Complimentary Online
• Advanced Reading Material
• Clinical Examination Videos
Available Only with GENUINE book

Dr. Wise
Innovative & Genius
AI Chatbot
access code inside

8th Edition

SRB's Manual of SURGERY

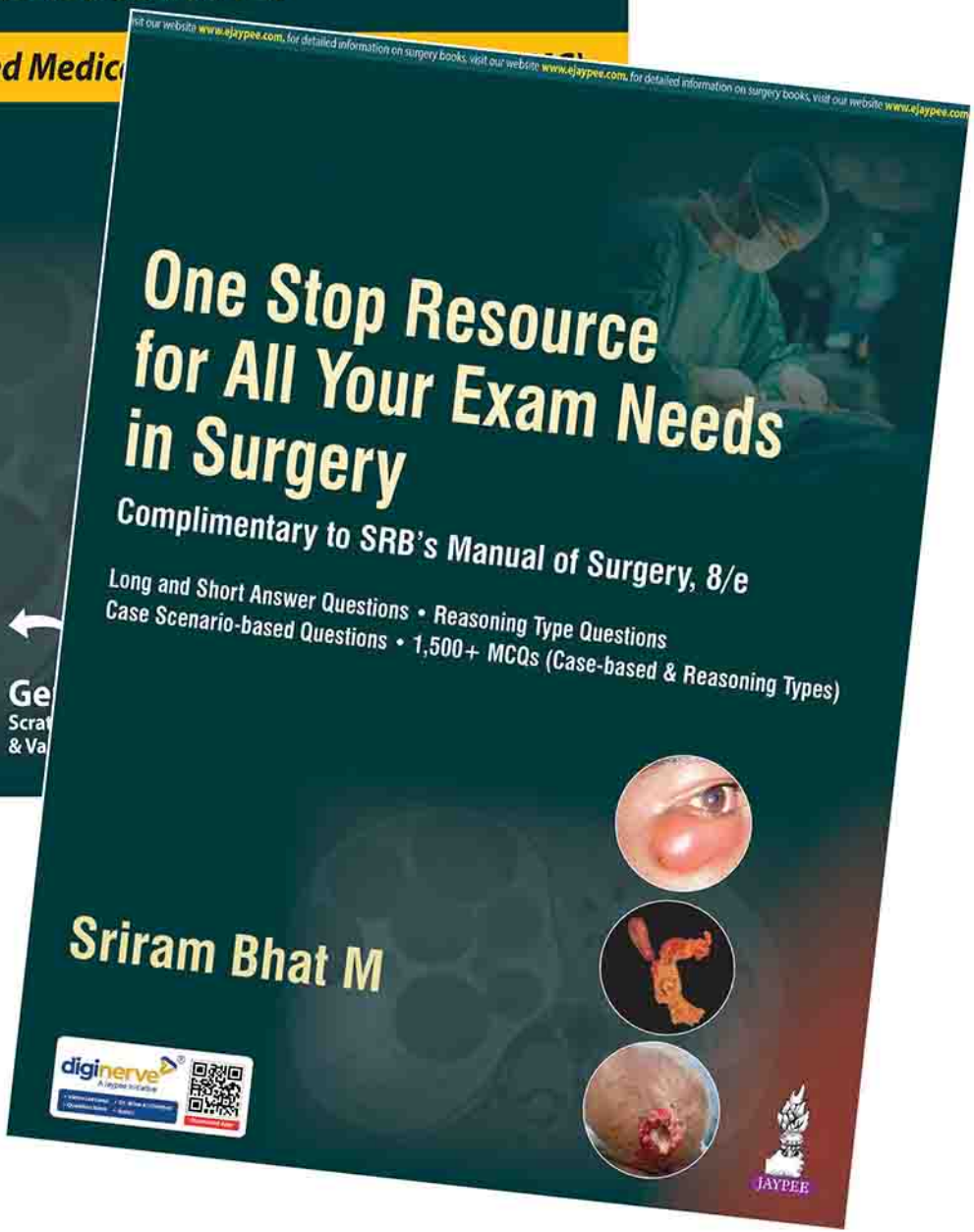
Complimentary Book Included

As per the Revised Competency-based Medic

Sriram Bhat M

Forewords
Thangam Verghese Joshua
GV Manoharan

Ge
Scra
& Va



Contents

Section 1: General Surgery

CHAPTER

55

Operative Surgery

Bearing in mind that it is from the vitality of the atmospheric particles that all the mischief arises, it appears that all that is requisite is to dress the wound with some material capable of killing these septic germs, provided that any substance can be found reliable for this purpose, yet not too potent as a caustic.

—**Joseph Lister**, 1867

COMPETENCY

SU14.1 : Describe aseptic techniques, sterilization and disinfection.
SU14.2 : Describe surgical approaches, incisions and the use of appropriate instruments in surgery in general.
SU14.3 : Describe the materials and methods used for surgical wound closure and anastomosis (sutures, knots and needles).
SU14.4 : Demonstrate the techniques of asepsis and suturing in a simulated environment.
SU16.1 : Minimally invasive general surgery: Describe indications advantages and disadvantages of minimally invasive general surgery.
SU10.3 : Observe common surgical procedures and assist in minor surgical procedures; observe emergency lifesaving surgical procedures.
SU10.4 : Perform basic surgical skills such as first aid including suturing and minor surgical procedures in simulated environment.
AN44.7 : Enumerate common abdominal incisions.
SU11.4 : Enumerate the indications and principles of day-care general surgery.
SU7.1 : Describe the planning and conduct of surgical audit.

CHAPTER OUTLINE

A. Sterilisation and Instruments

STERILISATION

- **Sterilisation:** It is freeing an article by removing or killing all bacteria, spores, fungi and viruses.
- **Disinfection:** It is killing of all bacteria, fungi and viruses but not spores.
- **Antisepsis:** It is inhibition of growth of microorganisms.
- **Asepsis:** Asepsis means—organisms are prevented to access the patient or individual.

Treat the patient as a whole, "Half a sheep is mutton".

DIFFERENT METHODS OF DISINFECTION/ STERILISATION

Physical Agents

- ***Burning*** or ***incineration*** is used to disinfect contaminated articles like dressings.
- ***Hot-air oven:*** Here temperature used is 160 to 180 degree for one hour.
- ***Boiling:*** It kills bacteria but not spores and viruses. Temperature is between 90 to 99 degree. It is used to disinfect syringes, utensils. It is not useful for gloves, rubber materials.
- ***Autoclave:*** It is steam under pressure. Temperature attained is between 120–135 degree. It is sterilised for 20 minutes with 15 pounds/sq. inch pressure. It kills all organisms including spores. Completeness of sterilisation is confirmed by using specific gelatin protein which precipitates only in steam underpressure for 20 minutes. Green coloured strip turns to black if autoclave is complete *(signaloc)*. Surgical gloves, linen, cotton, dressings, surgical instruments are sterilised by this method. Sharp and plastic instruments cannot be sterilised by this method. Bacillus thermophilus spores are used to assess the completeness of the sterilisation in mass scale. Double autoclaving is done for instruments of orthopaedic or ophthalmic surgeries **(Figs. 55.1 and 55.2)**.
- *The Bowie-Dick* method is also used to check the completeness of sterilisation.
- ***Radiation:*** *Ionising type of radiation:* Atomic gamma radiation is used as commercial method to sterilise suture materials, disposable materials in packets. It is viable, safe and cheaper.
- *Non-ionizing radiation* either infrared radiation or ultraviolet radiation is used to reduce the bacteria in air, water. Bacteria and virus are vulnerable to ultraviolet rays below 3000Å. Exposure to eyes and skin can cause burn injury.

Methods of sterilisation

Materials	*Method of sterilisation*
All theatre appliances	Autoclave
Sharp instruments (scissors, needles, blades), plastic materials	Glutaraldehyde 2%, lysol
Endoscopes	Glutaraldehyde
Rubber equipments	Glutaraldehyde
Syringes	Autoclave, hot air oven, gamma radiation
Heart-lung machine	Ethylene oxide
Disposable articles	Gamma radiation
Operation theatre and rooms	Ideally by ultraviolet radiation or by formaldehyde
Sera and biological materials	Filtration
Laboratory glassware	Hot-air oven
Ward, sick room, furniture	Formaldehyde, iodophor spray, glutaraldehyde
Clothes, bed sheets especially for burns patients	Autoclaving
Soiled dressings, materials, animal carcasses	Incineration, lysol, iodophors
Excreta	Lysol, iodophors
Cleaning of skin before surgery	Iodophors 2%, savlon, spirit
For cleaning infected wounds	Iodophors, acriflavine, savlon, H_2O_2
To remove slough from the wounds	EUSOL, H_2O_2
Before injection	Spirit is used to clean the skin
Cleaning the ward	Phenol, cresol, lysol
Hand wash	Chloroxylenol, savlon, spirit, iodophors
Bladder wash	0.1% potassium permanganate solution (Condy's lotion), solution of acetic acid and silver nitrate
Water	Chlorination, potassium permanganate
Fruits, vegetables	Potassium permanganate

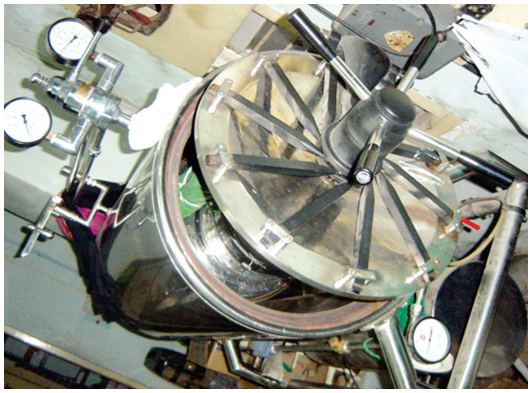


Fig. 55.1: Autoclave machine for sterilisation.

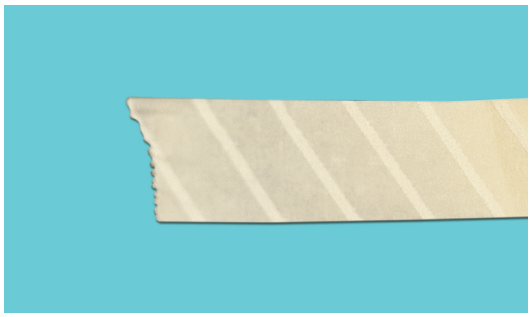


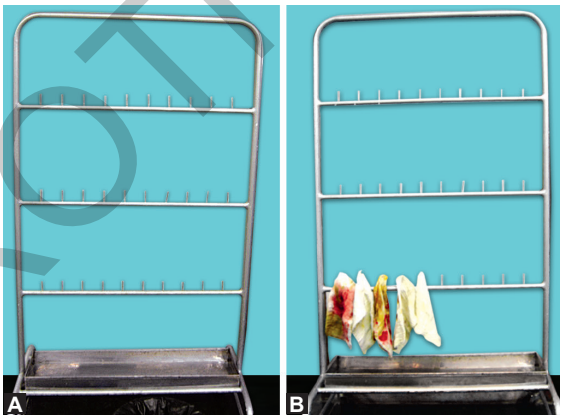
Fig. 55.2: Signaloc used for confirmation of completion of proper sterilisation.

Chemical Agents

- ***Phenol:*** It is used as standard to compare the efficacy of other agents.
- ***Cresol*** is more powerful and nontoxic. 5% solution is used.
- ***Lysol*** is emulsified cresol with soap. 2% solution is effective.
- ***Chlorhexidine (hibitane)*** is useful antiseptic.
- ***Hexachlorophane:*** It is not used in infants and children because it can get absorbed through intact skin in this age group causing severe neurotoxicity.
- ***Dettol (chloroxylenol)*** 5% solution is used.
- ***Cetrimide*** is cationic surfactant (cetavlon) 2% solution is used.
- ***Savlon*** is combination of cetrimide and hibitane. It is very commonly used antiseptic in operation theatres, wards.

Halogens

- Bleaching powder.
- Sodium hypochlorite.
- ***EUSOL: Edinburg University Solution*** contains sodium hypochlorite, boric acid and calcium hydroxide.
  EUSOL bath is dipping the ulcer bearing part in dilute EUSOL solution for 30 minutes 2–3 times a day.
- Iodine
- ***Iodophors:*** These are antiseptics and also sporicidals. They are non-irritant and do not stain skin. ***Povidone-iodine*** is a good example which is commonly used.
- ***Alcohols:*** Ethyl or isopropyl alcohols are used.
- ***Formaldehyde:*** It is useful to disinfect the rooms like operation theatre. It is effective at a high temperature and humidity of 80–90%. It is commonly used to fumigate the room. 500 mL of formalin with one litre of water is boiled to get formaldehyde vapour. Formaldehyde vapour can be created by adding potassium permanganate to the same solution. Room is kept closed for 12 hours.
- ***Glutaraldehyde (cidex 2%):*** It is used to sterilise sharp instruments. Instrument should be dipped for 10 hours to achieve complete sterilisation. It is potent bactericide, sporicide, fungicide and viricide.
- ***Hydrogen peroxide (H_2O_2):*** It is used as topical oxygen therapy. Because of its effervescence and release of nascent oxygen it removes the tissue debris. It is used to clean wounds, cavities, ulcers, as mouth wash and as ear drops to clear earwax.
- ***Acriflavine and proflavine*** are orange-red coloured dyes used as antiseptics. It is effective against Gram-positive and few Gram-negative organisms. It retains its activity in pus and body fluids.



Figs. 55.3A and B: Operation theatre mop rack to keep 'used mops' during surgery after use.

INSTRUMENTS

CHEATLE'S FORCEPS

It is used to pick sterilised articles like instruments and drapes so that touching of the instruments is avoided while transferring them. It is kept dipped in antiseptic solutions. It does not have lock.

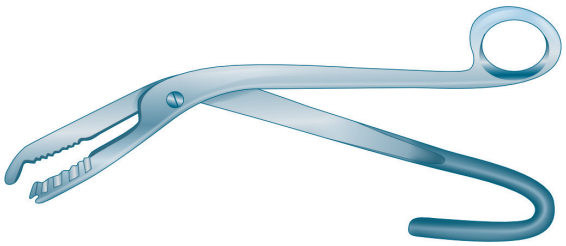


Fig. 55.4: Cheatle's forceps.

SPONGE HOLDING FORCEPS (RAMPLEY'S)

It has got fenestrated, serrated, flat distal end. It is used to clean the operative field, to swab the cavities, to mop the

oozing area, to hold gallbladder and cervix during surgeries, for blunt dissections, as ovum forceps.

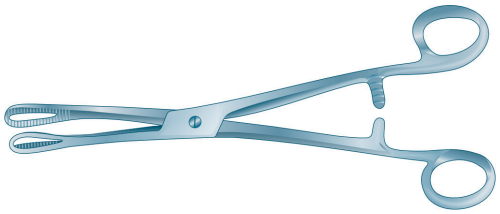


Fig. 55.5: Sponge holding forceps.

MAYO'S TOWEL CLIP

- It is used to fix drapes in operative field.
- It is used to fix suction tubes, diathermy wires, laparoscopic cables in operative table.
- It is used to fix ribs in flail chest.

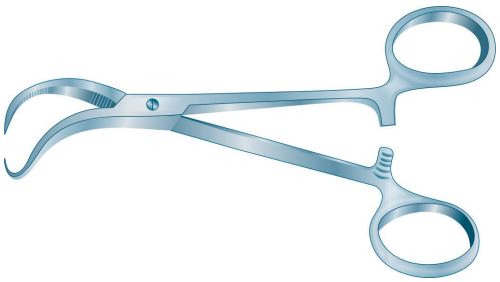


Fig. 55.6: Mayo's towel clip.

ARTERY FORCEPS (HAEMOSTAT)

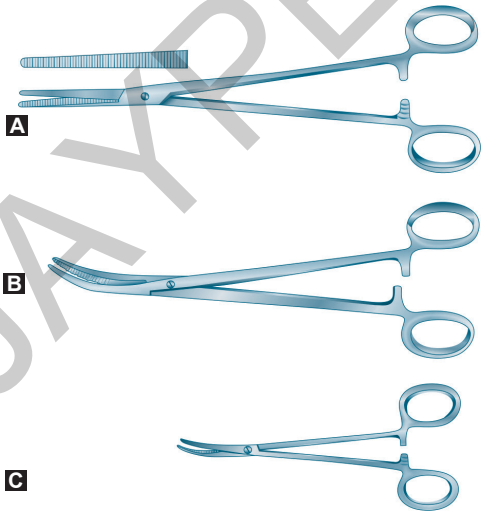
Types

Based on size:

a. Small or mosquito artery forceps.
b. Medium-sized artery forceps.
c. Large artery forceps.

Based on shape:

a. Straight artery forceps.
b. Curved artery forceps.



Figs. 55.7A to C: Artery forceps: (A) Straight; (B) Curved; (C) Mosquito.

Features of Artery Forceps

Distal blades have transverse serrations which are well-apposed. Lock in the proximal part.

BOX

Uses

- To catch bleeding points
- To open the fascial planes in different surgeries
- To pass a ligature
- To hold fascia, peritoneum, aponeurosis
- To hold sutures
- To drain an abscess like a sinus forceps
- To hold gauze as peanut

RIGHT ANGLE FORCEPS

It is used to dissect pedicles and to pass ligatures.

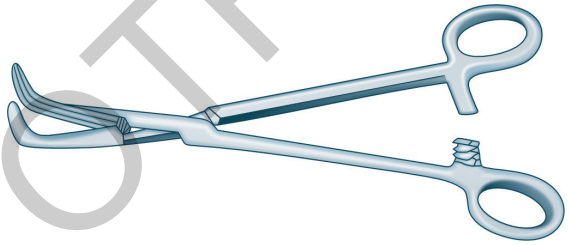


Fig. 55.8: Right angle forceps.

KOCHER'S FORCEPS

- It has got serrations in the distal blades and apposing tooth in the tip.
- It is used to hold pedicles, tough structures, cut ends of the muscles.
- It is used to hold gauze for blunt dissection, to hold resected bowel, to hold ribs during rib resection.

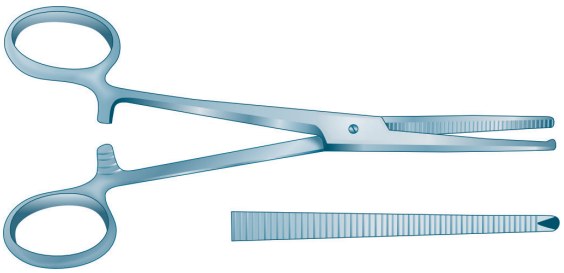


Fig. 55.9: Kocher's forceps.

ALLIS' TISSUE HOLDING FORCEPS

- Here distal blades are not apposing each other.
- Tip has got teeth in each blade which are apposing.
- It has got a lock on the proximal part.
- It is used to hold skin flaps, fasciae, aponeurosis, bladder wall.

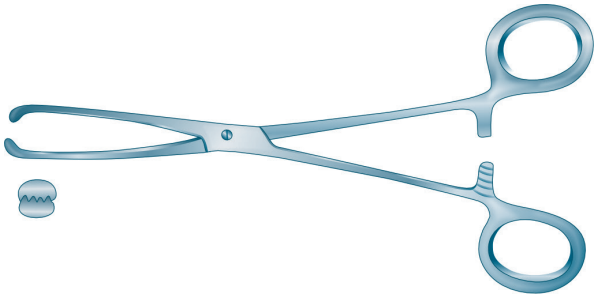


Fig. 55.10: Allis' tissue holding forceps.

BABCOCK'S FORCEPS

- Its distal part of distal blades are curved with a triangular fenestra in it which allow soft tissues to bulge out. Tip is non-traumatic with transverse serrations on it. It has got a lock in the proximal part.

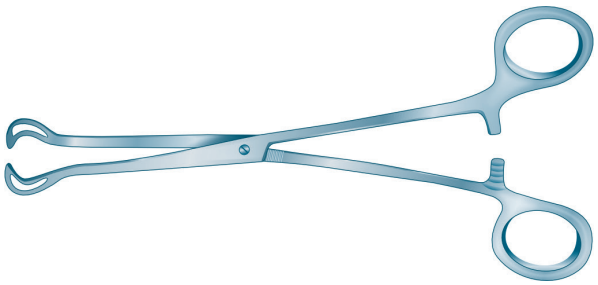


Fig. 55.11: Babcock's forceps.

- It is used to hold any part of the bowel, fallopian tubes, appendix, ureter, cord, etc.

LANE'S TISSUE HOLDING FORCEPS

- It has got thick, stout distal blades with oval fenestra in each blade.
- It has got apposing tooth in the tip.
- It has got a lock in the proximal part.

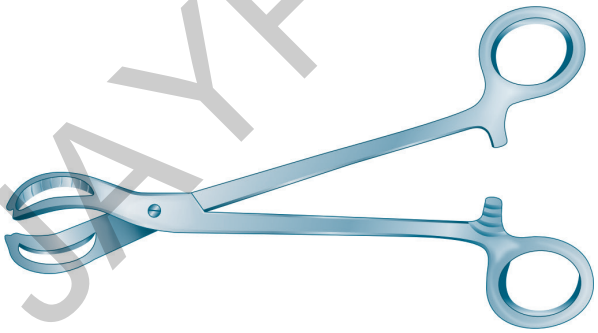


Fig. 55.12: Lane's tissue holding forceps.

- It is used to hold bulky and tough structures, to hold lymph nodes.
- It is also used as towel clip, as sponge holding forceps.

MORANT-BAKER'S APPENDIX HOLDING FORCEPS

It is like Lane's forceps but with apposing serrations proximal to the tooth. These serrations give a good grip in mesoappendix while holding appendix in appendicectomy. Its use is replaced by Babcock's forceps.

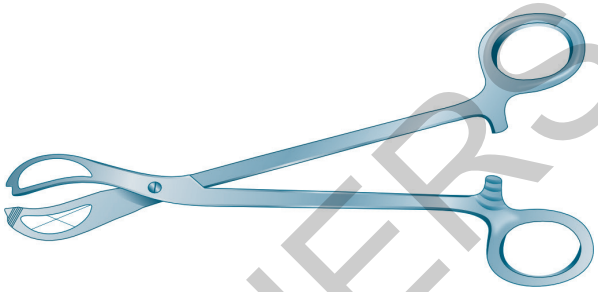


Fig. 55.13: Morant-Baker's appendix holding forceps.

VOLKMANN'S RETRACTOR

It is used to retract fasciae in soles and palms.

Fig. 55.14: Volkmann's retractor.

BOX

Retractors

- Superficial retractors
- Deep retractors
- Self-retaining retractors

LANGENBECK'S RETRACTOR

It has got a long handle and a small solid blade. It is used in hernia surgery or any superficial surgeries to retract skin, fasciae and aponeurosis, etc.

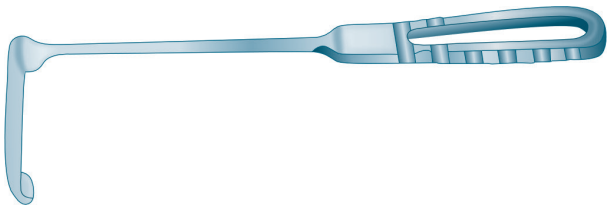


Fig. 55.15: Langenbeck's retractor.

CZERNY'S RETRACTOR (HERNIA RETRACTOR)

This retractor has got thick, small blade on one side and biflanged hook on the other side in opposite directions. It is used in surgeries like hernia, laparotomy especially during closure.

The postoperative treatment is as essential as the operation and the surgeon is as much responsible for the postoperative treatment as for the operation.— **Roscoe C Giles**

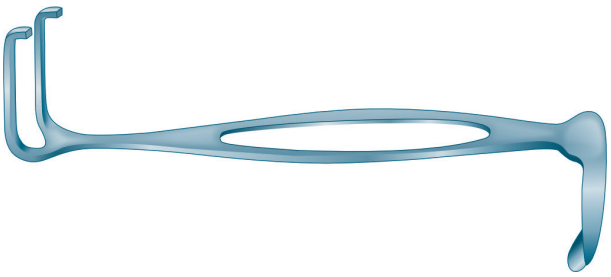


Fig. 55.16: Czerny's retractor.

MORRIS RETRACTOR

- It may be single blade type or double blade type.
- It is used to retract abdominal wall.

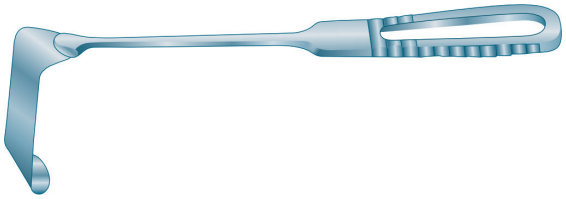


Fig. 55.17: Morris retractor.

DEAVER'S RETRACTOR

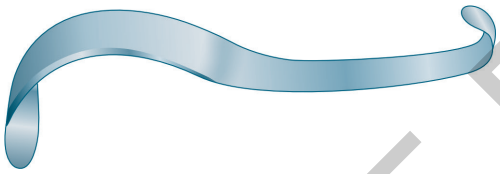


Fig. 55.18: Deaver's retractor.

- It is a retractor with a broad, gently curved blade.
- It is used to retract liver, spleen and other abdominal viscera.
- It is atraumatic and gives adequate exposure of the surgical field.

DOYEN'S RETRACTOR

It is used in pelvic surgeries.

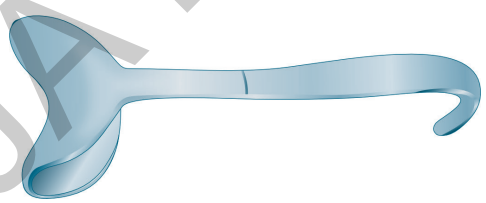


Fig. 55.19: Doyen's retractor.

SELF-RETAINING RETRACTOR

It has got different adjustable blades so as to retract abdominal wall and tissues during surgery (Balfour's retractor).

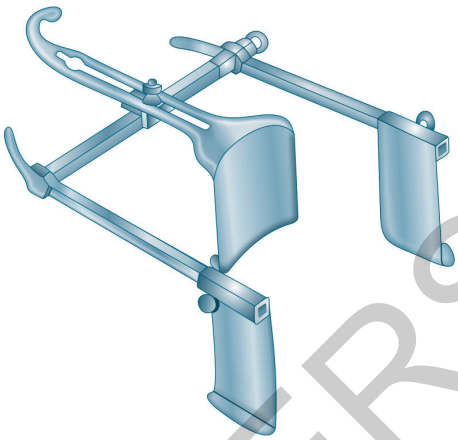


Fig. 55.20: Self-retaining retractor.

SINGLE HOOK RETRACTOR

It is used to retract skin.

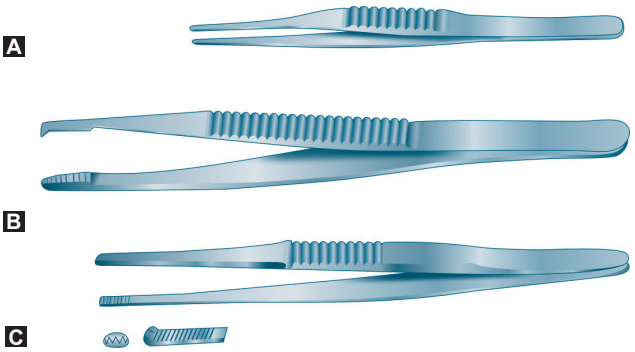
Fig. 55.21: Single hook retractor.

PLAIN NON-TOOTHED DISSECTING FORCEPS

It is used to hold delicate structures like peritoneum, vessels, bowel, nerves, tendons.

TOOTHED DISSECTING FORCEPS

It is used to hold skin and tough structures.



Figs. 55.22A to C: Dissecting forceps: (A) Non-toothed; (B and C) Toothed.

SURGICAL NEEDLES

Types

BOX

Based on the edge

- Round body needle
- Cutting needle
- Reverse cutting needle
- Taper cut needle
- Side-to-side flat—Hagedron needle

BOX

Based on curvature

- Straight needle
- Curved needle. Half circle; 5/8 circle, etc.

Based on Existence of the Eye

- ***Atraumatic needle*** is eyeless. Here suture material is attached to the needle by swaging. Size of the suture material and that of needle is same and so tissue trauma is less. Needle once used is disposed of (not reusable).
- ***Traumatic needle:*** It is eyed needle. Needle in the eye area is wider than the body of the needle and so tissue trauma is more. These needles are reusable.

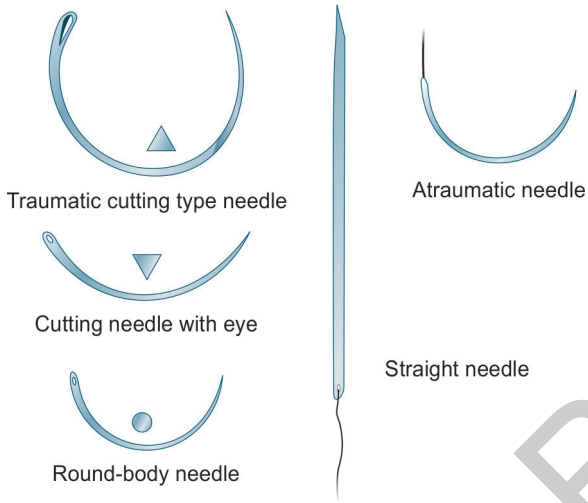


Fig. 55.23: Needles.

- *Round-body needles* are used in soft structures like peritoneum, muscle, vessel, nerves, tendons, bowel, soft tissues.
- *Cutting needles* are used to suture skin, aponeurosis and tough structures.
- Reverse cutting needle is used to suture mucoperiosteum.

NEEDLE HOLDER

- Smaller distal blades with criss-cross serrations often with a groove in the middle are the features of a needle holder.

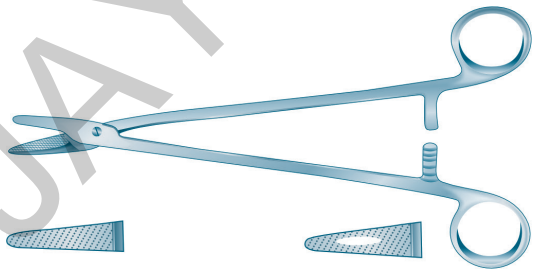


Fig. 55.24: Needle holder.

- It may be straight or curved. It may be available with different sizes. While holding a needle in a needle holder one should get a good control and good grip. This is achieved by placing the needle at the junction of proximal 2/3rd and distal 1/3rd. Needle holder should be held between thumb and ring finger.

JOLL'S THYROID RETRACTOR

It is a self-retaining retractor specifically used for thyroid surgeries.

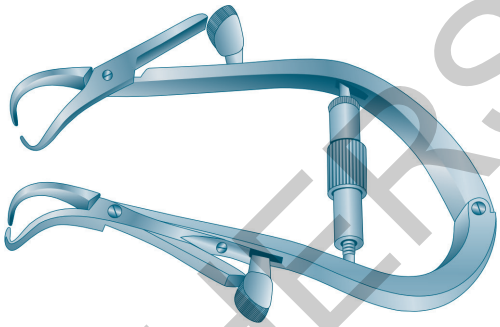


Fig. 55.25: Joll's thyroid retractor.

MOYNIHAN'S OCCLUSION CLAMP

- It has got long distal blades with longitudinal serrations.
- It may be straight or curved.
- It is non-traumatic, non-crushing type.
- It occludes lumen of the bowel/stomach and so prevents spillage of the content of the bowel.
- It also occludes the vessels in the wall of the bowel and so prevents bleeding during surgery.
- It is used during anastomosis of the stomach and other parts of the bowel.

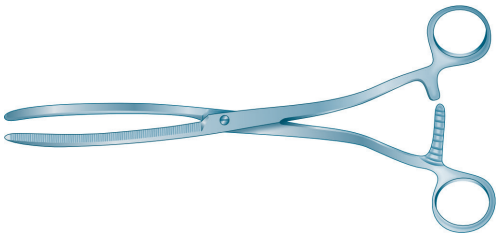


Fig. 55.26: Moynihan's occlusion clamp.

PAYR'S CRUSHING CLAMP (GASTRIC)

- It is stout and heavy instrument with double lever in the handle.

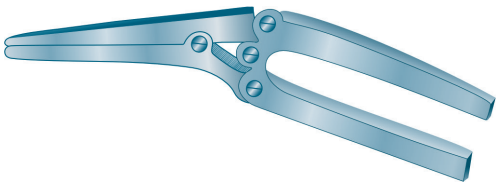


Fig. 55.27: Payr's crushing clamp.

- It crushes the bowel once applied. So before applying it, line of resection of stomach/bowel should be assessed properly. It is applied to the part which is removed. Viability of the bowel is lost once it is applied.
- It is used in gastrectomy and resection and anastomosis of the bowel.

DESJARDIN'S CHOLEDOCHOLITHOTOMY FORCEPS

- It has got long distal blades with smooth serrations and fenestra in the tip. It does not have lock and so accidental damage of CBD mucosa or crushing of the CBD stone are avoided.

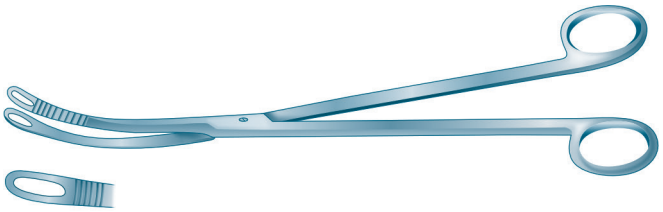


Fig. 55.28: Desjardin's choledocholithotomy forceps.

- It is used for choledocholithotomy (removal of CBD stones).

BAKE'S DILATOR

- It is long malleable metallic instrument with club at the terminal end.
- It is used to assess the CBD, duodenal papilla for patency or block.

Fig. 55.29: Bake's dilator.

SINUS FORCEPS (LISTER's)

- It has got straight, long blades with serrations in the tip. It does not have a lock.
- It is used to drain pus from abscess cavity (Hilton's method). It is called as sinus forceps because it was initially originated to pack the sinus cavities. It is less traumatic.
- Sinus forceps has no lock; no serrations; broad tip; blunt.

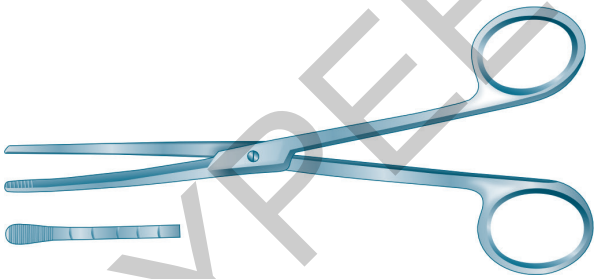


Fig. 55.30: Lister's sinus forceps.

SCISSORS

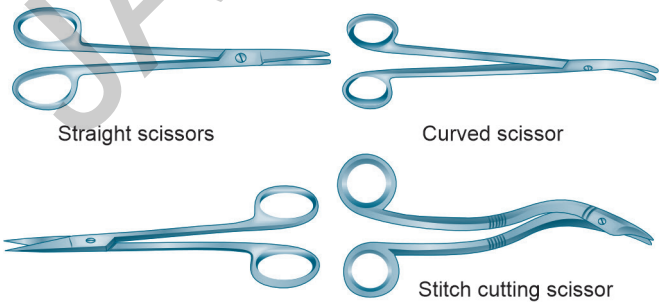


Fig. 55.31: Scissors.

VOLKMANN'S SCOOP

To scoop cavities, ulcer bed, granulation tissues.

On either side different sized scoops are present.

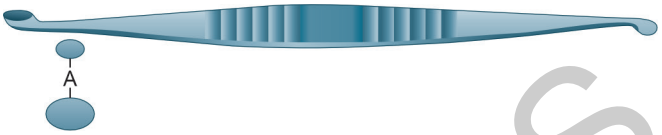


Fig. 55.32: Volkmann's scoop.

TRACHEOSTOMY TUBE

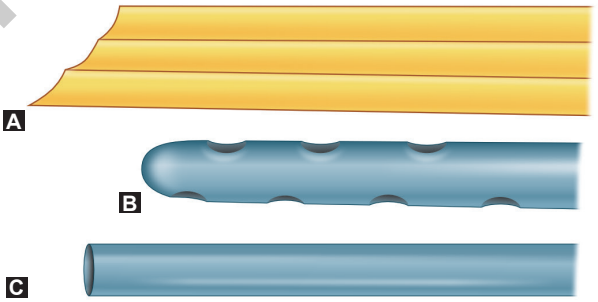
Refer Chapter 55B, page 1281.

DRAINS

A drain is a created channel which allows any fluid collected, to come out after closure of the main wound.

Types

- *Corrugated rubber drain:* It drains by capillary action and gravity. It is cheaper and technically easier. But it allows soakage of dressings and causes discomfort to the patient.
- *Tube drains*
  - Malecot catheter can be used as a tube drain.
  - Penrose soft latex rubber tube.
  - Multiple perforated tubes.



Figs. 55.33A to C: Drains: (A) Corrugated rubber drains; (B) Multiple perforated drains; (C) Tube drain.

BOX

Advantages of tube drains

- Quantity of fluid like bile, pus can be measured
- It can be kept for longer time
- Skin excoriation will not occur
- Patient remains more comfortable
- Infection rate is less; removal is easier
- Dye can be injected and cavity or communication can be assessed using 'C-arm'

- *Closed suction tube drain system.*
- *Glove drain.*
- *Wick drain* is a gauze drain to drain pus, discharge, etc.
- *Sump drain:* This is a type of drain where parallel air vent prevents the adjacent soft tissues from being sucked into the drain when negative pressure is applied.

BOX

Advantages of sump drain

- No drain blockade
- Resists collapse of the structure when suction is applied.

BOX

Uses of sump drain

- Collection of irritant discharges (enterocutaneous fistula)
- Collection of secretions having activated enzymes (high small bowel, pancreatic fistula)
- Draining proximal stump in TEF with oesophageal atresia to prevent aspiration

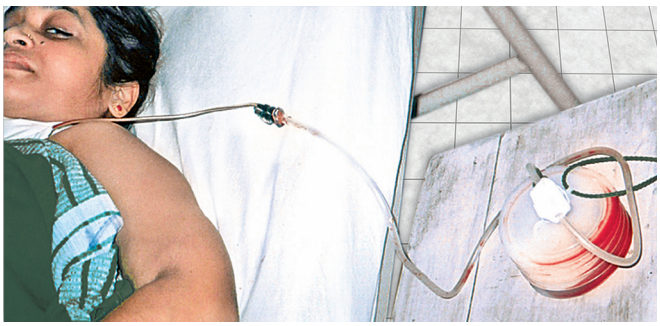


Fig. 55.34: Suction drain used in thyroid surgery.

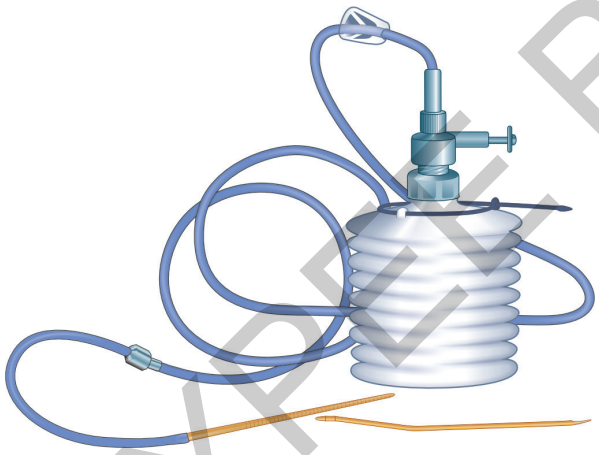


Fig. 55.35: Romovac suction drain. Here suction is created by pressing the suction corrugation. There is a sharp metallic introducer to pass the tube into the required area after puncturing the skin. It is used for thyroidectomy, mastectomy, radical dissection, wide excisions, flap surgeries, etc.

Classification of Drain Systems

- ***Open (static) drain:*** For example, corrugated drain, penrose drain. Infection rate is higher.
- ***Closed siphon drain:*** Here drain is connected to a sterile bag with or without one-way valve. It reduces the infection.
- ***Closed suction drain:*** Here negative pressure of—100 to 500 mm Hg is used to create vacuum to drain the secretions.
- ***Sump suction drain:*** Here negative suction with a parallel air-vent is used to prevent the adjacent soft tissues being sucked into the lumen of the drain.
- ***Under water seal drain*** to drain pleural space.

BOX

Indications for drains

- In drainage of an abscess
- In bleeding surgical conditions like trauma, peroperative bleed
- haemo-, pyo- or pneumothorax
- In acute abdominal conditions like peritonitis, haemoperitoneum
- In major abdominal surgeries like of pancreas, biliary tree, stomach, etc.
- In thyroid surgery
- In hydrocele surgery

Problems in Drains

- Infection can occur through the drain.
- Displacement.
- It may not drain adequately and can give a false information.
- It may interfere with healing process inside.

Presently keeping a drain itself is a questioned debate and controversy all over.

Older dictum was 'when in doubt keep a drain and the surgeon can sleep happily'—is questioned at present.

Drains if not used properly may be counterproductive.

FOLEY'S CATHETER

Refer Chapter 49A, page 1113.

MALECOT'S CATHETER

Refer Chapter 49A, page 1114.

SIMPLE RED RUBBER CATHETER

Refer Chapter 49A, page 1114.

LISTER'S URETHRAL DILATOR

Refer Chapter 49D, page 1170.

RYLE'S TUBE

It is one meter long and is made of red rubber or plastic.

It has got *three lead shots* in the tip which makes it radiopaque. It also facilitates easy passage of the tube through the oesophagus.

It has got markings at different levels:

- At 40 cm distance, at the level of gastro-oesophageal junction.
- At 50 cm distance, at the level of body of the stomach.

- At 60 cm distance, at the level of the pylorus.
- At 65 cm distance, at the level of the duodenum.

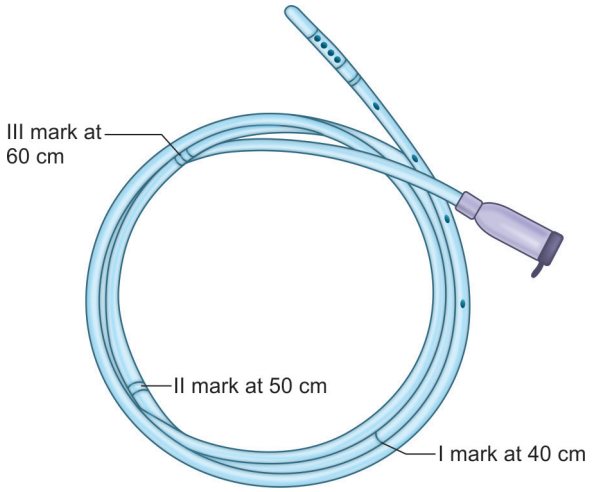


Fig. 55.36: Ryle's tube.

Indications

Diagnostic
- For gastric function tests—to assess free acid and total acid
- Hollander's test for completion of vagotomy
- To diagnose tracheo-oesophageal fistula
- Baid test for pseudocyst of the pancreas

Therapeutic
- In acute abdominal conditions like peritonitis/obstruction
- In abdominal trauma
- After abdominal surgeries
- In pyloric stenosis
- In upper gastrointestinal bleeding
- In paralytic ileus
- For feeding purpose in conditions like comatose patients, faciomaxillary injuries, major head and neck surgeries

INFANT FEEDING TUBE

- There are *no lead shots* and markings on the tube.
- It is used for feeding purpose in infants who is under coma, with faciomaxillary injuries and anorexia.

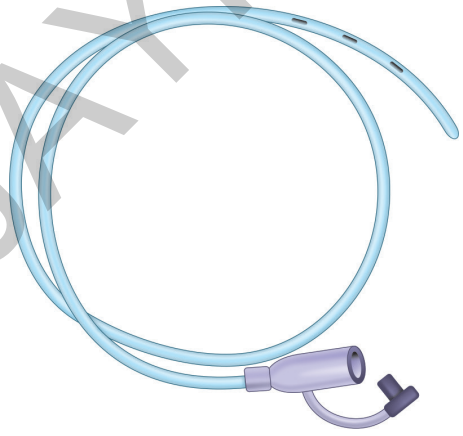


Fig. 55.37: Infant feeding tube.

KEHR'S 'T' TUBE

- It is used after opening common bile duct (CBD) (choledochotomy). CBD is closed once 'T' tube is placed in the CBD.
- It is made up of latex or red rubber.
- 'T' tube has got horizontal part which is placed in the CBD and vertical part which is allowed to come out, to drain bile. Amount of bile draining daily is measured.

Before removal of the "T" tube, patency of CBD should be confirmed.

It is done by following methods:
- The vertical limb is clamped (done in 12–14 days) and the patient is observed for development of pain, fever and jaundice in 24 hours. If normal, then one can presume that there is no obstruction in the CBD.
- Water soluble iodine dye is injected through the tube to visualize biliary tree and free flow of dye into the duodenum. (postoperative 'T' tube cholangiogram). It is done in 14 days which is the time required to develop fibrous track. Once there is free flow, tube is removed and track gets closed on its own.

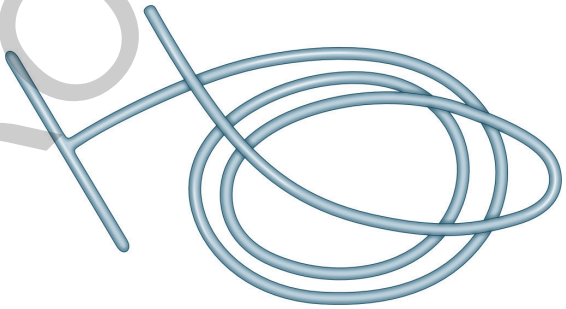


Fig. 55.38: Kehr's 'T' tube.

PROCTOSCOPE

Refer Chapter 48, page 1064.

FLATUS TUBE

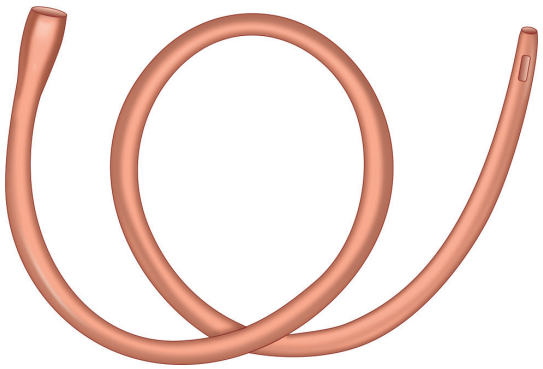


Fig. 55.39: Flatus tube.

It is made up of India rubber, 45 cm in length. There is one opening in the tip and another on the side proximal to the

tip. (Urinary catheter like red rubber catheter has no opening in the tip, only side opening is present). It is used in sigmoid volvulus to decompress and derotate; in paralytic ileus; in subacute intestinal obstruction. It is passed per anal into the recto-sigmoid area. Proximal end is connected to water container to observe the quantity of air bubble which signifies the amount of gas getting deflated.

SUTURE MATERIALS

BOX

Features of ideal suture material

- Adequate tensile strength
- Good knot holding property
- Should be least reactive
- Easy handling property
- Should have *less memory*
- Should be easily available and cost effective

CLASSIFICATION I

Absorbable Suture Materials

- **Plain catgut** is derived from submucosa of jejunum of sheep.
  - It is yellowish white in colour.
  - It is absorbed by inflammatory reaction and phagocytosis—absorption time is 7 days.
  - It is used for subcutaneous tissue, muscle, circumcision in children.
- **Chromic catgut** is catgut with chromic acid salt.
  - It is brown in colour.
  - Its absorption time is 21 days.
  - It is used for suturing muscle, fascia, external oblique aponeurosis, ligating pedicles, etc.
- **Vicryl** (polyglactic acid):
  - It is synthetic absorbable suture material.
  - It gets absorbed in 90 days.
  - Absorption is by hydrolysis.
  - It is violet in colour (braided).
  - It is multifilament and braided.
  - It is very good suture material for bowel anastomosis, suturing muscles, closure of peritoneum.
- **Dexon** (polyglycolic acid) is synthetic absorbable suture material like vicryl. It is creamy yellow in colour (braided).
- **Maxon** (polyglyconate) monofilament.
- **PDS (Poly Dioxanone Suture material)** is absorbable suture material. It is creamy in colour with properties like vicryl. It is costly but better suture material than vicryl.
- **Monocryl** (polyglecaprone) monofilament.
- **Biosyn** (glycomer) monofilament.

BOX

Uses of absorbable suture materials

- In bowel anastomosis like gastrojejunostomy, resection and anastomosis. Vicryl is used
- In cholecystojejunostomy (CCJ), choledochojejunostomy (CDJ), pancreaticojejunostomy. Vicryl is used
- In suturing muscle, fascia, peritoneum, subcutaneous tissue, mucosa
- In ligating pedicles. 1-zero chromic catgut or vicryl are used, e.g. ligation of pedicles during hysterectomy
- In circumcision, usually 3-zero plain or chromic catgut are used

Absorbable suture materials should not be used for suturing tendon, nerves, vessels (vascular anastomosis).

Non-absorbable Suture Materials

- ***Silk*** is natural, multifilament, braided, non-absorbable suture material derived from cocoon of silkworm larva. It is black in colour. It is coated suture material to reduce capillary action.
- ***Polypropylene*** (prolene) is synthetic, monofilament suture material. It is blue in colour. It has got high memory. (*memory of suture material* is recoiling tendency after removal from the packet. Ideally suture material should have low memory.) (Prolene mesh used for hernioplasty is white in colour).
- ***Polyethylene*** (ethylene) is synthetic monofilament nonabsorbable suture material. It is black in colour.
- ***Cotton*** is twisted multifilament natural nonabsorbable suture material. It is white in colour.
- ***Linen*** is derived from bark of cotton tree.
- ***Steel, polyester, polyamide, nylon*** are other non-absorbable suture materials.

BOX

Uses of non-absorbable suture materials

- In herniorrhaphy for repair
- For closure of abdomen after laparotomy
- For vascular anastomosis (6-zero), nerve suturing, tendon suturing
- For tension suturing in the abdomen
- For suturing the skincc

CLASSIFICATION II

- **Natural:** Catgut silk, cotton, linen.
- **Synthetic:** Vicryl, dexon, polydioxanone suture (PDS), maxon; polypropylene, polyethylene, polyester, polyamide.

CLASSIFICATION III

- **Braided:** Polyester, polyamide, vicryl, dexon, silk.
- **Twisted:** Cotton, linen.

CLASSIFICATION IV

- **Monofilament:** Polypropylene, polyethylene, PDS, catgut, steel.
- **Multifilament:** Polyester, polyamide, vicryl, dexon, silk, cotton.

CLASSIFICATION V

- Coated.
- Uncoated.

Numbering of Suture Material

2-Thick. For pedicle ligation.	5-zero. For vascular anastomosis.
1-	6-zero.
0-zero.	7-zero.
1-zero.	8-zero.
2-zero. For bowel suturing.	9-zero. For ophthalmic surgery. Requires operating microscope.
3-zero.	
4-zero.	

Fig. 55.40: Photograph showing different types of suture materials (with pack).

BOX

Types of suturing

- Continuous
- Interrupted simple
- Interrupted mattress
- Subcuticular
- Horizontal tension
- Vertical tension

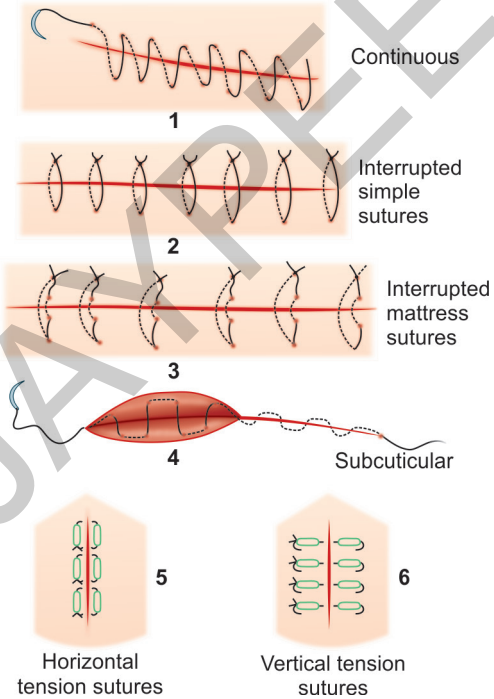


Fig. 55.41: Types of suturing.

BOX

Types of knots

- Reef knot
- Granny knot
- Surgeon's knot

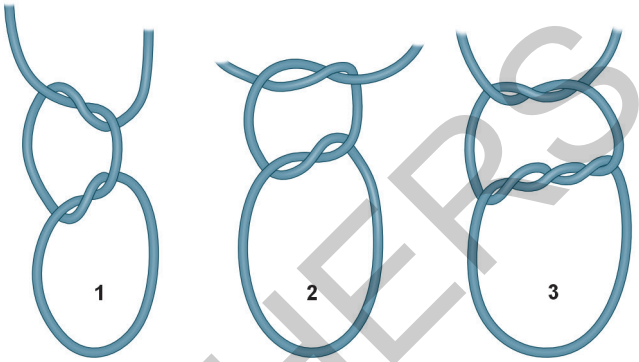


Fig. 55.42: Types of knots: (1) Reef knot; (2) Granny knot; (3) Surgeon's knot.

DIATHERMY (ELECTROCAUTERY)

It is the method to control bleeding or to cut the tissues during surgery.

Types

Based on type of current used:

- Unipolar cautery.
- Bipolar cautery. It is safer because its effect is seen only in between electrode points. Adjacent tissues will never get damaged.

Based on type of action:

- ***Coagulation cautery*** which causes haemostasis by tissue coagulation. Here temperature is 100 degree (blue switch).
- ***Cutting cautery*:** Here temperature is 1,000 degree which disintegrate the tissues. It is not haemostatic (yellow switch).
- ***Blended current*** is combination of both coagulation and cutting.

Differences Between Unipolar and Bipolar Cautery

Unipolar cautery	*Bipolar cautery*
Can be used for both coagulation and cutting	Only for coagulation
Conducting plate should be kept	No need
Cannot be used in patient with artificial valves	Can be used
Should be careful about adjacent tissues	Adjacent tissues will never get damaged

Uses

- For coagulation of bleeders during surgery to achieve haemostasis.
- To cut muscles, fascia, etc.

- It is essential for laparoscopic surgical procedures. Bipolar is commonly used.
- It is used to remove small cutaneous lesions, to control bleeding duodenal ulcer.

Disadvantages

- Infection.
- Cauterisation of normal tissues.
- Problem of explosion.
- Diathermy burn to the patient at the site where diathermy plate is kept.
- Burn injury or electrical shock to surgeon and assisting personnel.

Precautions

- Proper earthing.
- Avoid loose contact of electrodes.
- It should be kept off when not in use during procedure.

Fig. 55.43: Diathermy machine with plate, foot switch for use.

B. Operative Procedure

ABDOMINAL INCISIONS

Principles

- Incision should be long enough for a good exposure.
- Splitting the muscle is better than cutting, except rectus muscle.
- Avoid cutting nerves and vessels in the abdominal wall.
- Retract muscle, abdominal organs towards the neuro-vascular supply.
- Insert a drainage tube through a separate incision.
- Transverse incisions are better than vertical incisions.
- Close the wound layer by layer.

BOX

Requirements

- Accessibility
- Extensibility
- Security

BOX

Factors affecting the strength of the scar

- Type of surgery (acute abdomen, surgery for malignancy, major surgery)
- Obesity
- Pregnancy
- Straining
- Cough
- Ascites
- Nutrition
- Diabetes
- Immunosuppression
- Type of incision

Complications of Abdominal Incision

- Wound infection.
- Wound pain.
- Burst abdomen.
- Incisional hernia.
- Fistula formation.
- Adhesion and its complication.

Different abdominal incisions are:

- Upper midline.
- Upper right paramedian.
- Upper left paramedian.
- Kocher's incision (right subcostal).
- Left subcostal.
- Bucket handle.
- Upper horizontal.
- Thoracoabdominal.
- Subumbilical.
- Incision for lumbar sympathectomy.
- Lower midline.
- Lower right or left paramedian.
- Incisions for appendicectomy—McBurney's, Rutherfold Morrison's, Lanz, laparoscopic.
- Pfannenstiel incision.
- Lower horizontal.

- Upper incisions are always better.
- Horizontal incisions are better.
- Paramedian is better than midline.

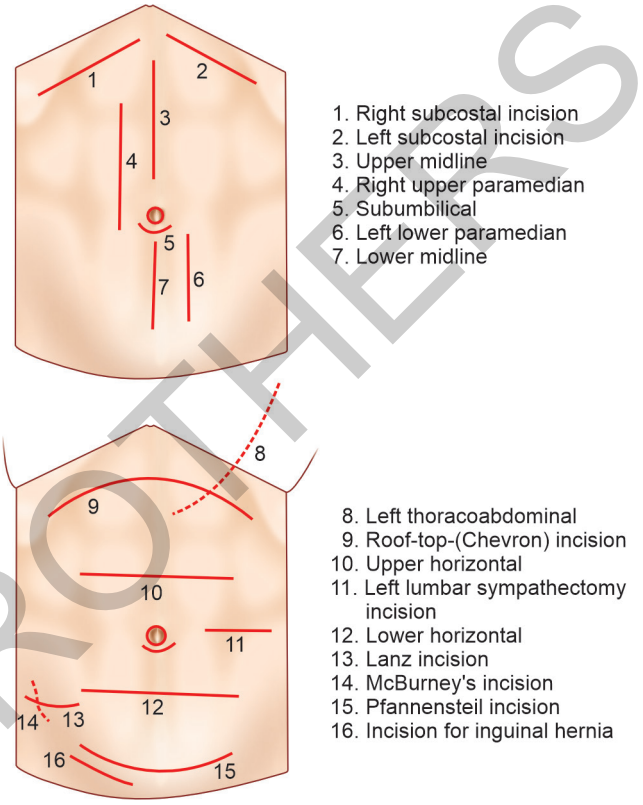


Fig. 55.44: Different incisions in the abdomen.

VASECTOMY

Indications

- Family planning (parents should have two healthy children, consent should be obtained).
- After prostatectomy, vasectomy is done to prevent retrograde infection of testes.

Procedure

Types

- Classical method—scalpel technique.
- No scalpel technique (Shunqiang Li, China).

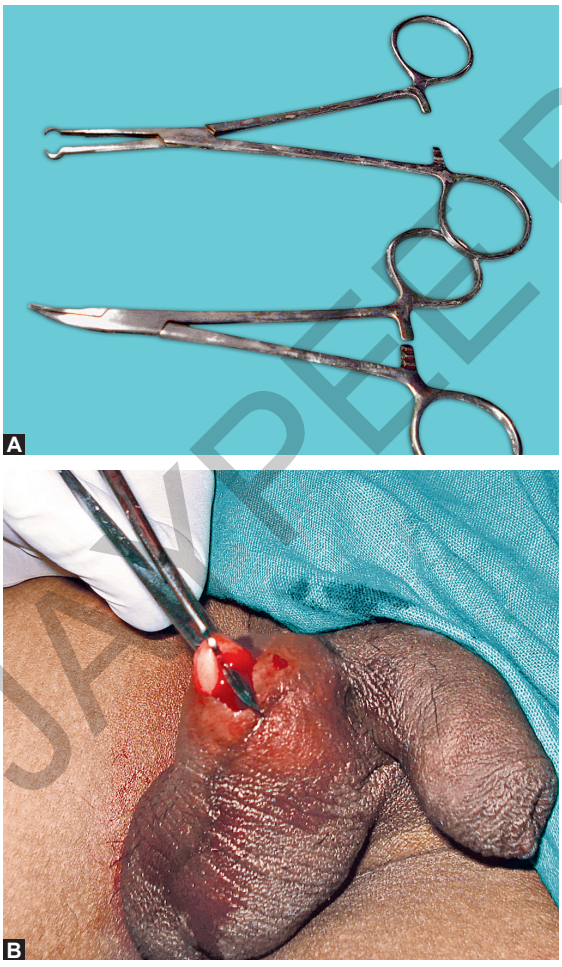
Classical Method

After cleaning and draping the scrotum, 2–5 mL of xylocaine plain 1 % is injected into root of the scrotum on lateral aspect. Skin, dartos are incised (1–2 cm vertical incision). Once spermatic fascia is incised cord structures are identified. Vas deferens is seen and felt as thickened whitish cord like structure. It is dissected using mosquito artery forceps. It is held using Babcock's forceps as loop outside the

wound. Vas is clamped in two different places with a gap in between using two artery forceps. A piece of the vas (5–10 mm) is excised. Cut ends are ligated using non-absorbable sutures like silk. Skin is closed with sutures. Procedure is repeated on the other side. Dressing is placed. Sutures removed after 7 days.

No Scalpel Technique

Two special instruments are used here. An extracutaneous ring clamp and Chongquing's sharpened curved mosquito clamp. After cleaning and draping, xylocaine 2% of 2–3 mL is injected under the skin of midline raphe proximal aspect. Vas deferens of one side is felt and pushed under the raphe. It is carefully held with extracutaneous ring clamp. Skin is incised using sharp tip of the curved mosquito clamp. Whitish cord like vas which is held with ring clamp is dissected → clamped → a small piece of 5 mm is cut. Cut ends are ligated using silk. Opposite vas is also similarly brought into the same wound by manipulation and clamped and ligated after cutting. Skin is not closed. It gets apposed automatically and heals on its own. Post-operatively antibiotics and analgesics are given. It is a *single incision procedure* also.



Figs. 55.45A and B: No scalpel vasectomy instruments and technique.

Advice

To avoid sexual contact or to use contraception for 3 months.

BOX

Complications

- Haematoma
- Haematocele
- Infection
- Pyocele
- Sperm granuloma
- Recanalisation occurs rarely but dangerous

- When there is hernia or hydrocele, vasectomy is done along with specific procedures for hernia or hydrocele.
- ***No scalpel vasectomy,*** using specialised instruments is becoming popular. Procedure does not require any suturing.

CIRCUMCISION

Refer Chapter 49E, page 1178.

HYDROCELE

Refer Chapter 49F, page 1187.

INGUINAL HERNIA

Refer Chapter 41, page 844.

APPENDICECTOMY

Refer Chapter 47, page 1051, 1054.

THYROIDECTOMY

Refer Chapter 29, page 551.

TRACHEOSTOMY

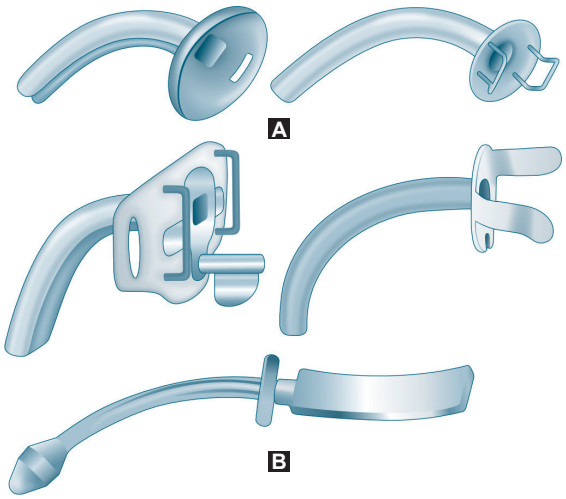
Types

- Emergency tracheostomy.
- Elective tracheostomy.

Tracheostomy Tube

- ***Fuller's bivalved tracheostomy tube*:** It has got outer tube and inner tube. Outer tube is biflanged and so insertion is easier. Inner tube is longer with an opening on its posterior aspect. Inner tube can be removed and re-inserted easily whenever required.
- ***Jackson's tracheostomy tube***: It has got outer tube, inner tube and an obturator.
- Red rubber tracheostomy tube.
- Polyvinylchloride tracheostomy tube.

Modern tracheostomy tubes are made of plastic. They are soft, least irritant and disposable. They have inflatable cuff which makes it easier to give assisted ventilation. Cuff should be deflated at regular intervals to prevent tracheal pressure necrosis. (For assisted ventilation endotracheal tube can be kept for 7 days. Beyond that period patient needs tracheostomy for further ventilation.)



Figs. 55.46A and B: Tracheostomy tube: (A) Fuller's; (B) Jackson's tracheostomy tube.

Fig. 55.47: Tracheostomy tube with inflation part and syringe (inflated with air).

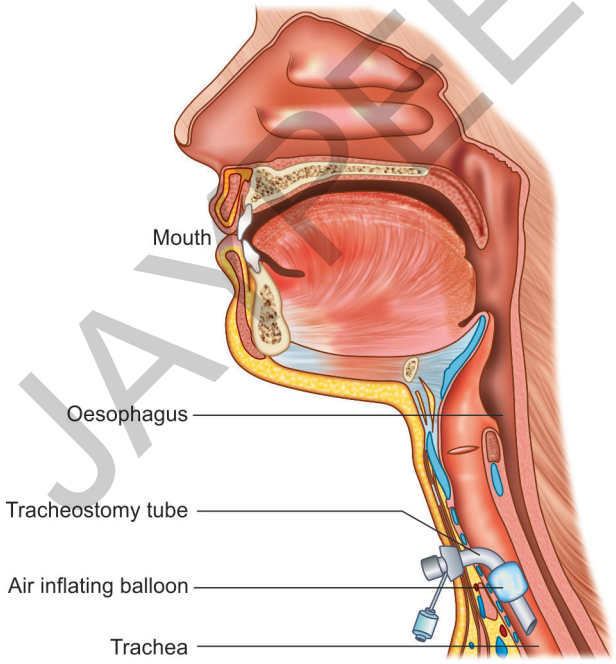


Fig. 55.48: Figure showing the position of tracheostomy tube.

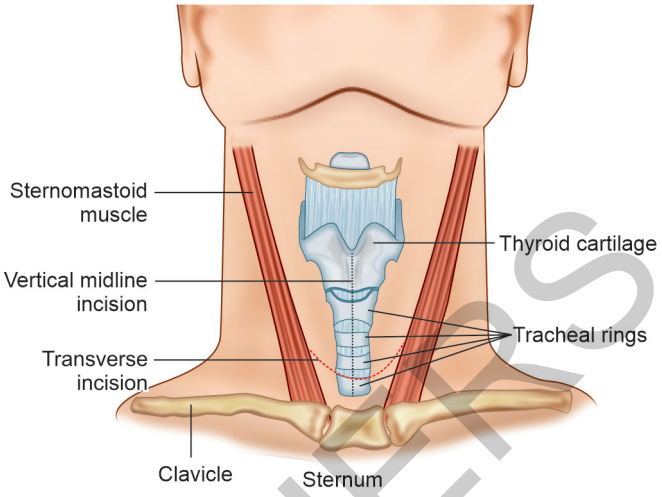


Fig. 55.49: Vertical midline or transverse incisions are used for tracheostomy. ***Vertical midline*** extends from cricoid cartilage to sternal notch. It is used both in emergency and elective tracheostomy and commonly used incision. It gives rapid access with less dissection but leads into poor scar. ***Transverse incision*** can be used in elective tracheostomy. It is placed two finger breadths above the sternal notch with a length of about 5 cm transversely. It has got a better cosmetic scar.

BOX

Indications for tracheostomy

- In head, neck and facial injuries
- Tetanus
- Tracheomalacia after thyroidectomy
- Laryngeal oedema/spasm/surgeries
- Major head and neck surgeries like commando's operation, block dissection, etc.
- ICU ventilation after 7 days

Technique of Tracheostomy

Neck of the patient is hyperextended by placing sand bags under the shoulder. Vertical (midline) or horizontal incision is made. Deep fascia is opened. Strap muscles are retracted laterally. Isthmus is divided or retracted below. 2nd and 3rd tracheal rings are opened and circular opening is made. Tracheostomy tube is placed. It is tied around the neck.

Note:
Endotracheal tube can be kept *in situ* only for 7 days.

Fig. 55.50: Advanced secondaries in neck with tracheostomy tube to control respiratory stridor.

Tracheostomy Care

- Regular suctioning of the tube.
- Cleaning of tracheostomy tube.
- Humidification of the inspired air.

BOX

Complications of tracheostomy

- Tracheal stenosis
- Bleeding
- Aspiration
- Pneumothorax
- Surgical emphysema in the neck
- Mediastinal emphysema
- Tracheostomy dependency

CRYOSURGERY

- It is the destruction of tissues by ***controlled cooling.***
- System contains an automatic defrosting device with a cryoprobe.

BOX

Gases used are:

- Nitrous oxide—minus 98°C temperature.
- CO_2—minus 60°C.
- Liquid N_2—minus 180°C.
- Freon—minus 190°C.

Commonly nitrous oxide is used as it is easily available, cheaper and achieves optimum temperature required for different procedures.

- ***Mode of action:*** It produces intracellular crystallisation, dehydration and denaturation of proteins and cell death; and it causes the obliteration of microcirculation and so cell death.
- ***Indications:*** To remove warts and lesions in the skin; cryotherapy for piles; for chronic cervicitis.
- ***Advantages:*** Relatively bloodless and painless; adequate control of extent and depth in freezing; equally effective.
- ***Disadvantages:*** Infection; discharge from the site.

LASERS IN SURGERY

It is **Light Amplification Stimulated Emission of Radiation**. Electrons in high energy status leave towards excited level from ground state and eventually return to ground state releasing its energy as photon particle of light. This laser light has got one specific wavelength and is monochromatic. Laser light is unidirectional with one specific colour and is coherent with a tight, strong and concentrated beam.

Power density and laser energy are two important parameters. Power density is the measure in unit beam area; it is Watts/cm^2. Laser energy is power delivered/second.

Molecules are placed in a compact area and power is passed through this so as to activate the molecules. Molecules get activated at different periods and move in different directions, which they hit each other releasing energy; this energy is allowed to act through optical system to area wherever required. Depending on the molecules used laser is being named like Nd YAG (**N**eo **d**ymium **Y**trium **A**luminum **G**arnet **Laser**), CO_2, Neon, Holmium, Erbium, etc.

Types Based on Generation of Power

1. *Continuous wave laser*: Generates continuous power for longer duration; it is commonly used in medical field.
2. *Pulsed laser*: Generates high power for short intervals in pulses. Nd-YAG pulsed laser is used in ophthalmology; diode pulsed laser is used in varicose veins.

Types, Based on Material Used

- *Solid state laser*: Nd-YAG laser (infrared light of 1064 wavelength). Nd-YAG laser is invisible which is absorbed easily by tissues; requires a visible guiding beam like red helium or neon beam; it penetrates tissues deeply for 5 mm; easily and effectively vaporizes tissues; it is used in endoscopic procedures, LITT (light induced thermal therapy).
- *Gas lasers*: helium, neon, CO_2 lasers are gas lasers. CO_2 laser has got wavelength of 10.6 mm; it penetrates tissues very poorly; it is absorbed rapidly by water in the tissues; it is invisible and needs helium or neon beam; it is used I surface lesions of skin and for haemorrhoids.
- *Dye lasers*: Rhodamine organic dye laser.
- *Semiconductor lasers*: They are diode lasers use low power.
- *Excited dimer (excimer) lasers*: Argon, krypton, xenon which are mixed with chlorine or fluorine creating dimer. Argon laser has got two wavelengths 514 (green) and 488 (blue); it is absorbed by haemoglobin red pigment; tissue vaporization is poor; has got limited penetration and so useful for surface lasers in skin, eye; it is useful in photodynamic therapy also.

BOX

Applications

- Focused heat beam of laser light is used to coagulate, excise, vaporize the tissues.
- It is used to cut tissues, cauterize blood vessels, photocoagulation.
- Photodynamic or photoradiation therapy using dye or diode laser after injecting photosensitizer photofrin intravenously.

Uses in surgery

- In gastroenterology—piles; debulking luminal malignancies like oesophagus, rectum; arrest gastrointestinal bleeding; to remove small tumour or angiodysplasias.
- In urology—to remove superficial low grade bladder tumours.
- In eye—in retinopathy, laser photocoagulation, retinal detachment, in glaucoma. Lasik surgery is done for myopia using microkeratome to reshape the cornea. It is laser- induced keratoplasty.
- In ENT—removal of small mucosal lesions
- In skin—argon or CO_2 lasers are used. Used in removal of tattoos (ruby laser, pulsed); excision of small lesions, haemangiomas.
- Vascular—laser angioplasty can be done.
- In gynaecology—in endometrial ablation, in removing precancerous lesion of cervix, adhesiolysis, fimbrioplasty.

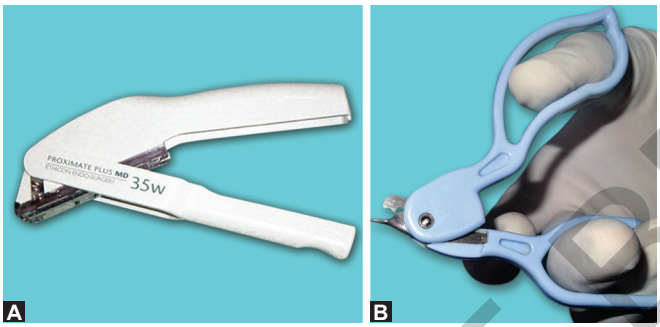
- ***Advantages:*** It is bloodless, small incision, fast recovery.
- ***Complications:*** Damage to normal tissues, adjacent bowel, vessels; Problem to operating beam—injury to skin, eyes causing corneal or retinal damage, cataract formation.
- ***Precautions***
  - All operating team staff should wear safety goggles.
  - Drapes should be wet; dry materials should be used.
  - Instruments ideally should be non-reflective (coated to avoid reflection).
  - Audible signals should be used.
  - Emergency shutter devices should be present.

STAPLERS IN SURGERY

Staplers are used for apposition of tissues. Used in skin, bowel, lungs, etc.

Types

- **Cutaneous staplers** give clean apposition. It is faster and technically easier. Problem is removal requires specific instrument and costlier than sutures.



Figs. 55.51A and B: (A) Skin staplers; (B) Staplers removed instrument.

- **Linear staplers** are used to close the bowel either completely or partially.
- **Circular staplers** also called as EEA stapler—**E**nd to **E**nd **A**nastomosis. It is commonly used for colorectal anastomosis in anterior resection for carcinoma rectum, oesophagogastric anastomosis after oesophagogastric resection in case of carcinoma at O-G junction.

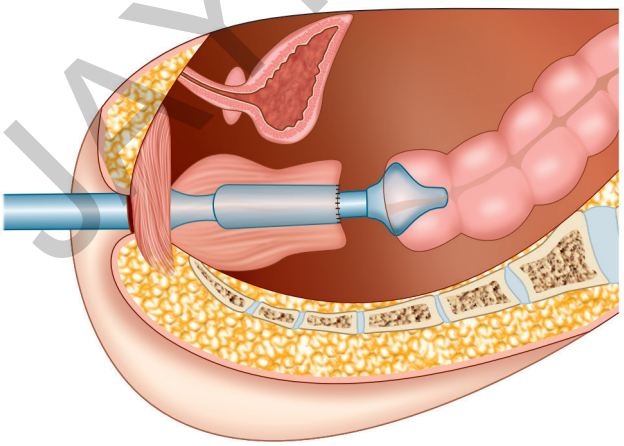


Fig. 55.52: Circular stapler for colorectal anastomosis.

Parts: *Stapler gun,* and *cartridge* with two rows of stapler pins for apposition. Loaded cartridge is detachable. Cut ends of bowel are placed over *gun* and *cartridge*. Once gun is shot, cartridge moves to the gun and creates anastomosis.

- **GIA stapler** (gastrointestinal anastomosis stapler) for *side to side* anastomosis, like small bowel or ileocolic anastomosis.
- **Stapler for lung apposition.**
- **Endostaplers:** These are used during laparoscopic surgeries. It is commonly used for bowel anastomosis. ***Endovascular staplers*** are used to ligate vascular pedicles like renal pedicles during laparoscopic nephrectomy.
- Stapled haemorrhoidopexy—costly.

Disposable staplers are available but are costly.
Advantages: Technically easier and faster.
Disadvantages: Cost factor, availability.
Problems with staplers:

- It is not completely haemostatic and so bleeding can occur.
- Leak from anastomosis, improper apposition.
- Intestinal obstruction.

NASOJEJUNAL TUBE FEEDING

- It is one of the methods of *enteral nutrition*. It is commonly used in acute pancreatitis. It is also useful in other enteral nutrition needs.

Fig. 55.53: X-ray showing nasojejunal tube for enteral nutrition purpose. It is useful and effective method of enteral nutrition. Its passage needs expertise, C-arm guidance. It can be kept for long time for 3 months. Its position often to be confirmed by X-ray.

- It is passed under C-arm guidance per nasally. It is passed up to the first loop of the jejunum across the duodenal C loop. It should be fixed properly to the nostril. Its position should be confirmed by X-ray. One should take care not to displace the tube.
- *Advantages* are—it is safer, easier and can be kept for 3 months. Complications of long-term TPN are not there.
- Disadvantages—irritation by tube, displacement, aspiration.

GOSSYPIBOMA (Gossypiboma—Cotton Based in Latin)

- By definition, it is the presence of *cotton based foreign body* that is in place of concealment following surgery.
- Forgotten foreign bodies (mop, gauze, etc.) intraoperatively especially in *abdominal cavity* (can occur in any cavities (thorax, pelvis) cause adhesions, provoke sepsis, often get encapsulated.
- It may cause an inflammatory mass, bowel erosion/perforation/peritonitis, intra-abdominal abscess, septicaemia, fistula formation.
- *Presentations* may be as—asymptomatic, pseudotumour, abscess, septicaemia, fistula.
- Often foreign body erodes and enters the bowel lumen and with peristalsis reaches ileocaecal valve causing intestinal obstruction. There are incidences patient has passed the foreign body like mop per anally few months after surgery (in 6% gossypiboma).
- Ultrasound, *CT scan* and MRI identifies the foreign body (gossypiboma). Plain x-ray is of less value.
- Incidende of gossypiboma is 1 in 3,000 surgeries. Migration commonly occurs into intestine either small or large but can occur into urinary bladder or stomach.
- 70% of retained foreign bodies are sponges/mops; 30% are instruments.
- *Commonest site* is abdominal cavity 55%, vagina (20%), thorax (10%) and rest on other cavities.
- Commonly gossypiboma present 3–12 weeks; rarely it can present as later as 5–7 years.
- It is more commonly observed in emergency surgery, trauma, and surgery for malignancies.
- *Treatment:* Surgical exploration and extirpation of the foreign body, antibiotics.
- *Legal problem:* Gossypiboma amounts for criminal negligence. Surgeon or team or hospital can be sewed for negligence either in consumer court or criminal court.

LAPAROSCOPIC SURGERY

History

First laparoscopic cholecystectomy was done by Muhe of Germany in 1985 and by Mouret in Lyon in 1987.

McKeran and Saye performed the first laparoscopic cholecystectomy in USA in 1988.

First laparoscopic appendicectomy was done by Semm as prophylaxis.

First laparoscopic appendicectomy for acute appendicitis was done by Schreiber in 1987.

Semm changed 75% open gynaecological surgeries into laparoscopic surgeries.

Professor TE Udwadia, Mumbai did first laparoscopic cholecystectomy in India.

ADVANTAGES OF LAPAROSCOPIC SURGERY

- Relatively less painful compared to open surgery. Trauma of access is very less.
- Shorter hospital stay and early return to work.
- Faster postoperative recovery.
- Better visualisation of the anatomy, i.e., better approach for dissection and visualisation of other parts of abdomen for any other pathology.
- Instrumental access to different abdominal locations is many times better compared to open method.
- Minimal scar on the abdomen.

Instruments Used

- Zero degree laparoscope is commonly used. Side viewing scopes are also used to have better visualisation 30°.
- Cold light source either halogen lamp or xenon lamp is used. Halogen lamp is used commonly and is cheaper. Xenon lamp gives high visualisation.
- Camera: 3 chip camera is commonly used with high resolution.
- Video-monitor to display images.
- CO_2 insufflator.
- Long fine dissectors like in open surgical techniques.
- Hooks and spatulas are used along with cautery for dissection.
- Clip applicators.
- Needle holders.
- Endostaplers.
- Veress needle.
- Suction-irrigation apparatus.
- Trocars of different sizes—10 mm, 5 mm.
- Reducers to negotiate smaller instruments through larger ports.

Figs. 55.54A and B: Laparoscopic set showing trolley, telescope and monitor instruments.

Preparation

Always general anaesthesia. Other preparations are same as for open method.

Technique

- Pressure bandages are applied to both legs to improve the venous return and to decrease the stasis.
- Head end of the table is lowered to have easier insertion of veress needle and scope.
- Ryle's tube and Foley's catheter are essential before insertion of the trocars.
- Pneumoperitoneum is created using veress needle through umbilical incision. Access can be achieved by open method through an umbilical incision.

BOX

CO_2 is commonly used to create pneumoperitoneum as:

- It is readily available
- It is cheaper
- It suppresses the combustion
- It is easily absorbed by tissues
- It has a high diffusion coefficient
- It is quickly released via respiration

- *Other gases used are:* Air, nitrous oxide, helium, argon.
- Pneumoperitoneum is created up to a pressure of 15 mm Hg which distends the abdominal cavity adequately to have proper visualisation of the abdominal contents.
- Laparoscope is inserted through the umbilical port (10 mm). Abdomen is evaluated for any pathology. Liver, gallbladder, pelvic organs are visualised.
- Additional ports (3–4) through trocars are placed depending on the procedure to be done. It may be either 5 mm port or 10 mm port. These ports are placed in such a way to have a proper triangulation of instruments for dissection.
- To use clip applicator 10 mm port is required.

Physiologic Changes due to Pneumoperitoneum

- CO_2 causes hypercarbia, acidosis and hypoxia.
- Pneumoperitoneum exerts pressure on the IVC, decreases the venous return and so the cardiac output.
- It increases the arterial pressure also.
- It compromises the respiratory function by compressing over the diaphragm impairing the pulmonary compliance.

Complications

- CO_2 narcosis and hypoxia.
- Sepsis—subphrenic abscess, pelvic abscess, septicaemia.
- IVC compression.
- Bleeding.
- Leak from the site, e.g., bile leak.
- Organ injury during insertion of ports, e.g., major vessels, bowel, mesentery, liver.
- Subcutaneous emphysema and pneumomediastinum.
- Gas emboli, though is rare but fatal.
- Postoperative shoulder pain due to irritation of diaphragm.
- Cardiac dysfunction due to decreased venous return.
- Injury to the abdominal wall vessels and nerves.
- Cautery burn to abdominal structures.
- Abdominal wall hernias.
- Wound infection.
- Mortality—0.5%.

Relative Contraindications

- Patients with compromised cardiac status.
- Peritonitis.
- Previous abdominal surgeries.
- Bleeding disorders.
- Morbid obesity.
- Third trimester pregnancy.
- Portal hypertension.

Basic Laparoscopic Surgeries

- Laparoscopic cholecystectomy.
- Laparoscopic appendicectomy.

LAPAROSCOPIC CHOLECYSTECTOMY

Refer Chapter 35, page 747.

LAPAROSCOPIC APPENDICECTOMY

Refer Chapter 47, page 1058.

ADVANCED LAPAROSCOPIC SURGERIES

- Presently most of the abdominal surgeries can be done through laparoscopy.
- It requires advanced technology and skill. Surgeon should be expert in doing intracorporeal and extracorporeal knotting.

Procedures

- Laparoscopic hernia repair.
- Laparoscopic splenectomy.
- Laparoscopic fundoplication.
- Laparoscopic vagotomy and gastrojejunostomy.
- Laparoscopic Nissen's fundoplication.
- Laparoscopic colectomy.
- Laparoscopic hysterectomy. It is becoming very popular.
- Laparoscopic urologic surgeries.
- Laparoscopic paediatric surgeries.

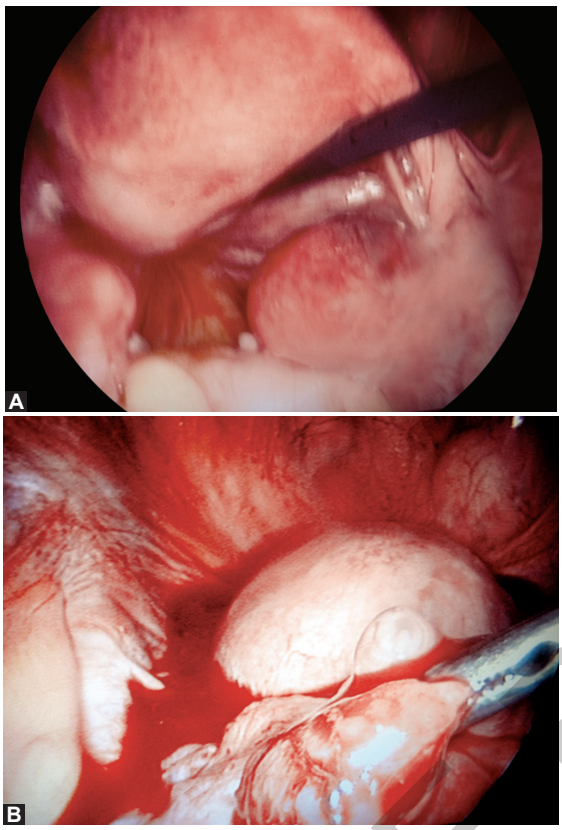
DIAGNOSTIC LAPAROSCOPY

Indications

- Acute pelvic conditions; ovarian diseases.
- Tubal pregnancy; infertility.

- Staging of the malignancy.
- Biopsy from the tumours.
- In chronic pain abdomen where ultrasound, endoscopies, barium studies are negative, then diagnostic laparoscopy is useful.

Needle laparoscopy of 2 mm sized becoming popular (especially for diagnostic purpose).



Figs. 55.55A and B: Diagnostic laparoscopy showing ectopic pregnancy in right fallopian tube. It is removed by salpingectomy through laparoscopy.

Advantages: Laparotomy is avoided and once diagnosis is made, therapeutic procedure also can be carried out in the same sitting.

RETROPERITONEOSCOPY

- It is becoming popular in urology to assess kidney, ureter, adrenals for various urologic procedures.
- Through a small loin approach, retroperitoneum is expanded by inflating balloon in the space. Once space is created, different ports are placed to do dissections.

BOX

Procedures done through retroperitoneoscopy are:

- Nephrectomy
- Pyeloplasty
- Adrenalectomy
- Pyelolithotomy
- Ureterolithotomy
- Retroperitoneal lymph node dissection (RPLND)

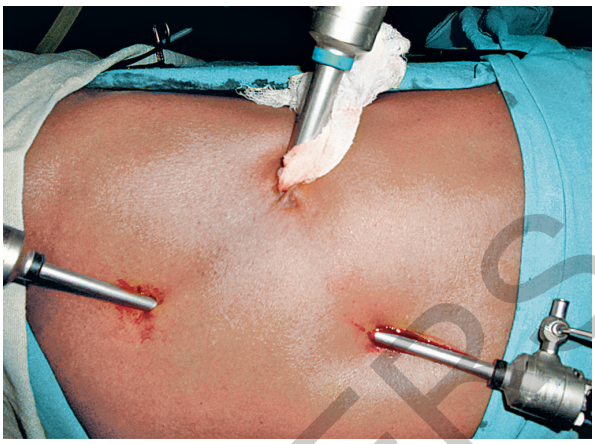


Fig. 55.56: Port positions for retroperitoneoscopy.

- ***Complications:*** Injury to vessels; Paralytic ileus; Bowel (colon) injury.
- ***Advantage:*** Complications of pneumoperitoneum is not present and so respiratory reserve is well-maintained.

NATURAL ORIFICE TRANSLUMINAL ENDOSCOPIC SURGERY (NOTES)

It is an experimental surgical technique whereby "*scar less*" *abdominal operations* can be performed with an *endoscope passed through a natural orifice* (mouth, urethra, anus, etc.) then through an internal incision in the stomach, vagina, bladder or colorectum, thus avoiding any external incisions or scars.

- This technique has been used for diagnostic and therapeutic procedures in animal models, including transgastric (through the stomach) organ removal. The transvesical and the transcolonic approaches are also used. Transgastric and transvesical combined approach is also used to increase the feasibility of moderately complex procedures such as cholecystectomy.
- NOTES was originally described in animals by researchers at Johns Hopkins University (Dr Anthony Kalloo et al.), and was recently used for transgastric appendectomy in humans in India (by Dr GV Rao and Dr N Reddy).
- On June 25, 2007, Swanstrom and colleagues reported the first human transgastric cholecystectomy. In late 2008, surgeons from Johns Hopkins School of Medicine removed a healthy kidney from a woman donor using NOTES. The surgery was called transvaginal donor kidney extraction.
- The ***transvaginal access*** to NOTES seems to be the *safest and feasible*. In 2007, the NOTES Research Group in Rio de Janeiro, Brazil, lead by Dr Ricardo Zorron, performed the first series of transvaginal NOTES cholecystectomy in four patients. With fewer potential complications, the procedure has a disadvantage of being possible only in women.
- Proponents and researchers in this field recognize the potential of this technique to revolutionize the field of

minimally invasive surgery by eliminating abdominal incisions. NOTES could be the next major paradigm shift in surgery, just as laparoscopy was the major paradigm shift during the 1980s and 1990s.

- **Advantages are**—lower anaesthesia requirements; faster recovery and shorter hospital stays; avoidance of the potential complications of transabdominal wound infections (e.g., hernias); less immunosuppression; better postoperative pulmonary and diaphragmatic function; and the potential for "scar less" abdominal surgery.
- **Disadvantages are**—it is single port surgery and difficulty in visualisation of the area in need from all directions which is essential for proper surgical dissection. Poor manoeuverability is the problem. Sepsis through this potentially infected area into sterile peritoneal cavity is a real risk. After procedure non closure of the port site opening in these approach sites or if closing their inadequacy are the real risk in NOTES.
- The general impression is that NOTES will be accepted as the newest frontier in minimally invasive surgery. As of today non-Bariatric minimally invasive surgery fellowships offer the best opportunity to train in this new approach.

C. Dressings and Bandages

DRESSINGS

They are the materials used to cover wounds, ulcers to provide support and to encourage healing.

Depending on the condition and amount of discharge from the wound/ulcer it is changed as required—twice a day/once a day/once in two days. Small dressings are done without anaesthesia. Large areas like burn wounds or dressing in children require general anaesthesia.

- ***Advantages:*** It covers the wound and so prevents further contamination and gives comfort to the patient.
- ***Disadvantages:*** It may get soaked and may delay the epithelial layer formation.
- ***Types:***
  - *Dry dressings:* It is used in clean, sutured operated wound. It is not changed at regular intervals
  - *Wet dressings:* It is used in ulcers and wounds. Dressings are made wet by using jelly or sofra tulle sheets.
- ***Components of dressing***
  - *Inner contact layer.* It is non-absorbent and only allows secretion to pass into the absorbent layer. It does not allow penetration of granulation tissue. It is usually kept wet. Either mesh gauze or sofra tulle is used.
  - *Intermediate absorbent layer* made up of cotton which absorbs the secretions.
  - *Outer layer as supportive* is made up of gauze.
- ***Dressings are fixed to the place by:*** Bandages; plasters; Dynoplast; crepe bandages.

BANDAGES

Technique of bandaging is called as dysmergia.

BOX

Indications

- To reduce the swelling like in lymphoedema
- To keep dressings in position
- To support splints
- To stop bleeding/oozing

Types of Bandages

a. *Roller bandages*
   - It is a continuous roll of material, which is rolled over the part to cover the area.
   - It is used in limbs.
   - It is available in different lengths and widths—1 inch, 2 inches, 4 inches or 6 inches.
   - It is used in different ways.
     - *Circular turns:* Continuous rolls placed over the same place.
     - *Spiral turns:* After the initial turn of the bandage, it ascends proximally overlapping the distal 2/3 of the previous turn.
     - *Reverse spiral turn:* Here each spiral turn is reversed in opposite direction so as to attain uniform pressure. It is used in limbs and areas which end as cones.
     - *Figure eight turn:* It is used in knee, elbow, wrist, ankle and for clavicle.
     - *Recurrent turn:* It is used in head, amputation stump. Here initially circular rolls are made and over that half turns are made to cover other parts of the area required.
     - *Spica bandage:* It has got ascending and descending turns, with each turn overlap and cross each other. It is used in hip, groin, shoulder, breast or thumb. *Spica means eye of a bean.*

b. *'T' bandages:* It is used in perineum and groin.

c. *Tailed bandages*: It may be four tailed bandages or many tailed bandages. It is used to support dressings on a wide area like in burns dressing, over abdomen or chest wall.

d. *Tubular bandages:* These are stockings which are unrolled over the limb to give pressure effects. It is used in lymphoedema, varicose veins and in the postoperative period following surgeries of the limb (Tubifix, Tubipress).

e. *Triangular bandage:* These are used for supporting the elbow or forearm. Here a wide gauze is used to cover the arm, forearm and elbow, which again winds around the neck.

f. *Cravat bandages:* It is a folded type of triangular bandage, which is used as sling around the neck, when elbow requires to be rested.

Principles of Bandaging

- Bandage is applied to the part from distal to proximal end.
- Proper positioning of the limb is a must before bandaging.
- After initial few circular turns, the required type of bandaging is then done.
- Bandage is unrolled outwards.
- During bandaging, latter turn should overlap 2/3rd of earlier turn.
- Firm, adequate pressure should be used during bandaging.
- After completing the procedure, the knot should not lie over the area or over the bony points or over the back.
- It should not cause venous or arterial compression.
- Digits should be left open and circulation in the digits should be observed for:

Anatomical place	Types of bandage
Finger/toe	1 inch
Arm	2 and 1/2 inches
Leg	4 inches
Thigh	6 inches
Trunk	6 inches
Head	4 inches

D. Day-Care Surgery

DAY-CARE SURGERY

- *Day-care surgery* is discharge within 23 hours (USA); surgery done without night stay (UK).
- ***Day-care surgery*** *means* patient is fit to return home in 23 hours usually with overnight stay. *Ambulatory surgery means* patient recovers after surgery and returns home on the same evening. *Office surgery means* patient recovers from surgery and returns home in few hours. *Outpatient surgery* is different from day-care surgery in that, patient is not previously fully assessed in outpatient surgery. Only minor procedures are done in this. Patient is not admitted in outpatient surgery. In day-care and ambulatory surgery patient is admitted in the hospital.
- ***Day-care surgery*** has been defined by *the Royal College of Surgeons* as when the surgical day case patient is admitted for investigation or operation on a planned non-resident basis and who nonetheless requires facilities for recovery. This definition excludes upper and lower GI endoscopies, outpatient procedures such as flexible cystoscopy, and minor superficial surgery under local anaesthetic, none of which require full day case facilities for recovery.
- *Day-care surgery* is an upcoming field in surgical practice. It is an unique method wherein general practitioner, nurse at day-care ward and theatre, surgeon, anaesthetist work in hand so that hospital stay and so the cost is reduced.
- Patient comes to hospital at morning for surgery and leaves the hospital on same day evening.

BOX

Advantages

- Minimal hospital stay
- Becomes cheaper
- Patient acceptance

- *Contraindications* for day-care surgery are—age >70 years; high-risk cardiac and respiratory patients; patients with bleeding disorders.
- *Basic requirements are:* In house anaesthesiologist; recovery room; theatre and recovery room/ward nurse; all essential surgical set up including monitor, ventilator.
- *Alertness; ambulation; analgesia and alimentation—basis for* day-care of surgery.
- *Assessment done prior to surgery by: Pre-anaesthetic clinics* with system evaluations; *health questionnaire* by surgeon and physician; *telephonic interviews*.
- Patient selection, patient information, patient acceptance are important parts in day-care surgery.

Selection Criteria

American Society for Anesthesiologist (ASA) category I and II patients can be taken up for day-care surgery. ASA III/or beyond are contraindicated for day-care surgery.

BOX

ASA (American Association of Anesthesiologists) grading of the patient for surgery

- Normal individual
- Mild-moderate systemic disease—diabetes and hypertension under control
- Severe systemic disease—uncontrolled diabetes and hypertension
- Incapacitating systemic disease
- Moribund status

Class E—emergency surgery

BOX

Exclusion criteria for day-care surgery are:

- ASA grade beyond III or more
- Obesity (BMT >35). Hypertension—not controlled
- Surgery requiring more than one hour
- Surgery with anticipation of major fluid/blood loss or needs postoperative critical care
- Preterm babies and infants less than 3 month's age
- Patient living in far and not easily reachable or able transport easily
- Unstable psychiatric illness
- If proper caregiver is not available
- Uncontrolled diabetes, alcohol abuse, chronic obstructive pulmonary disease (COPD), severe asthma, epilepsy
- Pregnancy

BOX

Levels of day-care surgery

Three levels are used but minor procedures in outpatient clinic, accident cases are not included.

- Minor ambulatory surgery.
- Major ambulatory surgery.
- Inpatient surgery—patient stays overnight and get discharged within a day.

Day-care surgery unit (DSU) is present in many centres. It may be hospital integrated or hospital based or free standing or officer based. It should have a separate dedicated unit with reception, surgery team, theatre, recovery unit, anaesthetist. Patient selection is done prior to surgery including all evaluations.

Many surgeries are done as day-care surgery—hernia, haemorrhoidal procedures, laparoscopic surgeries, excisions, biopsies, laparoscopic cholecystectomy, appendicectomy, ovarian cystectomy, varicose vein surgery, all endoscopies, circumcision, orchidectomy, hydrocele surgery, vasectomy, renal stone procedures like ESWL, skin grafting, liposuction, fracture manipulation, arthroscopy, surgical decompression of carpal tunnel syndrome, most of the eye surgeries, tympanoplasties, myringoplasty, adenoidectomy, laryngoscopy, orthodontic surgeries, laparoscopic sterilization, etc.

Any surgery which has got low-risk with less bleeding and early ambulation can be done as day-care surgery with fulfilling the selection criteria.

***Advantages are*—**less infection, home food, less chance of DVT, early ambulation, reduced cost, reduced waiting list, early return to work, psychological benefit.

Guidelines for safe discharge—stable vitals; proper orientation and recovery of the patient; tolerant for oral food adequately; ability to pass urine; able to move with or without support; no features of vomiting, nausea, severe pain, swelling or bleeding. Responsible relative to take care of the patient at home should be present.

Note:
Modified Aldrete scoring system is used for deciding the discharge from post-anaesthesia care unit (PACU). It includes activity; respiration; circulation and blood pressure; consciousness; O_2 saturation.

Problems: Postoperative nausea and vomiting (50%); postoperative pain and postoperative drowsiness/dizziness (50%) are the *common complications* in day-care anaesthesia.

Precautions

- Patient should be assessed properly before sending to day-care surgery.
- The nurse should give proper instruction to the patient as patient stays in the hospital for a short period.
- Patient should be warned about possible problems like bleeding, vomiting, pain, discomfort, and sedation.
- Before discharging, patient should be seen by the doctor for the fitness.
- All records should be carefully documented.
- Patient should be advised to rush to hospital if any problems arise or to communicate immediately.
- Now hernia; small gynaecology procedures; ENT, cataract surgeries are done as day-care procedures.

Nurses hold an important role in day-care surgery.

Note:
Day-care surgery is different in that patient is sent home same day evening after surgery; it practiced in UK more often with slight altered criteria and policies.

SURGICAL AUDIT

'Clinical audit' is a process used by clinicians who intend to improve the patient care. The process involves comparing various aspects of patient care that includes *structure, process and outcome* against *explicit criteria*.

Aspects of Patient Care

- Structure—includes what is there in that place—the people in place, their training and knowledge, the equipments and facilities provided, the organization, management and their payment, etc.
- Process—includes what procedure is followed in that place in managing referred patients, what antibiotics used, what diagnostic tests done, use of ICU facilities, use of postoperative rehabilitation care, what procedure used for discharge of patients, etc.
- Outcome—includes the overall results that include the morbidity, mortality, readmission, improvement/deterioration of the patient's condition.

Explicit Criteria

Proposal for changes can be made in the care of the patient if it falls short of the criteria chosen which can be undertaken at one or more levels:

- Individual level—more training can be given to the doctors.
- Infrastructure—upgrading of the newer diagnostic tools.
- Team level—nurses getting more trained in handling the procedures along with the doctors.
- Institution—change in the treatment strategy, or antibiotic policy.
- Regional level—providing a good referral centre with all facilities and trained personnel.
- National level—introduction of screening programmes and health campaigns.

Surgical audit is a systematic, critical analysis of the quality of surgical care that is reviewed by peers against explicit criteria or recognised standards, and then used to further inform and improve surgical practice with the ultimate goal of improving the quality of care for patients.

In surgical practice, there will be definitely variations in the results of the surgery done by a trainee or an experienced surgeon, variations in outcome of the operation done in peripheral setup and in referral institutions, usage of modern equipments and technique used.

Step 1
Determine scope

It should be clearly defined, otherwise results in ineffective/inappropriate data collection.

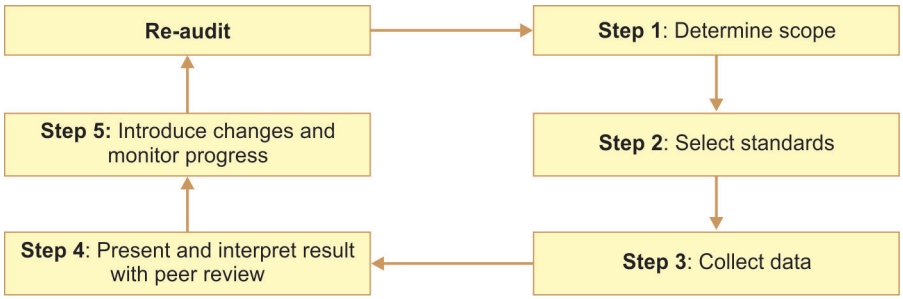


Fig. 55.57: Surgical audit cycle.

Even if you're on the right track, you'll get run over if you just sit there.—**Will Rogers**

It should also be relevant, easily measurable.

Common areas in scope of an audit include—duration of hospital stay/unplanned admissions/readmissions/operative specific complications/30 days mortality/morbidity/investigations done/management strategy/patient satisfaction.

Step 2
Select standards

Standards for the selected topic/practice area is decided based on relevant information obtained from:

- Evidence-based research and guidelines.
- Local guidelines for local relevance.
- New guidelines developed based on references from a library.

The standard which was already existing or developed must be clearly described, measurable, specific, and realistic.

Step 3
Collect data

It is important aspect of the audit which has to be informative for the audit to be successful. The best quality data collected depends on by whom it is being collected; when—retrospective/prospective collected; how—on form/PDA/computer; at/fter the time of surgery; follow-up data when collected; patient identification in a prospective/retrospective study.

Collected data must be relevant to the objectives of the surgical audit. Sometimes, the standards may need to be expanded or reduced/or the data collection methods may need to be modified.

Step 4
Present and interpret result with peer review

Audit aims in continuous improvement by experience and by making changes which is ultimately rewarding.

The outcome of the audit should be presented and discussed in a clinical meeting. It should undergo peer review. It involves viewing and analyzing one's outcome by one's own peers who are none other than other experienced trained surgeons. It should be conducted in an atmosphere of confidentiality, trust and teamwork, should not be an opportunity to blame or brag but exchange of frank, non-confrontational discussions between the colleagues. Mortality/morbidity meetings, grand rounds are one form of peer review.

Step 5
Introduce changes and monitor progress

Based on the conclusion of the audit and meetings certain changes to be made in respect to the patient care are decided and all the personnel involved in the process are informed or educated. The outcome due to changes made are monitored by follow-ups either by reauditing the whole process/ or only the part that has been changed.

SURGEON AND LAW

- It is important to a surgeon to know legal aspects in relation to his profession. Consumer Protection Act and criminal negligence are the two things surgeons are regularly worried about and face often problems.
- It is better to have a fair idea about Consumer Protection Act in relation to patient treatment.
- Surgeon should keep all documents regarding the patient with him or in the hospital.
- Case sheet should be written in detail. Daily follow-up should be written with date and time of visit with progress about the patient.
- It is better to take detailed consent after proper explanation about the disease and treatment protocol to patient and his close attender/relative. It is better to get signature about discussion given from them with date and time. In many centres, it is practiced to record the explanation part to keep it as document.
- Surgical method, its problems, risks due to anaesthesia, high-risk if any, risk of bleeding, complications, duration of hospital stay should be discussed.
- One should make sure that anaesthetist will do pre-anaesthetic check up prior to surgery; he should also write his preoperative/operative/postoperative anaesthetic notes.
- Daily information sheet should be used wherein patient or party should be informed about the condition of the patient. Timing of this and signature of surgeon and party should be taken.
- After surgery detailed surgical procedure technique should be written in case sheet and should be informed to patient. Specimens should be shown to patient party and should be sent for histology.
- Approximate cost of the procedure and entire bill in the hospital should be informed. One should also inform that it may change depends on complications, number of days in ICU, critical care, need for higher antibiotics, etc.
- Negligence about retaining mops/instruments are legally not acceptable; it is better to take care of enough precautions about that.
- Surgeon has got vicarious liability about the mistakes done by ward boys, nurses, theatre nurses, etc. So it is better to train them for proper care in OT, postoperative wards and ICU.
- It is ideal to show all reports to patient party and discuss/brief with them about the condition especially when patient is in ICU.
- If patient or party become arrogant or aggressive it is better to make a note of it in case sheet and inform police people about the same.
- It is better to make a professional indemnity insurance policy always to cover these problems in case if needed.
- It is again ideal to have an advocate to discuss these matters whenever needed.
- It is care which surgeon gives not cure always.

SRB's Manual of SURGERY

Entering its eighth edition, *SRB's Manual of Surgery* is the number one choice for medical undergraduates and surgical residents.

Salient Features

- The book is thoroughly revised and updated as per the latest CBME curriculum by NMC
- Flow of thoughts and easy-to-understand explanations with proper analysis are done in different topics with lucid language for students
- In this new edition, numerous interesting case scenarios with clinical pictures are added at the end of each chapter for better understanding of clinical correlation
- This edition is richly illustrated with more than 2,750 photographs giving the edge to students for grasping clinical pictures along with theoretical concepts
- Concepts of management have been updated wherever required, especially in managing malignancies like testicular tumor
- All classifications are updated as per the latest guidelines by AJCC and WHO
- Advance learning topics and sections like cardiac surgery are converted to digital form which users can access through learn.ejaypee.
- Along with the book, a complimentary question booklet is given, which includes new NMC pattern theory questions like long and short answer questions, reasoning type questions, case scenario-based questions, and 1,200+ MCQs (including clinical and reasoning type)

Srirama Bhat M MS (General Surgery) FRCS (Glasgow) is currently working as a Professor and Unit Head (Ex-HOD), Department of Surgery, Kasturba Medical College (KMC), Mangalore, Karnataka, India. He is also working as an Honorary Surgeon in the Government District Wenlock Hospital, Mangaluru, Dakshina Kannada, Karnataka, India. He was born and brought up in a small village in Sullia, Taluk Dakshina Kannada. Having completed his MBBS at KMC in 1986 and MS in General Surgery at KMC in 1990, he started his career in teaching as a Lecturer in the Department of Surgery at KMC in the year 1990, soon after completing his MS. Since then, having won the affection of all his colleagues and students, he has sailed onward his academic journey, becoming a Professor, and later worked as the HOD till January 2023. He under the aegis of Manipal Academy of Higher Education (MAHE) has lived up to the principles and expectations of profession. He is also a popular practicing surgeon in Mangaluru. Having been awarded "The Best Teacher Award" by the MAHE University, three times so far, he inspires his students to work hard toward their goal. A dedicated teacher with a teaching experience of 35 years, adored by his students for he has been an unending source of motivation and inspiration at viewing and understanding surgery as the subject it is. Other than being a loving, kind, simple, and an affectionate person, his traces of utmost dedication toward his profession can be seen in his efforts toward books that he has written. It is an honor to mention his other notable works like *SRB's Clinical Methods in Surgery, SRB's Bedside Clinics in Surgery, SRB's Surgery for Dental Students, SRB's Surgical Operations: Text and Atlas,* and *SRB's Atlas of Tissue Approximation*. All books have been published under the fruitful collaboration of the author and M/s Jaypee Brothers Medical Publishers (P) Ltd, New Delhi, India.

Shelving Recommendation
SURGERY

ISBN 978-93-6616-037-5
9 789366 160375