Section

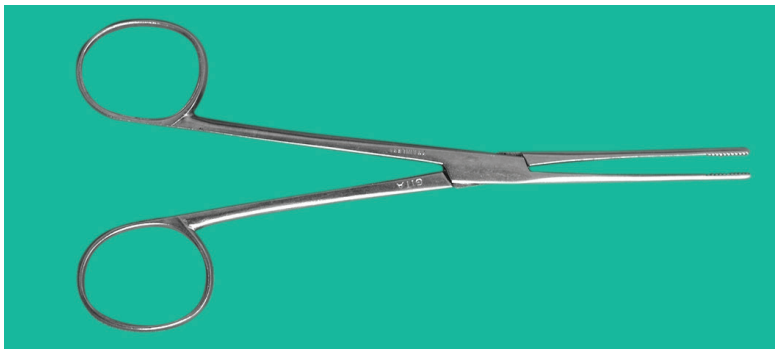
4

General Surgical Instruments

K Rajgopal Shenoy

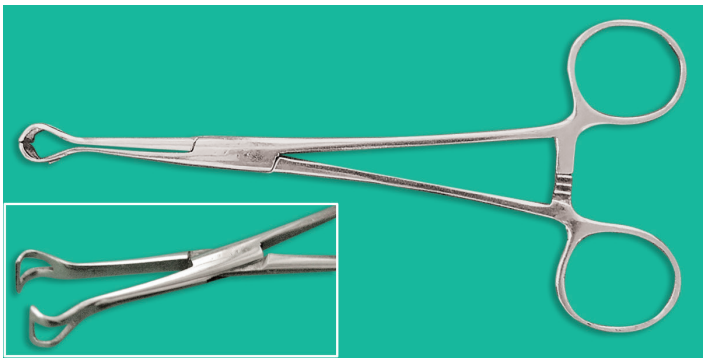
74. LISTER'S SINUS FORCEPS

- This is like an artery forceps which has no ratchet.
- Serrations are confined to the tip so as to hold the wall of an abscess cavity, **for biopsy**, if required.
- In Hilton's method of drainage of an abscess, once the incision is made, the sinus forceps is thrust into the abscess cavity and by opening the blades in all directions, the loculi are broken. To facilitate free opening of the blades, sinus forceps has no ratchet. Since the instrument is blunt, it causes less tissue damage, least chance of injury to underlying vessels or nerves. Examples: Parotid abscess, abscess in the neck and axilla.

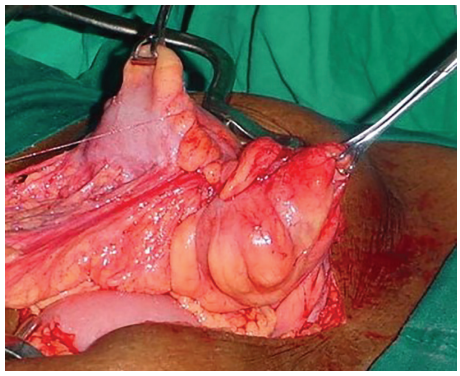


Lister's forceps showing serrations at the tip

75. BABCOCK'S FORCEPS



- An instrument with a ratchet catch, 2 blades and a triangular expansion with fenestrations at the operating end. It does not have any teeth. Thus, it is used to hold intestines during anastomosis or resection.
- It is a non-traumatic instrument.
- Each blade has fine transverse serrations.
- This instrument can also be used to hold many other structures such as thyroid gland, mesoappendix, uterine tubes, etc.
- By holding mesoappendix, appendix is lifted, appendicular artery is ligated, appendix is dissected up to base.



Babcock's forceps used to hold intestines

76. LANE'S FORCEPS

- This is similar to Babcock's forceps but the tip is more broad, expanded with a bigger fenestration.
- It has catch with lock mechanism.
- It has two blades which are curved inwards and with one in two fine teeth. They are thicker compared to Alli's forceps.

Uses

- It is used to hold mesoappendix.
- However, it does not seem to have any additional advantage when compared to Babcock's forceps.
- It can be used to hold small tumours during dissection such as lipoma, lymph nodes, etc.
- Because of fenestration, instrument is light and it provides more space for the tissues to be held.
- Other use of Lane's forceps is to use it as towel clip.

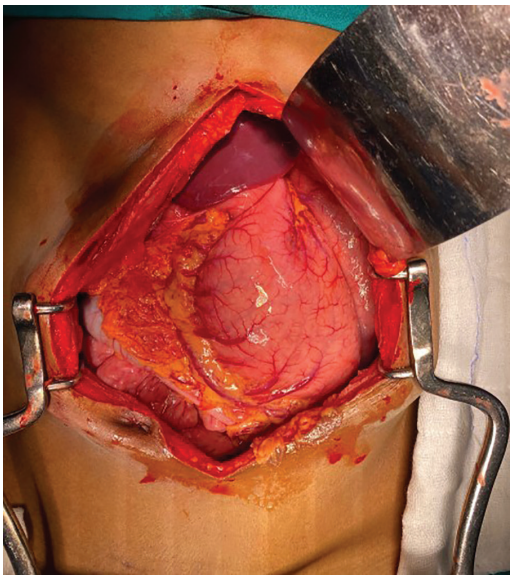
77. DEAVER RETRACTOR

- This is popularly called **Deaver liver retractor**.
- It has a long blade and operating end is curved.
- It can be used to retract the liver during vagotomy, cholecystectomy or gastrectomy, etc.
- Since it has long blades, it can be used to retract the kidney upwards, during lumbar sympathectomy or to retract the urinary bladder during surgery on the rectum.
- The handle is strong.

78. MORRIS RETRACTOR

- This is a long instrument with broad operating end.
- This is used **to retract the abdominal wall**, once the peritoneum is opened. Blade has a beaked end to give better hold over retracted tissues.
- However, if a self-retaining retractor is used to widen the laparotomy wound, the use of Morris retractor gets limited.

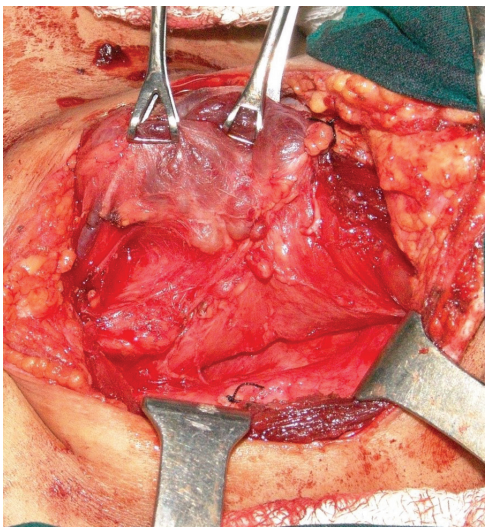
Morris retractor



Self-retaining retractor and Deaver retractor

79. CZERNY RETRACTOR

- This is a double-hooked retractor on one side and a single blade on the other side. Hooks and blades are directed in opposite direction.
- This is a **superficial retractor**, can be used to retract layers of the abdominal wall, muscles, etc. Thus, during appendicectomy, herniorrhaphy or thyroidectomy, this instrument is very useful.
- Biflanged end can be used for applying last stitch during closure of abdominal incision.

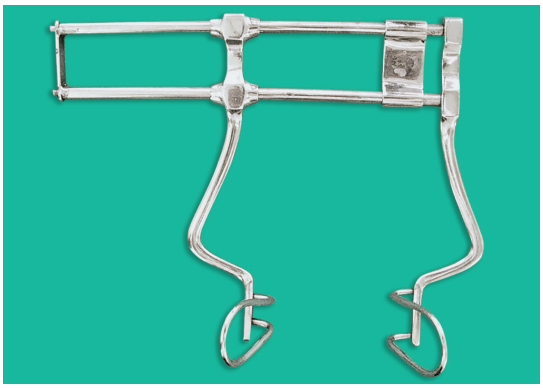


Czerny retractor used during thyroidectomy

80. LANGENBECK RETRACTOR

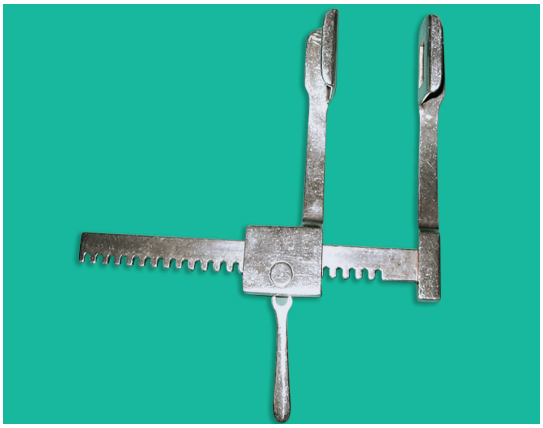
- This instrument has only **one blade**.
- Its uses are similar to that of Czerny retractor.
- Since blade is narrow when compared to Czerny retractor, it is used to retract the tissues when space available is less.

81. SELF-RETAINING RETRACTOR

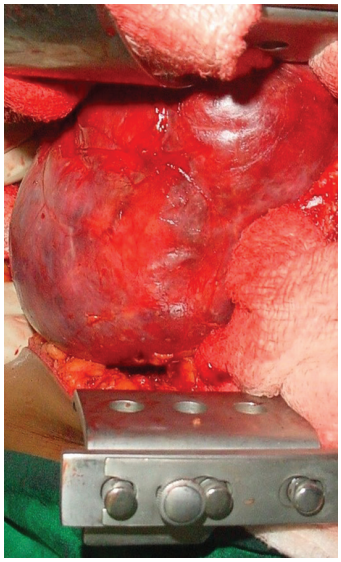


- It is a strong, heavy instrument with two blades.
- This is used to spread the laparotomy wound. Hence, it is called self-retaining retractor.

82. RIB SPREADER

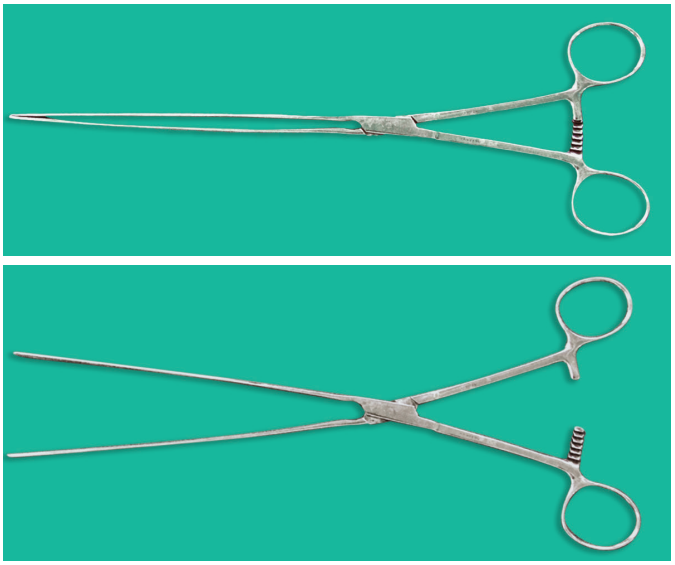


- This is also a strong heavy instrument with two long blades.
- Once an incision is deepened through the intercostal spaces and the pleura is opened, the rib spreader is used and by rotating the latch handle, the ribs are spread out.

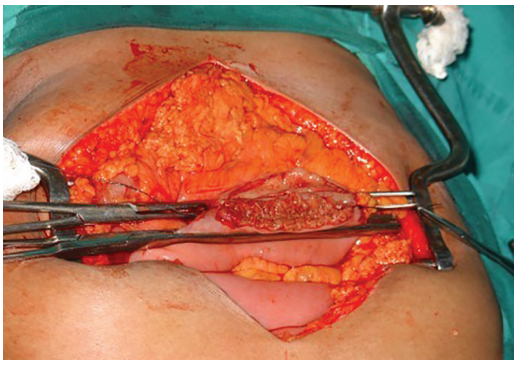


Rib spreader used during adrenal tumour excision

83. MOYNIHAN'S STRAIGHT OCCLUSION CLAMP



- This is a long instrument with a ratchet. The operating end has two long blades with serrations in the line of blades.
- This instrument is used **to occlude the intestinal lumen** to prevent spillage of intestinal contents during intestinal resection or intestinal anastomosis.
- It does not interfere with the vascularity of the intestine as it is non-crushing.



Occlusion clamps applied before dividing the intestines

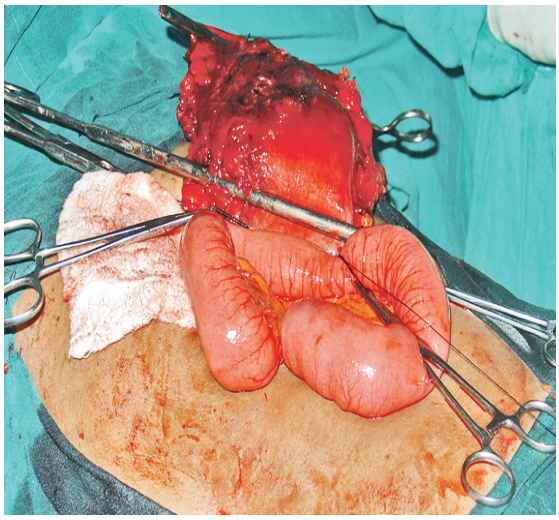
84. PAYR'S CRUSHING CLAMP

- This is a heavy instrument with **double lever system**, because of which it has a better grip.
- The two short blades have uniform serrations.
- During gastrectomy, when portion of the stomach is excised, this instrument is applied on the stomach side so that the stomach, with this instrument is excised.

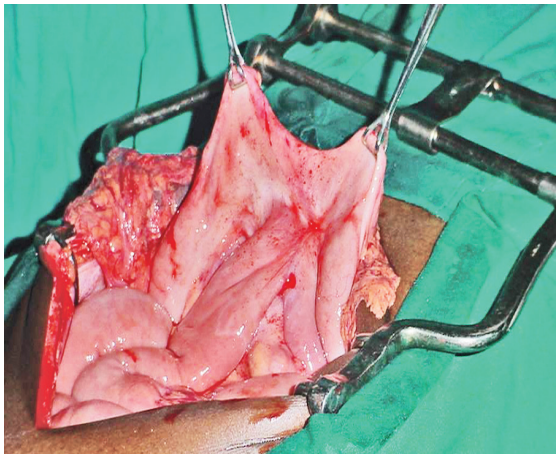
Why double lever system?

- First, lever to approximate the blades firmly.
- Second, lever to apply firm pressure on the hands.

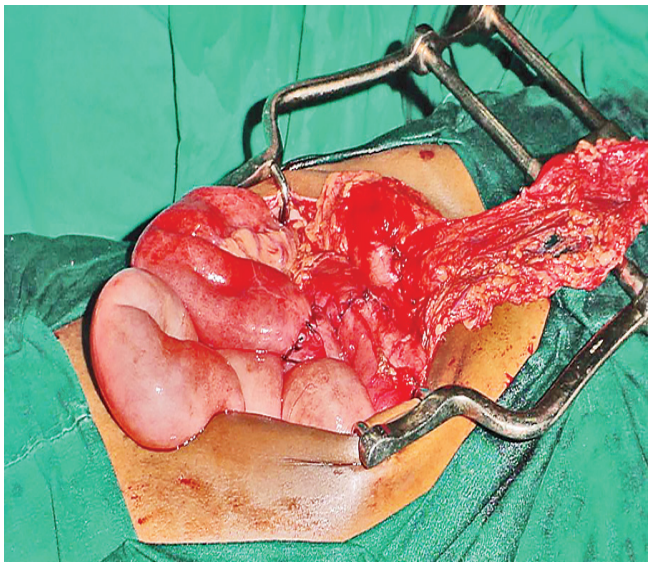
85. USAGE OF INSTRUMENTS IN GI SURGERY



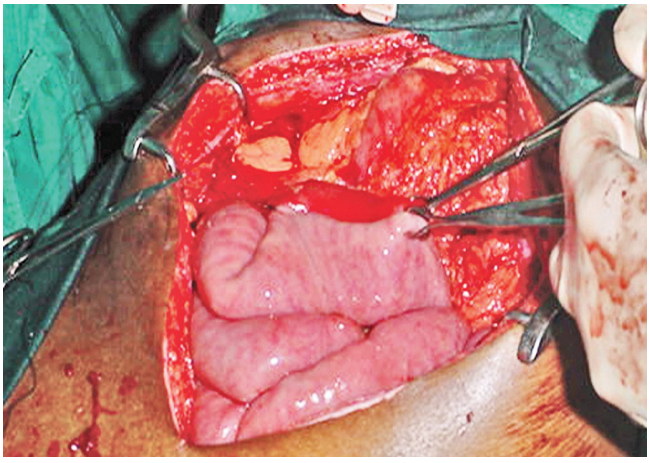
Occlusion clamp applied to the stomach to prevent contamination during GJ (gastrojejunostomy)



Babcock's forceps applied to lift the transverse colon



Wide exposure of the peritoneal cavity by using self-retaining retractor



Another example of Babcock's intestine holding forceps

86. DESJARDIN'S CHOLEDOCHOLITHOTOMY FORCEPS

- This is a long curved instrument with no ratchet.
- The operating end is expanded with fenestrations and serrations for a firm grip over the stone.
- The tip is blunt.
- This is used **to extract the stones from the common bile duct**. However, it can also be used to extract stones from the ureter.
- Since there is no ratchet, free opening is possible, and the stones do not get crushed. It also gives protection against any accidental damage to the common bile duct.

87. BAKE'S DILATOR

- This is a long malleable instrument available in various diameters. It has a handle, long body and the tip is blunt and clubbed end.
- Once common bile duct exploration is completed, this dilator is passed **to assess for any distal obstruction**.
- The free passage of Bake's dilators of different sizes indicates there is no distal obstruction (however, to be confirmed by cholangiogram).
- Useful in stenosis/stricture of sphincter of Oddi—it can be used to dilate the sphincter.

88. KOCHER'S THYROID DISSECTOR

- It has a long handle and the operating end is small and blunt with an opening.
- A few longitudinal serrations are present at the tip.
- It was used to dissect the upper pole of the thyroid gland
- This instrument can also be used to dissect the isthmus of the thyroid gland from the trachea.
- A **silk thread can be fed** into the opening so as to ligate the vascular pedicle or isthmus.
- With the availability of the right angled forceps, this instrument is not in routine use nowadays.

89. CURETTE

This instrument is spoon-shaped at both ends. The middle portion is strong and stout with serrations so that it can be held firmly. Spoon-shaped ends help in collecting tissues, necrotic or non-necrotic, which may be sent for histopathology depending upon the type of the cases.

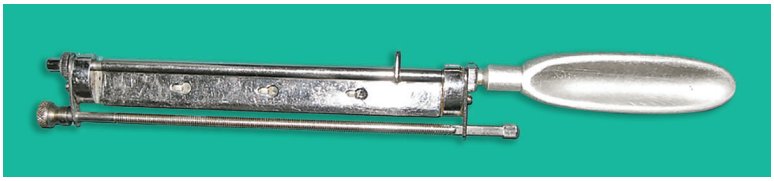
Uses

1. To remove the necrotic dead tissues from the depth once pus is drained as in incision and drainage
2. During excision of the pouting granulation tissue, curette is extremely useful
3. In cases of osteomyelitis, it is used to curette the bony tissues.

90. TROCAR AND CANNULA

- It has two parts. The inner sharp part is the trocar and outer blunt part is cannula. Trocar should be just longer than cannula.
- It is used to drain hydrocoele fluid (*see* Figure).
- Once hydrocoele sac is delivered, it is punctured with trocar and cannula, the trocar removed and the fluid drained.
- Make sure that trocar and cannula should match, otherwise injury to the deeper structures (testis) can occur.

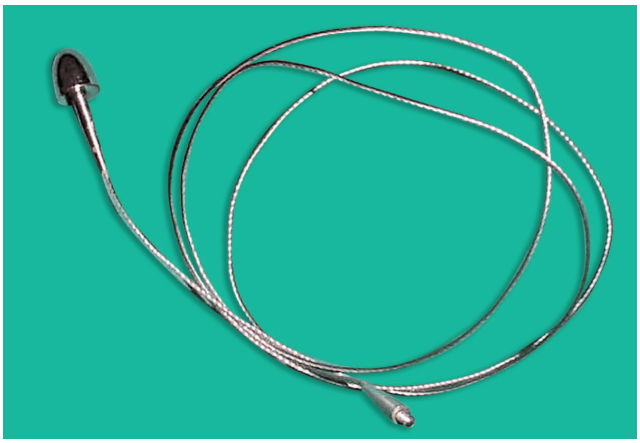
91. HUMBY'S KNIFE



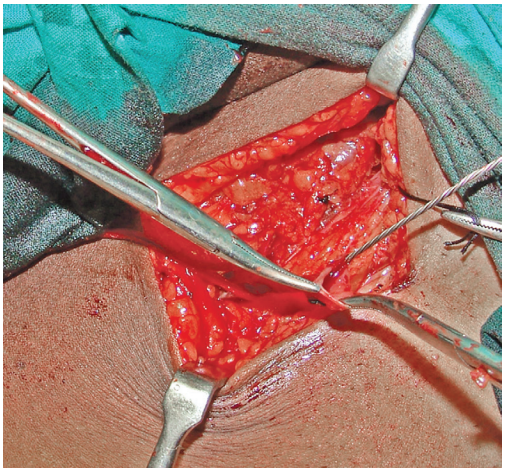
- This instrument has a handle and a long sheath.
- When in use, a disposable blade can be attached to it.
- The instrument is used to take skin graft. Hence, it is also called skin grafting knife.
- To facilitate the exact thickness of the skin to be removed, there is a screw at the operating end, with which, prior adjustment should be done.

Split skin graft taken from the thigh by using Humby's knife

92. MYER'S METAL STRIPPER

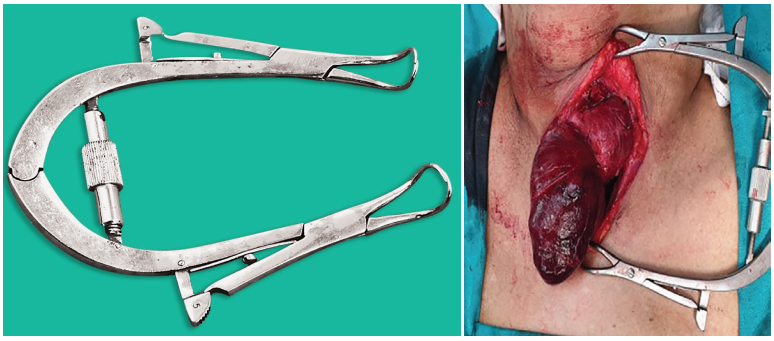


- This is a long metallic chain or a stripper used in varicose vein surgery.
- It has a handle which is T-shaped and the 'advancing' end which enters the vein. This is blunt. Once this end comes out of the cut end of the vein, a medium-sized head is connected to it.
- With gentle force (traction), exerted on the handle, the varicose vein can be stripped.
- Hence, it is also called vein stripper.



Vein stripper is introduced within the lumen of long saphenous vein in the groin region

93. JOLL RETRACTOR



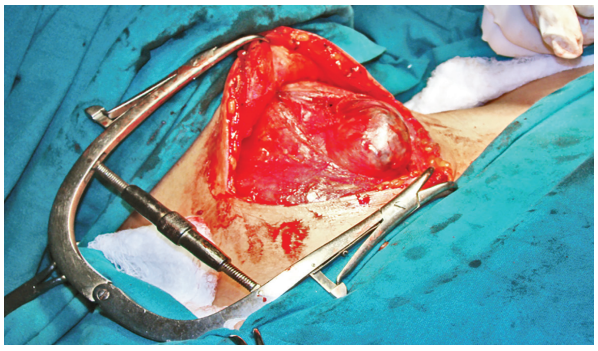
A small but stout instrument with sharp pointed ends having 2 teeth and adjustable screw arrangement.

Uses

It is used only in thyroidectomies as a self-retaining retractor. Once skin and subcutaneous tissues are incised, a plane is developed and flap is raised, Joll retractor is used.

How to operate the instrument?

The tip of the instrument is opened and both upper and lower flaps are caught by the sharp tooth. Screw is turned slowly the 2 blades distance themselves so as to give a good exposure of the thyroid gland.



As you see in this picture, by opening the blades, wide exposure of the thyroid gland is achieved and it is a self-retaining retractor

94. LISTER'S METAL DILATOR (LISTER'S BOUGIE)

- This is a long instrument curved at the tip. Its diameter is written near the handle. It is available in various diameters. The difference between the two numbers is 3. The maximum size of the Lister's dilator is 9/12.
- The tip is olive-pointed and the end of the handle is round. The minimum and maximum diameter of the instrument is written on the handle. The other type of bougie is Glutton's bougie with a plain tip and the end of the handle is trapezoid. The maximum size of Glutton's bougie is 24/28 and difference between the two numbers is 4.

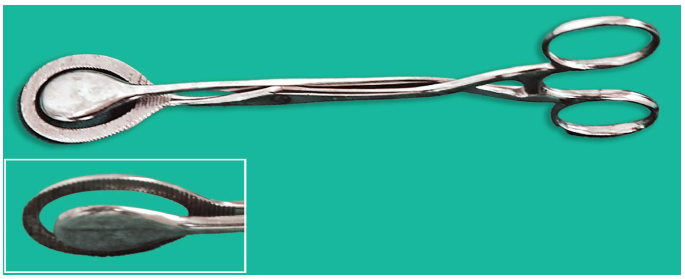
95. KIDNEY TRAY

It is identified by its shape like kidney, hence the name Kidney tray. Even though it is called tray, it is not used as a real tray, but to collect the material, specimen, gauze pieces, foreign body, etc. during surgery.

Uses and a Few Examples

1. Removal and collection of daughter cysts, laminated membrane
2. Necrotic pancreatic tissues
3. Collect purulent material from cases of peritonitis
4. Removal of sponge (foreign body).

96. TONGUE-HOLDING FORCEPS

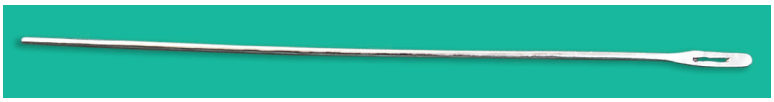


This is an instrument having a lock at the surgeon's end and a round, non-toothed operating end. Only one fenestration is present (unlike sponge-holding forceps which has 2 fenestrations). The serrations help in holding the tongue so that it can be pulled forwards.

Uses

1. Biopsy from posterior one-third of the tongue.
2. Minor excision procedures in the oral cavity, to retract the tongue.

97. FISTULA PROBE



It is a thin long instrument. The operating end is blunt so as to probe the external opening of the fistula without causing much trauma. Non-operating end has an opening.

Uses

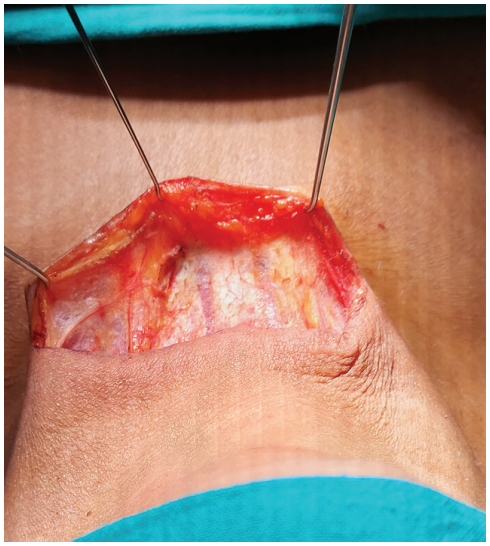
1. In the neck, probing can be done but carefully without any force. Advantage is to get some idea about the depth and track of the fistula as in branchial fistula, thyroglossal fistula, etc.
2. In cases of fistula-in-ano, probe is slowly advanced through the external opening and to come out of internal opening. Once whole track is defined, fistulectomy is done.

98. SKIN HOOK

It is a long thin instrument used to retract the skin. It has a hook present at the operating end.

Uses

1. **Superficial parotidectomy:** In this operation once the incision is given, thin skin flap is retracted by using skin retractors so as to rise the skin flap to expose the gland.
2. **Excision of superficial skin lesions** such as warts, corns, lymph node biopsy in the neck, etc. When a small incision is given, there may not be adequate place for the bigger retractors to retract. In this situations, skin retractors are very useful.



Skin hooks are used to raise flaps during thyroidectomy

99. VOLKMANN'S RETRACTOR—CAT'S PAW

It is an instrument having fine hooks or teeth at operating end and long shaft and handle in the non-operating end. Handle has serrations to give a better grip.

Uses

- It can be used to retract tough structures such as fascia of sole and palms.
- Can be used as a subcutaneous retractor (sharp teeth can cause damage if too much retraction is applied).

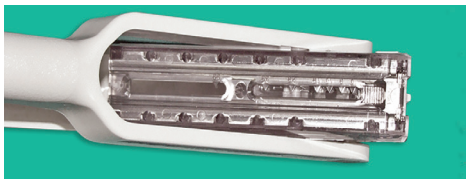
100. CORD-HOLDING FORCEPS

It is used in hernia surgery. It has an operating end which is circular, which can be opened and closed (locked). Non-operating end has 2 fenestrations to introduce fingers but no lock.

Uses

Once hernial sac is mobilized and separated from spermatic cord structures, cord holding forceps is used to hold the spermatic cord and gently pulled down so that it will not come in the way of repair or excision of the sac. Otherwise, there are chances of injury to the cord.

101. SKIN STAPLER



It is an instrument with an applicator. When gentle pressure is applied, it staples. Staplers are metallic but have strong bands with small spike at either end (operating end). Once skin margins are approximated by subcuticular sutures, staplers are applied.

Uses

Thyroidectomy skin closure, herniorrhaphy skin closure, etc.

Advantages

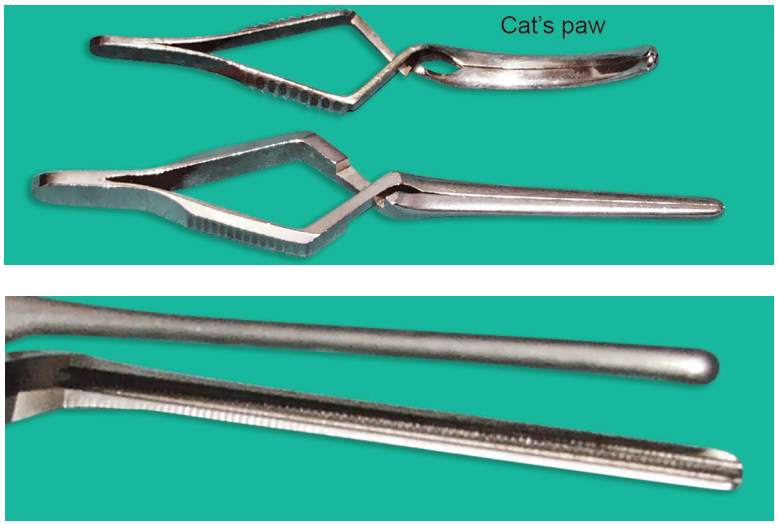
1. Cosmetically it gives a very good scar.
2. Approximation is perfect.
3. No risk of ingrowing of epithelium.
4. Decreases the time of skin closure.
5. Easy to apply.
6. Probably patients who are HIV and HBsAg positive, it is a good step to use staplers than skin sutures to decrease incidence of needle stick injuries.

Disadvantages

1. Costlier than silk or other skin sutures
2. Needs a separate instrument—stapler removal or extractor.

Thyroidectomy incision closed by skin staplers

102. POTT'S BULLDOG CLAMP



Bulldog clamp opened showing the jaws

It is an instrument having large strong jaws (blades). Jaws have serrations so as to get a better grip. Handle has a spring action. It is non-traumatic.

Uses

To clamp the major vessel temporarily to control the bleeding. Examples: Bleeding from internal jugular vein during neck dissections, from superior mesenteric vein during pancreatico-duodenectomy, etc. Once clamp is applied, identify the rent in the vein and suture it.

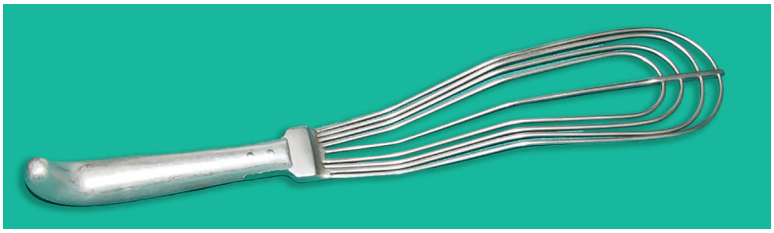
103. BRODIE'S FISTULA DIRECTOR

It is an instrument with winged end. Tip is malleable. It is used both as a probe and as a director.

Uses

- Used as a fistula probe to trace the tract of the fistula
- It was also used in external urethrotomy incision
- Non-operating end can be used for tongue tie release.

104. ALLISON'S LUNG RETRACTOR



It has a long curved handle with a firm grip. Blade or operating end is made of wires in the form of net (non-traumatic). Blade is attached to handle at an angle.

Uses

To retract lung in thoracic surgery. Example: Oesophagogastrectomy—2-stage Ivor-Lewis operation, hydatid lung surgery, etc.

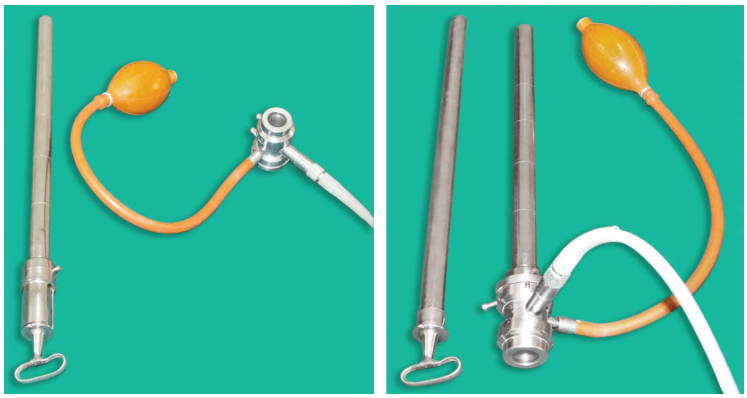
105. PROCTOSCOPE—ANAL SPECULUM

Used in lateral sphincterotomy (Cusco's speculum)

Used to visualise rectum and anal canal

- Position for proctoscopy is left lateral.
- This is an instrument used to visualise the rectum and the anal canal.
- It has an outer sheath with the handle.
- An inner blunt portion is called obturator.
- Before introducing the proctoscope one must make sure that obturator and the outer sheath must match. Lubricate the instrument well before introducing.
- In painful conditions such as fissure-in-ano, proctoscopy is contraindicated.
- Once rectal examination is done, proctoscope is held firmly with the left hand (buttocks separated), the obturator is supported by the right hand. The instrument is slowly introduced inside. The obturator is removed and rectum is visualised using light source.
- Proctoscope is used to diagnose haemorrhoids, carcinoma rectum or rectal ulcers, etc. Biopsy can be taken with a biopsy forceps in nonhealing ulcers of the rectum. Haemorrhoids can be injected and pelvic abscess can be drained into the rectum with the help of a proctoscope.
- Small polyps can also be removed with this speculum.
- Banding of piles can be done after removal of obturator.

106. RIGID SIGMOIDOSCOPE

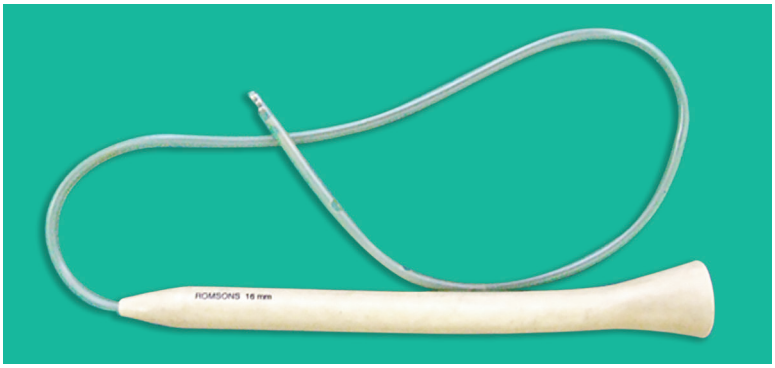


- Position for sigmoidoscopy is left lateral.
- This is an instrument used to visualise the rectum, anal canal and sigmoid colon
- It is 30 cm in length and has an outer sheath and inner blunt obturator. It is connected to air insufflator and electrical source to visualise the sigmoid colon.
- Once rectal examination is done, sigmoidoscope is slowly introduced inside under vision remembering the curvatures of the rectum. First, it is directed towards the umbilicus and later backwards.
- Sigmoidoscopy is used to diagnose carcinoma sigmoid and rectum. Biopsy can be taken with a biopsy forceps.
- Small polyps can also be removed.
- It is extremely useful in cases of lower gastrointestinal bleeding, especially which originates in sigmoid colon. Example: Diverticulosis of the colon, ulcerative colitis, angiodysplasia, etc.

Complications

Perforation of the sigmoid colon can occur if the lesion is very friable or colon is friable or too much force is exerted while pushing the sigmoidoscope within. If it occurs, immediate laparotomy and closure of the perforation is the treatment of choice.

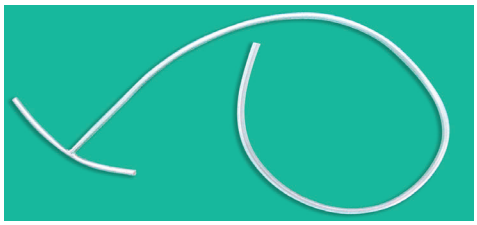
107. MOUSSEAU BARBIN'S TUBE



- This is also called MB tube. It is a funnel-shaped tube with Ryle's tube-like attachment. It is used in inoperable cases of carcinoma oesophagus to palliate dysphagia. It is stitched to the Ryle's tube which is brought out through the mouth and it is slowly drawn in by pulling the other end of Ryle's tube which is in the stomach, after doing a gastrotomy.
- Once the tube is below the level of growth, it is cut at a sufficient distance and is stitched to the stomach wall.
- With the availability of laser coagulation of the growth, and considering discomfort caused by the tube including its migration, the MB tube is not popular and not preferred.
- Tube is being replaced by metallic stents which can be inserted through endoscope, thus avoiding surgery. However, they are costly—mostly used in cases of tracheoesophageal fistula.

This instrument is obsolete now. Some examiners may ask questions on this tube, hence, it is given here.

108. T-TUBE (KEHR'S)



- This is a flexible tube made of latex with a long vertical limb and a short horizontal limb.
- Whenever the **common bile duct (CBD) is incised**, it is sutured after inserting the T-tube. The short horizontal limb is placed vertically within the common bile duct after making 2–3 holes within. The lower limb should be well above ampulla of Vater. Some surgeons slit open the entire length of the short limb. The long limb is brought to the exterior from the most dependent part of the common bile duct and connected to a sterile container.
- Presence of the T-tube may prevent peritonitis due to biliary leakage in cases of residual stones blocking the lower end of the CBD.

T-tube cholangiography

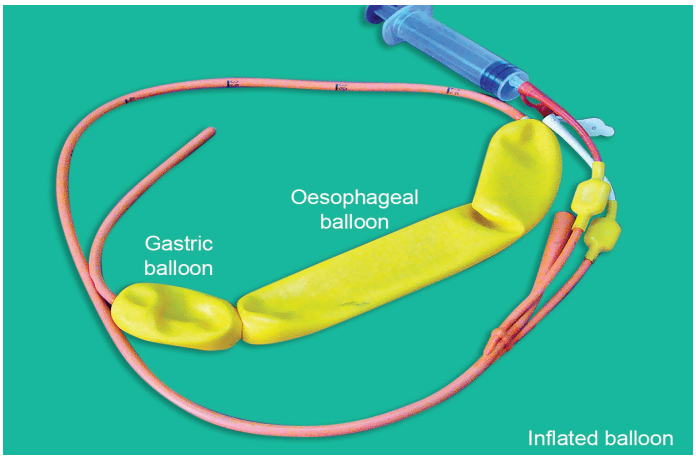
Removal of the Tube

About 7–10 days later, a T-tube cholangiogram is done and the T-tube is removed with a gentle pull, provided following criteria are fulfilled.

1. The dye flows freely into the duodenum.
2. No filling defects in the CBD.
3. After clamping the tube for 24 hours, there is no abdominal pain or fever.
4. Patient is passing normal coloured stools.

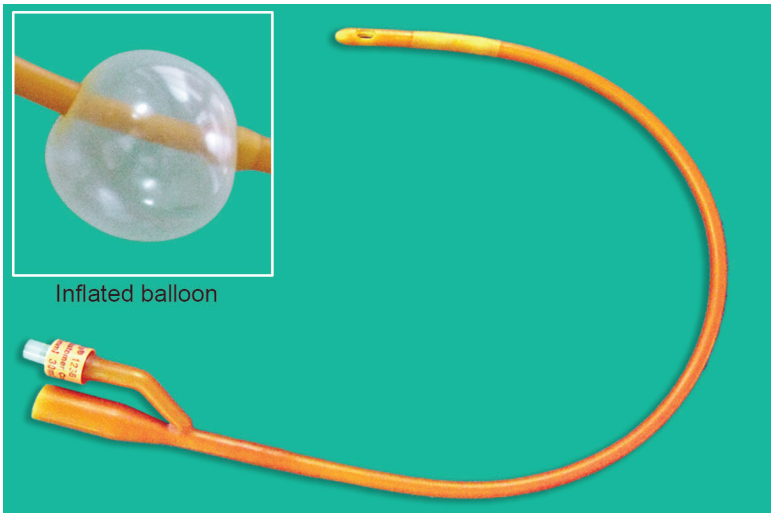
Once the tube is withdrawn, no biliary leak occurs because of contraction of fibrous tract. The leak will persist only if there is distal obstruction.

109. SENGSTAKEN-BLAKEMORE DOUBLE BALLOON TRIPLE LUMEN TUBE



- It is used in controlling bleeding oesophageal varices. It has 3 lumens and 2 balloons, a gastric balloon and an oesophageal balloon.
- **Gastric balloon is inflated** with about **200–250 ml** of air and oesophageal balloon is inflated with about **40–60 ml** of air. It is pulled upwards so as to snugly fit at the oesophagogastric junction and thus it acts by internal tamponade.
- Sengstaken tube should not be kept in place for more than 48 hours, because it can cause pressure necrosis of oesophagus.
- It should be deflated for a few minutes after 24 hours.
- Sengstaken tube should be used by an experienced physician. Oesophageal secretions and saliva cannot be aspirated while using this tube, and if gastric balloon is deflated suddenly, it slides up and causes choking. The oesophageal balloon should be immediately deflated in such situations.
- **Modification of Sengstaken tube is called Minnesota tube or 4-lumen tube.** It has 4 lumens. One to inflate oesophageal balloon, one to inflate gastric balloon, one to aspirate like a Ryle's tube, and the 4th lumen is used to aspirate oesophageal secretions. If there is any difficulty in breathing while using Sengstaken tube or Minnesota tube, bulb should be deflated or tube should be cut.

110. FOLEY'S SELF-RETAINING URINARY CATHETER

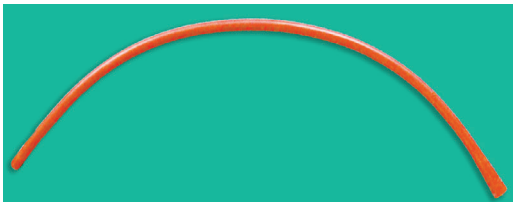


- This is made of **latex with silicon coating.** At the tip, there is a bulb, capacity of which is written at the other end.
- Before inflating the bulb, one must make sure that **catheter is in the urinary bladder, not in the urethra.** This is assessed by free flow of urine.
- After introducing the catheter, bulb is inflated using saline. Thus, it becomes self-retaining. After the usage, it is removed by deflating the bulb.
- It can also be used to drain peritoneal cavity as in biliary peritonitis. Inflated bulb compresses the prostatic bed and controls bleeding after prostatectomy.
- Other uses: It can also be used as feeding jejunostomy tube.
- Size of the catheter is in French scale.

$$\text{Diameter of catheter in mm} = \frac{\text{Catheter number}}{3}$$

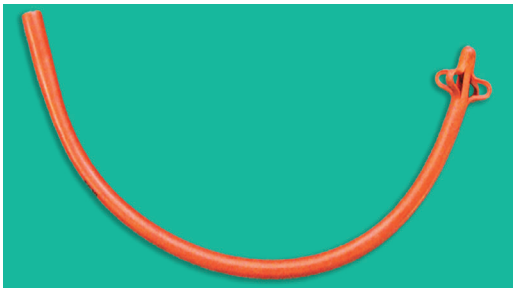
- Also available triple lumen tube—one lumen for drainage of urine, second for inflating and third for irrigation.

111. RED RUBBER CATHETER



- This is used to drain urine temporarily. It causes urethritis if it is left for a long time in the urinary bladder. Once the urine is emptied, it is removed. It is not a self-retaining catheter. Not routinely used nowadays because of availability of Foley's catheter. It is more stiff than Foley's catheter. Hence, **in cases of stricture urethra, where Foley's catheter cannot be passed, red rubber catheter may be used.**
- Being rubber it causes more tissue reaction if left for a long time.

112. MALECOT'S CATHETER



- This is made of red rubber. It has flower-shaped end and has a wide diameter. Tip is bulbous and winged. It is used to drain amoebic liver abscess. It is straightened with the help of an introducer and left in cavity and brought outside. It is a self-retaining catheter. This is used to drain urinary bladder after transvesical prostatectomy or can be used as **feeding gastrostomy tube.** It can also be used to drain empyema thoracis.
- Once the introducer is removed, flower-shaped end retains original shape, thus becomes self-retaining.
- With introduction of plastic tubes, Malecot's catheter is sparingly used nowadays.

113. RYLE'S TUBE

- Length of Ryle's tube is 1 metre. It is made of red rubber or plastic. This is also called **nasogastric tube.** At the end of this tube there are lead shots. After introducing into the stomach, its position is confirmed by pushing 5–10 ml of air and auscultating in the epigastrium or aspirating gastric juice. It is a long tube having 3 marks. When the tube is passed up to the 1st mark, it enters the stomach (40 cm). Usually, it is passed up to 2nd mark (50 cm). When it is passed up to the 3rd mark, it will be still within the stomach curled (60 cm).
- **Life-saving use of Ryle's tube is in acute gastric dilatation.**
- **In volvulus of the stomach, it is impossible to pass Ryle's tube.** Ryle's tube is used to aspirate as in intestinal obstruction or pyloric stenosis, used in the diagnosis of GI haemorrhage, also used to feed patients unable to swallow or comatose patients.
- Nasogastric tube should be nicely lubricated and passed through one of the nostrils. Once it reaches throat, ask the patient to swallow so that it will easily enter the oesophagus and stomach. Too much traction while fixing RT can result in injury to nasal cartilage. To avoid this, it can also be passed through oral cavity if you need the tube for short period (orogastric).
- Other nasogastric tube is Levine's tube. It is 1 metre long tube. No lead shot at the end of the tube. It is rigid with wide lumen.

114. TUBE DRAINS

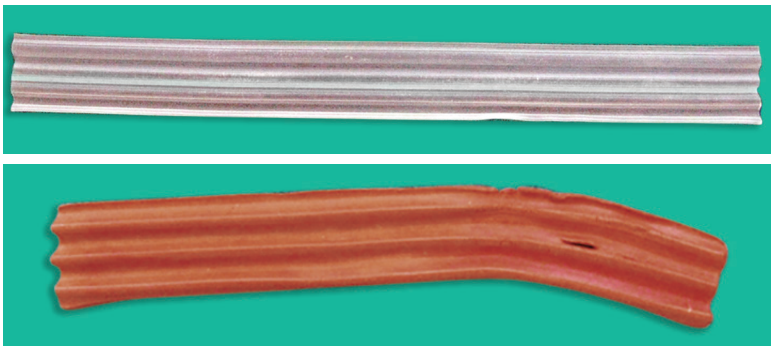
1. Contents can be measured
2. Soakage around wound is minimal
3. Secondary infection is less likely because it is a closed system.
4. Vacuum can be applied, hence it can also be called suction drains (Redivac, Romovac).
5. Lumen may get blocked if contents are thick—due to blood clot, tissues, pus, etc.
6. It is costly.

Key Box 4.1

Five important principles while using the drain can be remembered as **DRAIN**

D	Drain should be always placed in the **Dependent** position.
R	**Remove** when it stops draining (2–5 days).
A	**Anchor** it to skin by silk sutures.
I	Bring it out by separate **Incision**.
N	Bring it out by **Nearest** route.

115. CORRUGATED DRAIN



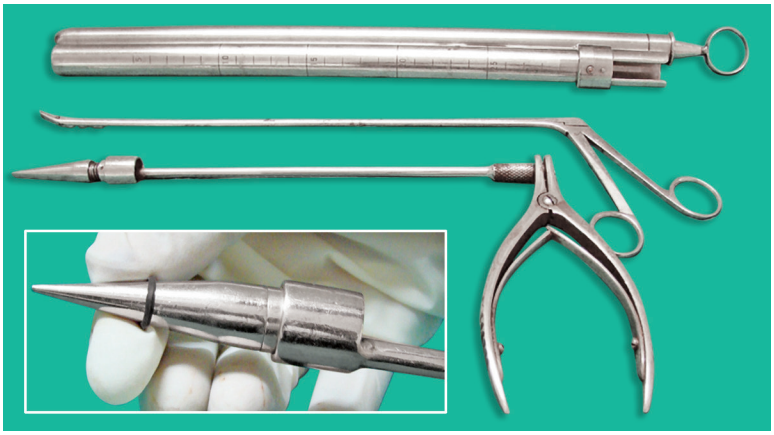
Drains are brought out by a separate stab wound and it is anchored by skin suture.

- It is made of red rubber or plastic. It has corrugation on both the sides. Whenever a major surgery is done, some amount of blood loss or anastomotic leakage is expected. This drain is used so that fluid can escape freely outside.
- Thus, it is used after thyroidectomy, gastrectomy, cholecystectomy, etc. The drain is removed after it stops draining. Usually, it takes about 3–5 days.
- After laparotomy for peritonitis, these drains are used to prevent residual abscess in the postoperative period.
- It acts as a drain by capillary action. It also does not allow the wound to close prematurely. However, nowadays after laparotomy tube drains are used more often.

Disadvantages of Corrugated Drains

1. Contents cannot be measured.
2. Soakage can be significant as in biliary fistula.
3. Secondary infection can occur if the drain is kept longer than required.
4. Vacuum cannot be applied.
5. It can also get blocked.
6. It is cheaper than tube drains.

116. HAEMORRHOID LIGATION SET (BARRON'S BAND APPLICATOR)



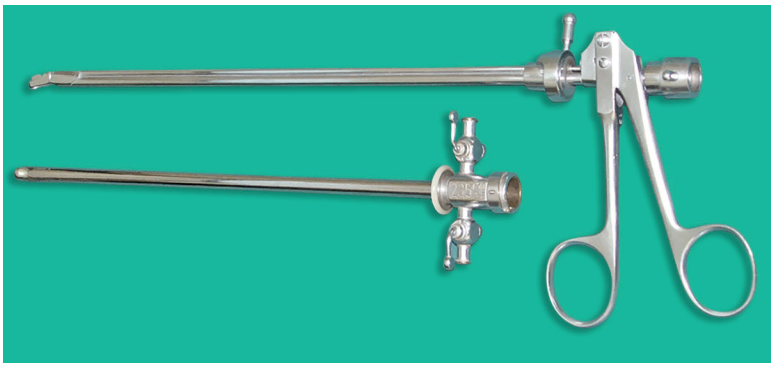
It has 3 parts:

- Large handle to approximate so that band can be transferred to pedicle of the pile mass.
- Ligator with stem, used to hold the pile mass and pull.
- Conical loader to load the bands.
- Small round, black latex bands are applied near the base of the pile mass. Since it is above dentate line, it is a painless procedure and is done in the outpatient department. Once applied, pile mass undergoes necrosis and a few days later band falls off by itself.

Indications

Ideally suited for grade 2 and sometimes in grade 3 piles.

117. CYSTOLITHOTOMY FORCEPS



The forceps is long with handle having ratchet. It has no lock. The tip is stout and grasps stone. Irrigation of the bladder is also possible to wash out sludge or minor stone particles.

Cystoscopy is done first and stone is identified—most of the bladder stones are phosphate stones, round and soft to firm. The forceps is introduced within the scope, the stone is grasped and is removed. If it is a large stone, it can be crushed and delivered outside.

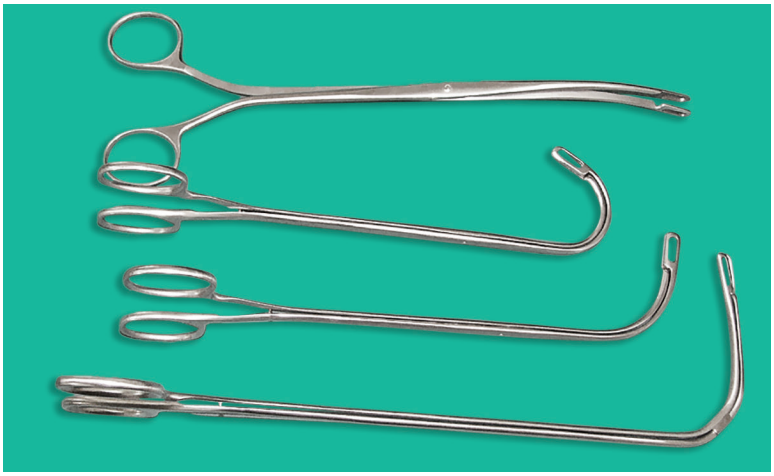
118. TURTLE FORCEPS

It resembles dissecting forceps but tip is broad and with fenestration.

Uses

To remove urinary bladder stone as in open cystolithotomy.

119. RANDALL'S NEPHROLITHOTOMY FORCEPS



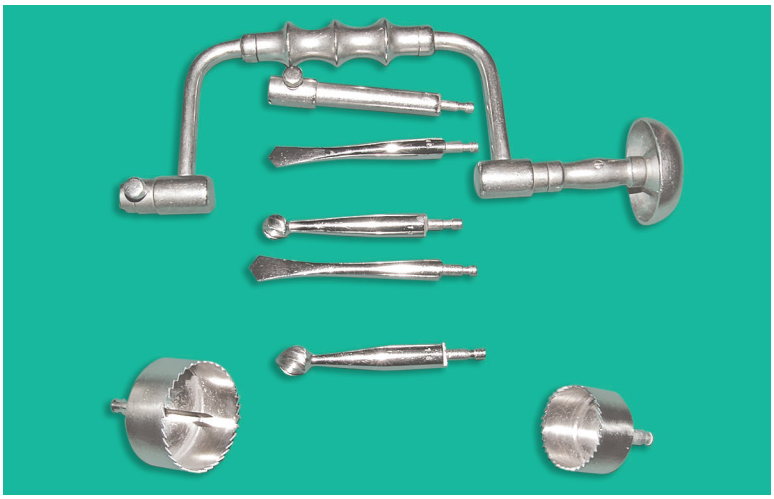
These are long instruments resembling choledocholithotomy forceps. It has no lock at the surgeon's end. The handle has fenestrations to introduce fingers. Its tip is blunt with fenestration to catch the stone. Curvatures of these instruments are in such a way that each one of them is meant for stones in different calyces, e.g. upper calyx, middle calyx, lower calyx stone.

Uses

To remove stones from calyces of the kidney.

120. HUDSON'S BRACE AND THE BURR

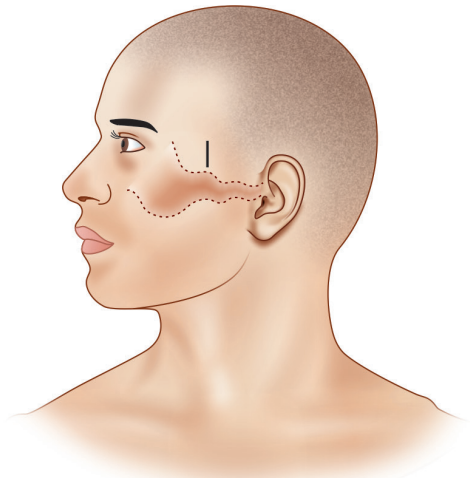
- This is a heavy instrument with a brace and the burr (drill).
- This is used to create **openings into the cranium** so as to get an access to the structures within.
- Thus, once a 'burr' is made, drainage of blood or fluid or pus can be done.



Procedure of Burr Hole

Extradural haematoma

- 3 cm vertical incision immediately above the midpoint of zygoma
- Strip the pericranium
- Burr hole with Hudson's brace
- Evacuate **black-currant jelly** clot
- Extend the burr hole and control bleeding from middle meningeal artery by bipolar diathermy
- Dural hitch sutures to prevent stripping of dura

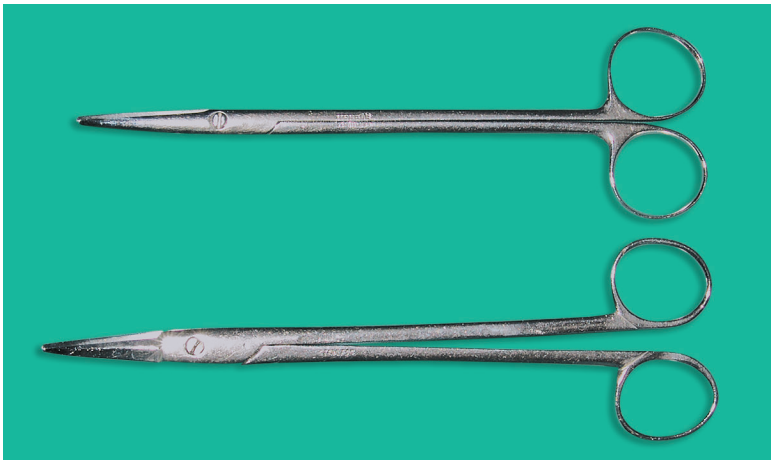


Site of temporal burr hole

121. SELF-RETAINING RETRACTORS

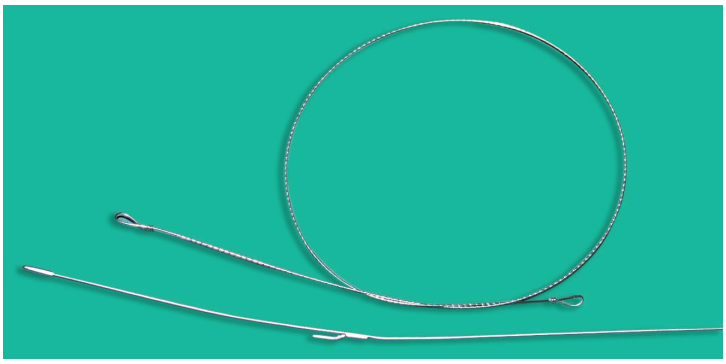
It is also called mastoid retractors. It is useful to keep the incised wound margins apart, while bone opening is being made.

122. DURA-CUTTING SCISSORS



It is used for cutting dura and other soft tissues.

123. GIGLI SAW AND GUIDE-CUM-DURAL PROTECTOR

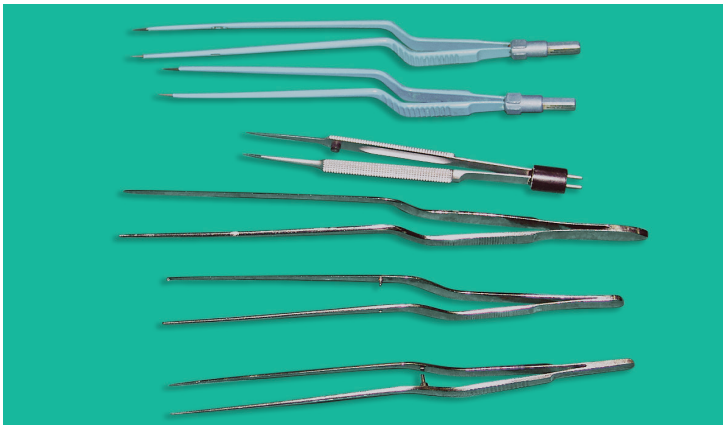


The Gigli saw wire is used to cut between burr holes to enable the pieces of bone to be removed en bloc.

The guide-cum-protector helps to introduce the wire from one burr hole to another and protects the dura from getting injured while cutting bone.

124. TOOTHED AND NON-TOOTHED BAYONET FORCEPS

Toothed and non-toothed bayonet forceps set is used during brain surgery. The bayonet shape helps to remove the holding hand away from the surgeon's trajectory of vision, thus enabling the action of the forceps to be seen, helps in precise work.



125. MICROSURGICAL INSTRUMENTS

Set of microsurgical instruments is commonly used during neurosurgical operations. Designed in such a way to minimise the size but at the same time serve the purpose.

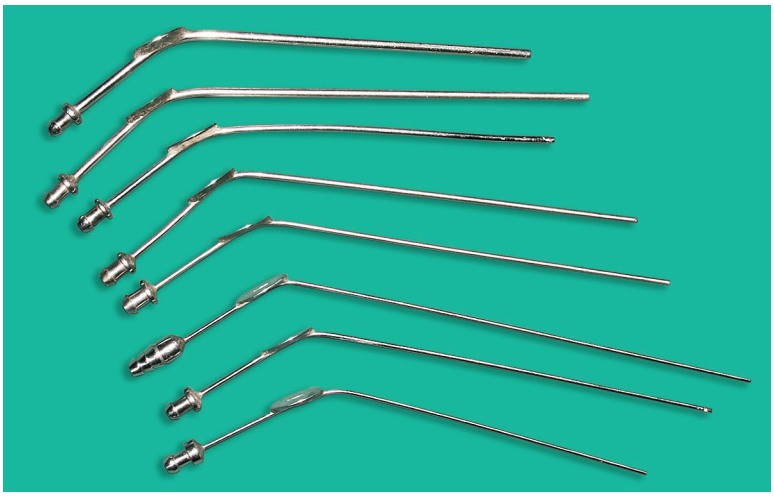
126. BONE NIBBLERS AND RONGEURS

It helps to nibble skull or vertebra to get adequate exposure.

127. SELF-RETAINING BRAIN RETRACTORS (LYELA RETRACTOR) WITH SUITABLE BRAIN SPATULAS

It helps to keep overlying brain retracted continuously with required pre-adjusted pressure. It helps to avoid manual brain retraction, thus minimizing brain damage.

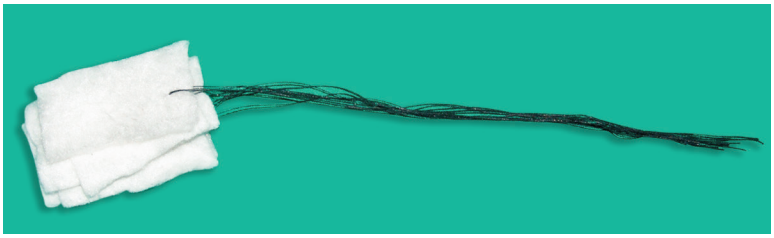
128. SET OF SUCTION NOZZLES



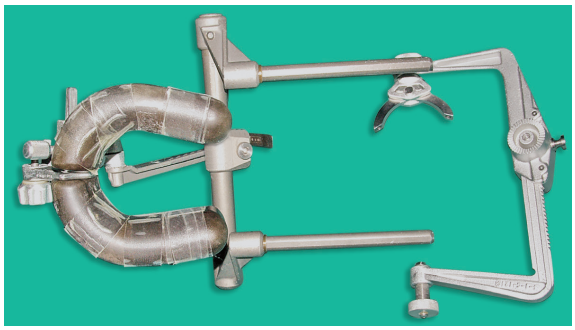
These are used to clear blood and brain tissue fluids. Designed in such a manner with angle so that the tip will be seen while operating and suction pressure can be adjusted by thumb controlling the opening. If the thumb control opening is not closed by the thumb, no suction pressure will be experienced at the tip of the nozzle, hence, called 'varying pressure nozzles'.

129. COTTONOIDS WITH ATTACHED SILK TAIL

These are used to avoid inadvertent misplacement while working in the depth of the brain. Some products are made radiopaque to detect postoperatively if there is a doubt about them missing.

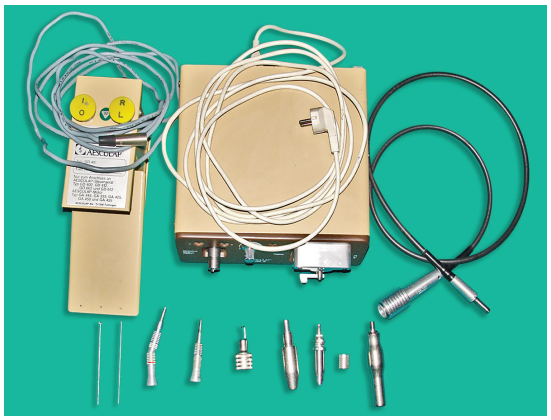


130. HEAD HOLDER WITH HORSESHOE HEAD REST AND PIN FIXATION FRAME



It helps to hold the head in the not designed position and angle can be adjusted during surgery (specially designed).

131. MICROSURGICAL HIGH SPEED DRILL UNIT WITH DRILL BITS



These specially designed drill bits have diamond finish to enable bone to be drilled through without injuring soft tissues. Rotates at a minimum of 50,000 RPM. May rotate while operating up to more than 1 lakh RPM. It is used in skull base and spinal surgery.

132. SUTURING NEEDLES

Traumatic

- Round body needle is an eyed needle. They are used to suture soft tissues, muscles, tendons, vessels, intestines, etc.
- Cutting needle is used to suture slim and some tough structures.
- Reverse cutting needle is used to suture mucoperiosteum.

These needles have an eye. The eye is wider than body of the needle, so tissue trauma is more.

Atraumatic

These needles have no eye. Suture is attached to the needle by a process called swaging. Tissue trauma is less, hence used in suturing vessels or to repair a small tear in the bowel, etc.

133. MESHES

INTRODUCTION

Repairs of hernias are the most frequently performed operations in general surgery. The last 60 years has seen rapid advances in our understanding of the causative factors of hernia development,

surgical technique for repair and, most significantly, the use of prosthetics. Prosthetic repair forms the most important repair done today—either by open or by laparoscopy. Every surgeon should know types of hernia, careful selection of a mesh and properties of mesh.

How does mesh work?

- Changes of the extracellular matrix (ECM) disturbances in collagen metabolism has been found to contribute to hernia disease—other factors which may contribute are genetic traits, age or smoking
- Once mesh is placed, a highly interlinked network is formed by cytokines and chemokines resulting in tissue remodelling and wound healing.
- Within 7–10 days, number of macrophages, fibroblasts and smooth muscle cells increase.
- Collagen is secreted and thus wound can attain strength around 80% of original strength.

Properties of Mesh

1. *Polymer type:* A few examples are: Polypropylene mesh (PPM), polyester (polyethylene terephthalate), ePTFE (expanded polytetrafluoroethylene), cPTFE (condensed), PVDF (polyvinylidene difluoride), polyglycolic acid, polyglactin 910.
2. *Pore size:* Main determinant of tissue reaction. Pores must be more than 75 µm in order to allow infiltration by macrophages, fibroblasts, blood vessels and collagen. Meshes with larger pores allow increased soft tissue in-growth and are more flexible because of the avoidance of granuloma bridging. Granulomas normally form around individual mesh fibres as part of the foreign body reaction. Bridging describes the process whereby individual granulomas become confluent with each other and encapsulate the entire mesh. This leads to a stiff scar plate and reduced flexibility.
3. *Mesh weight:* It depends on both the weight of the polymer and the amount of material used. Heavyweight meshes weigh 100 g/m^2—1.5 gm for 15 × 10 cm size mesh. They are thick polymers, have small pore sizes and high tensile strength,

Activates a profound tissue reaction and dense scarring, Increased complications—fistula formation, adhesion and pain. Lightweight meshes weigh 33 g/m^2 (0.5 g for 10 × 15 cm mesh). Thinner filaments and have larger pores (>1 mm), less pronounced tissue reaction and are more elastic despite reduced tensile strength, they can still withstand pressures above the maximum abdominal pressure of 170 mmHg (minimum tensile strength 16 N/cm).

4. *Tensile strength:* The maximum intra-abdominal pressures generated in healthy adults occur whilst coughing and jumping estimated to be about 170 mmHg. Meshes used to repair large hernias, therefore, need to withstand at least 180 mmHg before bursting (tensile strength up to 32 N/cm). This is easily achieved as even the lightest meshes will withstand twice this pressure without bursting (for example, burst pressure of Vypro = 360 mm Hg)
5. *Elasticity:* The natural elasticity of abdominal wall at 32 N/cm is about 38%. Lightweight meshes have an elasticity of about 20–35% at 16 N/cm. Heavyweight meshes have only half this elasticity (4–16% at 16 N/cm) and can restrict abdominal distension.
6. *Shrinkage capacity:* Shrinkage occurs due to contraction of the scar tissue formed around the mesh. Scar tissue shrinks to about 60% of the former surface area of the wound. The smaller pores of heavyweight meshes lead to more shrinkage due to the formation of a scar plate

Classification of Meshes

- *Class I:* Large pore meshes (characterised by a textile porosity of >60% or an effective porosity of >0%)
  - Ia Monofilament
  - Ib Multifilament
  - Ic Mixed structure or polymer
- *Class II:* Small pore meshes (characterised by a textile porosity of <60% and without any effective porosity)
  - IIa Monofilament
  - IIb Multifilament
  - IIc Mixed structure or polymer.

- *Class III:* Meshes with special features
- *Class IV:* Meshes with coated films
- *Class V:* 3D meshes
- *Class VI:* Biologicals
  - VIa Non-cross-linked
  - VIb Cross-linked
  - VIc Special features.

Ideal Mesh

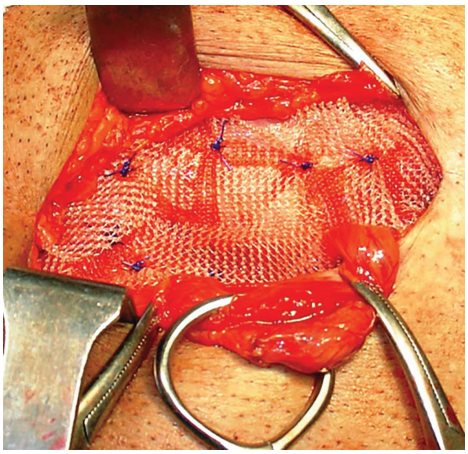
- Biocompatibility
- Infection risk
- Handling
- Socioeconomics
- Longevity

Polypropylene Mesh (Prolene)

- High tensile strength, Biocompatible, nonabsorbable
- Monofilament strong, elastic and transparent mesh.
- Ideal porosity for high visibility and colonisation.
- Strong mechanical reinforcement
- Encourages rapid ingrowth of connective tissue.
- Cheaper
- Flexible for any anatomic placement

Polyester Mesh

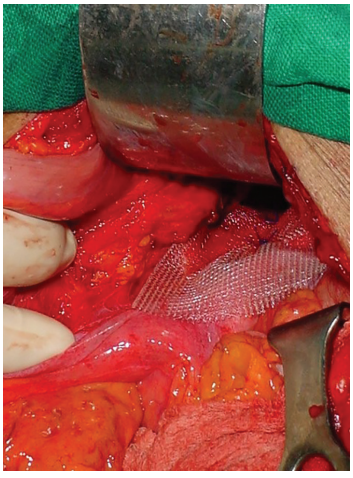
- Polymer of ethylglycol and terephthalate, and was developed in 1941. Like polypropylene, the raw material is melt extruded to produce fibers, which can be woven or bonded to produce threads or assembled sheets of material, hydrophilic in nature.
- The first monofilament polyester mesh was popularized by DuPont and was called Dacron®.
- Subsequently a multifilament polyester mesh called Mersilene® (Ethicon) was produced.
- A collagen-coated polyester mesh called Parietex™ Composite (Covidien™) was developed.
- Polyester meshes have not been as widely adopted world-wide as PPM; however, in France, Italy and Belgium they are commonly used, with satisfactory results.



- *Advantages:* Rapid fibroblastic infiltration and fixation to tissues, less mesh shrinkage compared with PPM
- *Disadvantages:* Higher rates of infection, adhesion to viscera if placed in the intra-abdominal position (without collagen coating), degradation/loss of strength over time

Biological Meshes

- Porcine small intestine submucosa
- Human acellular dermis
- Xenogeneic acellular dermis
  - They are recently becoming popular.
  - They are made from decellularised human or animal dermis or from submucosa or porcine small intestine.
  - Advantages are that chronic inflammation, foreign body reaction and mesh infection are very uncommon.
  - But they are costly compared to prosthetic meshes



Rectopexy by using prolene mesh for prolapse rectum