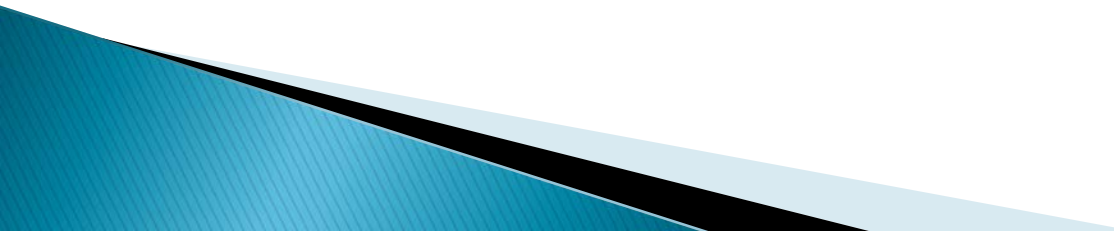


Sutures, Catheters and Drains

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What are sutures?

- ▶ Sutures are threads or strands with which two surfaces are kept in apposition.
 - ▶ The primary objective is to position and secure surgical flaps to promote optimal healing.
 - ▶ When performed properly, healing by primary intention occurs.
- 

Suture Armamentarium

▶ Needle Holder



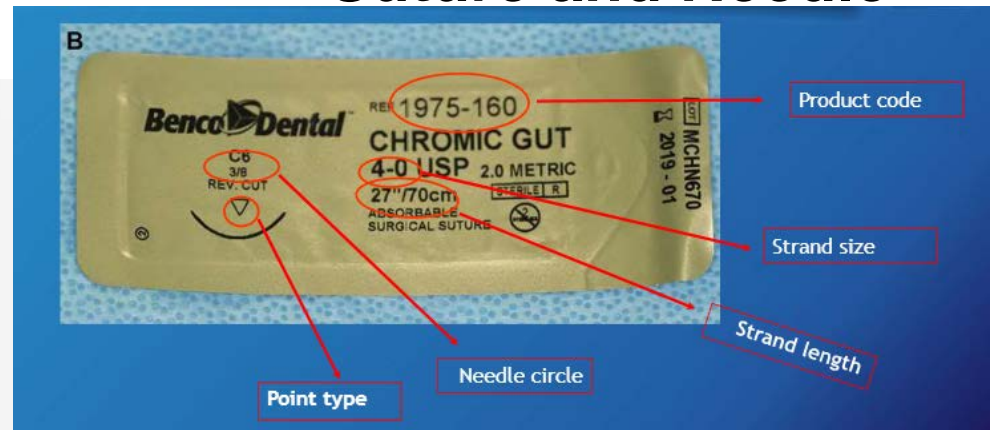
Needle scissors



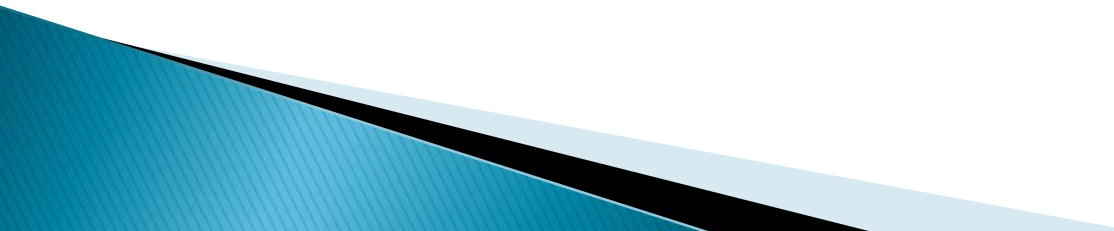
Forceps



Suture and Needle



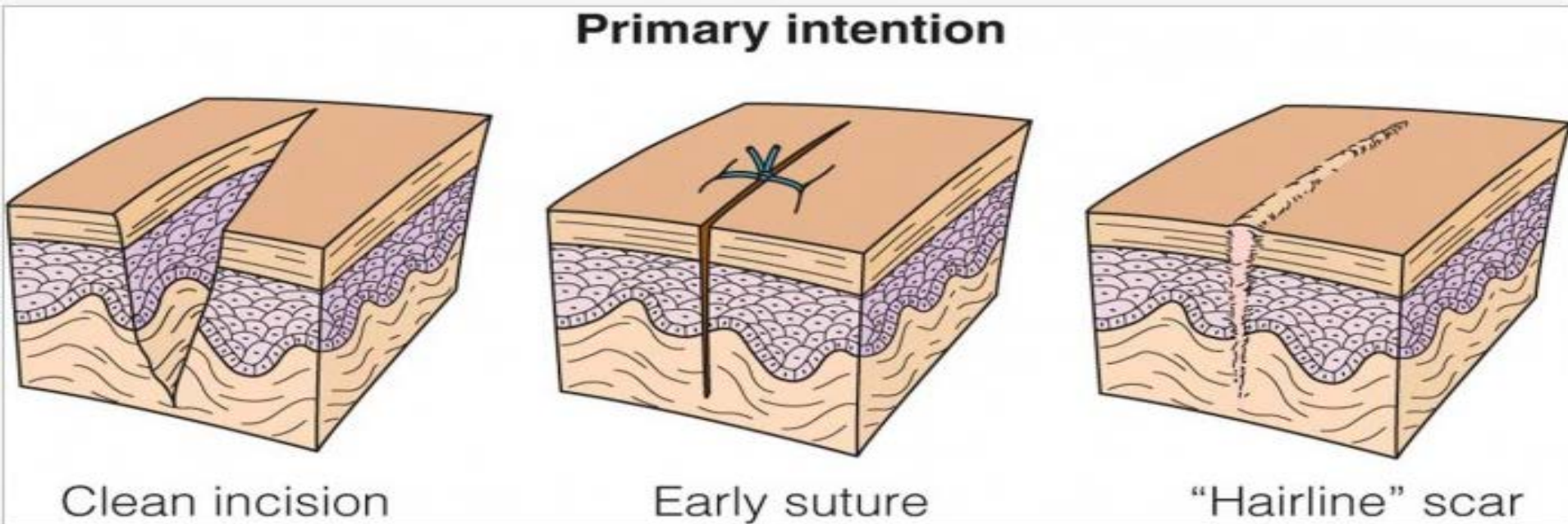
About wounds

- ▶ Any break in the continuity of the tissue is called a wound.
 - ▶ When wounds occur, the wounded tissue reacts with a repair or regeneration process known as healing
 - ▶ Correct approximation of the wound is desirable since it makes it possible to accelerate the healing process
- 

Types of wound healing

Primary wound healing or healing by primary intention

Healing of wound which are clean and uninfected, surgically incised, without much loss of cells and tissue and edges of wound are approximated by surgical suture resulting in a thin scar.

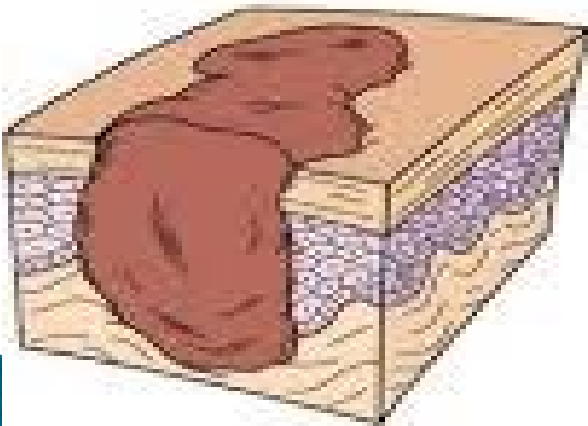


Types of wound healing

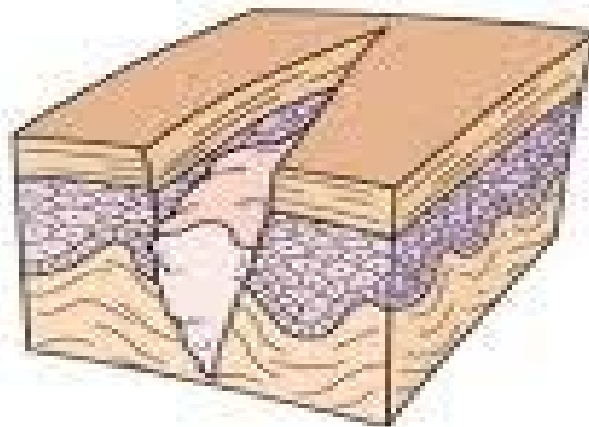
Secondary wound healing or healing by secondary intention:

This occurs when it is impossible to achieve primary approximation of tissues owing to extensive loss of tissue or secondary dehiscence of the surgical wound or the onset of infection.

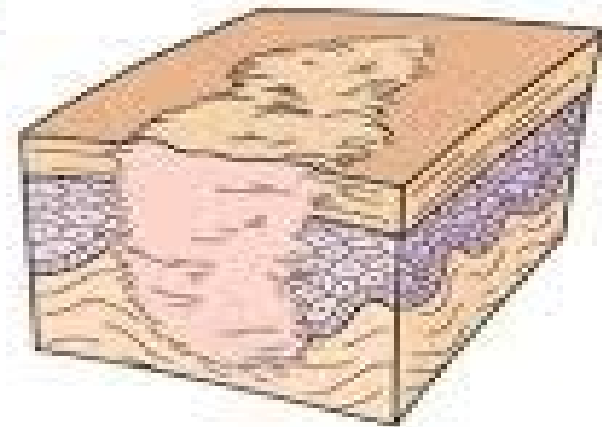
Secondary intention



Gaping wound with blood clot



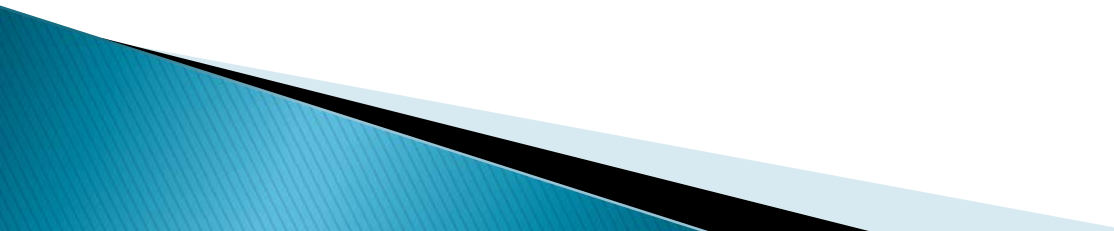
Granulation tissue fills in wound



Large scar

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.
- 

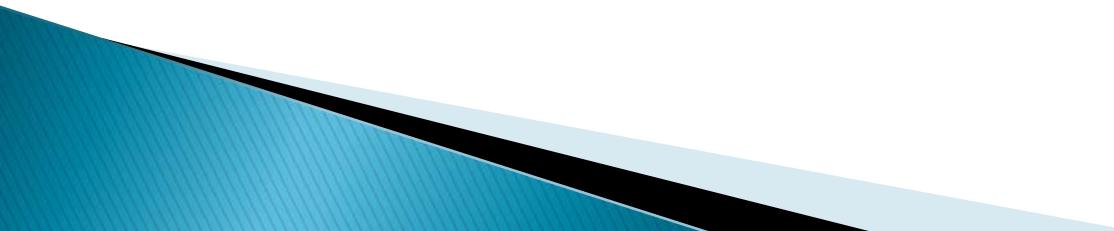
Properties of sutures

Size

- ▶ Small suture starts from 0 and goes down to 11–0 (11–0 actually means 11 zeroes). 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.

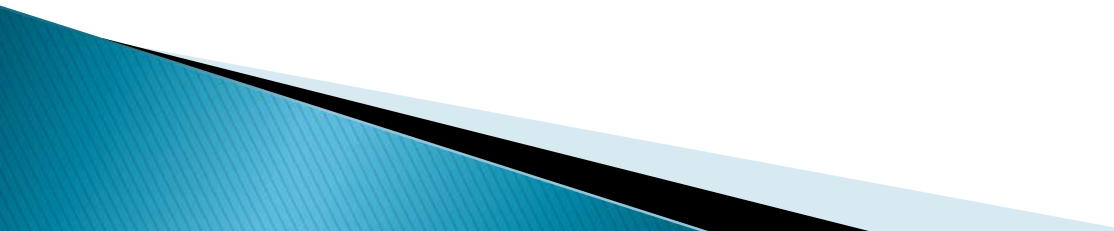
Properties of sutures

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.
- 

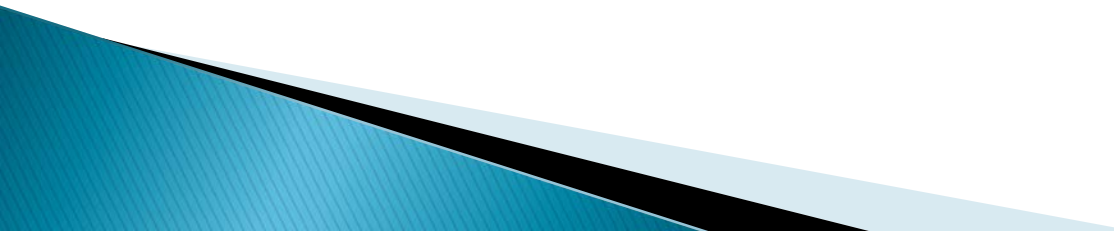
Properties of sutures

Elasticity

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

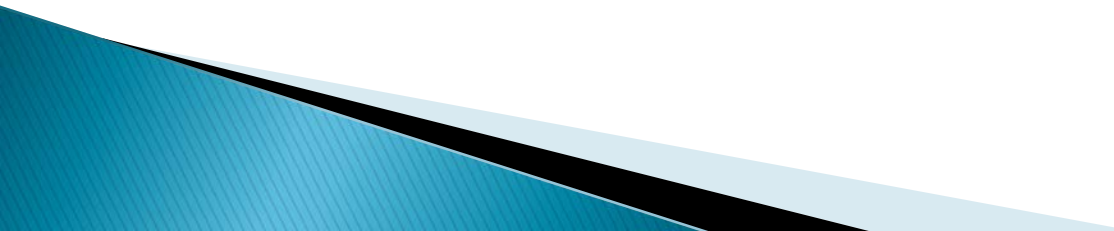
Properties of ideal sutures

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

Sutures are classified based on:

- 1. Duration in tissues: Absorbable vs Nonabsorbable**
 - 2. Structure: Monofilament vs Multifilament**
 - 3. Origin: Natural vs Synthetic**
- 

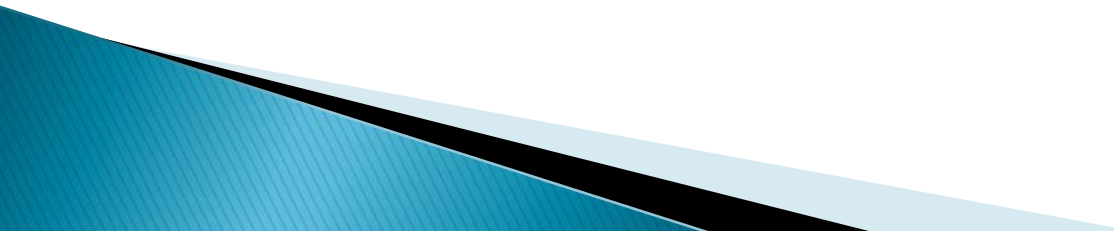
Absorbable sutures

- ▶ 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.

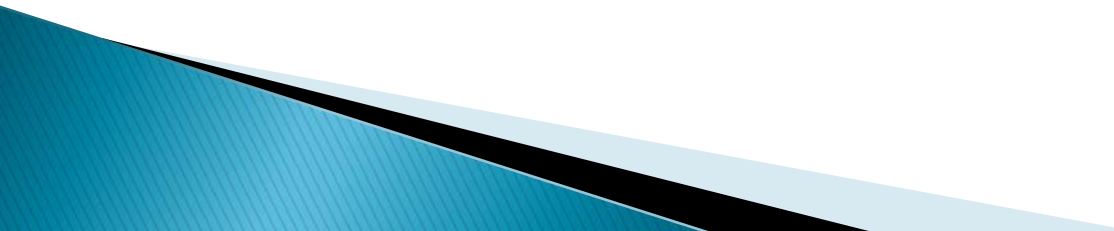
Absorbable sutures: Examples

- Naturally occurring (degraded enzymatically)
 - Catgut
 - Consists of processed collagen from animal intestines
 - Broken down after 7 days
 - Chromic catgut
 - Catgut treated with chromium
 - Loses tensile strength after 2–3 weeks and is broken down after 3 months
- Synthetic e.g. polydioxanone (PDX), polyglycolic acid (PGA)
 - Degraded non-enzymatically by hydrolysis when water penetrates the suture filaments and attacks the polymer chain
 - Tends to evoke less tissue reaction than those occurring naturally
 - Retains tensile strength longer than natural sutures

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

- ▶ These sutures are made of single strands. They resist harboring microorganisms, and tie 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.
- ▶ May harbour microorganism between its strands and by capillary action encourage transfer of microorganism from one part of the wound to another

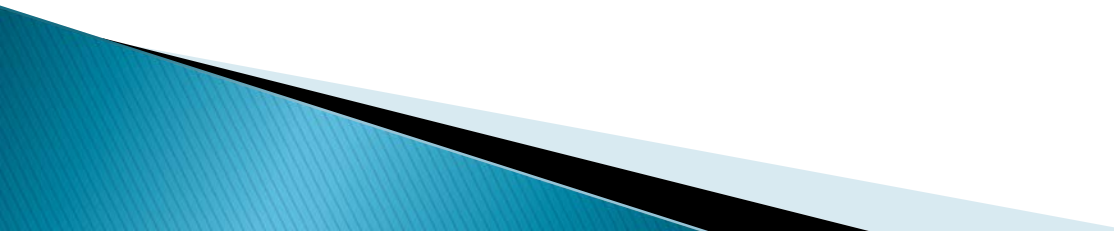


Surgical needles

- ▶ 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

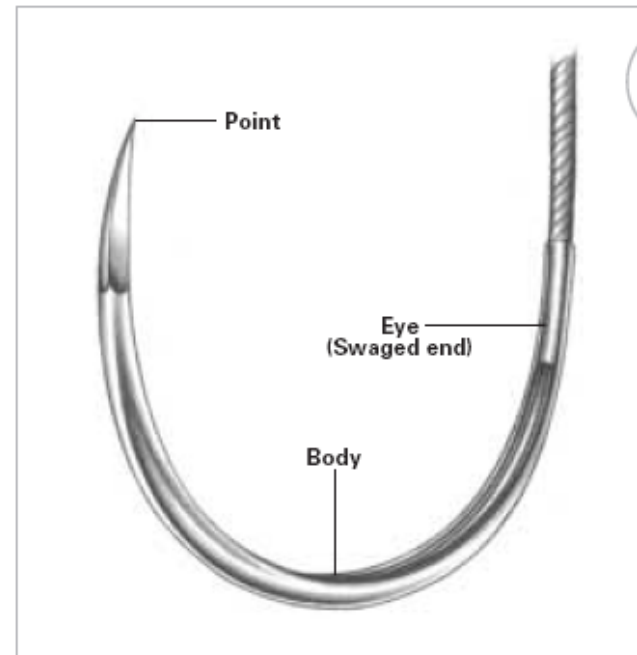
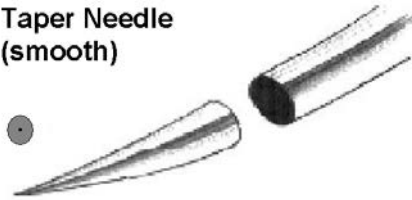


FIGURE
3

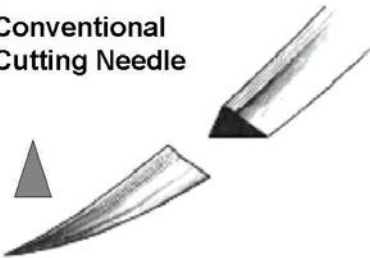
NEEDLE
COMPONENTS

Point

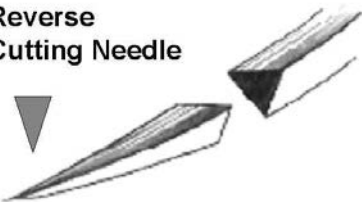
Taper Needle
(smooth)



Conventional
Cutting Needle



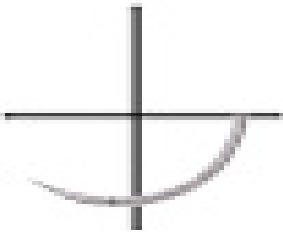
Reverse
Cutting Needle



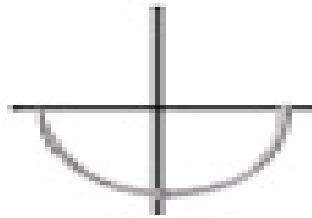
- **Tapered (round bodied)**
 - Gradually taper to a point and cross-section reveals a round, smooth shaft
 - Used for tissues that are easy to penetrate, such as bowel or blood vessels
- **Cutting**
 - Triangular tip with the apex upward, and forming a cutting surface
 - Used for tough tissues, such 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

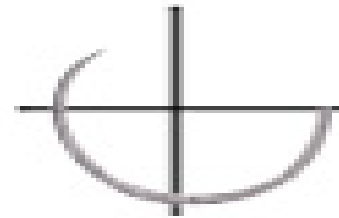
- ▶ Can be straight or curved



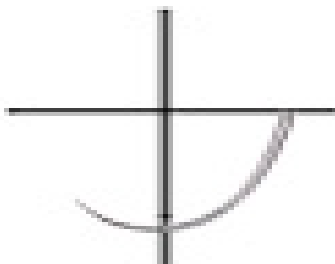
3/8 Circle



1/2 Circle



5/8 Circle



**Compound
Curved**



Straight



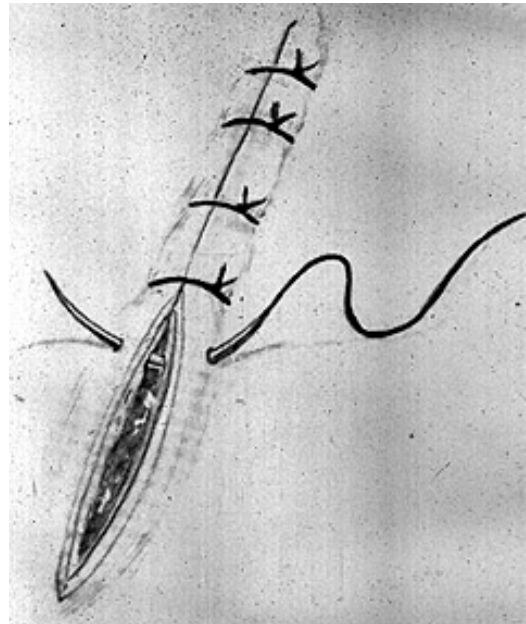
Half-Curved

Suturing techniques

- ▶ Continuous (Running)
 - This is an uninterrupted series of stitches using one suture, the stitches are fastened by just two knots, one at each end.
 - To be avoided when there may be a need to remove part of the sutures eg when infection is anticipated

Suturing techniques

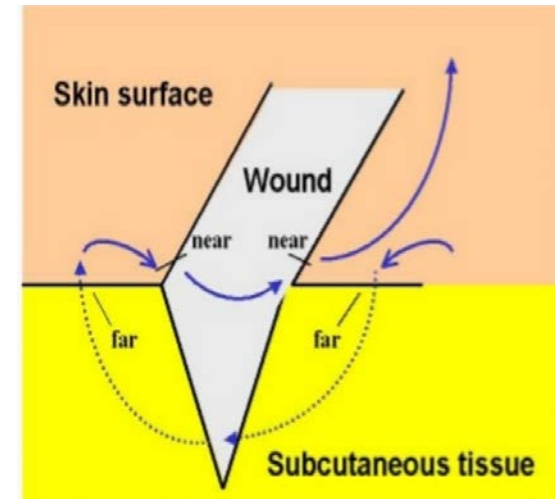
- ▶ Interrupted
 - The individual stitches are not connected
 - It is the most commonly used suturing technique



Suturing techniques

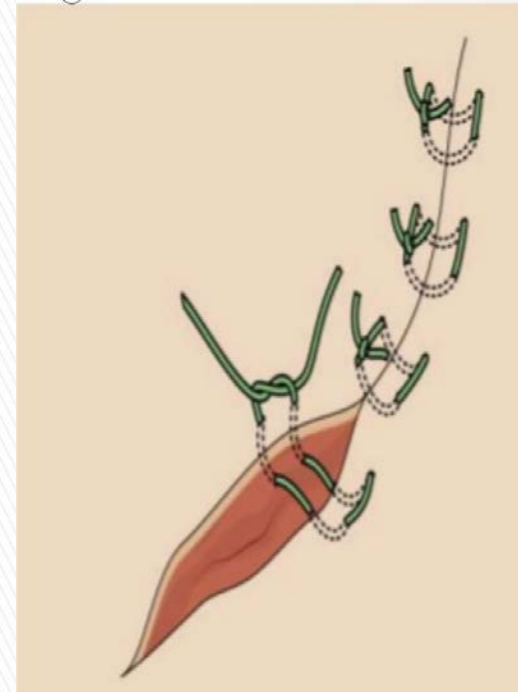
▶ Mattress

- This is a surgical stitch in which the needle is inserted on one side, exits the other side and reinserted again to exit and be tied (if interrupted) on the side where it was initially inserted.
- It produces eversion of the wound edge
- Can be horizontal or vertical



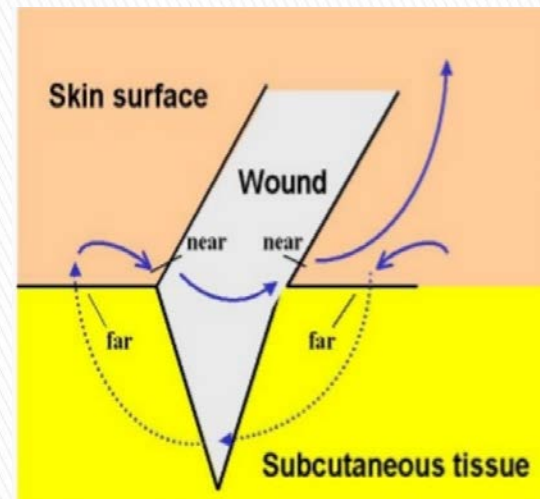
Suturing techniques

- **Horizontal**
 - The stitches are parallel to the edge of the wound
 - Produces strong sutures
 - Good for hemostasis

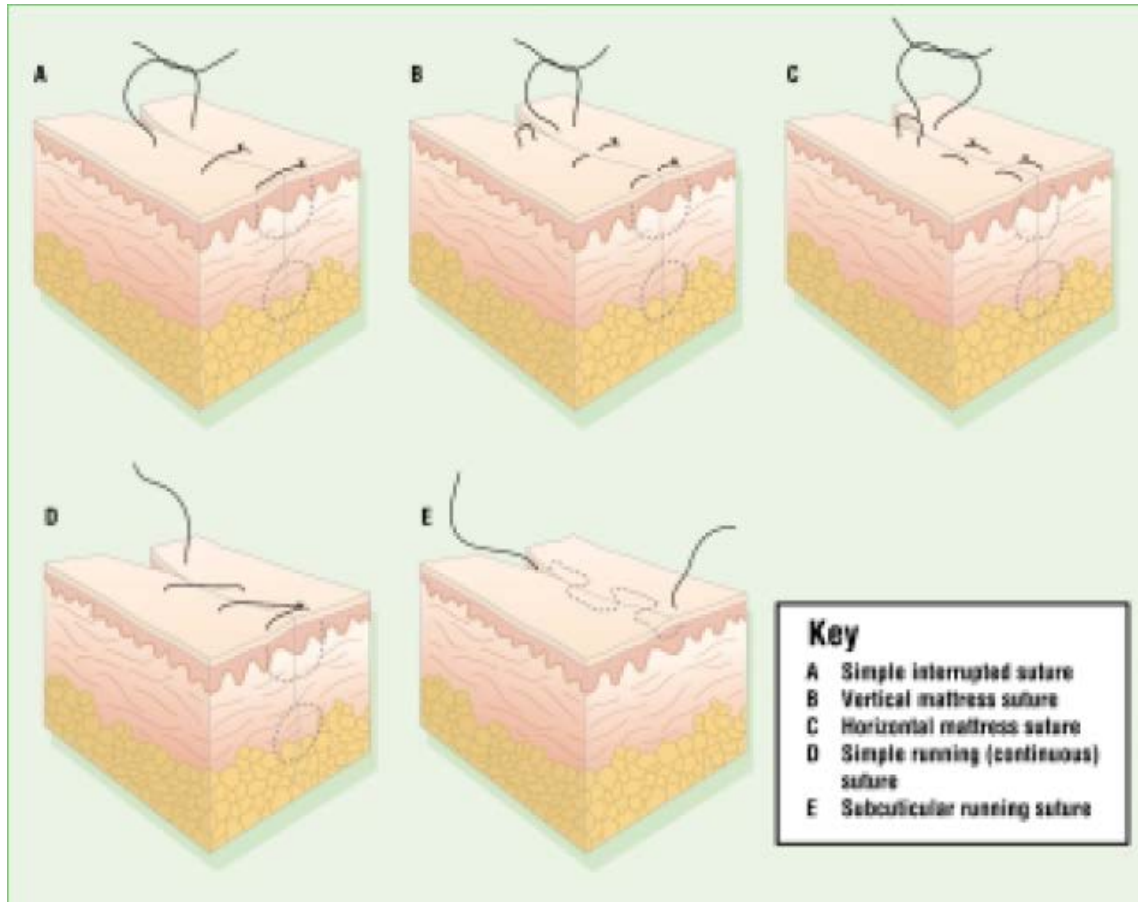


Suturing techniques

- **Vertical**
 - The stitches are at right angles to the edge of the wound



Examples



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

Knots

- ▶ This serves to secure sutures in place
- ▶ Formed by looping and tying the suture upon itself
- ▶ A patient's life may depend on the security of one ligature.
- ▶ Slippage of a tie may result in a life-threatening haemorrhage.



Types of Knots: Good Knots

- ▶ **Square (reef) knot**



SQUARE KNOT

- ▶ **Surgeon's knot**



SURGEON'S KNOT

Types of Knots: Bad Knot

- ▶ **Granny Knot**



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.

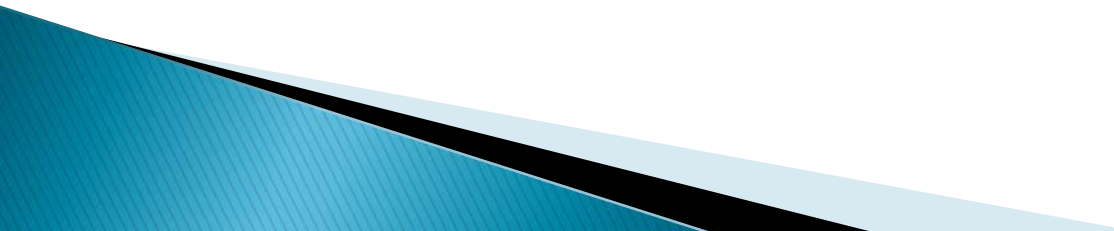
Drains

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

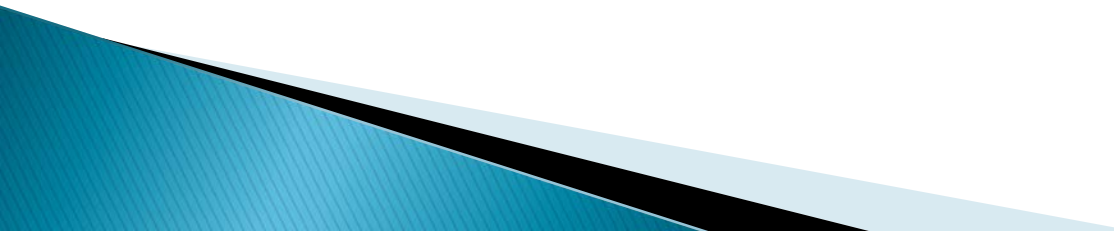
Goals

- ▶ 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
- 

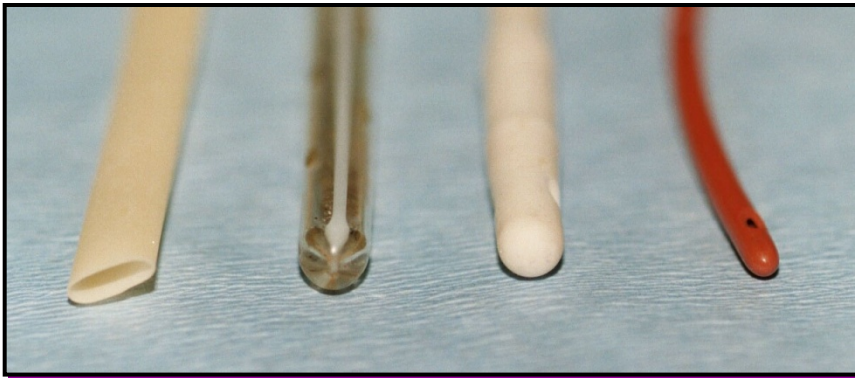
Material Composition

- ▶ *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

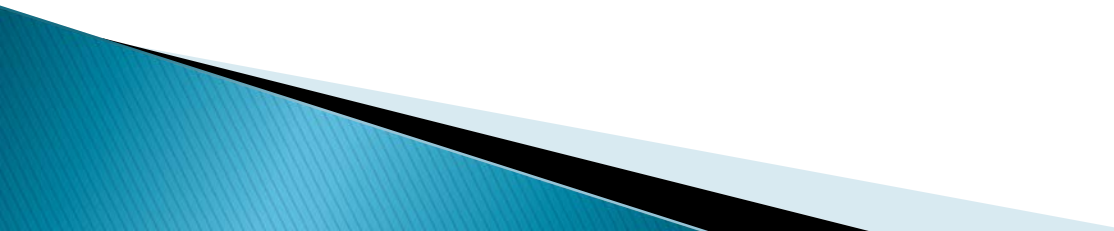
- Allow evaluation of volume and nature of fluid
- Prevent bacterial ascension
- Eliminate dead space
- Help appose skin to wound bed – quicker wound healing

○ Disadvantages

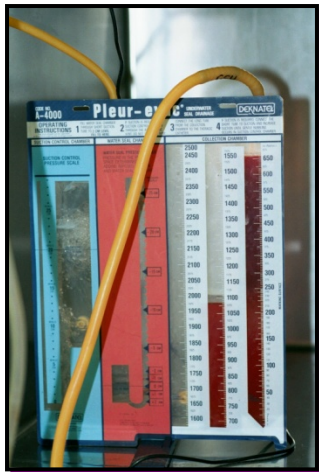
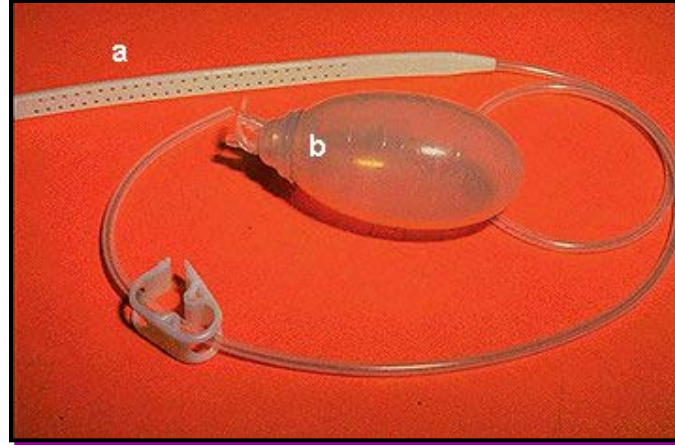
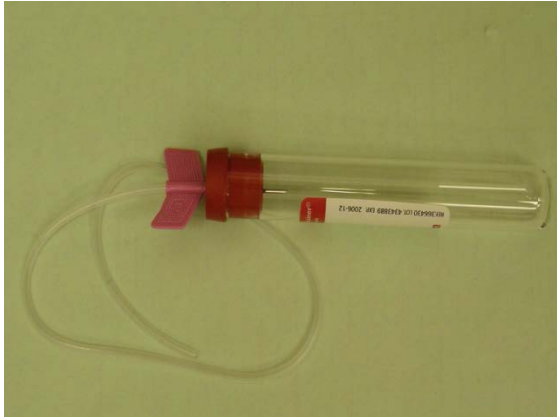
- Gravity dependent – affects location of drain
- Drain easily clogged



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

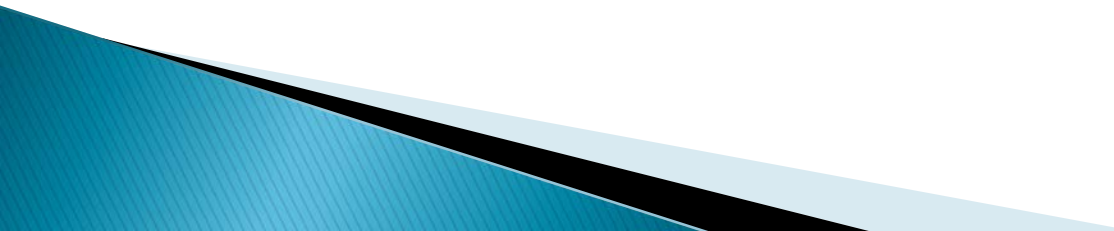
▶ Advantages

- 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

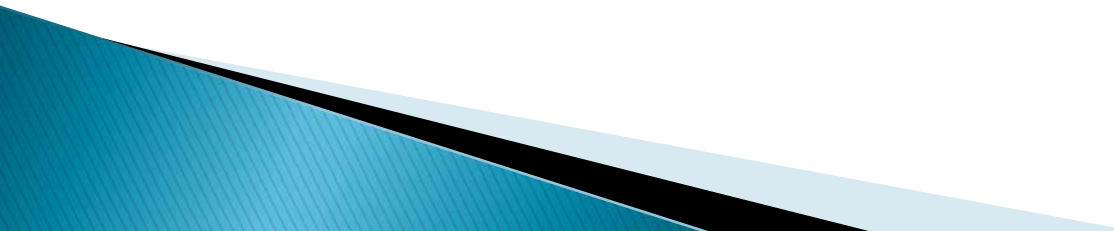
- High negative pressure may injure tissue
- Drain clogged by tissue

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
- 

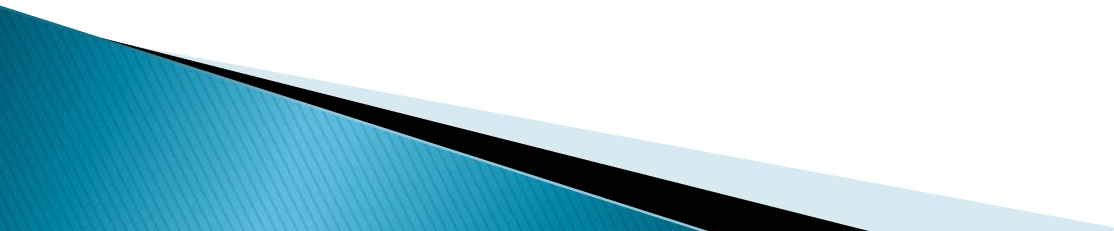
Complications and Failure of Drains

- ▶ 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

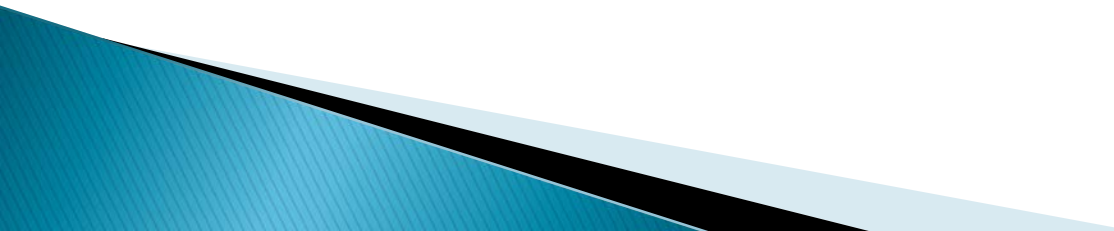
Complications and Failure of Drains

- ▶ Breakdown of anastomotic sites
- ▶ Erosion into hollow organs (firm/stiff 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

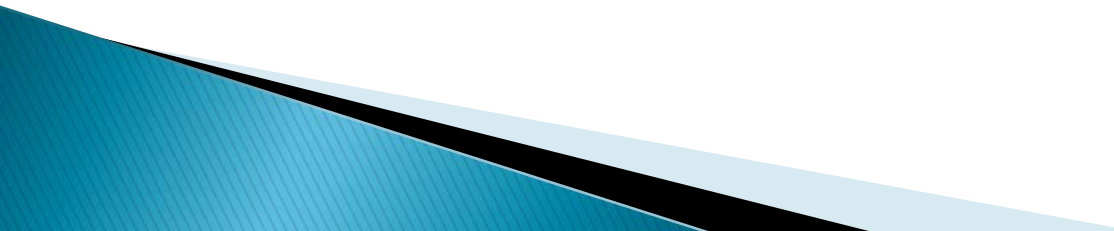
Diagnostic

- ▶ 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
- 

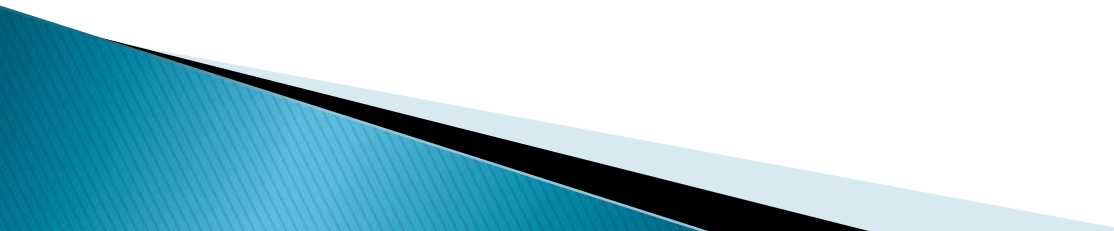
Complications

- ▶ 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

