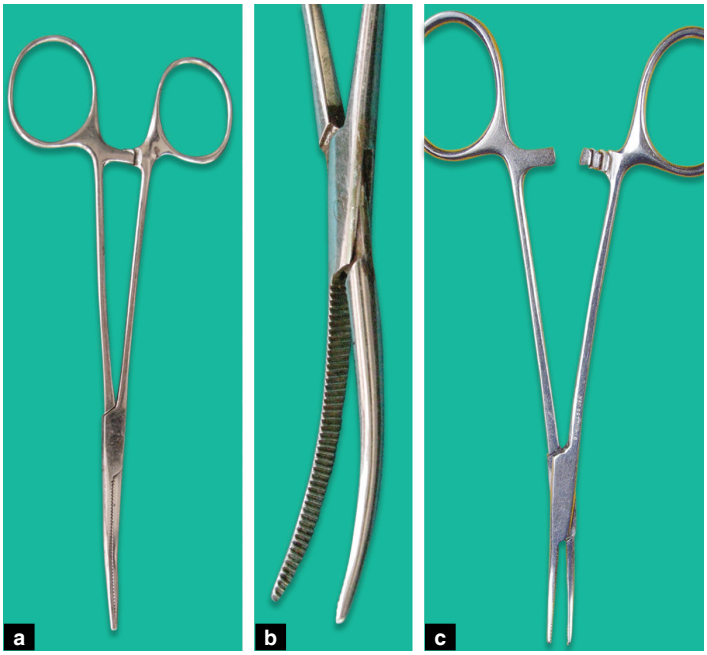
Section

1

Common Instruments and Suture Materials

Vijayendra K

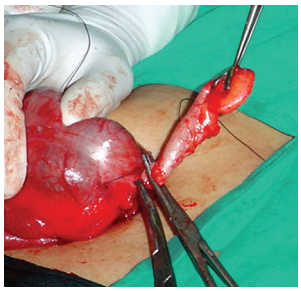
1. ARTERY FORCEPS



- It is also called **Spencer Wells' artery forceps**. It has a ratchet and two blades with uniform serrations.
- It is used to control bleeding, not only from arteries but also from the veins and capillaries. Once the bleeding points are caught, they are coagulated or ligature is applied, hence the name haemostat.
- The curved artery forceps is commonly used.
- The smaller version of this is called **mosquito forceps (Halsted)**. This is extremely useful in repair of harelip, cleft palate or other plastic surgery operations (Fig. a).
- It is also available as straight artery forceps which is used to hold the stay sutures.
- Transverse serrations are present **only in the tip** (Fig. c).
- ***Pedicle clamp:*** Transverse serrations are present **throughout** the extent of the blade—useful in splenic artery and renal artery ligation (Fig. b).

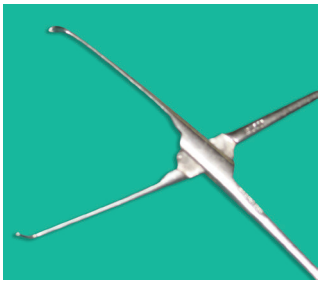
Other Uses of Haemostat

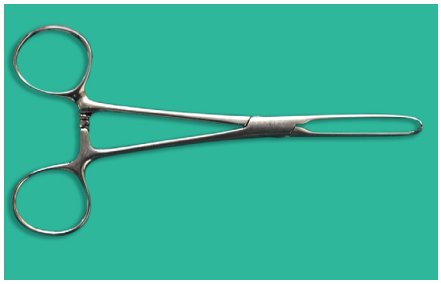
1. To crush the appendicular base as in this picture
2. To hold the hernial sac and to apply transfixation ligature
3. To hold fascia, aponeurosis, peritoneum, stay sutures, etc.



Haemostat is the most commonly used instrument

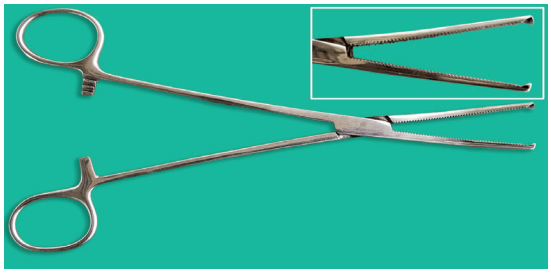
2. ALLIS TISSUE-HOLDING FORCEPS





- It has a ratchet and triangular expansion at the tip. Curved inwards with fine teeth at the tip of the instrument.
- Blades are straight along the longitudinal axis.
- It can be used to **hold tough structures** such as fascia, aponeurosis, hydrocoele sac, etc.
- Even though it can cause trauma, because of its better grip, it can be used to hold the duodenum for duodenal closure during gastrectomy. Alternatively, Babcock's forceps is a better instrument to hold the duodenum.
- Some commonly performed surgeries wherein this instrument is used are appendicectomy, thyroidectomy, to hold fascio-aponeurotic layer during laparotomies.
- It is used to hold bladder neck during resection of prostate.

3. KOCHER'S (ARTERY) FORCEPS



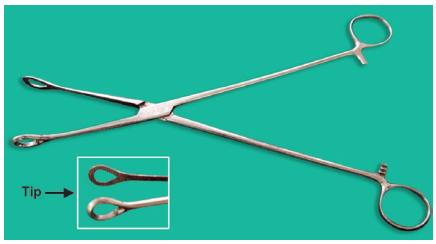
- This is similar to an artery forceps with serrations. It is available as curved and straight. Even though, it is called an artery forceps, it is not routinely used to control bleeding. However, in case a vessel is bleeding and retracting, this instrument can be used, e.g. in palms, sole, scalp.
- There is a sharp tooth at the tip of the instrument. Hence, it has a better grip.
- Kocher's forceps can be used to **hold tough structures** such as **aponeurosis, fascia**, etc.
- During thyroidectomy, it can be used to hold the strap muscles for dividing them.
- In gynecology, it is used to clamp pedicles during hysterectomy.
- In obstetrics, it is used in artificial rupture of membranes.
- Theodor Kocher, German surgeon, got the Nobel Prize for his contribution to thyroid surgery (Key Box 1.1).

Key Box 1.1: Kocher's name and surgery

- Kocher's forceps
- Kocher's test: In long standing goitres—gentle compression of both lateral lobes results in stridor. It occurs due to softening of tracheal cartilages—called tracheomalacia. In such cases, after total thyroidectomy, cartilages lose support and collapse. So, if this sign is positive, it is better to retain endotracheal tube for 1 or 2 days in the postoperative period.
- Kocher's vein: It is also called posterior external jugular vein.
- Kocher's incision: Collar neck incision for thyroidectomy
- Kocher's subcostal incision used to remove gall bladder—open cholecystectomy. Today more than 95 to 98% cholecystectomies are done by laparoscopic method.
- Kocher's gland holding forceps

Kocherisation: Mobilisation of duodenum by incising peritoneum on the lateral surface of 2nd part of duodenum to expose retroperitoneal structures such as inferior vena cava, etc. Kocher's sign—increased lid retraction in hyperthyroidism resulting in a fixed stare or a frightened look.

4. SWAB (SPONGE)-HOLDING FORCEPS (FOERSTER'S)



- It is 22.5 cm long.
- This has a ratchet and two long blades.
- Operating end is rounded with serrations.
- Ratchet lock helps to secure grip on holding the swab.

Uses

- It is used to hold the swab (gauze pieces) to prepare the parts with antiseptic agents at the time of surgery.
- This instrument can also be used as a blunt 'dissector' with the swab, while dissecting at a depth, e.g. lumbar sympathectomy, vagotomy, etc.
- In haemostasis, to apply pressure using a swab
- For grasping cervix in obstetrics
- To swab vaginal cavity
- To hold Hartmann's pouch (Babcock's forceps can also be used) in cholecystectomy.

Advantages

- As the shafts are long, the hands of the surgeon are well away from cleaning area.

5. DISSECTING SCISSORS

- This is also called **Mayo's scissors**.
- This instrument does not have ratchet and operating end is sharp.
- This is used to dissect tissue planes during surgical operations and to cut or divide important structures.
- It is popularly known as **tissue scissors**.
- What is shown in this picture is a golden hand scissors.

Key Box 1.1

- Mayo's scissors
- Mayo's herniorrhaphy: Double breasting repair done for umbilical hernia
- Mayo's gastrojejunostomy: Posterior gastrojejunostomy done for pyloric stenosis
- Mayo's vein: Prepyloric vein of Mayo

William Mayo and Charles Mayo, along with their father William Worrall Mayo, founded the world-famous Mayo Clinic in Rochester, Minnesota.

6. STRAIGHT SCISSORS

- It has handle and 2 long blades.
- No serrations
- Tip is sharp
- No ratchet
- It is used to cut the sutures or knots. Hence, called suture cutting scissors.

7. DISSECTING FORCEPS

- Outer surface has grooves to get a firm grip.
- This is a toothed forceps. It is also available as non-toothed forceps.
- Dissecting forceps along with dissecting scissors makes good 'tool' for a surgeon to **develop a tissue plane** in majority of surgeries.
- The forceps is very useful to 'pick' individual layers such as serosa, seromuscular layers, mucosa, etc. during anastomosis.
- Forceps with fine teeth can be used to catch bleeding points for coagulation purpose.
- Depending on the number of teeth, it is called one in two or two in three toothed forceps.

8. NEEDLE HOLDER

- This is a long instrument with a ratchet lock at non-operating end.
- The operating end has two small stout blades with serrations.
- The instrument is used **to hold the curved needles** which are used to suture the parts.
- A **firm grip** is essential to apply proper sutures.
- Generally needles are held at the junction of 2/3rd and 1/3rd so that it will allow a smooth clockwise movement of hand which in turn allows the needle to pass through tissues.

9. BARD-PARKER HANDLE

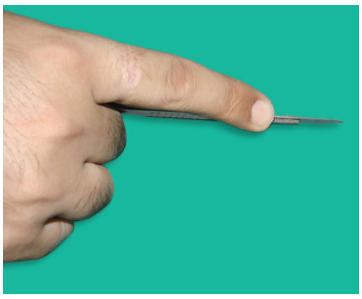
- Popularly called the **surgeon's knife**.
- A surgical blade can be attached to this handle. This is used to incise the skin and subcutaneous tissue.
- Due to the sharp nature, it can be used to divide a major vascular pedicle once ligatures are applied.

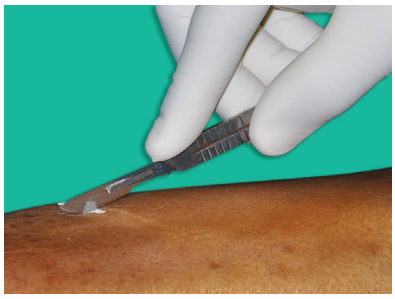
For example:

- Bard-Parker's (surgeon's)
- Beorver's
- Fischer's tonsillar knife.

Four Positions to Hold Knife

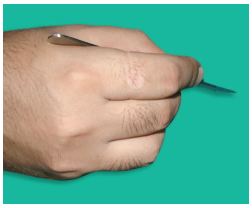
1. Surgical incision : Dinner knife position
2. Drainage of abscess : Stab incision
3. Fine dissection : Pen position
4. Gentle incision : Fiddle bow position



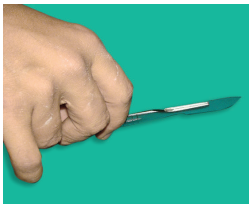


Dinner knife position: The index finger applies sustained pressure over the knife depending upon how deep the incision should be.

Stab position: While draining an abscess that is pointing, a stab incision is made. This is the best position to hold the knife in this situation



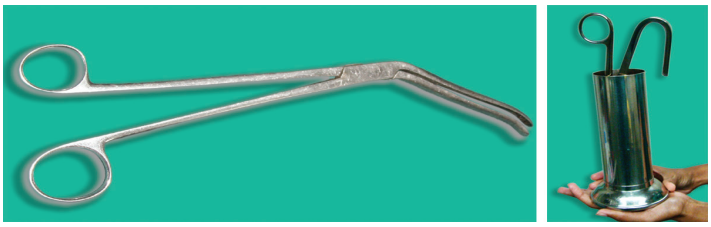
Pen position: Instead of forceps and scissors, knife can be used to dissect layers as in raising skin flap during thyroidectomy and mastectomy



Fiddle bow position: This position is used when you want a very fine dissection with the knife. Pressure applied is very less

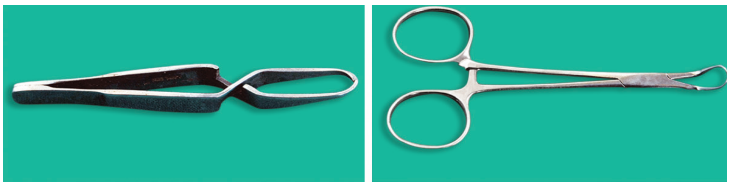
To make a nick over the pointing area of an abscess, firm grip is applied and it is stabbed.

10. CHEATLE'S FORCEPS



- It is a long, heavy, metallic forceps with curved blades.
- Serrations are present in the blades for a better grip.
- The **handle has no lock**.
- It is kept dipped in antiseptic solutions.
- This instrument is used to pick sterilized articles such as sponges, gauze pieces or other instruments and to transfer to the instrument trolley.
- Since it has long blades, the hands of a nurse or assistant are well away from cleaning area.

11. TOWEL CLIPS



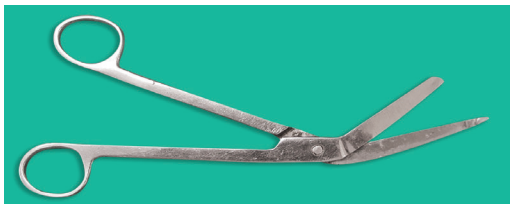
Doyen's towel clip | Backhouse towel clip

- This is a short instrument, has a ratchet and catch.
- Operating end is sharp.
- This is available in different sizes. Average size is 4–5 inches in length.
- Once the part is cleaned and draped, the clips are used to hold the towels in place.
- Can also be used to fix suction tubes/cautery cables, etc. to drapes.
- To hold sutured flap in position.
- Can be used to hold ribs while elevating ribs in stove-in-chest injury.

12. MIXTER/WESTPHAL RIGHT-ANGLED FORCEPS

- This is a long instrument with right angle at the operating end.
- Because it is long, dissections at deeper planes can be done easily instead, e.g. isolation of vagus (neck dissections and tonsillectomy).
- This instrument is extremely useful in **ligating the major vascular pedicles**. Following are a few examples:
  - Superior thyroid pedicle—thyroidectomy, cystic artery—cholecystectomy, lumbar veins—lumbar sympathectomy
  - Left gastric artery and vein in gastrectomy
  - Ligation of splenic artery near the upper border of pancreas
  - Ligating middle thyroid vein in thyroidectomy.

13. LISTER'S BANDAGE-CUTTING SCISSORS



Scissors is bent at an angle, to get below the bandage easily. The tip of the lower blade is flat and blunt (atraumatic).

Note: These scissors should not be boiled as it decreases the sharpness. Sterilized by immersion in Lysol/Cetrimide.

Joseph Lister, British surgeon, was the first to apply the science of Germ Theory to surgery and used carbolic acid to prevent infection in wounds. Lister's work reduced postoperative infections. He is called father of modern surgery.

14. NEEDLES AND SUTURES

INTRODUCTION

- Needles are very essential part of surgery. Every surgeon should know details about various types of needles, their diameter, their shape and their usefulness. Thus it helps in conduct of surgery very well. Wrong usage of sutures may result in serious complications—such as tissue trauma, bleeding, sepsis, anastomotic leak, etc.

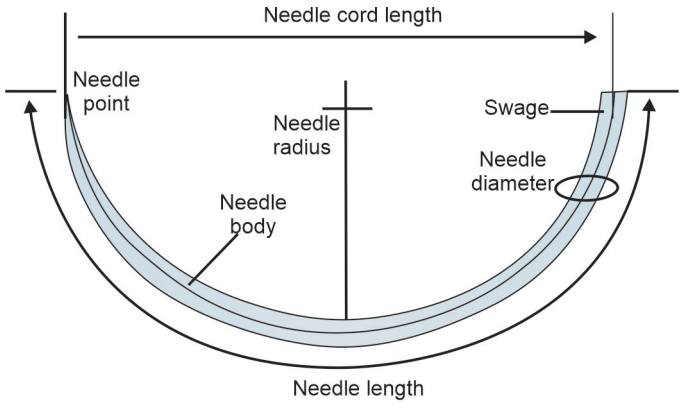
CLASSIFICATION

- **Traumatic:** Needles with eye, suture material loaded into the eye. Needle holes in tissues are larger than suture material.
- **Atraumatic:** Eyeless needles, suture material embedded into the needle. When suture is attached to needle with a single, continuous unit of suture and needle, it is known as swaged needle.

Scottish pharmacist George Merson, who runs a suture manufacturing company, developed eyeless needled sutures with a single strand of material pre-attached through the butt of the needle.

Parts of the Needle

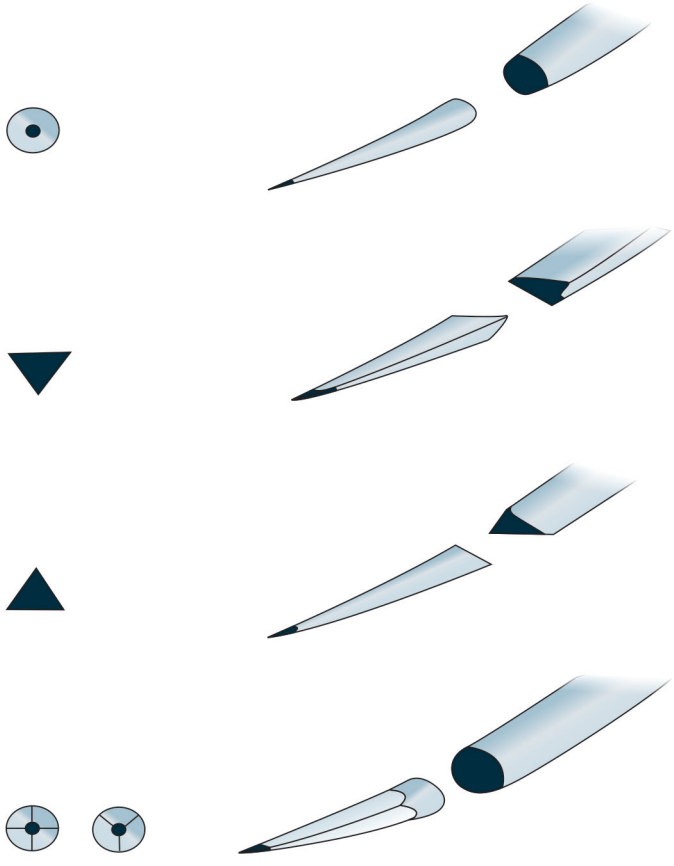
- **Needle has three main parts:** Shank, body, point. The body of the needle is either round, triangular or flattened.



- **Round-bodied needles:** Uniformly round, gradually taper to a point designed to separate tissue fibres rather than cut through soft tissue. *Examples:* They are used in intestinal and cardiovascular surgery.
- Cutting needles are used for suturing tough or dense tissue, e.g. skin, fascia, aponeurosis, etc.

Point of the Needle

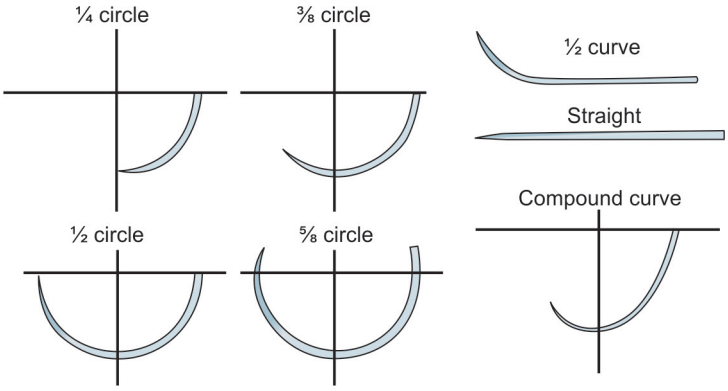
- Round with a tapered end.
- Reverse cutting in which the cutting edge is on the outside of the needle curvature.



- Conventional cutting—cutting edge faces the inside of the needle curvature.
- Taper cutting.

Choice of the Needle

- Choice of needle shape depends on accessibility of the tissue to be sutured—more confined the operative space, the more curved the needle. *Example:* Deep in the pelvis, stitches in and around gastro-oesophageal junction, etc.
- Half circle needles are commonly utilized in the gastro-intestinal tract.
- **J-shaped needles**, quarter circle needles and compound curvature needles: Used in special situations, such as the **vagina, eye and oral cavity, respectively**.
- Size of needle corresponds with the gauge of the suture material.



Special Needles

- Aneurysm needle is a blunt pointed curved needle with the eye at the point; used for passing ligatures around aneurysms or over the vessels.
- Aspirating needles: Long, hollow needle for removing fluid from a cavity.
- Menghini needle is a needle for liver biopsy, does not require rotation to cut loose the tissue specimen.

- Reverdin's needle is a surgical needle with an eye that can be opened and closed by sliding.
- Silverman needle is a biopsy needle for taking tissue specimens. It consists of an outer cannula and an inner split needle with a longitudinal groove in which tissue is retained when the needle is withdrawn.

Round body needle	*Cutting needle*
• Uniformly round needle	• No uniform shape
• Tip is tapered	• Sharp end has a triangular shape on cross-section.
• They separate the tissue.	• They cut, penetrate fibres and tough structures.
• Used to suture tissue fibres muscles, intestines, vessels.	• Used to suture fascia aponeurosis, linea alba and skin

15. SUTURE MATERIALS

INTRODUCTION

Selecting an appropriate suture material for surgery is equally important as selecting a needle. Suture materials are of different varieties, materials and properties. An understanding of properties of various suture materials will help in doing surgeries easily and effectively. A few common sutures and their uses have been given here.

CLASSIFICATION

- **Absorbable:**
  - Natural: Catgut
  - Synthetic: Polyglactone, polydiaxonone
- **Non-absorbable:**
  - Natural: Silk
  - Synthetic: Polypropylene, polyamide monofilament

Catgut

- The word **catgut is derived from kitgut means violin strings**.
- Natural absorbable suture, derived from submucosa of the sheep because of rich content of elastic fibres.

- It is easy to handle, knots well.
- Plain or chromicised (mixed with chromic salts).
- Tensile strength: 15 days for plain catgut and 28 days for chromic catgut.
- Absorbed in 60 days (plain) or 90 days (chromic)
- Plain catgut is used to suture subcutaneous tissue for closure, during circumcision, repair of wounds of lip or oral cavity.
- Chromic catgut is used to suture muscles, bowel anastomosis, closure of peritoneum, appendicectomy, etc.
- Chromic and plain catgut are preserved in 70% alcohol and it is kept soft due to 5% glycerine.

Synthetic absorbable suture polyglycolic acid and polyglactin has replaced catgut suture for most of the uses.

Vicryl (Polyglactin 910)

- Made of polyglactin -synthetic absorbable polyfilament suture.
- **Co-polymer of 90% glycolide and 10% L-lactide**
- **Digested by hydrolysis**, not by enzymatic degradation, hence less tissue reaction when these sutures are used.
- Maintains **tensile strength in the tissues for about 28–30 days** and get absorbed in 80–90 days.
- Available in different sizes ranging from No.1 to 8-0.
- The suture length may be 90 cm, 70 cm or 45 cm.
- Needles available with vicryl are round bodied, cutting, taper cut or atraumatic.
- Size of needles can be 30 mm, 22 mm, 16 mm, etc.
- Available as undyed vicryl and coated vicryl.
- **Triclosan, a broad-spectrum antiseptic agent, which has been used to provide Vicryl sutures with antimicrobial activity—it is called Vicryl plus**

Uses of Vicryl

- No. 1 or 1-0 suture may be used for closure of subcostal, paramedian, Pfannensteil, McBurney's incision.
- 3-0 or 4-0 sutures on atraumatic round bodied needles are used in biliary enteric anastomosis: Choledocho-duodenostomy, choledocho-jejunostomy, hepatico-jejunostomy.

- 4-0 sutures are also used in pancreatico-jejunal anastomosis.
- 2-0 sutures used in intestinal anastomosis, suturing external oblique aponeurosis in inguinal hernia repairs.
- Also used for subcutaneous closure, transfixation of vessels, achieving haemostasis, etc.
- Finer polyglactin sutures 5–0 and 6–0 are used in vascular surgery—mono-filament sutures
- **Reverse cutting endoport:** Used for closure of laparoscopic port incisions—the rectus or the umbilical port/camera port.

Rapid Vicryl

- A variety of polyglactin 910 suture, with rapid absorption. Undyed vicryl.
- Rapid absorption is due to exposure of coated vicryl to gamma irradiation which leads to the material having a low molecular weight than coated vicryl.
- Tensile strength: Maintained for 10–12 days.
- Gets absorbed in 42 days.
- Used for skin or mucosal closure.
- Sutures need not be removed, gets spontaneously absorbed.
- Used for circumcision.

Monocryl

- Polyglecaperone is a synthetic absorbable monofilament suture
- Available as undyed or may be dyed violet
- Good handling properties: Very smooth surface, passes through tissues with ease
- Tensile strength: 21 days.
- Absorbed by hydrolysis in about 90–120 days.
- Used for closure of subcutaneous tissue apposition.
- Used for skin closure, subcuticular sutures.
- **Used in urological procedures—pyeloplasty, ureter repair.**

Polydiaxonone (PDS)

- Polydiaxonone suture: Synthetic, delayed absorbable, mono-filament suture. Dyed violet.
- PDS II sutures: Improved version of initial PDS suture.

- Suture characteristics: Soft, pliable and smooth; allows easy passage through the tissues. Knotting characteristics—best among the synthetic absorbable sutures.
- Available in various sizes with different types of needle and different suture lengths.
- Tensile strength: Maintained for longer periods (about 56 days)
- Suture is absorbed by hydrolysis, complete in about 180–210 days (6–7 months)
- No. 1 loop PDS is used for closure of paramedian or midline and other abdominal incisions.
- 3-0 and 4-0 sutures are used for intestinal or biliary enteric anastomosis.

Silk

- Natural non-absorbable sutures
- Derived from cocoon of the silkworm larva
- It is braided and coated with wax to reduce capillary action
- Tensile strength: Maintained for a long time (2 years)
- In the tissues, it incites a polymorphonuclear reaction and a fibrous capsule formed around the silk in 14–21 days.
- *Available as:*
  - **Sutupak:** Sterile pack containing black braided silk, precut into different sizes. Suture thickness may be 6-0 to 3, 75 cm long.
  - **Silk reels:** Nonsterile, available in thickness from 6-0 to 4. Sterilized by autoclaving.
  - **With needles:** Different types of needles, and different sizes (No. 7-0 to 1) and different lengths (45 cm, 76 cm and 90 cm)
- 2-0 and 3-0 mersilk can be used for anterior and posterior seromuscular sutures in intestinal anastomosis and in gastro-jejunostomy.
- 3-0 mersilk may be used for pancreaticojejunal anastomosis.
- 4-0 mersilk may be used for suturing nerve.

Uses of Silk

- Cholecystectomy—to ligate the cystic duct and cystic artery.
- During intestinal resection—to ligate mesenteric vessels.

- Ligation of the pedicles—during nephrectomy, splenectomy, major amputations, etc.
- During Trendelenburg procedure and perforator ligation.

Ethilon

- Synthetic monofilament nonabsorbable suture (made of polyamide, a variety of nylon). Very low coefficient of friction—readily passes through the tissues
- Tensile strength: Maintained for a long time (tensile strength loss after 1 year is 25%).
- Available in different sizes.
  - **Suture:** Monofilament polyamide black, No. 2-0, 70 cm.
  - **Needle:** Reverse cut—used for closure of skin incision. (No.1, 1-0, 2-0, 3-0)
  - Also available as finer sutures 3–0, 4–0, 5–0 up to 10-0: Used in vascular surgery, reverse cutting, 45 mm, 3/8 circle

Prolene

- Polypropylene is a synthetic monofilament nonabsorbable suture
- It is inert, has extremely low tissue reactivity and is non-biodegradable
- Low coefficient of friction, slides through the tissues readily.
- Tensile strength maintained for indefinite period.
- Demonstrates memory, requires 4–5 knots to secure.
- Available with a variety of needles in various sizes from 8-0 to 1, with different lengths.
- **Suture:** Monofilament polypropylene blue, No. 3-0, 70 cm.
- **Needle:** Round bodied, 25 mm, 1/2 circle
- **Suture:** Monofilament polypropylene blue, No. 4-0, 90 cm.
- **Needle:** Taper cut needle, 26 mm, 1/2 circle
- Used in inguinal hernioplasty for closure of posterior wall defects, fixation of mesh, etc.
- Used during orchidopexy
- In vascular anastomosis 5 or 6-0 is selected. In microvascular surgery 8 or 10-0 sutures are used.

Ethibond Excel

- Polyester—synthetic nonabsorbable braided sutures
- Are dyed green for better visibility.
- Available along with pledgets.
- Used for cardiovascular surgery in valve replacements
- **Suture:** Polyester, No. 3-0, 100 cm.
- **Needle:** Round bodied, 26 mm, 1/2 circle

V LOC

- Novel suture materials: Eliminates the need for knot tying in some situations, such as laparoscopic surgery.
- These sutures have unidirectional or bidirectional barbs that secure the suture in the tissues.
- Available as absorbable (polymer of glycolide, dioxanone and trimethylene carbonate) and non absorbable (polybutester)
- **Suture:** Absorbable, No. 3-0, 30 cm.
- **Needle:** Taper, 26 mm, 1/2 circle