Basic Wound Closure & Knot Tying

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Objectives

- Provide basic information on commonly used suture materials
- Review general principles of wound closure
- Provide a general overview of basic surgical knot tying

Suture Material

- Generally categorized by three characteristics:
  - Absorbable vs. non-absorbable
  - Natural vs. synthetic
  - Monofilament vs. multifilament

Absorbable Suture

- Degraded and eventually eliminated in one of two ways:
  - Via inflammatory reaction utilizing tissue enzymes
  - Via hydrolysis
- Examples:
  - “Catgut”
  - Chromic
  - Vicryl
  - Monocryl
  - PDS (polydioxanone suture)

http://ecatalog.ethicon.com/sutures-absorbable

Non-absorbable Suture

- Not degraded, permanent
- Examples:
  - Prolene (polypropylene)
  - Ethibond (polyester/Dacron)
  - Nylon
  - Stainless steel
  - Silk*

(*not a truly permanent material; known to be broken down over a prolonged period of time—years)

Natural Suture

- Biological origin
- Cause intense inflammatory reaction
- Examples:
  - “Catgut” – purified collagen fibers from intestine of healthy sheep or cows
  - Chromic – coated “catgut”
  - Silk

Synthetic Suture

- Synthetic polymers
- Do not cause intense inflammatory reaction
- Examples:
  - Vicryl
  - Monocryl
  - PDS
  - Prolene
  - Nylon

Monofilament Suture

- Grossly appears as single strand of suture material; all fibers run parallel
- Minimal tissue trauma
- Resists harboring microorganisms
- Ties smoothly
- Requires more knots than multifilament suture
- Possesses memory
- Examples:
  - Monocryl, PDS, Prolene, Nylon

Multifilament Suture

- Fibers are twisted or braided together
- Greater resistance in tissue
- Provides good handling and ease of tying
- Fewer knots required
- Examples:
  - Vicryl (braided)
  - Chromic (twisted)
  - Silk (braided)

Suture Degradation

Suture Material	Method of Degradation	Time to Degradation
“Catgut”	Proteolytic enzymes	Days
Vicryl, Monocryl	Hydrolysis	Weeks to months
PDS	Hydrolysis	Months

Suture Size

- Sized according to diameter with “0” as reference size
- Numbers alone indicate progressively larger sutures (“1”, “2”, etc)
- Numbers followed by a “0” indicate progressively smaller sutures (“2-0”, “4-0”, etc)

Smaller ←----------→Larger

…..”3-0”…”2-0”…”1-0”…”0”…”1”…”2”…”3”…..

Needles

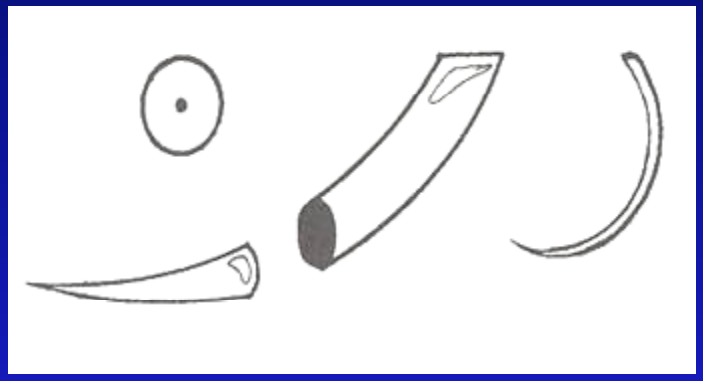
- Classified according to shape and type of point
  - Curved or straight (Keith needle)
  - Taper point, cutting, or reverse cutting

Needles

- Curved
  - Designed to be held with a needle holder
  - Used for most suturing
- Straight
  - Often hand held
  - Used to secure percutaneously placed devices (e.g. central and arterial lines)

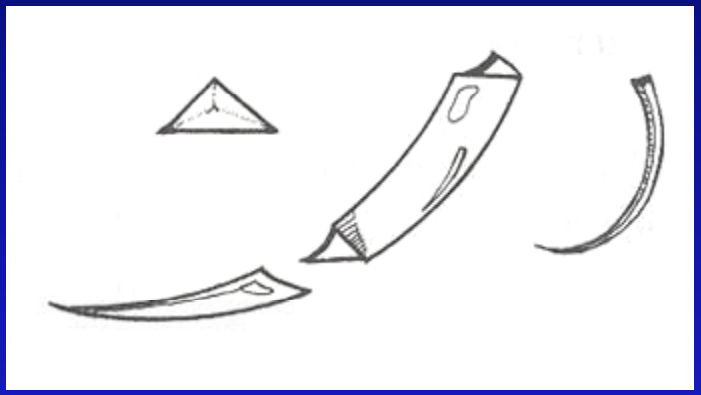
Needles

- Taper-point needle
  - Round body
  - Used to suture soft tissue, excluding skin (e.g. GI tract, muscle, fascia, peritoneum)



Needles

- Cutting needle
  - Triangular body
  - Sharp edge toward inner circumference
  - Used to suture skin or tough tissue



Suture Packaging

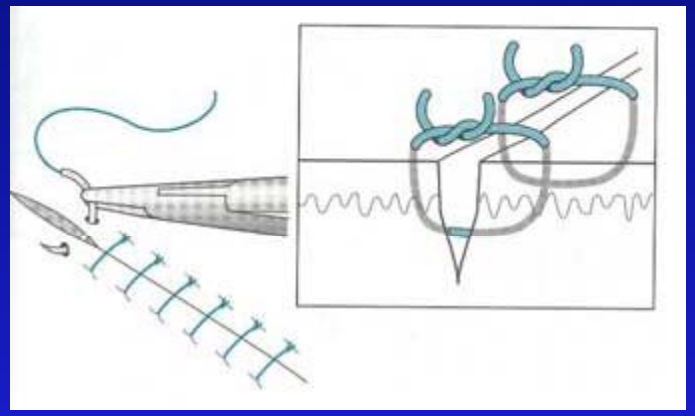
Wound Closure

- Basic suturing techniques:
  - Simple sutures
  - Mattress sutures
  - Subcuticular sutures

- Goal: “approximate, not strangulate”

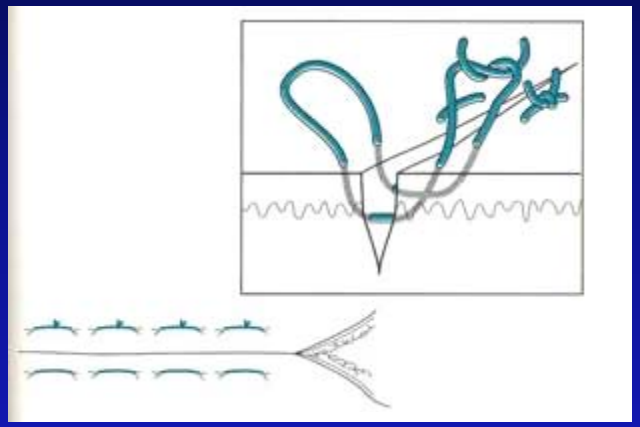
Simple Sutures

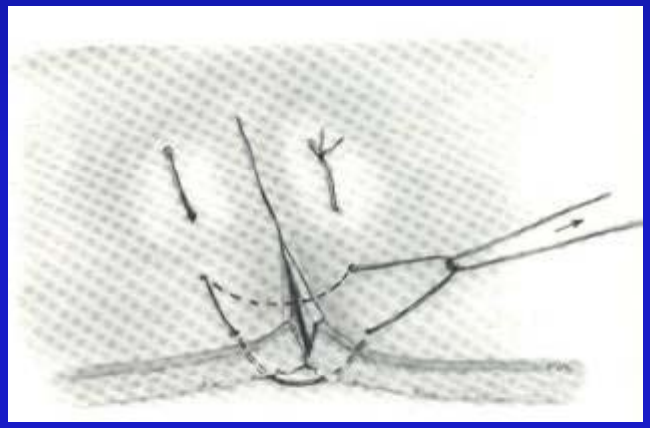
- Simple Interrupted
  - Single stitches, individually knotted (keep all knots on one side of wound)
  - Used for uncomplicated laceration repair and wound closure



Mattress Sutures

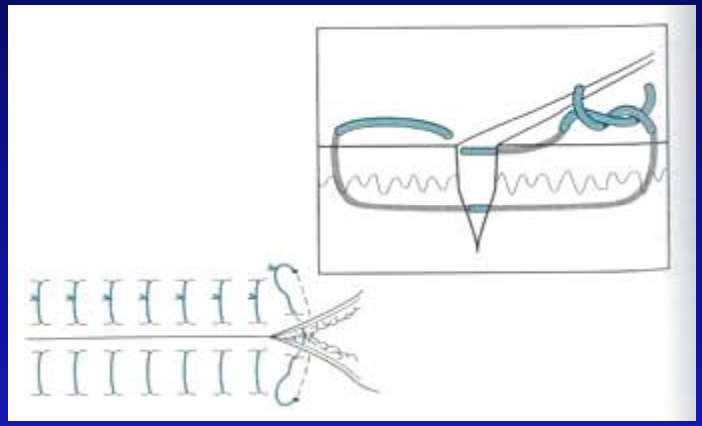
- Horizontal Mattress
  - Provides added strength in fascial closure; also used in calloused skin (e.g. palms and soles)
  - Two-step stitch:
    - Simple stitch then,
    - Needle reversed and 2nd simple stitch made adjacent to first
    - same size bite as first stitch

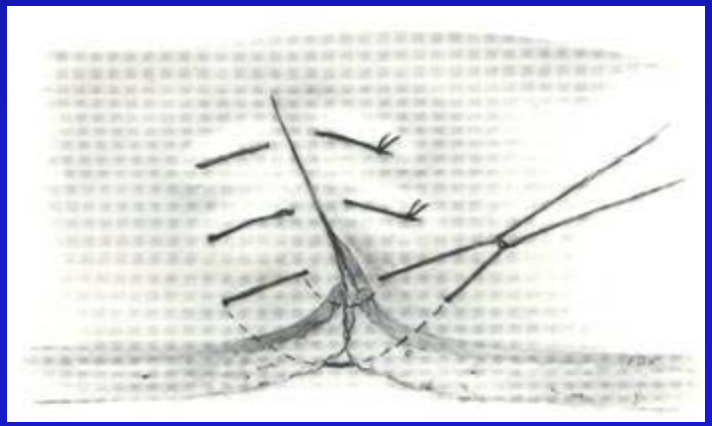




Mattress Sutures

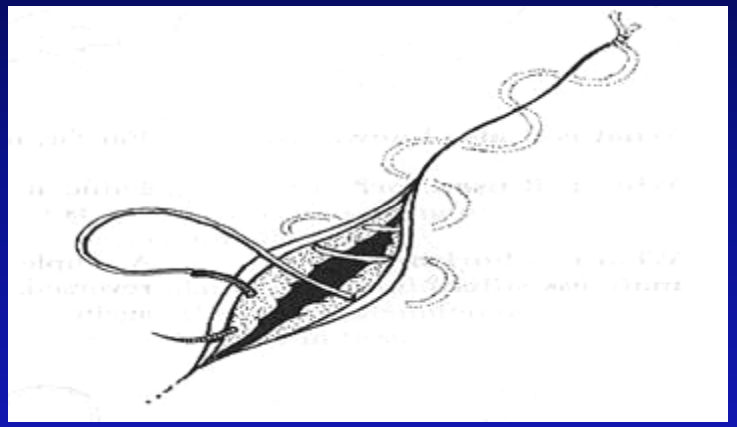
- Vertical Mattress
  - Affords precise approximation of skin edges with eversion
  - Two-step stitch:
    - Simple stitch made – “far, far” relative to wound edge (large bite)
    - Needle reversed and 2nd simple stitch made inside first – “near, near” (small bite)

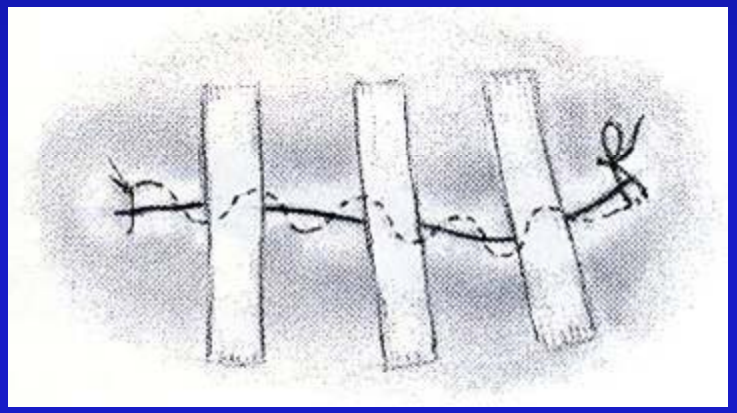




Subcuticular Sutures

- Usually a running stitch, but can be interrupted
- Intradermal horizontal bites
- Allow suture to remain for a longer period of time without development of crosshatch scarring



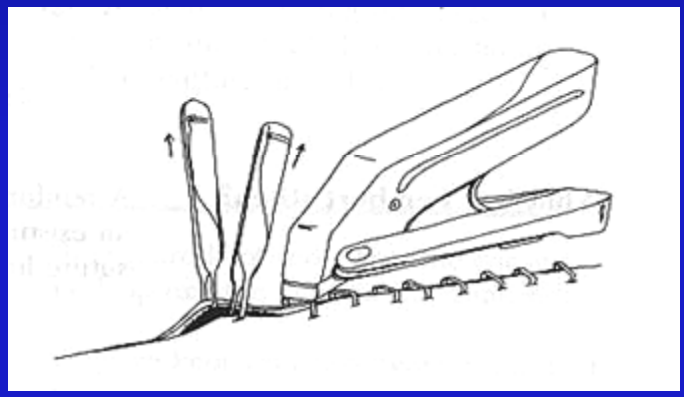


Steri-strips

- Sterile adhesive tapes
- Available in different widths
- Frequently used with subcuticular sutures
- Used following staple or suture removal
- Can be used for delayed closure

Staples

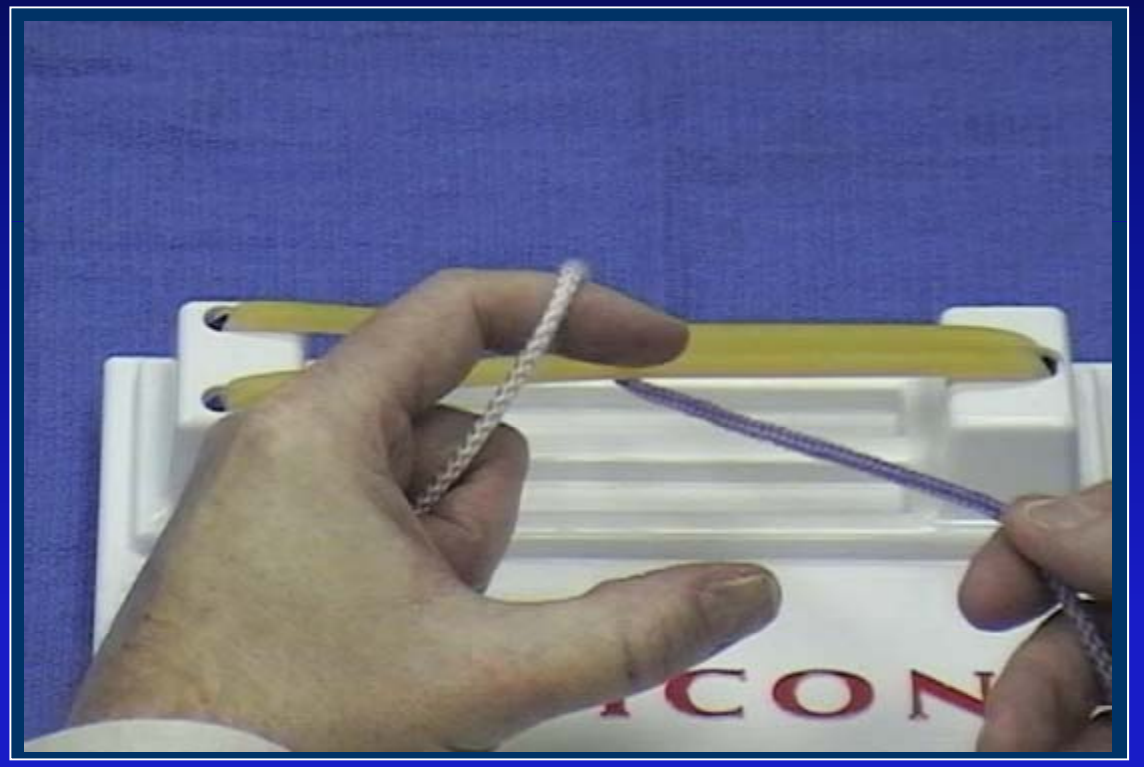
- Rapid closure of wound
- Easy to apply
- Evert tissue when placed properly



Two-Hand Square Knot

- Easiest and most reliable
- Used to tie most suture materials

(click image to start video)



Instrument Tie

- Useful when one or both ends of suture material are short
- Commonly used technique for laceration repair

(click image to start video)

References

- Encyclopedia of Knots provided by Ethicon; available at www.jnjgateway.com/public/USENG/5256ETHICON_Encyclopedia_of_Knots.pdf *(More extensive overview of knot tying with photos for those interested in surgery)*
- Blackbourne, LH, editor. Surgical Recall. 2nd ed. Baltimore: Lippincott Williams & Wilkins; 1998
- Cameron, JL, editor. Current Surgical Therapy. 7th ed. St. Louis: Mosby; 2001
- Edgerton, MT. The Art of Surgical Technique. Baltimore: Williams & Wilkins; 1988 *(Excellent resource for technical details of surgery)*
- Gomella, LG, Haist, SA. Clinician's Pocket Reference. 9th ed. New York: McGraw-Hill Medical Publishing Division; 2002 *(Useful book for anyone doing clinical rotations!)*

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