has made a revolution in laparoscopic surgery.

Barbed sutures can be:

- *Quill*: It is a knotless tissue-closure, helical barbed pattern which enables maximizes tissue "grab and hold". Quill suture are available in two needles, one needle, and a loop at the end (Fig. 5.6).
- *V-Loc*: This came after Quill suture. It has soft barbs, different lengths with different needles and with a loop ready opposite to the needle end of the thread to lock the first end of the suture, which allows tension to be distributed across the entire wound and very easy to work (Fig. 5.7).
- *Stratafix*: It is a knotless self-retaining sutures, but are little brittle with tendency to cut through (Fig. 5.8).

Advantages

- Reduced suturing time
- Need of assistance holding the thread is reduced.

Disadvantages

- Its costly
- Not suitable in all situations.

Fig. 5.6: Quill suture material.

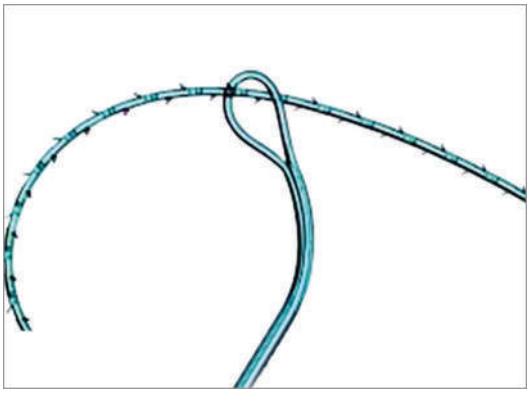


Fig. 5.7: V-Loc suture material.

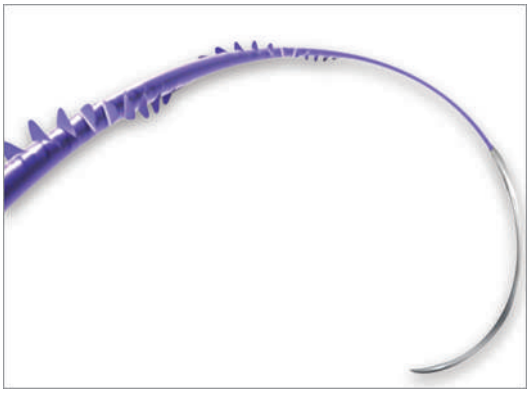


Fig. 5.8: Stratafix suture material.

SUTURING TECHNIQUES

Laparoscopic suturing techniques classified as: Intracorporeal and extracorporeal knots.

Intracorporeal Knot

Intracorporeal knot tying consists of reproduction of the same movements of traditional open surgery with the restriction of degrees of freedom due to fixed trocar sites.
Types of intracorporeal knot:

- Surgeon's knot
- Square knot
- Tumble square knot
- Dundee Jamming knot
- Aberdeen termination.

Surgeon's Knot: C-loop Technique (Fig. 5.9)

In this suturing technique consider where the tail of thread exits from the tissue. If the exit is on the right, the right instrument has to form the loop with right concavity (forming a C-loop), the suture has to be wrapped twice around the left hand needle holder, and the short tail of the thread is pulled through the loops. Then the instrument has to form the loop with left concavity (inverted C-loop), so the thread is wrapped once around the right hand needle holder, and the short tail is pulled through this loop. The configuration of the C-loop or inverted C-loop is a fundamental step for the following wrapping.

Dundee Jamming Knot and Aberdeen Termination

It is used for continuous suturing, while suturing the peritoneum. It should not be used where the tissues are under tension. Prepare Dundee jamming knot outside the abdomen. Then keep shorter end of the thread over the longer end, make a loop over loop by using the longer end thrice. Put this knot inside the peritoneal cavity with the help of needle holder and loop should

Fig. 5.9: Surgeon's knot.

be hid inside the trocar while inserting inside the abdomen. Then pass the needle through two edges of the tissue and take the needle out through the loop. Then take continuous suture, then at the end do the Aberdeen termination.

Extracorporeal Knot

Types of extracorporeal knot:

- Trivedi's simple knot
- Roeder's knot
- Meltzer's knot
- Tayside knot
- Tumble square knot.

Trivedi's Simple Knot

In this knot thread has one short arm and other long arm coming out of the trocar. The long arm is held by the assistant firmly, the surgeon keeps left middle finger to rotate the small arm 3–4 times and then a half hitch is made with the short arm. The knot is ready and a closed knot pusher slides the knot where required. These are secure fast, and dependable anytime (Fig. 5.10).

Roeder's Knot

Take the two ends of the thread, and make first single hitch. Make three circles above the hitch around both the ends, then make half circle around one thread and take out the short end of the thread through the loop and slide whole knot over the tissue (Fig. 5.11).

Meltzer's Knot

It is modified Roeder's knot. Instead of single hitch take two hitches, with three circles above the hitches and two half circles (Fig. 5.12).

Fig. 5.10: Trivedi's simple knot.

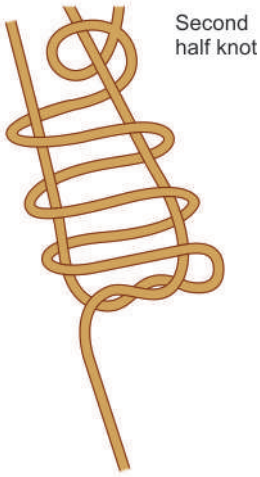


Fig. 5.11: Roeder's knot.

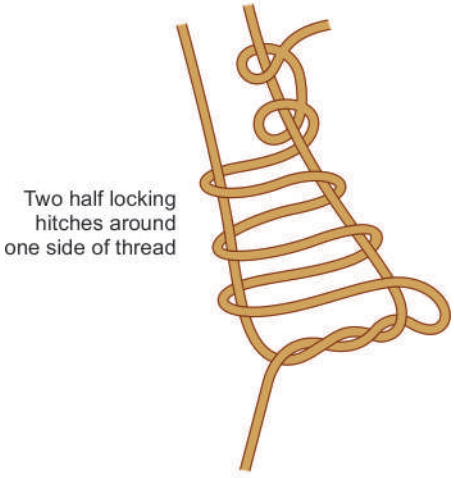


Fig. 5.12: Meltzer's knot.

Tayside Knot

Take one hitch then take three circles below the hitch and take out the short end of thread through the loop between hitch and first circle. It is used in Burch's suspension (Fig. 5.13).

Tumble Square Knot

It is same as intracorporeal, but it is to be done outside the abdomen.

Extracorporeal knot is designed mainly for tying the pedicles with larger vessels. The advantage of the knot is that once tied, it does not slip and get loosened. Apart from tying the pedicles like tubo-ovarian or infundibulopelvic ligament, it is used to approximate the

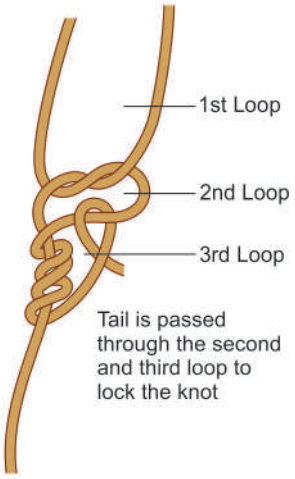


Fig. 5.13: Tayside knot.

uterine wall during myomectomy, during colposuspension or during the sling surgeries for prolapse, to fix Mersilene tape to the uterus or to the vault and to the anterior longitudinal ligament or pectineal ligament.

There are two types of extracorporeal knots. In the first one, the knot is formed by half hitch and the thread is pushed inside to tighten the knot with the help of a variety of "knot pusher". It actually pushes the thread when we are holding both the ends outside.

Other type is actually a "push knot". The knot is formed outside with the lock and then pushed with the knot pusher. To avoid the pedicle getting pulled, the long thread should be held steady (without pulling it) and the knot is pushed until it reaches the site. Only then, the long arm should be pulled slightly to tighten the knot. Premature pulling of the long arm may result into avulsion of the pedicle.

Sometimes when we complete the suturing, there can be ooze from the needle prick site. Here it is wise to wait for some time as the body's natural coagulation system can take care of it. If we interfere, it may increase as the tissue gets harden and the small vessels loose the compression of surrounding tissue. This is especially true when large cutting needle is used for myomectomy or suturing of uterine perforation that occurs during suction and evacuation. The side ports should be far enough from inferior epigastric vessels to avoid injury to them while insertion and removal of needle.

Suturing is one of the occasions to exhibit best of hand-eye coordination, sensory and motor orientation, imagination and anticipation. Though now technically simplified with the help of good needle holders, barbed sutures, auto sutures, clips and readymade loops, imagination of the end point/final picture at its best is the starting point for laparoscopic suturing. Suturing urinary bladder and intestines are very rare incidences in a gynecologist's practice. Tissues should not get pulled under tension and strangulated. The structure to be sutured should be stabilized with an appropriate atraumatic grasper. A short length of suture is more appropriate as it may cut through the tissue while pulling.

Chapter 6

Energy Sources in Minimal Access Gynecological Surgery: Simplified

Prakash Trivedi, Juan De Villegas, Soumil Trivedi

INTRODUCTION

Any form of surgery depends on multiple instruments and effects; one of the most important is an energy source. Though William Bovie in 1923 designed the first monopolar electrosurgical device still, today there is no ideal energy source. The primary requirement is balance between to cut and/or to coagulate tissues. Most of the energy used are electromechanical energies viz.,

- *Electrosurgery:* Monopolar or Bipolar
- *Laser:* Light
- *Mechanical:* Ultrasonic.

Electrosurgery generates heat at the tip of the instrument by current or laser by light and ultrasound mechanically.

- 0–40°C leads to preventable tissue damage
- 40–80°C leads to irreversible tissue damage—protein denaturation coagulation
- 80–100°C leads to collagen denaturation
- 100–150°C leads to drying of tissue—desiccation
- >150°C carbonization charring.

COLLAGEN-ELASTIN RATIO

Collagen-elastin ratio (CER) predicts burst pressure of an arterial seal created by bipolar vessel sealing device. Artery has high CER hence high burst pressure. The amount of collagen in an artery is a better predictor of bursting pressure than the vessel size. Further there are other vessels or tissues which have more elastin, viz. veins, or no collagen—lymphatics hence to desiccate and seal such structure are difficult. Thus we further depend on platelet sealing and the amount and quality of platelets; second, it also depends on the way in which the vessel is transected so if at 90° the lumen of the vessel is small then a vessel cut obliquely which may still bleed. Further in lymphatics because of extremely low collagen irrespective of the method of dissecting or cutting it will still leak, so we use compression. Different tissues have different conductivity for example. Fat is worst to get sealed compared to muscles and vessels.

Harvey Cushing, a neurosurgeon, realized that if we increase the frequency (Hz) the nerves and muscles does not identify—no stimulation above 100 KHz frequency.

Is Electrocautery and Electrosurgery Same?

- Electrosurgery, where body forms part of electrosurgical circuit, high frequency alternating current through living tissue and manipulation of electrons to produce heat within the cells to destroy tissues.
- Electrocautery, where body is not part of any circuit so imprecise direct current through a high resistance metallic conductor, essentially application of heat and burning of tissue.

Properties of Electricity

- Current flow of electrons during a period of time amperes.
- Impedance/resistance obstacle to the flow of current ohms.
- Voltage force pushing current through the resistance volts that decides thermal spread (Fig. 6.1).
- *Electrosurgery:* Dissection, hemostasis, vaporization, fulguration, desiccation, and coagulation.

Conventional Electrosurgery (Fig. 6.2)

- Monopolar, continuous (cut) and interrupted (coag) waveforms current less than 1 amp high voltage 3,000–9,000 V, cut voltage 1,350–4,000 V.
- Bipolar, continuous or interrupted waveforms low current less than 1 amp, high voltage 300–1200 V (Fig. 6.3).
- *Complications:* Direct unintended current, capacitance coupling, lateral spread of untitrated new electrosurgical equipment.

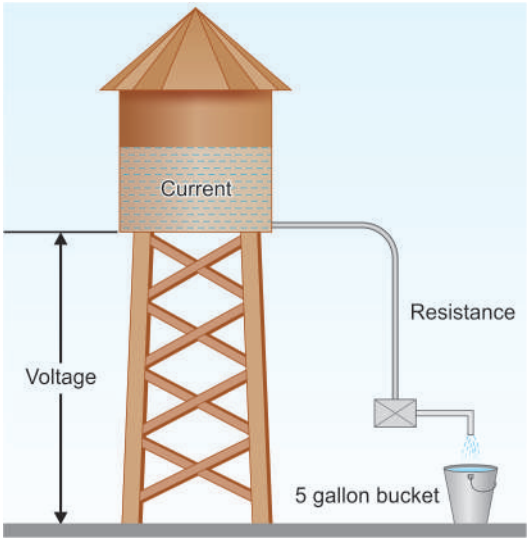


Fig. 6.1: Principles of current, voltage, and resistance.

Fig. 6.2: Bipolar, harmonic, and other vessel sealing devices.

Harmonic (Fig. 6.4) ultrasonic energy to induce high-frequency vibration 55,000/sec generates cavitational effect. Passive blade with Teflon lining to reduce spread of heat.

- Harmonic tissue tension, if increased—divides, decreased—hemostasis.
- Blade sharpness—fast division
- Oblique placement—decreases hemostasis or tightly closed the jaws.
- Time and power setting—decrease setting, increases hemostasis.
- Grip force—lightly—coagulates. Oscillation not current so less tissue sticking, no neuromuscular stimulation, sturdy and good dissector.

Vessel sealing device current—high 4 amp, low voltage 180 V.

- Measures impedance delivers pulsed energy continuous feedback, senses tissue response stops if complete.
- Withstand higher than systolic pressure. Vessel walls are fused.
- Does not depend only on proximal thrombus.

NEW ADVANCED SEALING DEVICES

Martin Maxim Robi, Gyrus PKS, Enseal, Ligasure, Thunderbeat.

Gyrus PKS (Fig. 6.5)

- High-density wave of electron oscillating in electromagnetic field transfer their energy in tissues has vaporization—coagulation—in pulses to cool.
- Deliver high current low voltage with continuous impedance monitoring tissue temperature below 100 °C so protein denaturation. But open unprotected tip 10 mm leads to maximum lateral spread.

Enseal (Fig. 6.6) Forceps with thermosensitive material containing embedded nano-particles on the grasping surfaces. The outer margin conducts electricity into tissue and the inner surface acts as a return electrode with virtually no current dispersion.

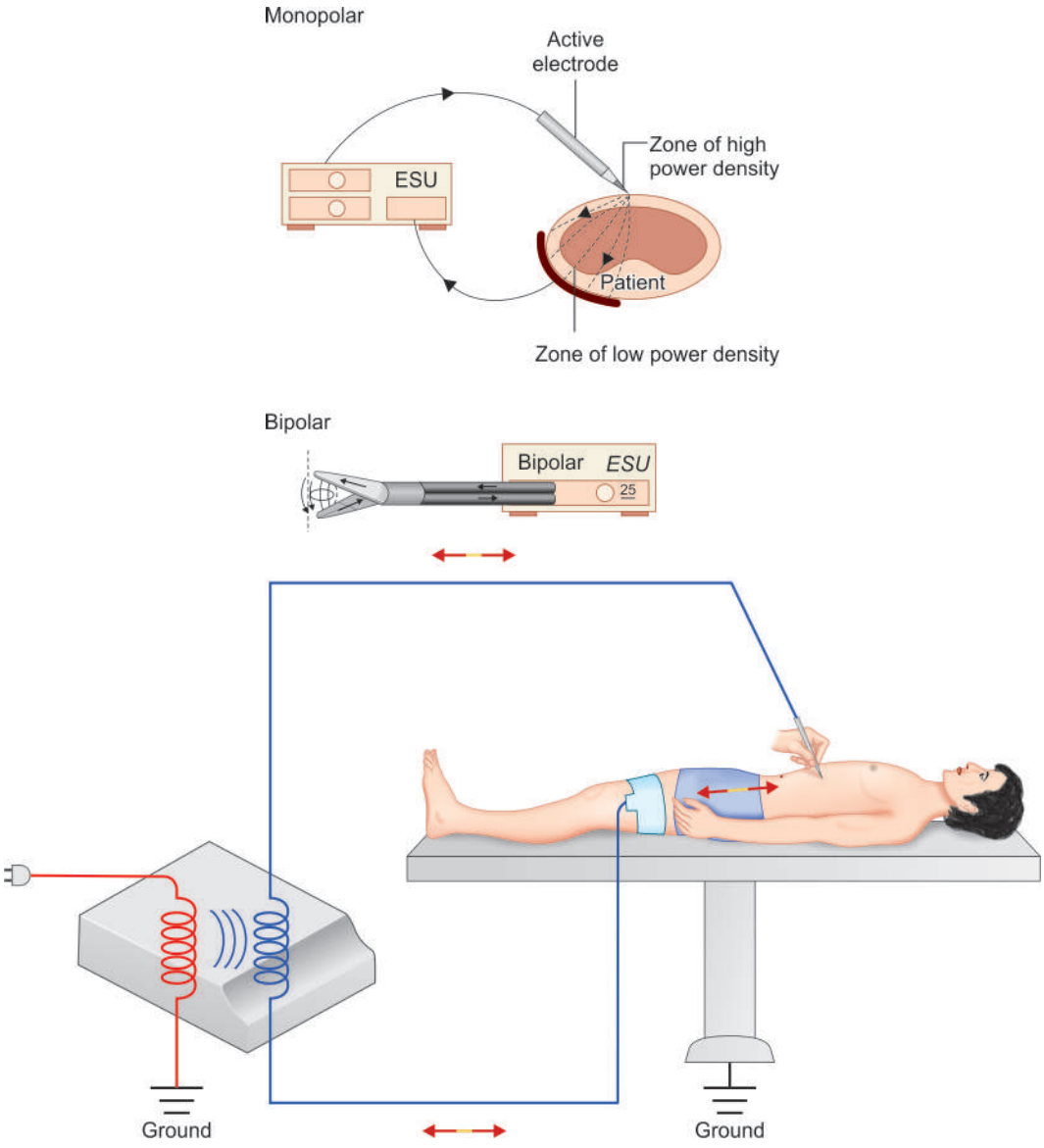


Fig. 6.3: Principles of bipolar and monopolar current.

- Minimal power input no carbonization/sticking and little smoke.
- Slow and variable burst pressure.

Ligasure, (Fig. 6.7) high current (amp) low voltage tissue impedance—modified mechanical compression increased.

Collagen and elastin fibers of vessels denaturated breaking of hydrogen bonds during cooling; cross linking between fibers leads to solid coagulum seals vessels. Hydrogen bonds of denatured protein with adjacent protein chain tangled intertwined matrix of protein strands

Fig. 6.4: Tip of harmonic.

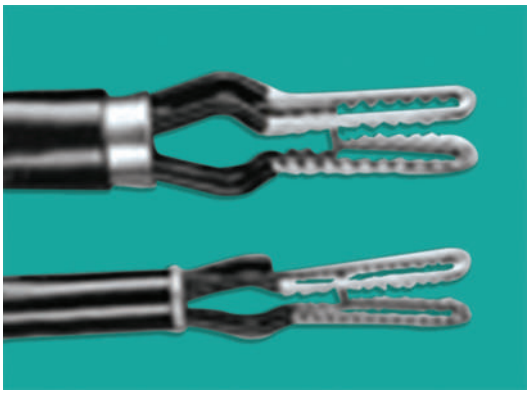


Fig. 6.5: Gyrus PKS.

Fig. 6.6: Tip of Enseal.

Fig. 6.7: Tip of Ligasure.

(*not involving biological coagulation).* Pressure on the jaws increases sticking together of denatured protein, *tissue welding*. Active nichrome heating elements (low voltage DC) with thermally insulated backing.

Isolates heating effect of the jaws closes over comfortable silicone boot mounted on the other jaw. Silicone boot creates narrow high-temperature cut zone flanked by low-temperature coagulation zone and bilateral symmetric shape allows sealing on both sides of cut vessels.

Nichrome (300–400°C) width of cut is bigger; at 1/1000th of mm (500 micron).

Thunderbeat synergistic energy (Figs. 6.8A and B)—an exclusive technology to deliver ultrasonically generated frictional heat energy and electrically generated bipolar heat energy simultaneously and synergistically. *Thunder – Electricity Beat – Wave of Ultrasonic.*

Synergistic energy, output control, wiper jaw mechanism tip design coating thus versatile, fast cut, easy dissection, good hemostatic seal. Reduced mist and good grasp. But one blade oscillates and is unprotected plus the tip is delicate.

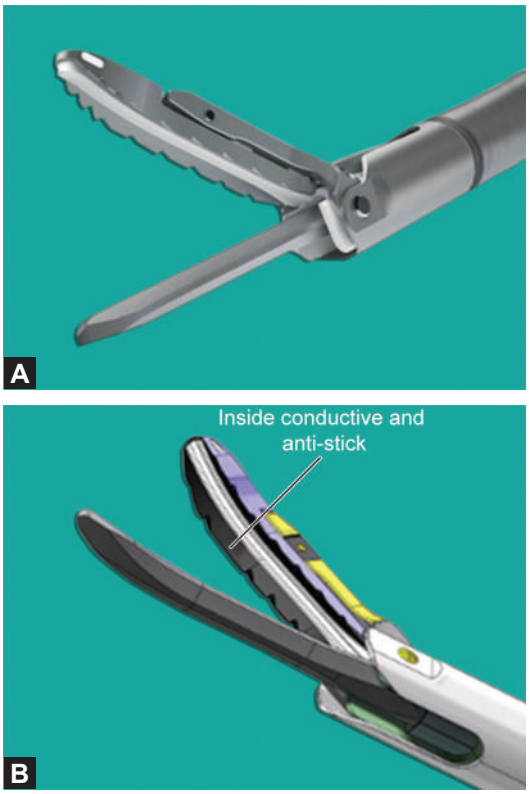
INSTRUMENTATION TECHNOLOGIES

- Laser CO_2, Nd:YAG (neodymium-doped yttrium aluminum garnet), diode laser
- Energy in hysteroscopy
- Resectoscope
- Versa Point
- Current settings in hysteroscopic surgery.

Resectoscopic Procedures: Monopolar

Endometrial or myoma resection 1.5% glycine, 100 W pure cut and 50 coagulation, avoid blended

Disadvantage: Fluid overload, hyponatremia, convulsions, glycine—ammonia toxicity, hepatic failure, and death.



Figs. 6.8A and B: Wiper jaw tip of Thunderbeat.

Bipolar Resectoscopic Surgery

Used with 5% dextrose or dextrose normal saline (DNS), safer, avoids complications of glycine toxicity. However, if fluid overloads more than 2 liters lead to hypokalemia, cardiac side effect, gas embolization and death.

FERTILITY ENHANCING ENDOSCOPIC SURGERY

Least amount of pure cut 60 w.

Bipolar 5% dextrose or DNS.

Versa point, new bipolar cut, Gyrus PKS not superior, but safe and used for office hysteroscopy.

The simplicity, ease, and expertise with which a skilled endoscopic and vaginal surgeon shows the benefits of difficult or complicated surgery, is actually the root cause of genesis of phenomenal morbidity and mortality of the universal application of the same procedures by untrained or poorly experienced surgeons or gynecologists.

Chapter 7

Role of Laparoscopic Surgery in Ectopic Pregnancy

Pandit Palaskar, Soumil Trivedi

INTRODUCTION

A pregnancy that develops following implantation anywhere other than the endometrial cavity is called ectopic pregnancy. The risk of ectopic pregnancy increases three to four times in women between the ages of 35 and 44 years compared to those from 15 to 24 years. About 64% of ectopic pregnancies occur in the ampulla, where fertilization occurs. The recent increase in incidence of ectopic pregnancy has been attributed to a greater incidence of sexually transmitted disease (STD), increased infertility and assisted reproductive technology (ART), delayed childbearing, previous surgical interference, and easy diagnosis.[1]

SITES OF ECTOPIC PREGNANCY

- Tubal ectopic pregnancy (most common) 95–97%.
- Interstitial (cornual) ectopic pregnancy 2–4%.
- Cervical ectopic pregnancy 0.1%. Ovarian ectopic pregnancy 0.5%.
- Abdominal ectopic pregnancy 0.03%.

DIAGNOSIS OF ECTOPIC PREGNANCY

For a successful outcome, an ectopic pregnancy must be diagnosed early, preferably before rupture.

Serum Beta-Human Chorionic Gonadotropin Assay

The β-human chorionic gonadotropin (β-hCG) doubling time can differentiate an ectopic pregnancy from intrauterine pregnancy; a 66% rise in the β-hCG over 48 hours represents the lower limit of normal values for viable intrauterine pregnancies. About 15% patients with viable intrauterine pregnancies have less than 66% rise in β-hCG levels 48 hours, and a similar percentage with ectopic pregnancy have more than 66% rise.[2] Serum β-hCG pattern that is most predictive of ectopic pregnancy is one that has reached a plateau (a doubling time of more than 7 days).

Transvaginal Ultrasonography

Pelvic ultrasound has revolutionized the diagnostic process of ectopic pregnancy. Transvaginal ultrasonography in particular can identify masses in adnexa as small as 10 mm in diameter and can provide more detail about the character of the mass than clinical examination.[3]

Laparoscopy

It remains the gold standard in the detection of ectopic pregnancy. In addition to permitting the diagnosis of an ectopic pregnancy, it enables surgical treatment. Laparoscopy also provides an opportunity to visualize the entire pelvis and other peritoneal organs. In particular, the condition of the unaffected fallopian tube can be assessed as well as the presence of pelvic adhesions and endometriosis. This information may be particularly valuable for those patients interested in future fertility.

MANAGEMENT OF TUBAL ECTOPIC PREGNANCY

Ectopic pregnancy can be treated either medically or surgically. Both methods are effective and the choice depends on the clinical circumstances, the site of the ectopic pregnancy, and the available resources.

Conservative Medical Therapy of Ectopic Pregnancy

- It is proven to be successful in 90% of selected cases
- American College of Obstetrician and Gynecologists recommends methotrexate for patients who desire future fertility and have an ectopic mass less than 3 cm in diameter, with β-hCG levels less than 1500 mIU/mL and no evidence of fetal heart on ultrasonography
- Methotrexate can be given as single dose (1 mg/kg) or multiple dose therapy[4]
- Follow-up is by monitoring β-hCG.

Surgical Management

Laparoscopy is not only suitable for early ectopic pregnancies, but it is also safe and feasible in instances where there is tubal rupture and hemoperitoneum, provided the patient is not severely compromised hemodynamically.

Indications for surgery in ectopic pregnancy include women with the following criteria:

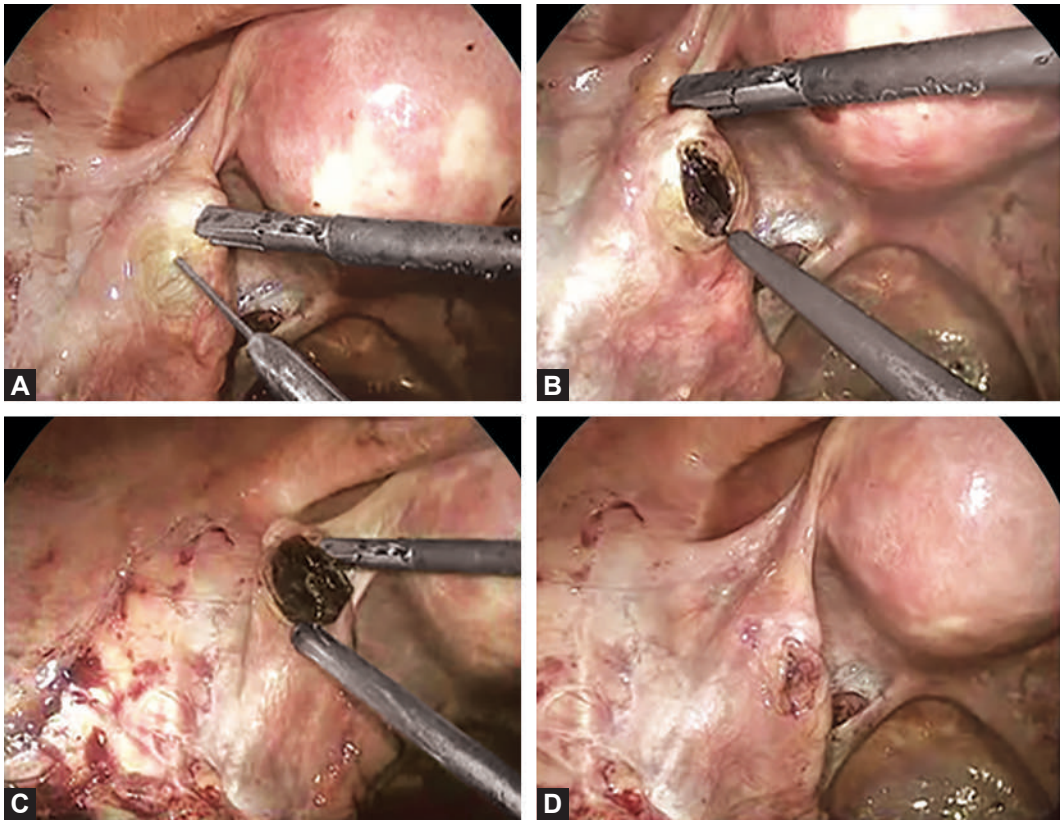
- Not suitable candidate for medical therapy
- Failed medical therapy
- Heterotopic pregnancy with a viable intrauterine pregnancy
- Hemodynamically unstable and need immediate treatment.

Conservative Surgical Treatment

Conservative surgical management of an unruptured ectopic pregnancy usually consists of one of two possible procedures, linear salpingotomy or segmental resection. A conservative surgical approach is possible when the diagnosis of ectopic pregnancy is made sufficiently early so that rupture of the tube has not yet occurred. Currently, most ectopic pregnancies are treated by laparoscopic surgery.

Linear salpingotomy (Figs. 7.1A to D): In women who wish to preserve their fertility, linear salpingotomy is considered the gold standard for the management of a distal tubal pregnancy. If laparoscopy is planned, the location, the size, and the nature of the tubal pregnancy are ascertained. If the bleeding has ceased or can be arrested adequately, ruptured tubal pregnancies can be treated endoscopically. Once bleeding is controlled, the products of conception and blood clots are removed. Heparinized saline should be used in cases of large hematoma. A 10 mm suction instrument is used to clean the abdominal cavity. Good irrigation pressure with normal saline should dislodge the clot and trophoblastic tissue from the serosa of the peritoneal organs with minimal injury to these structures.

For unruptured tubal pregnancy, the fallopian tube is identified and mobilized to minimize bleeding; a 5–8 mL diluted solution containing 20 unit vasopressin in 100 mL of saline is injected with a 20 gauge laparoscopic needle. It should be injected in the mesosalpinx just below the ectopic sac and over the antimesenteric surface of the tubal segment containing gestational sac. After stabilizing the tube by grasper in one hand and microelectrode in other, a linear incision is made on the antimesenteric surface extending 1–2 cm over the thinnest portion of tube. The fine needle tip should be used in the cutting mode, and should barely touch the



Figs. 7.1A to D: Steps of linear salpingotomy: (A) Vasopressin injection in ectopic pregnancy; (B) Incision over tubal ectopic; (C) Expulsion of tubal ectopic products; (D) Incision after removal of tubal ectopic.

tissue surface. The pregnancy usually should protrude through the incision and slowly slips out of tube. It may be teased gently out using hydro dissection or atraumatic forceps. Sometimes good irrigation pressure in the tubal opening can dislodge the gestation from implantation. As products are pulled out or extrudes from the tube, some of the products of conception can remain adhered to the implantation site by a ligamentous structure containing blood vessels. Using bipolar this structure should be coagulated before removing the tissue. The tube is then left open to heal by secondary intention. Depending upon the size of the product of conception ectopic is removed usually through a 10 mm trocar sleeve with a spoon forceps.

Persistent ectopic pregnancy (follow-up after linear salpingotomy): About 5–10% patients who undergo linear salpingotomy are at risk of persistent ectopic pregnancy due to residual live ectopic tissue remaining at the ectopic site.[5] The incidence can be minimized by removing all the chorionic tissue using thorough lavage. Serial β-hCG estimations are performed in the postoperative period. It may take several weeks for the titer to become negative. In patients at risk, the titers plateau or rise after an initial fall.

Risk factors for persistent ectopic: Ectopic in proximal portion of tube, small ectopic pregnancies (<2 cm diameter), early therapy (<42 days from last menstrual period), and high concentrations of β-hCG (>3000 IU/L) preoperatively.

Treatment includes expectant medical therapy (methotrexate) or salpingectomy. In high-risk cases, a single dose of methotrexate 1 mg/kg can be administered postoperatively for prophylaxis.

Segmental Resection

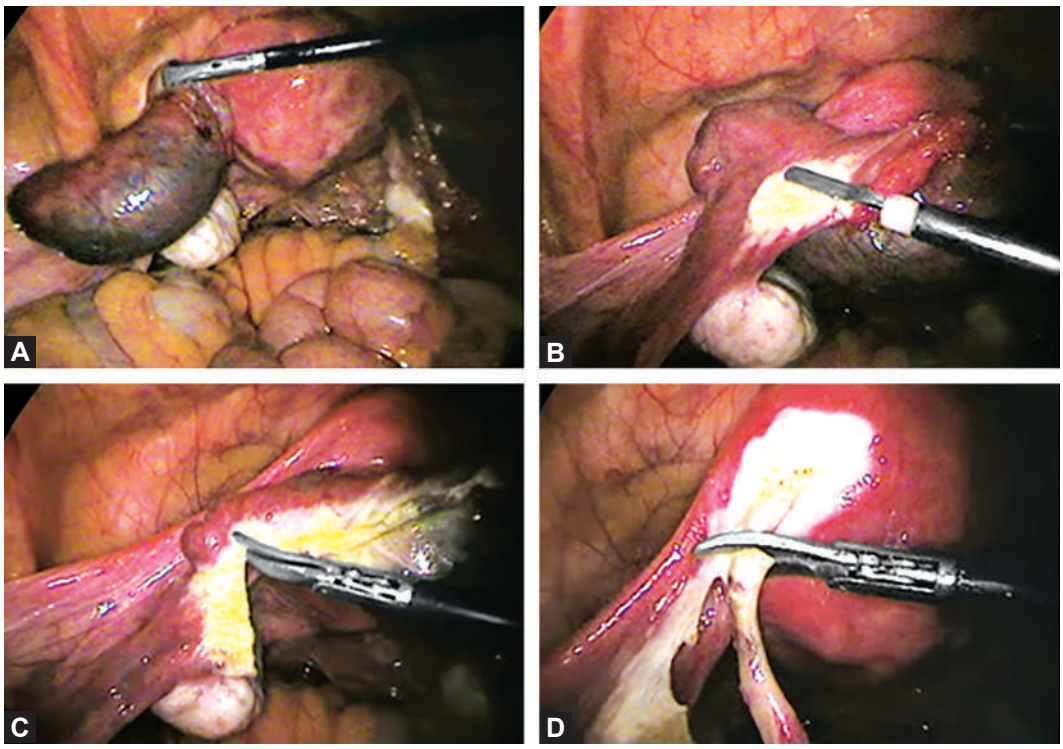
Resection of the tubal segment containing the gestation is preferable to salpingotomy for an isthmic pregnancy or a ruptured tube or if hemostasis is difficult to obtain. The optimal surgical approach to isthmic ectopic pregnancy remains controversial. Three conservative approaches have been described: segmental resection of the involved portion of the tube, segmental resection with reanastomosis at a later operation, and linear salpingotomy. In the isthmus the tubal lumen is narrower and muscularis is thicker than the ampulla. Thus, the isthmus is more predisposed to severe postoperative damage, and the rate of proximal tubal obstruction seems to be higher following linear salpingotomy.

Radical Surgical Treatment

Total salpingectomy is required when a tubal pregnancy has ruptured and a substantial hemoperitoneum has occurred.

Indications for Salpingectomy

- Ruptured ectopic pregnancy with hemoperitoneum
- A recurrent ectopic pregnancy in the same fallopian tube
- An ectopic pregnancy in a severely damaged tube
- Size of ectopic mass more than 5 cm
- Uncontrolled bleeding during linear salpingotomy
- An ectopic pregnancy in women who has completed her family.



Figs. 7.2A to D: Technique of salpingectomy: (A) Left tubal ectopic; (B) Mesosalpinx coagulated; (C) Mesosalpinx cut; (D) Tube transected.

Total salpingectomy (Figs. 7.2A to D) is performed by coagulating and cutting the mesosalpinx, beginning with the proximal portion of the tube to the fimbrial end. The tube is separated from the uterus using bipolar coagulation and scissors or harmonic scalpel. Care should be taken to completely remove the tube from cornual end; otherwise, it can be a site for repeat ectopic pregnancy. The mesosalpinx should be cut close to the tube, avoiding damage to blood vessels in mesosalpinx, to preserve the blood supply to the ovary. The isolated segment containing the tubal pregnancy is removed intact by spoon forceps or in sectioned part, through the 10 mm trocar sleeve. If the tissue is bulky and cannot be accommodated through cannula, endobag can be used for retrieval of tissue.

INTERSTITIAL (CORNUAL) PREGNANCY

Interstitial (cornual) pregnancy is a rare condition that accounts for no more than 2–4% of all tubal pregnancies. Timor-Tritsch and colleagues established transvaginal ultrasonographic criteria for interstitial pregnancy. These criteria include:

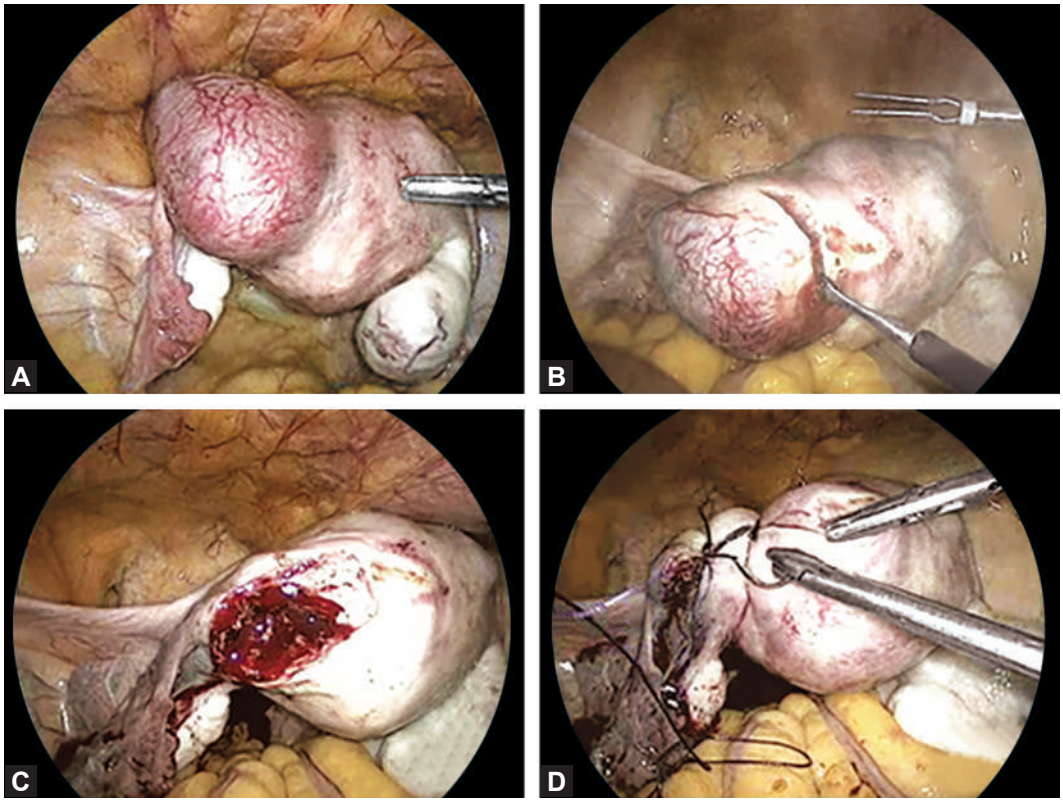
- An empty uterine cavity
- A chorionic sac seen separately and more than 1 cm from the most lateral edge of the uterine cavity
- A thick myometrial layer surrounding the chorionic sac.

Treatment of Interstitial Pregnancy

The choice of treatment depends on the extent of trauma that has occurred in the uterine wall and on the interest of the patient in preserving her child-bearing function. Systemic methotrexate has been used in a limited number of patients with unruptured interstitial pregnancies. If an interstitial pregnancy is observed when it is still small, it might be excised using conservative laparoscopic techniques.[6] For many surgeons cornual resection and repair of the defect by laparotomy remains the standard conservative surgical procedure. In cases when uterine rupture has occurred or a very large interstitial pregnancy is present, rarely a hysterectomy may be required.

Cornual Resection and Salpingectomy Technique (Figs. 7.3A to D)

Whenever possible, the ovary should be saved. Myometrium is infiltrated with diluted vasopressin (20 units in 100 mL saline) to optimize intraoperative hemostasis. The interstitial pregnancy sac is incised in V-shaped manner. Care should be taken to excise minimal myometrium as the tissue retracts once sac is excised and remove all the chorionic tissue



Figs. 7.3A to D: Cornual resection and suturing: (A) Left cornual ectopic; (B) Cornual resection; (C) Cornual resected; (D) Cornual suturing.

by thorough lavage. Myometrial walls are approximated with intracorporeal suturing like myomectomy.

PREGNANCY IN RUDIMENTARY HORN

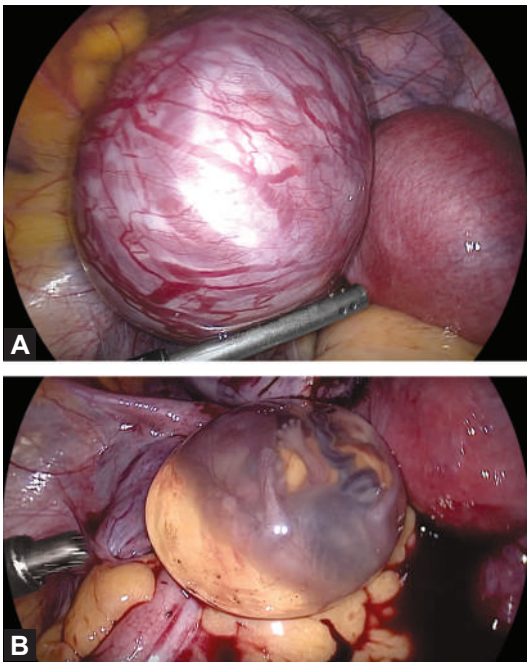
Pregnancy can occur in a rudimentary horn of the uterus, which may be attached to the uterus, quite often grows till 16 weeks. At times it may be difficult to differentiate tubal ectopic pregnancy from pregnancy in rudimentary horn. In such situations laparoscopy is useful, both for diagnosis and treatment. Laparoscopically, the rudimentary horn is excised completely (Figs. 7.4A and B), preserving the ovary.

CERVICAL ECTOPIC PREGNANCY

The cervix is a rare but hazardous site for placental implantation because the trophoblast can penetrate through the cervical wall and into the uterine blood supply.

Paalman and McElin proposed five more clinically practical criteria for the diagnosis of this condition:

1. Uterine bleeding without cramping pain following a period of amenorrhea
2. A soft, enlarged cervix equal to or larger than the fundus (the hourglass uterus)
3. Products of conception entirely confined within and firmly attached to the endocervix
4. A closed internal cervical os
5. A partially opened external cervical os.



Figs. 7.4A and B: Rudimentary horn ectopic pregnancy.

Treatment of Cervical Ectopic Pregnancy

The treatment for a cervical pregnancy is essentially surgical which can be a skillful D and C but the procedure has the potential to be complicated by profuse bleeding, which may require hysterectomy, which can be laparoscopic or abdominal. The preoperative preparations directed to reduce the vascularity of uterine cervix––such as transvaginal ligation of cervical branches of uterine arteries, angiographic uterine artery embolization or intracervical vasopressin injection––may reduce operative morbidity.[7,8] Medical therapy can also be considered for the primary treatment of cervical pregnancy or as an adjunct to surgical therapy through decreased vascularization of the mass. Uterine artery ligation or embolization does reduce bleeding at subsequent D and C.

OVARIAN ECTOPIC PREGNANCY

The pregnancy confined to the ovary represents 0.5–1% of all ectopic pregnancies and is the most common type of nontubal ectopic pregnancy.

Treatment of Ovarian Ectopic Pregnancy

An ovarian pregnancy is easily confused with a leaking corpus luteum hematoma. For this reason, a safe approach is to proceed with localized surgical resection of the bleeding mass with conservation of the ovary, if possible. It is possible to perform surgical resection by laparoscopic techniques. Unless the diagnosis is made late, the ovary can usually be preserved. If the last trophoblastic villus cannot be removed in the ovarian resection, the ovary should be preserved. Any remaining trophoblastic tissue will usually degenerate rapidly or respond to postoperative methotrexate therapy and therefore should produce no long-standing clinical problem. Only rarely if the hemorrhage so profuse that oophorectomy is required to control the bleeding.

ABDOMINAL ECTOPIC PREGNANCY

An abdominal pregnancy is perhaps both the rarest and the most serious type of extrauterine gestation. Abdominal pregnancies are classified as primary or secondary. Most are secondary, the result of early tubal abortion or rupture with secondary implantation of the pregnancy into the peritoneal cavity.

Management of Abdominal Pregnancy

Because the pregnancy can continue to term, the potential maternal morbidity and mortality are very high. As a result, early surgical intervention is recommended when an abdominal pregnancy is diagnosed. Early abdominal pregnancy can be managed by laparoscopy. Advanced abdominal pregnancy is usually managed by laparotomy. At surgery, if the vascular supply of the placenta is identified it can be ligated and removed. If the vascular supply cannot be identified the cord is ligated near the placental base, and the placenta is left in place. Placental involution can be monitored using serial ultrasonography and assessment of

β-hCG levels. Methotrexate is not recommended in this clinical setting because it can hasten trophoblastic degeneration, leading to accumulation of necrotic placental tissue, which may become infected.[9,10]

HETEROTOPIC PREGNANCY

Combined intrauterine and tubal ectopic pregnancies are rare (1:30,000). The incidence is on the rise due to in vitro fertilization and embryo transfer (IVF-ET). Five percent of ectopic pregnancies in IVF-ET are heterotopic.

Treatment of Heterotopic Pregnancy

Laparoscopy has been employed with reasonable success for the treatment of heterotopic pregnancy. Expectant management has no role, methotrexate therapy is contraindicated. During laparoscopic procedure uterine manipulator is not used. Three accessory ports may be used. Salpingectomy is performed using endoloop technique; electrocoagulation is avoided if possible.[11,12]

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Chapter 8

Laparoscopic Surgery for Adnexal Mass

Prakash Trivedi, Pallavi Erlekar, Ankita Fatnani

INTRODUCTION

The uterine adnexa consists of the ovaries, the fallopian tubes, and the uterus with ligaments. The adnexal pathology is ovarian cyst: simple, pseudomucinous, dermoid, hemorrhagic corpus luteum, chocolate cyst, and malignancy; solid ovarian tumor: benign or malignant; ectopic pregnancy: tubal isthmocornual, rudimentary horn, ovarian, and abdominal; hydrohematopyosalpinx: tubo-ovarian mass or abscess and pelvic inflammatory disease.

PREOPERATIVE EVALUATION

Diagnosis with thorough history, clinical examination, per vaginal examination and per rectal examination, and transvaginal sonography should be done. Routine blood investigations and tumor markers like CA125, carcinoembryogenic antigen (CEA), alfa-fetoprotein, beta-human chorionic gonadotropin (β-hCG) is to be done. Color Doppler is useful to rule out malignancy. An occasional computed tomography (CT) scan, magnetic resonance imaging (MRI) is useful in suspicion of malignancy. In history, it is important to notice any weight loss or gastrointestinal symptoms or edema feet especially in suspected ovarian pathology and an elderly woman.

In a suspected ectopic pregnancy history of amenorrhea, pain in abdomen, syncopal attack, and important history of any previous surgery or disease like Koch's etc. is important.

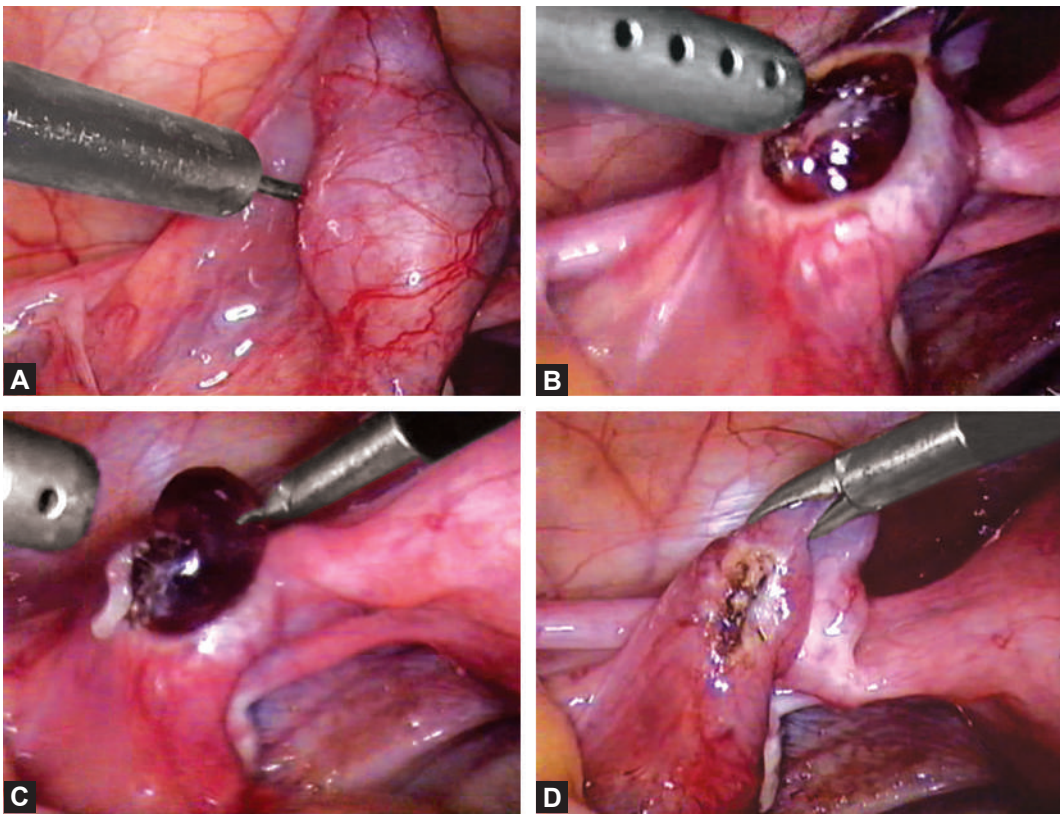
Ultrasonography showing ovarian cysts or masses more than 5 cm in diameter with thick septae, solid partly or papillary projections, bilaterality, indefinite margins, ascites, fluid in Pouch of Douglas, and excrescences of entire surface are highly suspicious of a malignant potential.

ECTOPIC PREGNANCY

Conservative Surgery

Salpingotomy (Figs. 8.1A to D)

The standard four ports inserted after evaluation, if there is a ruptured ectopic pregnancy, suction is done with suction cannula. The side, size of ectopic pregnancy, and the tubal



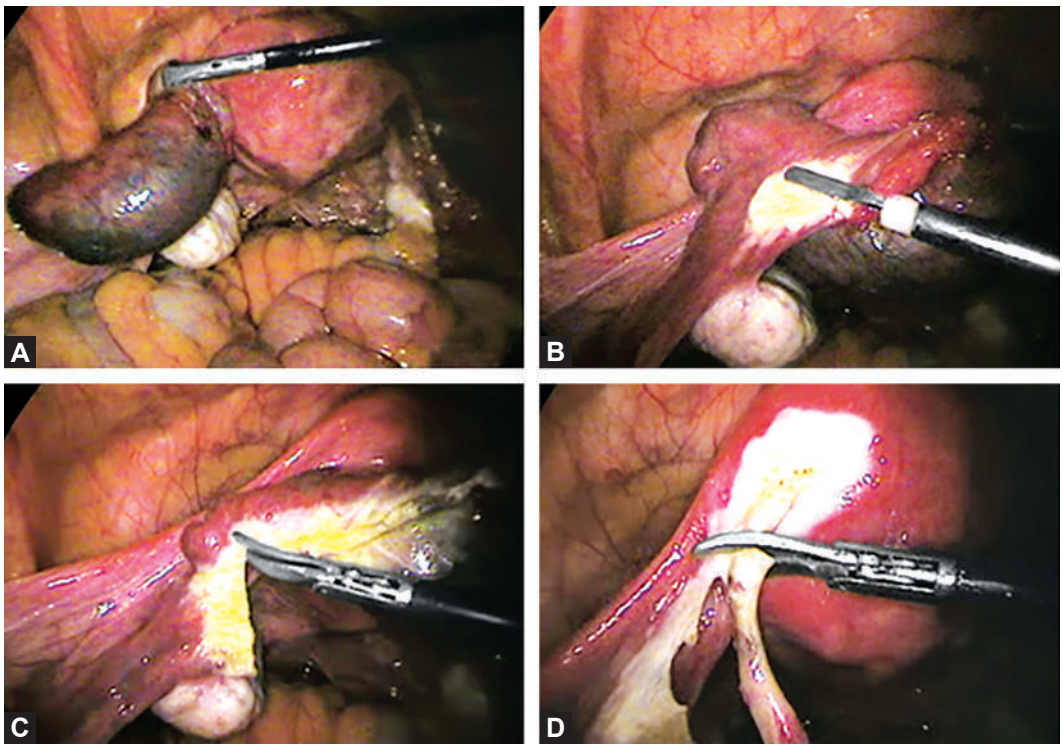
Figs. 8.1A to D: Steps of linear salpingotomy: (A) Vasopressin injection in ectopic pregnancy; (B) Incision over tubal ectopic; (C) Expulsion of tubal ectopic products; (D) Incision after removal of tubal ectopic.

status are assessed thoroughly in unruptured ectopic pregnancy instill dilute vasopressin in the mesosalpinx and the antimesenteric border. The proximal part of tube close to ectopic pregnancy is stabilized by grasper and with the monopolar point with a cutting cautery current an optimum incision is made on the tubal seromuscular area. Separate the ectopic pregnancy from the surrounding tubal mucosal attachment with the help of suction irrigation cannula. Then gently remove the products of conception by suction or with help of grasper. Bleeding from incised area is coagulated with bipolar forceps.

Salpingectomy (Figs. 8.2A to D)

Indications for salpingectomy:

- Ruptured ectopic pregnancy with hemoperitoneum
- A recurrent ectopic pregnancy in the same fallopian tube
- An ectopic pregnancy in a severely damaged tube
- Size of ectopic mass more than 5 cm
- Uncontrolled bleeding during linear salpingotomy.



Figs. 8.2A to D: Technique of salpingectomy: (A) Left tubal ectopic; (B) Mesosalpinx coagulated; (C) Mesosalpinx cut; (D) Tube transected.

An ectopic pregnancy in women who has completed her family, total salpingectomy is performed by coagulating and cutting the mesosalpinx, beginning with the proximal portion of the tube to the fimbrial end. The tube is separated from the uterus using bipolar coagulation and scissors or harmonic scalpel. Care should be taken to completely remove the tube from cornual end otherwise, it can be a site for repeat ectopic pregnancy. The mesosalpinx should be cut close to the tube, avoiding damage to blood vessels in mesosalpinx, to preserve the blood supply to the ovary. The isolated segment containing the tubal pregnancy is removed intact or in sectioned part, through the 10 mm trocar. If the tissue is bulky and cannot be accommodated through cannula, endobag can be used for retrieval of tissue. Lavage the upper abdomen in reverse Trendelenburg position to remove blood collected in the subdiaphragmatic space. Adhesion can be treated simultaneously without significantly prolonging the operation.

OPERATIVE TECHNIQUE

A standard four ports introduced. Intraoperatively cell washings from the pelvis and upper abdomen should be collected and sent for evaluation.

Mass characteristics, age of the patient should be seen and decision taken whether to do oophorectomy or cystectomy.

Laparoscopic Ovarian Cystectomy

There are three methods:

1. Drainage
2. Excision
3. Thermal ablation or coagulation.

Ovarian cystectomy removes the cyst intact with minimal trauma to the residual ovarian tissue or the cyst fluid can be drained to minimize spillage and facilitate its removal. Aspiration is preferred for functional cysts (Fig. 8.3).

Thermal ablation does not destroy the entire cyst wall, and the underlying ovarian cortex can be damaged by the heat. Therefore, excision is preferred.

Removal of cyst intact with minimal trauma to ovarian tissue is very difficult. If cyst is more than 10 cm then with 18 gauge needle pouch of Douglas (POD) fluid aspirated and sent for examination. Cyst wall identified and separated from ovarian tissue by applying 2 claw forceps on cyst wall and ovarian wall each and pulled apart. Cyst is punctured and opening is increased to accommodate suction irrigation.

Bipolar is used to control bleeding. For densely adherent cyst to lateral pelvic wall, sharp dissection should be done. Cyst can be removed intact in endobag.

Benign Cystic Teratoma

There are three types:

1. Solid
2. Cystic
3. Immature.

The immature teratomas are pure teratomas containing variable amount of immature tissue derived from any of the three germ cell layers. The development of the plane is very important, which may be done with the help of hydrodissection, or sharp dissection (Figs. 8.4A to D). After excision of cyst the base is coagulated with bipolar forceps if bleeding is present. The

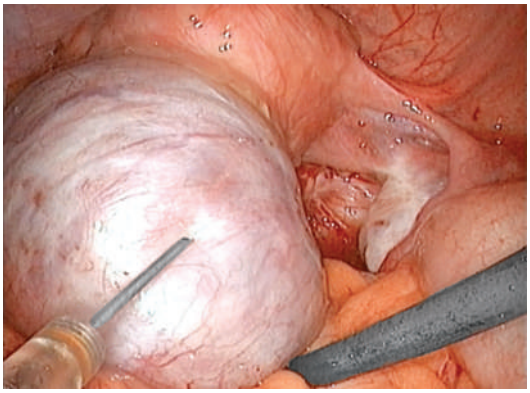
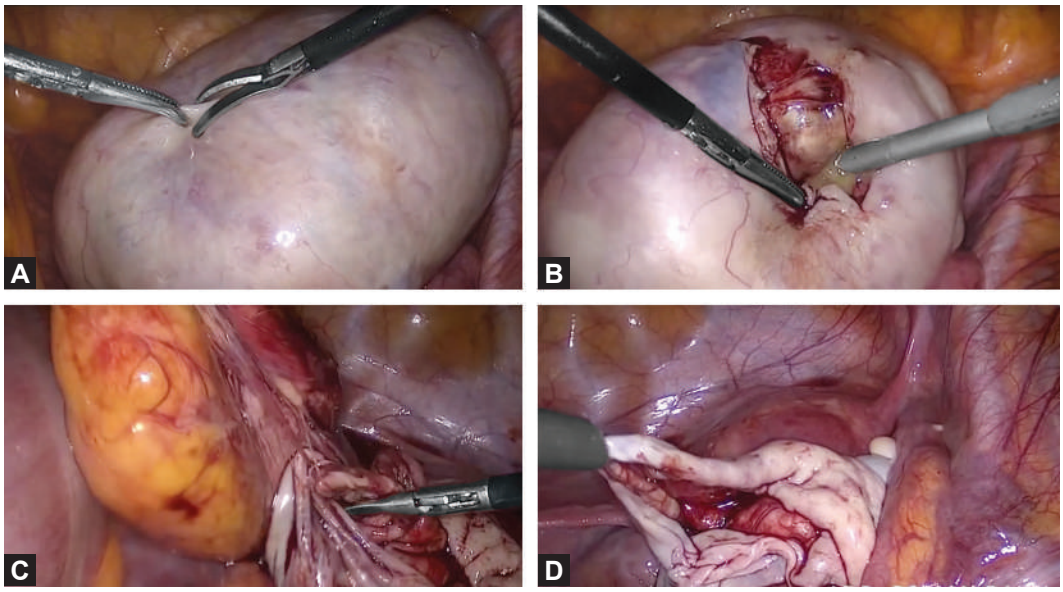


Fig. 8.3: Ovarian cyst.



Figs. 8.4A to D: Steps of excision of teratoma: (A) Making an incision on prominent part of cyst; (B) Suction of the cyst material; (C) Enucleation of teratoma; (D) Hemostasis checked.

edges of the ovaries are left open to heal. The suturing avoided as this causes bleeding, cutting through and postoperative adhesions.

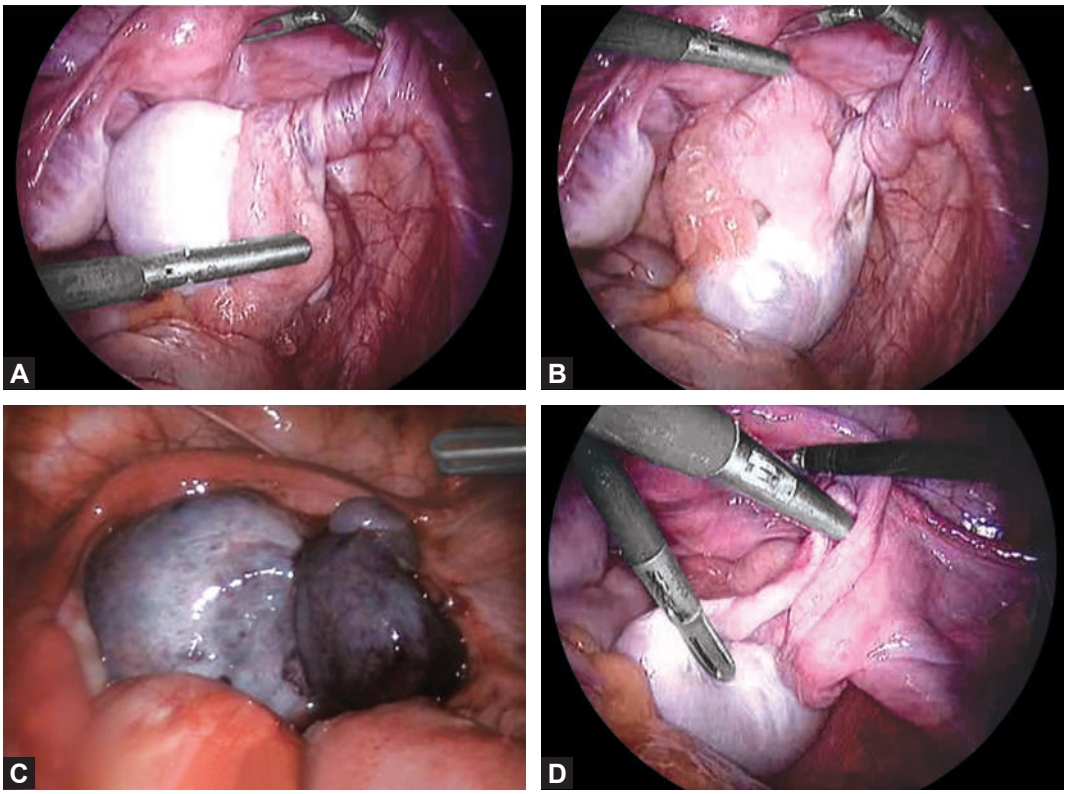
Torsion of Ovarian Cyst

Adnexal torsion is a surgical emergency. If detected early, the torsion can be untwisted. When the diagnosis is delayed, the cyst becomes hemorrhagic, necrotic and ischemic. The affected structures regain color after untwisting indicating viability of the organ (Figs. 8.5A to D). Too much delay causes gangrenous changes in the cyst which are irreversible and a salpingo-oophorectomy is advocated. The causes of ovarian or adnexal torsion include paraovarian cysts, functional and pathologic ovarian cysts, ovarian hyperstimulation, ectopic pregnancy, adhesions and congenital malformations. The ischemic structures are straightened gently with atraumatic forceps to avoid additional damage. In women with ovarian hyperstimulation, the functional cysts should be drained before untwisting. The abnormalities contributing to torsion should be treated.

Hydrosalpinx

Criteria to remove a hydrosalpinx in infertility patients:

- If the size is more than a thumb or easily seen on transvaginal sonography.
- Pyosalpinx or hematosalpinx
- Draining in uterine cavity during stimulation phase to avoid embryo toxic effect and defer embryo transfer.
- No rugae or mucosal folds on hysterosalpingography (HSG).



Figs. 8.5A to D: Twisted ovarian cyst: (A) Right twisted ovarian cyst; (B) Untwisting in process; (C) Necrotic ovary; (D) Untwisted ovarian cyst.

CONSERVATIVE SURGERY FOR HYDROSALPINX

The distended fimbrial end is stabilized with two nontraumatic graspers through lower left and right contralateral ports. The distended fimbrial end is punctured with monopolar needle fluid drained and cruciate incision with CO_2 laser taken from puncture site. The fimbrial ends everted and coagulated. The methylene blue dye injected and spillage is confirmed. Thorough lavage is given and hemostasis achieved (Fig. 8.6). The patency of fallopian tube is achieved in more than 75–80% and the pregnancy rate is never more than 12%. There are 8% chances of ectopic pregnancy.

TUBO-OVARIAN ABSCESS

The standard three ports inserted. The abdominal cavity thoroughly rinsed with irrigating fluid to remove blood, pus, and debris. With the blunt dissection probe omentum, small bowel, and large bowel are carefully dissected from the pelvic structures. The entire abscess cavity is rinsed to avoid contamination. Adnexal structures dissected free. Abscess cavity is

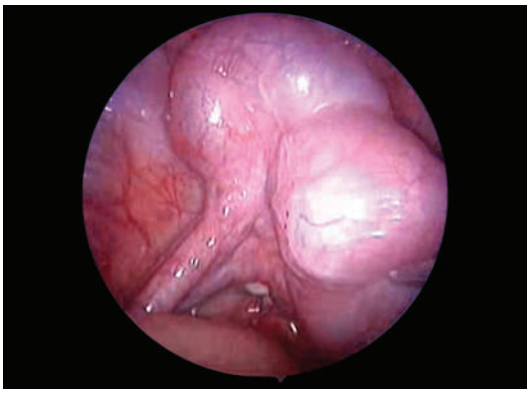


Fig. 8.6: Left-sided hydrosalpinx.

removed with tissue grasping forceps. The residual bleeding is controlled with the monopolar cautery.

Functioning rudimentary horn is excised like ectopic in rudimentary horn.

Ovarian fibroma is treated by laparoscopic oophorectomy.

ROLE OF LAPAROSCOPY IN OVARIAN MALIGNANCY

It has limited value in ovarian malignancy. It is used for staging laparoscopy. It may be attempted in small tumors suspected to be malignant in young patient in whom ovariectomy is attempted. It is used for retroperitoneal lymph node dissection in cancerous ovary.

Chapter 9

Laparoscopic Surgery for Endometriosis: Endometrioma

Prakash Trivedi, Soumil Trivedi, Megan Wasson

INTRODUCTION

Endometriosis is a nagging, perplexing, and less conquerable pathology. About 176 million women in the world suffer from endometriosis. Commonly presents with dysmenorrhea, infertility, dyspareunia, and dyschezia. Diagnosis is by history, clinical examination, sonography, and occasionally magnetic resonance imaging (MRI). Apart from medical treatment, laparoscopy is of gold standard, with variety of appearances, the classic "powder burn" lesions, red lesions, white lesions, peritoneal retractions, and endometriotic cysts or "chocolate cysts". The severity of endometriosis is usually expressed by the classification system developed by the American Society for Reproductive Medicine. In planning treatment many variables must be considered, such as age of patient, extent of disease, degree of symptoms, desire for fertility, and anti-Mullerian hormone (AMH) level. European Society of Human Reproduction and Embryology (ESHRE) endometriosis guideline development group September 2013 documents laparoscopic surgery for endometriosis has good spontaneous pregnancy rate, relief of pain, and even in Grade III/IV (Fig. 9.1) useful and complimentary to advance infertility treatment to achieve good results in infertility and pain.

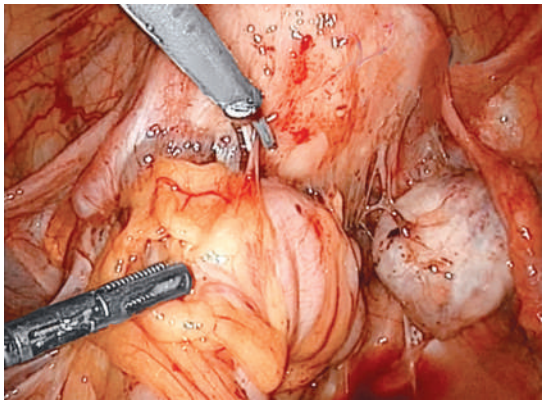


Fig. 9.1: Stage IV endometriosis with frozen pelvis.

PREOPERATIVE ASSESSMENT

Good preoperative investigations, evaluation, and counseling are important with special care given to patient's severity of symptoms, pain, severe dysmenorrhea, and desire for pregnancy. In infertile patients, ovarian conservation is given prime importance. It is important to assess the involvement of rectovaginal septum to plan for a difficult dissection or a probable rectal repair.

Bowel preparation is mandatory, fitness for anesthesia and surgery with proper operation theater facility and expertise.

MAIN PRINCIPLES OF SURGERY

- Adhesiolysis of ovary with endometriosis, uterus and bowel.
- Restoration of anatomy, drainage of endometrioma.
- Excision of the disease, with preserving healthy ovarian tissue.
- Additional procedures rarely presacral neurectomy.

OPERATIVE TECHNIQUE

Usually a standard four puncture pelvic laparoscopy is done. The primary evaluation of pelvis, the extent of disease, and visualization of the rest of abdominal cavity are done.

In a case of 5–6 cm endometrioma, usually first adhesiolysis is done, invariably the endometrioma opens up. The chocolate material is removed by suction. The ovary is next separated by surrounding structures. Next with two grasping forceps the cyst wall and the ovarian tissue are held with the assistance of scissor, the space is created between these two structures. Systematically the cyst wall is removed and only occasional area have little bleeding on ovarian site is fulgurated. For bilateral ovarian endometrioma, the steps of the surgery are same (Figs. 9.2A to D). Additional dissection of any rectovaginal or uterosacral endometriosis is done safely with a probe inserted in the rectum.

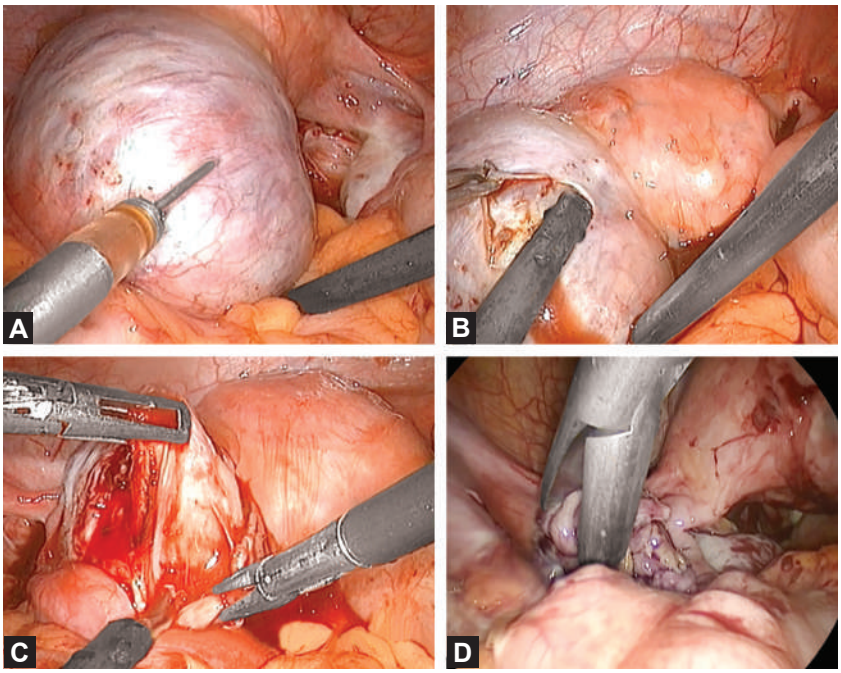
In recent times very often, dilute vasopressin is injected by few endoscopists to make the dissection easy and with less bleeding.

Very often peritoneal cavity has scattered red, white, brownish lesions, which are fulgurated. Use of CO_2 laser is optional as it is costly and also to set the laser unit takes time. The separated cyst wall is usually removed from the left lower port and sent for histopathology.

LARGE ENDOMETRIOMA

The essential difference between large endometrioma compared to the smaller ones is, due to a very big size of the endometriotic cyst, the adhesions may be few. It is easier to drain the entire endometrioma and make a small fenestrum (window), the cyst wall is peeled. Care is taken while peeling of the cyst wall to avoid button holing the normal ovarian tissue. The other side ovary and pelvic anatomy is visualized and all the remaining steps are done like the small endometrioma.

Large endometriosis adhere tenaciously to hilar blood vessels and attempts to strip or excise them can cause considerable bleeding. Controlling brisk hilar bleeding with bipolar coagulation risks devascularization and death of the ovary. To save the ovary, small portion of the ovary may be left attached to the hilum.



Figs. 9.2A to D: Step-by-step endometriosis cyst wall removal: (A) Injection of dilute vasopressin in the cyst wall; (B) Making an incision in the avascular plane; (C) Peeling of cyst wall from ovary; (D) Removal of cyst wall with spoon forceps.

In severe endometriosis, there will be adhesions, endometriomas and or obliteration of Pouch of Douglas (POD). Adhesions can involve bowel, bladder, tubes, ovaries, and uterus. The severity of adhesions depends on the number and type of previous surgeries, duration of endometriosis, and previous medical treatment.

GENITOURINARY ENDOMETRIOSIS

Ureteral involvement is reported in 1–11% of women diagnosed with endometriosis. Bladder lesions are excised in the same way as peritoneal disease followed by cystoscopy to rule out mucosal involvement. All the peritoneum over bladder is completely removed, peritonealization occurs in 1–2 weeks. Adhesion formation is prevented by using interceed.

RECTOVAGINAL ENDOMETRIOSIS

This is a different and a difficult condition fortunately not as frequent as other endometriomas. There is a clear debate that this is rectovaginal endometriosis is actually adenomyosis. Commonly they present with severe dyschezia, deep dyspareunia, and not infertility.

Apart from history, diagnosis of rectovaginal endometriosis is made by per vaginal, per rectal examination quite often simultaneously. A nodular area is palpated which may be tender. The rectal mucosa is checked for involvement in the disease. A transvaginal sonography and a transrectal sonography can be useful for diagnosis with color Doppler. MRI and pelvic soft

tissue imaging of the rectovaginal septum is diagnostic and also gives prognosis with respect to degree of involvement of rectovaginal septum and uterosacral ligaments.

After thorough preoperative evaluation and counseling, if laparoscopy surgery is planned then an expert gynecological endoscopist along with a colorectal surgeon is mandatory. A difficult medicolegal issue arises as we have to take a consent of diverting colostomy though needed in occasional case.

Important Brief Steps of Surgery

Two days of liquid diet and a good bowel preparation is compulsory along with proper consent.

Laparoscopic surgery is done with standard port placement; however, a good uterine manipulator vaginal and rectal probe is very useful.

Quite often there is also frozen pelvis, so a careful dissection separating the bowels is done for the deeper endometriosis the surgery begins from the pelvic brim starting from normal tissue identifying both the ureters which very often are pulled medially, ureterolysis and lateralization is important. At this stage, once the uterus is seen, dilute vasopressin is injected by few endoscopist. The uterus is manipulated to get maximum anteversion. The rectovaginal dissection usually starts with scissors more toward the uterus than the rectum. Inevitably you enter the rectovaginal endometriosis disease area but safely away from the rectum; a steep Trendelenburg position with a rectal probe taking the rectum away from the area of dissection. The dissection is carried from the center laterally wherein uterosacral involvement if present will come for dissection. Once a good plane is established then dissection is carried towards the vagina. The disease area drops down once all the disease area is separated from the normal tissue with the help of tenaculum, single tooth grasper the rectovaginal disease is held and again with scissors it is separated from the rectum. If the vagina is open accidentally then the rectovaginal nodule is removed vaginally. However, usually opening of the vagina is avoided unless hysterectomy is also indicated. The ureters, bladder, bowel and surrounding structures are observed after achieving proper hemostasis. At this stage, usually the pelvis is filled with 400–500 mL of saline, next rectally either a flatus tube or a Rubin's cannula is inserted which is connected to a 50 cc syringe with air and a Luer Lock to inject 150 cc of air in the rectum. Laparoscopically the water filled pelvis is seen for any air leak which signifies a bowel rectosigmoid injury.

However, once rectosigmoid integrity is checked, fluid is removed and then the rectovaginal disease nodule is separated are taken out through the left lower port. A 28 gauge drainage tube is inserted from one port and stabilized in the rectovaginal space. Pneumoperitoneum is removed and all the trocars are withdrawn, urosac is checked for adequacy and color of urine.

All these patients need much more intense postoperative care in terms of higher antibiotics, close monitoring, drainage output, etc. usually oral liquids and oral diet is started slowly after patient gives history of passage of flatus and confirming peristalsis.

In any endometriosis surgery, it is more important to give a proper postoperative treatment which is to reduce pain, recurrence and in cases of infertility to start active fertility treatment.

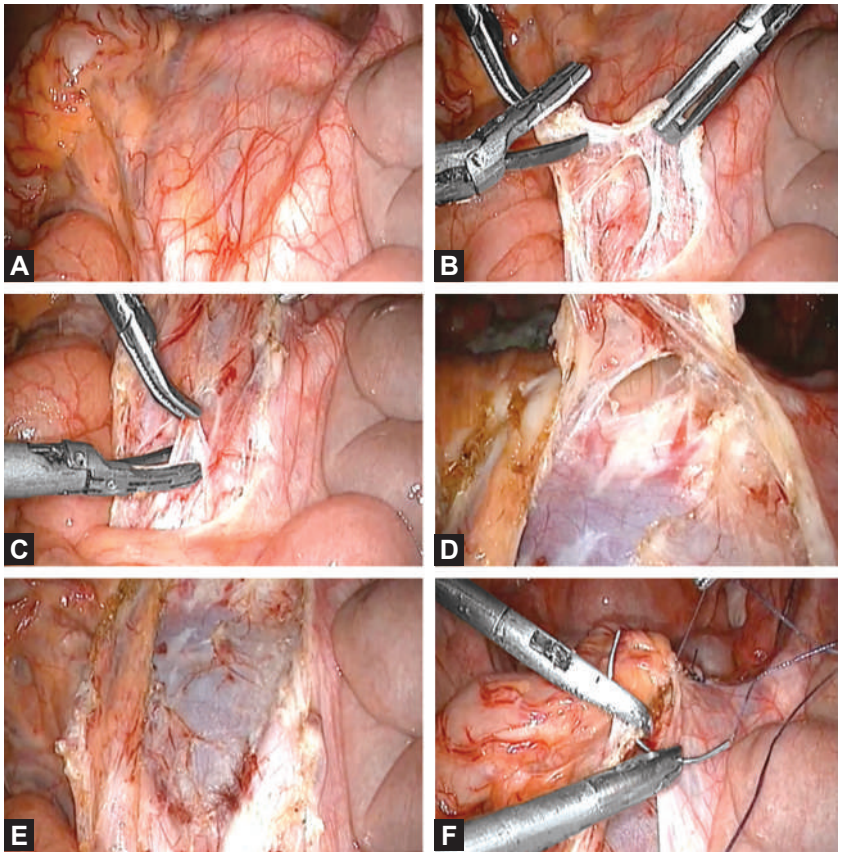
RECURRENT ENDOMETRIOSIS

It occurs in 25–27% of cases. It is better to avoid laparoscopic surgery for recurrent endometriosis especially in infertility cases. If ever needed surgery with drainage then do after confirmation with AMH levels.

PRESACRAL NEURECTOMY

Division of the superior hypogastric plexus is useful as an adjunctive procedure to eliminate the uterine component of dysmenorrhea. The plexus is formed as a continuation of the aortic and inferior mesenteric plexuses and passes over the bifurcation of aorta. It then continues, below the promontory of the sacrum before dividing into the right and left inferior hypogastric nerves. The procedure is carried out by inserting a 10 mm trocar in midline and placement of two accessory ports in each iliac fossa. A steep Trendelenburg position is given, the intestines are displaced cephalad and the bifurcation of the aorta and sacral promontory is exposed. Segments of the superior hypogastric plexus are removed by sharp dissection and electrosurgery. Bleeding is controlled by bipolar cautery (Figs. 9.3A to F).

Repeated laparoscopic surgery should not be done. It should be well supported with medical treatment.



Figs. 9.3A to F: Laparoscopic presacral neurectomy: (A) High port placement allows visualization of presacral area with aortic bifurcation; (B) Peritoneum overlying presacral area lifted and incised; (C) Nerves of presacral plexus identified and excised; (D) Neuro-fatty tissue excised up to sacral promontory avoiding the venous plexus and middle sacral artery; (E) Entire presacral area bared; (F) Presacral peritoneum closed.

Chapter 10

Laparoscopic Surgery for Fibroid

Soumil Trivedi, Mahindra Borse

INTRODUCTION

Leiomyomas of the uterus are benign, monoclonal uterine myometrial tumors that affect 25–45% of reproductive age women. Since the advent of better diagnostic modalities like ultrasonography, more and more fibroids are being detected incidentally even in asymptomatic women. Patients of fibroids present with menorrhagia, metrorrhagia, occasional dysmenorrhea, infertility, pressure symptoms on ureters, bladder or rectum, many present as lump in pelvis or abdomen, few are detected on sonography done for routine or other medical check-up.

PATIENTS WORK-UP

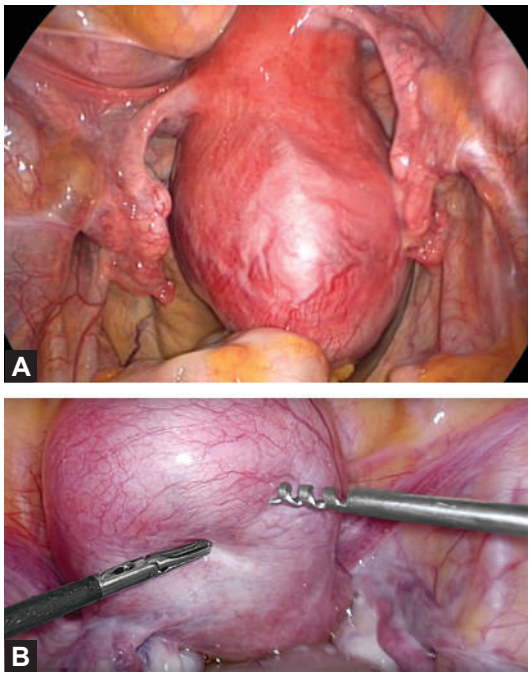
As nearly 40% of the fibroids need no treatment, presuming once we have a proper indication for the removal of the fibroids, a proper workup is mandatory. This includes accurate location, size, number, any other associated pathology, sonography, color Doppler and occasionally computed tomography (CT) or magnetic resonance imaging (MRI). Investigations for fitness for anesthesia and surgery, proper consent, and counseling are needed. The actual benefit, success and outcome results with limitation should be explained to the patient.

ACCEPTED INDICATIONS FOR MYOMECTOMY

- The presence of a submucous fibroid 2–5 cm
- Intramural fibroid more than 4 cm distorting the cavity, infertility of more than 3 years
- Large fibroid altering tubo-ovarian relationship
- Multiple large fibroids (space problem for pregnancy)
- Large fibroid causing back-pressure to kidneys
- Low large cervical fibroid likely to obstruct labor
- History of recurrent abortions.

IMPACT OF FIBROIDS BASED ON LOCATION

- *Intramural fibroids (~5 cm),*
  - Lower implantation rates (13.6% vs 20.2%)
  - Lower pregnancy rates (34.4.% vs 47.5 %)
  - Lower delivery rates (22.9% vs 37.7 %).



Figs. 10.1A and B: (A) Large posterior wall fibroid; (B) Large anterior wall fibroid.

- *All large myomas (>7 cm) and cavity distorting myomas* should be removed, if planning for an in vitro fertilization and embryo transfer (IVF-ET) cycle.
- *Subserosal (Figs. 10.1A and B) (<7 cm)* have very little effect on IVF-ET cycles
  - In 6,087 IVF cycles, presence of *noncavity distorting* intramural fibroids *reduced live birth rate (LBR) by 21% and clinical pregnancy rate (CPR) by 15%* compared to no fibroid.

TREATMENT STRATEGIES

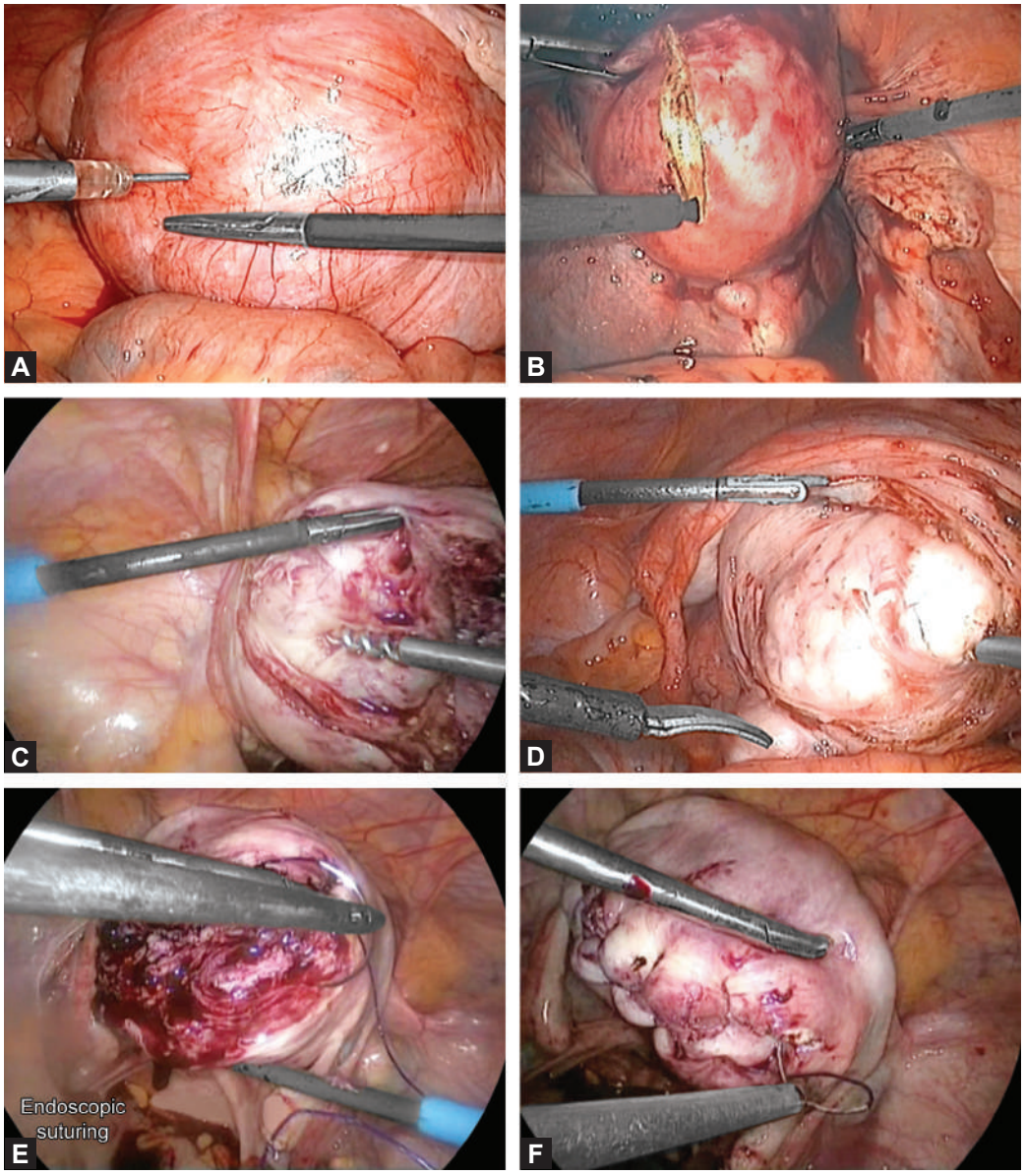
Medical Treatment

The drug, which can be temporarily used, is gonadotropin-releasing hormone (GnRH) analog depot in a patient of fibroid with significant size and having severe anemia—hemoglobin less than 8 g%, mainly to reduce vascularity of the fibroid, size of fibroid, reduce blood loss during removal of fibroid and most important is to build her hemoglobin prior to surgery. However, we have observed that use of depot preparation especially for laparoscopic myomectomy merges the plane of myoma and myometrium making surgery difficult.

Mifepristone is evaluated for treatment of symptoms of fibroids with fair success. Drugs like ulipristal acetate were introduced recently with great promise, in a symptomatic patient with fibroids 5 mg ulipristal for 3 months can be given followed by two cycles gap and then plan infertility treatment. The issue of hepatic dysfunction in 8 out of 7,65,000 patients given ulipristal acetate is a matter of concern.

Surgical Removal of Fibroids

The steps of laparoscopic myomectomy depicted in Figures 10.2A to F. In this chapter, we will cover fibroids at different locations and technique related to their safety. In-bag morcellation is covered in the next chapter.



Figs. 10.2A to F: Steps of the myomectomy: (A) Injection of dilute vasopressin by special needle; (B) Incision with monopolar spatula; (C) Fibroid stabilized with myoma screw while removal; (D) Fibroid enucleated with care; (E) Laparoscopic suturing of myometrial defect; (F) Final look after completing laparoscopic suturing of myometrium.

Broad Ligament Fibroid

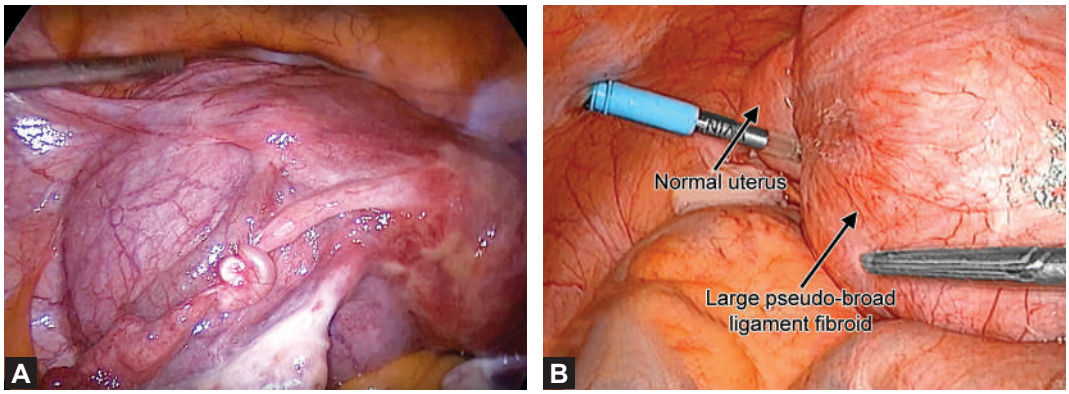
It is important to understand that almost all broad ligament fibroid (Figs. 10.3A and B) are actually arising from the uterus. Depending on the size and location, the important structure pushed laterally is the ureter; care also has to be taken of the uterine and infundibulopelvic vessels. A normal laparoscopic myomectomy has three steps: incision, separation of the fibroid followed by removal from the attachment, reconstruction, suturing of the myometrial defect and finally removal from the peritoneal cavity. In broad ligament, fibroid usually suturing of the defect is not necessary since it is the peritoneum. Primary step is injection of dilute vasopressin, making an incision, which is usually posterior, taking care that it does not extend laterally toward the ureter and medially toward the vessels. Thus, the incision is vertical at the most prominent bulge of the fibroid. Once the fibroid is stabilize by myoma screw, the removal of fibroid is very quick with traction and counter traction. If in proper plane bleeding is insignificant sparingly needing use of bipolar. This posterior incision is not sutured because it acts like a drain. Only when the broad ligament fibroid is totally anterior stretching the round ligament then the incision is anterior and posterior to the round ligament which is also incised. The removal of fibroid from the peritoneal cavity is done by morcellation.

Cervical Fibroid

A cervical fibroid can be posterior or anterior, small or large. After injecting dilute vasopressin, the preferred incision is vertical so as to avoid lateral extension to the uterine vessels which may bleed. A 30° laparoscope is better for good visualization, separation of fibroid and suturing which may be interrupted and vertical. Rest fibroid is removed by morcellation.

Multiple Fibroids

Here essentially surgical steps are same as myomectomy but the incisions may be multiple preferably through which more than 1 fibroid (Fig. 10.4) can be removed. Another important point is that if there are too many fibroids then vasopressin injection, separation of the fibroids,



Figs. 10.3A and B: (A) True broad ligament fibroid; (B) Pseudo-broad ligament fibroid.

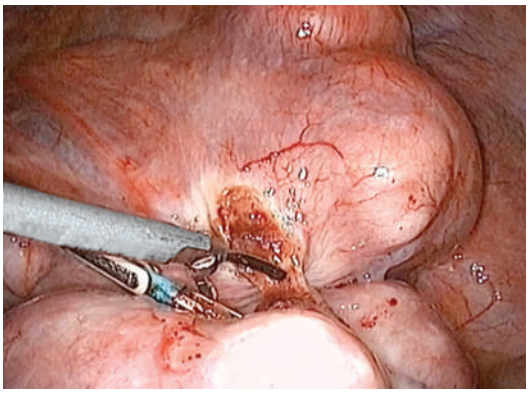


Fig. 10.4: Multiple fibroids.

and suturing of 3–4 are done at a time, so that the vasopressin effect is good and also spread over time. Further, suturing the defect of this fibroids stops unnecessary oozing from the myoma bed. Next the other sets of fibroid are taken. Finally, fibroids are removed by morcellation.

Degenerated Fibroid

Apart from the standard steps of myomectomy here we have to understand that, as the fibroids are soft, stabilizing with the myoma screw while separation may actually tear the fibroid. Also separation and dissection of such fibroids are preferably done by atraumatic forceps, further the same concern is kept while morcellating such fibroids. An in-bag morcellation of such fibroids is beneficial because even atraumatic spoon forceps can be used to hold fibroid.

Cornual Fibroid

The only additional precaution to be taken for such myomectomy is that you have to be careful of the fallopian tubes which should not come in your incision and suturing.

Please note suturing of different fibroids is done by different suture materials and different technique (Suturing techniques covered in other chapters).

FEW PRACTICAL COMPLICATIONS OF LAPAROSCOPIC MYOMECTOMY

- Improper hemostasis.
- Transient rise in blood pressure, fall in PO_2 during injection of dilute vasopressin.
- Difficulties in suturing fibroids at odd location.
- Practical problems of in-bag or morcellation otherwise.
- Encountering adenomyosis in a suspected case of fibroid.
- Limitations in terms of size or number depending on the skills of the laparoscopists there may be a need of open surgery.
- A breakage of myoma screw during forceful separation.

LATE COMPLICATIONS

- Accidental forgotten fibroid, which becomes parasitic.
- Less common multiple leiomyomatosis.
- There can be occasional scar rupture in case of laparoscopic myomectomy like abdominal myomectomy during advance pregnancy.

Kindly note that in parous women, colpotomy can be an alternative route to remove medium size fibroid.

In our study, especially in the group of IVF and intracytoplasmic sperm injection (ICSI), removal of fibroids of more than 5 cm in size except if they were serosal increased the success of assisted reproductive technology (ART) to 40% in the group of donor oocyte IVF–ICSI to 50% pregnancy rate.

CONCLUSION

Laparoscopic myomectomy in spite of continuous controversies still holds place in modern gynecology for selected yet significant indications of removal of fibroid. Even in a patient with family completed option of myomectomy should be offered as a treatment of their problem instead of rushing for hysterectomy.

Laparoscopic removal of fibroids in the indications specified above increased the pregnancy rate to 42% and decreased the abortion rate to 5% without increasing the rate of uterine scar rupture on pregnancy, but increasing need of doing elective cesarean section specially because of removal of large and multiple myomas.

The future drugs like ulipristal acetate which may be useful to reduce the symptoms of fibroid, arrest the growth and may even reduce incidence of surgical removal of fibroid, but major side effects can be hepatic dysfunction, which is a concern today.

Chapter 11

Demystifying Laparoscopic Morcellation of Myomas and Uterus with Myomas in Bag

Prakash Trivedi, Soumil Trivedi, Sandeep Patil, Chetan Kolhatkar

INTRODUCTION

After laparoscopic morcellation for fibroid and large uterus has been accepted,[1] noteworthy that a controversy erupted with one case of leiomyosarcoma in a patient of laparoscopic hysterectomy after morcellation leading to spread of sarcoma with significant morbidity. This brought a halt in laparoscopic morcellation followed by restricted use with black box warning on laparoscopic morcellation in 2014 by the United States Food and Drug Administration (USFDA).[2]

Though the risk of myomectomy or removal of large uterus involves many steps before morcellation, which are same with open or laparoscopic surgery yet, morcellation is blamed for spread of cells.

At the Total Health Care Centre, Mumbai, India, a large series of 250 cases of laparoscopic contained bag morcellation of myomas or large uterus with myoma was compared with the earlier technique of uncontained laparoscopic morcellation of 270 cases.

Total Health Care method is very specific with defined steps.

All patients were operated under general anesthesia and were in modified lithotomy position.

TECHNIQUE OF LAPAROSCOPIC MYOMECTOMY

A 0° 3D laparoscope is usually used in all cases, a 10 mm primary trocar is introduced in umbilicus or 2 inches above the palpable size of uterus in cases of large pathology or upper most point of vertical scar. Two 5 mm flower valve trocars are introduced on the left side 9–10 cm apart with the upper port medial to the lower for easy ipsilateral laparoscopic suturing. One 5 mm port is introduced on the right side higher than the left lower port. Dilute vasopressin 20 units in 200 mL of normal saline is injected,[3] quantity depends on the size of fibroid. Usually a horizontal incision is preferred in prominent bulge of the myoma with monopolar spatula evacuating smoke with suction or using active blade of harmonic scalpel. For a large fibroid of more than 10 cm, an elliptical incision is made to reduce dead space for endosuturing.

Fibroid is stabilized with myoma screw and dissected out with scissors or harmonic scalpel. Once separated, the fibroid is parked at the ileocecal and appendicular region, as it does not

interfere in movement of instruments from the right port. The OR sister keeps a check on the number of specimens, etc. parked.

Large myoma defects are closed by two layers of barbed suture using two needles in different directions. Myoma less than 4 cm is sutured in single layer with full thickness interrupted Vicryl No. 1 closure.

All separated myomas are removed by using a 15 mm reusable morcellator from the left lower port kept always under vision. Hemostasis achieved, wound is closed with port closure sutures. When barbed suture two layers of closure was done which obliterated the dead space, drainage is not kept, unlike earlier when single full thickness interrupted Vicryl closure was standard there was tissue exudate, hence a drainage tube was kept. Postoperative care and advice is given as deemed necessary.

Technique of laparoscopic hysterectomy for large uterus steps is covered in Chapter 12 on Laparoscopic Hysterectomy. Most steps are standard except for multiple large fibroid of more than 12 cm where an additional port on right side was added for manipulation.

After separation of fibroid or uterus with myomas, contained bag morcellation was done as follows:

Surgical Steps of Contained Bag Morcellation

The polyurethane stomach shaped specially designed bag (Fig. 11.1) is used, available in three sizes, viz. small, medium and large with a mouth opening of 13, 15, and 17 cm and volume of 1600 cc, 2100 cc, and 2600 cc, respectively. Undiluted Sensorcaine 0.5% injected around the left lower port to widen it to 1.5 cm and then the blunt trocar of 15 mm morcellator was passed to widen this port. There is a plastic open trocar, which comes with the sterile bag for morcellation. The mouth of bag is firm and is held like a tube to fit in the open plastic trocar. This trocar is inserted from the left lower port, assistant holds the bag (Fig. 11.2), and surgeon removes the plastic open trocar. In a series of horizontal pull on the bag by surgeon and assistant, the whole bag is now in the abdomen. At this moment, left lower port is replaced by 10 mm cannula with reducer and if gas leaks, towel clip is applied on skin. The mouth of the bag is opened and bag slides into the pelvis. The assistant stabilizes 12 O'clock

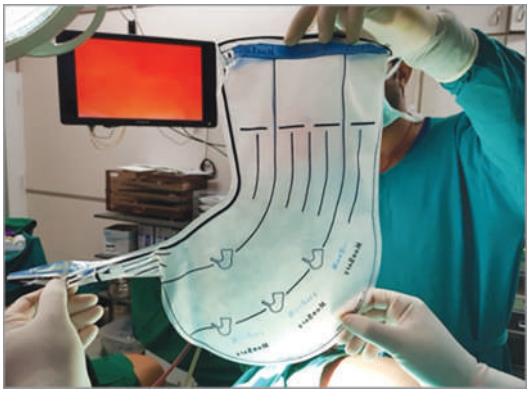


Fig. 11.1: MorSafe bag: Stomach-shaped multiport bag with ear-like tail.

position of dual-colored bag; surgeon stabilizes 6 O'clock position to keep the mouth open facing to camera. At this moment, Trendelenburg position is removed and the surgeon holds the fibroid or uterus with a single-toothed tenaculum and puts the specimen inside the bag (Fig. 11.3). As there no Trendelenburg, specimen stays in the bag. Next with this same tenaculum another fibroid is put into the bag. Once all fibroid, uterus, tubes are in, mouth of the bag is closed from assistant's to surgeon's side and the last grip is taken by the instrument in the morcellation port, pulling a part of bag outside. The mouth of the bag is pulled out of the abdomen (Fig. 11.4). Next the duodenum-shaped tail is inserted in a rail-road fashion into the umbilical or primary cannula (Fig. 11.5). Thus, the mouth is out of the left lower port and the tail end is out of umbilicus or primary port. This tail has an opening, which is widened and a 10 mm cannula is inserted through umbilicus or primary port (Fig. 11.6) then once the pneumoperitoneum is on, the CO_2 through the primary cannula distends the bag; the leak from the left lower port is prevented by a gloved finger. Now in the 10 mm primary cannula, optics is passed and shows the specimen in the bag. The entire peritoneal cavity and abdominal structures are out of the bag.

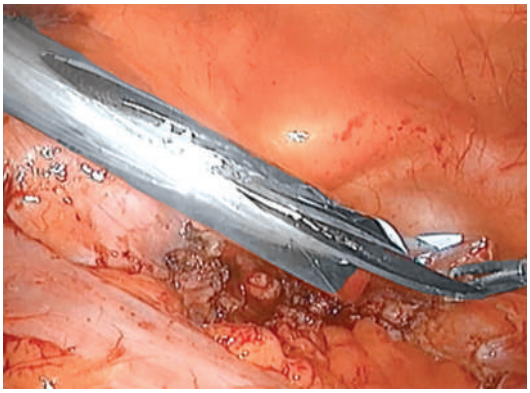


Fig. 11.2: Bag edge introduced with sheath through left lower port held.

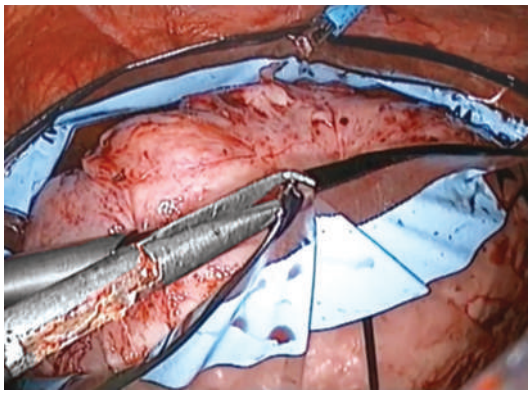


Fig. 11.3: Specimen placed into bag and bag edges drawn over the specimen.

Fig. 11.4: Flower-like mouth of bag retrieved through left lower port.

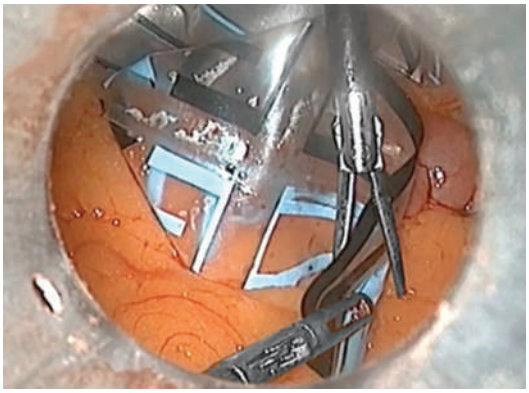


Fig. 11.5: Ear-shaped tail rail-roaded into umbilical cannula.

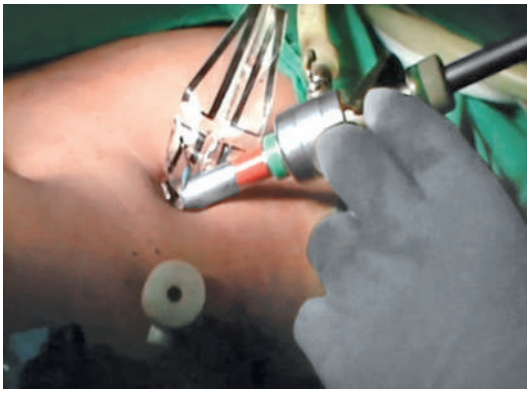


Fig. 11.6: Cannula reintroduced into opening in the tail and insufflation started.

Next a 15 mm blunt tip of morcellator is introduced through the left lower port, trocar removed, and morcellator plus grasper is introduced. The entire specimen can be morcellated now (Figs. 11.7 and 11.8). The surgical time in contained bag morcellation and conventional morcellation was comparable.

With these contained bag morcellation in 250 cases, up to 2,100 g uterus (Fig. 11.9), 17 fibroids and a fibroid of 20 cm were removed.

There is no spillage after morcellation. Morcellator is removed, primary cannula withdrawn. A knot is tied at the tail-end of bag below the opening through which the optics passed. Pneumoperitoneum is removed and holding the mouth of the bag the entire bag is removed (Figs. 11.10 and 11.11). In all the 250 cases, bag integrity has been checked with 1.5 L dilute methylene blue instilled in the bag (Fig. 11.12).

Next inserting the optics, hemostasis is checked and the morcellation port is closed with port closure needle with two stitches. No additional precaution is needed more than standard laparoscopic surgery.

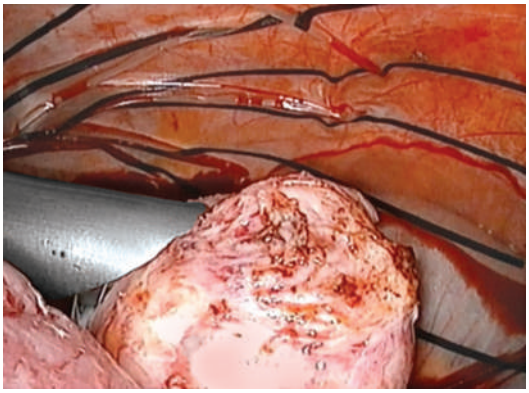


Fig. 11.7: Morcellation of myoma or uterus done within bag which replaces peritoneal cavity (Versator morcellator).

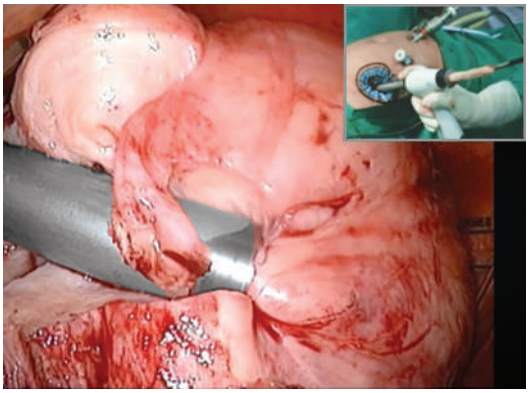


Fig. 11.8: Morcellation of multiple myoma in bag (Storz Rotocut morcellator).

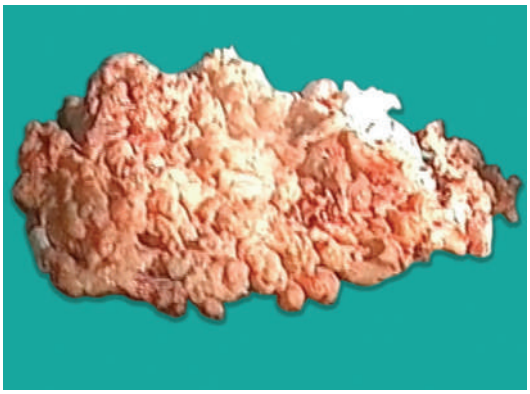


Fig. 11.9: Large specimen of 2.1 kg postmorcellation in bag.

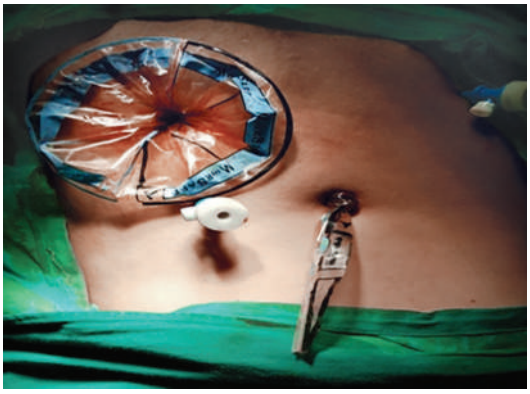


Fig. 11.10: Opening in tail secured with knot below and bag can be withdrawn.

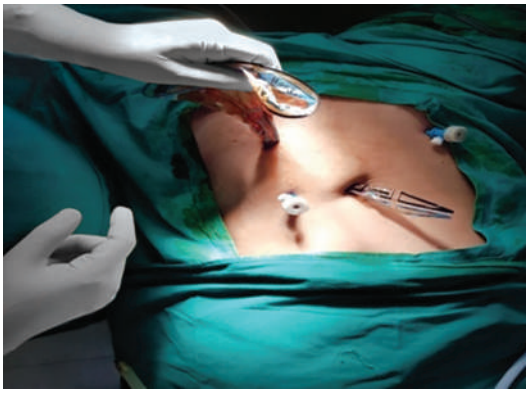


Fig. 11.11: Bag being pulled from left lower port with tail receding into the umbilicus.

Fig. 11.12: Bag filled with methylene blue to test for spillage and integrity check.

All patients were discharged in 48 hours and follow-up was done clinically, sonography and MRI after 6 and 12 months in 85% of cases. No case of residual tumor, leiomyosarcoma or leiomyomatosis was found.

RESULTS AND DISCUSSION

Duration of surgery, amount of blood loss, complications, conversion to open surgery, histopathologic findings of tissues for myoma, sarcoma, and any other were analysed.

There were no cases of leiomyosarcoma, two cases of symplastic tumor with no malignancy.

In two cases, conversion to conventional morcellation and one to open removal of very large myomas was needed in the study group.

Overall, the laparoscopic contained bag electromechanical morcellation was found to be efficacious regardless of age of the patient, size, weight, and number of fibroids. There were no major complications and contained bag morcellation was safe. In the study group, bag was cut due to technical issue in two patients followed by conventional morcellation and only in one case open surgery was needed to remove very large fibroids.

Contained bag morcellation may not be taken as an optional procedure but as a necessary art if one wants to carry out laparoscopic myomectomy and hysterectomy for fibroids in the present time.

There is no debate that even one case of accidental leiomyosarcoma morcellated could increase the spread of tumor affecting the patient safety in terms of morbidity and postoperative life span, but it is not the same for myoma. There is a myth that morcellation shortens the life span, but it is applicable for leiomyosarcoma and has no relevance for myomas.

Considering the fact that incidence of fibroids irrespective of the age of the woman and also the number of laparoscopic myomectomies done globally imparting huge benefit of minimal access surgery to the women, reported cases of leiomyosarcoma have been statistically insignificant. Further, there are no definitive methods of diagnosing leiomyosarcoma with the current available diagnostic modality. In young women in reproductive age group, needing myomectomy and also elderly women needing hysterectomy for large fibroids will be deprived

of minimally invasive laparoscopic surgery and will be forced to do open surgery which has more morbidity, more hospital stay, and expenses.

The steps of both methods of myomectomy open or laparoscopic surgery are same, viz. injecting dilute vasopressin, dissection of fibroids in either methods, further dissected fibroids that are separated come in contact with surrounding structures like omentum, bowel, etc. and finally even during closure if we are closing the sarcoma or cancerous bed with needle and suture touching all tissues can spread myoma, sarcomatous or malignant cells. In both, there can be residual leiomyosarcoma already spread in blood. This pre-existent spread cannot be prevented.

Obviously widening the belly button or colpotomy or even vaginal morcellation of large specimen can spread sarcoma or malignancy as the tissue and blood touch healthy tissues or peritoneal cavity.

The whole controversy is put on laparoscopic morcellation mainly due to spinning effect of tissues morcellated, which can spread sarcoma or even lead to leiomyomatosis.

It is interesting that laparoscopic radical hysterectomy with node dissection is accepted wherein tissue may be positive of cancer cells. MRI-guided focused ultrasound is accepted as a treatment modality for fibroids without ruling out the possibility of leiomyosarcoma, similarly uterine artery embolization is also accepted. Even laparoscopic surgery for uterine and early cervical cancers can be accepted though we are dissecting tissues with possible malignant cells. Thus, we suggest that laparoscopic contained bag morcellation of fibroids and large uterus with fibroids is acceptable and safe.

A key question is that, is there any documented evidence that a leiomyoma progressed to leiomyosarcoma? One Austrian multi-institutional study by Mayerhofer et al.[4] of 71 cases of leiomyosarcoma revealed that none developed from a confirmed myoma, which means that leiomyosarcoma is primarily a separate tumor thought to be arising from myoma, which is a myth.

Genetic differences between fibroids and leiomyosarcomas indicate that leiomyosarcomas do not result from the malignant degeneration of fibroids. Cluster analysis of 146 genes found that the majority is downregulated in leiomyosarcomas but not in fibroids or myometrium. Comparative genomic hybridization did not find specific anomalies shared by fibroids and leiomyosarcomas.[5]

CONCLUSION

We emphasize that the number of women having myomas in uterus globally, irrespective of age, is huge; many in reproductive age group needing myomectomy or at an advanced age, needing hysterectomy.

Contained bag morcellation in all such cases protects the interest of a few million women who are bereaved of the benefit of laparoscopic minimal access surgery, forcing all such females to resort to open surgery.

In our study, no case of leiomyosarcoma was found in patients with myomas. Contained bag electromechanical morcellation was found to be acceptable for myomas or uterus with myomas with marginal increase in operating time, yet safe.

The authors strongly believe focusing on women's health and protecting women's right for minimal access surgery for myomas should be offered as they deserve.

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Chapter 12

Laparoscopic Hysterectomy: Today

Prakash Trivedi, Soumil Trivedi, Ankita Fatnani

INTRODUCTION

Laparoscopic hysterectomy right from the time first laparoscopic hysterectomy was done, it was surrounded by controversies, challenges, issues of operating time, need of advanced equipment, and also special skills. As laparoscopic hysterectomy progressed globally in a decade, it got stabilized. Then came a huge amount of energy sources to dissect, seal, and cut together. These helped to reduce time for surgery, bleeding but added urological complications. Further improvisation of these instruments new versions of vessel sealers increased safety with effectivity. The next challenge was difficult pathology, big uterus, previous abdominal surgery and finally the controversy of morcellating large uterus with fibroid or tumors. There is no debate that vaginal surgery has high standards as a minimal access surgery and is further advanced.

CURRENT ADVANCES IN LAPAROSCOPIC HYSTERECTOMY

- Improved skills of gynecological laparoscopist.
- Better quality of 3D and total HD camera.
- Third generation of energy sources; safer, fast, multifunctional added to dedicated bipolar and scissors.
- Improved suturing techniques, normal and in complication.
- Gynecologist with laparoscopic surgery improved in management of intra- or postoperative urological or bowel complications under the visual supervision of specialist.
- Improved knowledge of pathological anatomy helped in dissection.
- Overcoming the issues of morcellation by in-bag techniques better established.
- Scientific, skilled, fearless gynecologist unified under the cause of safety to patients.
- Handling uterine artery at origin and dissecting ureter in all cases of total laparoscopic hysterectomy (TLH).

  All aspects of TLH from basic to the advances are discussed.

INDICATIONS FOR TOTAL LAPAROSCOPIC HYSTERECTOMY

- Uterus needing removal and are larger in size of 16 weeks or could not be removed vaginally without bisecting, coring or cutting the uterus into long strip.

- Uterus with large fibroids and bleeding not controlled by medical therapy.
- Uterus with adenomyosis and large.
- Endometrial or early cervical malignancy needing TLH with pelvic lymphadenectomy.
- Large ovarian cyst or tumors benign or borderline with intact wall along with TLH.
- Patient of recurrent endometrioma with or without rectovaginal adenomyosis with dysmenorrhea failed multiple treatments.
- Bad pelvic infection with one or bilateral tubo-ovarian mass after finishing childbearing.
- Prophylactic in case of Ca breast or such cancer where treatment may increase endometrial polyps or risk of ovarian malignancy.

Any situation where uterus with or without adnexa can be removed vaginally or there is risk to do laparoscopic surgery for medical reason is a definite contraindication for laparoscopic hysterectomy.

Techniques of TLH from basic to different methods of hemostasis and morcellation:

- Total laparoscopic hysterectomy with bipolar, simple scissors, and suturing
- Hysterectomy for previous cesarean section
- TLH for repeated or abdominal multiple scars
- TLH for a very big size uterus: large fibroids
- TLH for bad endometriosis
- Current Total Health Care technique of TLH
- TLH for endometrial/cervical malignancy
- TLH for obese women.

TOTAL LAPAROSCOPIC HYSTERECTOMY WITH BIPOLAR, SIMPLE SCISSORS AND SUTURING

Laparoscopic hysterectomy for years is done with good dedicated bipolar, scissors, and suturing.

Apart from modified lithotomy position, patient under general anesthesia four ports are introduced including primary umbilical port for the optics and camera. The pelvic anatomy, pathology and any variation are checked. Usually normal looking ovaries are kept for hormonal benefits with no age line cutoff. A simple uterine manipulator and Foley's catheter is introduced. Next with bipolar and scissors bilateral salpingectomy is done. The ovaries are separated after bipolar and scissor dissection from uterus. The round ligaments are transected and peritoneum is lifted above the bladder, the uterovesical fold is dissected to push the bladder safely down. Posterior peritoneum is dissected including uterosacral ligaments. The uterine vessels are prominent which can be coagulated with bipolar or suturing and then cut (Figs. 12.1 to 12.6).

Once vagina is separated a circumferential incision is made with monopolar spatula on a tube inserted vaginally.

The uterus is removed vaginally and the tube is reinserted. Laparoscopically 35–45 cm Vicryl on a curved needle is inserted from the left lower port. A continuous locking stitch is taken to close the vagina from one end to the other. Hemostasis is checked, ports are closed with single stitches.

Patient is discharged within 36 hours and is back to normal in a week.

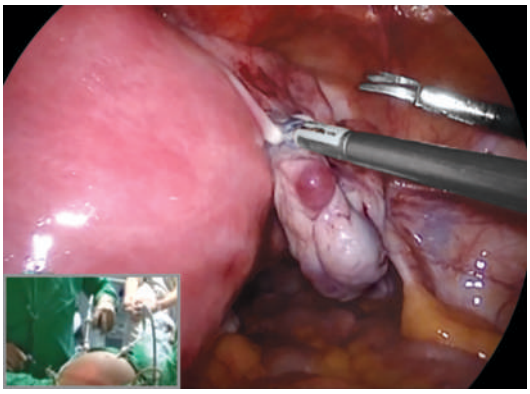


Fig. 12.1: Coagulating cornuals with bipolar.

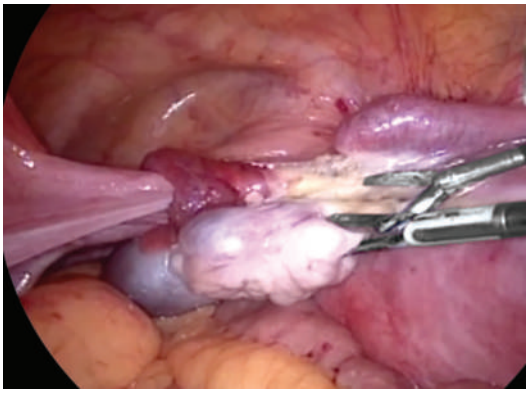


Fig. 12.2: Cutting the coagulated cornual pedicle.

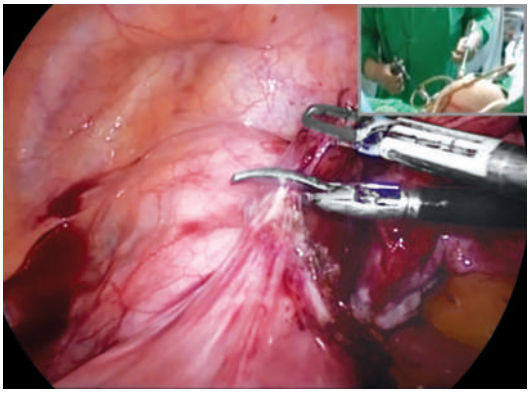


Fig. 12.3: Dissecting the uterovesical fold.

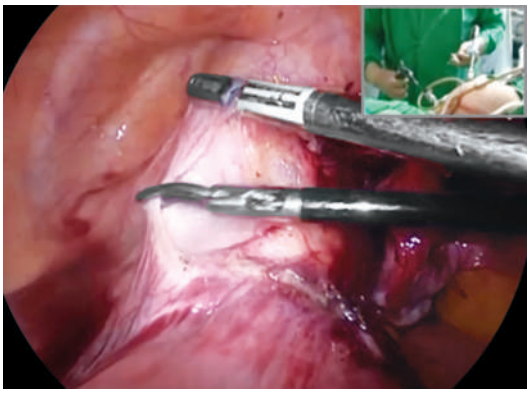


Fig. 12.4: Sequential use of bipolar and scissors.

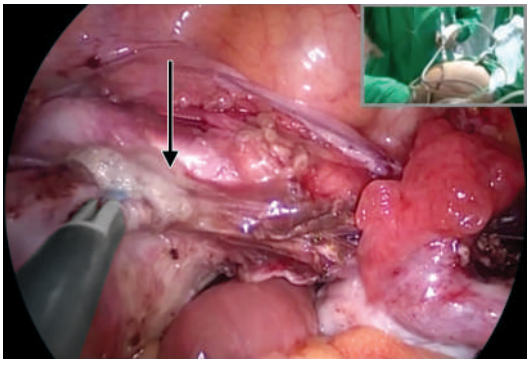


Fig. 12.5: Coagulating skeletonized uterine pedicle.

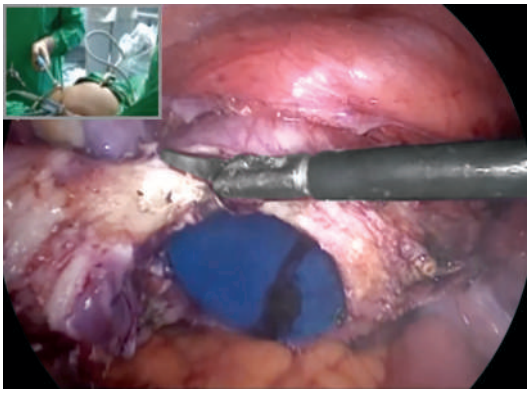


Fig. 12.6: Opening the vault on silicon tube.

TOTAL LAPAROSCOPIC HYSTERECTOMY IN CASES OF PREVIOUS CESAREAN SECTION

Today it is an era, where previous cesarean sections are more the norm rather than an exception. In cases where vaginal hysterectomy is possible, should be done. But all cases where additionally uterine size is big with other pathology, TLH is the method of choice. This hysterectomy is dealt in a separate way. There can be omental adhesions, which are to be divided after a safe entry of Veress needle and also trocar.

The important area is separation of bladder with adhesions of the cesarean usually is in the center. A safe approach is through the lateral window wherein after the round ligament is incised the dissection is carried out till anterior to the uterine artery with the bladder peritoneum already lifted by other grasper. A clear space in the isthmocervical region is seen which can be mechanically dissected with central adhesions still there, the same is done on the other side and then central adhesions are divided to finish TLH by regular steps (Figs. 12.7 to 12.12).

TOTAL LAPAROSCOPIC HYSTERECTOMY IN PATIENTS WITH REPEATED OR MULTIPLE ABDOMINAL SURGERY SCARS

A lot of patients who have undergone previous major surgeries which may/may not be gynecological related. The patients with previous midline vertical scars were encountered routinely. Palmer point entry for Veress needle and subsequently a 5 mm optics can be used.

We have successfully for decades without any complications used an entry port which is 2 inches from the upper most point of the vertical incision, 2 inches above the umbilicus in cases of multiple Pfannenstiel incisions and other abdominal incisions, this point is sometimes also called Lee-Huang's point.

Also the use of Ternamian trocar which is a port entry using a blunt tipped hollow trocar can be done in cases of repeated abdominal surgery and multiple scars after creating pneumoperitoneum.

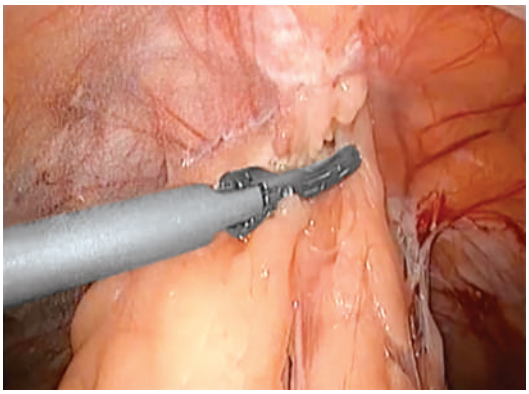


Fig. 12.7: Adhesions to anterior abdominal wall separated with harmonic or scissors.

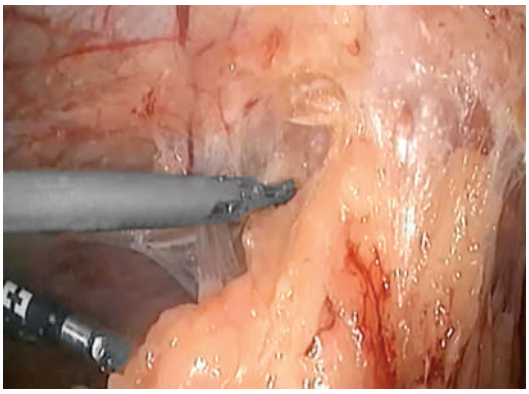


Fig. 12.8: Remain just on top of the fat but not too flushed to the anterior abdominal wall.

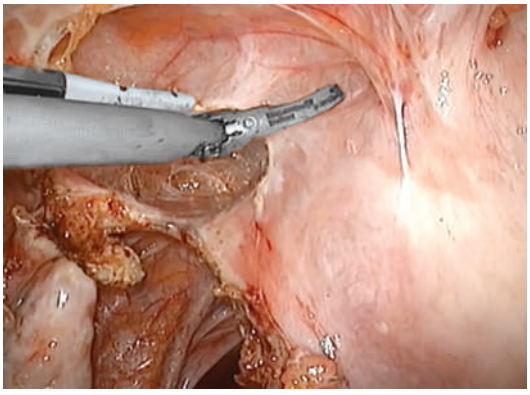


Fig. 12.9: Midline adhesion in previous lower segment cesarean sections (LSCS)—approach made laterally, usually adhesion free.

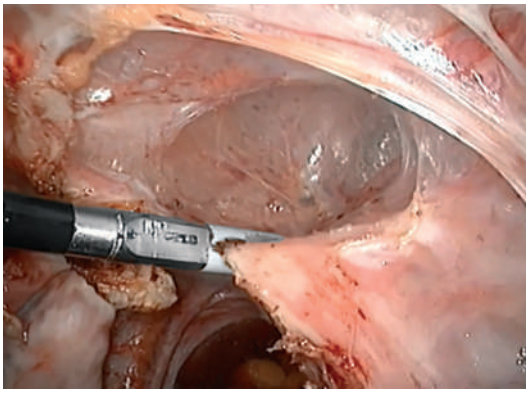


Fig. 12.10: The lateral window—anterior and medial to the uterine arteries.

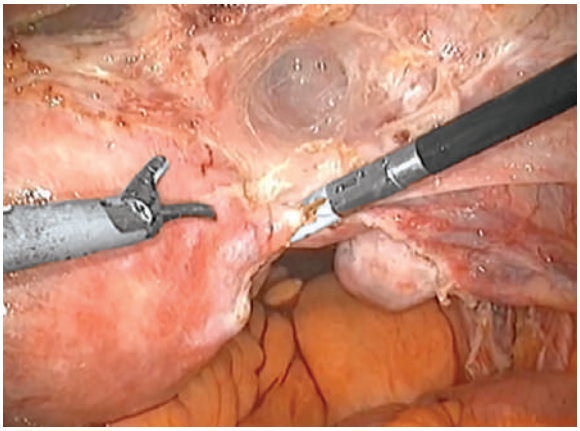


Fig. 12.11: Lateral approach and dissection on the right side.

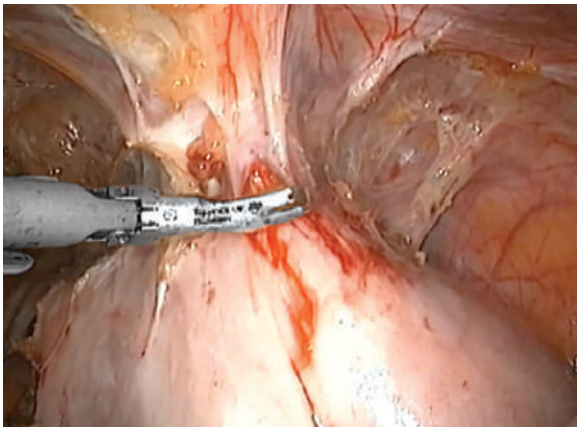


Fig. 12.12: Midline adhesion tackled last after lateral window dissection.

TOTAL LAPAROSCOPIC HYSTERECTOMY FOR A VERY BIG SIZE UTERUS MORE THAN 26 WEEKS AND LESS THAN 30 WEEKS

Here the primary difference in technique is to put primary and ancillary trocars much higher after a nasogastric tube is passed.

After the pneumoperitoneum is created with a 30° telescope or a 3D camera, the infundibulopelvic ligament if needed, cornual structures, uterine dissection, bladder dissection, and colpotomy all steps are same. Occasionally need of an additional 5 mm port on right upper side for manipulation with myoma screw.

Obviously morcellation will take longer time (Figs. 12.13 to 12.18).

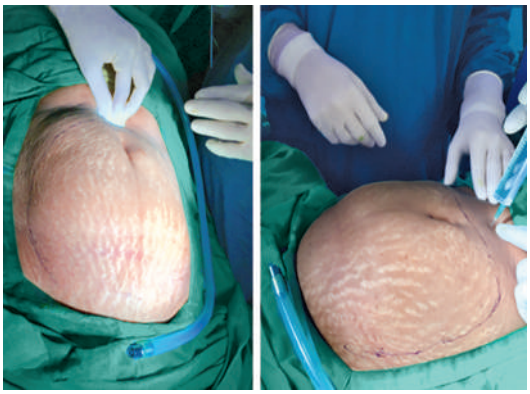


Fig. 12.13: External preoperative view with margins of uterus demarcated (28–30 weeks size).

Fig. 12.14: Laparoscopic view of the large uterus manipulation with myoma screw.

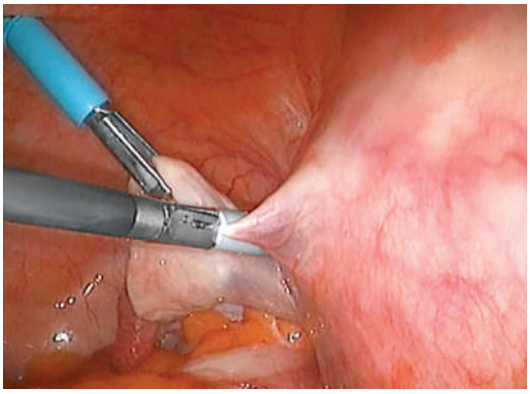


Fig. 12.15: Securing cornual pedicle with Ligasure.

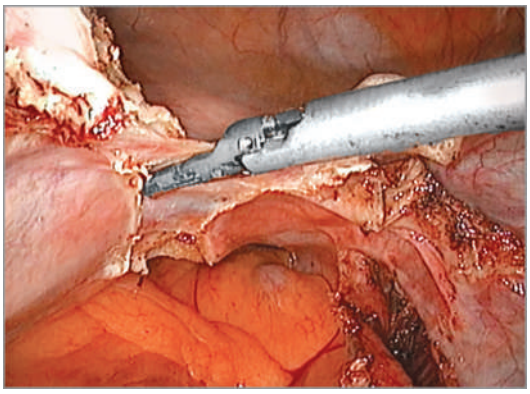


Fig. 12.16: Posterior peritoneal dissection for skeletonization of uterine pedicle.

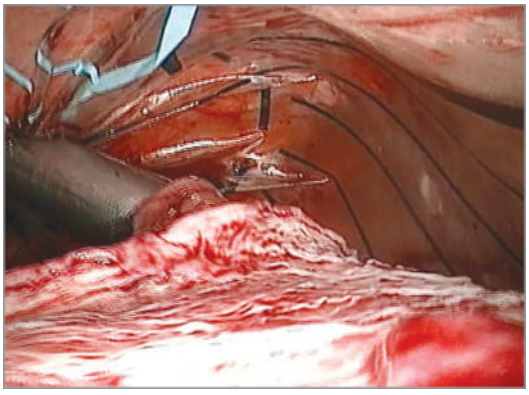


Fig. 12.17: Contained in-bag morcellation of the large specimen.

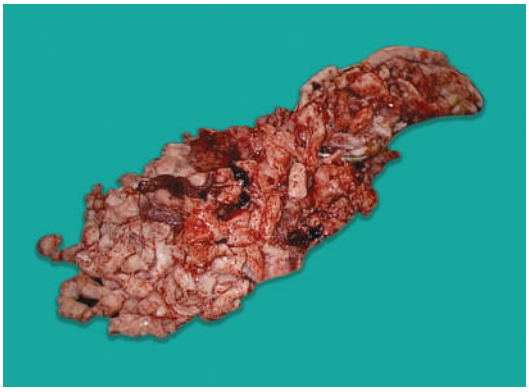


Fig. 12.18: External view of the morcellated uterus specimen weighing 2.1 kg.

TOTAL LAPAROSCOPIC HYSTERECTOMY FOR BAD ENDOMETRIOSIS WITH PREVIOUS SURGERY AND RECTOVAGINAL INVOLVEMENT

This TLH is the most difficult due to disturbed pelvic anatomy. We have to do first salpingo-ovariolysis and ureterolysis of adhesions, draining the endometrioma. Next go from normal side toward the diseased, identify and dissect ureter on both side especially separate from uterosacral—Mackendrot's ligament and rectovaginal area. Once this is done and uterines are taken, uterus is fully anteverted and rectovaginal endometriosis is dissected at the cost of uterus. After hysterectomy, rectal endometriosis can be shaved off holding with tenaculum. Integrity of rectum, ureter, and bladder is confirmed.

CURRENT TOTAL HEALTHCARE HOSPITAL TECHNIQUE OF TOTAL LAPAROSCOPIC HYSTERECTOMY

Modified lithotomy position with patient under general anesthesia with intubation and with multipara monitor; apart from umbilical or supra-umbilical port for optics, depending on the size of uterus, two 5 mm ports on left side and one port on right side; after evaluation of the pelvis, the first step is to get the uterine artery at the origin either by anterior or posterior approach to infundibulopelvic ligament. Ureter is identified for the entire course; uterine artery is the only structure crossing above horizontally, which is clipped (Figs. 12.19 to 12.23).

Both tubes are removed and only ovaries if diseased are removed. The cornuals is separated generally, harmonic ace is used to dissect and Ligasure or bipolar for vascular pedicle, dissecting posterior peritoneum and also cutting the uterosacral ligament at attachment. The anterior utero-vesical peritoneum is dissected from one round ligament to the other to push the bladder down; bladder is clearly dissected to see the vagina below the cervix. The uterine vessels are taken and further dissected out. A colpotomy is done on a tube inserted from the vagina.

For uterus, which is large in size, a stomach-shaped bag is introduced from the widened left lower port. Bag is opened; specimen loaded in mouth of the bag is pulled through the morcellation port end. Next the duodenum shaped tail is rail-roaded in umbilical trocar. The 10 mm primary cannula with optics is introduced from hole in the duodenum shaped tail here, pneumoperitoneum started. Next blunt tip morcellator is put through left lower port. After morcellation instruments are removed. The tail is secured by a knot below the eye or opening in the tail at umbilicus and the bag is removed from left lower port. The removed bag is checked for integrity by dilute methylene blue instillation. Hemostasis is checked and postoperative advice is given *(Refer to Chapter 11 for Illustrations of Contained In-Bag Morcellation)*.

RADICAL HYSTERECTOMY FOR ENDOMETRIAL OR EARLY CERVICAL CARCINOMA LAPAROSCOPICALLY

Laparoscopic surgery for indicated carcinoma is now well defined with 3D and full HD camera. The steps have been standardized to open the avascular spaces, pararectal, paravesical, vesicovaginal, and rectovaginal spaces.

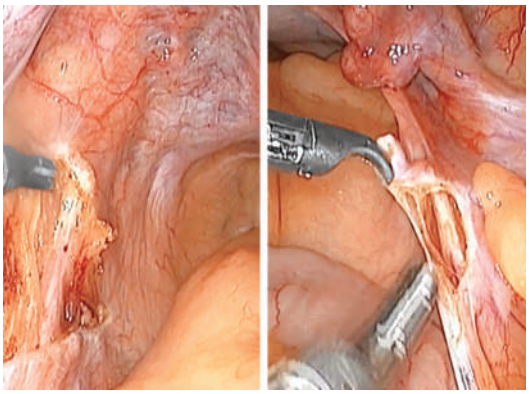


Fig. 12.19: Retroperitoneum overlying the ureters on both sides opened.

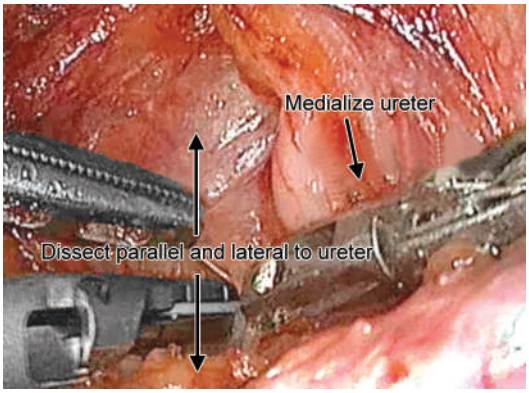


Fig. 12.20: Ureter medialized and dissection done parallel and lateral to ureter.

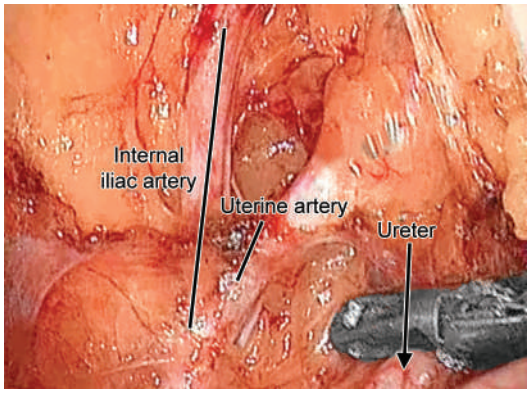


Fig. 12.21: Orient with the anatomy: Only horizontal offshoot from internal iliac is the uterine artery.

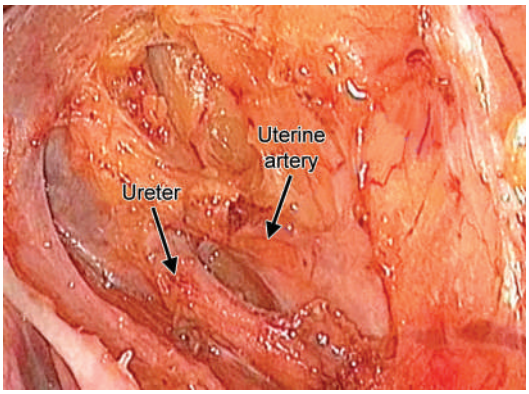


Fig. 12.22: Uterine artery crossing above the ureter on right side (Water under the Bridge).

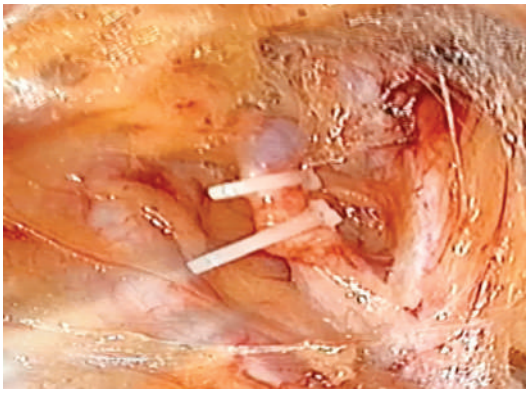


Fig. 12.23: Uterine artery clipped at origin with polymer clips with 5 mm applicator.

Pelvic lymphadenectomy comes last with external and internal iliac vessels bilaterally obturator lymph nodes, occasionally para-aortic lymph nodes in both cancers.

In early cervical cancer additionally ureteric tunnel dissection and lateralizing plus to take 2.5 cm of vaginal length circumferentially. Recovery is excellent. All the specimens are removed vaginally in a small bag (*Refer to Chapter 17 for Illustrations of Laparoscopic Oncological Procedures*).

TOTAL LAPAROSCOPIC HYSTERECTOMY IN OBESE PATIENT

The major change is that the medical risk factor, thromboembolic prophylaxis proper anesthesia and monitoring is important. The surgical technique remains the same except occasional need of longer trocar.

Postoperative care with early ambulation to reduce embolization is mandatory.

MANAGING COMPLICATIONS OF TOTAL LAPAROSCOPIC HYSTERECTOMY

Apart from usual complications of laparoscopic surgery urological and bowel complications are important as difficult indication is routine rather than exception.

Urinary bladder is at risk during previous cesarean section cases or a casual inappropriate use of energy or force. Identifying and closing in two layers with freshened free margin with catheter kept for 8–14 days depending on the type of injury.

Late detection of vesicovaginal fistula (VVF) can be sutured by new technique of passing ureteric catheter through fistula and bringing out cystoscopically is helpful. Ureteric injury is common on the opposite side from where surgeon is standing due to ureter being forked between uterine artery and vein, during bleeding pouncing for hemostasis or dissecting from the opposite side is the common cause. Further endometriosis, very big fibroid, double ureter can be a cause. If the injury is small, partial away from the bladder then ureteroureteral anastomosis on a stent is acceptable. If the injury is low close to bladder than ureterovesical anastomosis with psoas hitch laparoscopically or open surgery is acceptable.

Large bowel injury is mainly with bad endometriosis and pelvic infection adhesion. If small and below peritoneal fold of pouch of Douglas primary suturing after counseling is acceptable. However, if significant with energy source and poorly prepared bowels diverting colostomy is a safer option.

Biggest issue in TLH for every laparoscopic surgeon is that one should draw a line for the size of uterus, difficult pathology, oncology depending on their skill, teams experience and also the facilities of the operation theater and hospital.

Prevent vault prolapse in TLH by vaginal colposuspension with uterosacral ligaments and robotic TLH has very little place.

With future advances in laparoscopic surgery, we may have all hand instruments without any wire or tube connections to the brain unit.

Chapter 13

Modern Hysteroscopy and Hysteroscopic Surgery

Rahul Manchanda, Esha Sharma

"Every invention owes its origin to a happy combination of various circumstances; it is always born like a child, and like a child keeps becoming nearly perfect in a step-wise fashion.

Bozzini

INTRODUCTION

Modern hysteroscopy represents 200 years of innovative ideas that put practice in the form of instrumentation, techniques, and clinical applications.

Diagnostic and operative hysteroscopy have become standards in gynecologic practice replacing old, invasive techniques, such as dilatation and curettage.

Philip Bozzini, father of endoscopy, designed an instrument, which could reflect external light for visualization of body cavities, and named the device as Lichtleiter, or light conductor in 1805 (Fig. 13.1). Pantaleoni, in 1869, performed hysteroscopy for the first time, using Desormeaux hysteroscope. Since then, the development of hysteroscopy has flourished; 1980s and 1990s showed a shift of gynecology toward endoscopy as a specialty.

The various types of hysteroscopes originally used were quite large, necessitating extensive dilatation of the cervix, and were not very sophisticated optically. Hence, the visibility usually was not satisfactory.

In 1980, Hamou[1] designed a 4-mm microcolpohysteroscope for histologic diagnosis in the reproductive tract (Fig. 13.2). He used a lesser but continuous CO_2 flow rate, which permitted easier and safer endocervical and then endouterine distension. Because of small size introduction is atraumatic without prior dilation. Detailed examination of endocervical canal and endometrium can be done to localize abnormal areas.

Hysteroscopy has created a revolution in modern gynecology for last 60 years.[2] Advances in techniques and instruments since early 1980s have made hysteroscopy even less invasive and less painful, and as instruments have reduced in size, office hysteroscopy has begun to replace operating-room procedures (office hysteroscopy).[3-5]

Modern hysteroscopy has acquired "see and treat" approach, where possibility of performing biopsy of suspected lesions, removing endometrial polyp, adhesiolysis can be done in same sitting, in the outpatient setting without the need for an operating theatre.

Fig. 13.1: Endoscope designed by Philip Bozzini.

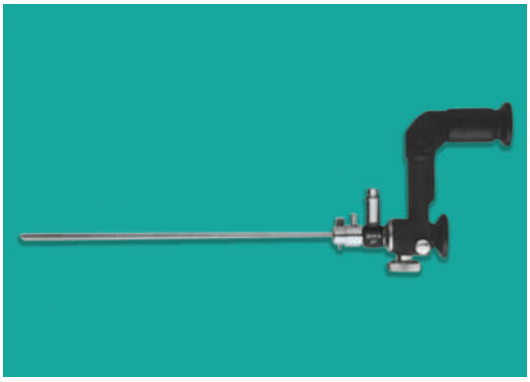


Fig. 13.2: Microcolpohysteroscope (The instrument is a 4-mm Storz microhysteroscope, 25 cm long, with a 30° foroblique view that offers panoramic as well as contact vision at different magnifications).

BETTOCCHI OFFICE HYSTEROSCOPE

Bettocchi office hysteroscope (2.9 mm) can be used with a single flow outer sheath (4.3 mm) in combination with an operating sheath (5 mm) as a continuous flow operating system. It is of an oval shape which fits the anatomy of cervical canal. 5 Fr mechanical instruments (e.g. scissors, biopsy cup, graspers, and corkscrews) are being used to perform procedure. There is no need for anesthesia and dilatation of the cervical canal. Bettocchi also demonstrated the possibility of performing hysteroscopy vaginoscopically, i.e. with the entry canal under direct visualization and without the need of a tenaculum, speculum, traction or local anesthesia, i.e. notouch technique (Figs. 13.3 and 13.4).[3]

BETTOCCHI INTEGRATED OFFICE HYSTEROSCOPE

It is fitted with handle compatible for use with Bettocchi system and consists of operating sheath, fibro-optic light connector and connectors for irrigation and suction fitted all into the handle. It is of 4 mm diameter. Telescope integrated into inner sheath (Fig. 13.5).

Fig. 13.3: Bettocchi office hysteroscope with telescope (1.9 mm), outer sheath (4 mm), and working element.

Fig. 13.4: Vaginoscopy.

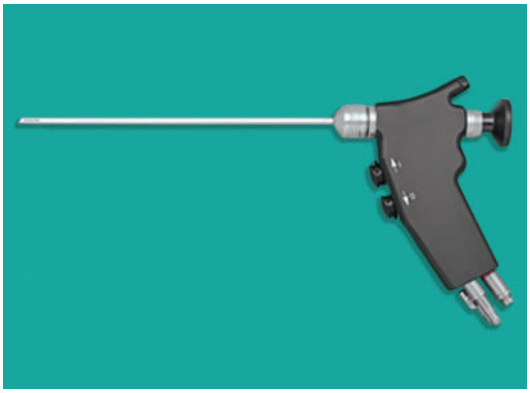


Fig. 13.5: Bettocchi integrated office hysteroscope.

TROPHY HYSTEROSCOPE

It is a compact rigid 30º hysteroscope with diameter of 2.9 mm. Lens and operating sheath is of 4.4 mm. The innovative feature of this hysteroscope is the ability to load with accessory sheath in active and passive position. For diagnostic procedure, the outer sheath is in passive position but can be advanced distally to active position (Fig. 13.6).

FLEXIBLE MICROHYSTEROSCOPE

It is of a diameter 3.1 mm with irrigation channel of 1.2 mm, no anesthesia is required, minor procedure like biopsy can be done in outpatient (Fig. 13.7).

ENDOSEE

Hysteroscopes with all-integrated systems viz. optics, LED lighting and camera with digital sensors, making these equipment much more versatile. The hand-held Endosee device can simplify this workflow to one office visit, resulting in a faster and more reliable diagnosis (Fig. 13.8).

HYSTEROSCOPIC TUBAL STERILIZATION

Essure

Hysteroscopic sterilization method where a flexible, specifically adapted catheters, can also be inserted through the 5/5.5 mm hysteroscope with a 5 Fr (1.7 mm) operating channel for tubal cannulation, selective chromopertubation, or for tubal sterilization (Figs. 13.9A and B).[5]

As gynecologists have grown better acquainted with the benefits and techniques of operative hysteroscopy, it has become the method of choice for treatment of intrauterine pathology.

A key point in the history of office operative hysteroscopy occurred in 1997, with the introduction of a versatile bipolar (5 Fr electrode) electrosurgery system the Gynecare VersaPoint® (Ethicon, Inc., Somerville, NJ) (Fig. 13.10). There has been a reduction in the use of the resectoscope and the operating room to a smaller number of cases with a tremendous increase in office operative hysteroscopy, to treat pathological condition.[6]

RESECTOSCOPY

Gynecologic resectoscope was designed for resection and removal of abnormal intrauterine tissue as well as ablation and septal dissection.

Two types of resectoscope differing in outer diameter, i.e. 22 Fr (7.3 mm) and 26 Fr (8.7 mm) are available (Figs. 13.11A and B).

In 1999, bipolar technology was introduced to address resectoscopic surgery, which needed an electrolytic solution as distension medium as compared to monopolar electrode which used 1.5% glycine and because of the spatial relationships between the active and return

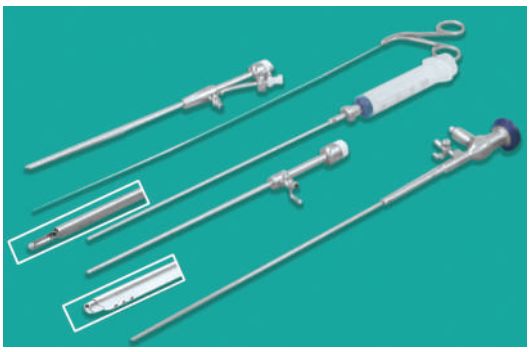


Fig. 13.6: Trophy hysteroscope with diagnostic and operative accessory sheet.

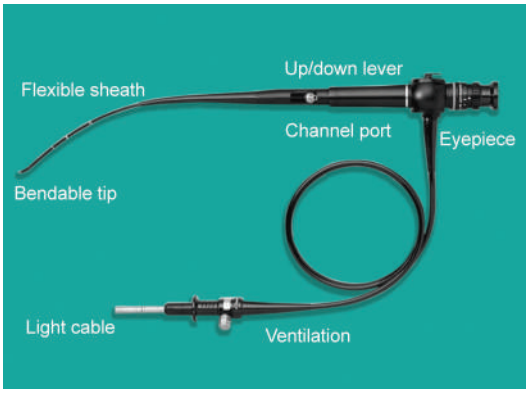
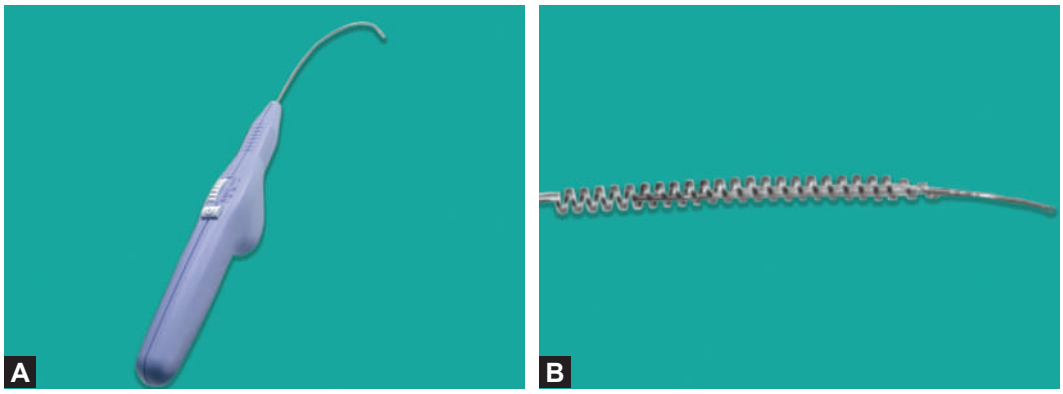


Fig. 13.7: Olympus HYF-XP flexible microhysteroscope.

Fig. 13.8: Endosee.



Figs. 13.9A and B: The Essure—hysteroscopic sterilization system: Hand piece, delivery system and micro-insert.

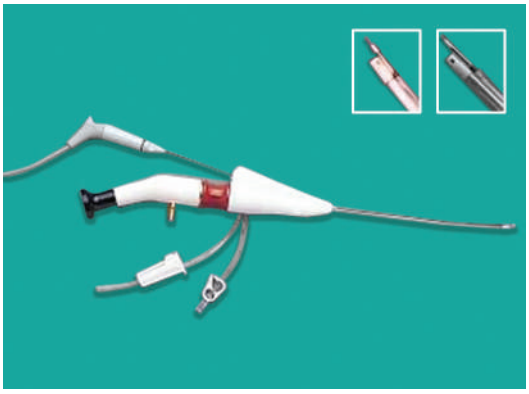
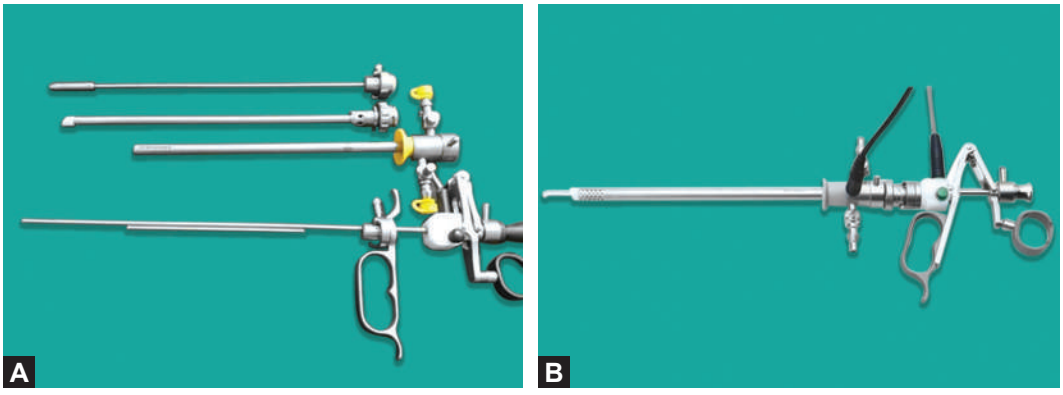


Fig. 13.10: Gynecare VersaPoint (Ethicon).



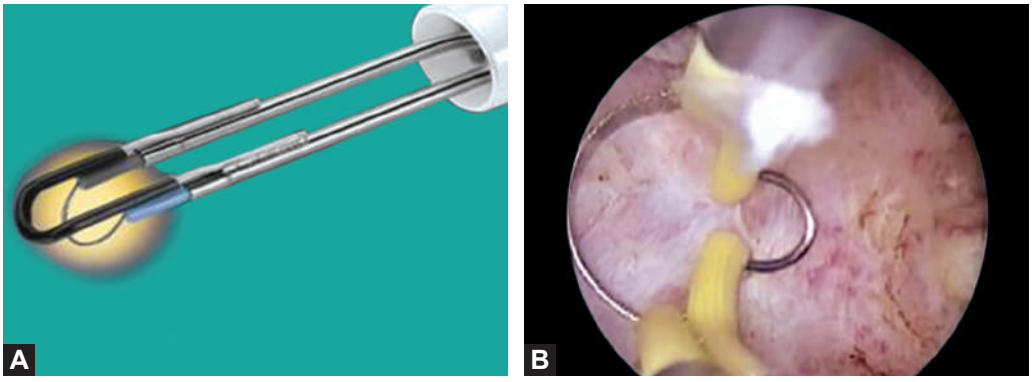
Figs. 13.11A and B: (A) Unipolar resectoscope; (B) Bipolar resectoscope.

bipolar electrode, the risks of severe electrolyte imbalance syndromes and unpredictable electrical burns were avoided, as compared to monopolar surgery.

In bipolar system, an electric arc is created between two electrodes. Once the electrode is close to the tissue, the arc converts the conductive solution of sodium chloride to a plasma-containing sodium particle that is highly charged with energy due active sodium particles. Once *plasma effect* has been created, contact with tissue provokes disintegration due to breaking of the carbon–carbon and carbon–hydrogen bonds and dissociation of the water molecules to H^+ and OH^- ions, resulting in cutting of tissue (Figs. 13.12A and B).[7]

MINI RESECTOSCOPE

Mini resectoscope of Gubbini of 16 Fr, with its reduced diameter, enabled the implementation of outpatient procedures with the technique of "slicing", increasing and facilitating the possibilities of "see and treat" outpatient. The functionality of the instrument has proved to be satisfactory as it allows the passage of current from mono to bipolar in the same resectoscope in use and under the same multipurpose handles (Fig. 13.13).[8]



Figs. 13.12A and B: (A) Plasma effect in bipolar electrodes; (B) Bipolar electrode in working.

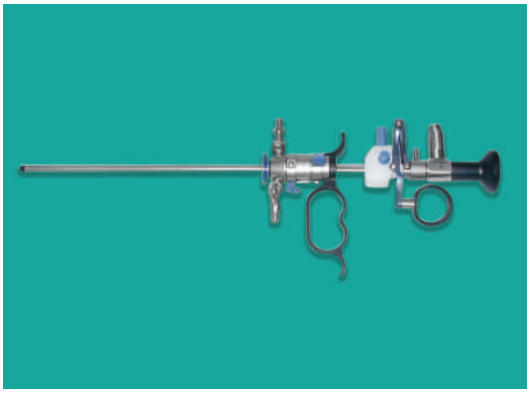


Fig. 13.13: Mini resectosope (Gubbini).

HYSTEROSCOPIC MORCELLATOR

Mechanical energy is used rather than high-frequency electrical energy to simultaneously cut and aspirate tissue.

TRUCLEAR

It is a new advance in operative hysteroscopy. It consists of two rigid cylindrical pipes, one fitted into the other, the internal, which acts as cutting tool, rotates within the outer, at a certain speed. It "shaves" the tissue as it rotates, and suction continuously occurs outward from the cavity toward a collecting container. The morcellator is of 4 mm in diameter and requires cervical dilation (Fig. 13.14).

Latest TruClear system of 2.5 mm diameter for resection of small polyps or fibroids as an office procedure is available.

MyoSure tissue removal system: Acts similar to Truclear but has a smaller diameter of 3 mm and is faster at tissue removal (Fig. 13.15 and Table 13.1).

Fig. 13.14: TruClear™ hysteroscopic morcellator.

Fig. 13.15: MyoSure tissue removal system.

Table 13.1: MyoSure device versus TruClear system.

Morcellator characteristics	*TruClear*	*MyoSure*
Device outer diameter	4 mm	3 mm
Hysteroscope outer diameter	9 mm	6.25 mm
Pump compatibility	Smith and Nephew pump	Any fluid management system
Blade rotational speed	1100 rpm	6000 rpm
Blade edge	Inner level	Outer level
Maximum rate of suction	200 mm Hg	400 mm Hg

THREE-DIMENSIONAL HYSTEROSCOPY AND ARTIFICIAL INTELLIGENCE

The latest and yet to be launched development is three-dimensional (3D) hysteroscopy. Depth perception dimension has been added. The device connects to any normal 2D endovision camera and can be used with any telescope and it changes the image from 2D to 3D. This opens up a whole new door to hysteroscopy as 3D has opened up laparoscopy.

To be able to perceive and see the depth of fibroids in the uterine cavity in 3D dimensions with or without artificial intelligence (AI) will be a quantum leap and will make surgery much more precise hysteroscopically. *This, we believe, will be and is the future of hysteroscopic surgery*.

As newer instruments and techniques continue to emerge, the prospects for improvement seem unlimited which remind us of Clarke's three laws.

Clarke's Three Laws are "laws" of prediction formulated by the British writer Arthur C. Clarke. These are:

1. When a distinguished but elderly scientist states that something is possible, he is almost certainly right. When he states that something is impossible, he is very probably wrong.
2. The only way of discovering the limits of the possible is to venture a little way past them into the impossible.
3. Any sufficiently advanced technology is indistinguishable from magic.

CONCLUSION

Hysteroscopy had a central role in the mini-invasive gynecological surgery. The modern office hysteroscopy has revolutionized the approach to the common uterine diseases, offering an easy, safe and cheap method to perform the operative procedures; sometimes complex in ambulatory setting and the same can be and will be incorporated in latest developments like 3D and AI to take modern hysteroscopy to new levels of magic.

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Chapter 14

Laparoscopic Tubal Recanalization

Pandit Palaskar, Vinod Bhivsane

INTRODUCTION

Microsurgical tubal reanastomosis is a surgical procedure of rejoining the separated segments of the fallopian tube that can restore fertility of women after a tubal ligation.

Many young women in their twenties or thirties are opting for tubal sterilization without any thought on other methods of contraception due to myths and fear of failure of contraception. Despite proper counseling and due precaution, about 2–10% women regret about sterilization.[1] One of important reasons for this regret of decision is a young maternal age at the time of sterilization. Other subsequent factors like loss of male child (20%) or loss of all child (70%), remarriage (5%), and desire to have another child because of improvement of the socioeconomic condition of the family.

SELECTION OF TREATMENT: SURGERY OR IN VITRO FERTILIZATION?

Two treatment modalities are available for women after having tubal sterilization: Microsurgical reversal and in vitro fertilization (IVF) treatment. The recommendation for surgery vs IVF has traditionally been based on multiple factors including age of the women, type of tubal ligation procedure, ovarian reserve, surgical fitness, other infertility diagnosis, economical status, number of children desired, and others.[2]

Recently, ASRM (The American Society for Reproductive Medicine) Committee Opinion concluded that although IVF has a higher per cycle pregnancy rate, tubal anastomosis with significantly higher cumulative pregnancy rates, is more cost-effective for all woman including those greater than 40 years of age.[2]

Current surgical management options include microsurgical technique by laparotomy and laparoscopic procedures. The laparoscopic approach has several important advantages over laparotomy, such as fewer complications, less postoperative discomfort, no incisional scar, a shorter recovery time, and earlier resumption of normal activities.[3]

A laparoscopic approach of this procedure was introduced by Sedbon et al.[4] in 1989 using biological glue and an intraluminal guidewire.

With advances in endosuturing and increasing expertise, tubal microsurgery is now routinely performed by laparoscopy. Microsurgery is a surgical philosophy, a dedicated surgical approach designed to minimize peritoneal trauma and tissue disruption while increasing the accuracy of the procedure and improving the outcome.

PRINCIPLES OF MICROSURGERY

Laparoscopy fulfills all principle of microsurgery like minimal tissue injury, avoiding introduction of foreign bodies into peritoneal cavity, meticulous pinpoint hemostasis, complete excision of abnormal tissues, precise alignment, approximation of tissue planes, and use of magnification. It helps in preventing adhesions formation and subsequently increases pregnancy rate.

PREOPERATIVE EVALUATION AND COUNSELING

Each woman who requests for tubal reanastomosis should be completely evaluated for her fertility potential including ultrasound examination for uterine status, ovarian reserve, associated pelvic pathology, and hormonal analysis. Semen analysis is also performed to show that the male partner is fertile.

Couple should be explained about the success rate and chances of ectopic pregnancy in spite of the risk of laparoscopy. They should be given other available treatment options. Also couple should be given idea about abandonment of surgery if tubes are severely damaged or sterilization at extremes of tubal ends. They need follow-up after conception to confirm intrauterine or ectopic pregnancy.

INSTRUMENTATION (FIG. 14.1)

- Three chip or HD camera
- High resolution monitor more than 800 lines
- Xenon light source
- KOH ultramicro instruments
- Sand-blasted instrument tips
- 6-0 to 8-0 delayed or nonabsorbable suture
- Dedicated team.

SURGICAL TECHNIQUE

The patient is placed in the lithotomy position under general anesthesia. Diagnostic hysteroscopy is routinely done in our center to rule out uterine pathology.

A 12 mm trocar is placed by direct method through an umbilical or supraumbilical incision and 10 mm, 30° telescope with an endoscopic camera system is introduced into the abdominal cavity followed by adequate pneumoperitoneum with CO_2 gas.

The surgical procedure started with evaluation of tubal length, site of tubal ligation, the quality of the fimbria and adhesions. If the tubal length is shorter than 3 cm or extensive

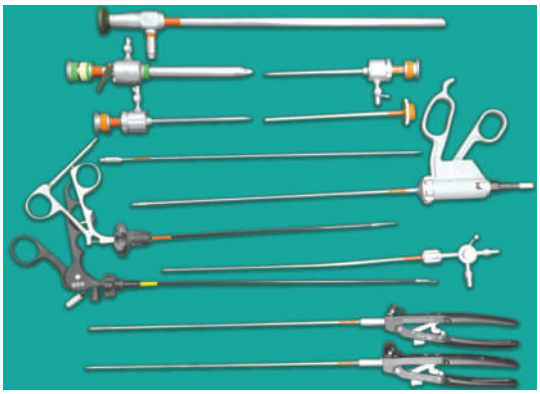

Fig. 14.1: Surgical instruments.

adhesions involving the tube or fimbriectomy or gross hydrosalpinx is present, the procedure is abandoned after the initial examination, three 3-mm trocars inserted in the lower abdomen. All of the instruments used for suturing and tissue dissection such as forceps, microscissors, graspers, and needle holders are 3 mm in size.

PORT PLACEMENTS

Generally, we follow four-port technique for reanastomosis (Fig. 14.2). The cut-ends of occluded tube are identified. Diluted vasopressin is infiltrated into mesosalpinx with spinal needle no. 23 G for hemostasis and hydrodissection. Transection of the obstructed fibrosed tubal stumps is done. The excision of at least 5 mm away from the obstructed area of medial and lateral segments of the tube is done to obtain normal cilial function. Patency of both segments is checked by injecting methylene blue dye. No stent is used during the procedure. We reanastomose tubal segments in two layers (muscularis and serosal layers). The mesosalpinx is then reapproximated with delayed absorbable polyglactin (vicryl) no. 6–0 to bring medial and lateral end closure. First suture is placed at 6-o' clock position on both segments such that the suture knot lies outside the lumen of tube excluding serosal layer. Three sutures placed in same fashion at 3, 9, and 12 o'clock positions. Serosal layer is approximated with placing three to four sutures depending upon tubal diameter. Tubal patency is checked after anastomosis. Final length of the reconstructed tubes is measured on each side and noted. Average duration of surgery is 60–90 minutes (Figs. 14.3 to 14.16).

All of the patients are discharged on the next day and they are advised to avoid pregnancy for the next 6 weeks for proper healing of tube and to prevent ectopic pregnancy. A hysterosalpingogram (HSG) is performed 1 year after surgery to assess tubal patency if pregnancy is not achieved.

ROBOTIC MICROSURGERY

Robotically assisted laparoscopic tubal reanastomosis has combined the advantages of open microsurgery and laparoscopy. The robotic arms and the unique design of the instruments

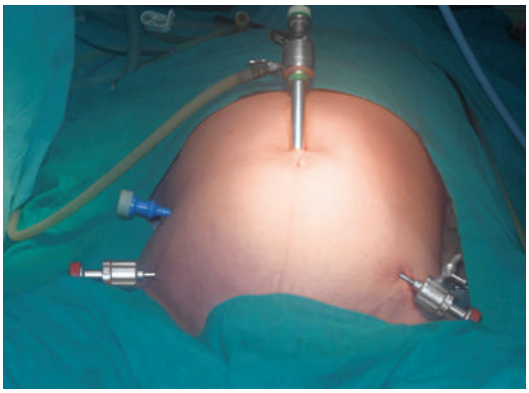

Fig. 14.2: Port placement.

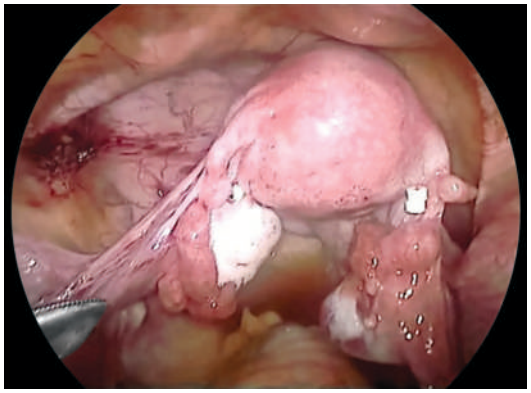

Fig. 14.3: Ligated tubes.

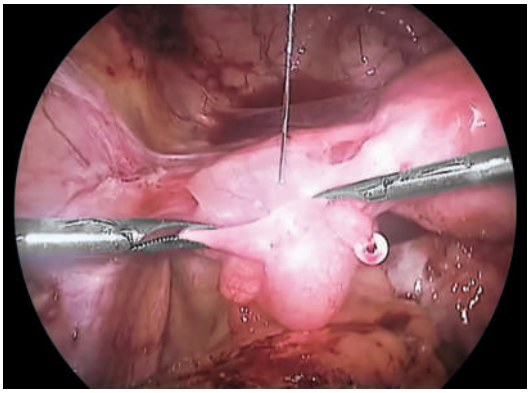

Fig. 14.4: Vasopressin infiltration in mesosalpinx.

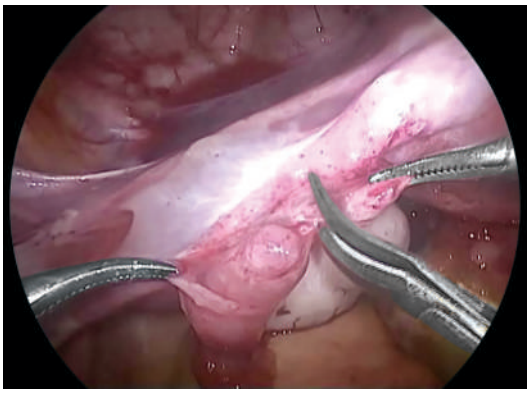

Fig. 14.5: Refreshing of lateral segment.

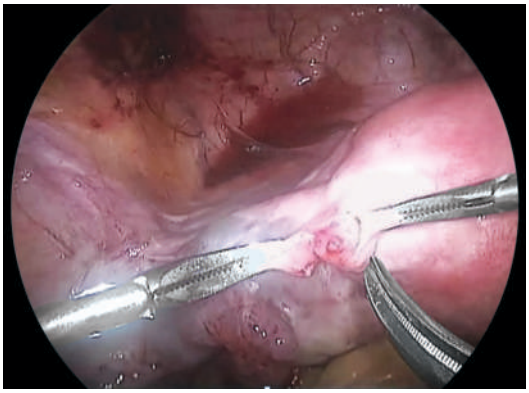

Fig. 14.6: Refreshing of medial segment.

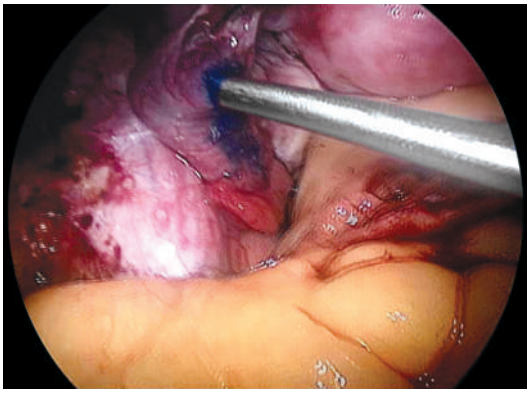

Fig. 14.7: Lateral segment patency test.

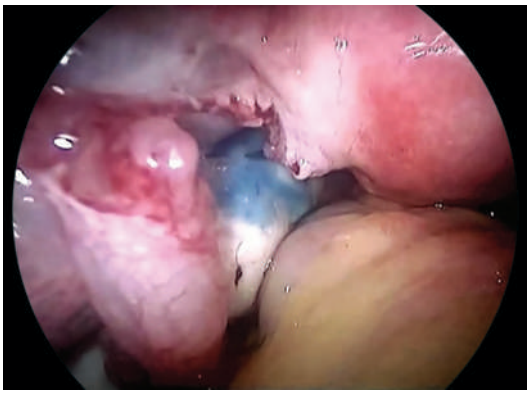

Fig. 14.8: Medial segment patency test.

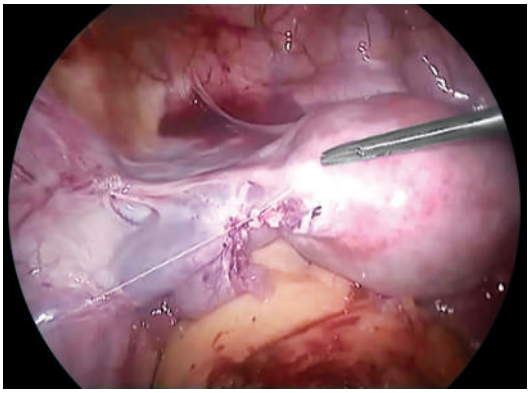

Fig. 14.9: Mesosalpingeal suture.

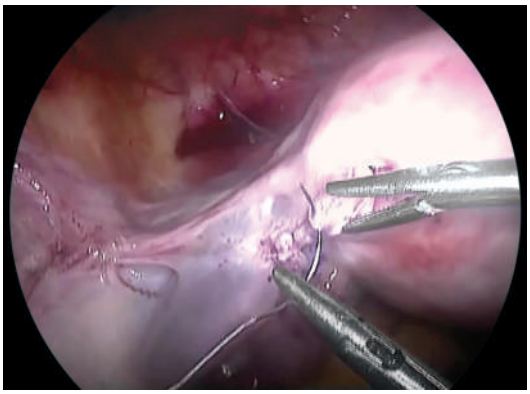

Fig. 14.10: Placement of 6-o' clock suture.

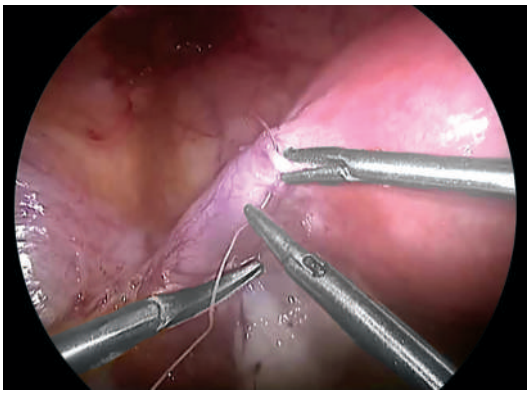

Fig. 14.11: Serosal suture.

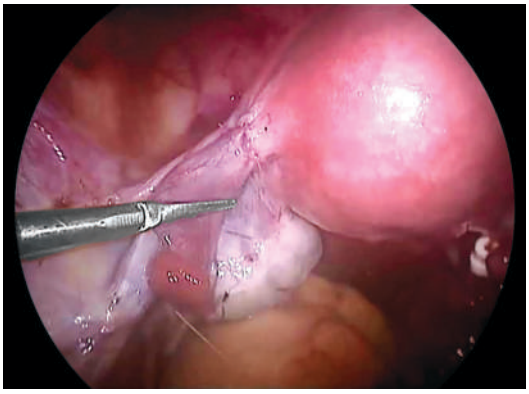

Fig. 14.12: Left tubal reanastomosis complete.

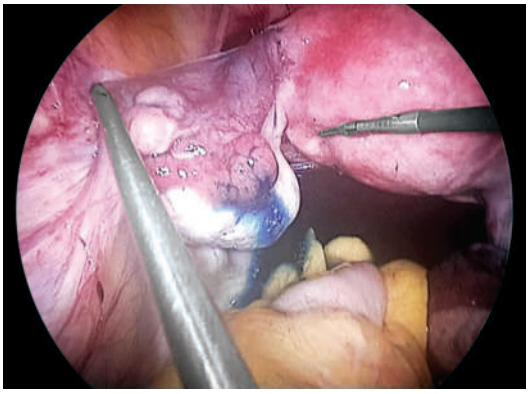

Fig. 14.13: Left tube freely patent.

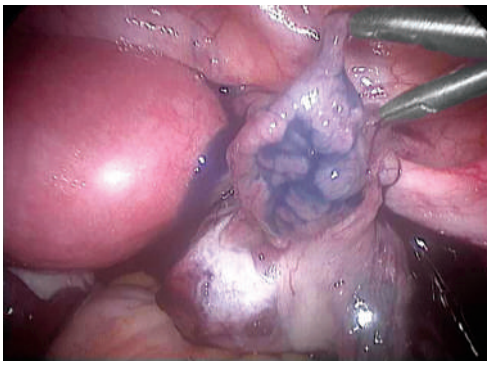

Fig. 14.14: Right tube freely patent.

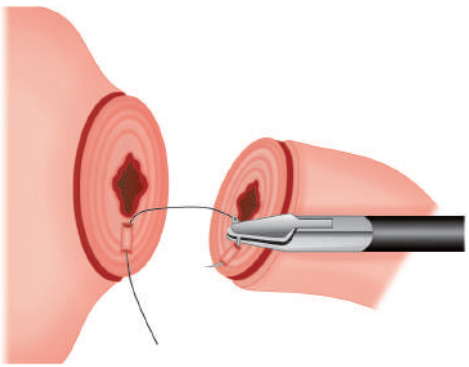

Fig. 14.15: 6 o' clock suture is taken from outside inside on proximal stump and inside outside on distal stump.

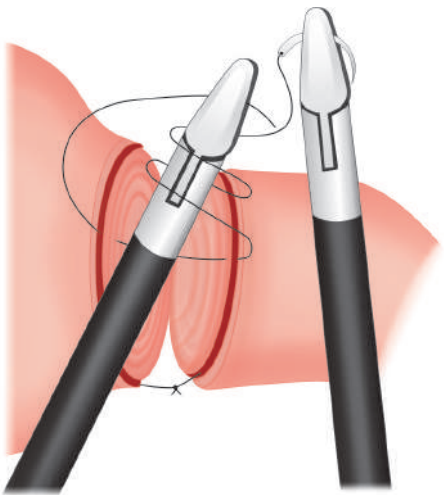

Fig. 14.16: The suture is tied intracorporeally.

with intra-abdominal articulation give the surgeon all necessary degrees of freedom allowing performance of complex movements in a limited space. The computer eliminates unintentional small hand movements and tremors.[5] Availability at selected centers and cost are the main limiting factors for robotic microsurgery.

SUCCESS RATE

Using microsurgical techniques, reported pregnancy rates vary between 57% and 84%,[6] with a risk for ectopic pregnancy of 2–7%.

Age at the time of tubal reversal is the most important factor in the outcome of tubal reanastomosis.

Women younger than 35 year at the time of surgery, 70% of them achieve pregnancies within 18 months after surgery.[7]

The remaining total tubal length appears to be one of the prognostic factors of tubal reanastomosis. Poor results have been reported when the total tubal length was shorter than 4 cm.[8]

Spivak et al.[9] and Winston[10] found that the site of anastomosis significantly affected the eventual outcome. An 88% intrauterine pregnancy rate was achieved after isthmic–isthmic anastomosis.

According to Vasquez et al.,[11] the results of reversal surgery are much better if the interval after sterilization is less than 5 years.

The surgeon's experience affects success of tubal reversal. Laparoscopic tubal reversal is a challenging surgery; it requires a qualified surgical skill and is considered as an advanced laparoscopic surgery. However, surgical techniques and instruments may also play an important role.

OUR EXPERIENCE

In our hospital, we have performed laparoscopic tubal reanastomosis in 492 cases from January 2002 to December 2017. In follow-up period, 340 patients (69%) conceived with tubal ectopic pregnancy in 11 patients (2.2%) (Table 14.1).

TUBAL RECANALIZATION IN ERA OF ASSISTED REPRODUCTIVE TECHNOLOGY

Tubal recanalization should be considered as a first-line treatment option for young women less than 35 years without other infertility factors. Microsurgical tubal surgery offers couples multiple cycles in which conception achieved naturally and the opportunity to have more than one pregnancy from a single operation.[12] It is most cost-effective comparative to assisted reproductive technology (ART). IVF is a palliative technique, whereas tubal surgery is curative. The choice of method depends on nature, extent of tubal disease, and age of patient.

In a study by Boeckxstaens et al. the cumulative pregnancy rate was 52.0% in the IVF group and 59.5% in the surgical reversal group.[13] The pregnancy rate decreases significantly with advanced age.

Table 14.1: Factors affecting success rate.

Good prognostic factors	*Poor prognostic factors*
• Age less than 35 years • Type of sterilization-clips or Falope rings • Residual tubal length: More than 5 cm, pregnancy rate drops to 50% with 3–4 cm. • Site of anastomosis: Isthmoisthmial gives better results than isthmic ampullary, cornual • Time interval from sterilization • Healthy status of tubes • Absence of pelvic disease • Status of other fertility parameters	• Age more than 40 years • Residual tubal length less than 3 cm • Anastomosis at extremes of tubal end • Bipolar tubal disease • Badly damaged tubes • Tubal hydrosalpinges

SUMMARY

Laparoscopic tubal reanastomosis is a well-established surgery giving improved or comparative results with open microsurgery. Results are best in a young patient when reanastomosis is isthmoisthmic, residual tubal length is more than 5 cm. Women with badly damaged tubes are best dealt by IVF.

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Chapter 15

Laparoscopic Surgery for Prolapse

Late Pravin Patel, Soumil Trivedi

INTRODUCTION

Pelvic organ prolapse is an increasingly common condition seen in women. Variety of treatment options are available depending on the degree and type of prolapse in conjugation with other circumstances of patient including age, parity, and previous treatments taken. Surgical reconstruction of pelvic organ prolapse may be performed by a variety of techniques.[1] One of the preferred options is vaginal approach because of its advantages in terms of reduced length of hospitalization and postoperative pain, as well as a faster return to normal activities and a better cosmetic result. However, some data suggest that anatomic outcomes may be less than optimal. Initially by laparoscopic reconstruction proven abdominal techniques were reproduced, but in a minimally invasive fashion. As more information was gained about the pathogenesis of prolapse, and as device innovations are introduced that improved surgical techniques have emerged. Compared with open abdominal surgery, laparoscopic surgery[1,2] is associated with a number of advantages, including: shorter hospital stay, decreased postoperative pain, cosmetic small scars, potentially reduced time before resumption of work, and other normal activities.

Technical advances include rapid carbon dioxide insufflators, 3D, three-chip, and high definition cameras that improve picture clarity, ultrabright light sources, safer energy sources, and changes in laparoscopic needle drivers and automated suturing devices.

PREOPERATIVE PREPARATIONS

Careful preoperative assessment should include anatomic and functional aspects of the pelvic floor; establishing and understanding individual patient's prolapsed defect to achieve an optimal anatomic outcome.

Urinary incontinence is an area of concern as it can develop de novo or worsen following prolapse repair. The urethra may be anatomically kinked in patients with huge prolapse. Following prolapse repair, insufficient urethral sphincter function may result in new onset (occult) stress urinary incontinence.

Preoperative cough stress test with a full bladder after manual reduction is recommended to decide how to proceed further.

SURGICAL TECHNIQUE

Factors that should be considered include the overall health of the patient (including her ability to undergo general anesthesia and abdominal insufflation), and previous approaches to prolapse surgery, such as retropubic procedures.

Informed consent should include the possibility of having to change rarely the surgical approach intraoperatively to an open laparotomy in the event that adhesions or other factors. A mechanical bowel preparation often improves laparoscopic visualization by decompressing the bowel.

In absence of any previous surgery umbilical placement of 0° telescope is preferred. In a previous vertical abdominal incision consider either an alternative location for Veress needle and initial trocar placement 2 inches above the uppermost point of the external scar, Palmer's point in the left upper quadrant in the ninth intercostal space (Fig. 15.1) is common option. The operating field is then carefully organized by fixing the sigmoid to the abdominal wall and clearing the pouch of Douglas.

Basic Surgical Techniques

The surgeon should be well verse and properly trained for extensive suturing and should use enough accessory trocars to allow for both retraction of tissues and transfer of needles from one needle driver or grasper to another.

Surgery can be divided into the anterior, posterior, or apical vaginal compartments correction. Several procedures are usually since multiple defects in the pelvic floor often occur, resulting in symptomatic and clinically evident prolapse of more than one organ.

Anterior

The most common defect leading to cystocele or anterior vaginal wall prolapse is secondary to primary apical descent.

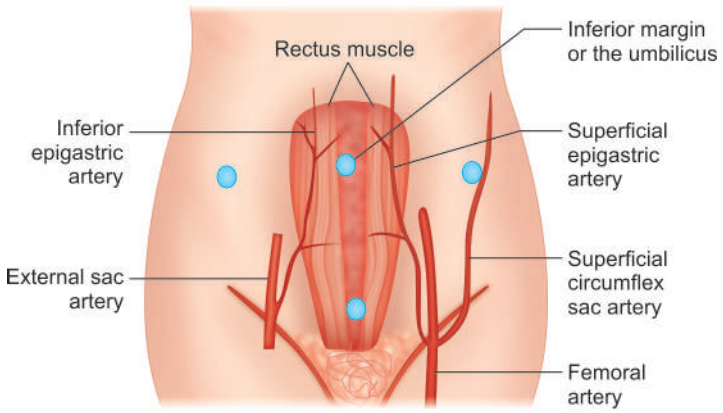


Fig. 15.1: Trocar placement.

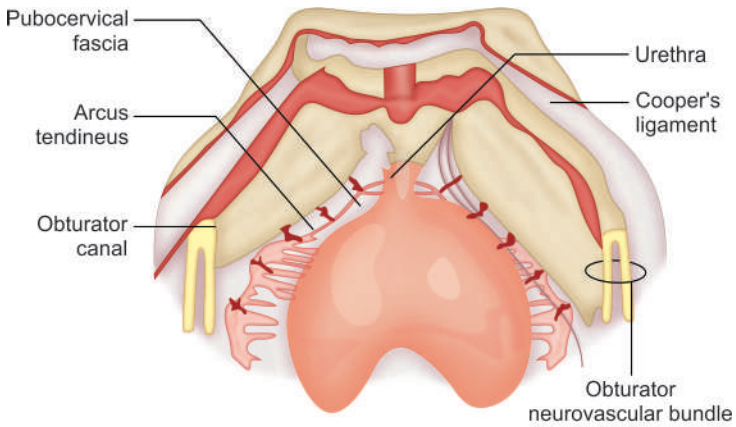


Fig. 15.2: Anterior compartment.

Paravaginal repair of cystocele may be performed after gaining access to the space of Retzius or retropubic space (Fig. 15.2). Most commonly, transperitoneal laparoscopy is performed and the retropubic space is entered using sharp dissection with electrocautery. Backfilling the bladder with 200 to 300 mL of stained fluid may be helpful in selected cases.[3]

After dissection, Cooper's ligaments are identified. Paravaginal repair involves placing a series of interrupted permanent sutures between the arcus tendineus fascia pelvis (ATFP) and the detached pubocervical fascia, starting near the ischial spine and working distally toward the pubic bone.

If a laparoscopic Burch procedure is performed for stress incontinence, the final paravaginal sutures are placed at the bladder neck, whereas if no Burch procedure is performed, the paravaginal repair is continued up to the insertion of the ATFP on the posterior-inferior surface of the pubis.[4-6]

There are no studies documenting equivalence of open abdominal versus laparoscopic paravaginal repair.

UTERINE PROLAPSE

Uterine suspension should be considered as an option for women who either are considering future childbearing or who would prefer to avoid hysterectomy for other reasons.

Uterosacral ligament uterine suspension: Mild-to-moderate degrees of uterine prolapse may be approached with uterosacral ligament uterine suspension.[7]

The proximal portion of the uterosacral ligament, at the level of the ischial spine, is identified and uses permanent sutures to bind distal aspect of the ligament, near its insertion into the lower uterine segment and cervix (Fig. 15.3).

The use of a uterine manipulator may assist with identification of the uterosacral ligaments. While working on uterosacrals, identification and proper retraction of pelvic ureters is mandatory to avoid complications.

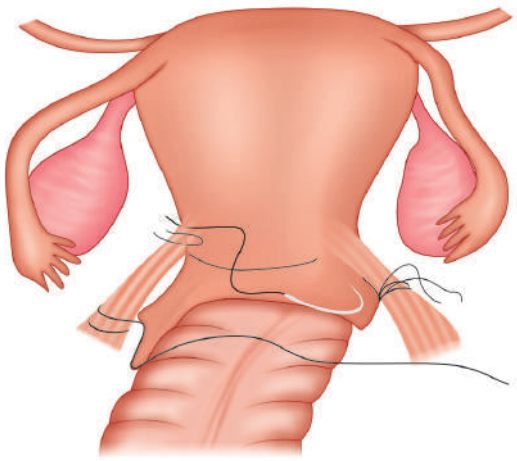


Fig. 15.3: Uterosacral ligament suspension.

SACROCERVICOPEXY (FIGS. 15.4 AND 15.5)

It is an alternative procedure for uterine suspension that involves suturing the posterior vagina and cervix to the sacrum using an intervening graft, which may be either synthetic (e.g. polypropylene, polyester) or biologic (e.g. fascia, dermis). This procedure may be appropriate for specific patient populations including young women with Stage III or IV uterovaginal prolapse.

To perform this procedure with uterine conservation, the peritoneum and rectum are dissected off of the posterior vaginal wall, followed by placement of a series of sutures in the rectovaginal fascia, distal uterosacral ligaments, and cervix. A solid plastic rectal probe may help identify and avoid injury to the rectum during dissection in the rectovaginal space.

The presacral space, the peritoneum is opened over the sacral promontory and dissection is carried down until the anterior longitudinal ligament of the sacrum is exposed. The peritoneal incision is continued inferiorly, medial to the right uterosacral ligament and lateral to the rectum, until it meets the peritoneal incision over the posterior vaginal wall. The graft/mesh is then sutured, without tension, to the sacrum with several permanent sutures and buried underneath the peritoneum alternatively, some titanium coils or stainless steel tacks for affixing the graft to the sacrum can be used.

Many surgeons prefer to dissect para rectal space till the levator plate is exposed and performing addition fixing of distal end of mesh with levator ani to complete three point fixations.

VAGINAL VAULT PROLAPSE

Vaginal vault prolapse may occur after any hysterectomy (Fig. 15.6), although it appears to occur more frequently in women whose hysterectomy was performed for prolapse, perhaps because the vaginal apex is insufficiently suspended following hysterectomy.[8]

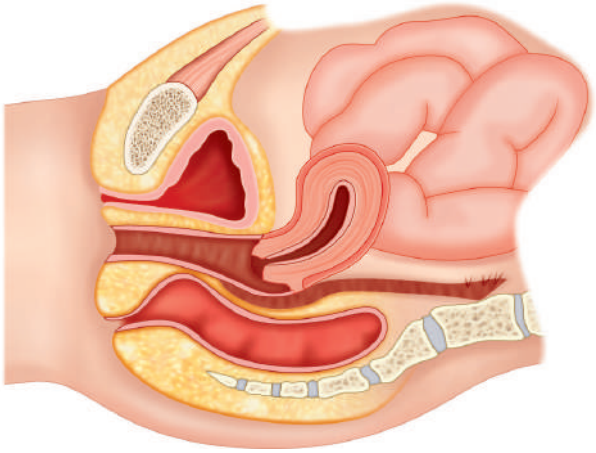
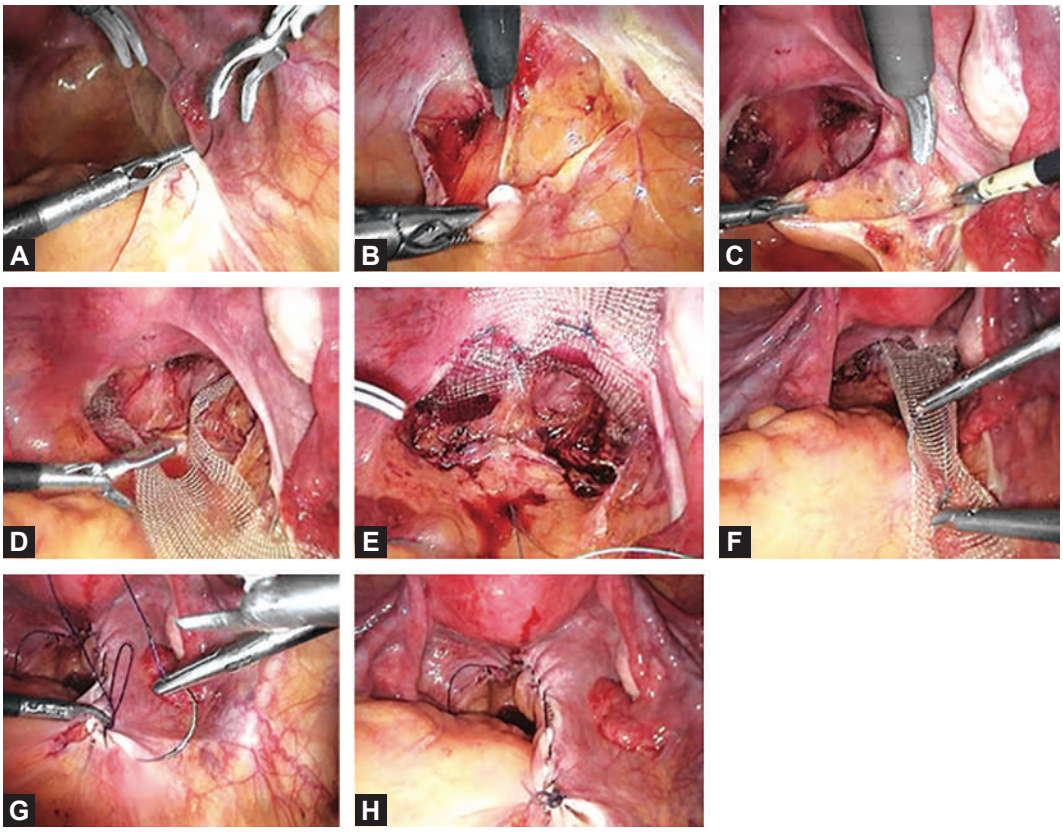


Fig. 15.4: Sacrocervicopexy.



Figs 15.5A to H: Laparoscopic sacrocervicopexy. (A) Presacral space dissection; (B) Promontory; (C) Lateral peritoneal dissection; (D) Mesh placement; (E) Cervicoisthmic mesh fixation; (F) Promontofixation; (G) Peritonization; (H) Peritonization complete.

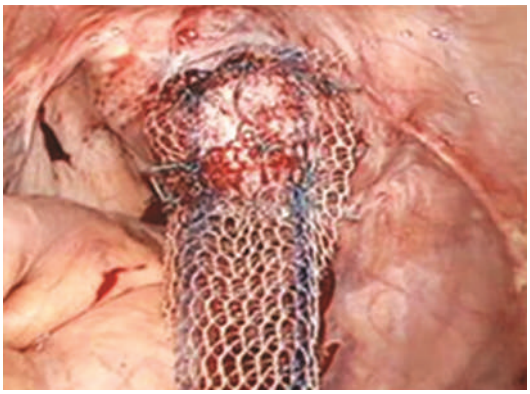


Fig. 15.6: Sacrocolpopexy.

SACROCOLPOPEXY

Laparoscopic sacrocolpopexy[9-11] is an option when pelvic organs prolapse quantification (POP-Q) stage II to IV vault prolapse is present. In these patients, it is often difficult to identify any useful remnants of the uterosacral ligaments for suspension.

In small nonrandomized studies, objective cure rates for the laparoscopic approach procedure of 93–100% have been reported at 6 months to 5 years follow-up. To perform laparoscopic sacrocolpopexy, after the bladder and rectum are dissected off the anterior and posterior vaginal walls, respectively, a Y-shaped synthetic graft is sutured to the anterior and posterior endopelvic fascia with a series of permanent sutures.[12-15] The graft is fixed to the anterior longitudinal ligament of the sacral promontory, after dissection is performed in the presacral space (as described for sacrocervicopexy). The procedure is typically completed by burying the graft under the peritoneum.

The goal of this laparoscopic procedure, is to duplicate the steps performed in the open procedure, as closely as possible, so that the results reported with the traditional surgery may be reproduced with minimally-invasive techniques. A retrospective chart review compared the outcome of laparoscopic versus abdominal sacrocolpopexy.[16-19] Surgical time was marginally increased in the laparoscopic group, blood loss was decreased. Rates of perioperative complications and subsequent procedures for pelvic floor defects were similar between the two approaches.

ENTEROCELE

Enterocele refers to herniation of bowel and the lining of the peritoneal cavity through the cul-de-sac of Douglas, without an intervening fascial layer.[20-22]

This most often occurs at the vaginal apex after hysterectomy, due to either a failure to properly reapproximate the anterior and posterior endopelvic fascia or breakdown of this repair.

Standard sacrocolpopexy technique does not require additional enterocele repair.[22] Some authors recommend resection of the enterocele sac (redundant vaginal epithelium) whereas others simply plicate fascia over the redundant tissue.

Rectocele (Posterior Vaginal Wall Repair)

Due to the ease of access via the vaginal route, there is no role for laparoscopic rectocele repair.

Levator Ani Muscle Plication Repair

Due to the risk of postoperative dyspareunia, it is not recommended as part of a laparoscopic reconstruction.

Robotic Sacrocolpopexy

The introduction of robotic surgery[23,24] to gynecologists has fueled a renewed interest in minimally invasive sacrocolpopexy and other procedures for prolapse that require endoscopic suturing. A number of small series have been published that appear to demonstrate the feasibility and short-term success rate of this approach to sacrocolpopexy.

COMPLICATIONS

- *Urinary tract injury:* Injury to the bladder and ureters occurs occasionally in laparoscopic reconstruction procedures or in open gynecological surgery. Due to these risks, intraoperative cystoscopy can be considered as a part of these procedures.
- *Urinary retention:* Although more commonly associated with suburethral sling procedures, any anti-incontinence[25] surgery (including Burch colposuspension) or vault suspension procedure may result in voiding dysfunction and/or urinary retention.[26] Continuous bladder drainage or intermittent self-catheterization may be used as a part of treatment.
- Prophylactic oral antibiotics are given to reduce the risk of lower urinary tract infections.
- *Mesh infection and mesh erosion:* Erosion of graft material or suture material, which may be caused by graft or suture infection usually secondary to vaginal wall penetration, performing the procedure adjacent to a vaginal incision, or securing the graft to an attenuated avascular wall with inadequate fibromuscular tissue.
  - Risks such as mesh infection or rejection are very rare with the newer mesh used, which is a macroporous soft polypropylene mesh.
    Other common causes for mesh infection include:
    - Intraoperative hemorrhage (especially in the presacral space)
    - Postoperative ileus
    - Wound complications, such as seromas and infections.
    - Early resumption of intercourse with vaginal wall penetration of sutures during repair.
- *Postoperative care*: Patients undergoing laparoscopic pelvic floor reconstruction are usually discharged on the same day or the day after surgery.[27,28] A prescription for oral analgesics (e.g., ibuprofen or oxycodone) is given and stool softeners are recommended until normal bowel habits resume. Heavy lifting for 8 weeks and intercourse for six weeks postoperatively should be avoided.

SUMMARY AND CONCLUSION

Laparoscopic promontofixation[29] is a feasible operation with a good anatomical success rate for young patients with uterovaginal prolapse. This technique is applicable for the treatment of pelvic floor defects, including all the stages of prolapse. It would be desirable to improve the results concerning urinary incontinence by treatment with TVT-O (tension-free vaginal tape-obturator), which could be systematic in women presenting considerable stress urinary incontinence preoperatively, while the use of the Burch procedure could correspond more to the repair of lateral cystocele, associated with paravaginal repair. Right use of patient selection, technique, material, and equipment is essential for optimal outcome.

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Chapter 16

Minimal Access Surgery for Female Urinary Incontinence

Prakash Trivedi, Pallavi Erlekar

INTRODUCTION

With advancing age; due to better health care of females, we have a larger section of women with good longevity. Of course, this comes at a price. Taking care at 40 plus becomes prevention and later due to advanced age it has to be cured or treated.

It is estimated that almost 16 million women in India have urinary incontinence of different types. Quite often, they are tossed up between general practitioner, gynecologist and urologist. Very often beyond antibiotic, vaginal cream, and urine alkalinizers are prescribed, with no benefit. One may have lack of knowledge in the subject or has knowledge but feels it is trivial and small for focused attention.

The woman suffers in silence and it does not become a laughing matter as they leak urine on a hearty laugh. There may be more than 130 surgeries for treatment for stress urinary incontinence (SUI) and unlike in the past, other incontinence–urge, bladder instability, frequency, etc. can be now dealt with newer medications quite effectively.

PHYSIOLOGY OF BLADDER FUNCTION

Reduced activation of sympathetic nervous system results in relaxation of the detrusor muscle, closure of the sphincter, and bladder filling. When the volume of urine in the bladder reaches 200–400 mL, the sensation of urge to void is relayed via the spinal cord to the brain centers. Voluntary voiding involves the parasympathetic nervous system and the voluntary somatic nervous system. Influences from these systems cause contractions of the detrusor muscle and corresponding somatic nervous activity, leading to sphincter relaxation.

Bladder Innervation

Micturition is fundamentally a spinal reflex facilitated and inhibited by higher brain centers subject to voluntary facilitation and inhibition.

MEDICAL MANAGEMENT OF URINARY INCONTINENCE

Antimuscarinic Agents

Tolterodine Tartrate

This agent was specifically developed for bladder, with some bladder selectivity. The usual adult dose is 2 mg twice a day. Newer extended release preparations make once a day dose feasible with a 2 mg and 4 mg option, with lesser incidence of side effects with equal efficacy.

Trospium Chloride

This is a quaternary ammonium compound with nonreceptor selective antimuscarinic anticholinergic activity. As it does not cross the blood-brain barrier, it is safe in elderly population. The drug is now available in India as a 20 mg immediate-release (12 hourly dosages) or 60 mg sustained-release preparation (24 hourly dosages). The side effect profile is comparable to that of tolterodine and oxybutynin.

Solifenacin

Solifenacin is one of the uroselective antimuscarinic agent, available in the Indian market. Given in the dose of 5–10 mg once a day, it has comparable efficacy with tolterodine with a better side effect profile.

Darifenacin

This is a highly selective M3 receptor antagonist, thus believed to be the most specific agent available so far in the drug treatment of overactive bladder. It does not cross blood-brain barrier because of its large molecule size. Thus, like trospium, it is safer in elderly population. The recommended daily dose is 7.5 or 15 mg once a day.

Anticholinergics (Antimuscarinics) with Mixed Actions

These agents have a direct antispasmodic action however, their therapeutic effects occur mainly through the antimuscarinic effect.

Oxybutynin Chloride

This is a potent muscarinic receptor antagonist recommended daily adult dose is 2.5–5 mg 3 times a day. The main bothersome side effects range from dry mouth to constipation and cognitive impairment. Once daily preparations are available as oxybutynin ER or XL (5 mg, 7.5 mg, 10 mg, and 15 mg).

Serotonin-Norepinephrine Reuptake Inhibitor

Duloxetine

Duloxetine is a potent and balanced dual serotonin and norepinephrine reuptake inhibitor (SNRI) that enhances urethral rhabdosphincter activity and consequently the bladder capacity. Clinically, duloxetine 80 mg per day (40 mg twice daily) decreases the incontinence

episode frequency and improves incontinence-related quality of life independent of baseline incontinence severity and also in patients awaiting surgery. The onset of action is within 1–2 weeks. The drug can also be started at 20 mg twice a day and slowly increased to the therapeutic dose. It is also available in a sustained release preparation of 60 mg SR.

Mirabegron Alpha adrenergic agonist in 25 or 50 mg sustained release relaxes bladder especially over active bladder and attains continence without side effects of parasympathetic muscarinic blockers like dryness of mouth, constipation, etc. Currently, this is a major breakthrough and most preferred drug.

ESSENTIALS FOR SAFE MANAGEMENT OF FEMALE URINARY INCONTINENCE

- Complete knowledge on the subject.
- To carry out necessary investigations, urodynamic studies, etc. when needed.
- Most important is accurate history taking.

Without going into elaborate details sufficing it to say that whether she has burning while passing urine or pain or fever may suggest cystitis, if she had many deliveries or forceps delivery and on cough, laugh, change in movements leaks small quantity of urine then this is SUI. The same takes place around menopause. SUI may be withheld for short time on medications by selective serotonin norepinephrine reuptake inhibitor (SS-NRI) which acts as a medical sphincter, till she plans surgery if genuine SUI (GSUI) or sphincter deficiency persists. Urgency, frequency and urge incontinence can be distinguished by proper history. Corrected by medical treatment with commonly used drugs tolterodine, rolefenacin, solifenacin, darifenacin, mirabegron.

CLINICAL EXAMINATION AND INVESTIGATION

The patient should be told to keep bladder partially full. On clinical examination she is asked to cough and watch for any demonstrable leak, even of small quantity of urine, then it is SUI.

If not in supine position, ask her to stand with legs apart and occasionally with knees bend and legs apart. We can see demonstrable small quantity of urine leak then it is stress incontinence. A large leak or less severe jet of urine on clinical examination can be picked up as GSUI or intrinsic sphincter deficiency (ISD) on urodynamic study.

A simple clinical evaluation of raising the mid urethra with two fingers upward gently pressed towards symphysis or with opened-sponge holder correcting leak of urine on cough or sneeze, suggest urethral hypermobility. Evaluate presence of cystocele, prolapse, etc. In a Q-tip test, a long bud or a stick just entering the bladder, if the tip goes upwards on cough or sneeze, it suggests urethral hypermobility. The same can be picked up by transvaginal sonography.

Urodynamic study is very useful but not compulsory in all cases, but in case of doubt of mixed incontinence, intrinsic sphincter deficiency, bladder instability, or failed procedure.

If surgery needed, choice of:

- Open burch or Tape-sling procedure.
- Laparoscopic burch sutures/tape.
- Transobturator sling-Outside-in method as in Trivedi's obturator tape (TrOT).

- TVT-O inside out.
- Bulking injections.

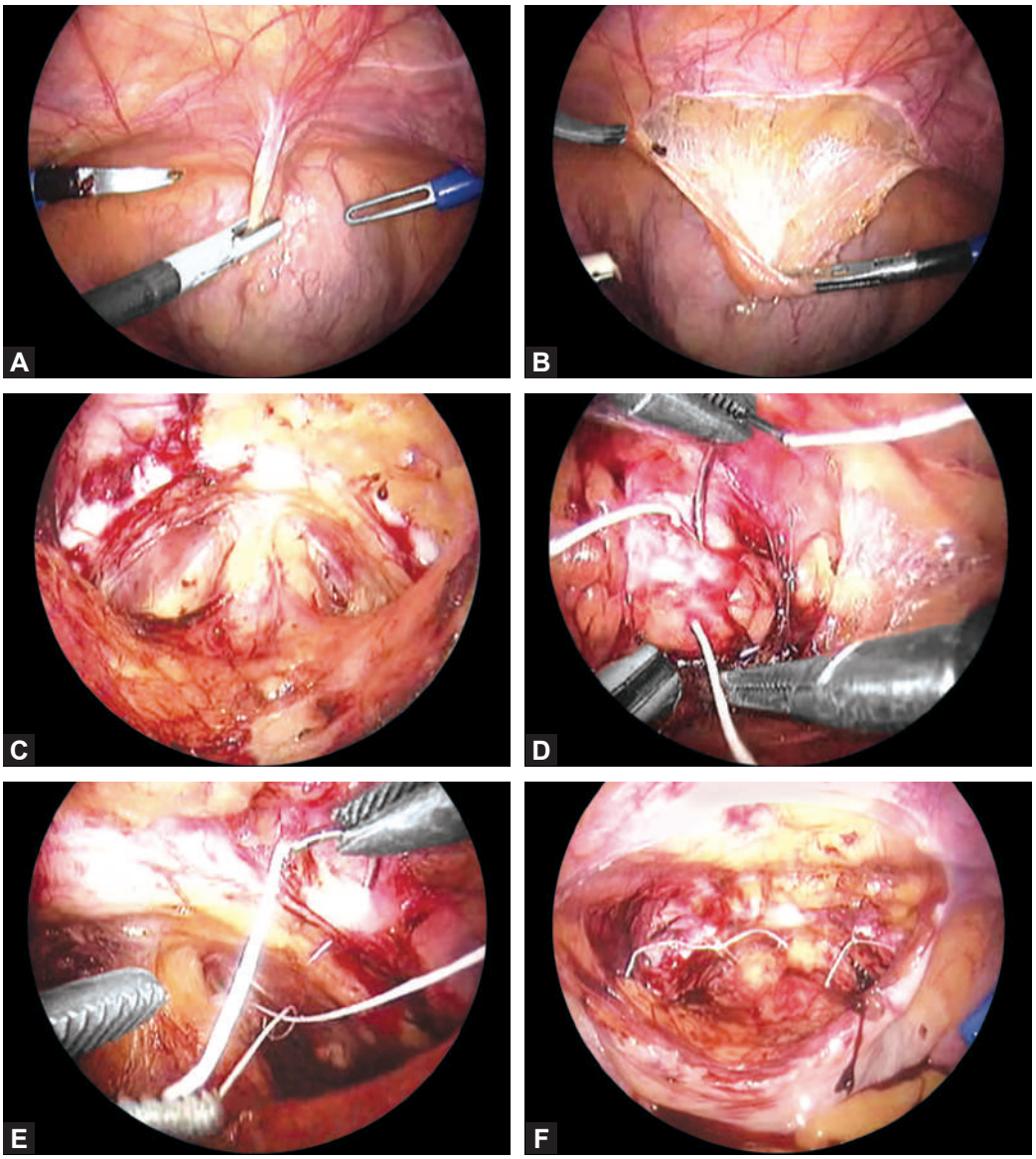
Anti-incontinence surgery can be done with or without any associated procedures like hysterectomy or anterior or posterior compartment defect corrected by open, laparoscopic, or trans perineal new mesh, though currently the transobturator sling is preferred with different products.[1]

Safety Points for Laparoscopic Burch

Modified lithotomy position with possible adjustable leg rest, fill the bladder by 250 mL of fluid, identify the upper limit of the bladder, make incision above it to enter space of Retzius. Laparoscopic CO_2 insufflation creates planes by bubbles between bladder and space of Retzius laterally. Harmonic scalpel is necessary and enhances by cavitational effect. Once the para urethral space is dissected, the bladder with catheter is seen and free space created around mid-urethra. The most important part now is to empty bladder, with the needle and Gore-Tex no. 2 sutures on curved needle are introduced through ports. Next, the operator puts his or her own fingers to elevate mid urethra while taking helical stitches 2 cm below and lateral to the bladder neck. Then same suture on the Cooper's ligament from the needle holder on the same side to avoid injury to aberrant obturator vessel which may present. The knots are tied with Goretex suture as hammock on both sides not too tight (Figs. 16.1A to F). A mersilene tape is used by many and tackers are used especially at Cooper's ligament and not ideally on vagina. The space of Retzius and peritoneum is closed to avoid bowel adhesion. Burch should not be done if there is intrinsic sphincter deficiency. The sling tape has replaced Burch for both GSUI and ISD.

Role of Sling: New Tapes—TSUIT, TrOT, TVT-O

It is based on the principle that the mid urethra is to be supported, on which the bladder rocks back on cough or sneeze. As the sub-urethral first group of sling were good but due to higher complication rate, they were replaced by transobturator sling or tape.[2] We will give more points of safety for transobturator sling-like or TrOT, outside-in technique. Placement of TrOT Patient is under spinal, epidural, saddle block, or short general anesthesia, patient in normal lithotomy position. There is no need for catheter or cystoscopy. The vaginal dissection is started by infiltration of a combination normal saline with 0.25–0.5% sensorcaine and 3–4 drops of adrenaline in 200 mL of normal saline. Vaginal incision is 1.5 cm from the external urethral meatus a vertical incision of 1.5–2 cm is taken. Dissect the vagina and the finger enters the space below the sub-pubic angle easily by blunt dissection. Small saline adrenaline soaked gauze is kept in the dead space. Now the important landmark for the outside in technique, identify the Adductor Longus tendon and below that the obturator foramen upper and medial most point close to the thigh crease, a 4 mm incision is made with 11 no. knife after infiltrating with 5 mL of 0.25–0.5% sensorcaine undiluted to reduce pain postoperative. The Monarc or TrOT outside in needle is first inserted perpendicularly to perforate obturator membrane, then with index of the other hand in the vagina and the thumb of the same hand guiding the needle, the handle which is angulated by 45° pushing the needle and gradually comes out in the vagina below the sub-pubic angle below the vagina dissected and out from the area with tip of the

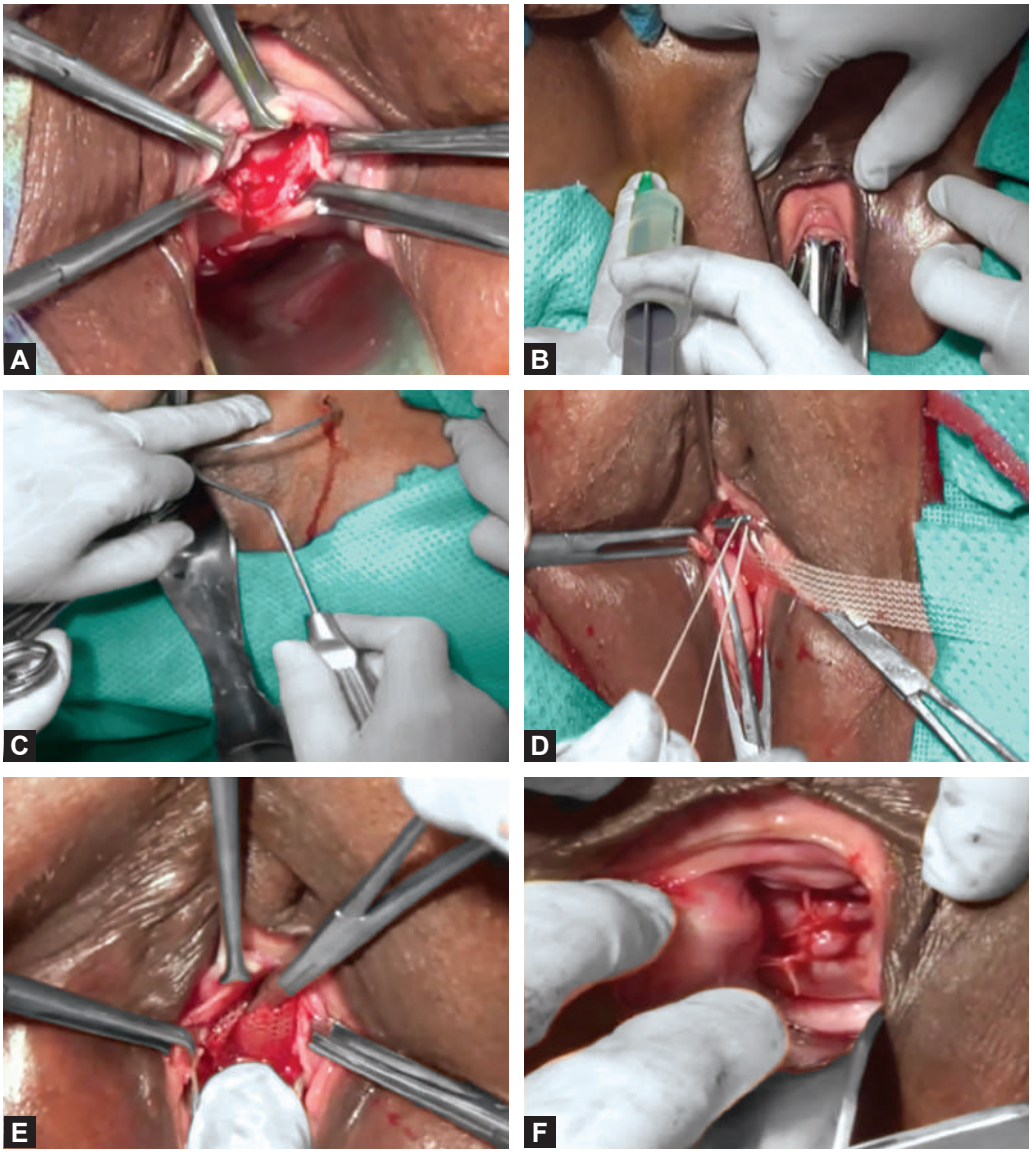


Figs. 16.1A to F: Steps of laparoscopic burch colposuspension: (A) Upper limit of the distended; (B) Entry in to space of Retzius bladder; (C) Space of Retzius dissected urethra, bladder neck and Cooper's ligament; (D) Right paraurethral helical stitch; (E) Right Cooper's ligament stitch; (F) Burch–Bilateral colposuspension.

needle pointing towards the urethra. The tape or sling is kept tension-free in the mid urethra. The vagina is closed and extra tape outside the obturator foramen is cut and skin is pulled, so the tape sinks in subcutaneous tissue (Figs. 16.2A to F). The results are on the spot and so are failures. In SUI the tape may not erode but can herniate through opening of vaginal suture with relief from SUI because fibrosis is already developed, in that case the tape can be cut and vagina freshened and closed again.

The chance of entering bladder is insignificant with TrOT or obturator route unless there is a cystocele; hence no cystoscopy or catheterization is needed.

Procedures like Miniarc and transvaginal tape (TVT)-secure are not elaborated as their long term results are not good and still in research.



Figs. 16.2A to F: Steps of transobturator placement of SUI tape: (A) Vaginal incision made 1.5 cm below external urethral meatus; (B) Infiltration done for needle entry below adductor Longus tendon—2 cm above EUM; (C) Specialized curved needle for tape insertion; (D) Needle maneuvered into vagina and end of tape fed into the eye of the needle; (E) Tape brought out on either sides until it sits over mid urethra tension free; (F) Vaginal incision over the tape closed. (EUM: External urethral meatus; SUI: Stress urinary incontinence)

Trivedi's Adjustable Tape

This is like TrOT but has specially woven nonabsorbable threads which allow us to tighten or loosen the tape till 48–72 hours after surgery and these four nonabsorbable threads can then be pulled out easily. Few more refinements would make this as the standard tape or sling for GSUI or ISD.

TVT or Trivedi's SUI Tape (TSUIT) the vaginal SUI sling, used less nowadays, was a sling placed sub mid urethra and coming out of the abdomen.

The original TVT and TSUIT needed a 20 French Foley's catheter to pass a metal guide to take the bladder on the opposite side where the needle were used usually from below upwards coming 3 cm lateral to the midline, i.e., the posterior part of pubic tubercle.

Further on 70° cystoscope with a fore oblique shape was necessary to identify the bladder injury or placement of the mesh in the musculature of bladder.

There were complications of retention. Also entry into the bladder and other structures around could be injured.[3-5]

Vaginal dissection is like TrOT, but the needle goes from the vagina entering through space of Retzius, coming out 3 cm away from the midline in the abdomen as the metal guide takes the empty bladder away. Attached tape is also pulled up. The same is repeated on the other side. Vagina is closed with continuous Vicryl 2-0.

CONCLUSION

Urinary problems, especially frequency, urgency, urge incontinence, bladder instability detrusor dyssynergia, GSUI, ISD affect millions of women who come more often to Gynecologist and General practitioners, less to Urologist directly. First four conditions are corrected by medicines very effectively. GSUI and ISD needs surgery, now a transobturator sling which is quick, easy, and has excellent results and need for catheter, cystoscopy being absent, having minimal complications have replaced Burch or Marshal Marcheti Krantz and other thread suspension procedures. The new Trivedi's adjustable tape can reduce postoperative retentions or poor outcomes, holds promise for future. Female urinary incontinence is to be managed by urogynecologist, i.e. either gynecologist or urologist having focused attention for the subject and experience.

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Chapter 17

Role of Laparoscopy in Early Cervical Carcinoma and Endometrial Carcinoma

Prakash Trivedi, Soumil Trivedi

INTRODUCTION

Cervical carcinoma accounts for majority of the adult female deaths in the world. It is the fourth most common cause of death among women worldwide. Developing countries are severely burdened by the rising incidence of this disease due to poor design or implementation of the preventive strategies. Among the developing nations, India alone accounts for one-fourth of the global disease burden. Nearly, 1 in 53 Indian women will have lifetime risk of developing cervical carcinoma.[1]

Due to numerous hindrances in screening and vaccination strategies accompanied by myriad cultural differences among the population, cervical cancer is usually detected in late stages and is associated with excessive disease-related morbidity and mortality. Association with human papillomavirus (HPV) as an etiological agent in the causation of cervical carcinoma has been well-documented in literature. Vaccination with bivalent, quadrivalent, and recently marketed nonavalent vaccines during childhood and adolescent age group have led to significant reduction in the incidence of preinvasive lesions. Screening of general population with cervical cytology and human papillomaviruses deoxy ribonucleic acid (HPV DNA) testing have been efficacious in decreasing the mortality due to cervical carcinoma.

Survival is based on numerous prognostic factors such as size of primary tumor, status of lymph nodes, stromal invasion, presence or absence of lymph-vascular space invasion, status of vaginal margins, parametrial extension, and histologic cell type.[2] According to the International Federation of Gynecology and Obstetrics (FIGO) 26th Annual Report, 5-year overall survival rates are as follows: stage IB2, 75.7%; stage IIA, 73.4%; stage IIB, 65.8%; stage IIIA, 39.7%; stage IIIB, 41.5%; stage IVA, 22.0%; and stage IVB, 9.3%.[3]

With the advent of single mode therapy, imaging plays a critical role in the clinical staging of cervical carcinoma. To determine the local pelvic tumor extent pelvic magnetic resonance imaging (MRI) is recommended whereas positron emission tomography-computed tomography (PET-CT) scan is recommended for nodal and distal metastasis to select cases, which require chemoradiation.[4]

For locally advanced cases, the standard treatment option includes chemoradiation whereas for a definite subset of early cervical carcinoma fertility sparing or radical surgeries are recommended.

HISTORY OF LAPAROSCOPIC RADICAL HYSTERECTOMY

With the advent of radiotherapy and its excellent application in the management of cervical carcinoma and significantly less morbidity, surgical procedures waned-off. Due to increased recurrence rates and radio-resistant histologies, resurgence in surgical approach gained popularity. Nerve sparing radical hysterectomy was pioneered by Okabayashi and Kobayashi in 1961. However, fertility was a concern with either approach. The concept of fertility sparing surgery was introduced by Dargent wherein he introduced the concept of radical trachelectomy. With the advent of laparoscopy, laparoscopic pelvic lymphadenectomy accompanied by radical trachelectomy via the vaginal route began the era of laparoscopic radical hysterectomy with pelvic lymphadenectomy. The first described laparoscopic radical hysterectomy with pelvic and para-aortic lymphadenectomy for cervical cancer was performed in June 1989 by Nezhat. Noted personalities in the field of laparoscopic radical hysterectomy include Possover, Querleu, and Leblanc in the modern era.[5]

INDICATIONS FOR RADICAL HYSTERECTOMY

Current evidence disagrees with the application of bimodal treatment in carcinoma of cervix uteri. Hence, candidates of surgical therapy should be carefully selected. Various international gynecologic oncology societies have come to a consensus on the indications of radical hysterectomy in carcinoma cervix. Although the definition of locally advanced carcinoma of cervix varies in literature, we usually limit it to the stages IIB–IVA as per FIGO 2009 staging for carcinoma cervix. Stage IA2–IIA (nonbulky < 4 cm) are appropriate candidates for radical hysterectomy. Fertility sparing options can be given to the patients wherein a radical trachelectomy with bilateral pelvic lymphadenectomy can be performed provided the case fulfills certain preoperative criteria.[4,6]

DATA ON LAPAROSCOPIC RADICAL HYSTERECTOMY

In comparison to abdominal and vaginal approach, laparoscopic route for radical hysterectomy and bilateral pelvic lymphadenectomy has been associated with fewer complications and reduced incidence of blood loss and postoperative pain. No consensus has been reached in Cochrane reviews due to small sample size and majority of the studies being observational.

However, in surgical outcomes many authors have reported their outcomes. With a sample size of 77 patients, Malzoni et al. reported an average blood loss of only 57 mL.[7] Chen et al. reported a median operative time of 162 minutes with average pelvic nodal yield being 22.[8] With respect to nodal yield, Pellagrino et al. achieved a median of 26 pelvic lymph nodes.[9] Hospital stay varied from 3.2 days to as high as 10.3 days in some series.[7-11]

LAPAROSCOPIC RADICAL HYSTERECTOMY STEPS

It is obvious that a detailed workup of each patient is done especially in terms of preoperative investigations, anesthesia fitness, and most important is proper clinical evaluation supported by imaging technology to stage the malignancy.

Kindly note that the port placement, general anesthesia and patients position is exactly like laparoscopic hysterectomy except if para-aortic lymph nodes are to be dissected, port positions are different.

Steps of Surgery

1. Bladder dissection is started anteriorly, till we reach at the fusion of visceral and parietal peritoneum which is the demarcation line; incision is given with fat remaining close to the bladder (Fig. 17.1). Harmonic creates cavitation effect which is further added by the pneumoperitoneum. The dissection is carried out laterally, anterior to the uterine vessel with fat close to bladder.
2. Once the lateral window is created, dissection on inferior and medial surface of obliterated hypogastric artery is done caudally to enter the paravesical space (Fig. 17.2). Dissection is carried out till the levator is reached (Fig. 17.3).
3. With the help of harmonic, incision is made from round ligament to infundibulopelvic ligament, remaining parallel to infundibulopelvic ligament (Fig. 17.4). First structure seen

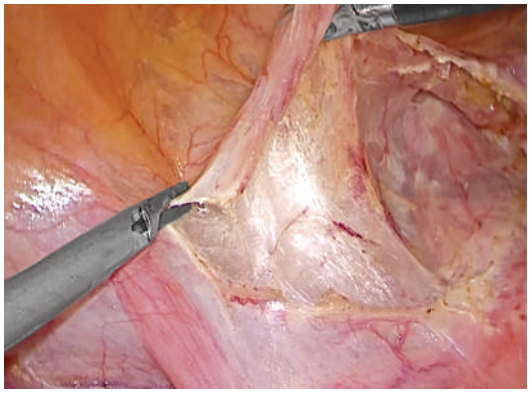

Fig. 17.1: Bladder dissection.

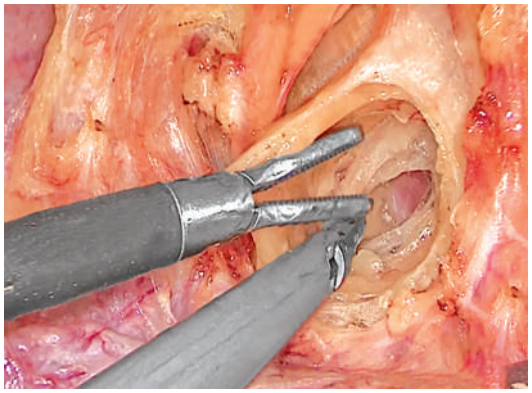

Fig. 17.2: Paravesical space.

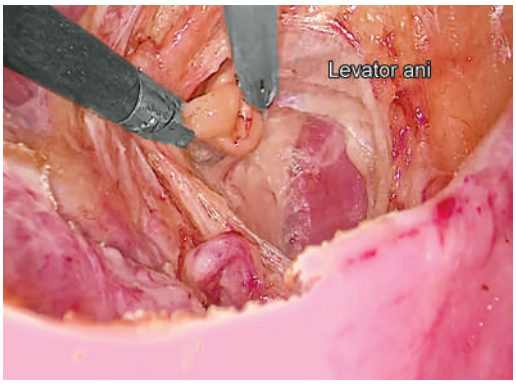

Fig. 17.3: Dissection carried out till levator ani.

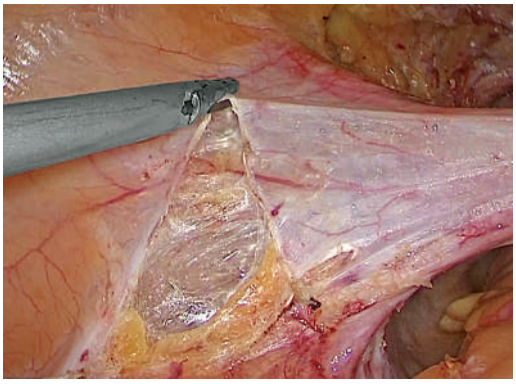

Fig. 17.4: Incision from round ligament to infundibulopelvic ligament.

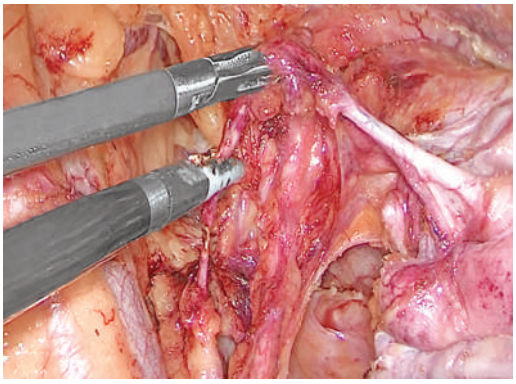

Fig. 17.5: Pararectal space.

is external iliac artery. As we dissect the external iliac artery, ureter is seen immediately. Then the plane between ureter and internal iliac artery, i.e. the pararectal space is entered (Fig. 17.5).

4. The ureter is now lateralized (Fig. 17.6) and dissection done till inferior hypogastric nerve is identified, so that nerve sparing radical hysterectomy is done. Once the ureter is lateralized adequately, uterine artery is lifted (Fig. 17.7) to further dissect the ureter as it enters the urinary bladder. This dissection is done by opening a blunt atraumatic forceps and the harmonic.
5. Lifting the uterine artery and taking it medially above the ureter (Fig. 17.8), it is totally separated from the ureter and the ureter is further dissected. This marks the completion of deroofing of the ureter and ureteric entry in the bladder can be witnessed. Usually, there are two capillaries above the ureter, which are sealed and cut and further dissection of urinary bladder is done at this stage.
6. Same procedure is repeated on the other side. Kindly note that the position of ureter is different on both sides.
7. To open the rectovaginal space, the fat anterior to the rectum is held by an atraumatic grasper. With harmonic scalpel incision (Fig. 17.9) is made in the plane which separates the uterus with vagina anteriorly and fat posteriorly. This is an avascular plane so further dissection is carried out by separating the blades of harmonic anterior to fat and then separation of posterior vagina (Fig. 17.10) can be done downwards till adequate length.

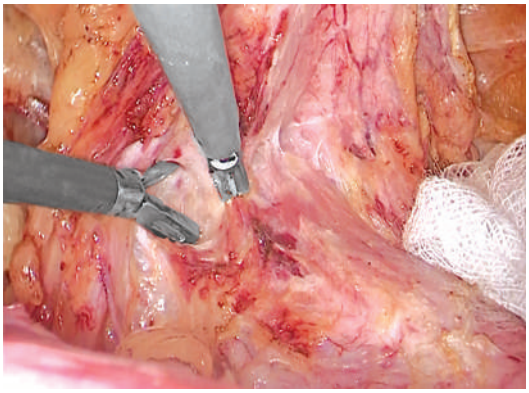

Fig. 17.6: Lateralization of ureter.

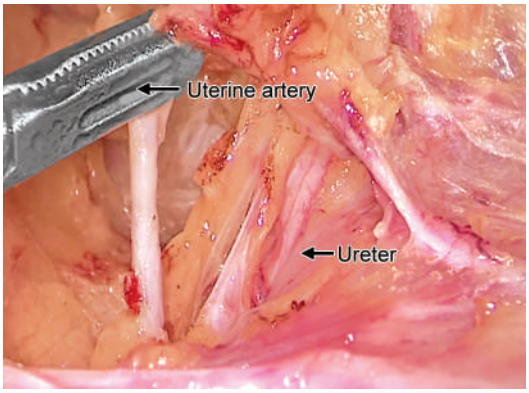

Fig. 17.7: Lifting of uterine artery.

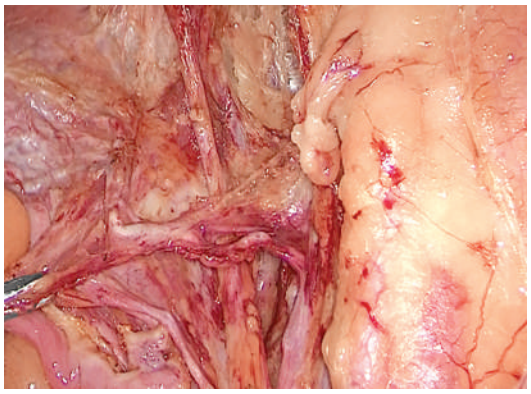

Fig. 17.8: Uterine artery pulled medially with properly dissected ureter.

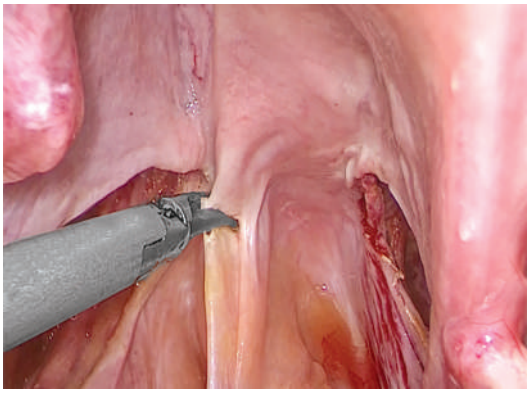

Fig. 17.9: Rectovaginal space opened with harmonic.

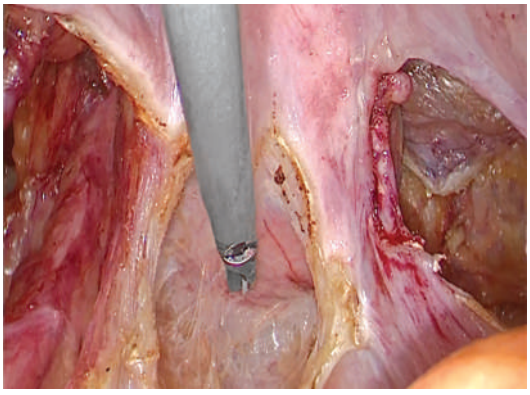

Fig. 17.10: Dissection of rectovaginal space.

8. Once the space is dissected, adequate amount of posterior parametrium is taken sparing the nerve.
9. Hysterectomy is completed by dividing the infundibulopelvic ligaments on both the sides (Fig. 17.11), uterine vessels are sealed and separated (Fig. 17.12). Paracolpos is also separated.
10. A circumferential incision (Fig. 17.13) is taken at vagina and at such a level wherein the free margins are free from the tumor for at least 2.5 cm distance (Fig. 17.14). The specimen can be removed at this stage in a bag (Fig. 17.15). Then the vaginal tube is reinserted and pelvic lymphadenectomy started.
11. The dissection is carried out lateral to external iliac artery towards psoas muscle separating fibrofatty tissue and remaining above the vessel. Lymph node dissection can be started below the bifurcation of aorta (Fig. 17.16). The fibrofatty tissue is held by an atraumatic grasper and with nonactive blade of harmonic (Fig. 17.17), fascia over vessel excised. This gives proper avascular plane and with use of harmonic, lymphatics are blocked.
12. Next going inferomedial to external iliac vein (Fig. 17.18), fibrofatty tissue are incised. Any small vessel during dissection can be handled by bipolar or interrupted buzz of harmonic.

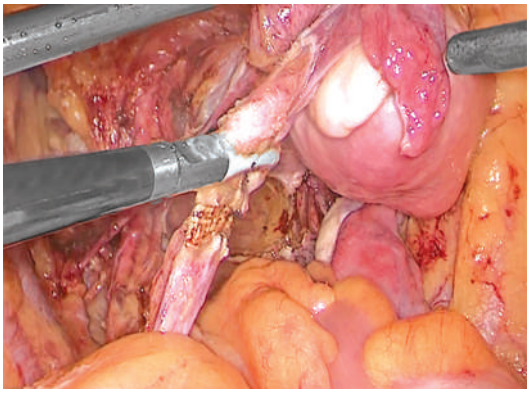

Fig. 17.11: Infundibulopelvic ligament division on both sides.

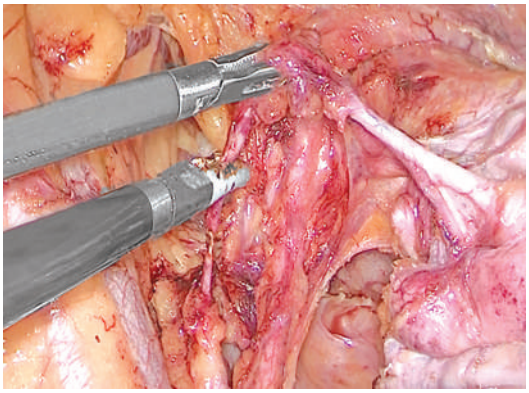

Fig. 17.12: Sealing of uterine vessels.

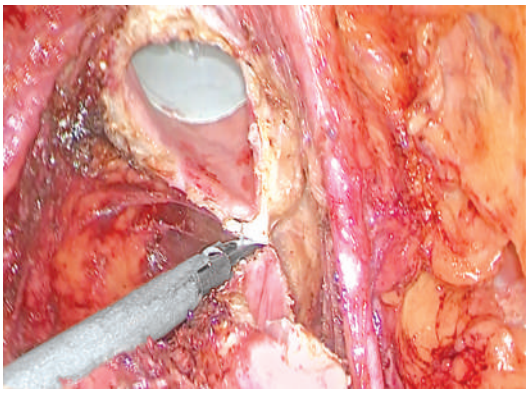

Fig. 17.13: Opening of vault.

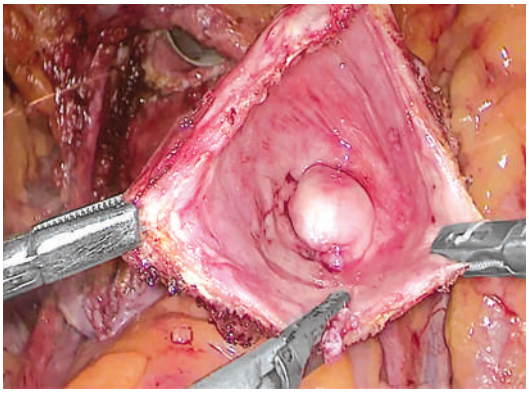

Fig. 17.14: Tumor free margin.

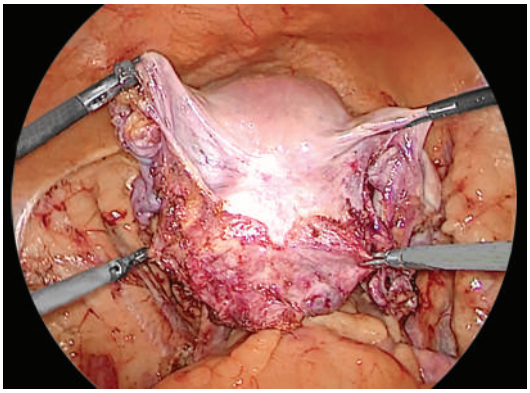

Fig. 17.15: Specimen retrieval.

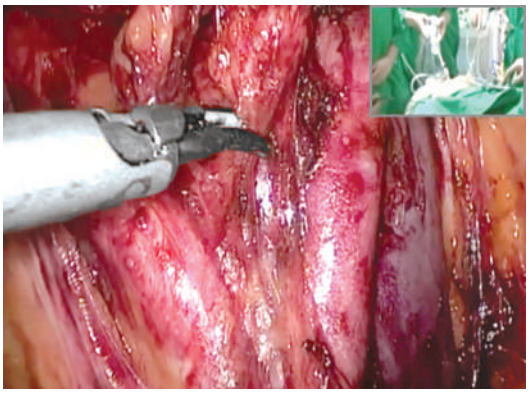

Fig. 17.16: Dissection carried out below bifurcation of aorta.

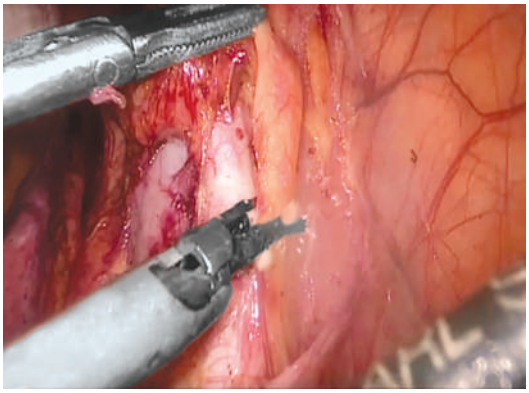

Fig. 17.17: Fibrofatty tissue held by harmonic.

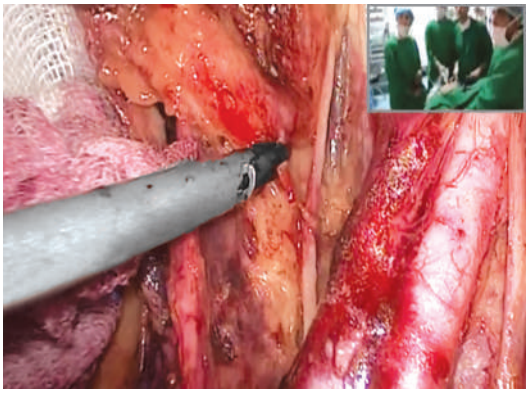

Fig. 17.18: Dissection carried out inferomedial to external iliac vein.

13. It may be noted that the vasa vasorum may occasionally bleed, which can be arrested by simple pressure for 2–3 minutes. Rarely energy needed to control the bleeding.
14. Gauge piece with a marker is quite often useful to clear the field and get good plane of dissection. Once the lymphadenectomy is completed on both sides, en block lymph nodes from both sides are put into a small bag introduced through the vagina and removed.
15. Inferomedial to the external iliac vein, further dissection usually exposes bony structure and the obturator fossa is entered. The lymph node and fibrofatty tissue is lifted and dissected with the obturator nerve being identified remaining superficial to the nerve.
16. Para-aortic lymph node dissection is not included to remain within the frame of a handbook.
17. It is important to note that continuous lavage which was popular many years back is totally avoided in laparoscopic radical hysterectomy and also infrequently used in conventional gynecological pelvic surgeries to avoid spread and also to reduce tissue edema.
18. Fibrofatty tissue around obliterated umbilical ligament is also removed.
19. The lowest limit of dissection is deep circumflex iliac vessel, which is part of "corona mortis".
20. Medial limit is internal iliac continuing as obliterated umbilical artery.
21. Okabayashi space is also called as the medial pararectal space. Developed between the mesoureter and rectouterine ligament by opening up a space between posterior leaf of broad ligament medially and ureter laterally.
22. Yabuki space is a space behind the ureter, just as it is entering the bladder.

COMPLICATIONS

There are various noted studies on complications of laparoscopic radical hysterectomy. Intraoperative complications include vascular, neural and visceral apart from anesthetic complication. Vascular injuries include injury to internal iliac vein, external iliac artery and vein and obturator veins. Visceral injuries include bowel lacerations, bowel incarceration, cystotomy, high uretric injury, and ureteral injury have been documented as intraoperative complications. Postoperative events have been classified as early and late as per literature. Early postoperative complications include febrile events, urinary retention, paralytic ileus, deep vein thrombosis, pulmonary embolism, vaginal evisceration, fistulous communications and septic events. Late complications usually are limited to lymphedema, lymphocyst formation, pelvic abscess, hyperesthesia, cellulitis, small and large bowel obstructions.[12]

Incidence of complications varies as per the stage of the disease, surgical experience and patient characteristics. Incidence of early complications vary from nil to almost 10% as cited in literature whereas that of postoperative complications is 2% to as high as 40%. However, recent studies have quoted less than 5% complications.[12]

QUALITY OF LIFE

Irrespective of the route of surgery (laparotomy vs laparoscopy) studies have shown that there is no significant difference in long-term quality of life and sexual function. However, short-term results do suggest a favorable outcome when laparoscopic route is chosen.[13]

CONCLUSION

Laparoscopy is safe and effective in the management of early cervical carcinoma. Compared to another routes, this minimal invasive modality has revolutionized the therapeutic efficacy of radical hysterectomy in terms of reduced hospital stay, minimal blood loss, and excellent surgico-pathological outcomes.

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Chapter 18

Prevention and Treatment for Complications in Minimal Access Surgery

Prakash Trivedi, Alberto Mattei, Soumil Trivedi

"If you believe in surgery you will have complications"
It's truly said that anatomical knowledge can come by cutting tissues apart but surgical wisdom comes by putting things together

INTRODUCTION

Achieving safety with less complication is the corner stone for piling up thousands of cases with acceptable morbidity and mortality in gynecological endoscopy and minimal access surgery.

CAUSES OF COMPLICATIONS IN LAPAROSCOPIC SURGERIES

Complications in laparoscopic surgeries can be as follows:

- Improper patient selection.
- Improper counseling of patients and relatives.
- Anesthesia related.
- Patient position related.
- Inadequate operation theater setup.
- Poorly qualified surgeon, assistant or nursing staff.
- Accidental or overconfident casual approach.
- Veress needle or trocars, insufflation or distension related.
- Technical problems with instruments.
- Electrocautery or energy source related.
- Related to the ports.
- Hypothermia.

COMPLICATIONS OF VERESS NEEDLE

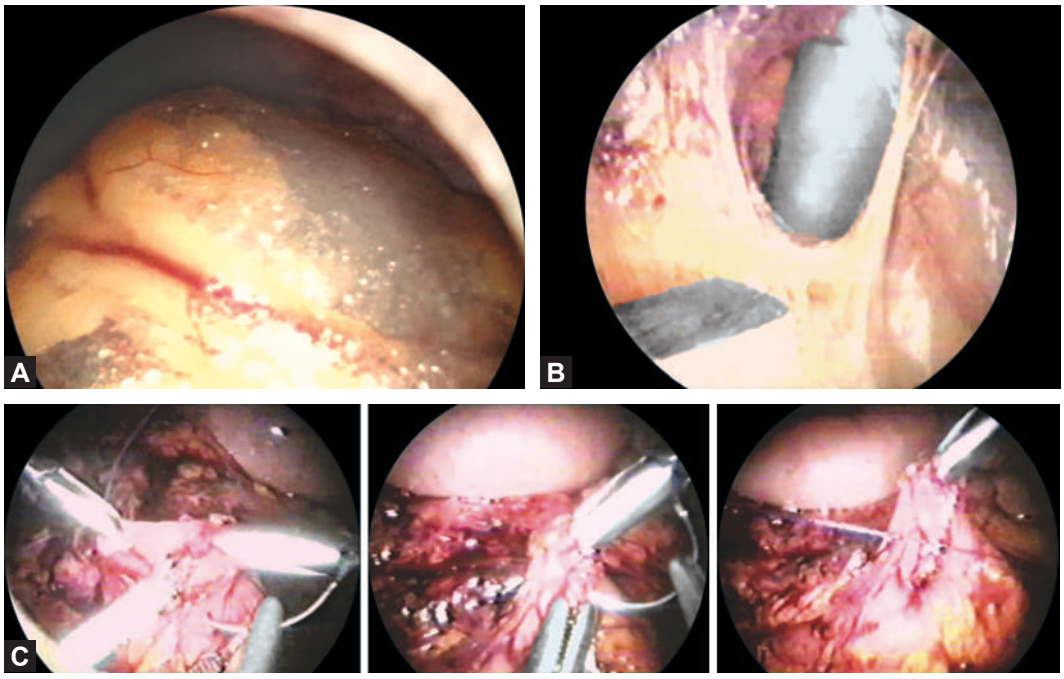
The Veress needle can be either reusable or disposable. If it is introduced obliquely towards the pelvis or if without checking the position needle is moved in the abdomen, problems of surgical emphysema can ensue. Rarely, entry into stomach or bowel and still rarely, vascular injury can occur.

If you are not sure of the position of Veress needle assessed by hanging drop of fluid on the hub, or by pressure shown on the electronic insufflators, it is better to remove and reintroduce. A fluctuating pressure of carbon dioxide (CO_2) suggests that you are in the wrong place like adhesions, lesser sac of omentum or bowel. After reinserting properly, observe any area of damage. Fall of partial pressure of oxygen (pO_2) on the insufflators can be vasovagal due to stretching of peritoneum, usually corrected by deflation, giving atropine or glycopyrrolate. A fall in end-tidal carbon dioxide ($ETCO_2$) suggests embolization, although rare with CO_2, as almost 300–400 mL of CO_2 can be absorbed per 100 mL of blood without any problem. If the anesthetist is watchful, cardiac arrhythmia due to CO_2 insufflation or diaphragmatic irritation does not occur. A pressure cut of 15 mm of Hg and an adequate flow rate of CO_2 at about 12–15 L/min does not cause any problem. Duration of surgery is important, but can be smoothened by good anesthesia, meticulous surgery and good postoperative analgesia. Many surgeons and gynecologist do a direct trocar entry or an open laparoscopy.

COMPLICATIONS OF TROCAR-CANNULA

Bowel Injury

Though rare, this can take place more with patients of previous abdominal surgery, adhesions, or accidentally (Figs. 18.1A to C).



Figs. 18.1A to C: (A) Pneumo-omentum; (B) Umbilical trocar inside an adherent bowel; (C) Bowel injured is sutured laparoscopically in two layers.

In case of previous surgery, Veress needle can be inserted 4–5 cm above the umbilicus after passing a nasogastric tube to empty stomach. Palmer's point is also used by many at left upper quadrant to look for adhesions at the umbilicus, separate and then introduce the umbilical port. Injury to a small bowel should be identified and sutured into layers without constricting the lumen.

A colonic injury with a prepared bowel preoperative can be sutured during laparoscopic surgery. Keep the patient nil by mouth for few days till peristalsis establishes and the drainage is not significant. A sigmoid injury with electrocautery or picked up later needs a diverting colostomy and later closing after 2 months gives enough time for lower bowel to avoid peritonitis and grave fatal outcome.

Out of 35,000 cases, we had one injury of small bowel, one injury of transverse colon during trocar entry, both closed laparoscopically and then finishing the surgery. One sigmoid injury, not due to trocar but scissor dissection needed diverting colostomy in an extremely bad case of left-sided endometriosis with bowel adhesions and an open surgery done for right side in an unmarried 20-year-old girl.

Vessel Injury

Ancillary trocars can injure small vessels, especially the epigastric vessel (Figs. 18.2A to E) (2–3 out of 25,000) treated by bipolar from the other port, temporarily Foley catheter pressure or through and through suturing on a gauze sacrificing that port site.

The ancillary small 5/3 mm ports also can injure bowels and one has to be careful. After confirming port placement, sharp instruments like scissors, needles, energy source, or electrocautery should be always kept under vision.

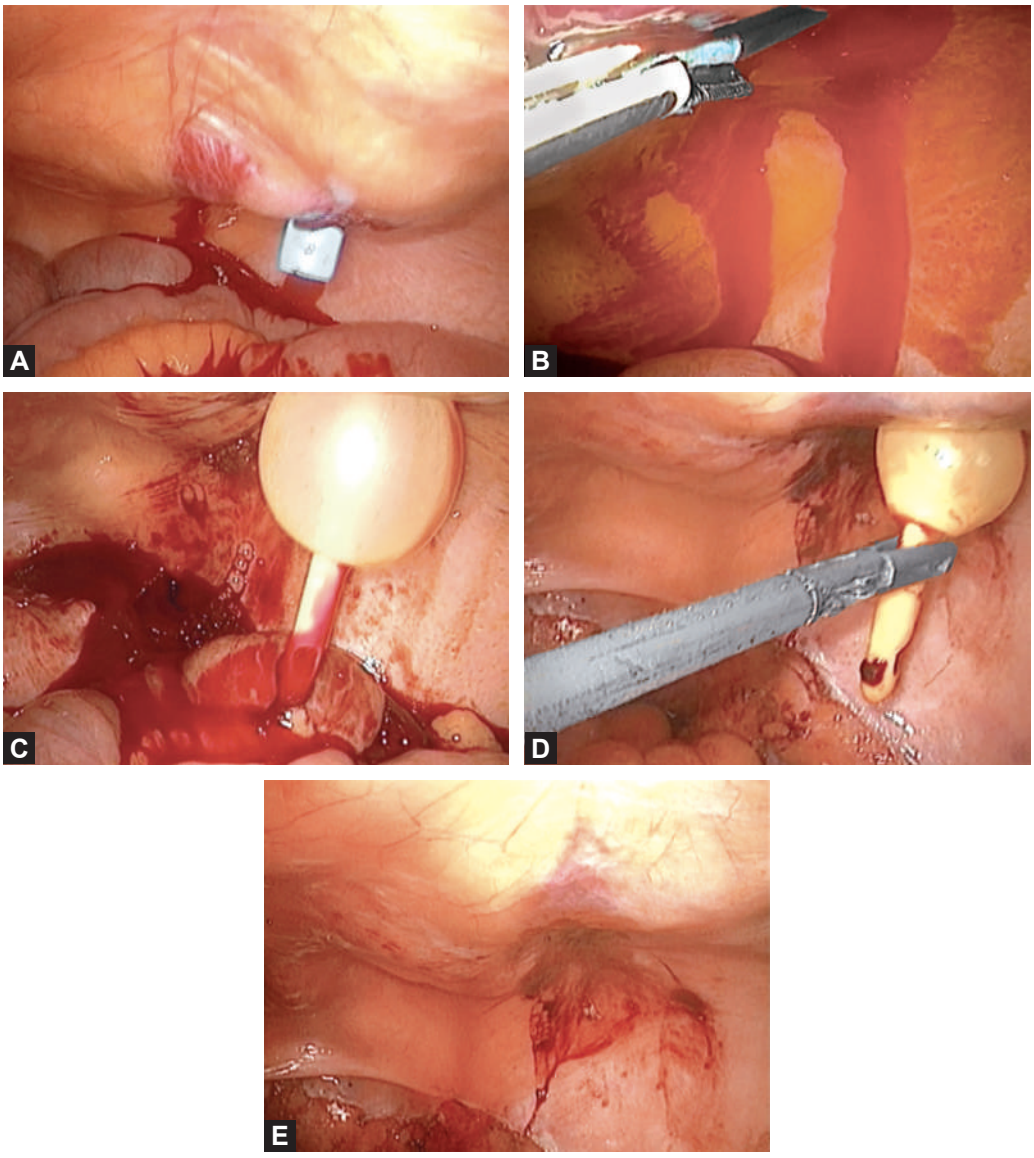
A blunt tip termanium cannula is useful after pneumoperitoneum to enter under vision without any sharp trocar. A safety shield disposable trocar does not exist nor can the OptiView prevent bowel injury.

ELECTROSURGICAL OR CAUTERY COMPLICATIONS

If the earthing is not proper then there can be cautery burns at the reducing monopolar plate. If non-metal ancillary trocars are used, capacitance burns takes place from an insulation leak to bowel or other structures.

Accidental stepping of a wrong foot switch can lead to injury and occasionally touching a hot cautery instrument tip to bowel or bladder after use can be dangerous. The point electrodes and hooks, etc. should always be retracted under the vision.

Vessel Sealing Devices or Harmonic can also cause injury due to lateral spread on to the ureter, bladder, etc. especially right ureter, in surgeons operating from the left side, if you are not careful to push the bladder down, ureter away, and lateral. We had all ureteric injuries (Figs. 18.3A to F) (6 out of 35,000) on right side with new energy sources or in a case of double ureter. The first injury occurred fourteen years after doing thousands of laparoscopic surgeries. Out of six, five were due to vessel sealing device and one with scissor all on right ureter. Ureteric double J (DJ) stenting was done under laparoscopic control. If required end-to-end uretero-ureteric anastomosis or ureteric implantation into bladder with psoas

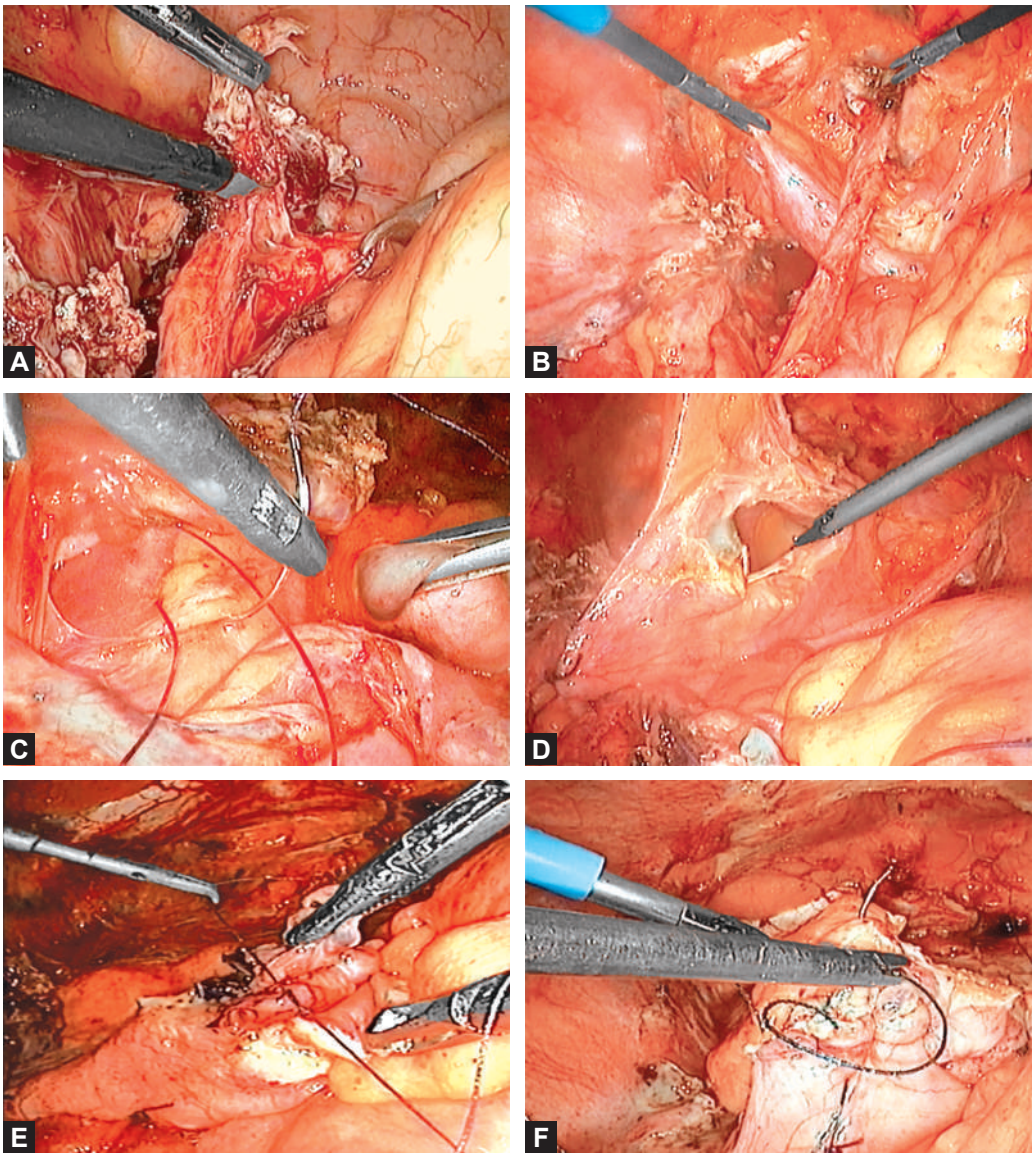


Figs. 18.2A to E: Step-by-step management of inferior epigastric vessel injury: (A) Lower trochar epigastric bleeding; (B) Attempt to control bleeding with bipolar; (C) Foley's catheter tamponade replacing trochar; (D) Foley's balloon decompressed; (E) Achieved hemostasis, Foley's removed.

hitch or Baori flap is also feasible laparoscopically, in hands of a skilled endoscopist with Urologist's supervision.

Bladder injuries (Figs. 18.4A and B) do take place during dissection or cutting of peritoneum, with energy source or scissors.

The number of bladder injuries has decreased in the hands of expert but total laparoscopic hysterectomy (TLH) can increase such injuries in the hands of an amateur surgeon.

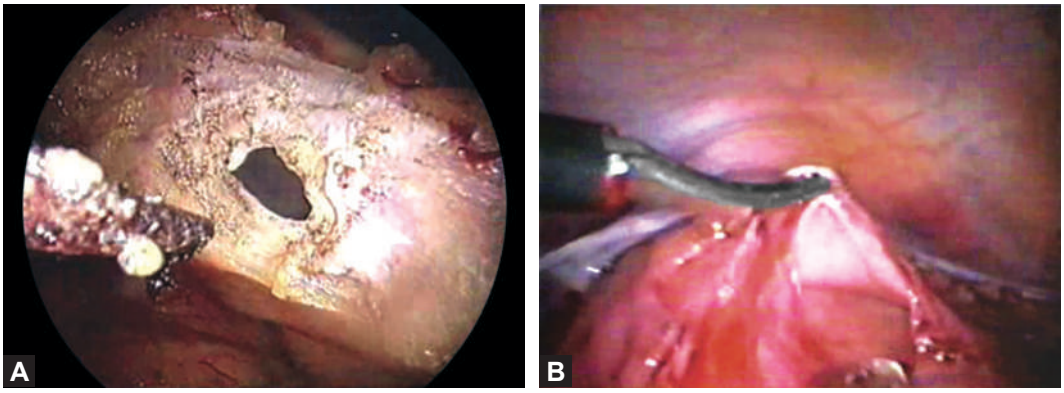


Figs. 18.3A to F: (A) Lower left ureteric injury due to involvement in endometriosis; (B) Adequate mobilization of bladder and involved ureter for re-implantation; (C) Psoas hitch suture for tension free approximation; (D) Intentional cystotomy to draw lower end of ureter into the bladder; (E) Suturing the internalized ureter with bladder mucosa after fish-mouthing ureter; (F) Layered bladder closure after ureterovesical anastomosis with double J stenting of ureter.

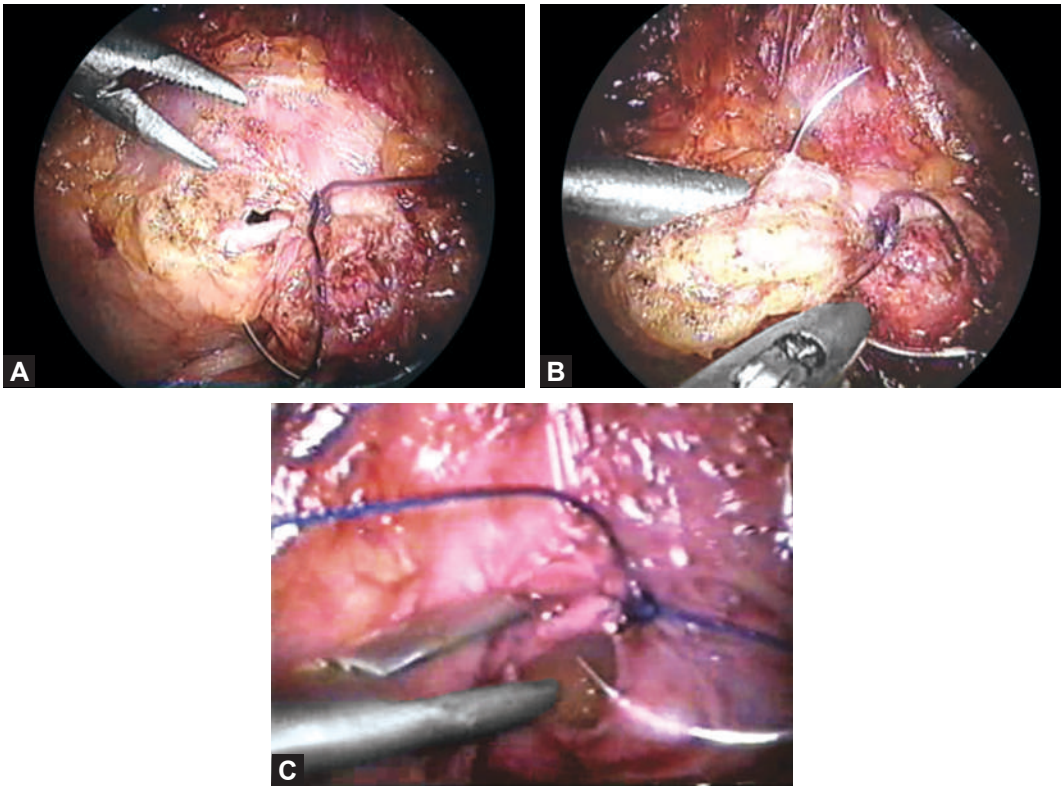
The bladder injury, if identified is closed in two layers (Figs. 18.5A to C) and catheter is kept for 8–10 days. We had 7–8 bladder injuries, more in cases with previous cesarean section with the use of monopolar spatula or scissors which is reduced by the Harmonic scalpel due to cavitational effects. Good planning, good assistants and proper manipulation of uterus

can reduce bladder injuries. If the urinary bladder is accidentally injured, recognition of the injury should always be immediate intraoperatively.

Injury to bladder takes place while dissecting urinary bladder away for safe colpotomy, when bladder is adherent to uterus extensively. Bladder is closed in two layers by 3-0 Vicryl suture.



Figs. 18.4A and B: Identifying bladder injury.



Figs. 18.5A to C: Laparoscopic closure of bladder injury.

Bleeding and Poor Hemostasis

Minimal blood loss and control of bleeding is of prime importance in laparoscopic surgery especially ectopic pregnancy, myomectomy, hysterectomy, etc.

In case of ectopic pregnancy and myomectomy, diluted vasopressin 2 mL in 100 mL of saline is injected, with a thin needle taking care of blood vessels into the ectopic-mesosalpinx and also at the point of incision for salpingotomy. If the ectopic is large or ruptured and with high hemoperitoneum, it may be wiser to do a salpingectomy with bipolar or vessel sealing device or Harmonic ace set at 2. Excision should be close to the tube and away from ovarian vessels, keeping less than 1 cm of the cornual end. The end is coagulated to avoid fistulas permitting sperms to go and lead to ectopic abdominal pregnancy. Though generally, it is a belief that fastest way to reach bleeding ectopic pregnancy is an open surgery but we disagree since by operative laparoscopy you can quickly reach the ectopic, suck out blood and achieve hemostasis. We have not done any open ectopic pregnancy surgery, since 1992 even if there is a large hemoperitoneum, rudimentary horn ectopic, etc.

In case of myomectomy, dilute vasopressin is injected to achieve temporary hemostasis, fibroid is separated and as the effect is wearing-off, we suture the uterine defect till the dead space is obliterated, with Vicryl or barbed knot less sutures. When there are multiple fibroids, it is advisable to separate 3–4 fibroids, suture their dead space and then separating the others. This allows good effect of vasopressin, for next fibroids without having much blood loss.

Remaining in the plane is important and detecting adenomyosis by preoperative sonography is good for planning the management.

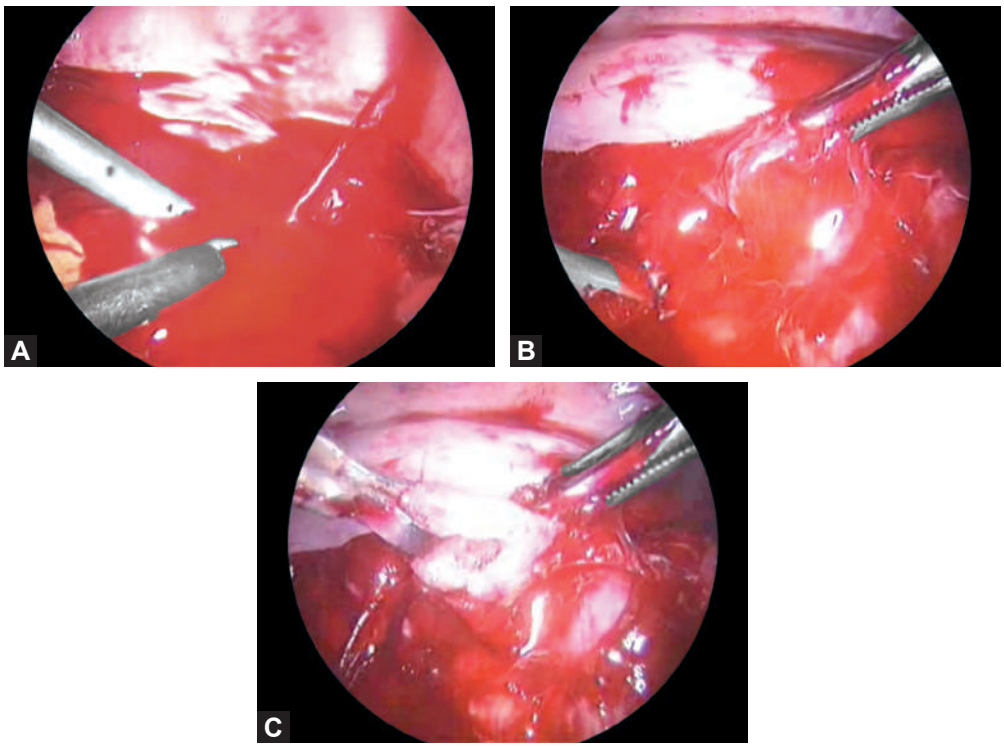
Many gynecologists advocate suturing of the uterine vessel prior to myomectomy to reduce blood loss, we do not prefer this as in simple cases it is pointless and in very large difficult case you cannot reach uterine vessels easily, further uterine vessel is not the only blood supply to the fibroids. Further, in patients desirous of future fertility, there is no need to suture uterine vessels. Occasionally, even injury to ureter in a clean benign case is not acceptable.

Bleeding during laparoscopic hysterectomy can take place at cornu, infundibulopelvic ligament, ascending or descending uterine artery or vein and the bladder plexus.

A good titrated bipolar 25–30 Watts or a vessel sealer is good for cornu or infundibulopelvic but one should not be too close to the uterus to avoid back flow bleeding and also too close to infundibulopelvic ligament. To dissect the bladder peritoneum down and laterally so ureter go away and uterine artery skeletonization is compulsory. After this, one can coagulate with bipolar or vessel sealing device or suturing the entire uterine knuckle, both ascending and descending. The uterines are then separated from the uterine wall to avoid avulsion bleeding on removing uterus. The bladder plane is crucial to avoid bleeding from paravaginal plexus, which can be coagulated with bipolar.

If the uterine artery or a major vessel slips during surgery then use suction irrigation and catch hold of the bleeder, coagulate with bipolar or rarely suture it (Figs. 18.6A to C).

If it is detected post hysterectomy on the table a meticulous lavage, identifying bleeders and coagulating them is necessary. For nonspecific generalized mild ooze SurgiCel is kept to form a clot. Nezhat et al. reported control of hemorrhage from the iliac artery following an injury by Verres needle by bipolar coagulation.



Figs. 18.6A to C: (A) Uterine artery spurter; (B) Mechanical occlusion achieved with atraumatic grasper before pouncing with bipolar; (C) Bipolar coagulation applied after identifying proper source rather than blind coagulation.

In case of small injury to a major vessel like iliac, use pulsed bipolar at low, 25 Watts as other methods may increase bleeding. Obviously, if it is a big bleeder not identified due to rapid hemoperitoneum, a laparotomy can be lifesaving.

Preventing bleeding is better than treating. A 16 French Ryle's tube drain in the peritoneal cavity in fibroids or extensive tissue dissection surgery is useful to reduce postoperative pyrexia and not missing important bleeding. This is rarely needed in surgery for endometriosis, etc., which is a fibrotic disease.

Omental bleeders should be identified and coagulated. Injury to large major vessels or retroperitoneal if not increasing, it is fine but if worsening a quick laparotomy with surgeon or vascular surgeon is safe.

TECHNICAL COMPLICATIONS WITH INSTRUMENTS

There can be plenty of malfunctioning, as breakage of one of the blades or myoma screw, which was removed laparoscopically.

A click line insert holding instrument can separate from the hand piece. Improper use and maintenance are both responsible for such problems. A good operation theater staff and technicians maintaining all instruments can help in avoiding them.

A major concern can be with suction, electrocautery, or needle holder not functioning properly. Insulations of all instruments should be meticulously looked upon and discard improper instruments.

Use of morcellator without experts' assistance and guidance can lead to injuries as it comes out of the fibroid strip dissected. Many morcellator have an auto-safety withdrawal of the sharp blade once free of resistance of dissecting fibroid or uterus.

Having good practical attention and handling it carefully by removing the instrument under vision or in line with the trocar and removing enmass, documentation is important. Similarly, the curved needles, specimens, lap sac and the number of fibroids also should be systematically removed.

In unusual situations, like a morcellator not functioning well, a posterior colpotomy can be done in a parous patient. But, use of non-well-functioning equipment is an act of negligence on the part of the surgeon and can cost a lot.

CONVERSION TO OPEN SURGERY

This is not a complication but quiet often is thought to be inability of the surgeon to do competently. This is totally incorrect as in all cases of laparoscopic surgery; consent for open surgery is always taken. When there is need to open, call the relative in the operation theater to inform why you need conversion and counsel him/her to avoid medicolegal problem.

Conversion is not a defeat or complication but it is a prudent judgment in favor of safety of patient, which helps your wisdom to control your extreme desire or fantasy to do laparoscopically.

We had 24 cases of conversion out of 35,000 surgeries. The common reason was bad case selection, conversion in the first 2–3 minutes and not after hours of struggle. Occasional conversion is for bleeding and patient's worsening, rarely extensive bowel injury needing attention. Quite often, previous surgery leading to lot of bowel adhesions can be a reason. Rarely, if you are not operating in your setup and are not comfortable with the instruments, equipment, assistants, or anesthetist for safe surgery, conversion is necessary.

MEDICAL, ANESTHESIA OR NON-GYNECOLOGICAL REASONS

In spite of doing all investigations and preoperative safety profile, more common in men than women, there can be factors which are either medical or anesthesia related, e.g. consistent drop in pO_2, fall in blood pressure (BP), cardiac arrhythmias, pulmonary vessel embolization, bronchospasm and unexplained cardiac arrest. You may convert to open or abandon the surgery.

Most of the gynecological endoscopic surgeries are done by entrepreneurs who do not have a surgical medical ICCU, which in few cases are mandatory. But they should have all the multiparameter monitors, good anesthesia machines, cardiologist or physician standby but still there can be unexpected reasons to convert a surgery.

"Safety is of prime importance and a true surgical genius is not born in crisis but he or she exhibits in crisis."

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Chapter 19

Anesthesia and Monitoring in Gynecological Minimal Access Surgery

Dinesh Bajani

INTRODUCTION

Now endoscopy is well-recognized, established and accepted mode of diagnostic and therapeutic procedure in almost all surgical fields including gynecology, oncology, neurosurgery, and bariatric surgery. It is this expanding application of endoscopic procedures in patients with compromised organ functioning involves considerable physiological alterations of cardiorespiratory, renal, neuroendocrinal and metabolic functions. Anesthetist and surgeon should be thoroughly aware of the pathophysiological effects of endoscopy on patient so that patient can receive optimum benefits from advance techniques, anesthesia machines and monitoring with minimum discomfort and complications.

Like laparoscopy; hysteroscopy has also become an indispensable procedure for its simplicity and usefulness in diagnostic and operative hysteroscopic procedures. It involves knowledge and understanding of distending devices and media and effects of distending media on the body.

PREOPERATIVE EVALUATION AND PREPARATION OF PATIENTS

Detail past and present history of diabetes mellitus (DM), hypertension (HTN), ischemic heart disease (IHD), jaundice, allergy, asthma, or any drug therapy should be taken. Proper, general, and systemic examination should be done.

Routine investigations include complete blood count (CBC), X-ray chest, electrocardiogram (ECG), serum creatinine, blood sugar, blood urea nitrogen (BUN), human immunodeficiency virus (HIV) and Australia antigen. Patients with cardiorespiratory problem and other associated medical problems should be further evaluated with 2D echo, treadmill test (TMT), renal function test (RFT), liver function test (LFT) or pulmonary function test (PFT) with physician fitness. Optimization (nebulization, steam inhalation, chest physiotherapy, control of DM, HTN, asthma, etc.) before surgery and preoperative medication is mandatory.

Informed consent should include possibility of laparotomy, longer duration of operation and longer hospital stay.

Selection of type of anesthesia technique depends on:

- Type of surgery
- Duration of surgery
- Medical condition of patient
- Skill of anesthetist
- A common understanding between anesthesiologist and surgeon.

Anesthesia techniques used are:

- Regional: Spinal/Epidural/Combined spinal and epidural (CSE)
- Total intravenous anesthesia (TIVA)
- General anesthesia with intermittent positive pressure ventilation (IPPV) [Intubation/laryngeal mask airway (LMA)]
- General anesthesia with regional anesthesia. In laparoscopic surgery combination of general and regional anesthesia (particularly epidural) works out to be best.

MONITORING (FIG. 19.1)

Routine monitoring of oxygen saturation (SpO_2), pulse, ECG, end-tidal carbon dioxide ($ETCO_2$), urine output are enough. For hysterosopic surgery you also need to have close watch on inflow or outflow of irrigating fluid charting. Similarly, for laparoscopic surgery addition of spirometry and temperature parameters would increase patient's safety.

Broadly anesthesia related to gynecological endoscopic surgery are covered under the following two groups:

1. Anesthesia for hysteroscopic surgery
2. Anesthesia for laparoscopic surgery.

Fig. 19.1: Anesthesia monitoring machine.

Anesthesia for Hysteroscopic Surgery

Anesthesia is required for diagnostic and various operative hysteroscopic surgeries, *viz.*, polypectomy, myomectomy, septal incision, adhesiolysis, tubal cannulation, and trans-cervical resection of endometrium (TCRE). Anesthesiologists should be aware of various distending devices; media and their side effects.

Diagnostic and short hysteroscopic procedures can be done under total intravenous anesthesia (TIVA). Longer operative hysteroscopic procedures can be done either by regional or regular general anesthesia with Laryngeal mask airway or ET intubation with IPPV.

Complications

Various complications related to hysteroscopy are:

- Water intoxication (pulmonary edema)
- Electrolytes imbalance (hyponatremia)
- Coagulation disorders (hemolysis)
- Transient blindness (glycine toxicity)
- Vagal stimulation
- Surgical trauma (bleeding and perforation of uterus).

Absorption of distending medium into the large opened venous sinuses under high hydrostatic pressure is inevitable. The rate of absorption of distending medium depends on duration and type of surgery and intrauterine pressure changes due to setting of inflow or outflow irrigation system (partially or fully-closed outflow). Whether the patient will suffer from complication due to absorption of distension medium depends on the amount and the type of fluid absorbed in given time and medical condition of patient.

Normal saline and ringer lactate are well-tolerated when absorbed intravascular, (similar to body fluid) but being electrolyte solutions they facilitate dispersion of high frequency current from the resectoscope and hence, was less popular for operative hysteroscopy. Though absorption of normal saline may not cause hyponatremia, it can cause deficiency of other electrolytes particularly potassium. Along with potassium, there can be hypocalcimia and hypomagnesemia. Distilled water when used as distending medium, the absorption of large quantity of water causes dilutional hyponatremia leading to hemolysis and central nervous system (CNS) changes in the form of confusion, convulsion, or even coma. At serum sodium level below 100 mEq/L, consciousness is lost, convulsion is impending, and cardiovascular dysfunction in the form of arrhythmias, hypotension and pulmonary edema occurs.

Nonelectrolyte solutions like, glucose, urea, mannitol, glycine are preferred. Absorption of nonelectrolyte solution causes dilutional effects on extracellular electrolyte composition. It is known that serum level of sodium produces CNS changes, which are believed not to be due to the sodium concentration of extracellular fluid in the brain but due to the sodium as an ion maintaining serum osmolality, which may result in intracellular shifting of fluid and cerebral edema. According to Miller this occipital cortical edema is considered to be the cause of transient blindness.

Presently most preferred distending medium is 1.5% glycine. It is basically a non-essential amino acid, occurring normally in body. Its normal level in body is 13–17 mg/L. As an irrigating fluid, glycine is known to cause cardiovascular and central nervous system abnormalities (i.e. dilated fixed pupils, nausea-vomiting, muscular incoordination and transient blindness).

Glycine is an inhibitory nerve transmitter in the CNS, spinal cord, and retina. Wang et.al. hypothesized that the elevated serum glycine levels may contribute directly to the visual disturbances; resulting from glycine's role as an inhibitory transmitter in retina independent of reduced serum level of sodium, because sodium is nearly nonspecific as far as visual physiological condition is concerned (i.e. high glycine level with normal serum sodium in case of transient blindness). In reported cases of transient blindness; the glycine level was found to be around 1,029 mg/L. However, after 12 hours, when vision returned plasma level was 143 mg/L. The absorbed glycine is metabolized into ammonia by oxidative biotransformation. Usually, hyperglycinemia is associated with hyperammonemia, which leads to CNS toxicity in the form of delayed awakening. Deterioration of CNS function occurs when ammonia level exceeds 150 μmol.

Since, the rate of absorption of the distending medium is a dynamic situation, vigilant monitoring is very essential. One of the earliest sign of water intoxication (pulmonary edema) is unexplained fluctuation of SpO_2 under general anesthesia and is soon followed by resistance to ventilate (increased air way pressure) the patient by rebreathing bag. On auscultation; crepitation, and rhonchi are heard and finally there is frothing from endotracheal tube, when pulmonary edema has actually set in.

In regional block because of loss of sympathetic tone, there is increased vascular capacitance that tends to mask the intraoperative fluid overload (if glycine is used, such patient can have glycine toxicity without having pulmonary edema). During wearing-off of regional block rebound phenomenon occurs, i.e. acute reduction in the venous capacitance leading to abrupt circulatory fluid overload. In diabetic patient with nephropathy as fluid is not thrown out efficiently, they can go in failure easily. Similarly, anemic patient with hemoglobin less than 9 gm%, can also show congestion early and may take longer time to recover.

Pulmonary edema is treated with oxygen, steroid, bronchodilators and if required assisted or IPPV with muscle relaxants and diuretics. Rate of absorption of distending fluid is more important than the volume of fluid absorbed. Most of the time giving diuretic at earliest prevents worsening of situation.

Usual rate of absorption is 30 mL of fluid per minute, i.e. 2–3 L in an hour. This rate may be higher if distending pressure is high, outflow is partially or completely closed and operative time is more (e.g. myomectomy), often in such cases rate of irrigation is as fast as 200–300 mL/min. You may not require any active treatment up to 500–700 mL of discrepancy. It is safer to give prophylactic IV Lasix 10–20 mg, if discrepancy is around 1000 mL. In patients with respiratory problem like chronic obstructive pulmonary disease (COPD) and patient with renal insufficiency, you may use diuretic, steroid and bronchodilators in the beginning to avoid overload.

Anesthesia for Laparoscopic Surgery

Special Problems Arising during Laparoscopic Surgery

For proper management of anesthesia for laparoscopic surgery, it is essential to consider and understand problems related to laparoscopic surgery. They are:

- Position of patient
- Pneumoperitoneum and its effects
- Insufflating gases and their effects.

Position of patient

a. Head low position (Trendelenburg)
   Respiratory system: It pushes intra-abdominal viscera up with occasional splinting of diaphragm.
   - Pnemoperitoneum and lithotomy position further aggravates the situation
   - All above factors progressively reduce vital capacity by 50% increases airway pressure and reduces lung compliance
   - Impairs respiratory mechanics and alters gaseous exchange. There is exaggerated response with the respiratory ailing patients.

   Cardiovascular system:
   - Increases venous return and central venous pressure (CVP) and hence, increases cardiac output.

   Central nervous system:
   - There is increased intracranial and intraoccular tension.

b. Head high position (Reverse trendelenburg)
   As intra-abdominal organs are pushed away, it improves respiratory mechanics. However, pooling of blood in lower limbs, reduces cardiac output, venous return and blood pressure. The fall is directly proportional to advancing age, degree of preoperative dehydration.

Pneumoperitoneum

a. *Creation of pneumoperitonium:* First puncture is blind and hence can be dangerous as it can cause trauma. All the care should be taken to avoid any vascular or visceral injury. Now many surgeons prefer to put open technique means even first puncture is also not blind and hence absolutely safe. Here, Verres needle is avoided and trochar is directly introduced in the peritoneal incision.
b. *Maintenance of pneumoperitoneum:*
   - It is required for adequate visualization of intra-abdominal contents, safe and proper dissection and cauterization of bleeding points.
   - Maximal intra-abdominal distension pressure (IADP) without distressing symptoms of physiological disturbances, is around 15–20 mm Hg. At this pressure there is usually compression of splanchnic circulation (squeezing action) pushing the blood in inferior-vena-cava, which increases central venous pressure and venous return.
   - At IADP more than 30 mm Hg, there is direct compression on capacitance vessels. IADP now obliterates these vessels decreasing the venous return, and the cardiac output, causing hypotension—an untoward effect.
   - Pneumoperitoneum pushes diaphragm up, decreasing functional residual capacity, decreasing vital capacity, increasing physiological dead space. There is rise in airway pressure (AWP). All these changes are exaggerated by head low and lithotomy and favor postoperative atelectasis.
c. *Renal function:*
   - There is unique relationship between intra-abdominal pressure, renal cortical perfusion and urine output.
   - With IADP of 15 mm Hg there is 60% reduction in renal cortical perfusion, which leads to 50% reduction in urine output.

- After release of pneumoperitoneum, renal cortical perfusion returns to normal or supra normal almost instantaneously, but reduction in urine output remains for another 2 hours. This suggests the role of hormonal factor in prolongation of oliguria namely aldosterone and antidiuretic hormone (ADH) which are raised (This is similar to other forms of abdominal compartment syndrome, e.g. Ascitis).
- Pneumoperitoneum-induced intraoperative oliguria is transient and reversible after a period of 2–3 hours.
- Such pneumoperitoneum induced systemic and renal hemodynamic changes are to be kept in mind by surgeon and anesthesiologist during extensive laparoscopic surgery in a patient whose medical condition is borderline with respect to cardiorespiratory and renal function (e.g. patient with HTN diabetes and IHD).

Insufflating gases and their effects

Air, oxygen, nitrous oxide, and carbon dioxide have been used as insufflating gases for pneumoperitoneum.

Recently, carbon dioxide is the most preferred insufflating gas, because it is highly soluble in blood, noninflammable, and readily diffusible across membrane. It is a safe insufflating gas because it takes five times as much carbon dioxide to produce symptoms of embolism as compared to air or oxygen. Because of its solubility and easy excretion through lungs, prognosis of cardiorespiratory integrity is much better if carbon dioxide embolization occurs.

Carbon dioxide with moist peritoneum forms carbonic acid, i.e., $\mathbf{CO_2 + H_2O = H_2CO_3}$

This acid causes peritoneal irritation and pain and shoots up BP. CO_2 absorbed from pneumoperitoneum is either eliminated by lungs or stored temporarily in the body. The total CO_2 storage capacity is 120 L. Bone is the largest reservoir. The longer the duration of pneumoperitoneum the greater its storage and longer duration of raised CO_2 level in blood after the procedure is over, i.e. storage depots have to return to baseline levels. Raised blood level of CO_2 can cause cardiac arrhythmias. The postoperative nasal oxygen supplement for such period helps.

ANESTHETIC MANAGEMENT

Aims

The aims of anesthetic management during operative laparoscopic surgery are:

- To provide optimal surgical conditions for the surgeons
- To provide adequate depth of analgesia and anesthesia, to cut down noxious painful stimulation and to safeguard the patient
- To facilitate rapid recovery and early ambulation of the patient.

Regional Analgesia

- For regional analgesia patient should be very cooperative with excellent pulmonary functions.
- The level of analgesia should be higher, i.e. up to T2–6 dermatome
- Intra-abdominal pressure for pneumoperitoneum should be low
- Insufflating gas flow rate should be low

- Head-low should be minimum
- Heavy sedation should be avoided
- Oxygen supplementation throughout laparoscopic procedure is must
- No postoperative sore throat and minimum nausea and vomiting
- Surgeon should finish the surgery in quick time preferably.

There are many limitations, discomfort to patient, surgeons and to the anesthetist in regional anesthesia. However, combination of general anesthesia and regional anesthesia is simplest and best choice particularly with epidural for postoperative analgesia.

General Anesthesia

Anesthesia with endotracheal intubation and IPPV is most commonly used technique because it provides optimal control of cardiorespiratory status of patients even in medically compromised and elderly patients, especially during long endoscopic surgical procedures.

Patients with medical problems like diabetes, hypertension, asthma, should be treated and prepared preoperatively. In major gynecological laparoscopic surgeries involving more than 2 or 3 hours, it is preferable that bowel remains deflated. Bowel preparation should be done one day preoperatively. Exelyte (90 mL) in 300 mL of lemon drink and two tablets of Bisacodyl on the day prior to surgery for bowel preparation is given.

PREMEDICATION

On the day of operation, H_2 receptor antagonists like ranitidine, antiemetics like Ondensetron, Amnestics, and sedatives like Midazolam and vagolytic drugs like glycopyrolate or atropine should be given 30–45 minutes before operation.

INDUCTION

During induction of major endoscopic surgery, infusion of Dextomid (Dextmeditomidine) is given which is continued intraoperative period also. It is given by syringe pump-50 μg in 50 mL saline (Fig. 19.2). Loading dose is 1 μg/kg/min for first 10 minutes and then between 0.2 μg/kg and 0.8 μg/kg. It causes bradycardia and hence should be given carefully in patient on beta-blockers. Syringe pump keeps you free to adjust the rate at any given time very accurately. Dextomid is having cardio protective effects and also potentiates the anesthetic and analgesic effects of anesthetic drugs, hence reduces their doses.

With advanced laparoscopic surgeries there is increased demand of steep head low, greater distension pressure and no or very little NO_2 which anesthetists is able to provide reasonably well because of free availability of Dextomid, fentanyl—an analgesic and sevoflurane—an inhalation anesthetic agent. Advanced anesthesia low flow machine with high technology vaporizers and ventilators have also played roll to meet the challenges.

Usual induction after preoxygenation is with fentanyl-midazolam-propofol or Etomidate-muscle relaxant, then intubation.

Muscle relaxants are used for smooth endotracheal intubation and then to allow better visualization of abdominal contents during laparoscopic surgery. Short-acting Depolarizing muscle relaxant, i.e. succinylcholine though causes myalgia, is safe for intubation in

Fig. 19.2: Infusion pump.

private set-up. Nondepolarizing muscle relaxants do not cause postoperative myalgia but takes longer duration (more than 90 sec) to achieve muscle relaxation adequate for intubation. Hence, it is very essential to assess about mask ventilation prior to intubation and possible unrecognized difficult intubation.

MAINTENANCE

Anesthesia for operative laparoscopic surgery is maintained by combination of several anesthetics. The triad of general anesthesia, i.e. amnesia, narcosis, and skeletal muscle relaxation is usually preferred. Usually mixture of nitrous oxide with oxygen along with volatile agents, muscle relaxants and narcotic analgesics are used. Use of nitrous oxide is controversial. Now because of Dextomid, fentanyl, sevoflurane, and low flow machine anesthetist is able to eliminate nitrous oxide.

Preoperative good bowel preparation keeps bowel deflated during intraoperative period. Nitrous oxide acts as analgesic and amnestic drug and hence reduces doses of amnestic drug, inhalation agent, and muscle relaxants and contributes in avoiding awareness during anesthesia.

Depending upon the duration of surgery, intermediate acting muscle relaxants atracurium or vecuronium are used. Among the inhalation agents, isoflurane and sevoflurane are commonly used. Sevoflurane is preferred as recovery is faster.

During laparoscopic surgery blood carbon dioxide level is raised. To maintain normal blood carbon dioxide level and PH value, minute ventilation should be increased. This can be achieved by increasing tidal volume and or Respiratory rate. Increasing tidal volume will increase, already raised air way pressure, which is not desirable, so increasing respiratory rate is to be preferred.

MONITORING

Besides regular monitoring with SpO_2, NIBP, ECG, $ETCO_2$ addition of spirometry gives detail respiratory status which is significantly altered in laparoscopy. One can see the difference in respiratory status once the pneumoperitonium is created. Changing the ventilatory settings one can achieve optimum respiratory status as prepneumoperitoneum level. In view of early

detection of gas embolism use of ultrasound Doppler and Transesophageal echocardiography (TEE) is excellent. However, incidence of gas embolism is rare and hence elaborate monitoring by Doppler and TEE are not indicated.

POTENTIAL COMPLICATIONS

Cardiovascular

CO_2 pneumoperitoneum leads to 65% rise in systemic vascular resistance, 90% rise in pulmonary vascular resistance and 20–59% decrease in cardiac index. Plasma renin and aldosterone increases four folds during laparoscopy. There is also rise in adrenaline, noradrenaline, and vasopressin.

Commonest abnormalities occurring during laparoscopy are alterations in blood pressure and cardiac arrhythmias.

Blood Pressure

Cardiac output and peripheral vascular resistance determines blood pressure.

Hypertension: Raised carbon dioxide level stimulates chemoreceptors, releases catecholamines and increases BP. Blood pressure also increases because of peritoneal stretching due to pneumoperitoneum, pulling of viscera during laparoscopic surgery and light anesthesia. The HTN is usually managed by narcotic analgesics, inhalation agents like sevoflurane or isoflurane or infusion of propofol and occasionally Nitroglycerin (NTG) drip.

Hypotension: Hypotension is basically due to decreased preload. This can be because of bleeding, massive venous gas embolism (VGE), excessive dose of inhalation agents or acute rise in IADP compressing inferior vena cava (IVC) affecting venous return and hence hypotension. Keeping watch on bleeding during laparoscopic surgery is often tricky because of simultaneous irrigation and suctioning. Timely infusions and transfusions are helpful. Hypotension due to acute rise in IADP is usually with bradycardia. Releasing intra-abdominal pressure and giving injection atropine are enough.

Arrhythmias

- *Vagal stimulation*: Stretching of peritoneum due to acute rise in IADP or manipulation by laparoscopic instrumentation can increase the vagal tone leading to sever bradycardia, nodal rhythm and occasionally asystole (pulling of tissues may be more dangerous than cutting). Releasing of tissues and IADP with intravenous (IV) atropine is, all that is required. Rarely, if cardiac arrest occurs, cardiopulmonary resuscitation (CPR) to circulate atropine is essential.
- Sinus tachycardia
- Ventricular premature beats (VPB).

Increased blood carbon-dioxide level, increases catecholamines, under which certain circumstances causes VPBs. VPB are observed more frequently when:

1. Insufflations with carbon dioxide versus nitrous oxide
2. Halothane versus isoflurane or enflurane

3. Spontaneous versus controlled ventilation
4. Mask anesthesia versus ET intubation and IPPV.

P.N.: Halothane spontaneous anesthesia under mask and carbon dioxide insufflation combination increases incidence of VPB. Sudden overdistention of abdomen has led to cardiac arrest and death.

Vascular Gas Embolism

Gas embolism can be

- *Arterial:* In this ischemia of blocked artery occurs and so far not reported.
- *Venous:* Venous gas embolism though extremely rare; it is serious complication. In laparoscopic surgery, it usually occurs at the time of first puncture (which is blind). Usually, omental vessels are accidentally cannulated, more commonly when there is history of previous abdominal surgery causing fibrosis resulting in relatively fixed vessels.

Actual detection and reporting of incidence depends on monitoring modality and severity of embolism. Basic monitoring with blood pressure ECG, oximeter, and central venous pressure the reported incidence of VGE was 8 –15 %**.** The incidence of reporting vascular gas embolism (VGE) has gone up to 25–50% with modern modality of monitoring with Doppler transducer, TEE. It is this early detection and prevention has decreased the occurrence of clinically significant VGE.

Pathophysiology

Rapid intravenous entry of large volume of gas leads to foaming and mechanical obstruction to out flow. This interferes with pumping action of myocardium causing severe cardio vascular collapse. Gas entrainment from right ventricle to pulmonary vessel creates shunt effect, increases respiratory dead space, decreases $ETCO_2$, increases central venous pressure, decreases cardiac output and causes hypotension. This results in release of vasoactive substance causing constriction of pulmonary arterial tree, increasing pulmonary vascular resistance resulting in pulmonary HTN.

Signs and symptoms of VGE depend on:

- Type of gas injected–severity of VGE with air/oxygen insufflation more than carbon dioxide/nitrous oxide insufflation
- Rate of injection of gas
- Total volume of gas injected
- Integrity of respiratory function.

Signs and symptoms: Abrupt collapse of the patient with

- Loud mill-wheel murmur
- Increase central venous pressure
- Hypotension
- Cyanosis due to hypoxemia
- Decrease end tidal carbon dioxide
- Increase arterial carbon dioxide tension. If the gas embolized is carbon dioxide, there is marked rise in blood CO_2 (Large gradient between increased $PaCO_2$ and decreased $ETCO_2$). Severe shock and death because of right ventricular outflow obstruction.

- ABG study shows acidosis and reduction in arterial oxygen tension (PaO_2).
- Doppler transducer kept over right heart and TEE are highly sensitive monitors to detect even minor bubbles of intravenous gas.

Management of VGE

- Stop the inflation of gas
- Start 100% oxygen
- Place the CVP line if not put before and aspirate the gas from the great vessels
- Give left lateral position and head low so that out flow tract of right ventricle is inferior to remove airlock
- Supportive treatment for cardiovascular collapse and CPR, if cardiac arrest.

Respiratory

General anesthesia alters ventilation perfusion ratio (v/p). It also induces atelectasis of varying degree. During general anesthesia for gynecological laparoscopy, lithotomy position, head low and peumoperitoneum all three progressively reduce lung compliance, FRC and VC to almost 50%. About 90% of the compression atelectasis occurring intraoperatively persist up to one hour and 50% till 24 hours postoperatively. Hence, the importance of oxygen supplementation in the postoperative period. The above three factors also increase AWP. AWP is also increased due to inadequate muscular relaxation, bronchospasm, obesity, COPD and inadvertent endobronchial intubation. Hypothermia during surgery can lead to abnormal surfactant production, which in turn leads to atelectasis.

Occasionally insufflation of gas may cause peumothorax, medistinal emphysema (congenital pleuroperitoneal fistula) subcutaneous emphysema or rarely to diaphragmatic rupture. There is alteration in arterial blood gases due to carbon dioxide insufflation. There is rise in $PaCO_2$ and decrease in PH.

Gastrointestinal

- *Nausea and vomiting:* Incidence of nausea and vomiting following routine surgical procedures is 15–30% and is markedly higher after endoscopic surgery.
- Physical and physiological factors causing nausea and vomiting are gastric distention, oral intake, movement of patient from OT to ward, operative pain, hemodynamic instability and drugs like opiods and anesthetic drugs and gases. They appear to interact at the vomiting center and the chemorecepter trigger zone in medulla of brain, with dopamine being a critical mediator.
- Vomiting is not only unpleasant, but also lead to volume depletion, aspiration of gastric contents, which can be disastrous, and rarely esophageal rupture.
- Positive assurance to anxious patients particularly those with history of motion sickness and nausea and vomiting during previous surgery reduces incidence of postoperative nausea and vomiting.
- To consider preoperative nonparticulate antacid (sodium citrate), H_2 blockers and anti-emetics.

- Smooth induction, roll of nasogastric drainage, smooth extubation, minimal pharyngeal suction and irritation, and 100% oxygen during periextubation period reduce incidence of nausea and vomiting.
- Regional and local anesthesia has lower incidence of postoperative nausea and vomiting (PONV) particularly for ambulatory surgical procedures.
- Pain itself causes nausea and vomiting, active retching may produce even more pain because of stress on incision site and diaphragmatic irritation. Usually, there is tendency to rely primarily on antiemetics and to withhold narcotic analgesic. Effective analgesia can be achieved by routine local infiltration with 0.5% sensorcaine at the puncture or incision site and use of non-narcotic analgesics. However, if still pain persists, narcotics may be given, though they themselves can induce nausea and vomiting.
- Monitoring of severely nauseating and vomiting patients should be continued along with nasal oxygen supplementation for 1–2 hours in recovery room.
- DRUGS: Although many drugs have been evaluated, no single drug has emerged as an effective prophylactic or therapeutic value. However, important ones are listed below.
  - Serotonine antagonist: Ondensetron 4–8 mg.
  - Anti-dopaminergic: Metoclopramide 20 mg.
  - Butyrophenones: Droperidol 0.625–1.25 mg.
  - Phenothiazines: Prochlorperazine (compazine)
  - Promethazine (phenergan)
  - Anti-histaminics
  - Anti-cholinergics: Scopolamines
  - Sympathomimetics: Ephedrine

Gastrointestinal Trauma

Gastric perforations have occurred during introduction of Veress needle or laparoscopic trocar. Gastric distention is more common when starvation is inadequate or there is difficult mask ventilation (and difficult intubation). Various bowel injuries have been reported during trocar insertion or by cautery burns. Such injuries can occur easily in patients with history of previous operation, causing adhesions with abdominal wall. Under such circumstances, it is safer to put trocar by open puncture method.

Renal

Raised IADP by direct compression and through hormonal axis reduces renal cortical perfusion and glomerular filtration rate (GFR) reducing urine secretion. Therefore, it is recommended that IADP should be kept at lowest which is optimal for adequate visualization and surgery, more so in diabetic and hypertensive patients with nephropathy. Drugs primarily excreted by kidney and nephrotoxic drugs can affect the recovery from anesthesia in such patients.

Temperature

Continuous insufflations of peritoneum with cold carbon dioxide, infusion of cold intravenous fluids, air-conditioned operation theatres for prolong laparoscopic surgery can cause

Fig. 19.3: Thermal blanket.

hypothermia. Hypothermia causes metabolic acidosis and delayed recovery. It also interferes with performance of oximeter. Drugs like halothane and fentanyl decrease threshold for temperature and exaggerate postoperative shivering. Shivering increases oxygen demand by three times. Hence, temperature monitoring in laparoscopic surgery is a valuable parameter. Insufflation of warm carbon dioxide, use of infusion warmer, warm air blower and proper covering of oximeter probe are all useful measures to minimize hypothermia (Fig. 19.3).

Dehydration

Peritoneal cavity and respiratory system covers very large surface area. Insufflations with dry carbon dioxide and ventilation with dry anesthetic gases involves considerable insensible fluid loss. Preoperative starvation adds to this. As a part of preoperative bowel preparation peglec is given to the patient. This induces large watery motions which can produce dehydration and electrolyte imbalance (one simple way to judge the dehydration is to have exaggerated hypotension on induction in otherwise normal fit patient). This dehydration also exaggerates reduction in GFR in kidneys. Liberal infusion of intravenous crystalloids is thus recommended.

Central Nervous System

During prolong gynecological laparoscopic surgery good degree of head low is given. This results in mild reversible cerebral and conjuctival edema, which does not require any special attention. However, it is good to consider intraoperative steroid and oxygen supplementation in postoperative period.

There are reported cases of nerve or brachial plexuses damage because of improper padding of legs in lithotomy position and of shoulder blades during the shift of patient.

In gynecological laparoscopy camera, open exposed eye, in addition conjuctival edema all can lead to exposure keratitis and visual disturbances. This can be avoided by eye applicab and covering eyes with soft eyepad.

Surgical Trauma

Surgical trauma can be vascular (arterial or venous) or visceral (stomach, bowel, rectum, ureter or bladder) as in any operative procedures. In laparoscopy usually due to bad adhesions and extensive use of cautery close to vital structures, trauma can occur. Timely identification of injuries and proper intervention in tackling such problems with adequate and strict post-operative care would avoid catastrophe.

CERTAIN SPECIAL CLINICAL POINTS

Postoperative Oxygen Supplementation

Routine postoperative oxygen supplementation in otherwise normally recovered patient is useful for following reasons

- Hypothermia causes postoperative shivering (particularly with halothane) which increases oxygen demand by 3 times.
- During post extubation in immediate recovery period there is diffusion hypoxia.
- Oxygen supplementation decreases incidence of PONV and hypotension
- During long standing head low in gynecological laparoscopic procedure there is varying degree of cerebral edema, which can delay recovery. Oxygen therapy helps in this period.

Is an Endotracheal Intubation a Must?

This question arises when laparoscopy is for short and simple procedure like diagnostic laparoscopy or laparoscopic tubal ligation. If intubation is not done following precautions can avoid catastrophe.

- Proper preoperative starvation.
- Premedication with vagolytic drugs and other specific drugs with respect to anxiety, asthma, COPD and upper respiratory tract infection.
- Routine preoperative H_2 blockers (ranitidine or omez) and anti emetics (ondensetron)
- Armamentarium for oxygenation, ventilation, intubation and suction must be ready and checked.
- Local infiltrations at puncture site reduces doses of anesthetic drugs and deep anesthetia.
- If you are not intubating the patient and giving muscle relaxant, the associated dangers should be kept in mind.
- Both hands of anesthesiologist are occupied for ventilating the patient and holding the facemask. Therefore, second competent doctor or nurse should always be available to help anesthetist for monitoring, filling up and injecting drugs as and when required.
- Peritoneal manipulation, stretching and handling of ovaries cause vagal stimulation. Also second and subsequent doses of succinylcholine causes severe vagal stimulation. If above two situations coincide with light general anesthesia, it can cause severe bradycardia including asystole. In such situation keeping watch on oxygen saturation, heart rate and keeping injection atropine ready can be of prompt help.

- Many a times so called short procedures to begin with can end up in sufficiently long procedures. Head low, lithotomy, and pneumoperitoneum causes respiratory distress. Ventilation under mask can lead to inflation of stomach and such incidences are higher in obese patient, smokers and patient with short neck. There is increased chance of regurgitation and inhalation of gastric content.

Laparoscopic In-Bag Morcellation and Anesthesia (Fig. 19.4)

With possibility of malignancy, it is considered whether specimen (ovary, fibroid or uterus) can be morcellated in the separate bag and taken out without any spillage in the peritoneum thereby preventing possibilities of spread from peritoneal cavity.

One large bag is introduced with special device; specimen is transferred in the bag. Trocar with inflow is introduced into the tail of the bag which is pulled out. Now this bag is inflated creating cavity inside the peritoneal cavity. The specimen is taken out like regular morcellation.

As an anesthetist two advantages are observed. Tiny pieces created during the process of morcellation falls in the bag cavity instead of peritoneal cavity which can come out with bag when removed. This saves lot of time and effort to remove these pieces from peritoneal cavity and prevents peritoneal soiling. Secondly when bag cavity is inflated, the direct pressure on the peritoneal cavity is reduced and limited. Also the irritation caused by carbon dioxide is removed as a result there is reduction in air way pressure and resistance and increase in compliance of the lungs improving respiratory mechanics. It means during the process of in bag morcellation, there is improved respiratory mechanics.

Fig. 19.4: Multipara monitor: Parameters during different stages of surgery depicting beneficial effect on $ETCO_2$ of laparoscopic in-bag morcellation.

CONCLUSION

Laparoscopic surgery involves transient but significant physiological imbalance. Laparoscopic surgery also involves high technology instrumentation. Hence proper knowledge of working of such instruments along with modern anesthesia machines and monitors like capnometer, oximeter, cardioscope, and NIBP is essential. Knowledge of methods to counteract altered physiological changes is also essential. This chapter attempted for highlighting the various technological advancements, early recognition of altered physiological changes and some complications and their skillful management and some special clinical conditions.

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Chapter 20

Credentiality of Gynecological Minimal Access Surgery

Shyam Desai

INTRODUCTION

Several practicing gynecologists are now carrying out diagnostic hysteroscopy, laparoscopy and tubal ligation procedures across the world, however when it comes to operative procedures not many can perform advanced procedures efficiently.

As gynecological endoscopic surgery has gained popularity among gynecologists all over the world, it is no wonder that more and more emphasis be placed upon the proper training and certification of those who embark on this fascinating sub-specialty. Gynecological endoscopy and minimal access surgery has advanced rapidly in last two decades and there is a growing need to have gynecologists comprehensive and extensive training in this field to have a complete knowledge of the subject.

Gynecologists should enhance their skills to a level to actually be able to perform simple to moderately advanced gynecological endoscopic surgery in a center, which is properly equipped with the infrastructure of instruments and equipment for safe endoscopic surgery.

Having attended a training program and watched several procedures being performed does not constitute adequate training the duration of any good course should be for a period of 6 months. The period is structured to give the candidate increased responsibility systematically

OBJECTIVES OF A TRAINING PROGRAMME

The candidate at the end of the training will acquire skill; full knowledge of advanced technology and shall be able to:

- Perform basic to moderate level of gynecological endoscopy and minimal access surgery pertaining to his/her field of specialty.
- Adapt various technologies of minimal invasive therapy that supplement each other and act together to decrease patient morbidity.
- Perform safe laparoscopic, hysteroscopic, and minimal access surgeries.
- Appreciate the benefits, limitations and complications of the newer techniques.
- Be aware of various instruments approximately equipment and their applications that are coming into vogue in the field of minimal invasive surgery.
- Detect and manage complications that may occur with these types of surgeries.

- Practice, ethical, and evidence based medicine.
- Develop communication skills to present papers, lectures, etc. at various platforms.
- Physiological and kinetic changes associated with pneumoperitonium for short or long duration needed for laparoscopic surgery and also the changes related to uterine distension media for hysteroscopic surgery. Basic knowledge of the anesthesia and multiparameter monitoring related to basic to advanced laparoscopic and hysteroscopic surgery.
- Role of diagnostic laparoscopy, microlaparoscopy, hysteroscopy, microhysteroscopy, and contact hysteroscopy or gynecological pathologies and conditions which are correctable by laparoscopy along with intrauterine pregnancy like ovarian cyst, concurrent ectopic pregnancy, appendectomy, etc. conserving uterine pregnancy and reducing chances of abortion.
- A comprehensive details of pathologies correctable by endoscopic surgery like endometriosis, fibroids, and adhesions, etc.
- A complete knowledge of all instruments and equipment used for laparoscopic and hysteroscopic surgery along with proper sterilization, proper usage, and proper maintenance of the same for effective and continuous functioning for safety.
- A complete knowledge of electrocautery and electrosurgery, the new energy sources, vessel-sealing devices, harmonic scalpel, lasers along with surgical or technical risks, complications, and management of the same.
- A full working knowledge of alternative procedures for endometrial ablation, thermal balloon techniques, etc.
- Two work stations regularly available for laparoscopic inanimate exercises, hysterotrainer, and endosuturing laboratory given at discretion of teacher. Adequate amount of hours of training and practice should be filled in a logbook signed and supervised by the teacher.
- A thorough clinical evaluation with adequate sonographic and hormonal assay levels for clinical correlation to give proper treatment to the patient.
- After 6–8 weeks of exposure to live surgery, adequate knowledge and reading the trainee will scrub with the teaching personnel as second and later first assisting surgeon to get hands on tissue feeling and confidence to operate independently later.
- Maintenance of a logbook with proper record of full management of laparoscopic and hysteroscopic surgical cases, which includes 60 cases in total.
- A complete knowledge with literature data and center's own data for fertility enhancing endoscopic surgery and also when not to do endoscopic surgery for a given patient.
- One subject can be taken by the delegate as a research activity or a comparative data analysis related to laparoscopic or hysteroscopic surgery or minimal invasive surgery in stress urinary incontinence (SUI)/Prolapse.
- A proper knowledge and live surgery observation of laparoscopic and alternative methods of treatment of stress urinary incontinence and prolapse and pelvic floor defect.
- Experience and expertise in endoscopic, minimal access and open surgery for various gynecological pathology and conditions affecting women's health.
- A proper knowledge with complete hands on experience of laparoscopic sterilization with Fallope rings and also cases with bipolar coagulation with small tubal segment excision confirmed on histopathology and also video recorded.

- Experience and knowledge of medicolegal and ethical aspects of gynecological endoscopic and minimal access surgery.
- Research, statistics, and audit of success, morbidity, and mortality, if any.
- Role and place of laparoscopic microsurgery theoretical, practical, and comparative knowledge with skill enhancement.
- Optimum knowledge of crisis management in gynecological endoscopic and minimal access surgery.
- Adequate knowledge to interact, discuss and learn from teachers, colleagues on all finer aspects of gynecological laparoscopic surgery.
- Full details of post endoscopic surgical care, follow-up advice.
- Knowledge of future technology like Robotic surgery, NOTES, Telemedicine.
- The trainee on finishing a 6-month phased course in gynecological endoscopic and minimal access surgery after getting the certificate should continue to expand his skills further.

The end point for this course is that the person attending has a definite complete knowledge, skill to do the gynecological endoscopic and minimal access surgery in a properly equipped setup.

COURSE CONTENTS

The course should be structured so that the following aspects are covered:

- The theory behind various kinds of laparoscopic surgeries.
- Knowledge about specialized instrumentation and their maintenance.
- Operative details about the various operative procedures.
- Indications, limitations of procedures and contraindications based on evidence-based medicine.
- Use of computers and various software to maintain surgical audit, prepare presentations, maintain website browse the net, to perform digitization of videos and edit them, and use of telemedicine and virtual reality.
- Evaluation of data based on surgical audit.
- Topics which includes ethical, legal, and social responsibilities of surgeons.

The various topics that would be covered in detail include:

Basic Laparoscopy

- History of laparoscopic surgery.
- Basic instrumentation.
- Operating room layout and troubleshooting.
- Anesthetic considerations.
- Laparoscopic space access and physiological significance.
- Gasless laparoscopy.
- Sterilization and disinfections in laparoscopy.
- Principles of laparoscopic hemostasis.

- Laparoscopic tissue approximation.
- Role of laparoscopic ultrasonography.
- Retrieval system in minimal invasive surgery.
- Complications of laparoscopic surgery.
- Laparoscopy during pregnancy
- Strategies for laparoscopic diagnosis of malignancy.
- Laparoscopic surgery for various gynecological conditions.
- Less invasive laparoscopy and alternative treatments.
- Role of laparoscopy in abdominal pain syndromes.
- Hysteroscopy and hysteroscopic surgeries.

Gynecological Endoscopy and Minimal Access Surgery

- Diagnostic laparoscopy.
- Laparoscopic sterilization.
- Laparoscopic adhesiolysis.
- Laparoscopic salpingostomy and fimbrioplasty.
- Laparoscopic management of ectopic pregnancy.
- Laparoscopic microsurgical tubal anastomosis.
- Laparoscopic management of ovarian cysts.
- Laparoscopic treatment of ovarian endometriomas.
- Laparoscopic management of tubo-ovarian mass.
- Polycystic ovaries, surgical management.
- Laparoscopic uterine nerve ablation.
- Laparoscopic surgery for pelvic pain
- Laparoscopic myomectomy.
- Laparoscopic hysterectomy.
- Laparoscopic assisted vaginal hysterectomy.
- Laparoscopic supracervical hysterectomy.
- Laparoscopic colposuspension.
- Laparoscopic repair of enteroceles and pelvic floor defects.
- Laparoscopic treatment of advanced endometriosis.
- Role of laparoscopy in gynecological malignancy.
- Hysteroscopic surgery for intrauterine septum, adhesions, polyps, fibroids, and tubal block.
- Hysteroscopy endometrial ablation and resection.
- Microlaparoscopy and microhysteroscopy.
- Urinary incontinence and pelvic floor defects minimal access and new mesh surgery.

Skills

The candidate will be given an opportunity to observe (O), assist surgeries (A), perform with assistance (PA) and perform independently (PI) in various cases and the minimum participation of the candidate will be as per Table 20.1.

Table 20.1: Skills of candidates.

	O	*A*	*PA*	*PI*
Diagnostic laparoscopy	10	10	5	5
Laparoscopy	-	-	5	
Laparoscopic sterilization	-	-	-	5
Ectopic pregnancy/Salpingectomy	-	5	5	-
Ovarian cystectomy	-	5	5	-
Endometriosis	-	5	5	-
LAVH	5	5	5	-
TLH	10	-	5	-
Ovarian drilling	-	-	10	10
Hysteroscopic surgery	15	-	20	15
Advanced gynecologic surgery	50	-	-	-

(LAVH: Laparoscopic assisted vaginal hysterectomy; TLH: Total laparoscopic hysterectomy; O: Observe; A: Assist; PA: Perform with assistance; PI: Perform independently).

TRAINING METHODS

There will be regular training sessions for the candidates, as follows:

- Lectures and pelvitrainer sessions.
- Video demonstrations.
- Seminars and symposia.
- Panel discussions.
- Ward rounds and case presentations.
- Journal club.
- Presentations of paper in conferences.
- Publication in important journals.
- Project work.
- Practical training in inanimate trainers, computerized modules, virtual reality modules.
- Assisting live surgeries.
- Performing surgeries under supervision.

Lectures

Didactic Lectures

Selected common topics will be discussed during the first few months of the course and most of them will be introduced to the candidate to enable him increase his productivity during the course. These would include:

- Biostatistics
- Use of library
- Research methods

- Communication skills, etc.
- Use of computers.

Integrated Lectures

These are a combination of multidisciplinary talks given by experts in the respective fields the intention being that we need to react with our inter-disciplinary colleagues and work with them.

These would include:

- Emergency surgeries.
- Management of multiple complications.
- Management of multiple pathological conditions.

Video Demonstrations

There will be a series of lectures based on DVD's demonstrations of various laparoscopic surgeries. This will be from the vast compilation of DVD's (> 100's laparoscopic, hysteroscopic, and minimal access surgeries performed by various gynecological endoscopic surgeons of international repute). Several points will be discussed during these sessions, which include:

- The operative procedure details.
- Problems that would be encountered during the surgeries.
- Dealing with different situations and pathologies.
- Various approaches to a given problem.
- Different techniques of surgery that can be adapted.
- Proper usage of various instruments and energy sources.

Seminars and Symposia

This will be held once in 3 months. The postgraduate students are invited to attend and actively participate in discussion. The candidate will present on various topics at least twice in 6 months. There will be evaluation of the candidate based on his participation and contribution for the seminar.

Ward Rounds and Case Presentations

The candidate will be doing rounds of all in-patients in the department of gynecological endoscopic and minimal access surgery this will be teaching rounds with faculty in the department. Candidates will be entering relevant data in their logbooks every day. There will be case presentations by the candidate during the rounds.

Practical Training

- *Pelvi-trainer sessions:* Practical training should be given on inanimate pelvi-trainers. Various types of exercises are taught in these trainers, the actions of which mimic the various steps of surgical procedures. Even though the basic hand movements can be taught

on a pelvi-trainer it cannot replicate the actual surgery experience which can be obtained by performing the steps in a live situation.

- Hysterotrainers and simulators for different pathologies.
- Virtual reality training module optional.
- *Assisting surgeries:* The candidate will be given opportunities to assist a number of surgeries. The assisting surgeries would include various surgical procedures, operating through the other ports other than what the surgeon is using and coordinating by holding the camera.
- *Performing surgeries under supervision:* Based on the performance and the active involvement of the candidate he/she will be allowed to perform certain operations under supervision by senior faculty. The type of surgery and number of surgery will be decided upon based on the expertise that the candidate as acquired. The trainee should be first given simple surgical procedures to be carried out such as simple adhesiolysis, cannulation of tubes and septum incision after which more advanced surgeries such as ectopic pregnancy simple ovarian cysts and PCOD cauterization before moving on to myomectomies and hysterectomies.
- A preceptor is one who observes and guides a candidate when he is performing the surgical procedure. A preceptor is one who is adequately trained to teach the candidate and one who can assess the competence of the operator.

Evaluation

Credentialing means to evaluate the trainee in various aspects of endoscopic surgery and certify him. He may be granted temporary privileges and allowed to perform surgeries and evaluated upon the outcome of the procedures.

The evaluation of learning outcome of trainees consists of:

Assessment Plan during the Course

There should be continuous monitoring and regular assessment of all academic activities of the candidate.

Formal evaluation is done by the staff of the department based on participation of students in various teaching or learning activities. The evaluation is structured on the basis of checklists that evaluate these various parameters.

The following aspects will be assessed:

- *Personal attitudes:* It is pertinent to assess and guide the candidate in facing stressful conditions in the ward and operating room, to assess the candidate's ability to work as a team and to evaluate the leadership qualities, and coordinating abilities.
- *Acquisition of knowledge:* This will be done by evaluation of the candidate's performance during the journal club, seminars, symposia, interactive conferences and discussions during the ward rounds (Table 20.2).
- *Teaching skills:* A close watch and guidance will be provided regarding the skills in communicating and teaching during the presentations that the candidates would make.

Table 20.2: Checklist of operative skills.

Parameters evaluated	*Poor*	*Below average*	*Average*	*Good*	*Very good*
	0	*1*	*2*	*3*	*4*
1. Preoperative preparation					
2. Setting up of equipment					
3. Creation of pneumoperitoneum					
4. Port placement					
5. Patient positioning					
6. Coordination with operating team					
7. Camera focusing					
8. Proper usage of instruments					
9. Overall dissection skills					
a. Dexterity of movements					
Dissection, hemostasis					
b. Maintaining clear field of vision					
c. Usage of energy sources					
d. Suturing and knotting					
10. Safety measures during surgery					
Handling crisis					

- *Clinical and operative skills:* This would include an evaluation of the candidate's sincerity, punctuality ability to diagnose correctly handling of the patient and relatives, the speed and effectiveness of the decisions taken in the outpatient department and the wards. The candidate's operative skills will be assessed based on performance in the operating room, and standard tests given in inanimate pelvitrainer, hysterotrainer, minimal access models session and assisting during surgery.
  - Prime importance should be given to maintaining a proper record of events of teaching and experiences that the candidate has obtained in a logbook. Internal assessment will be based on the evaluation of the logbook. The record will include academic activities as well as the presentations and procedures carried out by the candidate.
  - Endoscopic surgery has a long learning curve and it is important that proper training be imparted so that operative mishaps are kept down to a bare minimum.
  - Any surgical procedure will have its complications and it is not realistic to say that no complications are expected. However, by giving adequate and thorough training the morbidity and mortality following endoscopic surgery can be reduced.

Chapter 21

When not to do Endoscopy in Gynecology!

Prakash Trivedi, Paul Fogarty

"Technology is a tool specially minimally invasive endoscopy,
However if used improperly by a fool then it could be maximally traumatic".

INTRODUCTION

Gynecologist always dreamt to have eyes at the tip of the finger, they were blessed not only by having transvaginal ultrasound but also with hysteroscopy to visualize the uterine cavity and the laparoscopy to visualize the pelvic and peritoneal cavity.

Though, there can be innumerable use of endoscopy in gynecology we have to justify even when we do diagnostic or operative endoscopy, since at least they are minimally invasive. Judicious use of such technology out rules the unnecessary use or abuse scientifically.

We will highlight only few specific areas wherein use of endoscopic surgery can be avoided. It is very clear that endoscopy should be avoided in any place, center or hospital wherein there is no proper endoscopic infrastructure, trained expert, acceptable anesthetist and facility to manage complication, if any which can arise specially because of endoscopy. Further, mere presence of a pathology in an infertile women there is no need of doing operative laparoscopy, if it is not beneficial.

DIAGNOSTIC LAPAROSCOPY

In the presence of sufficient evidence, which are clinical, known by history, investigation or sonography there is no place for diagnostic laparoscopy just to confirm or find no pathology. For example, in patients of infertility a diagnostic hysterolaparoscopy is not compulsory and necessary in all cases, if all the clinical evidence suggests that there may not be an ectopic pregnancy or tubal or ovarian pathology ruled out by other modalities.

DIAGNOSTIC HYSTEROSCOPY

In all cases of infertility or even in abnormal uterine bleeding with clear findings by other diagnostic modalities except postmenopausal bleeding.

Tubal ectopic pregnancy unruptured with beta-human chorionic gonadotropin (βhCG) less than 2,000 IU usually responds to methotrexate injection does not need laparoscopy but needs good follow-up.

- Ruptured tubal ectopic pregnancy wherein patient is not stable, laparoscopy should be avoided.
- In diagnosed cases of endometriosis or endometrioma especially in unmarried women and asymptomatic, medical treatment is better than laparoscopic surgery. The same holds true for a married women with one or two children and asymptomatic.
- A recurrent endometrioma or patient with very poor ovarian reserve laparoscopic surgery should be avoided.
- In diagnosed cases of fibroid especially in unmarried women and asymptomatic, there is no need of laparoscopic surgery. The same holds true for parous women.
- An asymptomatic fibroid incidentally diagnosed in a patient with infertility do not need laparoscopic surgery.
- In a postmenopausal women with a large asymptomatic fibroid with normal color Doppler and no back pressure changes especially on kidneys.
- There is no conclusive evidence that fibroid turns into leiomyosarcoma and also the growth rate of fibroid is usually 0.3 cm per year. Rapid growth in fibroid is no indication about the cancer. We have oncologic center and pathology book evidence that fibroid and leiomyosarcoma are unconnected. Hence, removal of fibroid or uterus for an imaginary scare of developing sarcoma or cancer has no place for laparoscopic or open surgery.
- In patients of diffuse adenomyosis with severe pain irrespective of age there is no place for laparoscopic or open surgery for fertility benefit except in a patient who qualifies for hysterectomy.
- Though laparoscopic surgery for endometrial cancer and early cervical cancer is accepted in expert's hand. An option should be given for open surgery and most important is average gynecological laparoscopist should not do laparoscopic radical hysterectomy without proper training and actually doing adequate number of cases under supervision.
- Except in young patient with a unilateral ovarian malignancy contained within the capsule, there is no place for conservative laparoscopic surgery for ovarian cancer.
- If a laparoscopist encounters a complication like bleeding, bladder, or bowel injury, laparoscopic surgery should be persisted only if they have expertise, team supervised by respective specialty and facility of surgical intensive care unit (ICU), appropriate open surgery is accepted.

Conversion to open surgery in laparoscopy should be a decision made in quick time rather than delaying and compromising the health of the patient. Doing open surgery with suitable expertise is not a failure of laparoscopic surgery.

HYSTEROSCOPY

- Expertise in laparoscopic surgery is no certificate to do hysteroscopic surgery.
- Unnecessary hysteroscopic surgery, e.g. incision of septum in a patient who already has a child and no abortion or asymptomatic polyp, or intramural fibroid with no complaints and very small impact on the endometrium.

- Hysteroscopic endometrial resection in current times should be only done by experts after giving all other options.
- Hysteroscopic bipolar surgery should not be taken for granted as superior over monopolar resectoscopic surgery done by an expert. Proper instrumentation fluid management and handling complications before they arise is the most important factor.
- Office hysteroscopy leads to miniaturization of optics but is actually done in a proper operation theater with monitoring, quite often under anesthesia with pathology of limited size.

LASER IN GYNECOLOGICAL ENDOSCOPIC SURGERY

There are no evidence of whatsoever nature to prove that CO_2, diode, holmium, neodymium-doped yttrium aluminum garnet (NdYag) has any superiority in gynecological endoscopic surgery.

Robotic Surgery

There are no evidence of whatsoever nature to prove any superiority in gynecological endoscopic surgery, except oncology and probably tubal anastomosis.

A single port surgery or single incision multiple port surgery has limited indication in gynecological endoscopy and offers insignificant benefit and can be considered experiment.

Chapter 22

Medicolegal Aspects of Minimal Access Gynecological Surgery

Gopinath N Shenoy

INTRODUCTION

Law expects medical practitioners to render services which are free from "Deficiencies".

The word "Deficiencies" in services is defined by the Consumer Protection Act 1986 as:

"Deficiency" means any fault, imperfection, short coming or inadequacy in the quality, nature, and manner of performance which is required to be maintained by or under any law for the time being in force or has been undertaken to be performed by a person in pursuance of a contract or otherwise in relation to any service. Presence of negligence in the services is actionable.

NEGLIGENCE AND RASHNESS

Negligence is opposite of diligence. Negligence and rashness usually go hand in hand. Eminent jurists and leading judgments have assigned various meanings to negligence. The concept as has been acceptable to Indian jurisprudential thought is well-stated in the Law of Torts, Ratanlal and Dhirajlal (Twenty-fourth Edition 2002, edited by Justice GP Singh). It is defined as:

"Negligence is the breach of a duty caused by the omission to do something which a reasonable man, guided by those considerations which ordinarily regulate the conduct of human affairs would do, or doing something which a prudent and reasonable man would not do."

In short, it can be an act of commission or an act of omission. An act committed which no reasonable prudent doctor (placed under the situation) would commit or an act omitted to be performed which a reasonable doctor would have undertaken.

According to Charlesworth and Percy on Negligence (Tenth Edition, 2001), the essential components of negligence are three: "duty", "breach", and "resulting damage", that is to say:-

1. The existence of a duty to take care, which is owed by the defendant to the complainant;
2. The failure to attain that standard of care, prescribed by the law, thereby committing a breach of such duty; and
3. Damage, which is both causally connected with such breach and recognized by the law, has been suffered by the complainant.

In Poonam Verma versus Ashwin Patel, and Others (1996) 4 SCC 332 the Supreme Court has held that negligence has many manifestations—it may be active negligence, collateral negligence, comparative negligence, concurrent negligence, continued negligence, criminal negligence, gross negligence, hazardous negligence, active and passive negligence, willful or reckless negligence or negligence per se. Negligence per-se is an act or an omission which is declared as negligence because it is in violation of a statute or valid ordinance, or because it is so palpably opposed to the dictates of common prudence.

In Indian Medical Association versus V P Shantha 1995 (6) SCC 651 it has been held that the following acts are clearly due to negligence:

- Removal of the wrong limb;
- Performance of an operation on the wrong patient;
- Giving injection of a drug to which the patient is allergic without looking into the out-patient card containing the warning;
- Use of wrong gas during the course of an anesthetic, etc.
- For negligence a medical practitioner can be taken to the Civil Courts, the Criminal Courts, Medical Councils or the Human Rights Commissions.

STANDARD OR DEGREE OF SKILL AND CARE

The degree of skill and care required by a medical practitioner is stated in Halsbury's Laws of England as under:

"The practitioner must bring to his task a reasonable degree of skill and knowledge, and must exercise a reasonable degree of care. Neither the very highest nor a very low degree of care and competence, judged in the light of the particular circumstances of each case, is what the law requires, and a person is not liable in negligence because someone else of greater skill and knowledge would have prescribed different treatment or operated in a different way; nor is he guilty of negligence if he has acted in accordance with a practice accepted as proper by a responsible body of medical men skilled in that particular art, even though a body of adverse opinion also existed among medical men. Deviation from normal practice is not necessarily evidence of negligence. To establish liability on that basis it must be shown that (1) there is a usual and normal practice; (2) that the defendant has not adopted it; and (3) that the course in fact adopted is one no professional man of ordinary skill would have taken had he been acting with ordinary care".

MacNair, J in Bolam versus Friern Hospital Management Committee (1957) 2 All ER 118 (QBD) held:

"Where you get a situation which involves the use of some special skill or competence, then the test as to whether there has been negligence or not is not the test of the man on the top of a Clapham omnibus, because he has not got this special skill. The test is the standard of the ordinary skilled man exercising and professing to have that special skill. A man need not possess the highest expert skill. It is well-established law that it is sufficient if he exercises the ordinary skill of an ordinary competent man exercising that particular art".

In Hucks versus Cole (1968) 118 New LJ 469, Lord Denning stated that a medical practitioner would be liable only where his conduct fell below that of the standards of a reasonably competent practitioner in his field.

Finally, Lord President Clyde in Hunter versus Hanley 1955 SLT 213 observed that the true test for establishing negligence in diagnosis or treatment on the part of a doctor is whether he has been proved to be guilty of such failure as no doctor of ordinary skill would be guilty of, if acting with ordinary care.

CRIMINAL NEGLIGENCE

For fixing criminal liability on a doctor or surgeon, the standard of negligence required to be proved should be as high as can be described as "gross negligence" or "recklessness". It is not merely lack of necessary care, attention, and skill. The decision of the House of Lords in R. versus Adomako [(1993) 4 All ER 935; 15 BMLR 13; CA affirmed by (1994) 3 All ER 79 HL] relied upon on behalf of the doctor elucidates the said legal position and contains following observations:-

"Thus, a doctor cannot be held criminally responsible for patient's death unless his negligence or incompetence showed such disregard for life and safety of his patient as to amount to a crime against the State".

In Suresh Gupta Petitioner versus Govt. of NCT of Delhi and Anr. Respondent [SC] 2004 AIR 4091, the Honorable Supreme Court has held:

Thus, when a patient agrees to go for medical treatment or surgical operation, every careless act of the medical man cannot be termed as 'criminal'. It can be termed as 'criminal' only when the medical man exhibits a gross lack of competence or inaction and want on indifference to his patient's safety and which is found to have arisen from gross ignorance or gross negligence. Where a patient's death results merely from error of judgment or an accident, no criminal liability should be attached to it. Mere inadvertence or some degree of want of adequate care and caution might create civil liability but would not suffice to hold him criminally liable.

This approach of the courts in the matter of fixing criminal liability on the doctors, in the course of medical treatment given by them to their patients, is necessary so that the hazards of medical men in medical profession being exposed to civil liability, may not unreasonably extend to criminal liability and expose them to risk of landing themselves in prison for alleged criminal negligence.

In Jacob Mathew versus State of Punjab and Anr. 2005(3) CPR 70 (SC), the Honorable Supreme Court has held:

In order to hold the existence of criminal rashness or criminal negligence it shall have to be found out that the rashness was of such a degree as to amount to taking a hazard knowing that the hazard was of such a degree that injury was most likely imminent. The element of criminality is introduced by the accused having run the risk of doing such an act with recklessness and indifference to the consequences.

ACCIDENTS, MISADVENTURES, MISHAPS

Courts have held that it would be wrong, and indeed bad law, to say that simply because a misadventure or mishap occurred, the hospital and the healthcare providers are thereby liable. It would be disastrous to the community if it were so [Hatcher vs. Black (1954) Times, 2nd July].

A healthcare provider is not an insurer; he does not warrant that his treatment will succeed or that he will perform a cure [Hunter vs. Hanley (1955) SLT 213]. Naturally, he will not be liable if, a treatment which in ordinary circumstances would be sound, has unforeseen results. The standard of care which the law requires is not insurance against accident slips. It is not every slip or mistake that imports negligence. Law recognizes the dangers, which are inherent in surgical operations. Mistakes will occur on occasions despite the exercise of reasonable skill and care (Nathan, P C and Barrowclough, A R: Medical Negligence (1957).

ERROR OF JUDGMENT

An error of judgment does not of itself amount to negligence [Whitehouse v. Jordan (1981) 1 WLR 246]. Law allows errors of judgment which do not by themselves amount to negligence. The House of Lords in England held that some errors of judgment may be negligent and some may not. The error of judgment committed by a healthcare provider may or may not be indicative of negligence, but the proper test to be applied is whether he abided by the standards laid down by his peers (Bolam's Test).

The courts have held "No human being is infallible and in the present state of science even the most eminent specialist may be at fault in detecting the true nature of the diseased condition. A practitioner can only be liable in this respect, if his diagnosis is so palpably wrong as to prove negligence, that is to say, if his mistake is of such a nature as to imply absence of reasonable skill and care on his part, regard being had to the ordinary level of skill in the practitioner (Mitchel v. Dicksen 1954 APPD 519)".

With regard to junior healthcare provider inexperience is no defense. He must meet the standard of care expected of his rank and status (Anesthesiology and the Law of Medical Negligence Gopinath Shenoy and Gayatri G Shenoy, Ritanjan Publications, 2002).

INHERENT RISKS OF TREATMENT

Every procedure has its own risk factors. Just because one of these factors becomes manifest does not mean that the healthcare provider is negligent and his services defective. He can be held negligent only when the standard of care exhibited by him falls below the standards expected of a reasonable prudent healthcare provider practicing under the circumstances he is placed in [Hatcher vs Black (1954) Times, 2nd July].

CHOICE OF TREATMENT: DISCRETION

Many medical problems can be managed or treated in more than one ways. Healthcare providers have the discretion to choose the line of treatment they wish to adopt and can be faulted for the same only if their choice is palpably wrong and or dangerous to the patient. When there are two genuinely responsible schools of thought about the management of a clinical situation, the courts could do no greater disservice to the community or the advancement of medical science than to place the hallmark of legality upon one form of treatment [(Moore vs Lewisham Group Hospital Management Committee (1959) Times 5, February)]. A healthcare

provider is not liable for taking one choice out of two or for favoring one school rather than another [(Hucks vs Cole and Anr. (1968) 118 NLJ 469)]. He is only liable when he falls below the standard of a reasonably competent practitioner in his field. In the realm of diagnosis and treatment there is ample scope of genuine difference of opinion and a healthcare provider clearly is not negligent merely because his conclusion differs from that of other professional men, nor because he has displayed less skill or knowledge than others would have shown. If a healthcare provider has followed a course of treatment or procedures accepted by and followed by a responsible section of the profession, he would not be guilty of negligence even if another section of the profession does not subscribe to that practice and follow a different course (AS Mittal vs State of UP. AIR 1989SC 1570). A healthcare provider has discretion in choosing the treatment which he proposes to give to the patient and such discretion is wider in cases of emergency, but he must bring to his task a reasonable degree of skill and knowledge and must exercise a reasonable degree of care according to the circumstances of each case (Laxman B Joshi v. Trimbak Bapu Godbole and Anr. 1969 (1) SCR 2060).

GUARANTEE AND WARRANTY

Law does not expect healthcare providers to guarantee the results of their services.

The Honorable Supreme Court in Jacob Mathew Petitioner versus State of Punjab and Anr. Respondent 2005(3) CPR 70 (SC) holds:

"He does not assure his client of the result. A lawyer does not tell his client that the client shall win the case in all circumstances. A physician would not assure the patient of full recovery in every case. A surgeon cannot and does not guarantee that the result of surgery would invariably be beneficial, much less to the extent of 100% for the person operated on. The only assurance which such a professional can give or can be understood to have given by implication is that he is possessed of the requisite skill in that branch of profession which he is practicing and while undertaking the performance of the task entrusted to him he would be exercising his skill with reasonable competence. This is all what the person approaching the professional can expect".

VICARIOUS LIABILITY

Liability which is incurred for, or instead of, another can be defined as vicarious liability. Every person is responsible for his own acts or omissions but there are circumstances where for the acts committed by a person, the liability comes to lie, not on that person, but on someone else. A master is liable for the acts or omissions of his servant and the principal is accountable for the acts of his agent. *The hospital authorities are responsible for the whole of their staff, not only for* the nurses and the doctors but also for the anesthetist and the surgeons. It does not matter whether they are permanent or temporary, resident or visiting, whole-time or part-time. The hospital authority is responsible for all of them. The reason is because even if they are not servants, they are the agents of the hospital to give the treatment. The only exception is the case of consultants and anesthetists selected and employed by the patient himself [Roe vs Minister of Health and Anr. Court of Appeal. (1954) 2 QB 66].

DEFICIENCIES IN STATUTORY REQUIREMENTS

To practice medicine without proper registration with the State Medical Council or the Medical Council of India would violate the provisions of law [Indian Medical Council (Professional conduct, etiquette and ethics) Regulations, 2002]. So also employing staff that is unqualified will violate the provisions of the Indian Medical Council (Professional conduct, Etiquette and Ethics) Regulations, 2002 as formulated by the Medical Council of India. Institutions where medical termination of pregnancy is undertaken must also be registered with the Appropriate Authority under the Medical Termination of Pregnancy Act 1971. Ratios of judge-made laws or precedents are also applicable and binding on the healthcare providers and violation of the same also constitutes and offence that is actionable. Cross-pathy practice, that is, an allopathic practitioner prescribing ayurvedic drugs is bad in law (Poonam Verma vs Ashwin Patel and Ors. Supreme Court Civil Appeal No. 8856 of 1994. Decided on 10th May, 1996). Cross-specialty practice, that is, a surgeon undertaking a hysterectomy is also considered improper. Undertaking a tube ligation without the consent of the spouse is similarly actionable [Prasanth S Dhananka vs Nizam's Institute of Medical Sciences and Ors. 1986-99 CONSUMER 3299 (NS)].

Lord Justice Denning explained the law on the subject of negligence against healthcare providers and hospitals in the following words: "Before I consider the individual facts, I ought to explain to you the law on this matter of negligence against doctors and hospitals. Marvan Evertt sought to liken the case against a hospital to a motor car accident or to an accident in a factory. That is the wrong approach. In the case of accident on the road, there ought not to be any accident if everyone used proper care; and the same applies in a factory; but in a hospital when a person who is ill goes in for treatment, there is always some risk, no matter what care is used. Every surgical operation involves risks. It would be wrong, and indeed bad law, to say that simply because a misadventure or mishap occurred, the hospital and the doctors are thereby liable. It would be disastrous to the community if it were so. It would mean that a doctor examining a patient or a surgeon operating at a table instead of getting on with his work, would be forever looking over shoulder to see if someone was coming up with a dagger; for an action for negligence against a doctor is for him like unto a dagger. His professional reputation is as dear to him as his body, perhaps more so, and an action for negligence can wound his reputation as severely as a dagger can his body. You must not, therefore, find him negligent simply because something happens to go wrong; if, for instance, one of the risks inherent in an operation actually takes place or some complication ensues which lessens or takes away the benefits that were hoped for, or if in a matter of opinion he makes an error of judgment. You should only find him guilty of negligence when he falls short of the standard of a reasonably skilful medical man" [Hatcher v. Black (1954) Times, 2nd July].

Gopinath N Shenoy is an Obstetrician/Gynecologist and a medicolegal consultant and specializes in the defense of doctors in the consumer forums or commissions. He was a Member of the Consumer Court, Mumbai, Govt. of Maharashtra. He is an Honorary Assistant Professor of Obstetrics and Gynecology at the KJ Somaiya Medical College, Mumbai. He was also a Visiting Professor of Law at law colleges in Mumbai. Currently, he is a postgraduate examiner in law (LLM and PhD) Bombay University.

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