Sutures, Catheters and Drains

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What are sutures?

- Sutures are materials with which two surfaces are kept in apposition.

Properties of sutures

Tensile strength

- is the measured level of tension that a knotted suture strand can withstand before breaking. Generally speaking, the larger the size of the strand, the higher the tensile strength.

Properties of sutures

Size

- Small suture starts from 0 and goes to 11-0. The more zeros in the number, the smaller the suture.
- Heavy (large suture) starts at 1 and goes to 8. The larger the whole numbers, the larger the sutures.

Properties of sutures

Memory

- *The suture's tendency to return back to its resting or previous shape*
- *Therefore a high memory leads to poor knot holding.*
- *Monofilament sutures have higher memories than multifilament sutures.*

Properties of sutures

Elasticity

- Ability to return to its original length after stretching
- Also sometimes refers to as extensibility

Properties of ideal sutures

An ideal suture should

- elicit no tissue reaction
- handle perfectly
- tie securely
- not encourage infection
- Have no capillary action.
- No suture satisfies all these criteria.

Suture Classification

Three ways

- 1. Absorbable vs Nonabsorbable
- 2. Monofilament vs Multifilament
- 3. Natural vs Synthetic

Absorbable sutures

- Biodegradable
- Two major forms of absorption
  - Enzymatic: for natural absorbable sutures like catguts. The materials are digested by tissue enzymes
  - Hydrolytic: for synthetic absorbable sutures.

Absorbable sutures: Examples

- Naturally occurring (degraded enzymatically)
  - Catgut
    - Consists of processed collagen from animal intestines
    - Broken down after 7 days
  - Chromic catgut
    - Consists of intestinal collagen treated with chromium
    - Loses tensile strength after 2-3 weeks and is broken down after 3 months
- Synthetic
  - Degraded non-enzymatically by hydrolysis when water penetrates the suture filaments and attacks the polymer chain
  - Tend to evoke less tissue reaction than those occurring naturally

Non-absorbable

- Composed of materials which are not degradable by mammalian tissues
- Sutures may be:
  - Left in place indefinitely (during closure of abdominal fascia)
  - Removed following adequate healing (closure of superficial laceration)

Non Absorbables: Examples

- Naturally occurring (silk, cotton and steel)
  - Silk has the best knotting characteristics. Steel has the worst characteristic
- Synthetic (Prolene, Ethilon (Nylon), Nurolon, etc)
  - Nylon has poor knotting characteristics. But it is widely available and cheap

Monofilament

- This suture is made of a single strand. It resists harboring microorganisms, and it ties down smoothly.
- generally have poorer handling and knotting characteristics than multifilament sutures.

Multifilament

- consists of several filaments twisted or braided together.
- Has good handling and tying qualities.
- Harbours microorganism between its strands and by capillary action encourage transfer of microorganism from one part of the wound to another

Surgical needles

- Surgical needles are necessary for the placement of sutures in tissues

Ideal Needles

The ideal needle should

- carry suture material through tissue with minimal trauma.
- Be sharp enough to penetrate tissue with minimal resistance.
- Be rigid enough to resist bending, yet flexible enough to bend before breaking.
- Be sterile and corrosion-resistant to prevent introduction of microorganisms or foreign bodies into the wound.

Parts of a needle

- Point
- Body
- Eye or attachment

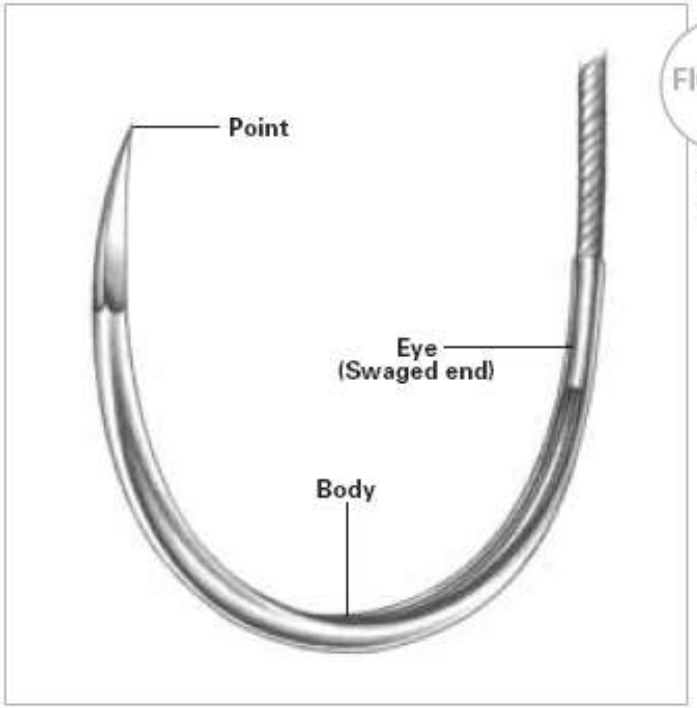
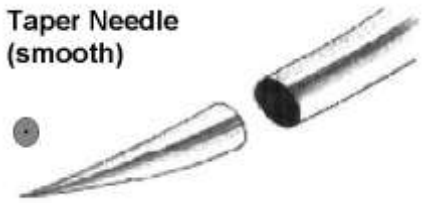
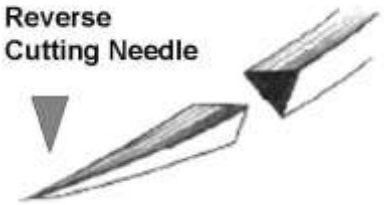


FIGURE 3

NEEDLE COMPONENTS

Point

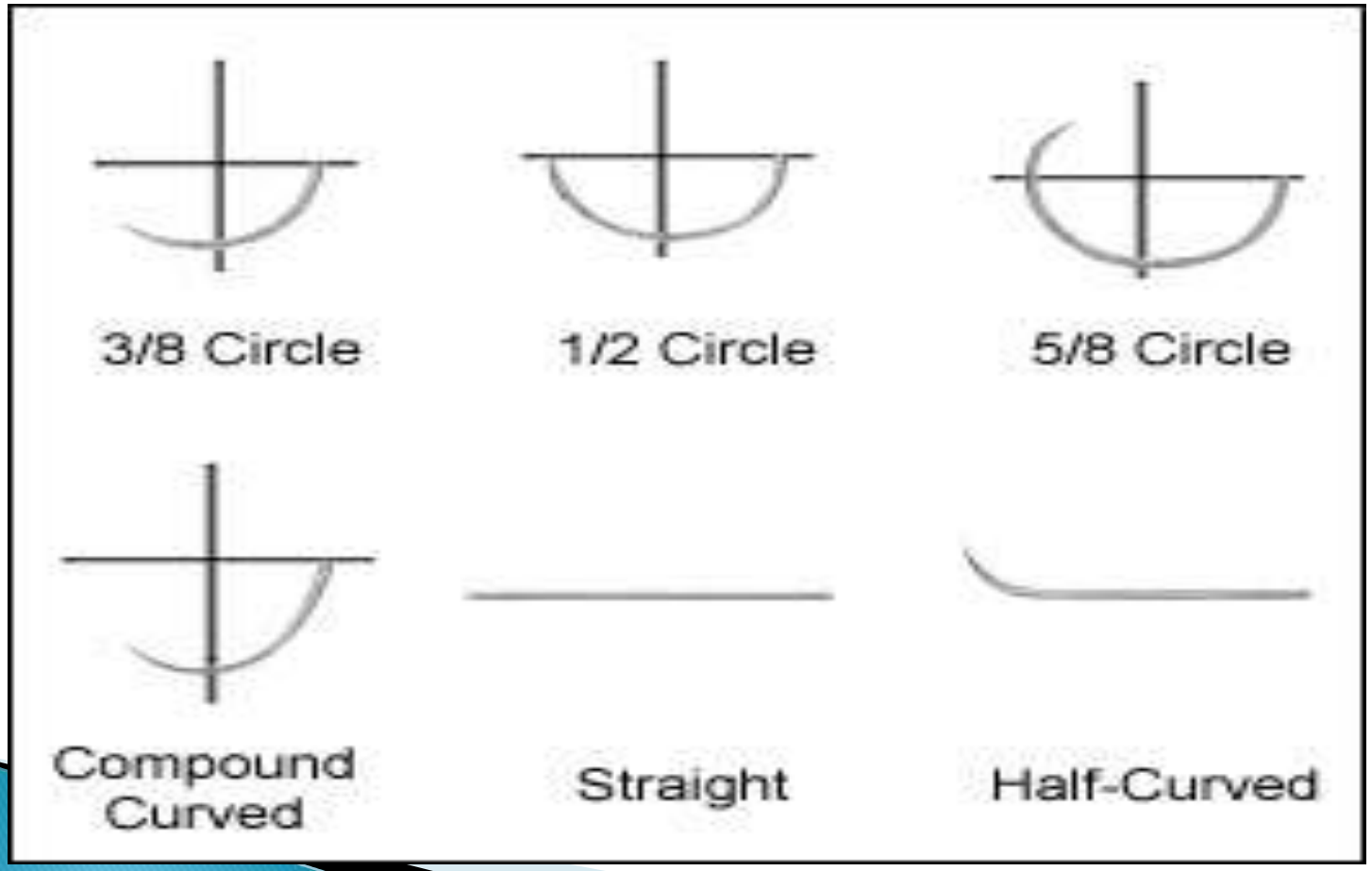




- Tapered
  - Gradually taper to the point and cross-section reveals a round, smooth shaft
  - Used for tissue that is easy to penetrate, such as bowel or blood vessels
- Cutting
  - Triangular tip with the apex forming a cutting surface
  - Used for tough tissue, such as skin (use of a tapered needle with skin causes excess trauma because of difficulty in penetration)
- Reverse cutting needle
  - Similar to a conventional cutting needle except the cutting edge faces down instead of up
  - This may decrease the likelihood of sutures pulling through soft tissue

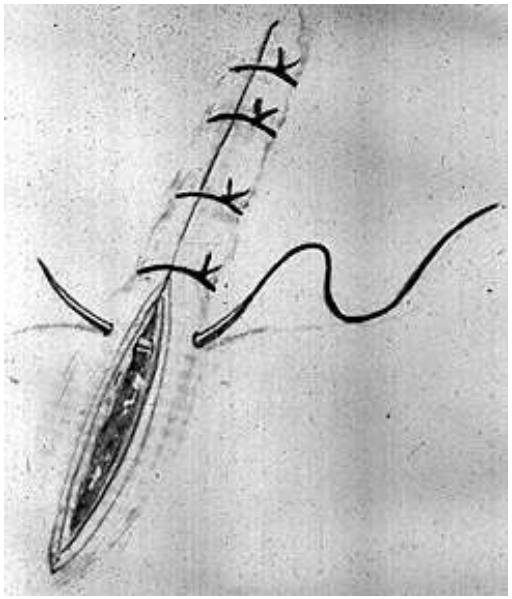
Body

- Can be straight or curved

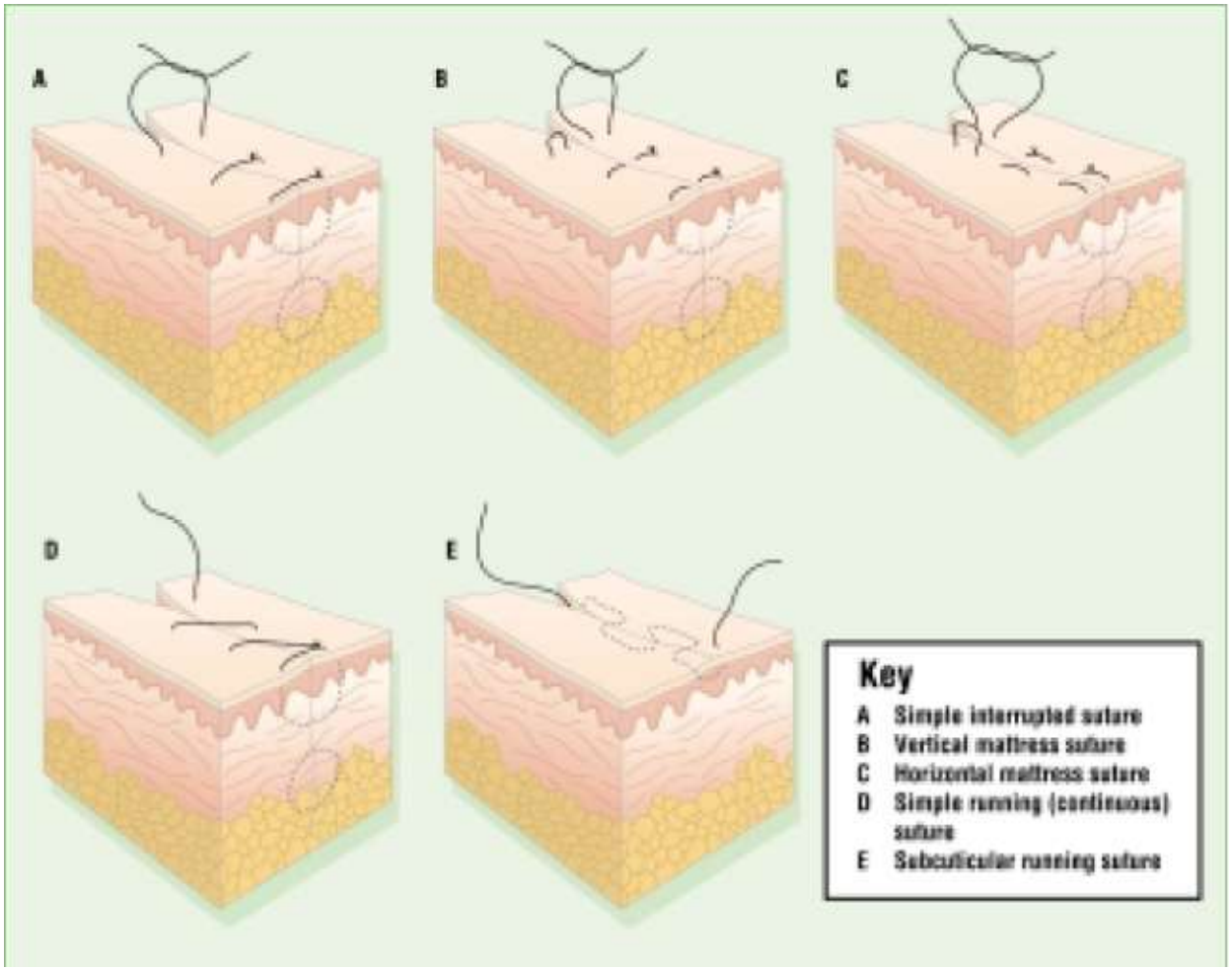


Suturing techniques

- Continuous
  - To be avoided when there may be a need to remove part of the sutures eg when infection is anticipated
- Interrupted



Examples


A
B
C
D
E
Key
A Simple interrupted suture
B Vertical mattress suture
C Horizontal mattress suture
D Simple running (continuous) suture
E Subcuticular running suture

When to remove sutures

- **Face:** 3–4 days
- **Scalp:** 5 days
- **Trunk:** 7 days
- **Arm** or **leg:** 7–10 days
- **Foot:** 10–14 days

Suture alternatives

Alternatives to Sutures

- – Staples
- – Skin tapes
- – Surgical adhesives

Drains

- Surgical drains are devices, usually in the shape of a tube or wick, for removing fluid as it collects in a cavity.

- Goals / Indications for Use
  - Why use a drain ?
- Types
  - What are the major types of drains and how do they work ?
- Principals of Use
  - Which drain to use ?
  - What are the complications ?

Goals

- Decrease Infection Rate
- Decrease Healing Time

Indications

1. To help eliminate dead space
2. To evacuate existing accumulation of fluid or gas
3. To prevent the potential accumulation of fluid or gas

Material Composition

- *Latex rubber*: These are soft, pliable but excite a lot of tissue reactions and thus should not be used in infected wounds.
- *PVC*: Much less reactive than latex rubber but is less pliant and tends to harden and split with prolonged use.
- *Silicon*: The least reactive and most pliant; the most ideal of the three.

Drain Types

- Passive
- Active
  - Continuous suction
  - Intermittent suction

Passive Drains

- Passive
  - Drain by means of pressure differentials, overflow, and gravity
  - Provides a stent that keeps a draining tract / opening open
  - Allow egress via a path of least resistance
  - Flat or with a lumen
  - Open or Closed – Closed preferred

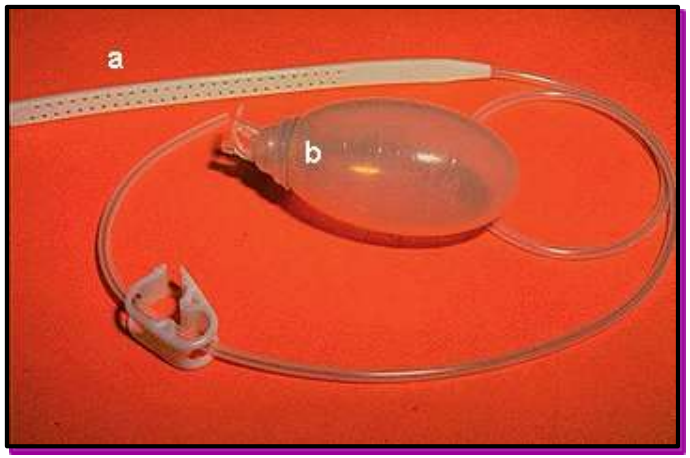
Passive Drains

- Passive closed
  - Advantages
    - Allow evaluation of volume and nature of fluid
    - Prevent bacterial ascension
    - Eliminate dead space
    - Help appose skin to wound bed – quicker wound healing
  - Disadvantages
    - Gravity dependent – affects location of drain
    - Drain easily clogged

Active Drains

- Vacuum pulls fluid / gas from the wound
- Closed to atmosphere = Closed suction
- Vacuum applied to a single lumen tube
- Not gravity dependent

Active Drains



Active Drains

- Advantages
  - Keep wound dry – efficient fluid removal
  - Can be placed anywhere
  - Prevent bacterial ascension
  - Help appose skin to wound bed – quicker wound healing
  - Allows evaluation of volume and nature of fluid
- Disadvantages
  - High negative pressure may injure tissue
  - Drain clogged by tissue

Causes of Complications and Failure of Drains

- Poor Drain Selection
- Poor Drain Placement
- Poor Post-operative Management

Complications and Failure of Drains

- Infection
  - Ascending bacterial invasion
  - Foreign body reaction
  - Decreased local tissue resistance
  - Bacterial hiding places
  - Poor placement – fluid accumulation, drain kinked
  - Poor postoperative management

Complications and Failure of Drains

- Discomfort / Pain
  - Thoracic Tubes – diameter too large
  - Stiff tubing
- Inefficient Drainage
  - Exiting in non-dependent locale (passive drains)
  - Kinked tube
  - Obstructed
  - Poor drain selection – diameter too small to remove viscous fluid

Complications and Failure of Drains

- Breakdown of anastomotic sites
- Erosion into hollow organs (firm drains)
- Incisional dehiscence / hernia
  - Poor placement
- Premature Removal
  - Accumulation of fluid

Common areas of drain placements

- Wounds
- Abdomen
- Thorax

Catheters

- A catheter is a flexible tube inserted into some part of the body that provides a channel for fluid passage or a medical device.
- Urinary catheterization is the most common indication.
- Also used to deliver devices and drugs via vessels and hollow organs internally.

Indications

- Therapeutic
- Diagnostic

Diagnostic

- Measurement of body statistics e.g. Central Venous catheters, Swantz Ganz catheters, compartmental pressure.
- Taking specimen cytological examination
- Taking specimen for microbiological examination e.g. catheter specimen of urine
- Monitoring patient's response to treatment e.g. catheterization in burns or shock patients
- To deliver radio-opaque dyes for venography or arteriography

Therapeutic

- To drain body cavities e.g. bladder, stomach, ventricle (hydrocephalus) etc.
- To deliver drugs to specific locations e.g. Intra-arterial cytotoxic drugs, or
- Post operative drains
- For feeding e.g. NG Tubes, parenteral nutrition
- In interventional radiology: To control internal haemorrhage by delivering emboli to the site of the bleeding
- As temporary arterial shunts

Complications

- Infections
- Blockage
- Migration
- Ejection
- Catheter tip breakage

Urinary catheters

- Most commonly used catheters
- Foley is the most common type used

Catheter Sizes

- The smaller the number, the smaller the catheter
- No. 8 fr and 10 fr; commonly used for children
- No. 14 fr and 16 fr; commonly used for female adults
- No. 18 fr and 20 fr and 22 fr; usually used for male adults

Types of Catheters

- Non-retention catheters
  - Used to drain the bladder for short periods (5-10 min)
  - May be inserted by patient
  - Commonly used with spinal cord injury patients

Retention catheters

- Purpose:
  - Continuous bladder drainage
  - Gradual decompression of over-distended bladder
  - Intermittent bladder drainage and irrigation

Placement

- Per urethral
- Suprapubic

Questions