

The American College of
Obstetricians and Gynecologists
WOMEN'S HEALTH CARE PHYSICIANS

Needles, Knots, and Sutures

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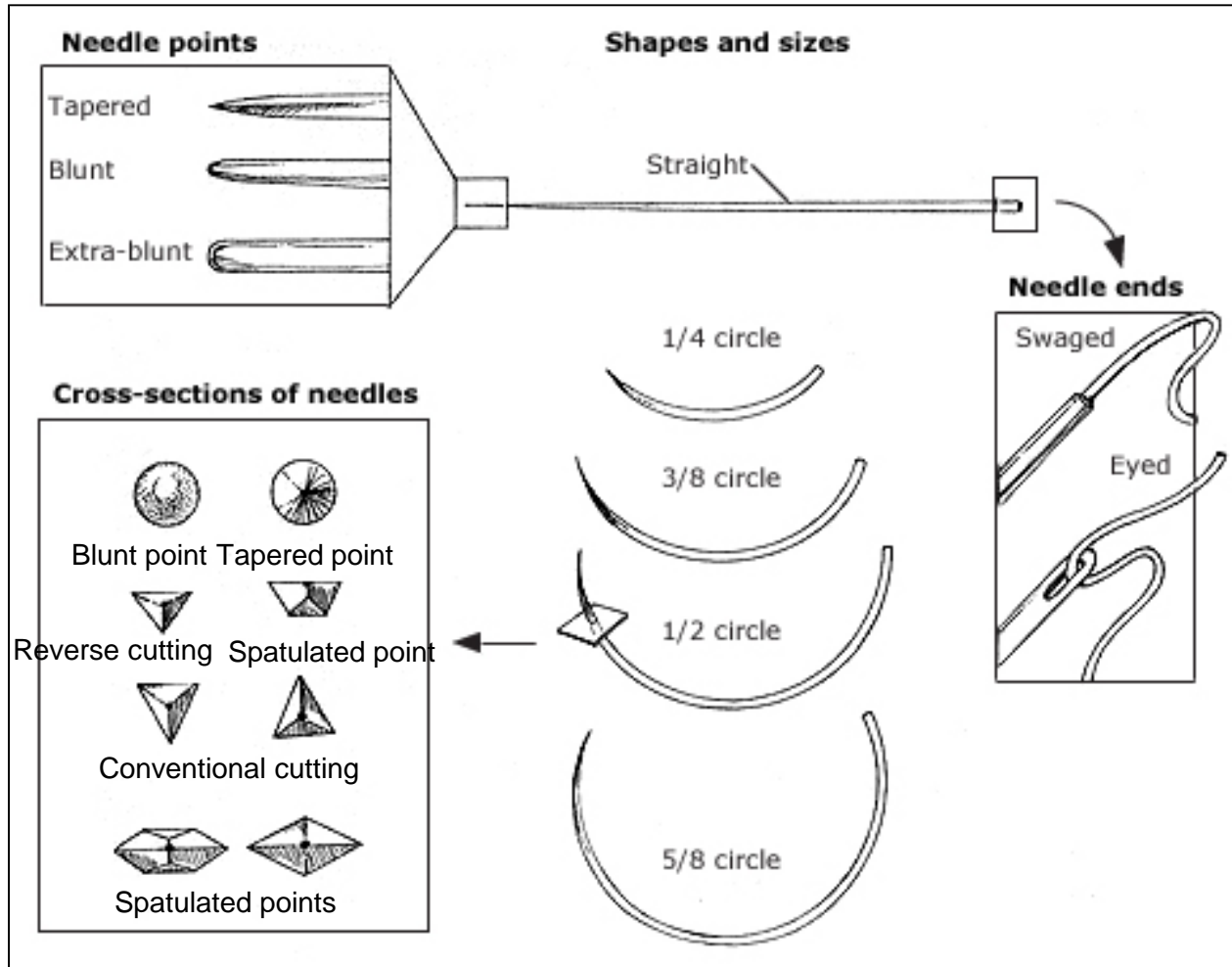
Objectives

By the end of this unit, the learner should be able to do the following:

- Identify the types of needles available and common indications for their use
- Demonstrate two-handed knot tying, one-handed knot tying, surgeon's knots, deep tying, and instrument tying
- Identify the types of available sutures and appropriate indications for their use
- Describe the difference between absorbable versus nonabsorbable, monofilament versus multifilament, and natural versus synthetic suture
- Demonstrate appropriate needle handling and knowledge of running sutures, running-locked sutures, and interrupted sutures



The Basics: Suture Needles



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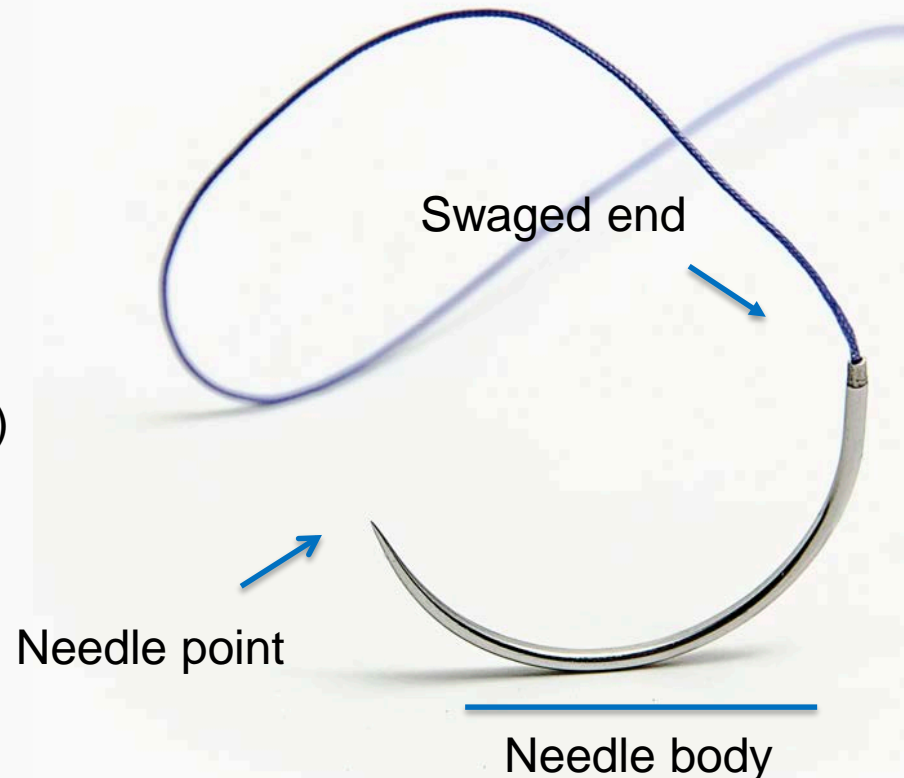
Surgical Needles

Needles

- Made of stainless steel alloy
- Some coated with silicone to assist with passage through tissue

Needle Anatomy

- Point: section going from tip to maximum cross section
- Body: most of needle length (strongest area because it is the area that will serve as the connection with the needle driver)
- Swage: attachment of suture to needle



Needle Points

Cutting

- Two opposed cutting edges to penetrate through difficult tissue
- Can be straight or curved

Taper

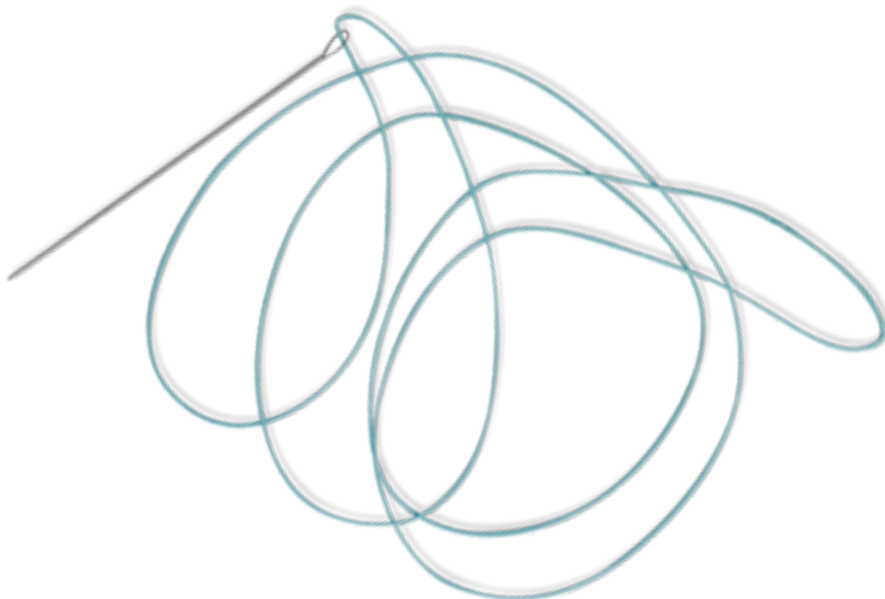
- Pierce and spread tissue without cutting it
- Use in easily penetrated tissue

Blunt

- May be used in tissues that are less dense
- May cause less glove penetration in the event of needle stick injury
- May take more effort to push through certain tissues and are more user-dependent

Needle Body Types

- Straight: Good for suturing tissue that is manipulated directly by hand
- Curved
 - Predictable path through tissue
 - Requires less space
 - Provides an even distribution



Selecting the Needle Type

- The two most important factors in selecting a needle are
 1. Whether it is tapered, cutting or blunt
 2. Size of needle
- Tapered needles usually are used on tissues inside the body
- Cutting needles usually are used for skin and tough tissue such as tendon and bone
- Blunt needles usually are used in less dense tissues and should be avoided in skin and bowel. They may be used for uterine and fascial closure during cesarean delivery to decrease needle sticks

Proper Needle Handling Tips

- Do not put your fingers in the finger holes of the needle driver
- Position the needle one third to one half of the way from the swaged end
- Place the needle at right angles to the tissue
- Use your wrist to turn the needle through tissue, not your whole body or elbow
- Do not use your hands to pick up the needle. Stabilize the needle with tissue forceps at the level of tissue and regrasp with the needle driver one third of the way from the swaged end
- Be aware of the needle location at all times and keep within the sterile field
- Always give the needle back, protected, to the scrub nurse

On the following slides, we will review types of knots.

Types of Knots

Square Knot (two-handed technique) – See video* in simulation

A square knot is the fundamental knot used in surgery. When appropriately performed, it provides optimal strength and minimal slippage.

Square Knot (one-handed technique) – See video* in simulation

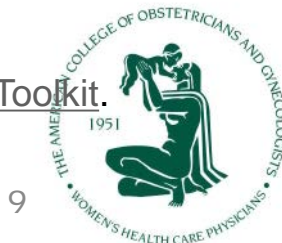
This square knot is an alternative to the two-handed technique for more advanced surgeons.

Surgeon's Knot – See video* in simulation

The surgeon's knot is a “friction knot,” used with some sutures, eg, coated vicryl, to prevent knot slippage after the first throw.

*Videos courtesy of Angela Chaudhari, MD.

Note: Videos and other simulations are also available in the [Simulations Working Group Toolkit](#).



Deep Tie

The deep tie technique avoids upward tension on tissue.



Image courtesy of Angela Chaudhari, MD

Instrument Tie

This technique is used when one or both ends of the suture are short.



Image courtesy of Angela Chaudhari, MD

Knot-Tying Principles

1. The completed knot must be firm to eliminate slippage. The simplest knot for the material used is the most desirable, which is why most surgeons prefer a simple two-handed tie.
2. Tie the knot as small as possible and cut the ends as short as appropriate for the suture material. This helps prevent excessive tissue reaction to absorbable sutures and helps minimize foreign body reaction to nonabsorbable sutures.
3. Avoid friction. "Sawing" between the strands may weaken suture integrity so put down knots smoothly.
4. Avoid too much tension on the knot because it may lead to suture breakage and may cut or pull through tissue.



Knot-Tying Principles (Continued)

5. Avoid damage to the suture material during handling, especially when using surgical instruments in instrument ties.
6. Do not tie sutures used for tissue approximation too tightly because this may contribute to tissue strangulation. This is particularly important on fascia.
7. Maintain traction at one end of the strand after the first loop is tied to avoid loosening of the throw.
8. Do not hesitate to change position in relation to the patient in order to place a knot securely and flat.
9. Extra throws do not strengthen a properly tied knot.



Suture Properties

Properties of suture material to consider when choosing the appropriate suture include

- tensile strength
- durability
- reactivity
- handling characteristics
- knot security



Suture Characteristics

- Size
 - Diameter of the suture material
 - Increased number: Smaller the size
 - Smaller the size: Less tensile strength
- Knot tensile strength
 - Force that the suture can stand before it breaks when knotted
 - Suture should be as strong as the normal tissue it is used in

Suture Types

- Absorbable or nonabsorbable
- Synthetic or natural
- Monofilament or multifilament

Absorbable or Nonabsorbable Sutures

Absorbable sutures

- Natural sutures are digested by body enzymes
- Synthetic sutures are hydrolyzed, water penetrates suture filaments:
Decreased tissue reaction relative to natural sutures
- May retain strength for up to 2 months

Nonabsorbable sutures

- Not digested by body enzymes
- Use in exterior skin closures, patients with prior tissue reaction to absorbable sutures, or as permanent sutures within tissue
- May retain strength for longer than 2 months

Synthetic or Natural Sutures

Synthetic Sutures

- Absorbable
 - Polyglycolic acid (Dexon™)*
 - Polyglactin 910 (Vicryl®)
- Delayed absorbable
 - Polydioxanone (also PDO, PDS)
 - Polyglyconate (Maxon™)
- Nonabsorbable
 - Polyamide (nylon)
 - Polyester (Dacron®)
 - Polypropylene (Prolene®)
 - Polytetrafluoroethylene (PTFE, GORE-TEX®)

Natural Sutures

- Absorbable (cat gut)
 - Plain
 - Chromic
- Nonabsorbable
 - Silk
 - Linen
 - Stainless steel wire

*Note: Any and all references to trademarks or registered companies are for educational purposes only. ACOG is in no way endorsing or promoting any product in these educational materials.



Monofilament or Multifilament Sutures

- Monofilament
 - Made of a single strand
 - Less resistance as they pass through tissue and tie down easily
 - Decreased infection rates at suture line
- Multifilament
 - Several filaments braided together
 - May be coated to pass smoothly
 - Greater flexibility
 - Better knot security

Types of Sutures

	Monofilament	Multifilament
Absorbable	Monocryl®* Maxon™ PDS	Plain gut Chromic Dexon Vicryl Polysorb
Non-Absorbable	Nylon Polypropylene	Silk

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Suture Strength

- Ascending order of strength by suture material:
 - Plain gut (weakest)
 - Chromic gut
 - Dexon™ / vicryl® / polysorb™
 - Maxon™ / PDS
 - Silk
 - Nylon
 - Polypropylene (strongest)

- Ascending order of strength by size:
5-0 (weakest), 4-0, 3-0, 2-0, 0, 1, 2 (strongest)

Next, you will review suturing techniques.

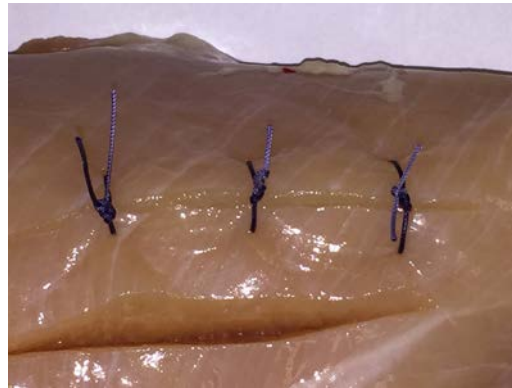
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Interrupted Sutures

The interrupted suture is a secure closure.

Simple interrupted



Vertical mattress



Horizontal mattress



Images courtesy of Angela Chaudhari, MD

Simple Interrupted Suture

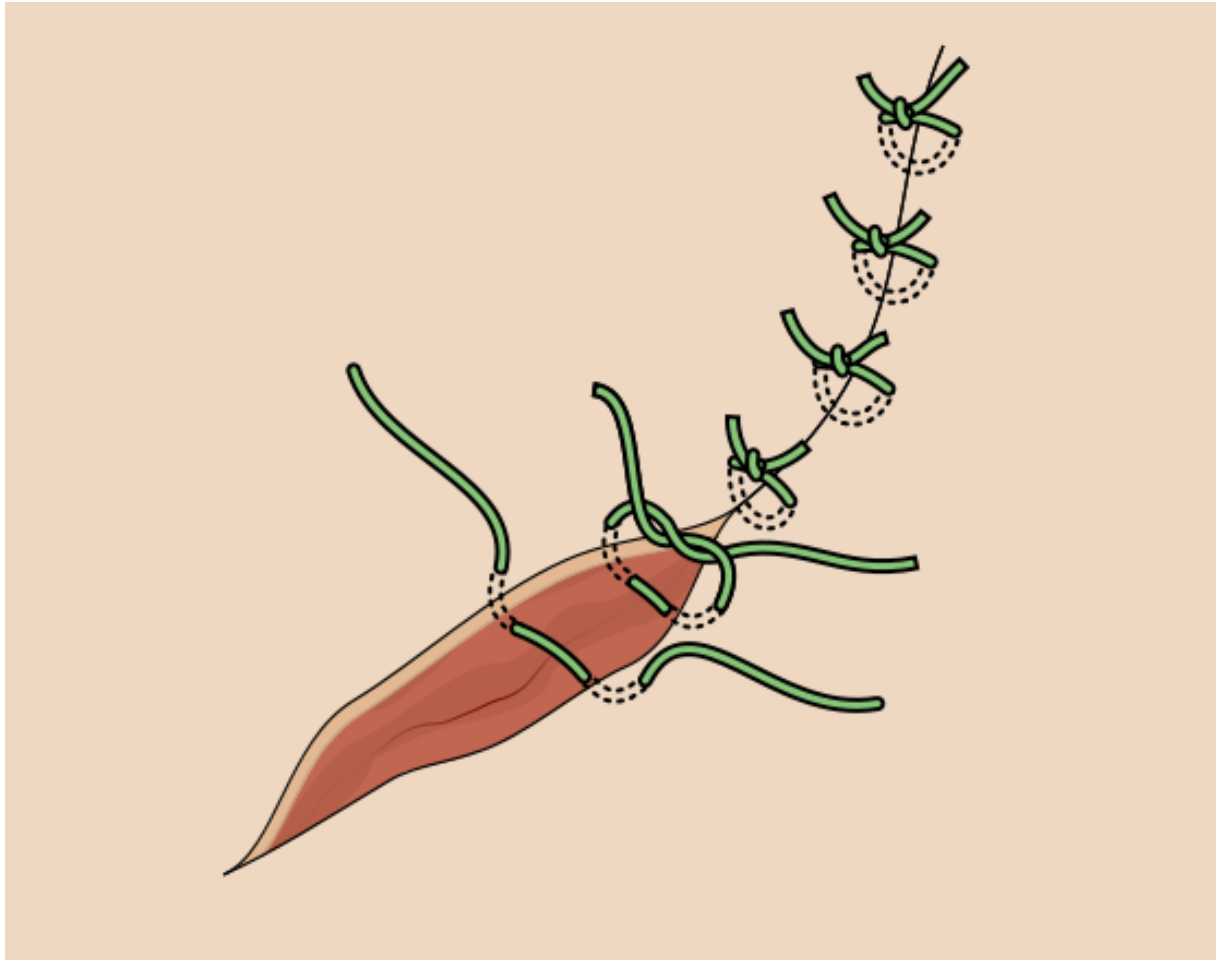


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Vertical Mattress Suture

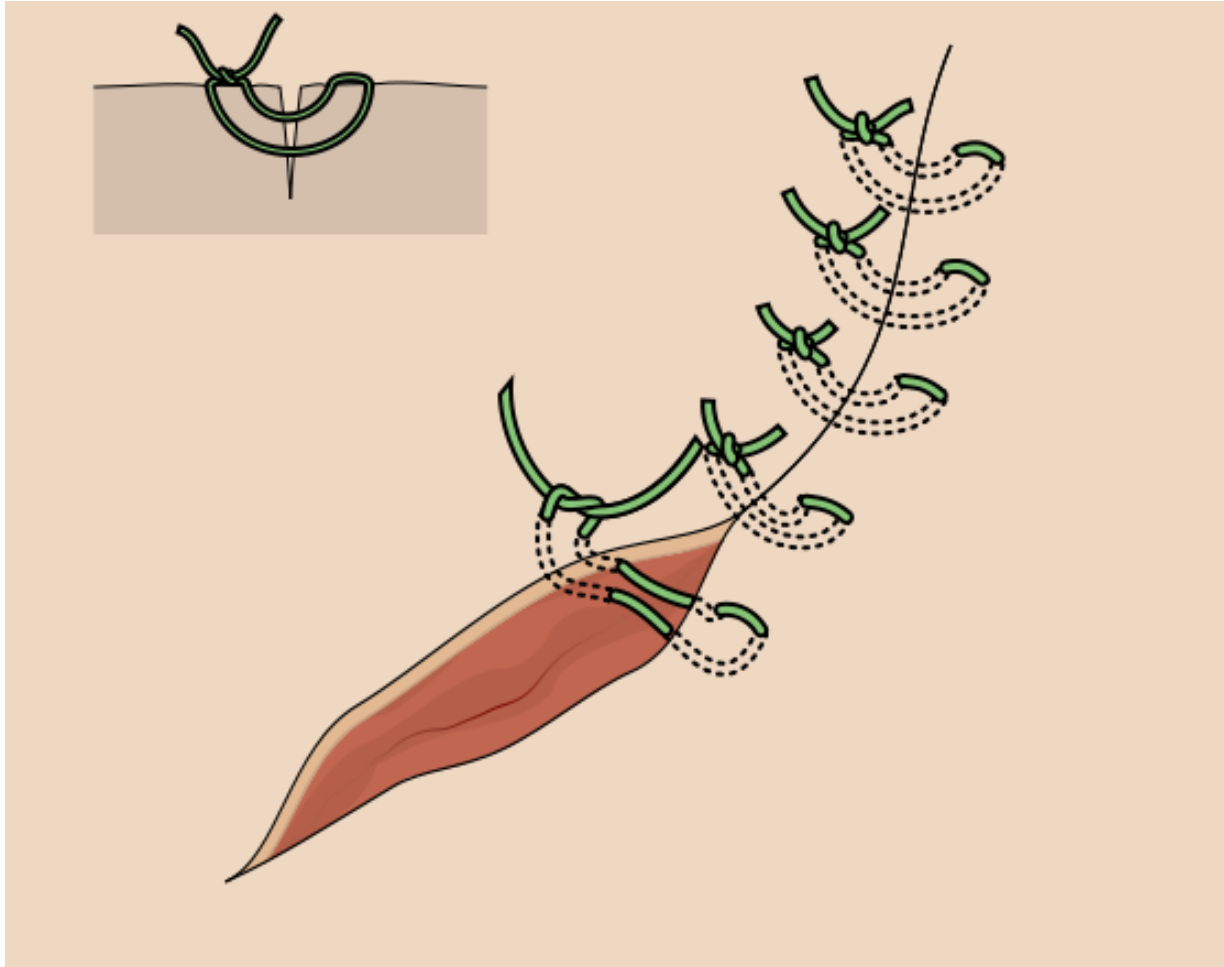


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Horizontal Mattress Sutures

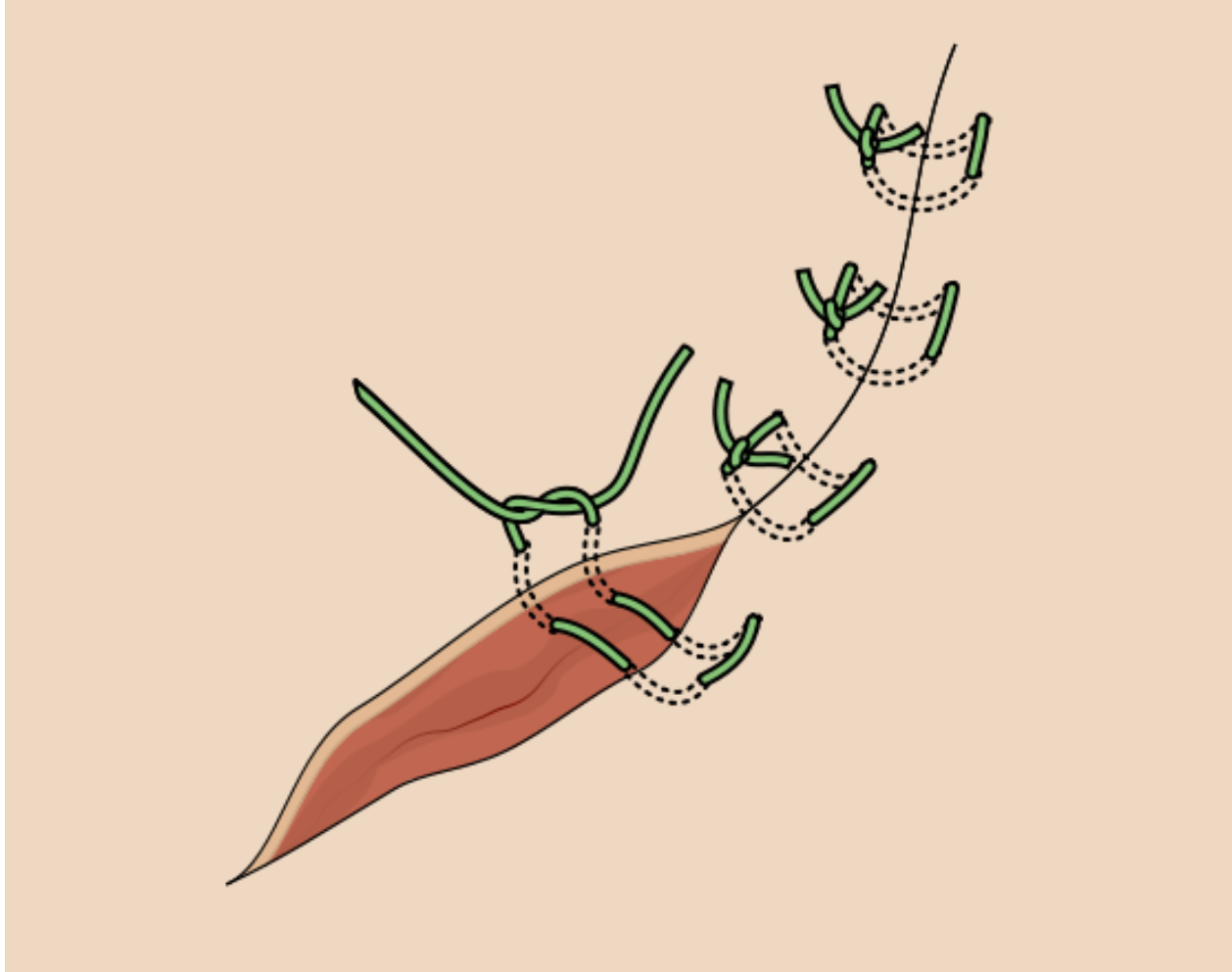


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Continuous Sutures

Continuous sutures are used to re-approximate tissue edges for healing by primary intention.

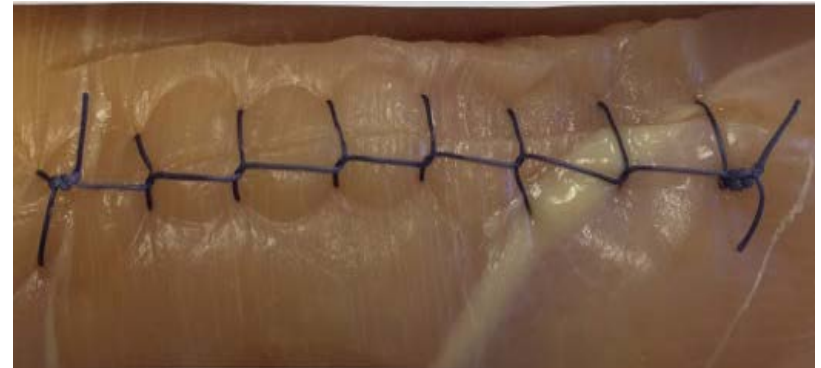
Running Looped Suture



Most common for approximation in obstetric-gynecology surgery.

Images courtesy of Angela Chaudhari, MD

Running Locked Suture



Used for closure when hemostasis is important, such as closing a vaginal laceration.

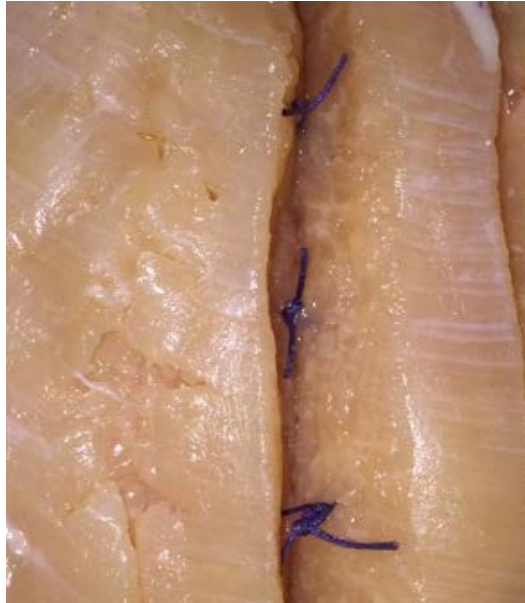
Skin Closure Methods

Subcutaneous Sutures



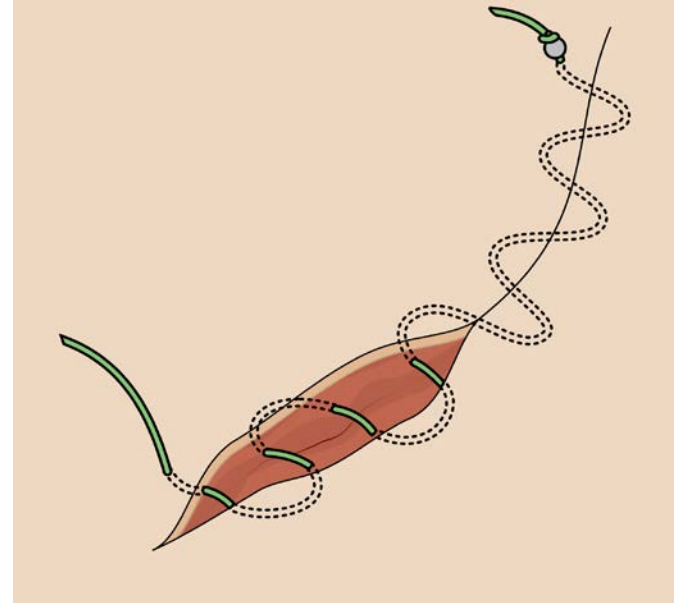
Subcutaneous sutures close dead space.

Deep Dermal Sutures



Deep dermal sutures are placed underneath the epidermis and may be continuous or interrupted.

Subcuticular Sutures



Subcuticular sutures are placed in the dermis in a line parallel to the wound.

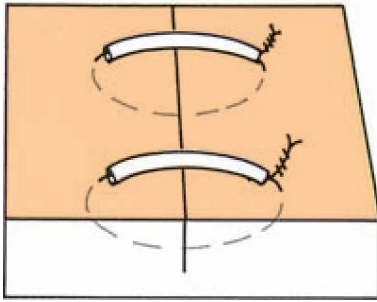
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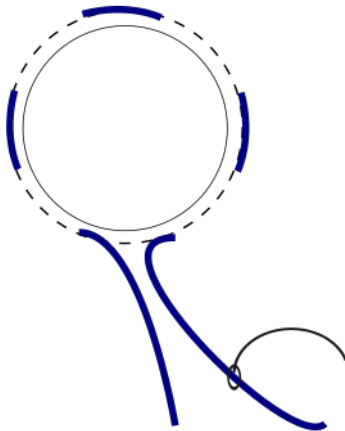
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Other Suture Types

Retention Suture



Retention sutures are placed from the peritoneum through the entire abdominal wall. This suture is used to relieve pressure on the primary suture line and to decrease the potential wound dehiscence.



Purse String Suture

Purse string sutures are placed around a lumen and closed like a drawstring to invert the lumina. It is a continuous running suture placed about the opening, and then drawn tight.

Optimal Suture Material for Selected Clinical Situations

Clinical	Suture	Justification
Tubal ligation	Plain gut (0 gauge)	Hemostatic but rapidly resorbed to prevent chronic inflammation and possible fistula formation
Repair of episiotomy, vaginal or perineal laceration	Chromic, Dexon, Vicryl, or Polysorb (2-0 or 3-0 gauge)	<ul style="list-style-type: none"> Improved tensile strength compared with plain gut Less inflammatory and reduces postpartum discomfort*
Closure of fascia - low risk of wound disruption	Dexon, Vicryl, or Polysorb (0 gauge)	<ul style="list-style-type: none"> More inert than plain gut or chromic Improved tensile strength
Closure of fascia - high risk of wound infection and disruption (eg, morbid obesity, DM, steroid use, preexisting infection)	Maxon, PDS, Nylon, or Polypropylene (0 gauge)	<ul style="list-style-type: none"> Patients at exceptionally high risk of wound infection or disruption may require permanent sutures. Silk suture should not be used in tissue when the risk of infection is high because this suture is inflammatory.

*Note: Never use permanent sutures for possible chronic inflammatory reaction leading to dyspareunia



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