Objectives

- Classify suture patterns based on their effect on tissue apposition
- Describe the steps involved in the accurate placement of basic suture patterns
- Discuss the advantages and disadvantages of various suture patterns
- Visually identify suture patterns
- Know when to apply these patterns in surgery

Role of Suture Patterns

- Significant impact on the apposition of tissues
- Plays a large role in wound healing
- Specific patterns can be used to accurately appose tissues, distribute wound tension, invert suture lines, and approximate the ends of tendons

How to suture (using “surgeon friendly” analogies)

- Right handed:
  - Suture right to left (like driving in golf)
  - Suture top to bottom (like raking in the dough)

General rule:
If you are suturing and your hand position feels uncomfortable, then stop and try another way (like transferring a case to medicine because it has diarrhea)

Appositional Suture Patterns

- Bring tissues into close approximation

Inverting Suture Patterns

- Turn tissue edges toward the patient, away from the surgeon, or toward the center of a hollow organ
**Everting Suture Patterns**

- Turn tissues edges outward away from the patient and toward the surgeon
- Rarely used and will not be covered in detail

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**Perverting Suture Patterns**

- Will be discussed by Dr. Birchard

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**Appositional Suture Patterns**

- Simple Interrupted (A)
- Interrupted intradermal (B)
- Interrupted cruciate (C)
- Simple continuous (D)
- Continuous intradermal (E)
- Ford interlocking (F)

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**Simple Interrupted**

- Most basic
- Most often used
- Insert needle on one side of wound, cross wound, and through tissue on opposite side

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**Simple Interrupted**

- **Advantages**
  - Easy to execute
  - Rapid
  - Disruption of one suture does not result in suture line failure
- **Disadvantages**
  - Excessive tension yields inversion or eversion
  - Costly in terms of time and suture (foreign) material

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**Simple Interrupted**

- **Uses**
  - Close skin, subcutis, and fascia
  - Ligate blood vessels
  - Close defects in the GI, urinary, and respiratory tracts
Simple Interrupted

**Interrupted Intradermal and Subcuticular**
- Apposes skin edges and diminishes tension on skin closure
- Essentially an upside down simple interrupted suture, with knot buried
- Deep-superficial, superficial deep, or entirely intradermal

Interrupted Intradermal and Subcuticular

**Interrupted Cruciate**
- Two passes which form an “X”
- SI bite, advance, SI bite
- Best apposition if corners create a square

Interrupted Cruciate

**Simple Continuous**
- A series of simple interrupted suture bites oriented at right angles to the incision
- Place SI, cut only tag end
- End by taking a bite in opposite direction and tying to loop

- Advantages
  - Covers a greater distance per suture than SI, thus saves time
  - Stronger closure than SI
  - Resists tension and tissue eversion
**Simple Continuous**

- **Advantages**
  - Conservation of suture compared to SI
  - Good apposition and a watertight seal
  - Good for layers under little tension

- Excessive tension can cause puckering and tissue strangulation
- A **running suture line** advances both above and below the tissue
- Rarely used in skin for small animals

**Continuous Intradermal or Subcuticular**

- Modified SC that runs horizontally through the dermis (intradermal)
- Typically used in addition to skin sutures due to lack of strength
- Can be used alone in young, healthy and MEAN animals

**Ford Interlocking**

- Modified simple continuous pattern in which each pass is partially “locked” by passing the needle through the loop
- Better apposition than SI
- Requires a lot of suture, and may be difficult to remove
- Used most often in cow skin closure

**Inverting Suture Patterns**

- Interrupted inverting seromuscular (A)
- Lembert (B)
- Halstead (C)
- Cushing (D)
- Connell (E)
- Parker-Kerr (F)
- Purse-string (G)
Lembert

- A variation of the vertical mattress pattern applied in a continuous fashion
- Primarily indicated to close hollow viscera with large lumen size
- Begins 8-10 mm from edge, exits 3-4 mm

Cushing and Connell

- Create tissue inversion and a watertight seal
- Essentially continuous horizontal mattress sutures with suture advancement parallel to the incision
- Cushing extends only to the submucosa, Connell into the lumen

Parker-Kerr Oversew

- Two layer closure historically utilized to aseptically invert a transected, clamped viscus
- Begins with a Cushing or Connell, followed by an inverting seromuscular pattern

Purse String

- A series of tissue bites taken adjacent to the tissue edge or orifice until a complete ring is formed
- Essentially a circular Lembert
Purse String

- Used to close the end of a hollow viscus, or to create a watertight seal around a tube

Tension Relieving Patterns

- Vertical mattress (A)
- Horizontal mattress (B)
- Vertical mattress over a stent (C)
- Far-near-near-far and Far-far-near-near (D)
- Through and through over a stent (E)

Vertical Mattress

- Placed by inserting needle 8-10 mm from the tissue edge, exiting 8-10 mm from the other side, reverse order and begin 3-4 mm from tissue edge, exiting 3-4 mm from edge on opposite side

- Resist tension better than horizontal mattress
- Everts less than horizontal mattress
- More time consuming than horizontal mattress
- Oriented perpendicular or vertical with respect to the incision

Horizontal Mattress

- Pass needle across incision, advance 6-8 mm and passes back across the incision
- Used primarily in areas of tissue tension
- May cause tissue eversion

- May cause tissue eversion
- Can be applied over a stent
- Oriented parallel to, or horizontal with respect to the incision
Horizontal Mattress

Three Loop Pulley
- Three loops of suture oriented 120 degrees to the previous loop
- Initial loop is a near-far, next midway, last is far-near
- Higher tensile strength and more resistant to gap formation than the locking loop

Locking Loop
- Inserted 1/3 distance from tendon edge, advanced along the tendon, across the gap, looped across the tendon, and passed back 1/3 from opposite edge, looped and tied
- Less bulk in sheathed tendons

Double locking loop applied to gastrocnemius tendon
Attached to calcaneus thorough drill hole

Transfixation Ligature
- Suture is passed through vessel or pedicle prior to tying of each half
- Transfixation prevents suture dislodgement, recommended on large vessels in which ligature security is critical