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FOGSI FOCUS

SURGICAL SKILLS IN OBSTETRICS AND GYNECOLOGY

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Jaideep Malhotra

Co-Editors
Pratima Mittal
Shalini Rajaram
Rekha Bharti

Foreword
Usha Sharma

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Surgical Skills in Obstetrics and Gynecology

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Dear FOGSIANS,

Greetings and Regards

We are happy to bring to you this third edition of FOGSI Focus—2018, on the occasion of North Zone Yuva FOGSI Conference. This FOGSI Focus on "Surgical Skills in Obstetrics and Gynecology" is specially aimed at empowering budding gynecologists with the elementary knowledge and expertise in surgical procedures required for day-to-day practice.

We would like to extend our thanks and appreciation to all editors and contributors for making this edition an academic feast.

Happy reading!

Jaideep Malhotra

Jaydeep D Tank

Foreword

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It is a privilege for me to write this foreword for FOGSI Focus dedicated to surgical skills. In this era, where technology is growing at a rapid rate and youngsters are more inclined towards learning artificial reproductive technologies and minimal invasive surgery skills, it is a felt need to go back to our basics. I have gone through the list of articles that have been compiled for this issue. They comprise of a unique blend of fundamentals in the field of obstetrics and upcoming advancements.

I would like to congratulate our dynamic President Dr Jaideep Malhotra and Vice President Dr Pratima Mittal for this brilliant initiative. I would also like to thank the authors for their valuable contribution and express my gratitude to the editors for bringing out such a fruitful FOGSI Focus.

With best wishes.

Professor Usha Sharma

Preface

This FOGSI Focus on "Surgical Skills in Obstetrics and Gynecology" is a unique concept in the teaching of surgical skills. This issue aims at providing the young obstetrician and gynecologist with basic concepts of surgery beginning with important articles on "quality and ethics" and "medicolegal issues and consent." No surgical procedure should be undertaken unless absolutely essential and only with proper counseling and consent. In this era of "doctor bashing," it is important to train oneself adequately and be on par with peers and update oneself constantly.

The initial chapters deal with important basic principles for performing a surgery safely; namely, antibiotic use, preoperative and postoperative care, incisions for abdominal entry, hemostasis, adhesion prevention, sutures, fluid management, blood transfusion, and finally thromboprophylaxis, which has assumed importance in recent years. The second half of this issue addresses surgical procedures both basic and advanced some of which one must be proficient in. The chapter on "Laparoscopic-assisted Uterus Retrieval from Live Organ Donors for Uterine Transplant" is an introduction to a highly skilled new surgical technique that all of us need to be aware of and appropriately refer patients who are highly motivated and have an intense desire for fertility. This issue has focused on techniques like "nondescent vaginal hysterectomy,"which is the least invasive of all routes of hysterectomy and also the fastest and safest. Surgical skills in management of obstetric emergencies like postpartum hemorrhage and uterine inversion are of prime importance as a patient can be lost in a few minutes if timely management is not rendered.

In the normal course of a postgraduate training program, it will be impossible for the student to witness and grasp all surgical procedures that are performed in their short tenure. The e-Focus which will also be released at this conference consists of surgical videos that aims to provide young practicing gynecologists with surgical techniques in obstetrics and gynecology which they can view over and over again till the technique is grasped.

Jaideep Malhotra

Pratima Mittal

Shalini Rajaram

Rekha Bharti

Contents

1

SECTION

Basics in Obstetrics and Gynecology Surgery

1

CHAPTER

Ethics in Obstetric and Gynecological Surgeries

Jaideep Malhotra, Monika Gupta

INTRODUCTION

As obstetrician and gynecologist, our biggest ethical challenge is to ensure that our patients receive the best possible care at any time of day or night. In addition to our ethical responsibilities in direct patient care, we have ethical responsibilities related to our involvement in the organization, administration, and evaluation of health care. We exercise these broader responsibilities through membership in professional organizations; consultation with and advice to community leaders, government officials, and members of the judiciary; expert witness testimony; and education of the public.

PRINCIPLE-BASED ETHICS

Physicians vary widely in their familiarity with ethical theories and methods and their sensitivity toward ethical issues. In recent times, principle-based ethics have become the mainstay of medical ethics.

There are four basic principles which offer a systematic and objective way to identify, analyze, and address ethical issues and dilemmas:

1. Respect for patient autonomy: A doctor's appreciation of the integrity of the patient as an individual
2. Beneficence: A doctor's commitment to acting in the best interests of the patient
3. Nonmaleficence: A doctor's obligation to do no harm
4. Justice: A doctor's obligation to see the fair distribution of scarce health resources.

ETHICAL ISSUES IN OBSTERICS AND GYNECOLOGIC SURGERIES

Patient's Interest

Conflicts may arise among the above mentioned various principles and rules. In cases of conflict, physicians have to determine which principle(s) should have priority. The physician then has to decide whether to respect the patient's choices or to refuse to act on the patient's preferences in order to achieve what the physician believes to be a better outcome for the patient. Paternalistic models of physician-patient relationships have been sharply challenged and often supplanted by other models. At the other end of the spectrum, however, the model of following patients' choices, whatever they are, as long as they are informed choices, also has been criticized for reducing the physician to a mere technician. Nevertheless, the physician should ensure that only indicated and justified surgeries are performed.

For instance, recently in some societies, obstetricians have had increasing requests from women to be delivered by cesarean section for personal rather than for medical reasons. The obstetricians also have an ethical duty to society to allocate health care resources wisely to procedures and treatments for which there is clear evidence of a net benefit to health. Physicians are not obligated to perform an intervention for which there is no medical advantage. Physicians have the responsibility to inform and counsel women in this matter. At present, because hard evidence of net benefit does not exist, performing cesarean section for nonmedical reasons is ethically not justified.

Informed Consent

Patients consent to surgery because they trust their surgeons. Yet what should such consent entail in practice and what should surgeons do when patients need help but are unable or unwilling to agree to it? Unfortunately, discussions for the purpose of educating and informing patients about their health care options are never completely free of the informant's bias. Practitioners should seek to uncover their own biases and endeavor to maintain objectivity in the face of those biases, while disclosing to the patient any personal biases that could influence the practitioner's recommendations.

A patient's freedom to accept or refuse recommended medical treatment has legal as well as ethical foundations. For agreement to count as consent to treatment, patients need to be given appropriate and accurate information about:

- Their condition and the reasons why it warrants surgery
- What type of surgery is proposed and how it might correct their condition
- What the proposed surgery entails in practice
- The anticipated prognosis of the proposed surgery
- The expected side-effects of the proposed surgery
- The unexpected hazards of the proposed surgery
- Any alternative and potentially successful treatments for their condition other than the proposed surgery, along with similar information about these
- The consequences of no treatment at all.

The additional duty of surgeons is to respect the autonomy of their patients, their ability to make choices about their treatments and to evaluate potential outcomes in light of other available modalities. Such respect is particularly important for surgeons because without it the trust between them and their patients may be compromised, along with the success of the surgical care provided.

Resources at Hand

Before performing any surgery, physicians should ensure that patients have access to adequate medical resources and preoperative and postoperative care. Surgeon should be well versed with the available resources at the opted place of surgery for any requisite procedure and in case of shortcomings, should not hesitate to postpone or cancel surgery or even refer a patient to a better equipped center for appropriate multidisciplinary care.

The surgical team should ensure that the best interest of the patient is achieved with the current available resources. The health facility providing surgical care should have the necessary infrastructure, manpower and expertise to provide intraoperative and postoperative care and handle both expected and unexpected complications arising out of an operative procedure.

The constraints of low-resource settings and the extreme vulnerability of patients that often exist in such settings is a challenge which is commonly faced by many obstetricians and gynecologists in India. In the provision of ethically appropriate care in resource-poor settings, professionals will encounter many challenging ethical considerations like quantity and quality of medical resources, level of surgical competence and training required for these efforts, assurance of adequate preoperative and postoperative care, protection of human participants in clinical and social research, and sustainability.

Maintaining Standards of Expertise

Surgeons must only offer specialized treatment in which they have been properly trained to optimize the success of operative procedure. Continued education throughout a surgeon's career in the wake of new surgical procedures in practice should be a norm. While training, surgery should be performed under appropriate supervision by someone who has appropriate levels of skill. Ethically, obstetricians and gynecologists must be prepared to provide care at a level at which they are qualified and opt out of procedures in which they do not have adequate experience.

Appropriate clinical audits at regular intervals should be done as an internal check of surgical standards. When these reveal unacceptable levels of success, no further surgical work of that kind should continue unless further training is undergone under the supervision of someone whose success rates are satisfactory. An imbalance between the interests of surgeon compared to that of patient is never morally or professionally appropriate.

Reducing Likelihood of Surgical Errors

Surgical errors may involve the performance of the incorrect operation or a procedure on the wrong site or wrong patient. Although these errors occur much less frequently than medication errors, the consequences of these errors are always significant. The attending surgeon should work with other personnel in operating room such as nurses and anesthesiologists, to ascertain that everything is in place.

Preoperative verification process is important to confirm correct person, correct site, and correct procedure through the elements of a preprocedure verification process, marking the procedure site, before starting the procedure. Universal application of surgical checklists involving preoperative, intraoperative, and postoperative steps should be strongly advocated by operating team and supporting staff to improve the safety of our patients in the operating room.

The World Health Organization's Safe Surgery Saves Lives program, endorsed by the International Federation of Gynecology and Obstetrics, significantly reduces surgical morbidity and mortality in multiple settings. It is a 19-item safe surgery checklist that includes a sign-in procedure before induction of anesthesia, a time-out procedure before skin incision, and a sign-out procedure before the patient leaves the operating room.

Handling Adverse Events

It is the moral obligation of every surgeon to communicate honestly with patients, particularly those who experience an operative adverse outcome. The patient and relatives must be apprised of the events whether expected or unexpected which led to complications intraoperatively. Open communication and transparency in health care will increase trust, improve patient satisfaction, and may decrease liability exposure.

Postoperative Care

One must understand that bringing the patient under knife is not the end of patient-surgeon encounter. Ethically, it is

imperative for the operating surgeon to provide standard postoperative care as per protocol with detailing the patient about requisite follow up and possibility of treatment modification depending upon the histopathology outcomes.

CONCLUSION

The quest for ethical aspects involved in patient safety is an ongoing, continuously refined process which requires incorporation of information sharing and collaboration into daily practice. Emphasizing compassion and patient-focused care will aid in creating a culture of excellence. Communication is a core element of the physician-patient relationship and is essential for the delivery of high quality, safe patient care.

Surgical complications are a considerable cause of death and disability around the world. They are devastating to patients, costly to health care systems, and often preventable, though their prevention typically requires a change in systems and individual behavior. Women's health care should be delivered in a learning environment that encourages disclosure and exchange of information in the event of errors, near misses, and adverse outcomes.

The final duty of an obstetrician and gynecologist is to provide surgical care, exercising all specific responsibilities with fairness and justice, and without prejudice. The conduct of ethical surgery illustrates good citizenship: protecting the vulnerable and respecting human dignity and equality.

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2

CHAPTER

Consent in Medical Context

Geetendra Sharma

INTRODUCTION

According to the Indian Contract Act—1872, two or more persons are said to consent, when they agree upon the same thing in same sense, i.e., "parties ad idem." It is not merely taking signatures of the patient on paper before subjecting her to any procedure, it consists of making sufficient disclosure of the pros and cons of the procedure to the woman and empowering her to take a conscious decision to undergo the procedure.

To understand consent, one must know what is meant by agreement and contract. Agreement is when two or more parties agree to the same thing. Contract is an agreement enforceable by law. All contracts are agreement but all agreements are not contract. Valid contract is a contract enforceable by law by either party.

HOW AGREEMENT CAN BECOME A VALID CONTRACT?

It should be free consent, between competent parties with lawful consideration and lawful object, and declared to be void.

Free Consent

Free consent is referred to consent which is not caused by coercion, undue influence, fraud, misrepresentation, and mistake of fact and of law.

Competent Parties

Both parties must be major, mentally sound, and not under the effect of any intoxicating substance or anesthesia. Minor contracts are void *ab initio* and a legal guardian should sign for minor and mentally retarded or insane.

Lawful Consideration and Lawful Object

There should be lawful consideration and lawful object, e.g., contract for euthanasia is illegal as it is legally not allowed in India and contract to divide the profit of prostitution business is void *ab initio* as prostitution is illegal by law.

CONSENT IN MEDICAL CONTEXT

Consent in medical context was discussed in appeal (civil) 1949 of 2004, in case of Samira Kohli versus Dr Prabha Manchanda, date of judgment was 16/01/2008, bench of judges comprised of BN Agrawal, PP Naolekar, and RV Raveendran, and the judgment was delivered by Raveendran.

The facts of the case were, on 9/5/95, an unmarried lady aged 44 years, reported with complaint of bleeding per vaginum for 9 days. Ultrasound showed fibroid uterus, right ovarian chocolate cyst, and small cysts on left side (endometriosis). She was advised diagnostic laparoscopy under general anesthesia for affirmative diagnosis. Consent for admission and treatment and surgery was taken. Consent form was filled by Dr Lata Rangan, assistant to the respondent. Consent for surgery (diagnostic and operative laparoscopy) said it is a minor surgery with the mention that laparotomy may be needed but there was no mention about hysterectomy or for any alternative treatment. While patient was under anesthesia on 10/5/95, she had abdominal hysterectomy and bilateral salpingo-oophorectomy. An assistant took consent for hysterectomy from old mother waiting outside operation theater. Appellant left the hospital 5 days later without settling the bill.

Doctor lodged complaint on 23/5/95 against patient's boyfriend for abuse and threatening her and also for recovery of unsettled bill of ₹39,325. Patient lodged complaint of negligence and unauthorized removal of reproductive organ which was filed on 31/5/95. On 19/1/96, she filed complaint before the National Commission claiming compensation of ₹25 lacs.

The allegations were negligence in treating; hysterectomy and salpingo-oophorectomy done without patient's consent when she was under anesthesia for a laparoscopic test was unlawful, unauthorized, and unwarranted; no preoperative information about alternative modalities; and suffering due to premature menopause necessitating prolonged hormone replacement therapy and having problem of its side effects.

Claim for loss of reproductive organs, loss of opportunity to become a mother, diminished matrimonial prospects, irreversible permanent damage, emotional stress and trauma, decline in health, and vulnerability to health hazards was filed.

National Commission held that the appellant voluntarily visited the clinic for treatment and consented for diagnostic and operative procedure. The hysterectomy and other surgical procedure were done with adequate care and caution. Surgery was necessitated as appellant was suffering from endometriosis grade-IV with likelihood to damage other organs. Expert opinion of Dr Sudha Salhan was taken and the complaint was dismissed.

Aggrieved by the decision of National Consumer Dispute Redressal Forum (NCDRF), the patient filed appeal in Supreme Court (SC) in 2004.

Principles Relating to Consent

In this case, SC discussed the principles relating to consent in details. This is a benchmark or landmark case in which consent is defined in detail. Seven questions are answered in this case in relation to consent in medical context.

Question 1: Whether informed consent of a patient is necessary for surgical procedure involving removal of reproductive organs?
Answer: A doctor has to seek and secure the consent of the patient before commencing a treatment (the term treatment includes surgery also).

Question 2: What is the nature of such consent?
Answer: Consent should be real and valid; free consent; capacity and competency to consent; lawful object and consideration; adequate information.

Question 3: What is the meaning of adequate information?
Answer: Adequate information includes nature and procedure of treatment, purpose of the treatment, benefits and effects of the treatment, alternatives if any available, an outline of substantial risks, and adverse consequences of refusing treatment.

There is no need to explain remote or theoretical risks involved, which may frighten or confuse the patient and result in refusal of consent for necessary treatment. Similarly, there is no need to explain remote or theoretical risks of refusal to take treatment which may persuade a patient to undergo a fanciful or unnecessary treatment which is not needed at all. A balance should be achieved and information should be of that extent which is accepted as normal and proper by a body of medical men skilled and experienced in the particular field.

That is why there is need to develop the common consents for routine operations by national organizations.

Question 4: Can the consent for diagnostic surgery be construed as consent for performing additional or further surgical procedure—either as a conservative or as a radical Rx—without the specific consent for such additional or further surgery?
Answer: No, one cannot do additional therapeutic procedure.

Question 5: Can there be a common consent for diagnostic and operative procedures where they are contemplated?
Answer: Yes.

Question 6: Can there be a common consent for a particular surgical procedure and an additional or further procedure that may become necessary during the course of surgery?
Answer: Yes.

Question 7: Can consent be taken by assistant doctor?
Answer: Yes.

Supreme Court Held

The doctor cannot be held negligent in taking decision of total abdominal hysterectomy (TAH) on table. Thanks to the expert witness by Dr Sudha Salhan and textbook references, but the doctor is still liable for assault and battery for doing TAH without consent. In this case, consent was for diagnostic laparoscopy and "laparotomy may be needed" implied conservative surgery and not TAH. So compensation awarded only for lack of consent was ₹25,000 + waiver of bill if unpaid + ₹5,000 cost. This case has been referred to and cited several times subsequently.

Mrs Zeba Hamid versus Hajela Hospital and Ors

Jst Kulshreshta/Mrs Pramila S Kumar on 31st October 2008:

- Primary infertility for diagnostic laparoscopy + hysteroscopy
- Did ovarian drilling and salpingectomy without consent
- Compensation awarded for lack of consent ₹25,000 + ₹2,000.

Ram Gopal Varshney versus Lasor Sight India Pvt. Ltd.

Consumer Disputes Redressal Commission (Jst KS Gupta/ Dr Shenoy) 29th September 2008:

- Cataract surgery on a 76 year old patient—consent of grandson only
- Case of loss of vision was well defended and no negligence found
- ₹25,000 + ₹10,000 cost awarded because patients consent was not taken.

Mrs Chandoke versus Sir Ganga Ram Hospital

- Dysfunctional uterine bleeding with previous two lower segment cesarean section for TAH
- On table decided to do vaginal hysterectomy
- Laparotomy needed because of bleeding from ovarian stump
- Needed nephrectomy.

Judgment

- Bleeding is no negligence
- Deviation from route not acceptable unless life-saving
- ₹5 lacs—compensation granted.

C Jayapal Reddy versus GS Rao, MD, Yashodha Group of Hospitals on 20 September, 2013—National Consumer Disputes Redressal

Para 16: We feel necessary to discuss about what is the valid consent?

Consent is not a one-off event of signatures on paper and not a submission of the patient to a particular treatment but rather a process of communication. It is then perceived as a proactive process empowering the patient to consciously decide on what he/she considers best. Thus, consent is a process of communication requiring the fulfilment of certain established elements like competence, sufficient disclosure, understanding, and volunteering.

Schloendorff versus Society of New York Hospital, 211 N.Y. 125, 105 N.E. 92 (1914)

The doctrine of informed consent finds its common law roots in the landmark decision of Justice Cardozo in Schloendorff versus Society of New York Hospital, 211 N.Y. 125, 105 N.E. 92 (1914), in which he wrote:

> *"Every human being of adult years and sound mind has a right to determine what shall be done with his own body and a surgeon who performs an operation without his patients consent commits an assault for which he is liable in damages. This is true except in cases of emergency where the patient is unconscious and where it is necessary to operate before consent can be obtained."*

CONCLUSION

We all must understand the value of consent and should abide by the guidelines given by the Supreme Court. Now these are the days of procedure specific consents. Separate consent for anesthesia is to be taken. Consent should be signed by doctor, patient, and at least two witnesses. Every human being of adult years and sound mind has a right to determine what shall be done with his own body and a surgeon who performs an operation without his patients consent commits an assault for which he is liable in damages. This is true except in cases of emergency where the patient is unconscious and where it is necessary to operate before consent can be obtained.

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3

CHAPTER

Preoperative and Postoperative Care

Bindiya Gupta, Rashmi Shriya

INTRODUCTION

Optimizing surgical outcome is a surgeon's priority and careful patient selection, systematic preoperative preparation, work-up, and good postoperative care is the key to a good outcome, along with good surgical skills and technique. The various components of preoperative care and evaluation and postoperative care for gynecological surgery are discussed in this chapter.

PREOPERATIVE CARE

Consent

A written informed consent is the most important component before planning any surgical procedure. The woman should have a clear understanding of the surgical procedure, its associated risks and must be competent to make treatment decisions on her own behalf. The consent should be voluntary and informed and should include patient particulars, name of the procedure and brief details of the procedure like incisions, extent of surgery, expected outcome, impact on fertility, any necessary concomitant extra procedures, use of prophylactic antibiotics and thromboembolic prophylaxis.

Preoperative Evaluation and Planning

The goals of preoperative evaluation are to reduce surgical morbidity, minimize expensive delays and cancellations, evaluate and optimize patient's health status and fitness for surgery, detect anticipated complications and prepare to tackle them, facilitate the planning of anesthesia and perioperative care, and reduce patient anxiety. The components of preoperative evaluation include complete history and thorough physical examination, laboratory testing and imaging procedures as well as consultations to promote optimal outcomes.

Anesthesia Evaluation and Preoperative Investigations

The anesthetic risk assessment of patient's preoperative physical status for all surgeries is established by the American Society of Anesthesiologists. It is a subjective assessment of patient's overall health and is divided into six classes depending on the patient physical condition, associated co-morbidities and systemic illness.

The purpose of laboratory tests is to detect a medical disease or defect that could adversely affect anesthetic and surgical outcome. Focal and selective preoperative testing is more useful than routine universal tests and some examples are given in table 1.

TABLE 1: Preoperative investigations in special cases

Preoperative test	*Medical condition*
ECG, X-ray chest, Echo, electrolytes, renal profile	Cardiac disease, hypertension, COPD, congestive cardiac failure, stroke, seizures
X-ray chest, ECG	Males >45 years, females >55 years
Blood glucose, HbA1c, glucose tolerance tests, renal profile	Cushing's and Addison's disease, marked obesity, steroid therapy
Glucose, renal profile, urine ketones	Diabetes, family history of diabetes
Coagulation profile, liver function tests	Hepatic disease, family history of coagulopathies, anticoagulant therapy, renal dysfunction
Calcium levels, thyroid function tests, serum parathormone, ECG	Hyperthyroid, parathyroid disease

ECG, electrocardiogram; Echo, echocardiography; HbA1c, glycosylated hemoglobin; COPD, chronic obstructive pulmonary disease.

In asymptomatic healthy women, hemoglobin or hematocrit must be measured in all patients over the age of 6 months; an electrocardiograph on all women over the age of 40 years; and a blood urea nitrogen test and a glucose test in all women over the age of 65 years. In the authors' hospital, a minimal investigative work-up is carried out, which includes blood glucose and kidney function tests, apart from hemoglobin, blood grouping and cross-matching, and electrocardiograph, X-ray chest. We also screen all women undergoing surgery for human immunodeficiency virus, hepatitis B, and hepatitis C.

Medical Management

Another important aspect is the regulation of medications taken by the patients prior to the surgery. For example, insulin dose may need modification in a diabetic woman, there may be a need for continuation/discontinuation of oral contraceptive pills. Warfarin should be stopped 5–6 days prior to surgery and unfractionated heparin should be started and ensure that international normalized ratio is <1.5. Estrogen containing oral contraceptive pills or hormone therapy should be discontinued 4 weeks prior to surgery.

Antibiotic Prophylaxis

Postoperative infections remain a major source of morbidity and risk factors for infection include older age, diabetes, obesity, past history of surgical infection, presence of malignancy, prior radiotherapy, peripheral vascular disease, coagulation disorder, anemia, poor nutritional state, long duration of surgery, and presence of indwelling catheters.

The antibiotics should be given either shortly before or at the time of bacterial inoculation (e.g., when the incision is made, viscus entered, or pedicles clamped); i.e., at least 15–60 minutes before skin incision ideally at the time of induction of anesthesia. A delay of only 3–4 hours can result in ineffective prophylaxis. For lengthy procedures (>3 h) and for procedures with increased blood loss (>1,500 mL), a second intraoperative dose of antibiotic should be repeated at intervals of one or two times the half-life of the drug (3–4 h after first dose) to maintain adequate levels throughout surgery.

First or second generation cephalosporin's (single dose of cefazolin 1 or 2 g single dose intravenously) have emerged as the drugs of choice for the vast majority of operative procedures because of their broad antimicrobial spectrum and low incidence of allergy and side effects. Alternatively, clindamycin or vancomycin plus an aminoglycoside (or aztreonam, or a fluoroquinolone) can be used.

Adjunctive Techniques to Prevent Postoperative Infections

Preoperative shaving of pubic and abdominal hair prior to gynecological surgery is not recommended; hair clipping is recommended at the time of surgery. Surgical site antisepsis with povidone iodine (PVP-I) is a crucial step to prevent postoperative surgical site infections. It is a nonirritant and has less reported sensitivity reactions. Four percent solution of chlorhexidine gluconate is a safe and effective alternative in case of PVP-I allergy. A shower with antiseptic soap in the evening before surgery remains a helpful adjunct to infection prevention.

Thromboembolism Prophylaxis

Low risk patients do not require specific prophylaxis other than early ambulation, while moderate and high risk gynecologic surgery candidates should be offered thromboprophylaxis. The recommendations are summarized in a later chapter of the book. Evidence suggests that unfractionated heparin and low molecular weight heparin are equally effective in preventing venous thrombosis.

World Health Organization Safety Checklist

It is mandatory to do the WHO safety checklist before all major gynecological surgeries. It is summarized in figure 1.

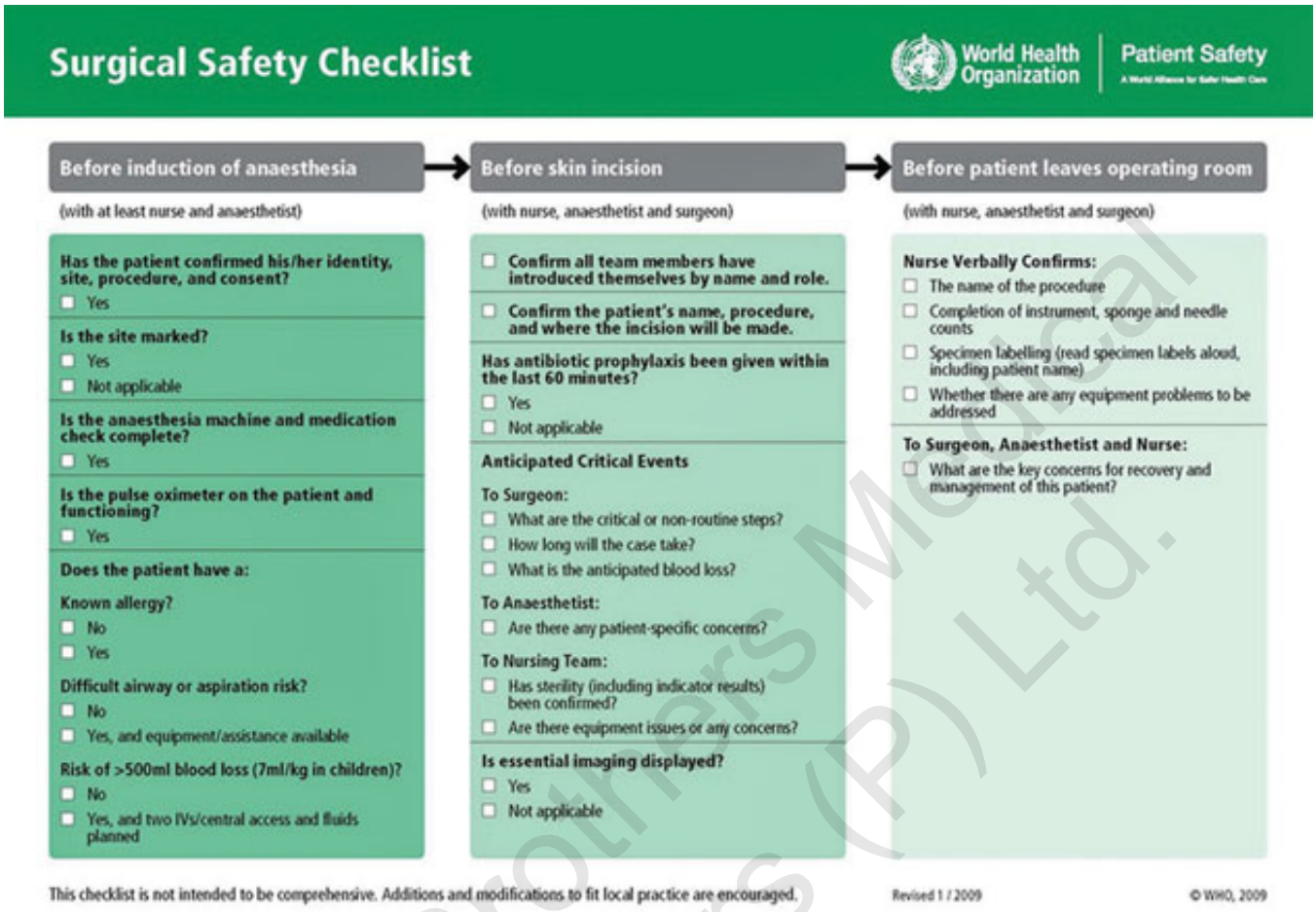
POSTOPERATIVE CARE

The postoperative period begin from the time patient leaves the operating room till he/she gets discharged and come for follow up. The care of the gynecologic surgical patient requires an accurate understanding of the pathophysiologic changes that occur perioperatively. During this period, the body attempts to maintain systemic homeostasis despite multiple iatrogenically induced alterations. Given the proper environment and appropriate interventions, the body eventually should correct for these derangements.

Postoperative complications are the most important factor in defining outcome of the first 72 hours following patient's surgical procedure. It is critical to monitor basic physiological parametric such as renal, cardiovascular and respiratory functions, and laboratory tests to optimize and sustain recovery from surgery and anesthesia.

In immediate postoperative period, vitals monitoring is important which includes monitoring patient's temperature, blood pressure, pulse rate, saturation monitoring, and input and output charting. Adequate administration of intravenous fluids, blood and blood products, and replacement of fluids is needed. In postoperative period special care should be taken to relieve pain and anxiety, adequate analgesia given along with psychological support.

Postoperative morbidity can be minimized by an appropriate preoperative assessment of the surgical patient. This should include emphasis on identifying the patient at risk for venous thromboembolic complications and administering prophylactic anticoagulation as discussed above. Optimized nutritional status and support has also been shown to improve wound healing and decrease the postoperative recovery time. The goal of postoperative care



Surgical Safety Checklist

World Health Organization | Patient Safety

Before induction of anaesthesia (with at least nurse and anaesthetist)

Has the patient confirmed his/her identity, site, procedure, and consent?
- ☐ Yes

Is the site marked?
- ☐ Yes
- ☐ Not applicable

Is the anaesthesia machine and medication check complete?
- ☐ Yes

Is the pulse oximeter on the patient and functioning?
- ☐ Yes

Does the patient have a:

Known allergy?
- ☐ No
- ☐ Yes

Difficult airway or aspiration risk?
- ☐ No
- ☐ Yes, and equipment/assistance available

Risk of >500ml blood loss (7ml/kg in children)?
- ☐ No
- ☐ Yes, and two IVs/central access and fluids planned

Before skin incision (with nurse, anaesthetist and surgeon)
- ☐ Confirm all team members have introduced themselves by name and role.
- ☐ Confirm the patient's name, procedure, and where the incision will be made.

Has antibiotic prophylaxis been given within the last 60 minutes?
- ☐ Yes
- ☐ Not applicable

Anticipated Critical Events

To Surgeon:
- ☐ What are the critical or non-routine steps?
- ☐ How long will the case take?
- ☐ What is the anticipated blood loss?

To Anaesthetist:
- ☐ Are there any patient-specific concerns?

To Nursing Team:
- ☐ Has sterility (including indicator results) been confirmed?
- ☐ Are there equipment issues or any concerns?

Is essential imaging displayed?
- ☐ Yes
- ☐ Not applicable

Before patient leaves operating room (with nurse, anaesthetist and surgeon)

Nurse Verbally Confirms:
- ☐ The name of the procedure
- ☐ Completion of instrument, sponge and needle counts
- ☐ Specimen labelling (read specimen labels aloud, including patient name)
- ☐ Whether there are any equipment problems to be addressed

To Surgeon, Anaesthetist and Nurse:
- ☐ What are the key concerns for recovery and management of this patient?

This checklist is not intended to be comprehensive. Additions and modifications to fit local practice are encouraged.

Revised 1 / 2009

© WHO, 2009

Figure 1: World Health Organization safety checklist.

is to restore to normal physiologic and psychological health and early recognition and treatment of complications.

Immediate Postoperative Care

As soon as the patient is shifted to recovery area from the operation theatre.

Follow the ABC of postoperative care:
- Airway
- Breathing
- Circulation.

Respiratory status:
- Oxygen saturation
- Effort of breathing/use of accessory muscles
- Respiratory rate
- Symmetry of respiration/expansion
- Breath sounds
- Percussion note.

Breathing:
- Note rate and depth of respiration
- Is there any sign of hypoxia?

Circulatory volume status assessment:
- Hands—warm/cool
- PR/rhythm
- Blood pressure
- Conjunctival pallor
- Jugular venous pressure
- Urine color and output
- Drainage from drain sites, wounds
- Any hemoperitoneum or vaginal bleeding.

Documentation of clinical assessment:
- Temperature
- Pulse rate
- Blood pressure
- Respiratory rate
- Pain assessment
- Urine output
- Peripheral oxygen saturation
- Vitals should be monitored:
  - Every 15 minutes for first hour
  - Every 30 minutes for next 2–3 hours
  - Every hourly for next 24 hours.

When Shifted to Ward

Patient is shifted toward after ensuring the vitals are stable, maintaining input and output (25 mL/h), her pain controlled, and have necessary analgesics and fluids been prescribed. Before shifting ensure that postoperative notes are properly written as shown in box 1.

BOX 1 Postoperative orders

- Postoperative diagnosis and operation performed
- Vital signs and input output charting
- Intravenous fluids
- Analgesics
- Antibiotics
- Instructions for Foley's catheter
- Diet NPO ~6–24 h then liquid diet—soft diet—regular diet
- Record intake/output of urine (25–30 mL/h)
- Wound dressing (on postoperative day 3)
- Drain care
- Early ambulation as soon as tolerated
- Frequent deep breathing

NPO, nil per oral.

TABLE 2: Antimicrobial prophylaxis regimens with procedure

Procedure	*Antibiotic*	*Dose (single dose)*
Hysterectomy	Cefazolin	1 g or 2 g IV
Urogynecology procedures, including those involving mesh	Clindamycin plus Gentamicin or Quinolone or Aztreonam	600 mg IV 1.5 mg/kg IV 400 mg IV 1 g IV
	Metronidazole plus Gentamicin or Quinolone	500 mg IV 1.5 mg/kg IV 400 mg IV
Laparoscopy • Diagnostic • Operative • Tubal sterilization	None	–
Hysteroscopy • Diagnostic • Operative • Endometrial ablation • Essure	None	–

Antibiotic Prophylaxis

As discussed above in preoperative care administered within 2 hours before incision so as to be present in good concentration in tissues at time of incision. Post operative infections should be treated with agents other than used for prophylaxis. The same antibiotic is continued in the post-operative period (injectable for 48 h and then switched to oral (usually cefixime 200 mg twice a day). In cases of infection/abscess triple injectable antibiotics (gram positive and gram negative coverage and anaerobes) should be started and given for prolonged time. The various antibiotic regimens used in gynecologic surgery are shown in table 2.

Analgesia

Adequate analgesia to be given in postoperative period either in form epidural if not then morphine boluses (plus an anti-emetic) (intravenous bolus of morphine 2.5 mg, rest intramuscular; maximum dose 7.5 mg) or intermittent doses via a patient controlled analgesia system. Once pain subsided, change to an oral form, with a step-down approach use codeine phosphate, paracetamol, or an nonsteroidal anti-inflammatory drug initially, later paracetamol can be continued.

Postoperative Nausea and Vomiting

Postoperative nausea and vomiting (PONV) is very common and troubling for patients undergoing gynecologic surgery. Vomiting occurs in 12–30% and nausea in 22–80% potentially leading to prolonged hospitalization and distress. Several risk factors have been identified for PONV including age <50 years, gynecologic surgery, laparoscopic surgery, female gender, history of PONV or motion sickness, non smoking, use of volatile anesthetics, long duration of anesthesia, postoperative opioid use, obesity, and use of nitrous oxide. To prevent this prophylactic antiemetics are administered to patients with moderate or high risk of developing PONV. Metoclopramide 25–50 mg intravenously for prophylaxis, and rescue therapy every 6–8 hours is given. Ondansetron 4–8 mg intravenously can be repeated 6 hours after surgery.

Fluid Management

Postoperative fluid management is dependent on current deficits, maintenance requirements, and abnormal losses. The status of the patient's current conditions should be determined first. The patient's fluid status or deficits can be determined by preoperative vomiting, bowel distention, oral intake, intraoperative hemorrhage, extravascular fluid accumulation (third space), and previous fluid replacement.

A physical examination, vital signs, recent weight change, and a record of fluid balance also can help determine the status of the intravascular volume and total body water. If uncertainty exists regarding the patient's actual fluid status, invasive monitoring can be used to measure central venous pressure (CVP) or preload.

The daily maintenance requirement for water in the healthy individual with normal renal function is approximately 1–1.5 L. In the surgical patient with a higher insensible loss and less than optimal renal concentrating ability, a daily maintenance requirement from 35 to 40 mL/kg/day is necessary. Electrolyte replacement after uncomplicated surgery rarely requires more than sodium chloride and potassium supplementation, both at 1 mEq/kg/day. This requirement is met easily by administering 0.25% normal saline with 20 mEq KCl/L at the volume predicted above for daily fluid needs.

In consideration of the volume, electrolytes, and glucose requirements 0.25% normal saline with 20 mEq KCl/L at 100–

TABLE 3: Complications in postoperative period

Immediate	*Early*	*Late*
• Primary hemorrhage • Reactive hemorrhage • Basal atelectasis • Shock • Low urine output	• Dehydration, sepsis • Nausea and vomiting • Analgesia or anesthesia related • Pyrexia • Secondary hemorrhage • Pneumonia • Wound/anastomosis dehiscence • Deep vein thrombosis • Acute urinary retention • Urinary tract infection • Postoperative wound infection • Bowel obstruction	• Bowel obstruction • Incisional hernia • Recurrence of disease in case of malignancy

125 mL/h can be given. Other intravenous fluids are Ringer's lactate and 5% dextrose. Additional fluid requirements for low blood pressure, inadequate urine output, or decreased CVP/left ventricular filling volume can be supplemented with isotonic sodium chloride solution. Urine output should be charted and urine flow of <30 mL/h should demand clinical attention.

Nutritional Support

A low-residue diet 6 hours after major gynecologic surgery for benign indications can be started. Healthy recovery from surgery may include transient loss of appetite and mild nausea. This is usually secondary to anesthetic agents and other perioperative medications. Symptoms can be treated easily with antiemetics, such as promethazine at 25 mg intramuscularly every 4 hours, as needed. H2 blockers like ranitidine or proton pump inhibitors like pantoprazole should be given. After a major transperitoneal procedure, a dynamic ileus may be responsible for continued nausea, abdominal distention, and absence of flatus. The return of small bowel function occurs within 6 hours of surgery and is highlighted by the return of bowel sounds. In cases of bowel injury or resection, surgical principles are different.

Gastric emptying and pyloric sphincter function require 2–3 days and coincide with decreased nausea and decreased nasogastric tube output. Finally, the return of colonic peristalsis that occurs in 3–5 days is signaled by the passage of flatus.

COMMON POSTOPERATIVE PROBLEMS

The common postoperative complications are summarized in table 3.

CONCLUSION

Adequate preoperative care and evidence based guidelines for postoperative care and antimicrobial prophylaxis is important for a successful outcome. Proper care when given in preoperative and postoperative period enables a successful and faster recovery reduces postoperative mortality rate, reduces length of stay of patient.

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4

CHAPTER

Adhesion Prevention in Gynecological Surgery

Abha Sharma

INTRODUCTION

Adhesion formation in abdominal and pelvic surgery is a significant complication (70-90%). It is more important in gynecological surgeries because of the risk of infertility, chronic pelvic pain, bowel obstruction and difficulty in subsequent surgeries. Another aspect of this complication is the future mental, physical, and financial cost to the patient if readmission is required. Therefore, all surgeons must inform their patients regarding risk of adhesion related complications.

Operations for endometriosis, adhesiolysis, myomectomy, and adnexal surgeries are more likely to be associated with adhesion formation and as most of these patients are also subfertile, use of adhesion prevention strategies are likely to improve outcomes.

Meticulous surgical technique, minimally invasive surgery, and microsurgery reduce the risk of adhesion formation but do not completely eliminate it. Several anti-adhesive agents have been developed like pharmacological agents (steroids/heparin, etc.), nonpharmacological agents like barrier films, gels etc., but each has its limitation. The search for a successful anti adhesive agent is still on.

SURGICAL TECHNIQUES TO MINIMIZE ADHESION FORMATION

Careful surgical technique is a means of preventing adhesions. Following factors need to be kept in mind and a surgeon should make it a habit to employ these as a matter of routine during surgery:

- The risk of adhesions increases with each abdominal and pelvic surgery performed on one patient; therefore, every surgery needs to be carefully planned in this context specially endometriosis
- The surgery should be attempted using the least invasive approach possible in order to decrease the risk of adhesion formation. When feasible, for example, a vaginal or laparoscopic surgical approach is preferable to an abdominal approach. Laparoscopic surgery does not guarantee the prevention of adhesions because longer operative times, high insufflation pressure and desiccation of tissues due to exposure to light can still promote adhesion formation
- Tissue trauma should be minimized. Carefully handle tissue with limiting packing, crushing, and manipulating tissues
- Perform diligent hemostasis and ensure adequate use of cautery or harmonic
- Avoid ischemia as the resultant hypoxia leads to formation of myofibroblasts which are highly adhesive
- Reduce cautery time and frequency keeping in mind lateral thermal damage. Excise tissue rather than coagulate to reduce fulguration, e.g., in endometriosis
- Reduce duration of surgery
- Reduce pressure and duration of pneumoperitoneum in laparoscopic surgery
- Reduce risk of infection. Antibiotic prophylaxis wherever required
- Reduce drying of tissues.
- Use frequent irrigation and aspiration in laparoscopic and open surgery
- Limit use of sutures and choose fine non reactive sutures
- Avoid contaminants like fecal matter or foreign bodies when possible
- Avoid non peritonised implants and meshes
- Always use wet towels or sponges in laparotomy
- Use starch, powder, and latex-free gloves in laparotomy
- To prevent uterine adhesions avoid mechanical uterine curettage. Medical management of spontaneous or induced abortion may be recommended rather than surgical management. In case of uterine curettage, aspiration technique should be utilized

- Reduce the use of electrosurgical energy in hysteroscopic surgery (rather use "cold" mechanical instruments).

Despite employing above measures, some surgeries are more prone for adhesion formation like endometriosis, pelvic inflammatory disease, and myomectomy; therefore, surgeons could consider using another method like pharmacological agents or adhesion barriers.

PHARMACOLOGICAL AGENTS

Several pharmacological agents have been used to promote full healing without adhesion formation. Steroids and heparin have been used extensively in fertility conserving pelvic surgery. However, meta–analysis failed to demonstrate reduction in adhesion formation. Furthermore, the use of steroids may impair the healing process and suppress the hypothalamic pituitary axis.

Antihistamines, heparin, and nonsteroidal anti–inflammatory agents have not been found to be effective in adhesion prevention.

NONPHARMACOLOGICAL AGENTS

The basis of these agents is to separate the injured tissue from the surrounding organs and the abdominal wall throughout the time of peritoneal healing, i.e., the critical time for adhesion formation. These could either be in form of mechanical barrier agents to protect a particular incision line like myomectomy scar and around ovary, or fluid agents left in abdominal cavity if a large area needs to be protected.

Mechanical Barriers

- **Interceed:** Interceed is an oxidised regenerated cellulose membrane placed over a suture or a deperitonealized area. It needs to be moistened before placement and is absorbed within 4 weeks. It has been shown to be effective in various studies, and significantly reduces adhesion formation even in severe endometriosis. It is necessary to achieve meticulous haemostasis before placement, because otherwise it can increase adhesion formation
- **Seprafilm:** It is a hyaluronate-carboxymethyl cellulose membrane, which is placed over a suture or an injured area without stitches and remains in place for 7 days. It can be used in presence of blood in contrast to interceed. Seprafilm is fragile and therefore difficult to handle particularly in laparoscopy
- **Gore-Tex:** It is expanded tetrafluroethylene membrane which requires suturing at specific site. Long-term safety remains a concern as it is nonabsorbable though gets integrated with tissues
- **Gel barriers SprayShield/SprayGel and Intercoat:** They are gel barriers sprayed over the damaged area incision line. However, further research is needed to evaluate the efficacy of these mechanical barriers during the healing process. Hyalobarrier gel and CoSeal are also similar compounds being developed as gel barriers.

Several other products like gelatin sheet and fibrin sheets are also being investigated.

Broad-coverage Fluid Agents

- Previously crystalloids like normal saline or lactated Ringer's solution were used frequently but these are rapidly resorbed by the peritoneum and therefore are not suitable for adhesion prevention
- Adept (Icodextrin 4% solution) is a glucose polymer and is responsible for the longer absorption time of up to 4 days. At the end of a procedure, 1,000 mL of solution is instilled into the abdominal cavity; it separates the injured tissue by hydroflotation. An adverse effect of Adept is the labial or vulval swelling which mostly resolves after a short period. Adept is contraindicated in patients with allergy to cornstarch-based polymers, maltose or isomaltose intolerance, or with glycogen storage disease.

Adhesion barriers have been available since the 1980s, but uptake among surgeons remains low and there is no clear evidence that they reduce clinically significant outcomes such as chronic pain or infertility. The latest Cochrane database review also found no evidence on the effects of barrier agents used during pelvic surgery on either pain or fertility outcomes in women of reproductive age. It concluded that low quality evidence suggests that oxidized regenerated cellulose (Interceed) and sodium hyaluronate with carboxymethylcellulose (Seprafilm) may all be more effective than no treatment in reducing the incidence of adhesion formation following pelvic surgery but there was no conclusive evidence on the relative effectiveness of these interventions. They also commented that a substantial proportion of research in this field has been funded by private companies that manufacture these agents, and further high powered, independent trials will be needed before definitive conclusions can be made.

CONCLUSION

The reduction of postoperative adhesions may be associated with clinically significant benefits such as improved fertility, reduction in pelvic pain, and improved quality of life. Meticulous surgical technique with adequate hemostasis remains the cornerstones of adhesion prevention. In specific cases like myomectomy or tubal surgery, adhesion barriers may be used. Post-extensive adhesiolysis fluid agents may be used for adhesion prevention. Molecular basis of adhesion formation is an area of potential research and search for effective mechanical barriers and pharmacological agents continues.

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5

CHAPTER

Antibiotics in Obstetrics and Gynecology

Jaya Chaturvedi, Amrita Gaurav

INTRODUCTION

Infections caused by microorganisms have threatened human health since ancient times. In the pre-antibiotic era, these microbial infections were a major concern leading to high morbidity and mortality in humans. Virulent organisms had the potential to spread infection at a very rapid rate leading to worldwide outbreaks, epidemics, and pandemics. With the discovery of the first antibiotic, "the wonder drug" penicillin in the year 1943, patients could be cured efficiently of many life-threatening infections. This gave a huge relief to the medical fraternity. The next three decades were rich in discovery of various new antibiotics. However, subsequently new discoveries declined and eventually a discovery void post antibiotic era began to commence. It began from 1987 and continues till now.

ANTIMICROBIAL RESISTANCE

This is the post-antibiotic era in which the medical practitioners have to treat and manage all types of infections with equal or greater efficiency. Unscrupulous use of antibiotics led to the natural development of antimicrobial resistance in the microorganisms. The frequent and inappropriate use of all newly discovered antimicrobial drugs led to the development of altered mechanisms in the pathophysiology of the concerned microbes as a survival technique. Such antibiotic selection pressure kills the susceptible microbes and helps in selective replication of drug resistant bacteria. These resistant bacteria already existed in the population along with the susceptible ones or susceptible bacteria acquired resistance during antimicrobial treatment. Eventually, such resistant bacteria multiplies abundantly and entirely replaced the susceptible bacterial population. This leads to treatment failure or ineffective management of such patients.

Antimicrobial resistance has been observed and reported with practically all the newly discovered antimicrobial molecules till date. It makes the treatment of patients difficult, costly, and sometimes impossible. Emergence of antimicrobial resistance in pathogens has become a matter of great public health concern. Incomplete courses of antibiotic therapies and the unnecessary use of broader spectrum regimens play a role in the development of such resistance. Adherence to both treatment and prophylaxis guidelines likely assists in reducing infection and antibiotic resistance. It is important to avoid injudicious and unnecessary usage of antimicrobials in clinical practice.

It is estimated that 50% or more of hospital antimicrobial use is inappropriate. There is a need for increased education and awareness about antimicrobial resistance among the public and health care providers. One needs to develop and improve the surveillance system for antimicrobial resistance and infectious diseases in general, particularly through improved linkage of data.

INFECTIOUS MORBIDITY

Infectious complications following obstetric and gynecological procedures are a significant source of morbidity and potential mortality. They include urinary tract infection, endometritis, wound infection, perineal infection, and sepsis, which often lead to prolonged hospital stays and increased burden on health care systems. All such infections are further complicated by antimicrobial resistance. More than 50% of *Escherichia coli* strains causing urinary tract infections are reported worldwide to be resistant to fluoroquinolones. Similarly, patients suffering from gonorrhea are reported to be resistant to the last resort of antibiotics—third generation cephalosporin. High mortality (64%) was seen among patients infected with methicillin resistant *Staphylococcus aureus*. Overall, the antimicrobial resistance is associated with higher mortality rate, longer hospital stay, delayed recovery, and long-term disability.

Surgical site infections in the form of cellulitis, abscess, or dehiscence can occur following abdominal and pelvic surgeries. Pelvic infections, such as an abscess or infected hematoma, are a risk with any surgical procedure that

involves entering the abdominal cavity. Cuff cellulitis is a specific postoperative complication for hysterectomy. Endometritis can commonly result from cesarean section or surgical abortion. Urinary tract infections can occur as a result of any procedure that involves catheterization of the bladder. To avoid all these potential complications, the agent used for antibiotic prophylaxis must be administered in a way that it is ensured that serum and tissue levels of the antimicrobial agent are adequate before an incision is made and that therapeutic levels of the agent can be maintained in serum and tissue during surgery and for a few hours at the most after the incision is closed.

PRINCIPLES OF ANTIBIOTIC PROPHYLAXIS

The use of prophylactic antibiotics in obstetric and gynecological surgery is an important part of conventional medical practice. Prophylaxis does not prevent infection caused by postoperative contamination. Prophylaxis is intended for elective procedures when the incision will be closed in the operating room.

Surgical site infections complicate around 5% of patients undergoing surgery. Selective use of antibiotic prophylaxis leads to reduction in the incidence of surgical site infection. Prophylactic antibiotic use differs from treatment with antibiotics in that the former is intended to prevent infection, whereas the latter is intended to resolve an already established infection, typically requiring a longer course of therapy. The purpose of antibiotic prophylaxis in surgical procedures is not to sterilize tissues but to reduce the colonization pressure of microorganisms introduced at the time of operation to a level that the patient's immune system is able to overcome. All these eventually lead to reduction in the incidence of surgical site infections.

Many institutions and jurisdictions have their own established protocols which should be taken into consideration with the use of the antibiotic prophylaxis. In addition to antibiotic prophylaxis, it is very essential to review all factors that may lead to increase in risk of infections. Adherence to appropriate preoperative skin preparation procedure, including hair clipping as opposed to shaving, and effective antisepsis of both patient and staff are required. Special emphasis should be laid upon principles of hand hygiene as it leads to major reduction in incidence of surgical site infections.

Sterile surgical fields must be ensured in the operating room, and ongoing quality assessment of sterilization technique, air ventilation, and postoperative wound care is needed in addition to the use of prophylactic antibiotics. Consistent infection control surveillance and reporting of infectious complications lead to minimize the morbidities and possibly identify clusters of infection and the emergence of antibiotic resistant organisms.

ANTIBIOTIC PROPHYLAXIS IN OBSTETRICS AND GYNECOLOGY PROCEDURES

For a number of procedures in obstetrics and gynecology, the use of prophylactic antibiotics has been shown to reduce infectious morbidity in a safe and cost-effective manner (Table 1).

TABLE 1: Prophylactic antibiotic recommendations for obstetrical procedures

Procedure	*Antibiotic*	*Dosage*	*Level of evidence*
Emergency or elective cesarean section (no labor, no rupture of membranes)	Cefazolin IV 15–60 min prior to skin incision	1–2 g IV	1A
If penicillin allergic	Clindamycin or Erythromycin	600 mg IV 500 mg IV	–
Operative vaginal delivery	None recommended	N/A	II-1C
Manual removal placenta	None recommended	N/A	III-L
Repair third or fourth degree laceration	Cefotetan Cefoxitin	1 g IV 1 g IV	1-B I-B
Postpartum dilatation and curettage	None recommended	N/A	No evidence
Hysterectomy	Cefazolin(single dose)	1–2 g IV	–
Urogyneclogical procedures	Clindamycin plus Gentamicin or Quinolone or Aztreonam	600 mg IV 5 mg/kg IV 400 mg IV 1 g IV	–
Laparoscopy (diagnostic/therapeutic)	None	–	–
Hysteroscopy	None	–	–
Laparotomy	None	–	–
Hysterosalpingogram	Doxycycline	100 mg BD for 5 days	–

Contd…

Contd…

Procedure	*Antibiotic*	*Dosage*	*Level of evidence*
Induced abortion	Doxycycline Metronidazole	100 mg oral before procedure and 200 mg orally after procedure 500 mg BD for 5 days	–
Endometrial biopsy	Not recommended	–	–
IUCD insertion	Not recommended	–	B
PPROM without chorioamnionitis	Amoxy/ampicillin 2 g IV. 6 hourly for 48 hours, antiobiotics for latency e.g., erythromycin 250 mg orally, 6 hourly for 10 days or erythromycin (400 mg orally, 6 hourly for 10 days)	–	–
PPROM with chorioamnionitis	Amoxy/ampicillin 2 g IV; 6 hourly plus gentamycin IV plus metronidazole 500 mg IV, 12 hourly)	–	–

IV, intravenous; N/A, not applicable; BD, twice a day; IUCD, intrauterine contraceptive device; PPROM, preterm premature rupture of the membranes.

Antibiotic Prophylaxis at Cesarean Section

Traditionally, antibiotics at cesarean section were given after cord clamping, due to several potential concerns. However, now there is strong evidence that antibiotics given prior to skin incision reduce the risk of post operative endometritis and surgical site infection by approximately 50%. These trials have not observed any increase in neonatal sepsis rates among patients randomized to pre incision antibiotics. Whether the magnitude of benefit is the same for elective as emergency cesarean section is unclear.

Surgical data suggests that for antimicrobial prophylaxis to be effective, ideally it should be administered at least 30 minutes before cesarean section, to ensure a bactericidal concentration is reached by the time of incision. Narrow-spectrum antibiotics that are effective against gram-positive and gram-negative bacteria with some anaerobic bacteria are the most appropriate choice. One gram of intravenous cefazolin is an appropriate antibiotic choice, with an increased dose (2 g) indicated for obese women (>100 kg).

For women with a significant allergy to β-lactam antibiotics, such as cephalosporin and penicillin, clindamycin with gentamicin is a suitable alternative. Surgical prophylaxis should still be administered even if the patient is receiving antibiotics for prolonged rupture of the membranes.

Single dose antibiotic prophylaxis is sufficient for patients undergoing hysterectomy. Preoperative and postoperative treatment of bacterial vaginosis with metronidazole for at least 4 days beginning just before surgery significantly reduces the incidence of vaginal cuff cellulitis among women with abnormal flora.

Antibiotic in Preterm Premature Rupture of Membranes

Antibiotic prophylaxis for women with preterm premature rupture of the membranes (PPROM) is associated with the intent of prolonging pregnancy and reducing maternal and neonatal infection. The choice of antibiotics in PPROM depends on whether clinical signs of chorioamnionitis are present. The use of antibiotic prophylaxis in women with preterm labor in the absence of membrane rupture is not supported by the evidence. There are two rationales for administering antibiotics in PPROM:

- For group B streptococcal chemoprophylaxis due to the high risk of spontaneous preterm labor
- To prolong gestation (increase latency period).

CONCLUSION

Appropriate antibiotics used at the correct dosage and time and with the appropriate frequency will reduce infectious postoperative complications and minimize the development of antibiotic resistant organisms. There remain a number of procedures where the utility of prophylactic antibiotics is either unclear or not well documented.

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6

CHAPTER

Entering Abdomen for Obstetrics and Gynecology Surgery

Rashmi Malik

INTRODUCTION

Abdominal entry is required for performing various gynecological procedures for malignant and nonmalignant conditions. In obstetrics the commonest procedure requiring transabdominal approach is cesarean delivery. Although the buzz in gynecologic surgery is a minimally invasive approach, certain benign and malignant gynecologic disease states still require a laparotomy to treat. For abdominal entry, there are two approaches—open surgery and minimally invasive approach (laparoscopic surgeries). One of the lasting marks of any abdominal surgery, and most noticeable to the patient, is the scar made by the incision.

BASIC PRINCIPLES

Choice of Incision

While planning the incision, important considerations are:

- Adequate exposure for the anticipated procedure
- Certainty of the diagnosis
- Possibility that planned procedure may change depending upon intraoperative findings or complications.
- Emergency/urgency for rapid entry
- Previous scars
- Anatomical considerations so as to interfere minimally with abdominal wall function by preserving important structures, minimizing bleeding, nerve injury
- Need to enter the upper abdomen like in Ovarian malignancies
- Healing with adequate strength, minimizing complications like wound disruptions and hernia
- Postoperative pain
- Cosmetics (patient's preference).

Relevant Anatomy

Important anatomical aspects while performing incision on the anterior abdominal wall are summarized in table 1.

TABLE 1: Clinical importance of anatomical structures

Anatomical structure	Significance
Dermal fibers oriented transversely	More tension on vertical incision, resulting in wider scar
Superficial inferior epigastric vessels	Isolate and ligate in lateral extent of transverse incisions, online from femoral vessels to umbilicus
Insertion of pyramidalis muscles	Identifies midline
Deep inferior epigastric vessels	Isolate and ligate in Maylard incision
Tendinous inscriptions between rectus sheath and muscles	Sharp dissections required to elevate rectus sheath in Pfannenstiel incision. Due to these attachments, rectus muscles do not retract even when cut as in Maylard incision
Arcuate line	Repair posterior sheath above this
Bladder reflection on peritoneum	Enter lateral to midline
Hypogastric and ilioinguinal nerves	Identify and spare

GENERAL MEASURES IN ALL INCISIONS

Measures to control surgical site infection including skin antisepsis, prophylactic antibiotics, proper hand hygiene, and surgical technique with minimal tissue trauma should be followed.

Making Skin Incision

Controversy persists regarding the choice of scalpel or electrosurgery for making abdominal wall incisions. Systematic review and meta-analyses by Ahmad et al. and

Ly et al. respectively, comparing the outcomes of abdominal incisions using cold scalpel or diathermy found no significant differences in the wound complications.

Using blade, a sharp incision should be given in the skin and subcutaneous tissue. Care should be taken to make as few blade strokes as possible in the subcutaneous tissues to minimize tissue damage. Changing surgical blade after skin incision has no advantage regarding infection. Electrosurgery is acceptable and may lower postoperative analgesic requirements.

Control of Superficial Bleeding

Small vessels stop bleeding after some time due to constriction. Vessels continuing to bleed can be cauterized limiting extra tissue damage. Large vessels like inferior epigastric artery are isolated by dissection, clamped and ligated.

Different Incisions for Open Surgery

There are two main types of incision—transverse and longitudinal (vertical). Studies have found that transverse incisions have various advantages over longitudinal incisions like lower incidence of adhesion formation and postoperative bowel obstruction. There is less postoperative pain and pulmonary dysfunction, lower incidence of incisional hernia. However, a systematic review by Bickenbach et al. comparing transverse and midline incisions found no significant differences in the incidence of early or late postoperative complications, and recovery times were also similar. Rather few studies found a higher incidence of wound infection in transverse incisions. Due to the fact that data strongly supporting one incision over another are lacking, the choice of incision remains the preference of the surgeon.

CHOICES AND TECHNIQUES

For gynecological surgeries and cesareans, incisions are generally required in the lower abdomen and rarely supra umbilical extension is required as in ovarian malignancies or for classical cesarean section.

Longitudinal Incisions

Types of vertical abdominal incisions include midline, paramedian, and wide paramedian incisions. The most commonly used is a midline incision especially in gynecologic oncology surgery.

Midline Incision

In the lower abdomen, the incision is made from just above the pubis to below the umbilicus in the midline. As only terminal branches of the abdominal wall blood vessels and nerves are located at the linea alba, this is the least hemorrhagic incision with minimal nerve damage. Exposure is excellent. If required, this incision can be extended above umbilicus. The midline incision provides the most rapid entry, which is especially important if the patient is hypotensive due to bleeding or septic shock. One of the main indications for a midline incision is an exploratory laparotomy when diagnosis is not certain. The disadvantages are increased requirement of analgesia, pulmonary compromise, and wound dehiscence compared with transverse incisions.

Steps

Skin and subcutaneous tissues are incised. There is no need to separate fat from rectus sheath as it creates unnecessary dead space. Rectus sheath is incised in the midline and two rectus muscles are separated longitudinally. Preperitoneal fat is dissected bluntly. Thin peritoneum is held with artery forceps and incised. Electrocautery should not be used to divide the peritoneum due to the risk for thermal injury to underlying bowel. Incision is extended vertically after ruling out or separating adhesions if any. If incision is to be extended up, it is usually done by going around umbilicus preferably on left to leave the ligamentum teres intact

Paramedian Incision

A paramedian incision is made 2–5 cm to the left or right of the midline. In true paramedian incision, rectus muscle is split longitudinally thereby increasing risk of bleeding and nerve injury. In modified incision, rectus muscle is retracted laterally exposing posterior rectus sheath and peritoneum which is incised. Paramedian incisions have excellent exposure (especially on the side of incision) and extensibility. The paramedian incision may decrease the risk of dehiscence or hernia as compared with midline incisions, although conflicting data have been reported. These incisions take longer to perform, restrict access to the contralateral pelvis, and risk injury to the epigastric vessels and rectus paralysis due to nerve injury. So, paramedian incision is rarely used.

Transverse Incisions

Various transverse incisions have been used for caesarean section and gynecologic surgeries, more for benign diseases. Advantages include better cosmetic results, less pain, and decreased incidence of hernia formation. Disadvantages include greater blood loss, higher incidence of abdominal wall hematoma and paresthesia due to nerve injuries as compared to a midline incision. Moreover, transverse incisions limit exploration of the upper abdomen especially in oncology surgeries. However, when a planned operation is likely going to be confined to the pelvis, low transverse incisions are often used.

All of the incisions described below begin with a transverse skin incision cantered above the symphysis pubis. Placing the incisions in the pubic hair line or in a natural skin crease may enhance the cosmetic result. However, the incision should not be placed in a deep skin fold of a large

panniculus where maceration of the skin can increase the risk of infection.

Various transverse incisions are:

- Pfannenstiel's incision, a muscle-separating operation (most common)
- Cherney's incision, a tendon-detaching operation
- Maylard's incision, a true muscle-cutting incision
- Küstner's incision, a median incision using a transverse skin incision.

The Pfannenstiel's incision and the Maylard incision have been compared directly with cesarean delivery and are judged to be comparable.

Pfannenstiel's Incision

The Pfannenstiel's incision is the most frequently used incision in both obstetrics and gynecology. It is a curved incision about 2–5 cm above the symphysis, with lateral apices smiling upward toward anterior superior iliac spine. The incisional length is approximately 10 cm (8–14 cm) depending on the type of surgery. Superficial epigastric vessels may be encountered near lateral ends of the incision. The rectus fascia is incised transversely on either side of the linea alba. The rectus sheath is separated from the underlying muscle either blindly by traction or cutting across attachments. The rectus muscles are then separated in the midline, and the peritoneum is opened vertically. The peritoneum is opened at the upper end of exposure and off the midline so as to avoid injuring bladder.

Lateral extension beyond the edge of the rectus can result in injury to the iliohypogastric or ilioinguinal nerves resulting in neuroma formation. To avoid injury during suturing, at lateral ends sutures should be applied only to external oblique aponeurosis.

Limitations: Limitations include lack of upper abdominal exposure, increased risk of hematoma or seroma formation and greater operating time. There is minimal opportunity to extend the incision if wider exposure is desired. Therefore this incision is used only when pathology is confined to the pelvis.

Joel Cohen's Incision

This incision is used for cesarean cases. This relies more on blunt dissection than sharp dissection. This is a straight transverse incision given 3 cm above the pubic symphysis. Only central subcutaneous fat is incised. Transverse incision in central rectus sheath is widened by craniocaudal stretching. Recti are stretched from midline laterally. Peritoneum is opened by fingers or a small nick and widened craniocaudally. This allows fast entry and is also associated with less blood loss, less postoperative pain and fever, shorter hospital stay, and thus faster recovery as compared to Pfannenstiel's incision.

Cherney's Incision

It is similar to the Pfannenstiel's incision, except it involves incising the rectus tendons and is placed slightly lower on the abdomen. The tendons of the rectus and pyramidalis muscles are incised at their insertion to the symphysis following blunt separation from the underlying bladder and adventitial tissue. A half-centimeter segment of tendon is left on the symphysis for reattachment. The muscles and tendons are retracted, and the peritoneum is incised longitudinally. Cherney's incision provides excellent exposure to the retropubic space of Retzius (making it a good choice for retropubic urethropexy) and pelvic side walls. If required, a Pfannenstiel's incision may be converted to Cherney's incision to enhance exposure.

Maylard's Incision

It is a true transverse-muscle-cutting incision in which all layers of the lower abdominal wall are incised transversely. The incision provides excellent pelvic exposure and is used by many surgeons for radical pelvic surgery, including radical hysterectomy with pelvic lymph node dissection and pelvic exenteration. In this incision, rectus fascia is incised transversely, and the sheath is not detached from the underlying muscle. Laterally inferior epigastric vessels, lying on the posterolateral border of each rectus muscle, are identified and ligated. Rectus muscles are then cut transversely. Muscles may be sutured to the overlying rectus sheath for better approximation during closure. The peritoneum is incised transversely.

In a case with impaired circulation to lower limb due to obstruction of the common iliac arteries or terminal aorta, blood flow from inferior epigastric artery may be the only collateral blood supply to lower limb. In such situation ligation of this artery could result in lower extremity ischemia and a real vascular surgical emergency. In such situation, midline incision should be preferred.

Küstner's Incision

This incision is uncommonly used. It is a transverse skin incision approximately 5 cm above the symphysis and just below the anterior iliac spine. Subcutaneous adipose is separated from the rectus sheath in a vertical plane to reveal the linea alba. A vertical midline incision is made in the linea alba. The procedure for the midline incision is subsequently followed. Küstner's incision combines the disadvantages of both midline and transverse incisions and, therefore, has limited utility. Collection of blood and serum increases the risk of infection and may necessitate drainage. The incision affords less exposure than the Pfannenstiel and almost no extensibility. It was developed to reduce the risk of evisceration; however, the incidence of herniation is similar to that of midline incisions. It offers little or no tensile strength advantage. Due to the need for extensive hemostasis, this incision tends to be very time consuming

Modified Gibson Incision

It is used for extraperitoneal lymph node dissection. The incision is started 3 cm superior and parallel to the inguinal ligament, extended vertically 3 cm medial to the anterior

superior iliac spine to the level of the umbilicus. The fascia is cut and the peritoneum bluntly dissected. The round ligament and the inferior epigastric vessels are ligated to facilitate surgical exposure. Care should be taken as too much traction on the peritoneum can result in avulsion of the inferior mesenteric vessels.

Reentry Incisions

For patients who have had prior surgery at the same planned incision site, it is preferable to make the incision through the previous scar. If the prior scar is cosmetically unacceptable, it may be excised at the beginning or end of the procedure. This is easily accomplished by elevating the old scar with Allis clamps and making an elliptical incision around the old scar. Skin incision can be extended beyond the previous scar so that the peritoneum can be incised in adhesion free area.

The various incisions of open surgeries are shown in figure 1.

The relative advantages and disadvantages of various abdominal incisions are summarized in table 2. Special precautions need to be taken in obese patients, patients with history of previous surgery or abdominal Koch's, and large cervical fibroids and ovarian cysts in which bladder might be pulled high up.

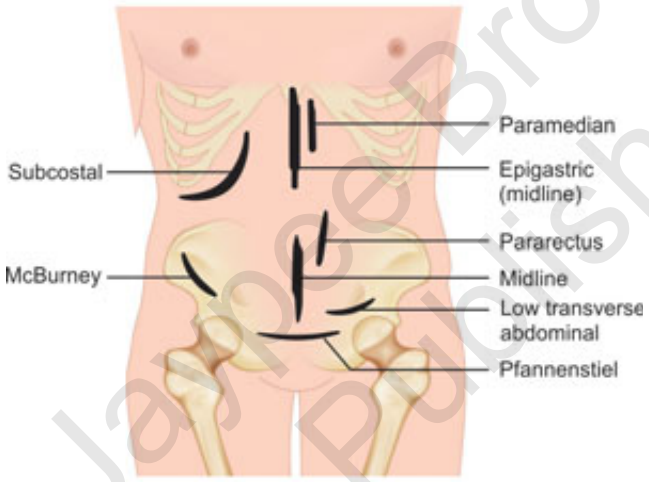

Figure 1: Laparotomy incisions.

TABLE 2: Characteristics of lower abdominal incisions

Incisions	*Pfannenstiel*	*Cherney*	*Maylard*	*Vertical*
Pelvic exposure	++	+++	++++	+++
Upper abdomen exposure		+	++	++++
Potential blood loss	++	++	+++	+
Potential hernia	+	+	++	++++
Evisceration risk		+	++	+++
Speed	++	+++	+	++++

CONCLUSION

Entering the abdomen without complications requires sound knowledge of the anatomy of the abdominal wall. Choosing right incision in the open surgery and the method of entry and site of port placement in laparoscopy are very important for proper exposure and surgery and also result in the best post-operative outcome. Every case presents a unique challenge and choice should be made which is optimal for the situation.

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7

CHAPTER

Suture Materials and Needles

Kavita Khoiwal, K Aparna Sharma

INTRODUCTION

Sutures are surgical thread-like materials used to stitch (tie, ligate, or oppose) tissues during surgery. An ideal surgical suture should be cheap, should not harbor microorganisms or elicit an inflammatory reaction, should not be toxic, or have any carcinogenic agents. It should retain its tensile strength until the wound has healed and not affect the tensile strength of the wound. Most commonly used system to measure the strength of sutures is still the old conventional system. The finest sutures are measured in "zeros" and the thicker ones are numbered. From finest to thickest, the sequence is 6/0, 5/0, 4/0, 3/0, 2/0, 0, 1, 2, 3, and 4.

CLASSIFICATION OF SURGICAL SUTURES

Surgical sutures can be classified in various ways:

- Absorbable and nonabsorbable suture—on the basis of their ability to get absorbed by the body. Table 1 shows absorption rates for various absorbable sutures
- Monofilament and multifilament suture (twisted and braided)—on the basis of the material used for their manufacturing
- Natural and synthetic suture—on the basis of source of suture material
- Coated and noncoated.

TABLE 1: Time taken for absorption of various absorbable sutures

Suture	*Time taken for complete absorption (days)*
Plain catgut	70
Chromic catgut	90–120
Polyglactin (vicryl rapide)	42
Coated polyglactin (vicryl)	56–70
Monocryl	91–119
Polydioxanone (PDS)	183–238
Barbed polydioxanone	180

COMMONLY USED SURGICAL SUTURES IN OBSTETRICS AND GYNECOLOGY

Plain Catgut

It is a natural type of suture made from submucosa of healthy sheep and serosa of healthy cattle. This is absorbable and microfilament (single thread) suture; contains collagen and causes inflammation which leads to release of proteolytic enzymes that digests it within 5–6 days.

Chromic Catgut

A plain catgut suture coated with chromic acid, which leads to slower absorption and makes it more inert to decreases the chance of allergic reactions and inflammation. It has a good memory (strength lasts for about 21 days) and good handling property. It is used to ligate small vessels to control hemorrhage for inner layer of bowel anastomosis and for viscera and is particularly used in modified Pomeroy technique of tubal ligation.

Polyglycolic Acid (Dexon)

It is a synthetic, delayed absorbable, multifilament, braided suture without coating, is absorbed by hydrolysis. The characteristics include good healing, poor memory, poor capillary, and non inflammatory. It can be used for any tissue within the body as well as skin.

Vicryl

Polyglactin 910 is a synthetic, absorbable, multifilament, braided (rough) suture coated with dye with purple color for identification. It is composed of a copolymer made from 90% glycolide and 10% L-lactide. It has good handling property, poor memory, and decreased chances of inflammation. It usually gets absorbed in 3 months by hydrolysis. It can be mounted on a round body or cutting needle. Commonly used

for ligation of vessels, skin closure, subcutaneous closure, and bowel anastomosis.

Vicryl Rapide

Polyglactin 910 is a synthetic absorbable sterile surgical suture composed of a copolymer made from 90% glycolide and 10% L-lactide. It is irradiated and hence is absorbed much more quickly than Vicryl. It is commonly used by obstetricians for episiotomy repair where only short term wound support (7–10 days) is required.

Monocryl

A synthetic, absorbable, monofilament suture made from vicryl, also known as polyglycoprone. Features are similar to vicryl except faster absorption, intermediate memory, lesser chances of inflammation, no capillary action, and handling is not as good as vicryl. Commonly used for subcutaneous closure.

Silk Suture

A natural suture made from the raw silk from the cocoon of the silkworm. It is nonabsorbable, multifilament, braided, usually coated with wax, not degraded by proteolysis, and undergoes fragmentation. It is dyed with black color. Its properties include good handling, poor memory, less inflammation, and high capillary (can carry fluid) that is why it is coated with wax. The high capillary can decrease its strength when wet and also cause infection move from place to place. It is used in outer layer of bowel anastomosis, omental resection, ligation of very large vessels, skin closure, and ligation of stump in appendectomy.

Prolene Suture

It is a synthetic, nonabsorbable and polypropylene monofilament suture. Characteristics include intermediate handling and memory, no capillary effect and inflammation, and antithrombogenic property (does not form thrombus). It undergoes fragmentation. It is used mainly for vascular anastomosis; other uses include subcutaneous closure and closure of fascia.

Polyamine (Nylon)

A synthetic, nonabsorbable suture, either monofilament or multifilament and black in color. It has a good memory, poor handling properties, noncapillary, and does not cause inflammation. Used in skin closure, posterior wall repair, apposing fascia, tendon, hernioplasty, and subcutaneous skin closure.

Polydioxanone

It is a synthetic smooth suture which is delayed absorbable, monofilament and lasts longer than dexon. It is absorbed in 6 months; other properties are the same as dexon. Commonly used for rectus sheath closure.

Barbed Suture

Barbed suture is the latest addition to various suture materials. It is a synthetic suture that can anchor to the tissue without knots. It can be made of both absorbable and nonabsorbable monofilament materials polydioxanone, polyglyconate, poliglecaprone 25, glycomer 631, nylon, and polypropylene. It can be either bidirectional (Quill's) or unidirectional (V-Loc).

Quill bidirectional barbed polydioxanone suture was the first US Food and Drug Administration (FDA) approved barbed suture material in 2004. Later in 2009, FDA approved unidirectional barbed suture V-Loc from covidien.

Bidirectional barbed sutures are manufactured by micromachining technique from monofilament fibers in which suture would cut into the barbs around the circumference in a helical pattern. The barbs are separated from one another by a distance of 0.88–0.98 mm and are divided into 2 groups that face each other in opposing directions from the suture midpoint. Needles are swaged onto both ends of the suture length (Fig. 1). In the process of creating barbs, the effective diameter of the suture would decrease. Because of that barbed suture is considered equivalent to 1 USP suture size greater than its conventional counterpart (e.g., a 2-0 barbed suture is equal to a 3-0 smooth suture). Unidirectional barbed sutures (V-Loc) are similarly manufactured from monofilament fibers, but needles are swaged onto only one end whereas the other end maintains a welded closed loop to facilitate initial suture anchoring (Fig. 2). Whether bidirectional or unidirectional barbed suture is better is not known, though there are reported complications of unidirectional barbed sutures migrating or extruding.

Barbed suture is commonly used in laparoscopic myomectomy and total laparoscopic hysterectomy.

IDEAL TIME TO REMOVE SUTURES POSTOPERATIVELY

It depends upon the blood supply to the sutured area. The more the blood supply, the less the time it takes for the

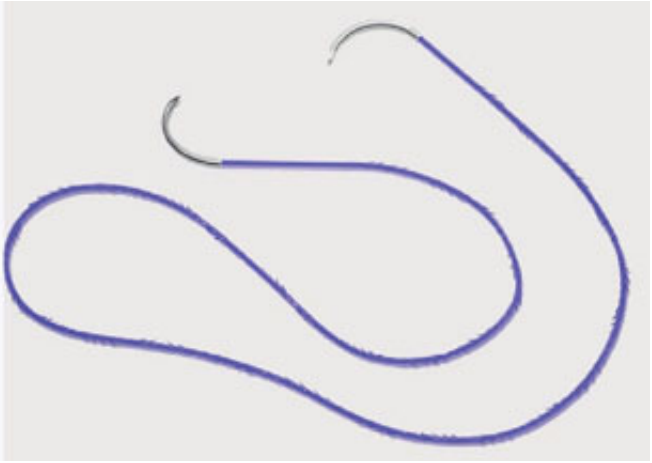

Figure 1: Quill bidirectional barbed suture.

Figure 2: V-Loc unidirectional barbed suture.

surgical wound to heal, hence the sutures can be removed early. Nonabsorbable sutures usually take about 7–10 days. In obstetrics and gynecology, the stitch removal in transverse scar is done on day 7 (or day 10 days in cases of previous transverse scar) and in midline vertical scar at day 10 (or day 14 if the patient had previous vertical scar).

SUTURE NEEDLES

Needle can taper to a point or have cutting edges. Longer points are required for improved penetration. The swage is a hole which is drilled into the end of the wire and the material is attached to this hole. For premium needles, the needles are laser drilled which provides a smooth transition between needle and material thus reducing tissue trauma. Anatomy of a needle is shown in figure 3.

Needles can be classified into two types:

- Nontraumatic/round body needle—cross section is round and used for subcutaneous tissue, visceral organs

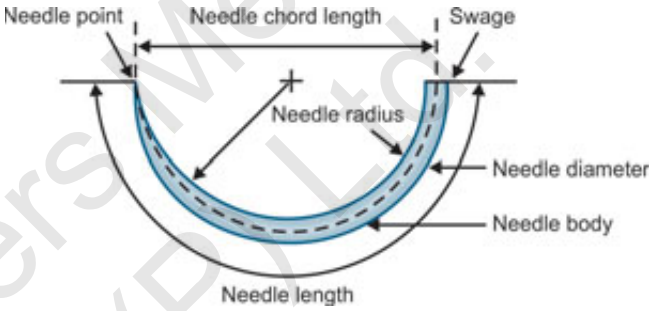

Figure 3: Anatomy of suture needle.

- Traumatic/cutting needles—cross section is triangular, very sharp and is used for skin.

Needles can be thin or thick, large or small, with or without eye, straight or curved into 3/8, half, or 5/8 of a circle (basic shapes are shown in figure 4). The choice of needle shape is frequently governed by the accessibility of the tissue to be sutured, and normally the more confined the operative

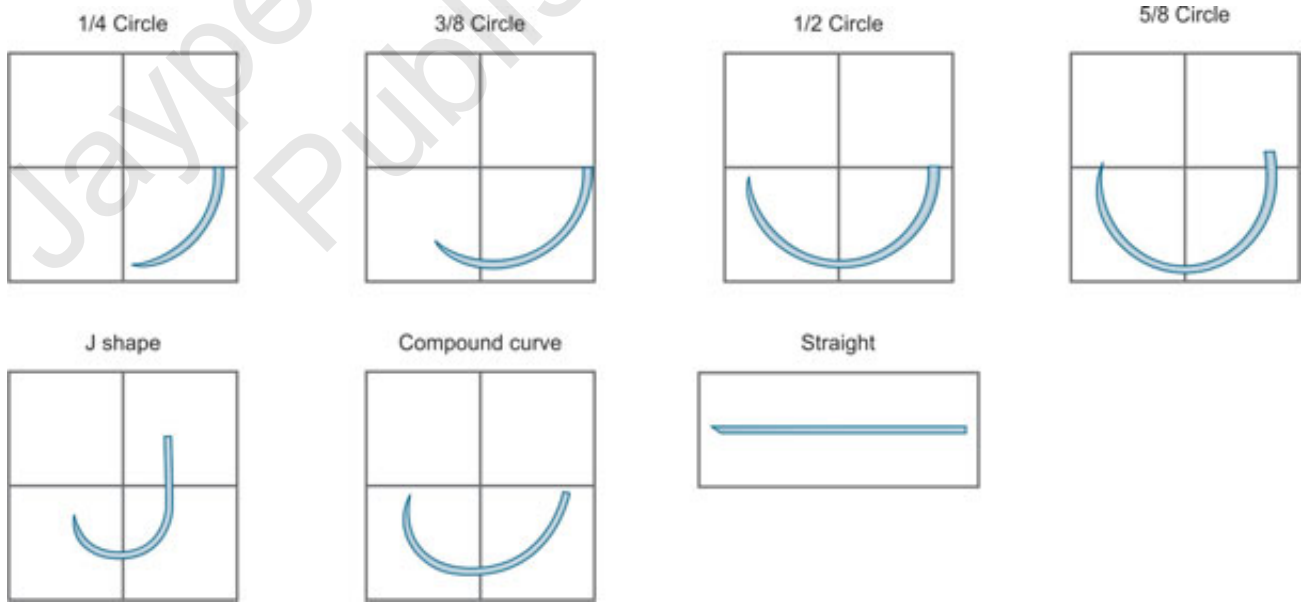

Figure 4: Various shapes of suture needle.

site the greater the curvature required. A 3/8 circle needle is used in a shallow space and a 5/8 needle in a deep one. The narrower and deeper the space, the smaller and more curved needle has to be used.

Always use atraumatic needles to suture gut, the urinary tract, blood vessels, nerves, the cornea, and face and a cutting needle for the skin and tough fascia.

Mayo's needle is a hybrid as it has a curved round shank and a trocar point. It is used for wide vascular pedicles and tough tissues, such as ligaments.

Needle holder is always needed to hold small needles and to suture in a confined space. A short needle holder should be used near the surface whereas a long needle holder for deeper space. Big needles should be used with big holders and small needles in small holders.

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8

CHAPTER

Hemostasis during Surgical Procedures

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INTRODUCTION

Best results in any surgery can be attained with meticulous high order skills and thorough perioperative hemostasis. Minimization of blood loss is an essential requisite for proper visualization and exposure during surgery.

Inadequate control of bleeding is associated with grave detrimental upshots as extended duration of surgery, unanticipated blood transfusions, shock, infection, impaired wound healing, extended hospital stays, increased morbidity, and even mortality.

Appropriate clinical management of bleeding in the surgical and trauma settings requires meticulous collaborative preparation and clinical proficiency of the entire perioperative team. By incorporating evidence-based approaches into practice, surgeons can support effective intraoperative hemostasis, thereby improving patient outcomes.

MECHANISM OF HEMOSTASIS

Following a vessel injury, our body starts forming clots through series of mechanisms.

Vessel injury → vasoconstriction → platelet plug formation → fibrin clot formation and fibrinolysis.

Tissue factor exposed at a wound interacts with factor VIIa and initiates clotting by two pathways: (i) activation of factor X to Xa (i.e., the extrinsic pathway) and (ii) conversion of factor IX to IXa, which activates factor X to Xa (i.e., the intrinsic pathway). Conversion of X to Xa is done in the presence of factor V, prothrombin is subsequently cleaved to release thrombin, which, in turn, converts fibrinogen to fibrin. The resultant local generation of fibrin, in turn, enmeshes and reinforces the platelet plug.

CHALLENGES TO PERIOPERATIVE HEMOSTASIS

Hemostasis can be stalled by platelet abnormalities (such as thrombocytopenia), antiplatelet medications (such as aspirin, clopidogrel, or prasugrel), use of therapeutic anticoagulation medications (such as heparin or warfarin), and may also occur in conjunction with sepsis, cirrhosis, autoimmune disorders, or consumptive conditions that have depleted the patient's coagulation factors. Intraoperative hypothermia exemplifies as an environmental factor that inhibits clot formation.

METHODS OF ACHIEVING HEMOSTASIS DURING SURGERY

Optimal hemostasis happens when surgical technique controls all surgical sources of bleeding and the patient's own coagulation system efficiently seals microvascular bleeding. In this favorable situation, no additional hemostatic management is required; however, ideal circumstances do not always transpire.

Perioperative measures should be focused on achieving satisfactory hemostasis without resorting to transfusion. Hemostasis challenges and associated interventions vary in accordance with bleeding severity (i.e., minimal, moderate yet controlled, uncontrolled). Successful accomplishment of hemostasis through mechanical or systemic methods can avert the need for transfusion.

Hemostasis can be accomplished endogenously by allowing the patient's physiologic system to reach hemostasis naturally or by using supplemental mechanical techniques or use of thermal energy sources, failing which direct application of a topical hemostat to the bleeding surface is adopted (Table 1).

TABLE 1: Mechanical techniques or thermal energy advocated for control of bleeding

Mechanical method	*Thermal energy*
• Direct pressure • Fabric pads/gauze/sponges • Sutures • Ligation clips	• Monopolar electrocautery • Bipolar electrocautery • Advanced bipolar • Ultrasonic devices

These methods in most cases do control bleeding and systemic hemostatic strategies are also considered with these techniques.

SYSTEMIC HEMOSTATIC STRATEGIES

These are employed in select surgical or trauma situations. Perioperative administration of vitamin K in patients who are taking warfarin, protamine administration in those receiving heparin before surgery or receiving intentional intraoperative heparin or utilization of fresh frozen plasma, cryoprecipitate, and platelets or factor VII to accelerates clot formation or reverses preoperative or intraoperative coagulopathy.

Tranexamic acid is a commonly used systemic hemostat, which is a synthetic derivative of the amino acid lysine that exerts its antifibrinolytic effect through the reversible blockade of lysine binding sites on plasminogen molecules. When administered at the outset for surgery, it reduces intraoperative blood loss.

Topical hemostatic agents may allow surgical teams to achieve hemostasis after exhaustion of traditional surgical methods.

The following are helpful in managing impossible/difficult bleeding situations like:

- Difficult access bleeding sites (hard to reach sites)
- Bleeding inside cavity post evacuation (tumor/hematoma)
- Sinus bleeding
- Raw parenchymal tissues surfaces
- Raw bony surfaces/edges
- Inflamed/friable vessels
- Stripped adhesions.

Knowledge of the characteristics, safety, efficacy, and costs of available topical hemostatic agents endorses their appropriate selection (Table 2).

The two main categories of topical hemostatic agents are mechanical agents which promote hemostasis using a passive substrate, and biologically active agents, which enhance coagulation at the bleeding site.

TABLE 2: Factors considered while choosing a right hemostats

Clinical factors	*Product factors*
• Degree of bleeding, e.g., mild or heavy • Patient factors, e.g., coagulopathic or comorbid • Tissue type, e.g., solid organ, soft tissue, vessel, bone • Access to bleeding sites—surface versus deep • Site characteristics—raw surface, laceration, penetration, suture, or staple line	• Efficacy/time to achieve hemostasis • Ease of use (preparation application and device flexibility)

Mechanical Agents

Mechanical agents provide a stimulus that activates platelets and the extrinsic pathway and accelerate the coagulation cascade to control bleeding and provide a nidus for thrombus deposition. The dry matrix also absorbs water and concentrates hemostatic factors at the site of bleeding.

Various physical agents incorporate the topical hemostat into an absorbable format, such as a sponge or pad; options being porcine gelatin (e.g., Gelfoam, Surgifoam), bovine collagen (e.g., Avitene, Helistat) oxidized regenerated cellulose (e.g., Surgicel), and microporous polysaccharide spheres (e.g., Arísta). Bovine collagen is typically the most efficacious, followed by porcine gelatins, polysaccharide spheres, and oxidized regenerated cellulose. However, an intact coagulation cascade is a must to ensure that fibrin can ultimately be produced after application of the mechanical agent. When hemorrhage is caused by a significant coagulopathy, these agents may not be effective. Most of these agents are fully absorbed by six weeks except porcine gelatins (Arísta) which is absorbed within 48 hours.

The presence of the foreign body in the wound can predispose the patient to infection. Fluid absorption by the mechanical agent causes swelling. These should not be used intravascularly because they will cause thrombosis, or in confined spaces where expansion of the product could lead to compression symptoms. The acidity of cellulose may neutralize the effectiveness of thrombin or other sealants by altering the pH of the microenvironment.

Types available are:

- Bone wax and putty:
  - Bone wax which is composed of beeswax, paraffin, and wax-softening agents, physically occludes bleeding vessels. It can lead to infection or granuloma formation which can interfere with healing. Usually used in bone surgeries
  - Ostene is a wax-like compound of a water-soluble alkaline oxide copolymer sealing bleeding vessels
  - Bone putty is a resorbable hemostatic (Hemasorb Plus), comprising of granular hydroxyapatite/beta-tricalcium phosphate and water-soluble components that are fully synthetic and resorbable
- Dry matrix; Dry agents form a matrix that activates the coagulation cascade and serve as a scaffold onto which thrombus can easily form. Though easy to use; they are less effective in brisk bleeding. The agent is applied to the site of bleeding followed by gentle pressure with a surgical sponge. It must be removed carefully from the sponge since these agents generally adhere to the underlying tissue and will remove the clot that has formed if removed too quickly
- Oxidized regenerated cellulose is a dry, absorbable sterile mesh (e.g., surgicel) that can be applied directly to an area of bleeding. A single-layer sheet is fully absorbed in approximately 14 days. Results are optimal if bleeding is minimal (i.e., oozing). Oxidized regenerated cellulose is pliable, it can be rolled and passed easily through laparoscopic trocars

- Gelatin matrix (e.g., Gelfoam, Surgifoam) is a hydrocolloid made from acid and porcine-derived collagen that is whipped into foam and then dried. It absorbs blood or fluid up to 40 times its weight, is pliable after moistening, and passes easily through laparoscopic ports. Once in place, pressure is applied for several minutes to achieve hemostasis. The sponge is completely absorbed after 4–6 weeks. Disadvantages are increased incidence of infection, granuloma, formation, fibrosis and clot disruption if the sponge is removed
- Microporous polysaccharide spheres (Arista) are derived from potato starch, acting as a molecular sieve to absorb water and concentrate platelets and blood proteins. After achieving a relatively dry surface by applying pressure to bleeding site, powder is liberally applied with the bellows applicator. Advantages include low cost, rapid absorption within 48 hours, and freedom from transmissible viruses or allo-antigens
- Microfibrillar collagen is an absorbable acid salt obtained from bovine collagen (e.g., Avitene). It acts as a scaffold for clot formation and activates platelets. Microfibrillar collagen remains effective with heparinization, however is less effective when platelet counts are < 20,000/mm^3.

Biologically Active Agents

Biologically active agents augment hemostasis. The thrombins short-circuit the coagulation and enables topical thrombin cleavage of fibrinogen to produce the fibrin clot. Fibrin sealants work by combining human thrombin with its target fibrinogen to create fibrin. These are ready made clots effective irrespective of coagulation profile.

- Topical thrombin is reconstituted from a lyophilized powder, which when sprayed is useful for managing diffuse bleeding from oozing peritoneal and pleural surfaces or directly applied to a specific area of bleeding with needle and syringe. Three types are available—bovine thrombin (Thrombin-JMI), pooled human plasma thrombin (Evithrom), and recombinant thrombin (Recothrom). These may be associated with immunogenic reactions and transmission of infection
- Flowables: Thrombin can also be used in conjunction with a gelatin matrix agent (sponge or granules) that provides the thrombin with an immediate scaffold for clot formation. In combination with gelatin foam or granules, it is useful for promoting hemostasis at vascular graft suture hole sites. Due to its liquid nature, thrombin applied in combination with gelatin granules (e.g., FloSeal, Surgiflo) may control bleeding more quickly. Urine does not significantly inhibit thrombin or thrombin-fibrin combination products
- Fibrin sealants, a two-component system including a solution of concentrated fibrinogen and factor XII, and a solution of thrombin and calcium, can be used to control bleeding at vascular anastomotic sites or from cut surfaces
- Tranexamic acid when topically applied to the bleeding surface has the potential to inhibit local fibrinolysis at the site of bleeding, reducing bleeding with minimal systemic effects
- Light-activated hemostatic agent is a novel, hydrophobic light-activated adhesive, which is a fluid/blood-resistant tissue glue. It consists of a prepolymer, (polyglycerol sebacate acrylate) that is biocompatible, biodegradable, and hydrophobic, which, when mixed with a photo-initiator and exposed to ultraviolet light, cross-links *in situ*. Hydrophobic light-activated adhesive can be applied as a liquid and activated when needed to cure and bond. It has the advantage of not dissolving in an aqueous or intravascular blood environment, even when subjected to pressure and flow. Its use is investigational.

External Agents

These are used outside the operating room, in rescue situations, external hemorrhage is generally controlled with direct pressure and standard dressings; however, when these are ineffective, external topical agents can be used as specialized dressings to temporize hemorrhage until definitive management is possible. Some examples are:

- HemCon bandage: It is a dressing composed of biodegradable lyophilized chitosan. Strong adhesive properties of chitosan enables it to attach firmly to wet tissues and seals bleeding vessels
- ChitoFlex: It is a rolled version of chitosan in a different formulation. It is very pliable being intended to be packed into a wound tract
- QuikClot: It is a zeolite-based granule with 1% moisture that, when placed on a bleeding wound, absorbs water and concentrates red cells, platelets, and clotting proteins at the injury site, thereby promoting rapid coagulation and arresting hemorrhage. Heat released during reaction causes thermal injury in some tissues, depending on the formulation used (granules, gauze, and pad).

ADVERSE EFFECTS AND COMPLICATIONS OF HEMOSTATIC AGENTS

Adverse effects and complications from topical hemostatic agents are generally uncommon. Most problems can be avoided by limiting the amount of agent remaining within the wound once hemostasis has been achieved. Thrombin-based agents, which are blood products, have the potential for transmission of blood-borne disease, and anaphylaxis and immune-mediated coagulopathy are rare complications associated with bovine-derived agents. Other complications include embolism, infection, impaired wound healing, and thrombosis.

CONCLUSION

A major goal during any surgery is minimization of blood loss, which reduces the need for blood transfusion. Significant

bleeding during surgery is controlled with vessel ligation, suturing, and electrocautery. Topical hemostatic agents are useful adjuncts to surgical hemostasis for controling nonspecific bleeding.

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9

CHAPTER

Fluids and Electrolytes in the Postoperative Period

Jyotsna Suri, Rekha Bharti

INTRODUCTION

Water constitutes approximately half of the body weight of a woman. This water is distributed between the cells and the extracellular compartment in a ratio of about 3:1. Of the water in the extracellular space about 25% is within the intravascular compartment and the rest is in the interstitial space (Fig. 1). The osmolarity of the extracellular fluid is mainly dependent on the concentration of sodium and chloride; whereas the electrolytes within the cells are potassium, magnesium, and phosphate.

Fluid and electrolyte management in the post operative period can be quite challenging and is one of the most important components of the care. The fluids transfused to the postoperative patient can be either for replacement of lost fluids in the perioperative period or for maintenance of the physiological functions of the body.

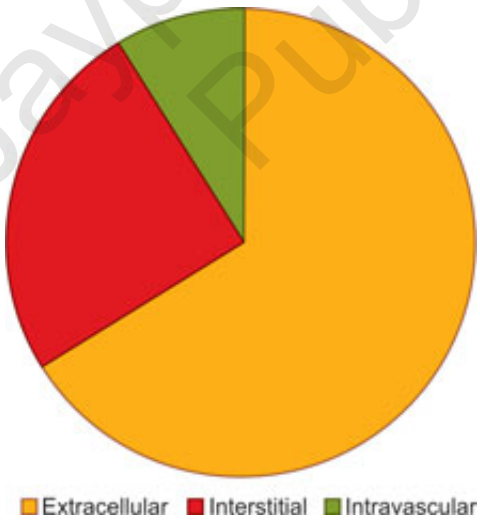

Figure 1: Distribution of body water.

REPLACEMENT FLUID (FLUID RESUSCITATION)

Replacement therapy is indicated in many postoperative patients to compensate for deficits related to residual preoperative or intraoperative deficits, third-space losses related to the stress response of surgery and to replace ongoing gastrointestinal or other bodily fluid losses. It is calculated by the deficit between the perioperative loss and amount of fluid /blood products transfused. The goal of fluid resuscitation is normal organ perfusion; blood volume must be restored to within 15–20% of normal. Physiologic markers of adequate perfusion include normalization of heart rate and blood pressure in healthy patients but may be unreliable in critically-ill patients. Serum marker of adequate resuscitation is a normal lactate level. The crystalloids—normal saline and lactated Ringer are the fluids of choice for resuscitation. The hypotonic fluids and dextrose solutions are never used for resuscitative purpose. Infusion of Ringer's lactate (RL) should be avoided in the same line as blood, as RL contains calcium which can chelate with blood.

The composition and uses of the fluids are shown in table 1.

Resuscitative fluids are commonly administered as successive intravenous boluses (3.5–14 mL/kg) over 30–60 minutes until the desired response is observed (e.g., improved urine output, improved mentation, normalizing base deficit). It is recommended that fluid be warmed to body temperature if large quantities are transfused rapidly so as to prevent hypothermia.

MAINTENANCE FLUIDS

Maintenance fluids maintain hydration, electrolyte, and acid-base status and avoid catabolism in postoperative patients who cannot tolerate oral or enteral intake. For maintenance, the fluids used are mainly isotonic or hypotonic with added dextrose and potassium (Table 1). Five percent dextrose water can also be used as maintenance fluid to stimulate

TABLE 1: Composition of commonly used intravenous fluids

Fluid	*pH*	*Na^+ mEq/L*	*Cl^- Eq/L*	*K^+ mEq/L*	*Ca^{2+} mEq/L*	*Other*	*mOsm/L*	*Comments*
Plasma	7.4	140	100	4	24	Glucose – 0.85	290	–
0.9% NaCl (normal saline)	5.5	154	154	0	0	0	308	Fluid choice for replacement, watch for hyperchloremic acidosis
Lactated Ringer	6.5	130	109	4	3	Lactate 28 mEq/L	275	Fluid choice for replacement
Dextrose 5% (D 5%)	4.5	0	0	0	0	Dextrose 50 g/L	285	Free water, hypotonic
Dextrose 5% lactated Ringer	5	130	109	4	3	Dextrose 50 g/L	275	Initial postoperative maintenance
Dextrose 5% normal saline	4	154	154	0	0	Dextrose 50 g/L	308	Initial postoperative maintenance
Dextrose 5% normal saline 4.5%	4	77	77	0	0	Dextrose 50 g/L	154 + 285	Hypotonic
Dextrose 5% normal saline 2.5%	4	34	34	0	0	Dextrose 50 g/L	68 + 285	Hypotonic

basal insulin secretion and prevent muscle breakdown. For postoperative patients with normal organ function, a volume of maintenance fluid between 1 and 1.5 mL/kg/h will meet requirements. However, if patient is not fit for enteral nutrition even after 5–7 days, muscle breakdown may take place without adequate nutritional support and hence parenteral nutrition is indicated.

A common formula to calculate daily maintenance fluids is: 1500 + [(weight in kg–20) × 20]. For example, a 60 kg patient would need: 1500 + [(60–20) × 20] = 1500 + [40 × 20] = 1500 + 800 = 2300 mL.

The daily requirement of sodium is 1–2 mEq/kg body weight, whereas the daily potassium requirement is 1 mEq/kg body weight. The daily requirement of dextrose is 50–100 g/day. This is the minimum requirement to prevent starvation ketoacidosis.

Keeping the above facts in mind, it can be appreciated that most of the commonly used fluids such as normal saline, lactated ringer and dextrose normal saline have more than required quantity of sodium (Table 1). However, most of the fluids are deficient in potassium (K). The only fluid which contains potassium is RL (4 mEq/L), however even if 2 L of Ringer is given, it will give only 8 mequivalents of potassium, which is grossly inadequate. Thus, in a postoperative patient who needs intravenous fluids for >1–2 days, replacement of certain electrolytes like potassium becomes crucial to avoid complications like paralytic ileus.

The ideal maintenance fluid which provides the daily requirement of sodium, potassium and glucose would be D5 half (4.5%) normal saline with 20 mEq of added potassium per liter of fluid infused (Table 1).

The maintenance regimen given above can be continued unless one of the following events:

- If the serum sodium starts to fall, a more concentrated solution should be given (e.g., isotonic saline)
- If the serum sodium starts to rise, a more dilute solution should be given (e.g., one-quarter isotonic saline)
- If the serum potassium starts to fall, more potassium should be added, and, if it rises above normal, potassium should be corrected.

IMPORTANCE OF ELECTROLYTE BALANCE IN THE POSTOPERATIVE PERIOD

Postoperative patients are at a risk of developing electrolyte imbalance because of the trauma of surgery, release of stress hormones, intravenous fluids, blood transfusion, acid base disorders and also due to the underlying medical and surgical conditions of the patient. Electrolyte imbalance can be a life-threatening condition and can lead to sudden cardiac arrest. It is also responsible for postoperative ileus, seizures, and arrhythmias. Hence, it is very important for all clinicians to be familiar with the management of this condition.

All postoperative with the following conditions should have daily electrolyte testing:

- Continuous intravenous fluid administration
- Blood transfusion
- Fluid resuscitation (e.g., fluid boluses for hypovolemia)
- Major organ dysfunction (cardiac, renal, hepatic)
- Head injury (e.g., traumatic brain injury, neurosurgery)
- Continuous bladder irrigation
- Abnormal bodily fluid losses (e.g., high-output ostomy)
- Ileus
- Parenteral nutrition.

More frequent assessment is required in patients who are receiving fluids or blood >50 mL/kg/day and in women who have abnormal electrolyte values and need correction.

REPLACEMENT OF ELECTROLYTES

Deficiencies of potassium, calcium, magnesium, and phosphates should be detected and treated before it leads to the above mentioned problems.

Potassium

As discussed above, hypokalemia is a common problem encountered during the postoperative period. This can be managed by adding injection of potassium chloride to the maintenance fluids, e.g., dextrose in normal saline or dextrose half normal saline. Typically about 20 mEq are added per liter. The rate of infusion should not be >10 mEq/h. In severe hypokalemia, if faster correction is desired then the infusion rate can be increased to 20 mEq/h but this requires continuous electrocardiographic monitoring.

Sodium

Hyponatremia in postoperative period is to be treated by infusion of normal (0.9%) saline. No hypotonic fluid like D5W or half saline should be used in these patients. It is important to note that patients with any brain conditions (e.g., hepatic encephalopathy, posterior reversible encephalopathy syndrome) tolerate hyponatremia poorly as the brain edema can be worsened. For the same reason, these hypotonic fluids should be avoided in preeclampsia/eclampsia patients.

Magnesium

Magnesium levels need to be corrected to facilitate treatment of hypokalemia and hypocalcemia. For each 0.4 mg/dL below the target serum magnesium level, the authors' give 2 g (8 mmol) magnesium sulfate intravenously.

Calcium

Ionized (unbound to albumin) calcium is a better indicator of calcium function as compared to total calcium levels. For each 0.15 mg/dL below the targeted ionized calcium level, 1 g of calcium gluconate is administered intravenously. For severe (level <75% of normal) or symptomatic hypocalcaemia, calcium chloride, which provides three times the amount of elemental calcium per gram (compared with calcium gluconate) is preferred.

ELECTROLYTE EXCESS

Potassium

Potassium excess is normally seen in renal disorders or in women on drugs which inhibit the renin-angiotensin-aldosterone system. Emergency treatment is required when there are electrocardiographic changes (tall peaked T waves, widened QRS, bundle branch blocks, ventricular fibrillation, asystole) in the presence of potassium levels >5.5–6 mmol/L. As hyperkalemia with ECG changes can lead to cardiac arrest, the immediate drug which can inhibit the depolarization effect of potassium is calcium. It is given as 10 mL of 10% calcium gluconate over 2–3 minutes with cardiac monitoring. The effect starts immediately and lasts for only 60 minutes. Hence, it is always combined with more long lasting therapies such as infusion of 10 units insulin in 500 cc 10% dextrose over 60 minutes or 10 units insulin in 50 mL of 50% dextrose. The effect of these lasts for 4–6 hours. Nebulization with albuterol is also used adjunctively. Cation exchange resins such as sodium polystyrene sulfonate are used in chronic renal disease. The other emergent treatment for hyperkalemia is hemodialysis.

Sodium

This situation may arise if there is loss of fluid or excessive transfusion of normal/hypertonic saline. Treatment is administration of either free water by mouth/Ryles tube or infusion of hypotonic solution like D5W.

CONCLUSION

Fluids and electrolyte balance is one of the cornerstones of postoperative patient management. The implications of electrolyte imbalance can be critical and life-threatening and hence it is imperative for all clinicians to manage this aspect of post op care diligently and with due care.

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10

CHAPTER

Blood Component Therapy

Alpesh Gandhi

INTRODUCTION

Blood component therapy is an essential and important aspect of high risk pregnancy and critical care in obstetrics. The World Health Organization (WHO) strategy for blood safety emphasizes the need to reduce unnecessary transfusions. The inappropriate transfusion rate is around 15–45%, either due to transfusion in non indicated cases or due to too late or too little transfusion in indicated cases. In the countries of the South-East Asia region Region, obstetric cases need blood the most and account for 30% of total transfusions (WHO, 2010). It is a myth that when hemorrhage occurs, patient loses whole blood and only whole blood should be given and it will take care of all. The fact is that the use of whole blood is an unscientific, inefficient, unhealthy, and criminal waste of a valuable resource (WHO).

GOALS OF BLOOD COMPONENT THERAPY

- To restore intravascular volume
- To restore the oxygen capacity of blood by replacing red blood cells
- To replace clotting factor and correction of anemia.

WHOLE BLOOD AND BLOOD COMPONENTS

A sample of 350 mL/450 mL of blood is collected from a donor into a plastic bag containing an anticoagulant. This is called 1 "unit" of whole blood. Whole blood can be separated into "blood components." Types of blood components are red blood cell concentrate (packed red blood cells), platelet concentrate, fresh frozen plasma (FFP), cryoprecipitate, separated by differential centrifugation. Others include plasma proteins—intravenous immunoglobulin G coagulation factors, albumin, anti-D, growth factors, and colloid volume expanders. Apheresis may also be used to collect blood components.

Storage requirement for blood components is different. Whole blood is stored at 4–6°C, red cells at 4°C, platelets at 22–24°C (on shaker), FFP at –20 to –30°C, cryoprecipitate is stored at –20 to –30°C. So when whole blood is given, FFP and cryoprecipitate have already lost its functions. Similarly, shelf life of each component is also different. For red cells it is 35–40 days, for FFP/cryopoor plasma—1 year, for platelets —5 days, for cryoprecipitate—1 year, and for white blood cells—2 days. So when whole blood is given to a patient who requires only red cells, unnecessary FFP and cryoprecipitate will be wasted which otherwise could have been separated, stored, and used later on in a patient who requires it. On comparing packed red cells with whole blood, former has low volume which is good to prevent overload and has low citrate, low sodium, low potassium, low ammonia, and low unwanted plasma than whole blood which are responsible for more complications of blood transfer. Whole blood is also not rational for better patient management as concentrated dose of required components which are low in quantity is also useful to avoid circulatory overload, to minimize reactions, and to decrease cost of management.

COMMON TERMINOLOGY USED

There should be an understanding on the terminology to be used for blood components between blood bank staff and clinical staff to avoid any misinterpretation in emergencies. Extremely urgent can be used when blood is required within 15 minutes, very urgent means within an hour, urgent means within 2–3 hour and on the same day for during the day.

DO BLOOD COMPONENTS NEED WARMING BEFORE TRANSFUSION

Warming blood or blood products is not normally necessary. It is often sufficient to keep patient warm during transfusion; however, when numerous units of blood are administered

quickly, it may be necessary or desirable to warm the blood products. Warming of blood products should be done using a blood warmer device that is licensed for it which has visible thermometer and audible warning alarm. The device should not allow the temperature of blood to exceed 42°C.

IMPORTANT TIPS ON BLOOD AND BLOOD COMPONENT THERAPY

In appropriate cases, it is advisable to keep blood ready rather than not keeping it. Separate and specific consent is to be taken for the same in advance. Prior to transfusion, written and informed consent from the patient should be taken as blood transfusion involves additional risk. The blood bag which has been kept for >4 hours at room temperature or pack that has been opened or shows any sign of deterioration should be discarded.

Choosing the Donors

While choosing the donors, preference should never be first relation, as first relation blood has 50% human leukocyte antigen match white cells especially lymphocytes. These cells remain viable in recipient circulation and develop their clones of cells, producing antibodies which act on recipient cells. Worst fatal rare complication graft versus host disease can take place in 3 weeks which has nearly100% mortality.

Fresh Blood

Whenever it is possible, fresh blood should not be used. Ultra fresh blood is the immediately unrefrigerated collected blood and fresh blood is the blood stored within 24 to 48 hours of collection. Any stored refrigerated blood for >6 hours, platelets lose its function. For >24 hours, all clotting factors lose their property to prevent bleeding. Before component therapy, whole blood was the principal product available and it was known that components like platelets and coagulation factors were present in full for few hours, so at that time fresh blood was justified. In fresh blood, proper screening of blood is not possible. Risk of disease transmission is more as intracellular pathogens [cytomegalovirus (CMV), human T cell lymphotrophic virus type 1 (HTLV)] can survive in leukocyte in fresh blood. *Treponema pallidum* can survive for 72–96 hours in stored blood, malarial parasite can survive up to 72 hours in stored blood. If <24 hours stored whole blood is transfused, there is risk of transmission of malaria and *T. pallidum*. This risk is eliminated if >72 hours stored blood is transfused. Fatal reactions are more with fresh blood because of presence of viable lymphocytes and granulocytes.

Blood Component Transfusion

Transfusion of FFPs, platelets, and cryoprecipitates should not be given only on the basis of clinical suspicion unless there is delay in obtaining results of blood counts and coagulogram.

Blood Component Compatibility

Fresh frozen plasma and cryoprecipitate should ideally be of same blood group of recipient. However, if unavailable, FFPs of different blood group can be given, provided the unit does not have high anti-A or -B activity. Anti-D prophylaxis is not required if Rh-D negative women receive Rh-D positive FFPs or cryoprecipitates. The platelets should ideally also be ABO group compatible. Rh-ve women should receive Rh negative platelets. Injection of anti-D will be needed if the platelets are Rh positive and the recipient Rh negative.

Cytomegalovirus Screening

Cytomegalovirus (CMV) seronegative red cells and platelets should be used for CMV seronegative pregnant women. Cytomegalovirus screening is necessary; however, urgent transfusion should not be delayed if CMV seronegative components are not immediately available.

Factor VIIa

It has a pivotal role in initiating the process of blood coagulation. The introduction of rFVIIa has stimulated interest in its use in patients with intractable bleeding despite corrective measures, such as replacement of plasma coagulation factors, fibrinogen, platelets, and red cells. The availability and use of rFVIIa is limited and owing to its financial cost, it is advisable to keep rFVIIa in the blood bank stock in case of any bleeding emergency. Prerequisites for using rFVIIa, before administering rFVIIa, are Hb levels should be preferably above 7 g/dL, platelet levels should be >50,000/cumm, and fibrinogen level of a minimum of 100 mg/dL, preferable >150 mg/dL must be ensured before administration of rFVIIa. In case these parameters are deranged, they must be corrected by using appropriate therapy before rFVIIa administration. Also, correction of the pH to ≥7.2 is recommended before rFVIIa administration because efficacy of rFVIIa decreases at a pH ≤7.1. If required, bicarbonate may be used to elevate the serum pH.

Calcium Gluconate

Donated blood is stored in bag containing anticoagulant Citrate. Citrate binds with calcium in the blood and thus depletes the concentration of free calcium in the blood. In adults rapid liver and kidney metabolism of citrate usually prevents this. If >3 bags are given to a person in a row within a day, then body may not cope up with rate of decline of free calcium. Therefore, extra calcium is to be given for that purpose. Hypocalcemia with hypothermia and acidosis is dangerous and will decrease cardiac output, causes bradycardia and dysrhythmia thus calcium gluconate indicated here.

Monitoring During Transfusion

Vital signs, temperature, pulse, respiration rate, blood pressure, and oxygen saturation must be taken before starting

blood products. Vital signs should be repeated at minimum 15 minutes after infusion has started, at every 30 minutes during transfusion and at the end of transfusion, patient should be informed of possible adverse effects of transfusion.

MASSIVE TRANSFUSION

Major hemorrhage is defined as blood loss >2,000 mL or rate of blood loss of 150 mL/min, or 50% blood volume loss within 3 hours. It may result in a decrease in hemoglobin >4 g/L, or an acute transfusion requirement of >4 units. Goals of therapy for massive hemorrhage are to restore intravascular volume, maintain tissue oxygen delivery, and eliminate the source of hemorrhage.

Immediately insert two large intravenous cannula. Take blood at the same time for urgent cross match (type specific), full blood count and coagulation screen. Start volume replacement with up to 1–2 L of crystalloid. Follow plasma expanders until the blood is available. Dextran should be avoided as it has been associated with bleeding due to decreased platelet adhesions and dilution of clotting factors. It also interferes with subsequent cross match. Foley's catheter should be inserted to monitor urine output. Monitor central venous pressure and arterial pressure. The recognition and removal of the underlying cause is an important part of the management of obstetric hemorrhage. To discuss medical and surgical obstetric management of massive hemorrhage, it is not the aim or scope of this article. Besides, the main therapeutic endeavor remains replacement of massive blood loss.

Massive Transfusion Protocol

It is different in different institutes but it usually known as a rule of 4 or rule of 6. In patients likely to need massive transfusion, begin resuscitation with blood products as soon as possible to prevent dilution coagulopathy. Administer blood products in a ratio of 4 units packed red blood cells—4 units FFP, 4 units platelets, and 4 cryoprecipitate.

COMPLICATIONS

Blood transfusion can be associated with many mild to fatal complications. There is a risk of transfusion transmitted diseases. Risk for infection from transfusion for hepatitis C in 1:103,000, hepatitis B in 1:64,000, and HIV in 1:493,000. Disorders of excessive neutrophil function like respiratory distress syndrome, transfusion-related acute lung injury, and multiple organ failure can occur which are fatal. Once patient is stable, the risks of transfusion far outweigh the benefits of transfusion and so transfusion should be given only when indicated.

Common transfusion reactions can be immune mediated and nonimmune mediated.

Transfusion complications:

- Acute transfusion reactions
- Chronic transfusion reactions
- Transfusion related infections.

Acute transfusion reactions:

- Acute hemolytic reactions
- Febrile reactions
- Allergic reactions
- Transfusion related acute lung injury
- Coagulopathy with massive transfusions
- Bacteremia.

CONCLUSION

A blood transfusion should never be ordered unless it is worth the risk. Blood transfusion is lifesaving but can lead to life-threatening complications. Single unit transfusion has no significant therapeutic benefit. Blood should be used only in those conditions when equally effective alternatives cannot be used. Moreover, the collected blood should be separated into its components and used in conditions with specific requirements for optimal utilization. The aim is to reduce unnecessary blood transfusions, promoting proper use of blood and its components and to minimize its complications. One should ensure the rational use of blood components, meaning the right patient should get the right product in the right amount at the right rate at the right time.

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11

CHAPTER

Perioperative Thromboprophylaxis

Niharika Dhiman, Shefali Gupta

INTRODUCTION

Venous thromboembolism (VTE), encompasses pulmonary embolism (PE), and deep vein thrombosis (DVT), it is a preventable cause of morbidity and mortality in surgical patients. It is estimated that, without appropriate mechanical or pharmacological thromboprophylaxis, approximately 5–45% of patients undergoing gynecological surgery will experience either symptomatic or asymptomatic DVT. Almost 20% of these patients will develop thrombus in the popliteal and femoral vessels, and of theses 40 % will progress to PE with high risk of mortality. The risk of VTE is particularly higher in patients undergoing surgery for malignant disease. It is estimated to be 40–80% in the absence of routine thromboprophylaxis, while approximately 10–20% of patients will develop proximal DVT. SymptomaticPE may occur in up to 4–10% of surgical cancer patients. Overall, surgery for cancer confers a nearly 7-fold higher risk of perioperative PE when compared to similar surgical procedures for benign disease.

In contrast to the characteristic symptoms of established DVT resulting from painful vessel wall distension, inflammation, and/or venous blood flow obstruction, there are no clinical signs that can reliably indicate early DVT development. Moreover, non-invasive tests, such as compression ultrasonography, have limited sensitivity for a diagnosis of asymptomatic DVT. Even asymptomatic DVT harbours a significant risk of developing a post thrombotic syndrome, and most fatal PEs may occur without clinical notice. Thromboprophylaxis is, therefore, the most effective strategy to reduce morbidity and mortality in surgical patients considered at risk for VTE. However, both the indication and the choice of thromboprophylaxis should be individualized and adapted according to the risk assessment.

CARE PATHWAY FOR THROMBOPROPHYLAXIS

- Assess level of mobility, VTE, and bleeding risks (Box 1). Significantly reduced mobility is defined as "bed bound, unable to walk unaided or likely to spend a substantial proportion of the day in bed or in a chair >3 days"
- Balance risks of VTE and bleeding
- Choose appropriate method of thromboprophylaxis
- Do not offer pharmacological prophylaxis if bleeding risk outweighs risk of VTE
- Reassess VTE and bleeding risk within 24 hours of admission and whenever the clinical situation changes. If the VTE or bleeding risk changes during the admission, the VTE prophylaxis must be reviewed and adjusted as appropriate.

RISK FACTORS FOR VENOUS THROMBOEMBOLISM

When assessing the risk of VTE in surgical patients, both patient- and surgery-related risk factors should be considered.

BOX 1 Bleeding risk factors

Patient related

- Active bleeding
- Acquired bleeding disorders (such as acute liver failure)
- Concurrent use of anticoagulants known to increase the risk of bleeding (such as warfarin with international normalized ratio >2)
- Acute stroke
- Thrombocytopenia (platelets <75 × 109/L)
- Uncontrolled systolic hypertension (≥230/120 mmHg)
- Untreated inherited bleeding disorders (such as hemophilia or von Willebrand's disease

Patient-related Factors

They confer a moderate-to-high risk of VTE and include age <40 years for major surgery and >60 years for nonmajor surgery, obesity (moderate 75–90/>20% above ideal weight; morbid 115 kg or >30% of the ideal weight), previous VTE, malignancy, dehydration, a positive family history of VTE (i.e., VTE in a first-degree relative), prolonged immobilization, lower limb paralysis, use of hormonal therapy (estrogen-containing contraceptive therapy or hormone replacement therapy), varicose veins with phlebitis, pregnancy or <6 weeks postpartum, comorbid conditions (e.g., stroke, heart disease; metabolic, endocrine, or respiratory pathologies; acute systemic infectious diseases; inflammatory conditions), and known thrombophilia (e.g., antiphospholipid syndrome or activated protein C resistance). Although thrombophilia increases the risk of VTE, routine laboratory screening for inherited or acquired thrombophilia in surgical patients is not recommended. In addition, there is no established value of coagulation activation markers such as preoperative D-dimer or thrombin-antithrombin complexes in predicting perioperative VTE occurrence in surgical patients.

Surgery-related

These risk factors are mainly determined by the indication for surgery and the magnitude of the surgical trauma. In this regard, extensive abdominal and pelvic procedures for malignant or inflammatory conditions confer a particularly high risk of VTE. Total anesthetic + surgical time >90 minutes, surgery involving pelvis or lower limb and total anesthetic + surgical time >60 minutes, surgery with significant reduction in mobility. Laparoscopic procedures should be attributed a VTE risk similar to that of the corresponding conservative approaches.

The American College of Chest Physicians utilizes a risk stratification model based on two previously validated risk factor point systems Rogers Score and Caprini Score. In contrast to the Rogers Score, the Caprini Score is relatively easy to use and appears to discriminate reasonably well among patients at very low (0–1 point), low (2 points), moderate (3–4 points), or high (≥5 points) risk and the observed risk of VTE (%) is 0, 0.7, 1, and 1.9, respectively.

All VTE risk categories should receive basic measures of thromboprophylaxis such as early mobilization, active or passive range of motion exercise, and avoidance of dehydration, routine pharmacological thromboprophylaxis, preferably with low-molecular-weight heparin (LMWH), is only indicated in patients at moderate or high risk of VTE.

THROMBOPROPHYLAXIS

- Basic measures
- Mechanical thromboprophylaxis
- Pharmacological thromboprophylaxis.

Basic Measures

- All patients undergoing surgical procedures should receive basic measures of thromboprophylaxis. These include early mobilization, active or passive range of motion exercise, and avoidance of dehydration
- Oral contraceptives and hormone replacement therapy (HRT): Advise women to consider stopping oestrogen-containing contraceptives or HRT 4 weeks before surgery
- Preexisting antiplatelet therapy: Assess risks and benefits of stopping preexisting antiplatelet therapy 1 week before surgery. Consider involving the multidisciplinary team in the assessment
- Anesthesia: Consider regional anesthesia, in addition to other methods of VTE prophylaxis, as it carries a lower risk of VTE than general anesthesia. If regional anesthesia is used, plan the timing of pharmacological prophylaxis to minimize risk of epidural hematoma.

Mechanical Thromboprophylaxis

Mechanical methods serve to prevent venous stagnation in the lower limbs by promoting venous outflow. Mechanical methods can be used as monotherapy in all perioperative patients with low risk and along with pharmacological agents in moderate to high risk patients. These include elastic stockings with graduated compression, intermittent pneumatic calf compression (IPC) devices, and foot pumps. Of these, elastic graduated compression stockings are most widely used in clinical practice. Elastic graduated compression stockings are efficacious in preventing perioperative DVT, with an estimated risk reduction of 67%. Intermittent pneumatic compression devices produce sequential compression from distal to proximal, thereby creating a "milking" effect.

- Measure legs and use correct stocking size. Document stocking size
- If edema or postoperative swelling develops, ensure legs are remeasured and stockings refitted
- If arterial disease suspected, seek expert opinion before fitting stockings
- Encourage patients to wear the stockings day and night from admission until they no longer have significantly reduced mobility
- Remove stockings daily for hygiene purposes and to inspect skin condition
- If patient has significant reduction in mobility, poor skin integrity, or sensory loss, inspect skin two or three times per day, particularly over heels and bony prominences
- Discontinue use of stockings if there is marking, blistering, or discoloration of skin, particularly over heels and bony prominences, or if patient has pain or discomfort. If suitable, offer intermittent pneumatic compression or foot impulse devices as alternative
- Thigh-length stockings may be more efficacious in preventing VTE than calf-length stocking.

Contraindications to elastic stockings:

- Known allergy to the material of manufacture
- Suspected or proven peripheral artery occlusive disease
- Peripheral arterial bypass grafting
- Peripheral neuropathy or other causes of sensory impairment
- Dermatitis, gangrene, or recent skin graft
- Severe leg edema or pulmonary edema from congestive heart failure.

Pharmacological Thromboprophylaxis

Surgical patients with moderate or high risk of VTE should be considered for pharmacological thromboprophylaxis.

Low-dose Unfractionated Heparin

It is a mixture of mucopolysaccharides of various chain lengths with an elimination half-life of 1–2 h that exerts its anticoagulant effects mainly through the enhancement of antithrombin-dependent inhibition of thrombin and factor Xa. It is used in a dose of 5,000 U subcutaneously 2 hours prior to surgery followed by 5,000 U every 12 hourly after surgery for 5 days. In patients with previous history of VTE or with multiple risk factors, 5,000 U 8 hourly should be used.

Low-molecular-weight Heparins

They are produced by depolymerizing unfractionated heparin (UFH) to generate heparin chains with a mean molecular weight one-third that of UFH (i.e., 5,000 Da and 15,000 Da, respectively) and have an average elimination half-life of 4–6 h. Similar to UFH, LMWHs inhibit factor Xa and, to a lesser extent, thrombin in antithrombin-dependent manner and are excreted predominantly via the kidneys, which requires particular caution in patients with severe renal insufficiency.

Compared to UFH, LMWHs have improved pharmacological properties including a more predictable bioavailability. For pharmacological thromboprophylaxis, most LMWHs are administered as fixed doses once per day (i.e., routine dose adjustments based on the patient's body weight are not required). Based on their overall safety and efficacy profile, the significantly reduced risk of heparin-induced thrombocytopenia and probably also of osteopenia, and the convenience of once daily injections, LMWH is preferred over low dose UFH for pharmacological thromboprophylaxis in surgical patients. Drugs available are enoxaparin, daltaperin, fragmin, and lovenox.

Enoxaparin Dosing

- Mild or no renal impairment (eGFR >30 mL/min/1.73 m^2) – enoxaparin 40 mg once a day
- Moderate renal impairment (eGFR 15–30 mL/min/1.73 m^2) – enoxaparin 20 mg once a day
- Severe renal impairment (eGFR <15 mL/min/1.73 m^2) – heparin 5,000 units twice a day (do not use LMWH)
- Enoxaparin 20 mg OD for patients with bleeding risk and significant VTE risk.

Rapid reversal of enoxaparin if bleeding occurs—administer 40 mg intravenously protamine sulfate given slowly at 5 mg/min. This may need to be repeated due to the continuous absorption of enoxaparin.

Fondaparinux

Fondaparinux is a synthetic pentasaccharide with an elimination half-life of 17 h that is excreted almost exclusively via the kidneys and specifically inhibits factor Xa in an antithrombin-dependent manner. It has no effect on thrombin inactivation. Fondaparinux exhibits excellent bioavailability after subcutaneous injection and is given once daily at a dose of 2.5 mg per day. It can be used in cases where the use of LDH and LMWH is contraindicated. Compared to the LMWH, enoxaparin, fondaparinux is associated with an almost 50% reduction in thromboembolic events in patients undergoing major surgery, but this superior efficacy may be somewhat counterbalanced by a slightly increased risk of bleeding, especially when the factor Xa inhibitor is administered too early (i.e., before 6 h) after surgery.

When these agents are given in prophylactic doses, anticoagulation monitoring is not required.

Vitamin K Antagonists

Vitamin K antagonists such as warfarin or phenprocoumon are indirect anticoagulants that inhibit the production of functional clotting factors II, VII, IX, and X. Vitamin K antagonists are efficacious in preventing perioperative VTE, but their rather slow onset of action (2–3 days) and narrow therapeutic window necessitating regular monitoring of the international normalized ratio and frequent dose adjustments limit their use in clinical practice.

Direct Oral Anticoagulants

The direct oral thrombin inhibitor, dabigatran etexilate, and the direct oral factor Xa inhibitors, rivaroxaban and apixaban, which specifically and reversibly inhibit both free and clot-bound thrombin and factor Xa, respectively, are currently approved in Europe for the prevention of perioperative VTE in patients undergoing major orthopedic surgery However, none of the three drugs is currently approved for pharmacological thromboprophylaxis in other surgical indications, due to their currently unpredictable effects on hemostasis and wound healing in the immediate postoperative period.

Antiplatelet Drugs

Although the platelet inhibitor, acetylsalicylic acid, at doses of 75–325 mg per day shows some efficacy in primary and secondary VTE prevention, it should not be used for perioperative thromboprophylaxis.

Heparinoid

Danaparoid, is an antithrombin-dependent, heparin-free factor Xa inhibitor with a rather long elimination half-life of

22–24 hours. Prophylactic doses of danaparoid (750 IU anti-Xa subcutaneously per day) have shown safety and efficacy for VTE prevention in stroke and trauma patients. The current use is mainly restricted to situations in which heparin is contraindicated (e.g., due to drug allergy or a history of heparin-induced thrombocytopenia). The recombinant hirudin (lepirudin and desirudin), a direct thrombin inhibitor with a renal route of elimination that is approved, at a subcutaneous dose of 15 mg per day for primary VTE prevention, have a limited role in gynecological surgeries.

Duration of Pharmacological Thromboprophylaxis

Pharmacological thromboprophylaxis when indicated should be continued for at least 7–10 days postoperatively. Prolonged pharmacological VTE prophylaxis over 3–4 or even 5 weeks is recommended in patients at particularly high risk, including those with major cancer surgery.

Timings for Epidurals/Spinal Anesthesia

Insertion or removal of an epidural/spinal catheter should be delayed for 12 hours after administration of prophylactic doses of LMWH and may be administered 4 hours after spinal/epidural catheter removal.

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2
SECTION

Important Surgical Procedures

12

CHAPTER

Laparoscopic-assisted Uterus Retrieval from Live Organ Donors for Uterine Transplant

Shailesh P Puntambekar

INTRODUCTION

Technological advances in medical science have constantly addressed challenges in our clinical practice and have aimed at improving quality of life of patients. Treatment of absolute uterine factor infertility (AUFI) remains challenge in reproductive medicine. It is estimated that 1 in 500 women have infertility due to AUFI. In India, prevalence of AUFI could be higher. This is because of genital tuberculosis and cervical malignancy in fertile age group. Reports of successful live births after human uterus transplant have opened new door for newer research concepts. In the future, it may be established as a treatment option for women with AUFI and as an alternative to surrogacy. Uterus transplant is unique type of tissue transplant and differ from other transplant because its only aim is pregnancy. Once desired parity is achieved, the uterus is removed to prevent long-term side effects of immunosuppression. Minimal invasive technique has been applied to various organ transplants like kidney and liver with successful results. Team of China performed the world's first robotic assisted uterine transplant surgery emphasizing on benefits of minimal invasive methods for procurement of the uterus.

PREPARATION BEFORE UTERINE TRANSPLANT

A transplant team of 12 members was formed at Galaxy CARE Laparoscopy Institute, Pune, India, that included laparoscopic oncology surgeons, gynecologists, a vascular reconstructive surgeon, a transplant surgeon, an assisted reproductive technology specialist, a high-risk obstetrician, a neonatologist, an anesthetists, an intensivist, a psychiatrist, a transplant counsellor, and a transplant coordinator. Screening of the candidates was done using the modified Montreal Criteria as guidelines. After a thorough screening by the transplant team, two candidates with AUFI were found suitable, with their mothers as the donors.

In Vitro Fertilization

In vitro fertilization for recipients was done 4 weeks before the uterine transplant surgery according to the recommendations of the transplant committee. An antagonist protocol was used and continued after oocyte retrieval on alternate days for three doses. In the first recipient, four embryos were obtained and in the second recipient, eight embryos. On day 3, the embryos were frozen. Recovery of the ovaries was confirmed by ultrasound after 2 weeks.

SURGICAL TECHNIQUE

The donor uterus retrieval and recipient surgeries were performed simultaneously in different operating rooms. Preoperatively, both patients received intravenous antibiotics half an hour prior to surgery. Both donor and recipient received antifungal and antithymocytic globulin (2.5 mg/kg) 12 hours before surgery.

Bench Surgery

The uterus harvested from donor was received on a sterile trolley in tray full of ice slush and carried to the bench surgery operation room. Under operating loupe magnification and operation theatre light bench surgery carried out. Bilaterally, internal iliac and ovarian vessels were identified, dissected, skeletonized, terminal openings prepared kept ready for anastomosis. Nearly 1,000 mL custodial solution was infused through bilateral uterine and ovarian pedicles. In first case, ovarian pedicles had significantly small bilateral ovarian veins and in second case pedicles had only veins and right ovarian artery which was in confluence of 4–5 small pedicles.

Recipient Surgery

Simultaneously, the recipient surgery was started. Standard laparoscopic port placement was done under epidural and general anesthesia.

Bilateral oophorectomy was done for both donors even though they were of reproductive age because the author feared that after harvest of the ovarian vessels, the ovaries may undergo avascular necrosis.

CHALLENGES DURING SURGERY

The main challenge of venous anastomosis is the small caliber of vessels. A good vascular surgeon with experience in coronary bypass can easily overcome this difficulty, as was seen in the author's cases.

In the author's first case, the recipient had bleeding from the sutured vaginal edges after the reperfusion of the uterus. In the second patient, the author sutured the recipient's cervicovesical fascia and Denonvilliers' fascia to the donor's vagina, which prevented bleeding from the vaginal anastomosis site. This, the author believe, is the most important step. She did not have any bleeding intraoperatively and required no blood transfusion.

Most of the literature also raises concern over the elasticity and the pliability of the anastomosed vessels during pregnancy. The space required for the uterus to expand in pregnancy is less. Taking the ovarian anastomosis higher up gives adequate space for the uterus to expand cranially, minimizing any strain to the vascular anastomosis.

POSTOPERATIVE

Both donors and recipients were transferred to isolation intensive care unit (ICU) for better monitoring and later shifted to a ward. Reverse barrier nursing was provided, and aseptic precautions were taken.

Donors

The donors were shifted out of the ICU after 24 hours. Urinary catheters were removed on postoperative day 3. Their hospital stay was uneventful discharged after 1 week. Double J stents were removed after 6 weeks. After discharge, both the donors were started on hormone replacement therapy by our endocrinologist.

Recipients

The author did a hysteroscopy for both recipients as a method of surveillance for graft rejection. The cervical biopsies were taken under hysteroscopy guidance. The main purpose of doing hysteroscopic-guided cervical biopsies was to get a closer and magnified look of the cervix and at the same time take the biopsy of the cervix under vision. Routine cervical biopsy requires traction on the anterior lip of cervix with a vulsellum, which could disrupt our suture line of the transplanted uterus. This can be safely avoided with the help of office hysteroscopy because all possible angles and sides of the cervix can be visualized and biopsy taken under direct vision distention medium was used in view of aseptic precautions to prevent retrograde transmission. The author did not encounter any cervical stenosis. Office hysteroscopy of the recipients was done after 3 months post-transplant. This enabled the author to detect mild signs of rejection early on. The author believe that office hysteroscopy along with cervical biopsy gives better chances of finding the earliest sign of graft rejection and is a superior method for surveillance of graft rejection compared with traditional cervical biopsy alone. Although invasive, both patients did not have any kind of complication from hysteroscopy and are healthy.

CONCLUSION

Minimally invasive techniques for uterus retrieval are the future of uterus transplant. With many teams taking up uterine transplant trials, in the near future, uterus transplant may become a mainstay procedure offered to women with AUFI. Live birth rather than successful surgery will be the real proof needed to show that minimally invasive surgical techniques can be successful for uterine transplant.

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13

CHAPTER

Extraperitoneal Cesarean Section

Dipak A Desai, Saurabh V Patil

INTRODUCTION

We have almost conquered the mortality of cesarean section, but the morbidity of cesarean section in terms of pain, infection, and adhesions still persists. This morbidity is mainly due to the soiling or the pollution of the peritoneal cavity. When the peritoneal cavity is opened, it is subjected to the entry of organisms. It is subjected to the physical trauma of desiccation and handling, and there is chemical and immunological trauma due to the contents of amniotic fluid.

To reduce the then severe mortality of classical transperitoneal cesarean section in the pre-antibiotic era, the extraperitoneal approach was devised. The procedure was further modified by Mr Latzko, Mr Waters, and Mr Norton. This extraperitoneal approach reduced the mortality to a significant extent.

WHY THE PROCEDURE WENT OUT OF PRACTICE?

These extraperitoneal procedures required extra skill and the procedures had increased complications such as bladder and vascular injuries and also the "incision to baby delivery time" was prolonged, almost to the extent of 10–12 minutes. After the advent of antibiotics and the easier methods of transperitoneal lower segment cesarean section (LSCS) developed by Mr Monro Keer, the extraperitoneal cesarean section operation fell into disuse.

This is the authors' humble attempt to modify the extraperitoneal approach to make it as simple and as safe as the conventional cesarean section. The authors' method is almost like the conventional cesarean section, only the approach to the lower segment is different.

In the authors' study of more than 1,000 cases of extraperitoneal cesarean section, the mean time from skin incision to baby delivery has come down to 2 minutes and the mean time for the surgery is 12 minutes.

ADVANTAGES OF EXTRAPERITONEAL CESAREAN SECTION

In the extraperitoneal approach, as the peritoneal cavity is not opened, the pain due to peritonism is reduced.

- As there is no bowel handling and as the pain is reduced and ileus is reduced
- As there is minimal chance of entry of organisms, intraperitoneal infections are reduced
- There is no chance of losing a surgical mop in the peritoneal cavity
- The chance of long-term sequel of intraperitoneal adhesions is reduced
- The patient can be discharged 48 hours after the surgery

AVOIDING COMPLICATIONS DURING PROCEDURE

- The problem of bladder trauma in extraperitoneal LSCS is averted by keeping the bladder deflated (as opposed to an inflated bladder in the previous techniques) and the dissection is done lateral to the bladder initially and then continued between the two layers of cervicovesical fascia
- If proper precautions are taken there is no chance of injury to the blood vessels
- In the event of difficulty the procedure can be immediately converted to a transperitoneal procedure.

STEPS OF THE PROCEDURE

- The patient is given spinal anesthesia or general anesthesia as per requirement
- The bladder is catheterized by simple urethral catheter
- Transverse suprapubic skin incision at the natural lower supra pubic skin crease is made
- The rectus sheath is incised transversally
- Pyramidalis insertion in the linea alba is detached

- Recti are separated
- After separation of the recti, transversalis fascia is separated until the right inferior epigastric vessels are visualized (Fig. 1)
- Transversalis fascia is pierced bluntly, medial to the inferior epigastric vessels, and the fascia is stretched to widen the opening
- This exposes the lower segment covered with bladder
- The lateral limit of the bladder is demarcated by medial umbilical ligament (Fig. 2)
- The fat pad (the bladder cushion) lateral to the medial umbilical ligament is teased and bladder is pushed medially to expose the uterovesical fold of peritoneum
- Inferior to the fold is the cervicovesical fascia which has two layers (the superficial layer invests the posterior vesical surface and the deep layer invests the lower uterine segment) (Fig. 3)
- The superficial layer is opened with a knife and the space is created between it and deep layer to allow an easy access to the lower segment by pushing the bladder medially and downwards out of harm's way (Fig. 4)
- The uterus is incised transversely and the incision is extended with the help of fingers giving good space to deliver the baby. The placenta and membranes are delivered
- The same extraperitoneal approach can be achieved from the left side
- The uterus is sutured with number one polyglactin 910 in single layer starting at one end and ending in the center—

Figure 1: Transversalis fascia identified after separating the recti.

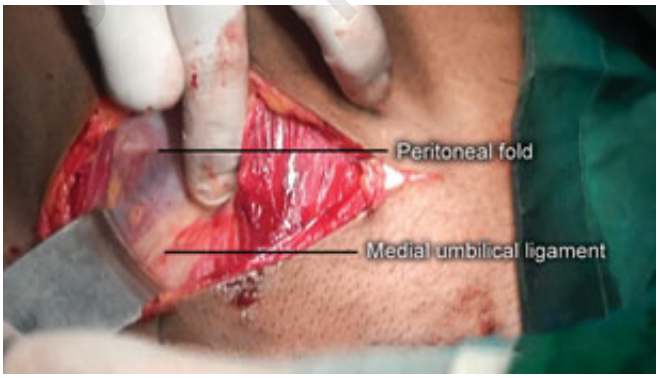

Figure 2: Lateral limit of the bladder is demarcated by medial umbilical ligament.

Figure 3: Cervicovesical fascia lies inferior to uterovesical fold.

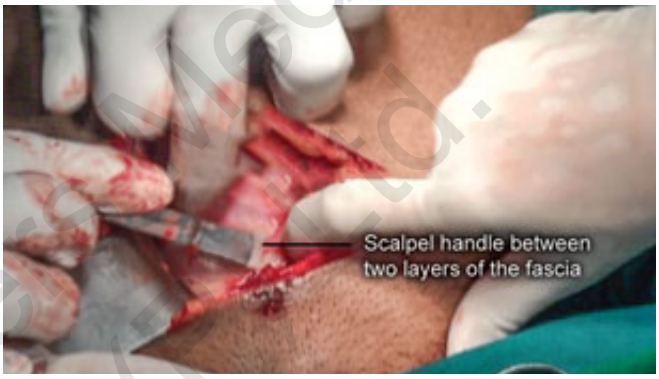

Figure 4: Space created between superficial and deep layer of cervicovesical fascia.

the same is repeated from the other corner and the knot is tied in the center. This ensures adequate hemostasis at the angle and allows us to tackle the corners properly

- Hemostasis is checked and achieved. After confirming the mop count and the instrument count, rectus muscles are approximated and rectus sheath closed with polygalctine number 0
- The skin is closed with subcuticular stitch with 910 polygalactin rapid three zero
- The simple urethral catheter is removed before patient is shifted out of operation theater.

CONCLUSION

All the extraperitoneal structures in the body (e.g., kidney, urethra, and bladder) are approached extraperitoneally to avoid the contamination of the peritoneal cavity. The lower segment of the uterus is also an extraperitoneal structure, it should be approached extraperitoneally in order to avoid the contamination of the peritoneal cavity and reduce the morbidity of cesarean section.

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14

CHAPTER

Cesarean Myomectomy

Reeta Mahey, Monica Gupta, Alka Kriplani

INTRODUCTION

First cesarean myomectomy (CM) was done by Bonney et al. in 1913 but has been discouraged by most of the authors and textbooks. To do or not to do, the procedure of CM is still controversial. Reason for the procedure not being popular is risk of atonic postpartum hemorrhage, intractable bleeding, and risk of peripartum hysterectomy. The first series of CM was published by Burton et al. in 1989 and authors concluded that elective CM can be considered safe and feasible in selected patients. Lately, due to technical advances in surgery, availability of blood products, and anesthesia expertise, the acceptance for CM is increasing. There have been reports and meta-analysis reporting the safety of CM in comparison to cesarean alone. Incidence of excessive intraoperative blood loss in CM varies from 0 to 35% depending upon size of myoma.

INDICATIONS OF CESAREAN MYOMECTOMY

- All the myomas which can be removed without or minimal hysterotomy incision are considered safe to be removed at the time of cesarean section, e.g., anterior wall, subserous pedunculated myoma (Fig. 1)
- Myomas in lower uterine segment and interfering with safe fetal extraction and suturing should be removed
- Myomas presenting with complications in pregnancy, e.g., torsion, subacute intestinal obstruction, and degeneration are considered for removal
- Any myoma can be removed while doing cesarean section to give advantage of two surgeries at one time provided the operating obstetrician/gynecologist is expert in carefully selecting the patients weighing the benefits and risks of the surgery
- Patient's choice is vital while planning for cesarean myomectomy. Counseling should be done with potential benefits and risks of the surgery. This is important in primigravida patients when there is question of future fertility.

FACTORS AFFECTING SUCCESS OF CESAREAN MYOMECTOMY

- Obstetrician/gynecologist's experience: Most important factor for the success of the procedure is proper case selection and surgical expertise
- Size of myoma: Large myomas (>5 cm) are more difficult to manage due to risk of intractable hemorrhage and inadvertent hysterectomy. Cesarean myomectomy is found to be equally safe in larger myomas in expert hands
- Location of myoma: The procedure is safest in single anterior wall or lower segment myomas especially in subserous and pedunculated myomas. In patients with myomas with close proximity to large blood vessels, highly vascular myomas, CM should be avoided due to risk of intractable hemorrhage, vascular injury, and risk of peripartum hysterectomy
- Number of myoma: The safety of cesarean myomectomy in solitary myomas has been documented in retrospective series and case studies. The risk of intraoperative bleeding and atonic postpartum hemorrhage (PPH) is more in patients with multiple myomas. In case of multiple myomas, only those which can be removed easily (subserous, pedunculated) without much myometrial defect and minimal hysterotomy incisions should be removed
- Previous history of abdominal myomectomy: The success of CM is affected if there is previous history of myomectomy. Difficulty may be encountered due to scarred uterus and adhesions of previous surgery.

CONTRAINDICATION TO CESAREAN MYOMECTOMY

- Presence of hypotonic/atonic uterus
- Close proximity of myoma to adjacent blood vessels
- Highly vascular myoma with thick vascular pedicle
- Multiple myomas requiring multiple hysterotomy incisions
- Presence of congenital or acquired coagulopathy
- Moderate to severe anemia

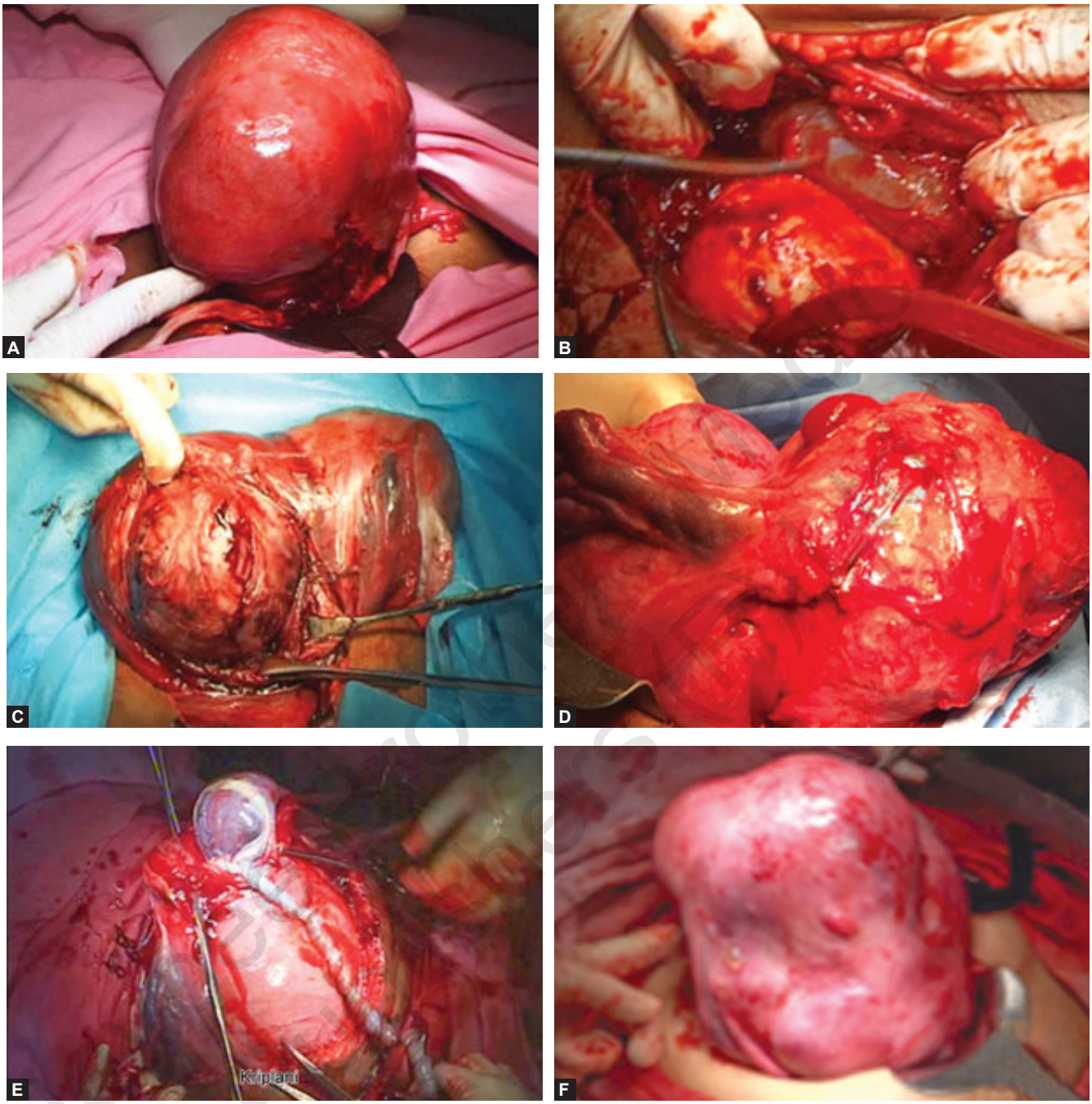

Figure 1: Different locations of myoma . **A,** Anterior wall intramural/subserous myoma; **B,** Submucous myoma in lower uterine segment presenting at incision line; **C,** Type 1 submucous myoma; **D,** Right broad ligament myoma; **E,** Large cervical myoma; **F,** Multiple myoma in patient with previous myomectomy.

- Nonavailability of expert surgeon.

Various techniques have been discussed in literature regarding the procedural steps and different methods to avoid excessive blood loss during surgery.

Main procedural steps of CM are as follows:

- Transverse/vertical abdominal incision is given depending upon size, number, and location of myoma
- Assessment is done and baby is delivered. If fibroid was in lower uterine segment, then a higher transverse/vertical incision is given
- Injection of 30 IU oxytocin is given intravenously after delivering baby
- Uterine contraction ensured before proceeding with myomectomy.

METHODS TO REDUCE BLOOD LOSS DURING SURGERY

- Injection of carboprost 0.25 mg intramuscularly
- Injection of methergin 0.2 mg intravenously

- Applying hot mops to the exteriorized uterus
- Tablet of misoprostol 1,000 μg per rectal
- Bilateral uterine artery ligation
- Bilateral internal iliac artery ligation
- Intermittent clamping of infundibulopelvic ligaments
- Once uterine contraction is ensured, diluted vasopressin is injected (20 IU in 200 mL normal saline) into the subcapsular space of the myoma
- Incision over the myoma is given and enucleation was done using electrocautery and blunt dissection
- Myomectomy is done by dissecting in correct plane and being inside the myoma capsule
- The myoma bed is sutured with barbed sutures (V-LocTM180)
- Hemostasis is ensured and intra-abdominal drain is inserted if required
- Injection of 20 IU/500 mL oxytocin infusion is continued for the first 24 hours after CM.

RISKS AND PITFALLS OF CESAREAN MYOMECTOMY

- Intractable hemorrhage: Main risk associated with CM is intractable hemorrhage. Bleeding may be either due to atonic PPH or from the myomectomy sites. This is because of high vascularity of the gravid uterus
- Need of blood transfusions: Due to excessive blood loss during CM these patients are at risk of multiple blood transfusions during intrapartum and postpartum period. Therapeutic dose oral iron or injectable iron therapy should be given in antenatal period and hemoglobin should be kept >12 g/dL
- Prolonged operative time and hospital stay
- Risk of peripartum hysterectomy
- Maternal morbidity (postoperative fever, paralytic ileus, puerperal sepsis)
- Need of reoperation due to intra-abdominal hemorrhage
- Need of ICU care in postoperative period
- Placental implantation abnormalities in next pregnancy
- Uterine scar integrity and healing: As there are constant uterine contractions in the postpartum period during involution phase, healing will be delayed compared to myomectomy scar in a nongravid uterus.

ADVANTAGES OF CESAREAN MYOMECTOMY

Though traditionally not accepted, the procedure of CM has its own advantages over interval myomectomy.

- For same size of myoma, incision required is smaller at the time of cesarean compared to nongravid uterus
- Myomectomy itself is technically easier to perform, due to easier identification of cleavage planes
- Due to more elasticity of gravid uterus, closure of uterine defect after myomectomy is easier compared to nongravid uterus
- Regular uterine contractions in postpartum period and physiological involution in the puerperium further reduce hemorrhage
- Hypertrophied uterine muscles contract more strongly, thus occluding the vessels. With the addition of uterotonic drugs, hemorrhage and hematoma formation at the myomectomy site can be further prevented
- It is technically easier to visualize ascending uterine artery against light after exteriorizing uterus. It may be required either prophylactically in large vascular myoma or as a measure to avoid excessive bleeding
- There is advantage of two major surgeries being performed safely at one time. This reduces the overall cost, anesthesia risks to the patient, surgical morbidity, exorbitant costs of operative procedures, hospital stay, and overall improvement in symptoms and quality of life
- Leiomyoma if left *in situ* has its own complications in postpartum period and in future pregnancies.

In last 5 years, the authors' have performed CMs on 60 women. Three women conceived, one patient delivered vaginally, and two patients underwent cesarean with repeat CM due to recurrent myoma. A part of this data has been accepted for publication. The author found higher blood loss in women with >5 cm myoma though the difference was not statistically significant. The duration of surgery was significantly higher in patients with larger myomas. None of the patients underwent cesarean hysterectomy.

CONCLUSION

Cesarean myomectomy can be considered safe and feasible if the surgeon is experienced in myomectomy in nongravid uterus and careful selection of cases is done. The procedure may be planned even in large leiomyomas. If two procedures can be safely performed at same time, the risk of anesthetic complications, multiple surgeries, adhesions, and intra- or postoperative hemorrhage, exorbitant costs of operative procedures and hospital stay could be reduced.

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15

CHAPTER

Surgical Management of Postpartum Hemorrhage

Sheela V Mane

INTRODUCTION

Severe bleeding after delivery is still the most significant cause of maternal death. It accounts for nearly one quarter of all maternal deaths worldwide and 90% of maternal deaths due to postpartum hemorrhage (PPH) are preventable.

Trends in maternal mortality specifically due to hemorrhage over 20 years in rural India found that obstetric hemorrhage was the contributory cause of maternal mortality in 19.9% of the cases. The leading cause of fatal hemorrhage was postpartum hemorrhage due to an atonic uterus. In a detailed and critical analysis, Mukherji et al. showed that 58.0% of the cases of maternal death due to hemorrhage were actually due to PPH, mainly stemming from the lack of provision of emergency transport at community level.

Women are not dying because of a disease we cannot treat. They are dying because societies have yet to make the decision that their lives are worth saving

– Mamoud Fatulla, President FIGO, World Congress, Copenhagen, 1997

CAUSES

Causes for PPH may be considered to relate to one or more of the four Ts:

- Tone (abnormalities of uterine contraction)
- Tissue (retained products of conception)
- Trauma (of the genital tract)
- Thrombin (abnormalities of coagulation).

MANAGEMENT

A systematic and stepwise management of PPH can be achieved with the use of mnemonic "HAEMOSTASIS." The mnemonic is conveniently divided in to two parts—medical and surgical (Box 1).

Surgical Management

Surgical management of PPH is contemplated when medical management and other conservative methods like tamponade fail and has traditionally relied on hysterectomy and ligation of internal iliac arteries. However, over the last few years, a number of newer and simpler techniques which preserve fertility are in vogue prior to resorting to more complicated major surgical procedures.

Abd Rabbo reported a stepwise devascularization procedure for intractable PPH not responding to classical management. He reported hysterectomy avoidance rate of 100% in 103 case series.

BOX 1 Hemostasis mnemonic

General medical management

- H—Ask for help
- A—Assess (vital parameters blood loss) and resuscitate
- E—Establish etiology, ecbolics, ensure availability of blood
  - Establish etiology: 4 Ts—tone, tissue, trauma, thrombin
  - Ecbolics (syntometrine, ergometrin, bolus syntocinon)
  - Ensure availability of blood and blood products
- M—Massage the uterus
- O—Oxytocin infusion, prostaglandins (intravenous, rectal, intramuscular, intramyometrial)

Specific surgical management

- S—Shift to operating theatre
  - Bimanual compression
  - Anti-shock garment especially if transfer is required
- T—Tissue and trauma to be excluded and proceed to tamponade balloon, uterine packing
- A—Apply compression sutures
- S—Systematic pelvic devascularization (uterine, ovarian, quadruple, internal iliac)
- I—Interventional radiology, uterine artery embolization
- S—Subtotal or total abdominal hysterectomy

Stepwise uterine devascularization consists of:

- Right uterine artery ligation
- Left uterine artery ligation
- Low bilateral uterine artery ligation
- Right ovarian vessel ligation
- Left ovarian vessel ligation.

Uterine Artery Ligation

Uterine artery ligation is one of the easiest and most effective surgical measures to control PPH. Bilateral uterine ligation as described by O'Leary and O'Leary (1974) accomplishes the same goal and easier and quicker to perform. The uterine arteries supply 90% of the blood to the uterus; therefore, ligation drastically decreases blood flow and subsequent blood loss. Despite this percentage, the surgeon should not worry about resultant uterine necrosis, as adequate blood supply is still available (Fig. 1).

Procedure

First, the uterovesical fold of peritoneum is identified and incised transversely in order to mobilize the bladder inferiorly. Next, the uterus is exteriorized for full exposure in order to identify an avascular window in the broad ligament. If an avascular area is not readily apparent, the surgeon may use the lateral border of the uterus. A number 1 chromic catgut or polyglycolic suture should be used to make a posterior to anterior stitch through the myometrium at a site 2–3 cm medial to the uterine artery. The needle is returned anterior to posterior through the avascular window at a site just below the level of the uterovesical peritoneal reflection. The two ends are tied securely, completing the ligation. The ureters, bladder, and bowel should all be inspected for inadvertent trauma before repeating the procedure on the contralateral uterine artery.

Low Uterine Artery Ligation

Bladder is pushed further down and a similar stitch is taken about 3–5 cm below the above stitch and procedure repeated on the opposite side.

Utero-ovarian Artery Anastomosis Ligation

Ligation of the utero-ovarian artery anastomosis is similar to the uterine artery ligation. An avascular area is identified in the meso-ovarium, just inferior to the utero-ovarian ligament. Using this site as a securing point, a ligature is placed around the utero-ovarian anastomosis.

Internal Iliac Artery Ligation

Internal Iliac artery ligation is the next step in treatment. Bilateral ligation of the vaginal branch decreases pulse pressure in the distal arteries by 85%, improving. Unfortunately, this procedure has a low success rate, estimated at 40%, mostly attributed to the late stage at which the ligation is attempted and that it is frequently complicated by hematoma formation and tissue edema that obscure the anatomy.

Procedure

An incision is made in the peritoneum, parallel and lateral to the ureter which opens the retroperitoneal space. The peritoneal flap with the ureter is retracted medially so that the internal iliac artery may be dissected out (Fig. 2). A right-angled clamp is used to place two ligatures around anterior division of internal iliac artery, 2–3 cm distal to division of common iliac artery. It is important to check the external iliac artery to confirm that adequate pulse pressure is present for perfusion of distal branches (femoral artery). It is also important to inspect the ureters for signs of trauma. Once these are completed, the steps are repeated

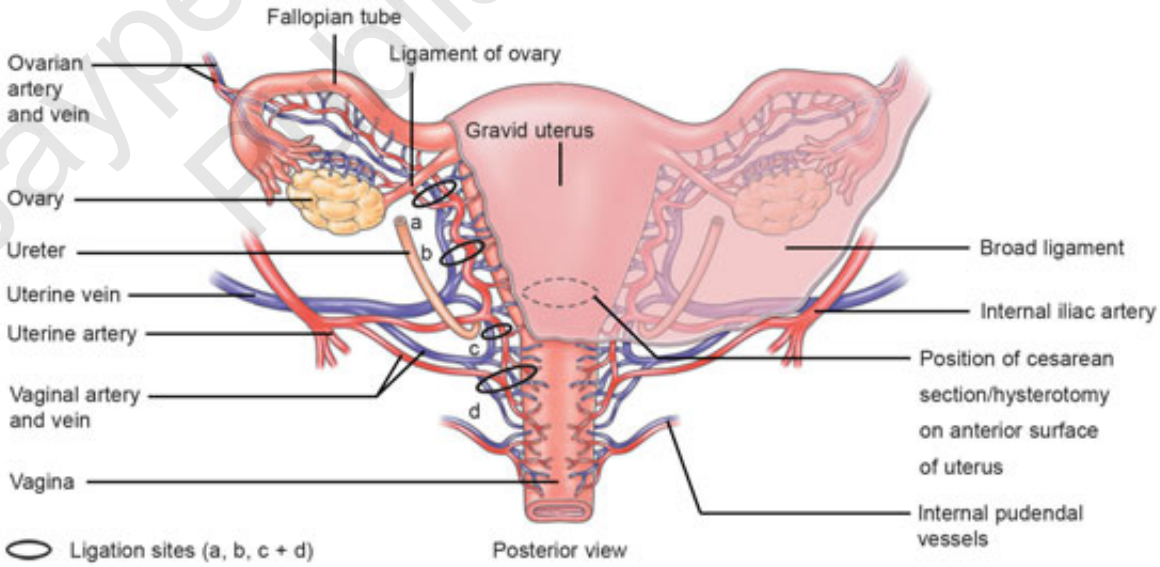

Figure 1: Ligation sites a, b, c, and d.
Source: Arulkumaran S, Karoshi M, Keith LG, et al. Textbook of postpartum haemorrhage. 2nd ed.; 2012.

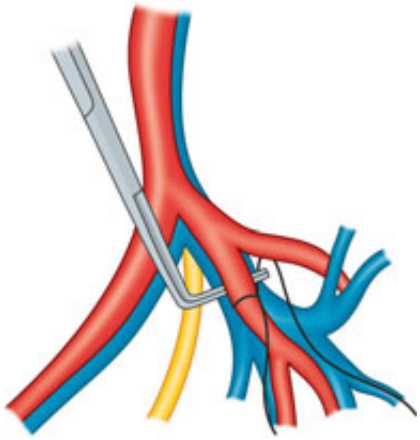

Figure 2: Internal iliac artery (hypogastric artery) ligation.

on the contralateral side. Complications of this procedure can be severe, including ischemic damage to the pelvis and decreased blood flow to the gluteal muscles (if the ligation is performed above the branch point of the posterior branch, or injury to the iliac vessels).

Safety of Devascularization Procedure

Since it is a fertility preserving procedure, there is concern about the safety of this procedure. A study involving 19,421 deliveries wherein 58 stepwise devascularizations were performed revealed that bilateral uterine artery ligation for PPH did not appear to compromise patient's subsequent fertility and obstetrical outcome. Patients who had stepwise devascularization with bilateral suspensory ligament of ovary ligation had major complications like ovarian failure, uterine synechiae, and one required subsequent hysterectomy due to ischemia and necrotic uterus with persistent septic condition. Several authors proposed bilateral utero-ovarian artery ligation rather than ligation of bilateral suspensory ligament of ovary.

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16

CHAPTER

Inversion Uterus

Jyotsna Suri, Pratima Mittal

INTRODUCTION

Inversion of the puerperal uterus is the passage of the uterine fundus through the endometrial cavity and the cervix, so as to turn the uterus inside out. It is a rare but catastrophic complication of the third stage of labor, which is associated with a very high maternal morbidity and mortality and hence it is very important for all obstetricians to be familiar with the emergency management of this condition. The incidence of uterine inversion has been variably reported from 1 in 1,200–57,000 deliveries. A retrospective review over a 24 year period estimated an incidence of 1 in 3,737 after vaginal delivery and 1 in 1,860 after cesarean section. After the institution of active management of third stage of labor in 1988, the incidence of inversion following vaginal delivery has fallen 4.4-fold.

RISK FACTORS FOR INVERSION UTERUS

The pathogenesis of inversion of the puerperal uterus is not clearly known. However, the factors which have been associated with this condition are discussed below.

Factors Related to Labor Management

Mismanaged third stage of labor has been considered historically as a very important pathogenetic mechanism in the causation of inversion uterus. However a recently published randomized controlled trial has shown inconsistent results between third stage management and inversion of the uterus. The practices which have been associated with inversion of uterus are:

- Excessive cord traction especially on a fundal placenta
- Fundal pressure (Credes maneuver) during the third stage of labor
- Rapid labor and delivery
- Use of tocolytics- relaxed uterus and lower segment.

Placental Factors

- Fundal attachment of placenta
- Retained placenta
- Placenta accreta (especially if fundal)
- Short cord.

Maternal Factors

- Anomalies of uterus
- Uterine fibroids
- Nulliparity
- Fetal factors
- Macrosomia.

HOW DO WE CLASSIFY INVERSION UTERUS?

Inversion can be classified by timing since delivery and extent of inversion of the fundus.

The classification according to timing since delivery is as follows:

- Acute inversion—occurs within 24 hours of delivery and before contraction of the cervical ring-this is the commonest (Fig. 1)
- Subacute inversion—presents from 24 hours to 4 weeks after delivery and after contraction of the cervical ring
- Chronic inversion—presents after 4 weeks of delivery and is the rarest presentation.

Classification of inversion of the uterus according to the extent of inversion of the fundus (Fig. 2):

- First degree: The fundus dips into the uterine cavity; also known as incomplete inversion
- Second degree: The fundus traverses the uterine cavity and through the cervix; also known as complete inversion
- Third degree: The fundus protrudes up to or beyond the introitus; also called the prolapsed inversion. Most of the acute cases present in the emergency in the 2nd or 3rd degree

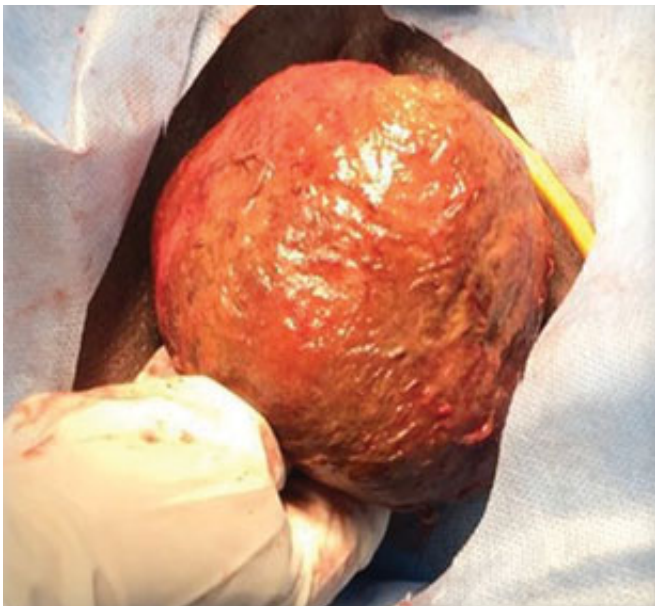

Figure 1: Acute presentation of inversion uterus.

- Fourth degree: The uterus and vagina invert completely and come out of the introitus; referred to as total inversion. This condition is most often seen in the nonpuerperal state.

DIAGNOSIS OF INVERSION UTERUS

Clinical presentation is usually diagnostic, especially in case of complete inversion. The postpartum patient usually presents with a smooth round mass protruding through the introitus and postpartum hemorrhage, which may be accompanied by shock. Since the shock is usually out of proportion to the blood loss, it is considered to be of neurogenic origin, chiefly due stretching of the parasympathetic nerves in the pelvis and increased vagal tone. However, it is possible that the blood loss is underestimated as is often the case and the pathogenesis of shock is hypovolemia. The other presenting features can be pain abdomen and sometimes retention of urine.

Per abdomen examination reveals loss of the fundus in the periumbilical area. Vaginal examination confirms the presence of a firm globular mass protruding from the cervix.

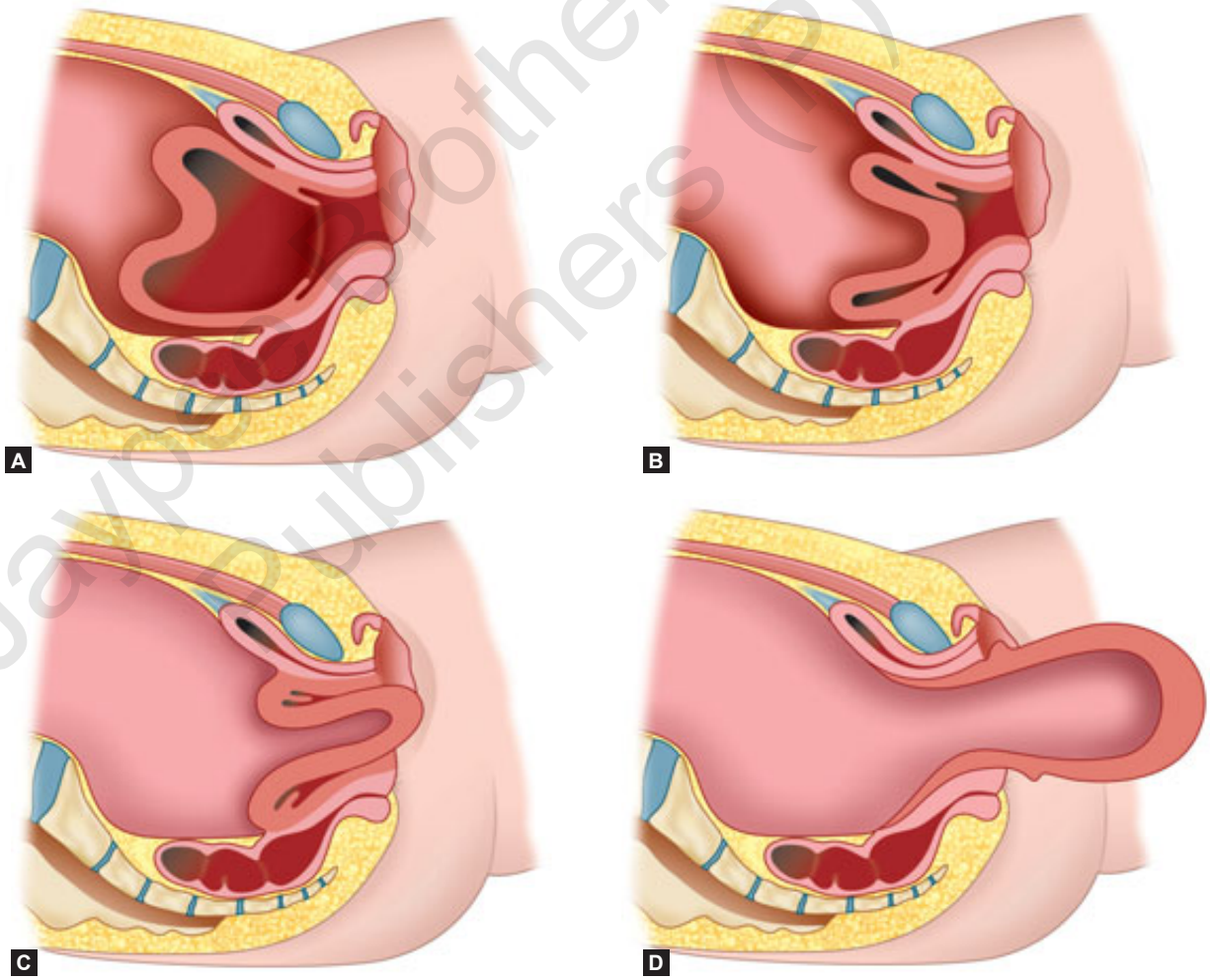

Figure 2: Degrees of uterine inversion. **A**, First degree inversion; **B,** Second degree inversion; **C,** Third degree inversion; **D,** Fourth degree inversion.

In case of prolapsed inversion, the inverted uterus will be seen lying outside the introitus.

The diagnosis of incomplete inversion is more challenging, as the bleeding and pain may be milder. The abdominal examination shows absence of the normal globular fundus of the uterus; instead the fundus may appear cupped. Examination through the dilated cervix reveals the fundus within the uterine cavity.

Imaging is not required normally for the diagnosis. In some cases where the differential diagnosis of a prolapsed fibroid is considered, an ultrasound scan may be useful. A homogenous mass in the uterine cavity and absence of fundus, confirms the diagnosis. Magnetic resonance imaging is rarely required.

PRINCIPLES OF MANAGEMENT

- Reposit the prolapsed uterus with or without anesthesia
- Treat the shock/postpartum hemorrhage
- Prevent reinversion.

Repositioning the prolapsed uterus is to be done as soon as the diagnosis is made; delay may lead to formation of the cervical constriction ring, which makes the repositioning more difficult and may result in need for surgical intervention. The patient should be managed with great alacrity as delay has shown to increase the maternal morbidity and mortality.

TECHNIQUES FOR REPOSITION OF INVERTED UTERUS

Manual Replacement

- Call for help and mobilize the operation theater staff, anesthetist, and an experienced obstetrician
- Rusticate the patient using the ABC approach. Insert two wide bore canulae and draw blood for blood grouping, cross matching, hemogram, and coagulation study. Give boluses of crystalloid fluid till the patient stabilizes. Blood products are to be transfused if inversion is accompanied with PPH, which is often the case
- Stop administration of any uterotonic drug as this will make repositioning more difficult
- Do not try to remove the placenta if it is still attached to the uterus. This can lead to torrential bleeding and collapse of the patient
- In case of bradycardia due to vagal stimulation, injection atropine, 0.5 mg intravenously can be given
- Manual repositioning should be attempted without any delay. The right hand of the obstetrician should be inserted along the axis of the vagina and the fundus should be gently pushed in a direction towards the umbilicus (Fig. 3). This procedure is known as the Johnson maneuver
- In case a cervical ring is felt, give pressure on the part of the uterus closest to the cervical ring and then proceed upwards, i.e., the portion which prolapsed last is reposited first and the part which prolapsed first (the fundus) is reposited in the end
- If manual reposition fails due to constriction ring, uterine relaxants can be given and another attempt made. Any of the following relaxants can be given—nitroglycerine 50 μg intravenously; terbutaline 0.25 mgintravenously or subcutaneously and magnesium sulfate 4–6 g intravenously over 20 minutes. Inhalational agents like isoflurane and halothane can also be given. These can only be administered in the operating room after securing the airway of the patient.

Hydrostatic Method

An alternative to manual replacement is the hydrostatic method popularized by O'Sullivan and published in British Medical Journal in 1945. Pressure of 3–5 L of warm water held about a meter above the patient is allowed to flow into the vagina via tubing which is placed into the posterior fornix. The pressure of fluid is maintained with the palm of the surgeon and by the labial apposition around the surgeons palm by the assistant. A modification of the procedure uses a vacuum cup to which the tubing is attached. The vacuum cup is placed in the vagina and the seal between the cup and vagina prevents leakage of the fluid (Fig. 4).

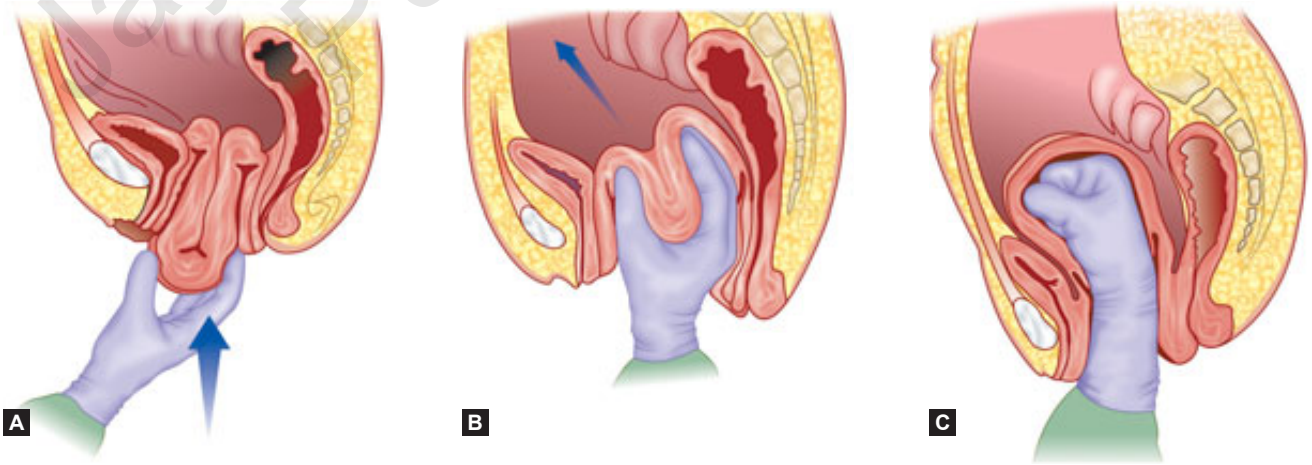

Figure 3: The direction in which the inverted uterus is reposited.

Figure 4: Modification of the O'Sullivan hydrostatic method. Here a vaccum cup is used to create a seal after placing the inverted uterus into the vagina. Note the fluid which is flowing under pressure through the vaccum cup.

Surgical Methods

Surgical means are resorted to when manual or hydrostatic reposition is not successful due to a tight constriction ring. The surgery may be conducted by the abdominal or the vaginal route.

Abdominal Approach

- Huntington procedure—during laparotomy, the fundal structures are identified inside the cup of inversion. Babcocks clamps is used to hold both the round ligaments. Progressive upward traction and reclamping is performed till the inversion is corrected. The whole process can be facilitated by pushing the fundus of the uterus vaginally by an assistant
- Haultain procedure—this procedure involves the bisection of the posterior aspect of the cervical constriction ring. Once the ring is released, a manual reposition or the Huntington procedure can be performed to bring the uterus back to its anatomical position followed by repair of the incision.

Vaginal Approach

Spinelli procedure: This approach is rarely used. The cervical constriction ring is incised anteriorly and the manual replacement of the inverted uterus is done, followed by repair of the incision. The risk of bladder injury limits the practice of this approach.

Prevention of Reinversion

- If the placenta is still attached to the uterus, we can wait for its spontaneous separation. Alternatively, manual removal can be done, in the operation theatre so that any complication can be handled immediately
- It is important that the uterus should remain contracted after it is reposited back, to prevent PPH and reinversion. The fundus should be stabilized by the surgeon till it is firmly contracted and in position
- Twenty to forty of oxytocin in 1 L of crystalloid should be infused at the rate of 125 mL/h. The other oxytocics which can be given are 250 µg carboprost intramuscularly, repeated 6 hourly for 24 hours (contraindicated in respiratory disorders); misoprostol, 800 µg inserted in the vagina or rectum; and methergonovine 200 µg intramuscularly, 6 hourly for 24 hours (contraindicated in uncontrolled hypertension)
- Broad spectrum antibiotics should be administered to prevent endometritis and puerperal sepsis.

Recurrence of Inversion in Next Pregnancy

The risk of recurrence of inversion in the next pregnancy has not been studied extensively. The available literature does not indicate an increased risk for inversion in the subsequent pregnancies.

CONCLUSION

Inversion of the uterus is a catastrophic event which entails a high maternal mortality and morbidity due to massive postpartum hemorrhage and shock. It is therefore important to recognize and treat it with great alacrity. The uterine inversion can be classified according to the degree of inversion and the timing of presentation in relation to the delivery. The principles of treatment include prompt repositioning of the uterus, management of shock and postpartum hemorrhage. and prevention of reinversion. Hydrostatic method and its modification using the vacuum cup also have good results and should be attempted before a surgical intervention. Post-reposition of the uterus patient should be given uterotonics for at least 24 hours to prevent reinversion.

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17

CHAPTER

Nondescent Vaginal Hysterectomy

Shirish S Sheth

INTRODUCTION

Hysterectomy is the most frequent procedure done by gynecologists. Although it can be performed by abdominal or vaginal routes, vaginal route remains the method of choice for most of the gynecologists. If hysterectomies are done regularly by vaginal route, the skills to deal with difficult situations like ovarian cysts, broad ligament fibroids, and other adnexal pathology can be acquired easily. Large size of the uterus is not a contraindication to perform vaginal hysterectomy as debulking of the uterus can facilitate its removal by vaginal route without need for abdominal invasion. It is of paramount importance that the vaginal route allows access to the posterior cul-de-sac, which can facilitate surgery or offer an alternative route for achieving the desired outcome. One must become familiar and friendly with area. This will promote to master vaginal route. Gynecologists who practice vaginal surgeries are known to be better equipped to serve their patients as this route is associated with superior outcomes when compared with other approaches to hysterectomy.

STEPS OF NONDESCENT VAGINAL HYSTERECTOMY

- The procedure is started after careful examination under anesthesia, excluding contraindications and confirming the route of hysterectomy
- Cervix is held with traction suture and preferably with a vulsellum
- Infiltration is done with 20–40 cc of 1 in 200,000 saline with few drops of adrenaline after anesthetist's concurrence. Infiltration can be done with up to100–200 cc of saline
- Important step is an access to vesico-uterine peritoneum and pouch of Douglas (POD)
- Careful anterior incision is given just below the bladder till firm cervical surface is reached and careful separation of the bladder is done
- Posteriorly, Allis forceps is put a centimeter below the first rugosity on the vaginal wall and cut just above it to access the peritoneum/POD
- Important is to keep the bladder retractor well between bladder and cervicouterine surface. This keeps bladder and ureters away
- Keeping self-retaining catheter is optional. The author always catheterized once before starting the procedure and put self-retaining catheter only after completion of surgery. Do not keeping self-retaining catheter during vaginal surgery
- A finger in POD is taken laterally to the uterocervical border to facilitate feeling the uterosacral ligament (USL)
- No. 1 vicryl is used to take suture lateral to the utero-cervical border, engulfing the ligament. The pedicle may contain bit of Mackendrot's ligament. Finger is gradually withdrawn as needle travels forward, performing it clampless. That is the author's routine method. This is followed by taking similar suture without clamp on the opposite side
- Next, the suture is taken higher up and lateral to the utero-cervical border and below the uterine arteries, it includes Mackendrot's ligament and may also take bit of USL and descending cervical vessel. The same procedure is repeated on the contralateral side
- The next is clearly uterine vessels which are well visualized. They are carefully secured with suture taken lateral and close to the utero-cervical border. Prophylactically, second suture is taken for uterine vessels lateral to the first one or as convenient. (One for the patient and second one for the operator and colleague's night sleep)
- Once uterine vessels are secured, it is easy to take suture. The sutures are taken from below upwards to include

broad ligament tissue, also reach round ligament and include it
- At this stage, uterus can be partly delivered from posterior and permit putting clamp on the upper pedicle. Inserting finger from POD and bringing it anteriorly below the bladder retractor, facilitates clamping upper adnexal pedicle or suture and secure it clamplessly
- Though hysterectomy till upper pedicle is without clamp, the author do not hesitate to clamp upper pedicle and free the uterus from one side and make completion easier
- Hysterectomy is now completed by excision of contra-lateral upper pedicle, with or without clamp
- Tubes and ovaries are always inspected for normalcy. If ovaries are to be removed, after securing upper adnexa on one side, round ligament is cut on the contralateral side as laterally as possible. This facilitates clamping the infundibulopelvic ligament and performing salpingo-oophorectomy. Same is repeated on other side to complete bilateral salpingo-oophorectomy
- After hemostasis is checked, lavage is given and before closure, mop, gauze and instrument count is thoroughly checked. Preserved sutures of upper pedicles including utero-ovarian ligament and uterosacral along with Mackendrot's ligaments are utilized to anchor the vault.

HOW TO DEAL WITH OVARIAN CYST AT VAGINAL HYSTERECTOMY?

- If hysterectomy by vaginal route was well-indicated but ovarian cyst declined it, in case of benign and mobile cyst, one could consider oophorectomy to avoid extra invasion by abdominal route
- The ovarian cyst has to be benign for removal at vaginal hysterectomy. In case of right ovarian cyst, once uterus with all the pedicles has been cut from bottom to top on left side with intact right upper pedicle
- Right ovarian cyst can be seen bulging from POD and filling up vagina. An isolation mop, green color plastic sheet is inserted to avoid spillage, infection, and provide good isolation
- Ovarian cyst is then caught with Allis forceps and gently exteriorized to facilitate the access and removal
- Right round ligament is then cut as laterally as possible to facilitate accessing infundibulopelvic ligament. This can be done with intact ovarian cyst. If very large, the cyst can be debulked
- Hysterectomy is then completed with right salpingo-oophorectomy. For contralateral salpingo-oophorectomy, there is space and ease in accessing the infundibulopelvic ligament and securing it but only after cutting round ligament as laterally as possible
- In brief earlier, ovarian cyst is carefully separated from surroundings and finger is inserted from posterior to guide to reach right infundibulopelvic ligament, apply clamp and secure it. This excision brings out tube and intact right ovary with cyst
- Infundibulopelvic ligament is transfixed with 2 sutures (one for patient and one for operator and team's night sleep). Salpingo-oophorectomy is then performed on the contralateral side and closure done after usual safety steps.

BROAD LIGAMENT FIBROID AT VAGINAL HYSTERECTOMY

- A patient desired hysterectomy by vaginal route but the presence of left broad ligament fibroid contraindicated it. Routinely, such a case is then subjected to laparoscopic approach or even laparotomy
- As the vaginal hysterectomy is getting completed, and the contralateral uppermost pedicle is distinctly seen, infundibulopelvic ligament is accessed and if required salpingo-oophorectomy performed on that side
- Then it is easy to put finger in the other side broad ligament area and feel the broad ligament fibroid. Even though it is laterally placed, it is medial to the pelvic wall and larger the broad ligament fibroid, easier it is to feel it. If infundibulopelvic ligament can be reached for salpingo-oophorectomy at vaginal hysterectomy, why should one not feel broad ligament fibroid easily
- This is followed by catching the broad ligament fibroid with tenaculum or bull dog vulsellum. The capsule is then gradually and slowly incised to enucleate the fibroid. Slight oozing, if any, is controlled by cauterization
- As the fibroid is seen getting almost completely out and is just attached with the basal layer in the broad ligament. This is carefully excised. Allis forceps and/or vulsellum before excision confirm that the capsule or the covering layer contains no other tissue. Hemostasis checked and closure done after usual safety steps.

UTERINE DEBULKING AT VAGINAL HYSTERECTOMY

- If uterus appears large at vaginal hysterectomy, the procedure by vaginal route is not contraindicated, but it may need debulking. Size that is contraindicated for vaginal hysterectomy is uterus >12–14 weeks size, however, this can also be dealt with vaginally by debulking. In practice, ideally one should go by uterine volume
- During hysterectomy, only after the uterine arteries are secured, cervix is bisected. After cervical bisection, thick uterine wall is debulked from inside, keeping away from uterine serosal surface. Invariably, it is thick adenomyotic wall
- Then after fibroid is easily seen, it is caught with vulsellum and/or tenaculum and enucleated. Before enucleation, all-around separation from the uterine wall is done. This facilitates reaching the uterine fundus and completing the hysterectomy
- In other method, after uterines are secured and cervix is bisected, distinctly seen fibroid is held with bull dog

vulsellum and enucleated. This facilitates access to much larger fibroid, which is then carefully morcellated

- There is almost no bleeding and field is dry as uterines are secured. Finger helps the separation of fibroid all-around and/or with knife or even scissor. Thus large fibroid is caught with instrument, exteriorized and enucleated
- This permits reaching fundus of the uterus and feeling it from top. Uterus is then partly delivered from posterior and upper pedicle is caught with clamp and cut to complete the hysterectomy.

CONCLUSION

As far as possible, gynecologists should do hysterectomy by vaginal route. Presence of benign ovarian cyst, broad ligament fibroid, and large uterine size are not contraindications for vaginal hysterectomy.

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18

CHAPTER

Debulking Techniques in Nondescent Vaginal Hysterectomy

Kawita Bapat

INTRODUCTION

With over 600,000 hysterectomies performed annually, <20% are performed via the vaginal approach; with substantial increase in rate in the last 13 years. This is despite strong evidence that the vaginal hysterectomy involves less morbidity and hospital cost compared with the abdominal and laparoscopic approaches.

The low vaginal hysterectomy rate may be attributed to inadequate training during residency, resulting in a lack of the requisite skills to perform the procedure. Most of the literature supports the view that vaginal hysterectomy, when feasible, is the safest and most cost-effective.

Conditions leading to arrest the descent of the uterus:

- Parametrial and broad ligament fibrosis from previous chronic infection
- Pelvic endometriosis
- Mechanical obstruction by fibroids
- Adhesions binding the uterus to the abdominal organs.

DEBULIKING

Debulking is reducing the size and volume of the uterus to facilitate its delivery. All uteri with fibroids do not need debulking. A uterus with more than 12–14 weeks will invariably require debulking to complete the hysterectomy. It is impossible to know whether large uterus can be removed through the vagina until the actual attempt is made.

Prerequisites for Debulking

- No contraindication to vaginal route for hysterectomy
- Examination under anesthesia prior to surgery
- Absence of "atypia" on endometrial histopathology
- Debulking instruments such as a myoma screw, tissue forceps, knife, and optionally a morcellator.

Precautions for Debulking

- Bladder should be empty
- Debulking should commence only after ligation of the uterine arteries
- It should be under vision
- Keep debulking till fundus is reachable as high as possible
- Keep bisecting the anterior and posterior uterine walls to morcellate and/or enucleate.

Techniques for Debulking

Uniformly enlarged uteri: Size of the uniformly enlarged uteri can be reduced by:

- Bisection of the uterus
- Morcellation
- Cervical
- Spiral incision and traction.

Irregularly enlarged uteri debulking of irregularly enlarged uteri can be reduced by:

- Wedge excision
- Myomectomy
- Cervical wedge.

Bisection of the Uterus

A longitudinal midline incision is made on the long axis of the uterus extending from the fundus to the cervix, after securing and ligating the uterine blood supply. The resulting two hemi-sections can be dealt with as separate entities. The pedicles on the lateral aspect of the hemi-section can be ligated and secured when traction is applied on the cervix by this method.

Circumferential Incision

Circumferential incision is resorted to when it is determined that the body of the uterus is movable but too large to permit

comfortable delivery by flipping the fundus either through the anterior or through the posterior pouch, and morcellation is not desired.

Wedge Excision

The procedure consists of excising wedge from the most accessible tissue, the apex of the wedge being carried to the highest level, the surgeon can reach with the scalpel. This results in an automatic decompression of the walls of the uterus leading to their collapse and eventually leading to its descent.

Spiral Incision (Lash Technique)

A continuous spiral and downward incision starting from highest accessible point of the anterior uterine surface down to the cervix, converts the transverse bulk of the cervix into a narrow cylinder.

Morcellation

It is an effective method, especially, when uterine enlargements are asymmetrical and an excessive disproportion exists between the size of the uterus and the available pelvic space. It consists of excavating moderate-sized myometrial chunks, resulting in collapse of the uterine wall and diminishing thickness of the fundus.

Morcellation can involve a range of techniques. Whenever a large uterus prevents further progress, and the uterine vessels have been ligated, uterine morcellation can be performed. Morcellation techniques originated when vaginal hysterectomy was the archetypal gynecologic operation, and include uterine bisection, Lash intramyometrial coring, myomectomy, and wedge debulking. Although every surgeon has a favorite, some or all of these procedures may be necessary in the same patient. In all cases, it is mandatory that the uterine vessels be ligated before any morcellation procedure is initiated.

This technique is a nearly bloodless procedure that does not violate the endometrial cavity when it is performed properly. In addition, any intramyometrial fibroids can be easily removed.

If coring does not decompress the uterus enough for safe delivery, the core can be cut off and the remaining uterus can be further morcellated by removing wedges of myometrium or by bivalving the uterus. Since there is usually more room in the posterior vagina than in the anterior vagina, as much of the wedge morcellation as possible should be done posteriorly.

Myomectomy

- Internal: It is a tunneling procedure for removal of fibroids as recommended by Victor Boney. It consists of burrowing the way through and removal of as many fibroids from the cavity, without accessing the serosal surface
- External: It is a direct myomectomy and entails pulling the uterus down till the lowest part of subserous fibroid is just visible.

COMPLICATIONS OF PROCEDURE

The primary intraoperative complications are visceral injury and hemorrhage. Reported rates of hemorrhage range from 1.4 to 2.6%, whereas reported rates of ureteral and bladder injury are 0.88% and 1.76%, respectively.

The most common postoperative complication is pelvic infection. Febrile morbidity occurs in approximately 15% of women who undergo vaginal hysterectomy and can be reduced by means of prophylactic antibiotics. Infections after vaginal hysterectomy include vaginal cuff cellulitis, pelvic cellulitis, and pelvic abscess. These infections occur in approximately 4% of women.

CONCLUSION

Debulking, if done meticulously, can make vaginal hysterectomy of large uteri a much easier Procedure. Bisection of the uterus still remains more feasible in de-bulking.

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19

CHAPTER

Salpingo-oophorectomy at Vaginal Hysterectomy

Sunita Malik

INTRODUCTION

Bilateral salpingo-oophorectomy (BSO) has the perceived advantage of reducing the risk of ovarian cancer, also causes surgical menopause. Ovarian cancer has the highest mortality rate out of all gynecologic malignancies because of its late detection and advanced stage at the time of presentation. Familial or inherited syndromes account for approximately 13% of cases of invasive epithelial ovarian and fallopian tube cancer. The life time risk of developing ovarian cancer is shown in table 1.

Bilateral salpingo-oophorectomy significantly decreases the risk of ovarian cancer if done prophylactically. A meta-analysis by Marcheti et al. found a significant decrease in ovarian cancer risk after risk reducing bilateral salpingo-oophorectomy (rrBSO), risk ration 0.19 (95% confidence interval 0.13–0.27). New evidence is emerging all over the world about the fallopian tube being the site of origin especially for epithelial and endometrial ovarian cancers. Occult fallopian tube cancer has been found in women who have undergone risk reducing BSO.

SHOULD BILATERAL SALPINGO-OOPHORECTOMY BE DONE IN ALL WOMEN WHO UNDERGO HYSTERECTOMY FOR BENIGN CONDITIONS?

Historically, it was stated that it should be done in all women after the age of 45 years even if she has not attained menopause to avoid residual ovary syndrome. A retrospective analysis over 11 years of all oophorectomies performed for ovaries preserved at the time of hysterectomy showed that out of 202 women, 77.2% presented with chronic pelvic pain, and 14.4% had asymptomatic pelvic mass, 67% had dyspareunia, 3% had malignant change when hysterectomy was performed after the age of 40 years.

TABLE 1: Life time risk

Category	*Risk of ovarian cancer (%)*
BRCA1 gene mutation	35–46
BRCA2 gene mutation	13–23
Lynch syndrome	3–20
General population	1.5

Bilateral salpingo-oophorectomy that causes surgical menopause reduces the risk of ovarian cancer, but may increase the risk of cardiovascular disease, osteoporosis and cognitive impairment. American Congress of Obstetricians and Gynecologists (2015) recommends ovarian conservation at the time of hysterectomy in premenopausal women who are not at an increased genetic risk of ovarian cancer. They advise consideration of oophorectomy in women who are postmenopausal or have a condition that may benefit from BSO, e.g., endometriosis, pelvic inflammatory disease, and pelvic pain.

TYPES OF BILATERAL SALPINGO-OOPHORECTOMY

Risk reducing bilateral salpingo-oophorectomy: Removal of ovaries and fallopian tubes in a woman with hereditary ovarian cancer syndrome.

Elective salpingo-oophorectomy (eBSO): Removal of ovaries and fallopian tubes in a woman who has no known indication for this procedure.

Prophylactic salpingo-oophorectomy: This term has been used inconsistently to refer to prevention of ovarian cancer in either woman at an average risk or those with hereditary ovarian cancer syndrome.

The surgeon and patient should discuss the potential benefits and risks of removal of fallopian tubes alone or BSO during a hysterectomy beforehand and informed consent

regarding hormone replacement therapy in future should also be taken especially in young women. The approach to doing hysterectomy should not influence the surgeon in decision for oophorectomy. A vaginal hysterectomy should not be changed to a laparotomy or laparoscopic hysterectomy simply to perform a BSO. Using various techniques, a 97.5% success rate of oophorectomy at vaginal hysterectomy can be achieved.

INITIAL PROCEDURE

The vaginal hysterectomy has to be done in a standard manner. The position of surgeon whether standing or sitting is one's own choice. However, horizontal light sources are very desirable while working in the pelvis. Lighted speculum/retractor or fiber optic forehead lamp or laparoscopic camera light can help in the illumination of ovaries deep in the hollow of sacrum. Trendelenburg position (5–10 degrees) is also helpful. Curved clamp especially designed by Shirish Sheth, who is a pioneer of vaginal hysterectomy in India, is a great help. The assistants should be enthusiastic and retract the anterior and posterior vaginal walls adequately for decent exposure and avoidance of injury. Prior ultrasound should be done if there is a small ovarian cyst to ascertain its benign nature.

STEPS OF BILATERAL SALPINGO-OOPHORECTOMY

One should try to find the accessibility of ovaries as soon as the fundal structures, i.e., round and ovarian ligaments are reached. There may not be any descent of the ovaries or one may be able to pull them upto the midvagina. Pack the intestine and omentum with a gauze pack. In the majority of women, the ovaries are easily accessible at the time of vaginal hysterectomy. The ovary can be grasped with the sponge forceps and clamp applied across the infundibulopelvic ligament.

Clampless technique that uses a modified aneurysm needle to pass the suture around the pedicle is favored by some surgeons as it takes up less room. Alternatively, clamp, cut, and transfix the cornual end structures on the side first where the ovary is better accessible. Leave the thread long for use later in the procedure. Take a bite through the round ligament, a little higher up and separate it from the ovarian pedicle. This permits traction on the IPL. Now a clamp is placed across the IPL while holding the ovary with babcock forceps (Figs 1 and 2). On the other side, the uterus is still attached with the fundal structures which help in giving traction to the IPL without undue force. Clamp and separate the round ligament first on this side also and open two leaves of broad ligament as is done in abdominal hysterectomy. This makes the IPL pedicle narrow and easily accessible for the large curved clamp. Care should be taken to apply the clamp medially to avoid injury to the ureter.

If excessive adhesions are present, the leaves of broad ligament may be spread by funneling with the scissors tip for mobilization of the components separately.

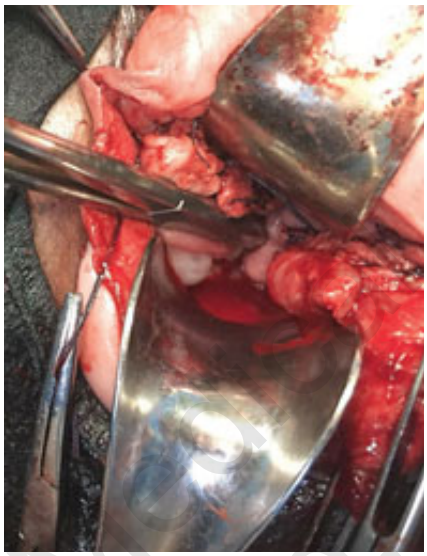

Figure 1: Clamp on infudibulopelvic ligament.

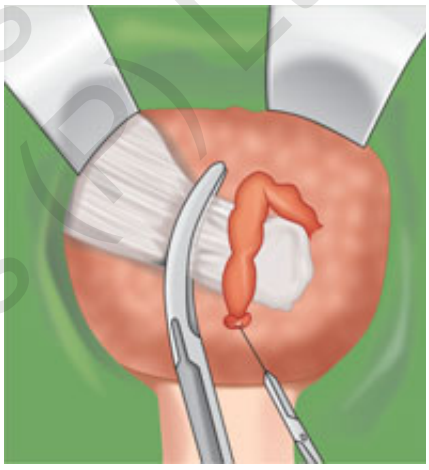

Figure 2: Diagrammatic representation of clamp on infudibulopelvic ligament.

Other Alternatives to the Standard Approach

- If IPL is not accessible for clamp, use a loop ligature of 1–0 polyglactin suture or a endoloop suture tightened around the pedicle
- The ovary can be removed first by clamping and cutting the mesovarium. This leads to better visualization of tubes which can be subsequently removed with a ligature around IPL. This approach is useful when the size of ovary is bigger or a benign tumor is present. One can even aspirate a simple cyst vaginally with care avoiding the spillage of contents
- Newer clamps that cauterize and obviate the need for suturing like bipolar cautery/ligasure/harmonic scalpel can also be used to cut the mesovarium
- One can use the laparoscope also through the vaginal route and staple the ovarian vessels

- If all these maneuvers fail due to pelvic adhesions, the laparoscopic approach may be used for BSO.

SALPINGECTOMY

For salpingectomy alone, traction is given on the fallopian tube with an atraumatic grasping forceps and a ligature passed around or mesosalpinx is cut with bipolar cautery from proximal side to distal extent below the ampulla and tube is freed.

The vault is subsequently closed after achieving complete hemostasis.

COMPLICATIONS

- Injury to the bladder, ureter, or rectum
- Pelvic hematoma can form due to injury or slippage of ligature from ovarian artery. If the ovarian vessel has retracted, it is very difficult to access from below. One may have to do laparoscopy or laparotomy to deal with this situation
- Sepsis: Attention to asepsis and perioperative antibiotic helps in prevention.

CONCLUSION

Salpingo-oophorectomy with vaginal hysterectomy is not difficult if performed meticulously and in a stepwise manner. Learning curve may be a little longer. The surgeon has to learn the fundamental procedures and evolve their own technique over the years.

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20

CHAPTER

Radical Hysterectomy Made Easy

Shalini Rajaram, Bindiya Gupta

INTRODUCTION

Radical hysterectomy represents the mainstay of treatment for early stage cervical cancer. In fact, technical and technological improvements allow the execution of an abdominal radical hysterectomy in a safe and effective way, thus allowing the extirpation of the tumor and reducing damage on surrounding tissue (i.e., bladder, bowel, and vagina) that are injured by radiotherapy.

The indications include early stage cervical cancer [stage 1A and stage 1B1 (<4 cm)] International Federation of Gynecology and Obstetrics stage II endometrial cancer. For stage 1B2 cervical cancer, chemoradiation is the standard of care. In the present chapter, the standard technique of Wertheim-Meigs surgical procedure and pelvic lymphadenectomy via abdominal incision is described.

CLASSIFICATION

The classification of radical hysterectomy was revised to define the extent of parametrial resection, lymphnode dissection, and nerve dissection by Querleu and Morrow in 2007. Extent of radical hysterectomy and level of lymphadenectomy is classified separately. Type A is defined as extrafascial hysterectomy, paracervix removed medial to ureter and <1 cm of vagina is removed. In type B hysterectomy, the paracervix is removed at the level of ureter and partial uterosacral and vesicouterine ligaments are resected. It is further classified as B1 and B2 depending on the removal of paracervical nodes. In type C, uterosacral ligaments and vesicouterine ligaments are resected at the level of rectum and bladder, respectively, 2–3 cm of vagina is removed and paracervix is removed at the level of internal iliac artery. It is further classified as C1 with preservation of hypogastric nerve and C2 without nerve preservation. In type D complete paracervical resection is done. D1 is with hypogastric vessels and D2 with hypogastric vessels and adjacent fascia and muscular structures.

Lymphadenectomy is classified as level 1 with removal of external and internal iliac nodes. Common iliac nodes including presacral areremoved in level 2 while infra-mesentric paraaortic nodes are removed in level 3. Level 4 is removal of para-aortic infrarenal lymph nodes.

PROCEDURE

Anesthesia and Position

Usually general anesthesia (GA) is preferred for the procedure. Epidural anesthesia may be combined with GA as it is useful in the postoperative pain management. A prophylactic antibiotic (usually third generation cephalosporin) should be given at the time of induction. Pneumatic compression device is placed for prophylaxis against deep vein thrombosis.

The patient is placed in Tredelenburg position. Sometimes, lithotomy position may be needed to facilitate intraoperative pelvic organs exposure of the operative field, when the creation of vaginal cuff is done from below or in cases of sentinel lymph node sampling. Pelvic examination may be performed again under anesthesia to confirm findings. A Foley catheter is placed in the bladder.

Incision and Abdominal Entry

The abdominal incision can be midline extending above the umbilicus or transverse. The authors prefer a midline incision since it allows an accurate exposure to the upper abdomen and aortic lymph nodes. For transverse incisions, usually a muscle cutting (Maylard's or Cherney incision) incision is used in case the exposure is not adequate. After the skin incision, the abdominal wall is opened in layers.

A self-retaining retractor is used for adequate exposure in the operating field. The intestine is packed in the upper abdomen, thus allowing exposure to the pelvis. The uterus is held using clamps placed on the cornua bilaterally.

Assessment of Operability

The bladder mobility should be assessed as occasionally tumor may infiltrate into the bladder base, making hysterectomy impossible. The abdomen is usually closed and the patient treated with primary chemoradiation. The parametria are palpated for any thickening and nodularity. The pelvic and para-aortic nodes are palpated and if enlarged, removed and sent for frozen section. If frozen section is positive for malignancy, the patient should be closed and given radical chemoradiation.

Opening the Paravesical and Para Rectal Spaces

The left round ligament stretched and incised laterally close to the pelvic sidewall. The anterior leaf of the left broad ligament is opened in such a way that the incision is taken down vertically lateral to bladder for 3–4 cms The peritoneum above the bladder is grasped and elevated. Uterovesical fold is opened using sharp dissection with scissors and the bladder is mobilized caudally up to the anterior upper vagina (at least 3–4 cm). The posterior leaf of the broad ligament is opened, exposing the infundibulopelvic ligament. The ureter is identified on the medial fold of peritoneum up till at the level of the common iliac vessels and is held using an infant feeding tube. If the ovaries have to be removed, the infundibulopelvic ligament is clamped, cut, and doubly suture-ligated keeping the ureter away. In cases of younger patients, the ovaries are preserved so that the infundibulopelvic ligament is not ligated and the broad ligament is further incised parallel and inferior to the infundibulopelvic ligaments. The utero-ovarian ligament is then clamped, cut, and ligated. In such cases, after the completion of procedure, ovariopexy is done high above the pelvic brim on the lateral pelvic wall to prevent radiation damage. Clips are placed for identification.

The paravesical space is dissected anteriorly on both sides using sharp and blunt dissection between the obliterated umbilical artery and external iliac vein up to the levator ani muscle. It is bordered by the obliterated umbilical artery (a continuation of the superior vesicle artery) running along the bladder medially, obturator internus muscle laterally, cardinal ligament or paracervix posteriorly and pubic symphysis anteriorly.

The pararectal space is developed posteriorly on both sides up to the levator ani muscle between the ureter medially and internal iliac artery. The borders are rectum medially, hypogastric artery laterally, cardinal ligament, or paracervix anteriorly and sacrum posteriorly. The procedure is done on both the sides. The paravesical and pararectal space is shown in figure 1.

Pelvic Lymphadenectomy

The iliac vessels are identified (common iliac, external iliac, and internal iliac vessels) and the ureter are exposed on both pelvic sides. The authors' prefer to do it before completing the hysterectomy as it helps to gain better access to the parametrial web of tissue. In some institutes, nodes are sent for frozen section analysis if positive the procedure is aborted in favor of chemoradiation, thus reducing morbidity of a combined treatment.

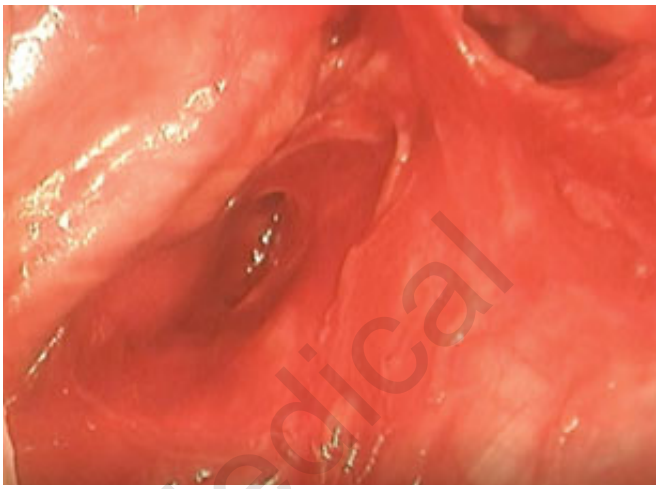

Figure 1: Paravesical and para rectal spaces.

Once the vessels are identified, the lymph nodes and the fatty tissue is removed en bloc proceeding cranially to caudally or vice versa. The fatty tissue is stripped off using either sharp dissection with Metzenbaum scissors, or cautery (blend current 30–40 at spray mode unipolar or bipolar). The sheath of external iliac artery is opened fatty tissue is stripped off the vessels from the mid-common iliac region to the circumflex iliac vein distally. The genitofemoral nerve on the psoas muscle is preserved. Once the internal and external iliac nodes are removed using a vein retractor the obturator fossa is entered either on the medial or the lateral side of external iliac artery. The fatty tissue in obturator fossa is removed including both above and below the obturator nerve. Care must be taken to identify the accessory obturator vein, which is seen in at least 30% of patients and it enters the distal external iliac vein inferiorly.

Ligation of the Uterine Artery

The uterine artery usually arises from the anterior division of internal iliac artery. The artery is ligated at its origin in a type III or type C radical hysterectomy (Fig. 2), or at the point where it crosses the ureter in the modified or type B radical hysterectomy. The medial end of the vessel is held long for traction as it helps in parametrial dissection. The superficial uterine veins must be identified and clipped or troublesome bleeding will occur. The uterine veins (superficial and deep) are ligated and mobilized medially.

Dissection of the Ureteric Tunnel

The ureter is identified via blunt dissection and retracted medially, separating it from the structures of the pelvic

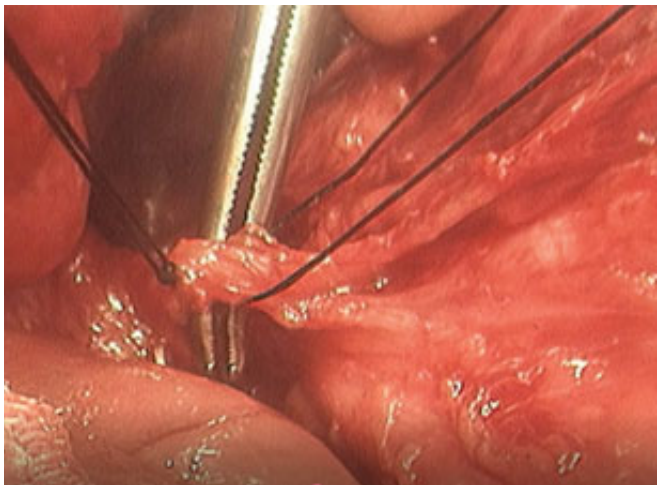

Figure 2: Ligation of uterine artery at its origin.

Figure 3: Hypogastric nerves in medial leaf of broad ligament.

sidewall. Care should be taken not to strip the peritoneum while dissecting the tunnel throughout its length as the blood supply may be hampered. The roof of the ureteric tunnel is the anterior vesicouterine ligament. This can be taken down in a piecemeal fashion bilaterally, thereby avoiding the troublesome venous bleeding. Then the posterior or caudal vesicouterine ligament is divided in a type III hysterectomy but not in a type II. The anterolateral surface of the distal ureter is left attached to the bladder. In a nerve sparing approach when the caudal vesicouterine ligament is transected, the inferior hypogastric plexus is identified and the bladder branch is preserved. A gentle traction on the ureter is paramount to avoid damage to the ureter.

Posterior Dissection

The landmarks of the pararectal space are the ureter and the rectum medially, the sacrum caudally, the internal iliac vessels and the pelvic sidewall laterally, and the cardinal ligament ventrally.

The peritoneum across the pouch of Douglas is incised and the rectovaginal space is created. The rectum separated from the posterior vagina and the uterosacral ligaments are clamped cut and ligated at the rectum near the origin (type III) or closer to the cervix (type II or B). The lower part of the uterosacral ligaments, containing the parasympathetic nerves have to be preserved during this step.

In a nerve sparing approach before clamping the uterosacrals, a space medial to the ureter (Okabayashi) space is created and the hypogastric nerves which run 1–2 cm dorsal to the ureter in the same peritoneal leaf are identified (Fig. 3). They are gently dissected from the peritoneal leaf along with the ureter and lateralized.

Lateral Dissection and Vaginal Resection

After division of the uterosacral ligaments, the cardinal ligaments (paracervix) and paravaginal tissue are clamped at the level of the pelvic sidewall. In a nerve sparing procedure, only the paracervical tissue above the deep uterine vein is taken, which preserves the autonomic nerves at this point.

The length of vagina to be removed depends on size of the primary lesion. Usually 2–3 cm of vaginal length is taken as the clamps are applied at right angles on the vagina. Some surgeons do a circumferential excision of the vagina. The vaginal cuff is closed using interrupted sutures.

Hemostasis is ensured and drains are avoided as these maybe a source of infection. Incision is closed in layers.

CONCLUSION

The above approach is a simplified approach of Wertheim-Meig-Okabayashi surgery through a laparotomy incision. Surgical techniques have evolved to include minimal invasive approaches, and more recently, to include robotic assisted techniques. However, randomized data of radical hysterectomy for cervical cancer have not been published until recently when a revelation was made in the Society of Gynecologic Oncology meet in 2018 in New Orleans, Louisiana, United States, where data from phase III randomized trial of laparoscopic or robotic versus abdominal radical hysterectomy in patients with early stage cervical cancer— LACC trial was presented. Minimally invasive surgery was associated with a decrease in overall survival (3/312 vs. 19/319, hazard ratio = 6.00, 95% confidence interval 1.48–20.3, p = 0.004). There were no differences in rates of intraoperative complications by treatment received (11% in both, p = 0.76).

As we all wait for the publication of the LACC trial, surgeons should tailor their techniques for maximum patient advantage. Open radical hysterectomy still stands to be the standard of care unless more evidence is available for minimally invasive surgery. Given the current prevalence of minimally invasive surgery radical hysterectomy , it is important to ensure that patient outcomes, including survival, cancer recurrence, and need for adjuvant therapy, are not compromised with newer surgical techniques.

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21

CHAPTER

Radical Vulvectomy

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INTRODUCTION

Radical vulvectomy is defined as removal of vulvar soft tissue upto depth of inferior fascia of urogenital diaphragm. The lateral borders of the incision are at the labiocrural folds, anterior border is at the mons pubis, posterior border is across the perineal body and medial borders, are within the vestibule.

Modified radical vulvectomy is the radical removal of vulva containing the tumor with approximately 2 cm margin.

INDICATIONS OF RADICAL VULVECTOMY

Tumors of vulva with >1 mm invasion and that are up to 4 cm in size (stage IA, as well as small stage IB and II tumors that are ≤4 cm).

PREOPERATIVE ASSESSMENT

- A preoperative vulvoscopy and mapping biopsies may help in the planning of surgery
- Human papilloma virus is responsible for multifocal lesions; hence, colposcopic examination of cervix and vagina is mandatory to look for any lesions which could be present.

STEPS OF RADICAL VULVECTOMY

Incision

Traditionally: The lateral skin incision is given along the labiocrural crease approximately 2–3 cm from the lesion; anteriorly it extends up over the mons pubis; posteriorly crescent shaped incision extends anterior to the anus. The medial incision is usually located along hymenal ring and anterior to the uretheral meatus (Fig. 1).

Current practice: The incision of the primary vulvar tumor is individualized based on its location, with consideration given to sparing vital organs, such as the urethra, clitoris, and anal sphincter, while ideally maintaining a 1–2 cm margin from the tumor (Figs 2 to 4).

Depth of incision: Colles fascia is dissected and retracted off the underlying muscles. Bulbocavernosus, ischiocavernosus, and superficial transverse perineal muscles are removed and enbloc dissection is performed till the inferior fascia of urogenital diaphragm.

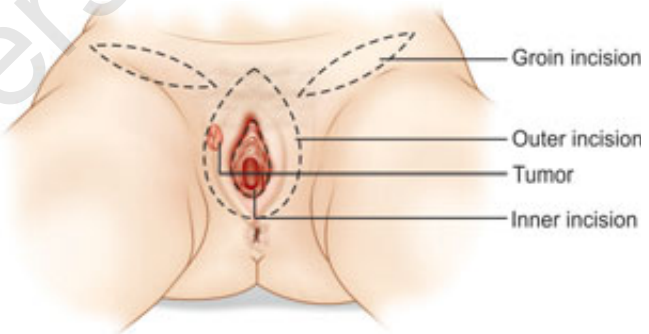

Figure 1: Total radical vulvectomy with bilateral inguinofemoral lymph node dissection.

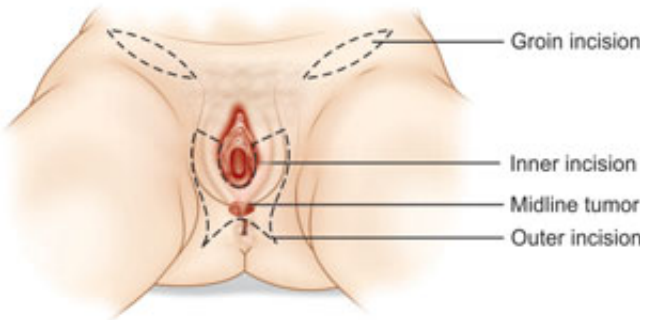

Figure 2: Posterior hemi vulvectomy with bilateral inguinofemoral lymph node dissection.

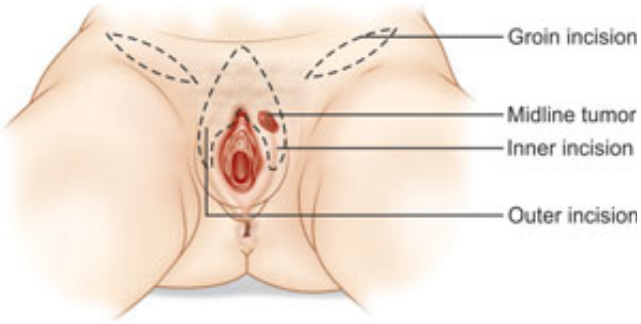

Figure 3: Anterior hemi vulvectomy with bilateral inguinofemoral lymph node dissection.

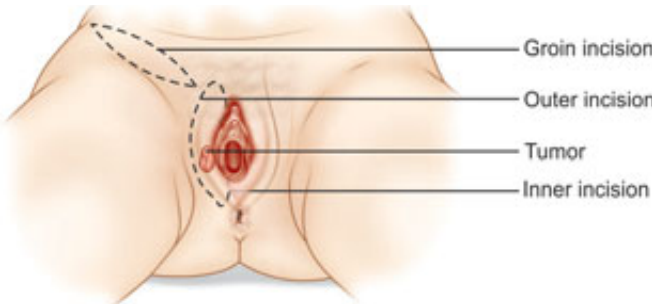

Figure 4: Right hemi vulvectomy with right bilateral inguinofemoral lymph node dissection.

Hemostasis

Most of the dissection should be done using electrical cautery and venous stumps can be secured with the absorbable stitches. Right and left pudendal vessels are clamped at 8 and 4 o'clock position.

Closure of Wound

Primary closure is accomplished in most cases, although reconstruction may be necessary for the larger defects. In perineal area, fascia of the levator ani muscle is approximated in the midline to prevent prolapse of vaginal walls.

Continuous bladder drainage is done for 72 hours to avoid soiling of wound with urine.

Inguinofemoral Lymph Node Dissection

A crescent shaped incision is made in the skin starting about 2–4 cm medial to and about 2 cm caudal to anterior superior iliac spine. Skin should be separated along with the subcutaneous tissue, from the underlying structures to prevent sloughing of skin. The incision curves downwards medially 2 cm below and 2 cm medial to pubic tubercle.

Lymph node dissection is done along:

- Superficial circumflex iliac vessels
- Superficial epigastric vessels
- Great saphenous vein
- Sapheno femoral junction.

Whole lymphatic tissue should be removed enbloc.

Suction drainage tube is kept in situ on one side in unilateral bilateral inguinofemoral lymph node dissection or both sides in bilateral bilateral inguinofemoral lymph node dissection.

IMPORTANT POINTS FOR CONSIDERATION

- In unifocal tumors of <4 cm maximum diameter where there is no clinical suspicion of lymph node involvement, patients can be safely managed by removal of the identified sentinel lymph nodes
- A lateralized lesion is defined as one in which wide excision, at least 1 cm beyond the visible tumor edge is done and that would not impinge upon a midline structure (clitoris, urethra, vagina, perineal body, and anus)
- Lymphatic cross-over is less likely in lateral tumors; therefore, only an ipsilateral groin node dissection may initially be performed. If the ipsilateral nodes are subsequently shown to be positive for cancer, the contralateral nodes should also be excised or irradiated, as the nodes are more likely to be positive in this scenario
- Groin node surgery should be undertaken through separate incisions (triple incision technique) to reduce the morbidity. The incidence of skin bridge recurrence in early-stage disease is low
- Excision of atypical skin (lichen sclerosus or vulvar intraepithelial neoplasia) affecting the remainder of the vulva should be considered, as these areas might contain separate foci of invasion and pose an increased risk of recurrence
- Removal of any lichen sclerosus or vulvar intraepithelial neoplasia (usual type and differentiated vulvar intraepithelial neoplasia) need not be to the same depth as that for invasive disease unless occult invasion is suspected
- For patients with larger tumors (stage I and II with vulvar tumors >4 cm), macroscopic nodal metastases (e.g., stage IIIB and IIIC), or extended localized disease to the adjacent organs (stage IVA), the treatment course consists of chemoradiation, with external beam radiotherapy to the tumor, groin, and pelvis, as well as concomitant chemotherapy, which usually consists of cisplatin.

TIPS AND TRICKS

- Prior to surgery, proper assessment of lesion to tailor the incision
- Colposcopic assessment of vagina and cervix must
- Primary wound closure preferred
- Suction drainage of groin dissection must to avoid seroma formation
- Pressure dressing to be done for groin wounds
- Keep vulval wound dry after daily dressing.

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