

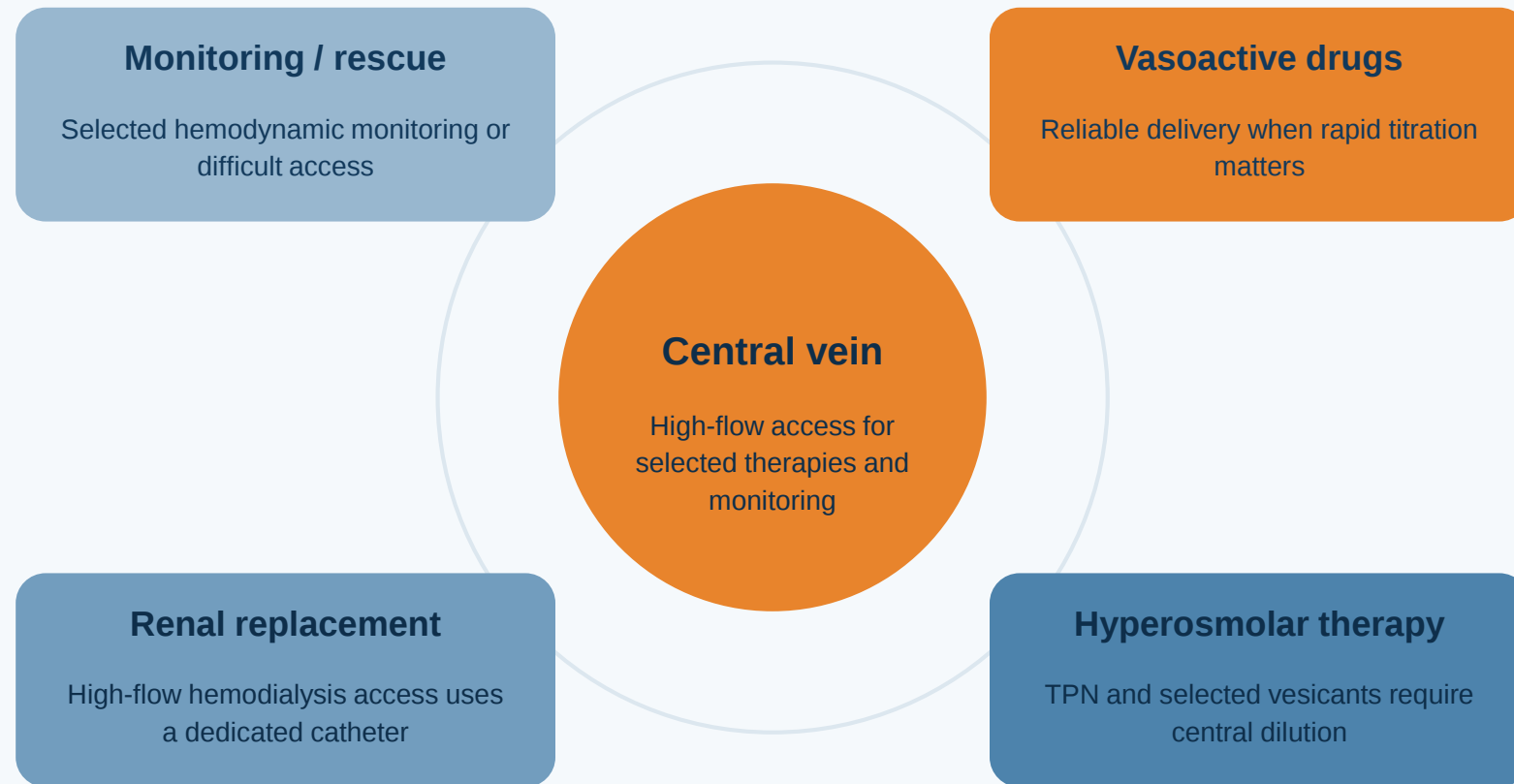
ACADEMIC LECTURE · PHYSIOPATHOLOGY

Invasive Access & Drainage Systems

From Anatomy to Clinical Management

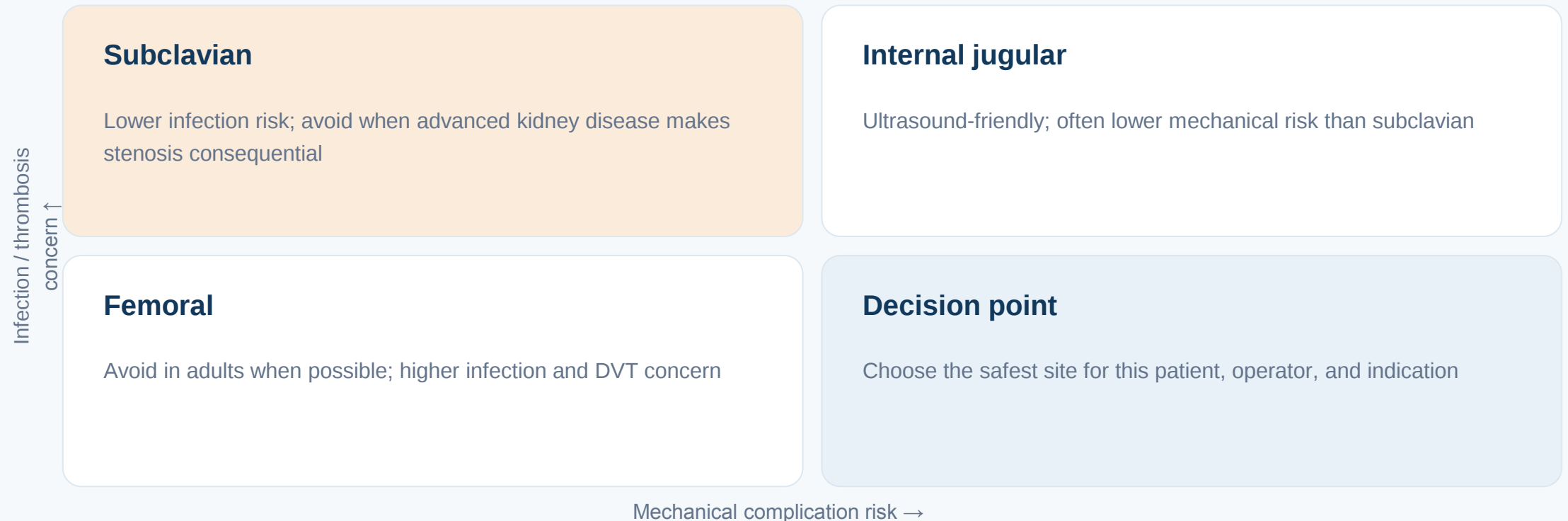
CVCs deliver therapy when peripheral access is not enough

Central venous access is a physiologic escalation—not a convenience line



CVC site choice is a trade-off—not a universal ranking

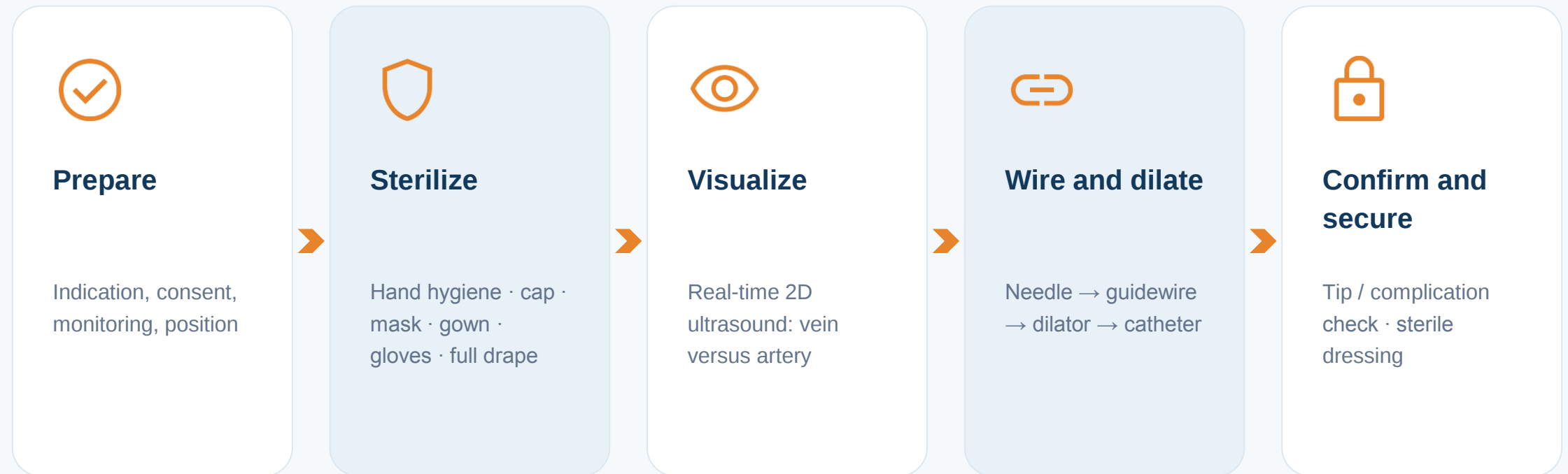
Infection risk must be balanced against mechanical risk and future access needs



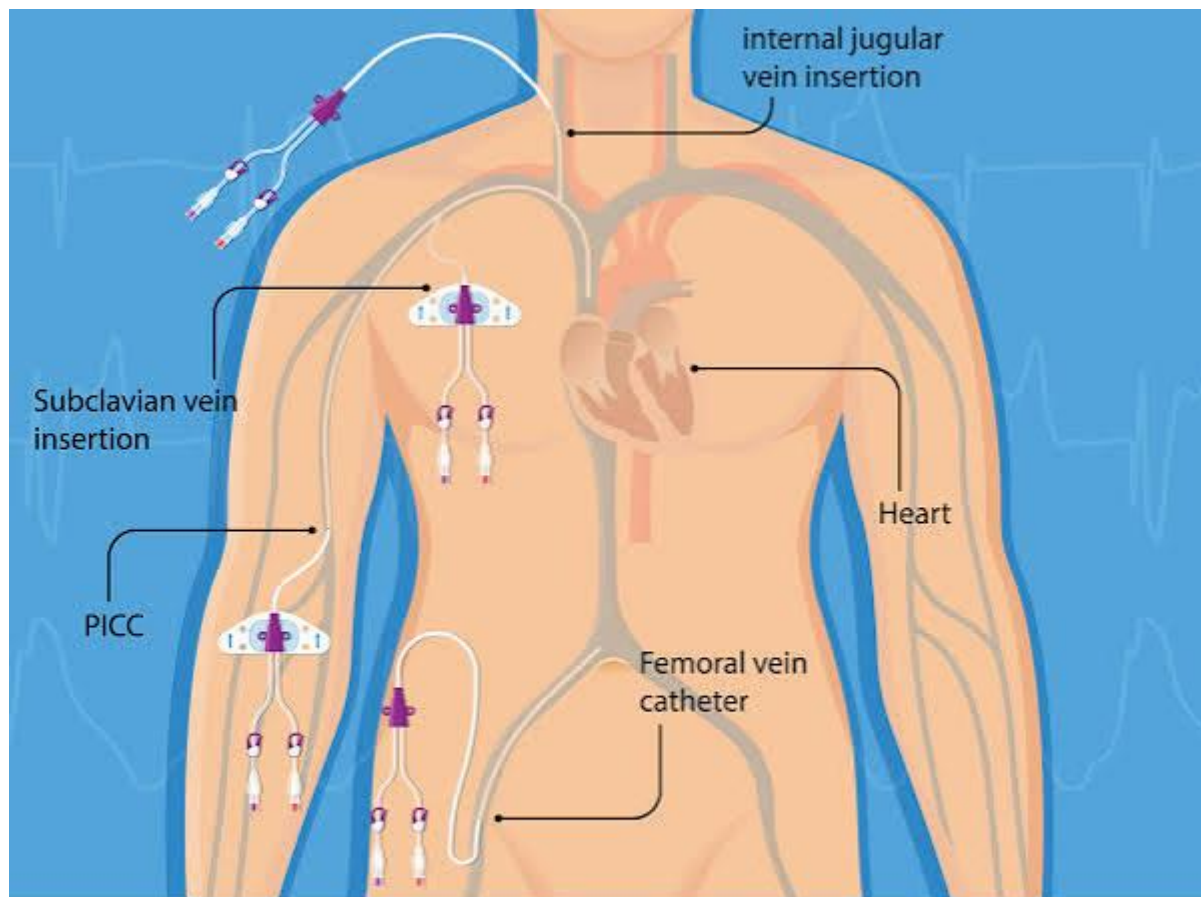
CDC: subclavian lowers infection risk for adult nontunneled CVCs—but context matters.

Ultrasound plus maximal sterile barriers reduce avoidable harm

Seldinger technique: a controlled sequence

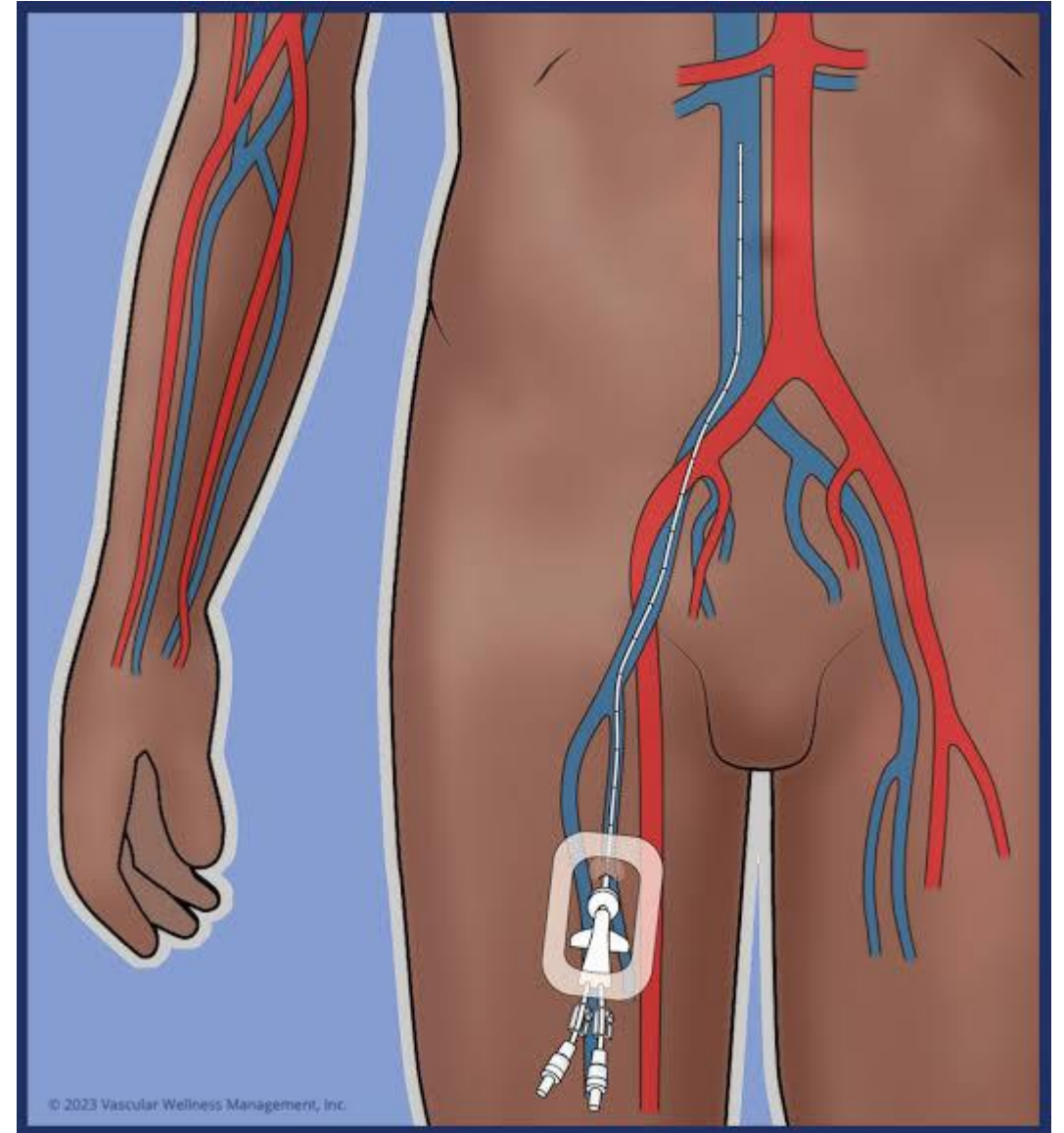
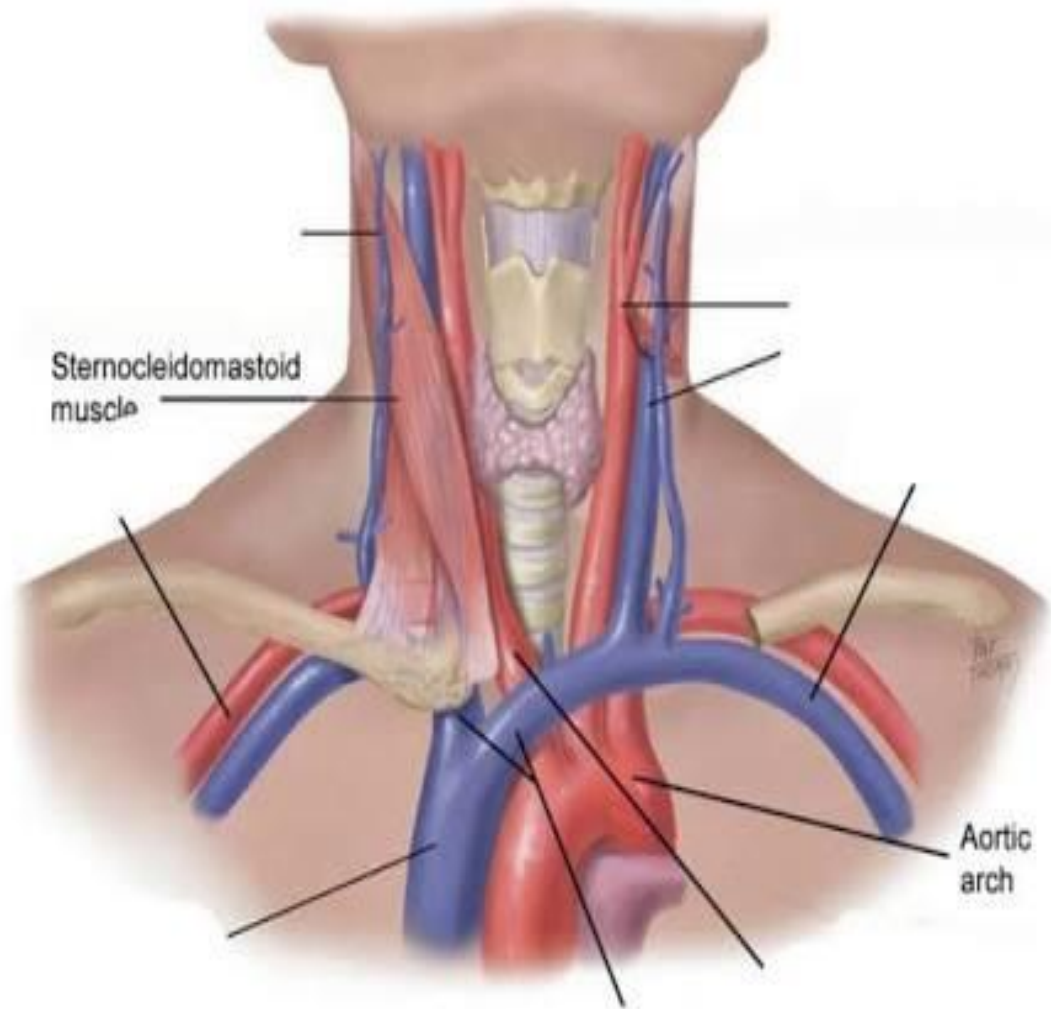


Ultrasound is a safety intervention when the operator is trained.



Central Venous Catheter

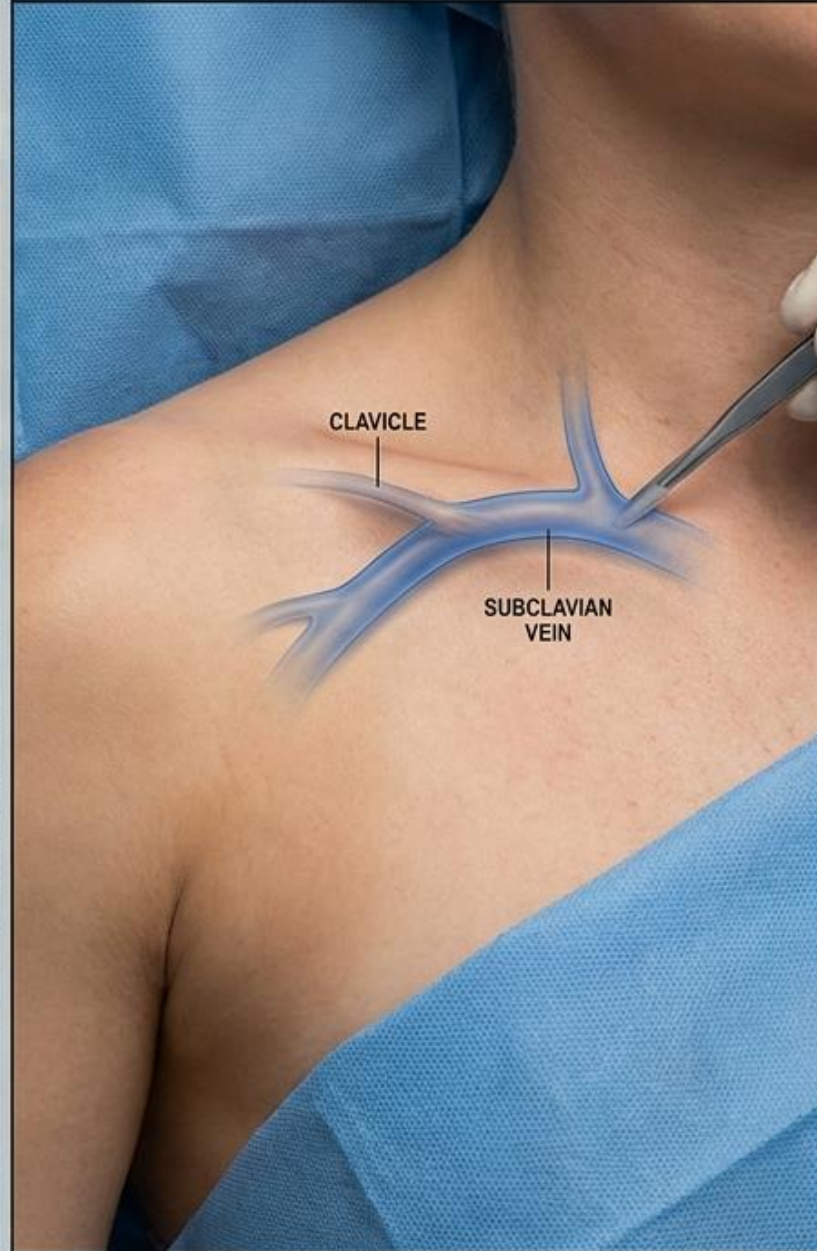




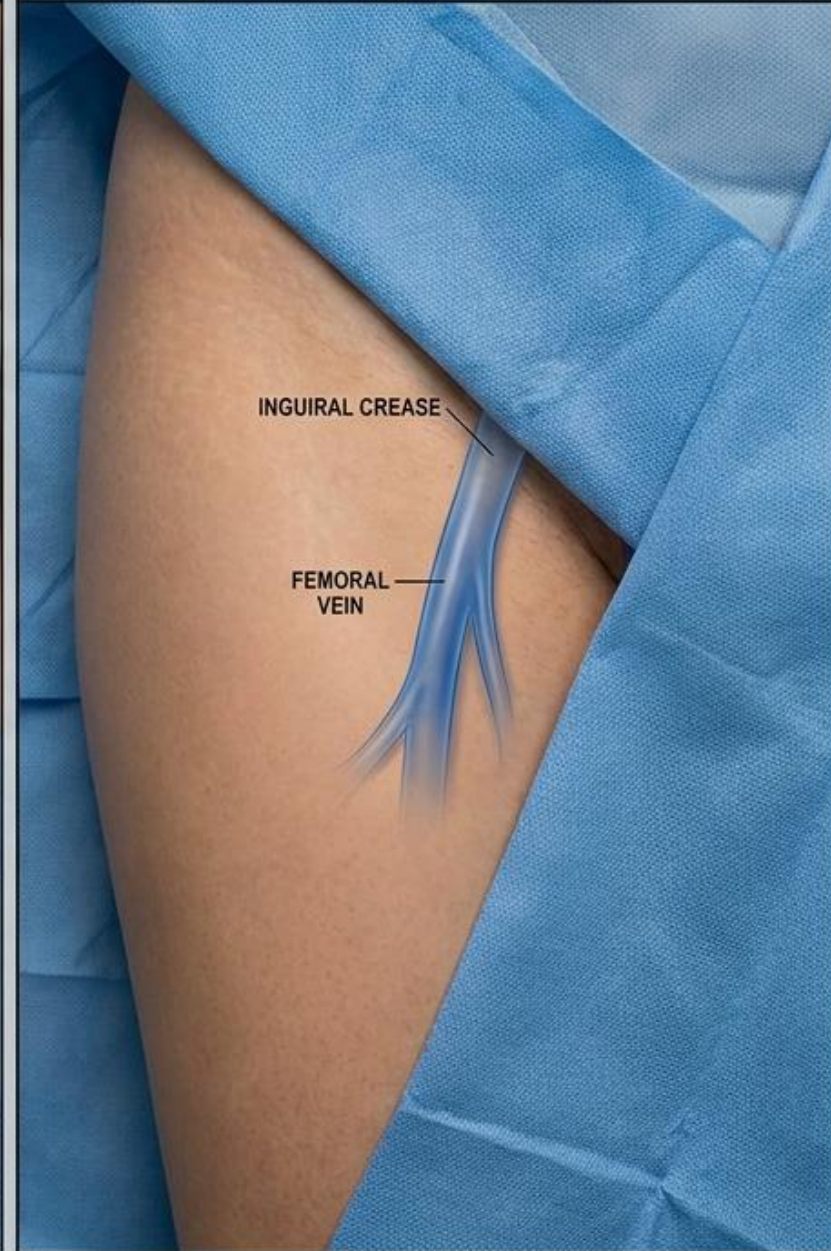
INTERNAL JUGULAR VEIN

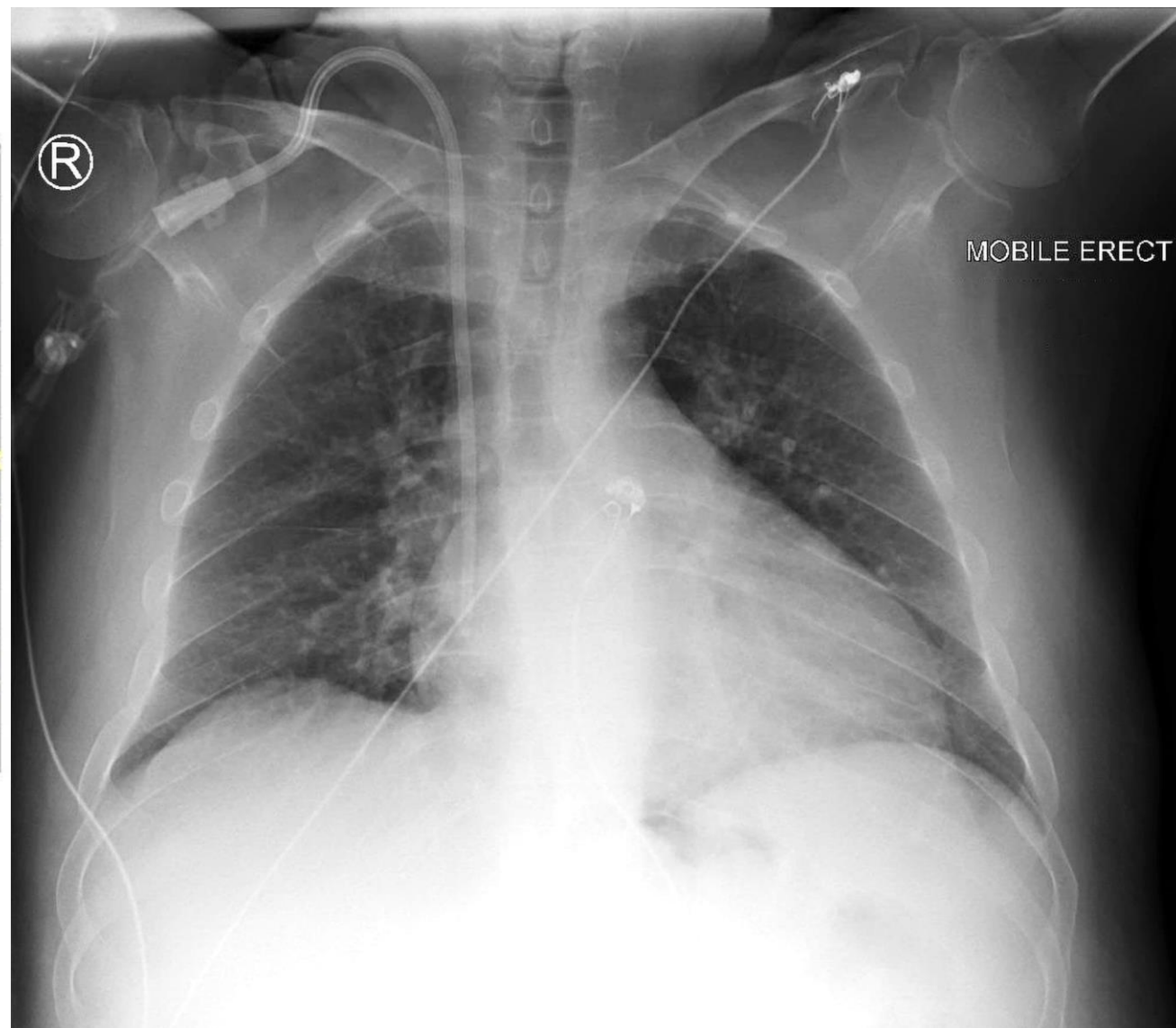
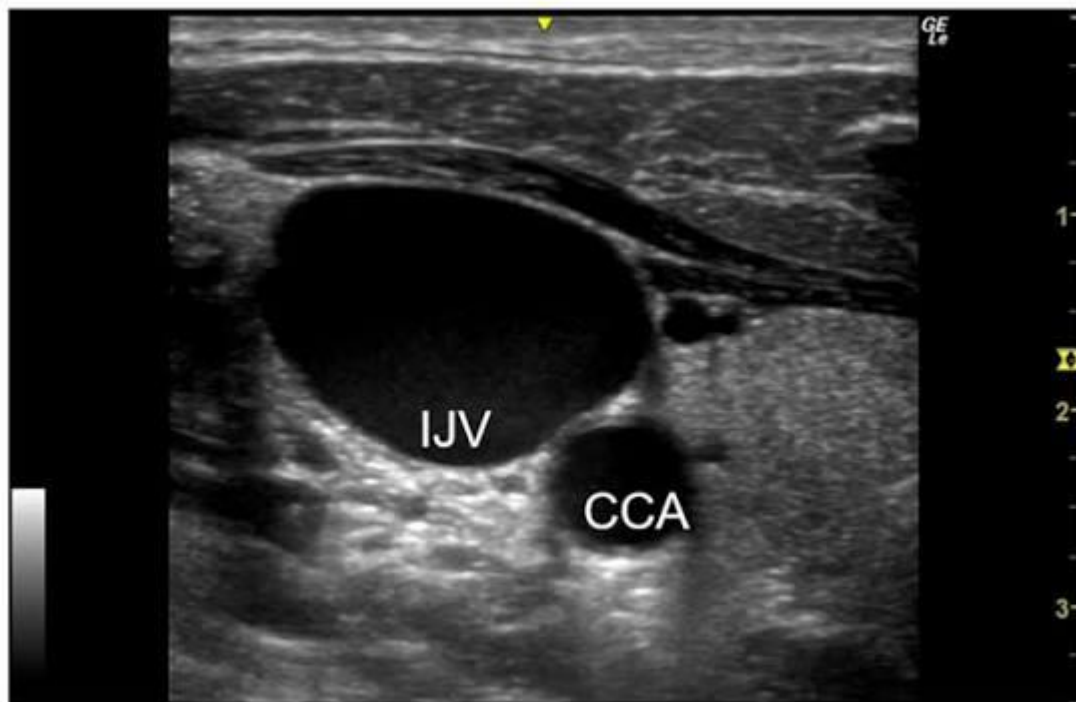


SUBCLAVIAN VEIN



FEMORAL VEIN





Maintenance prevents more infections than scheduled replacement

The bundle is a daily behavior system

REMOVE



When no longer essential

Prompt removal is a Category IA CDC recommendation.

01

Hand hygiene + asepsis

Before every access, dressing change, or manipulation

02

CHG-based skin antisepsis

Use an appropriate chlorhexidine preparation unless contraindicated

03

Minimum lumens

Use the fewest ports needed for care

04

Daily necessity review

A line that is no longer essential is a preventable exposure

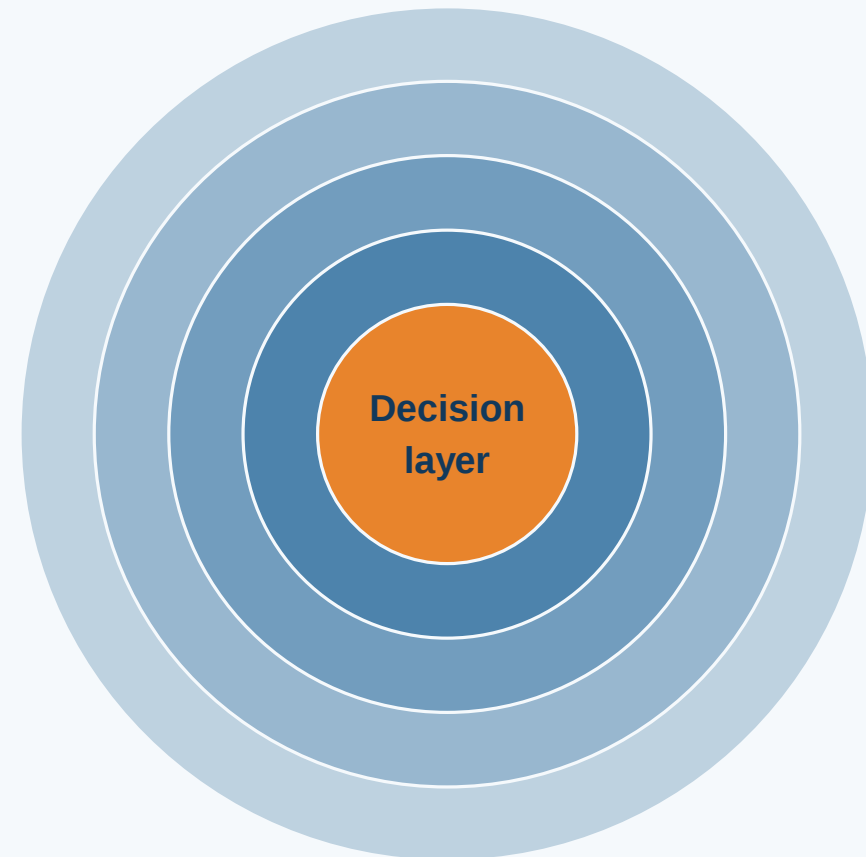


Prevention is superior to routine replacement.

Chest drainage changes pressure, volume, and pleural biology

Drain only when the pathophysiology and patient risk justify it

- **Pleural space**
A potential space with near-negative pressure
- **Air: pneumothorax**
Loss of apposition impairs ventilation; tension adds hemodynamic compromise
- **Blood: hemothorax**
Volume occupies the space and may clot
- **Pus: pleural infection**
Loculations and inflammation require source control
- **Decision layer**
Observe, aspirate, drain, or escalate based on symptoms and risk



Small-bore drainage is often enough—and often less painful

Choose diameter for the contents and the clinical job

Small-bore / pigtail

- Often suitable
- Mechanism
- Trade-off

Large-bore tube

- Selected indications
- Mechanism
- Trade-off

Larger is not always better: match bore to contents, flow, and source control.

The safe triangle turns surface anatomy into a safety boundary

Place the tube where the anatomy gives you room

Map before puncture

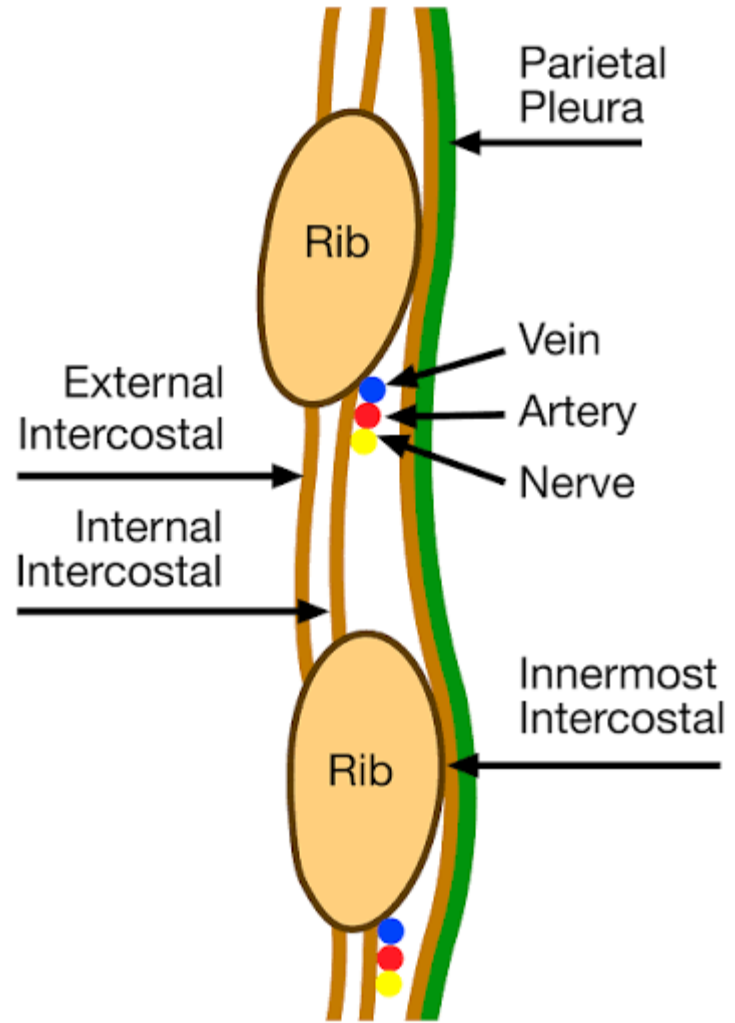
Triangle: lateral pectoralis major · anterior latissimus dorsi · 5th intercostal space; apex below axilla

Position, ultrasound
when useful, analgesia,
and a controlled tract
convert landmarks into
a safer procedure.



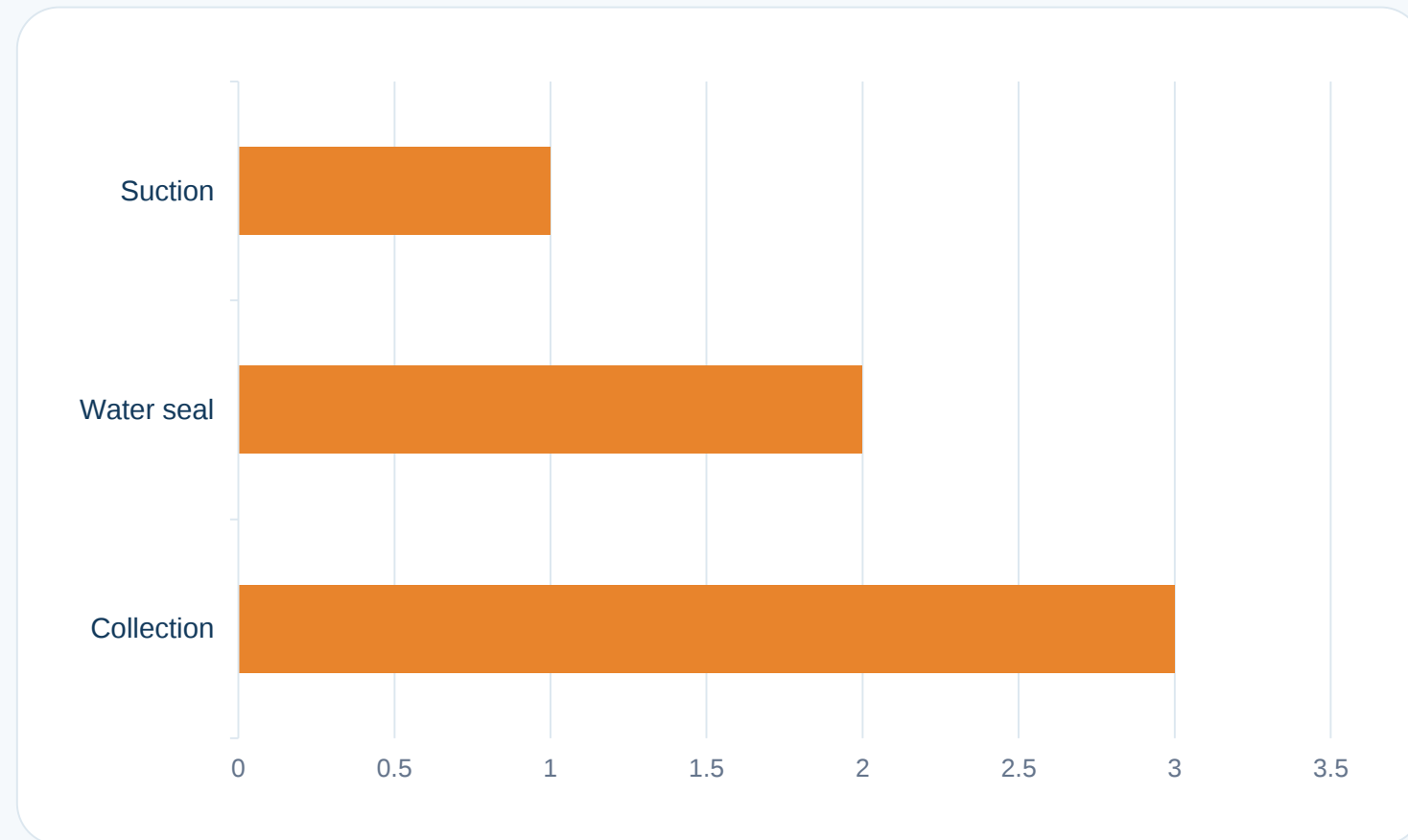
Enter above the rib

Localize the space; pass just superior to the rib
to reduce intercostal neurovascular injury



The three-chamber circuit converts pleural physics into bedside signals

Collection → water seal → suction



Read the system, not just the tube

Collection holds fluid; water seal limits reverse air flow; suction adds controlled negative pressure. Bubbling suggests an air leak; tidaling reflects pressure transmission and must be interpreted in context.

Setup & Mechanism

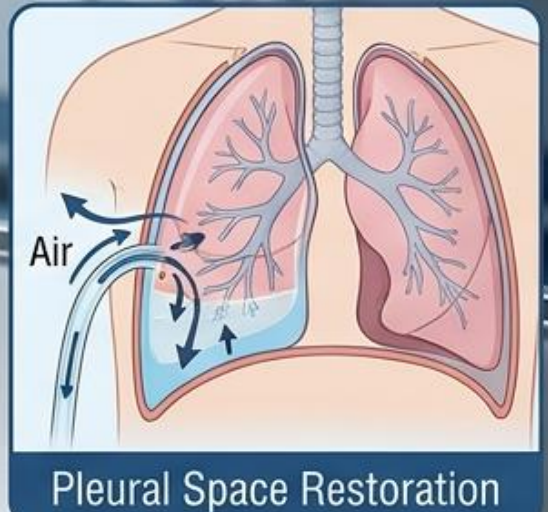
Chest Tube > Water Seal > Suction Source (Gomco Pump)

Indications

- Pneumothorax
- Pleural Effusion

Clinical Protocol

- **Air Leak Assessment:**
Observe for bubbling
- **Removal Criteria:**
<100ml/24hr output,
Full Lung Re-expansion



Blunt dissection is a controlled path into the pleural space

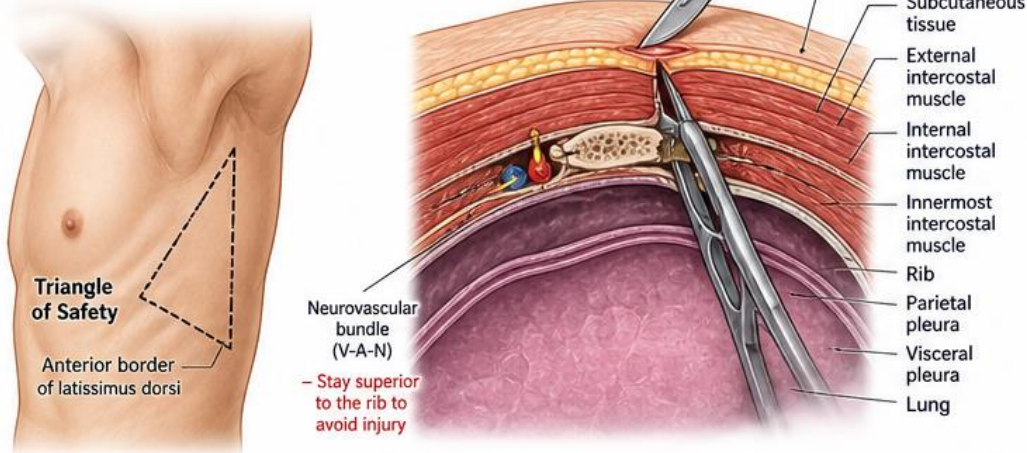
Procedure sequence for a surgical chest drain



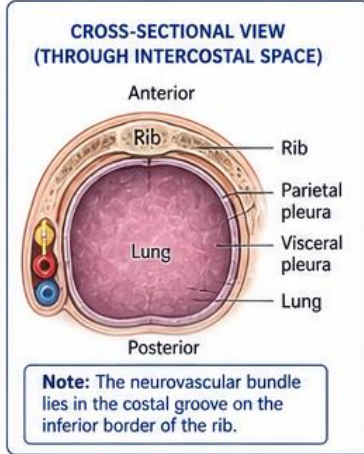
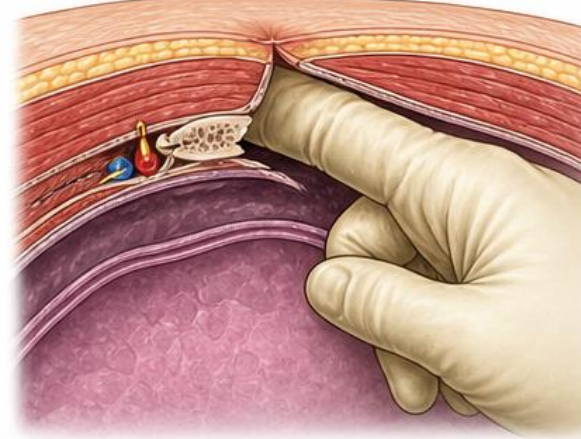
CHEST TUBE (TUBE THORACOSTOMY) INSERTION IN THE TRIANGLE OF SAFETY

Step-by-Step Technique

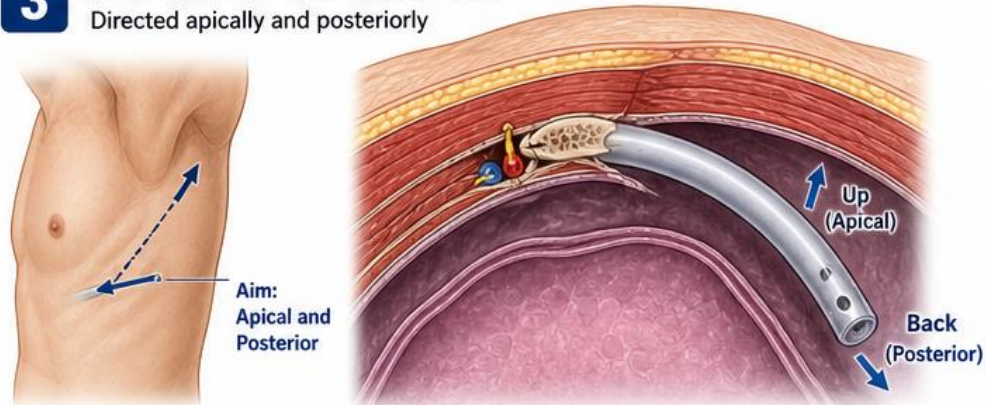
1 SKIN INCISION AND BLUNT DISSECTION OVER THE TOP OF THE RIB (avoiding the neurovascular bundle)



2 DIGITAL EXPLORATION (insert gloved index finger into the pleural space to sweep for adhesions)

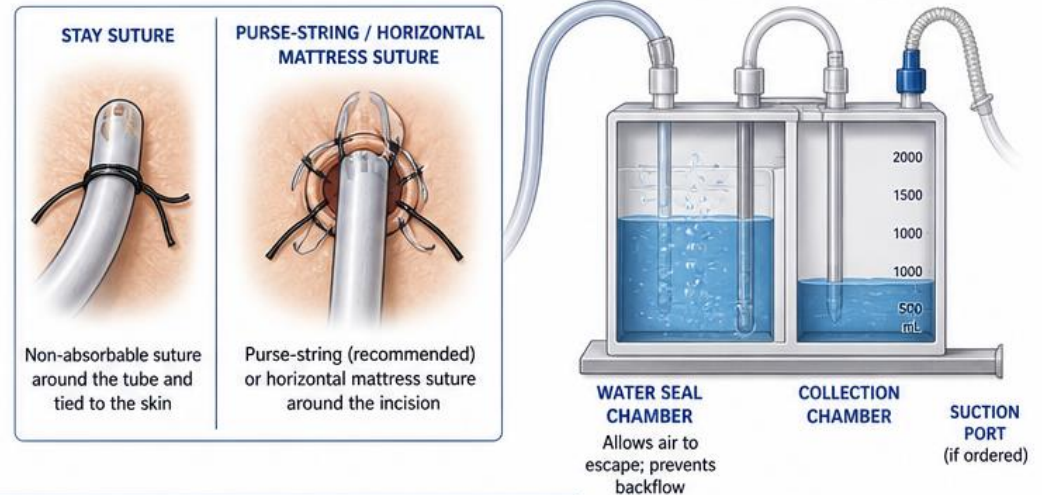


3 INSERTION OF THE CHEST TUBE Directed apically and posteriorly



Typical entry site: 4th or 5th intercostal space, anterior to the mid-axillary line within the triangle of safety.

4 SECURING THE TUBE AND CONNECTION TO WATER-SEAL DRAINAGE SYSTEM



Key Points: Enter over the top (superior border) of the rib. Stay within the triangle of safety. Direct the tube apically and posteriorly. Secure the tube well and ensure an airtight connection to the drainage system.

Complications are recognized by anatomy, output, and imaging

A drain can fail by being in the wrong place—or by changing the wrong physiology

Malposition / organ injury

Unexpected course, poor function, bleeding, or new instability
→ reassess urgently

Air leak / emphysema

Persistent bubbling or expanding subcutaneous air → inspect circuit, tube, and lung

Infection / pain

Fever, erythema, or uncontrolled pain → examine site and treat the cause

Removal decision

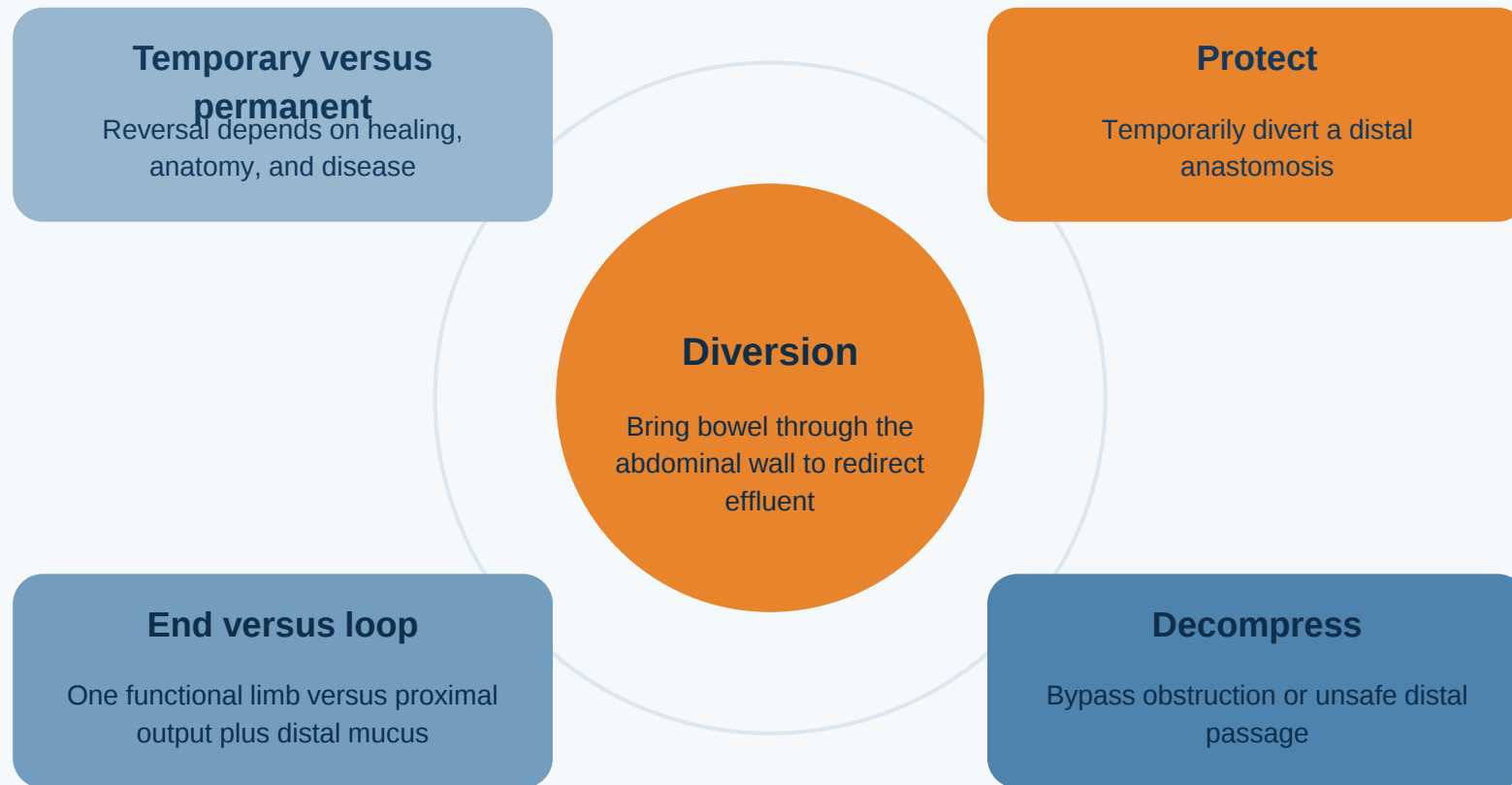
Indication resolved; output and air leak acceptable; imaging and clinical status support removal

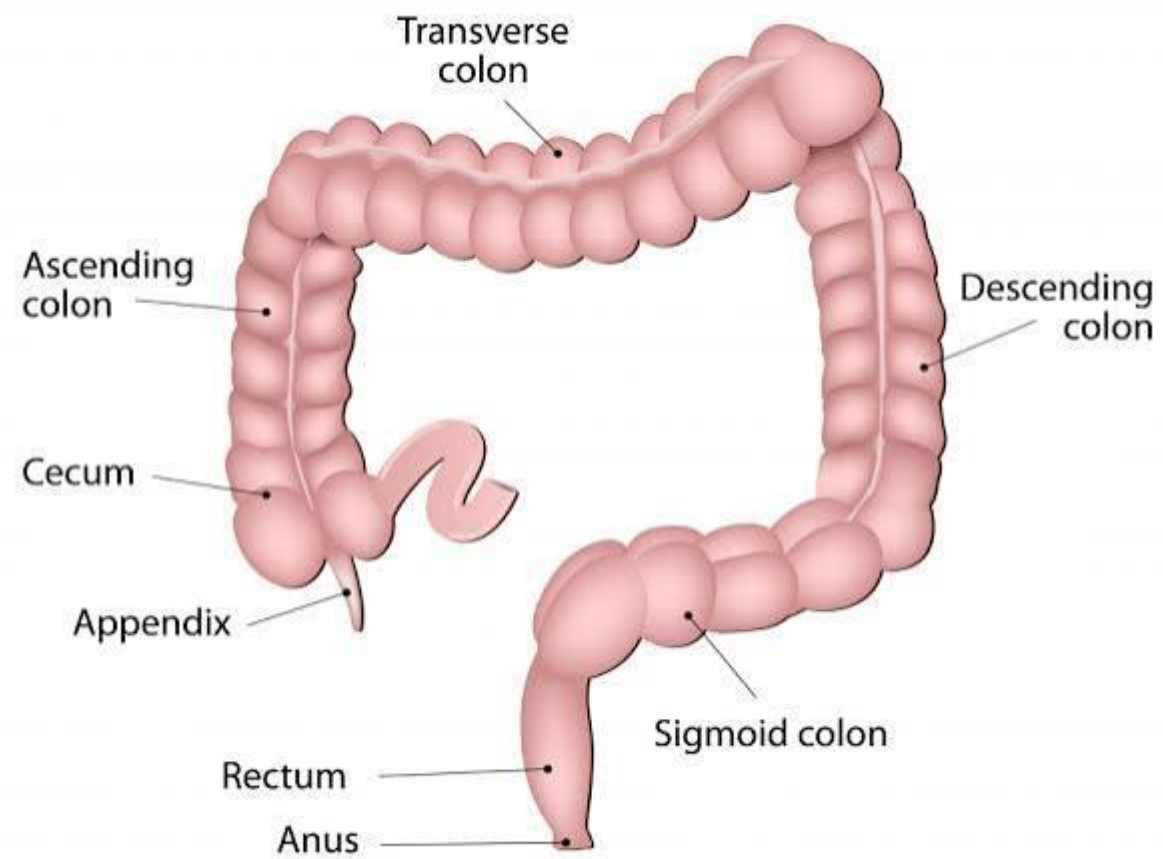


Do not clamp routinely: obstruction can convert a leak into tension.

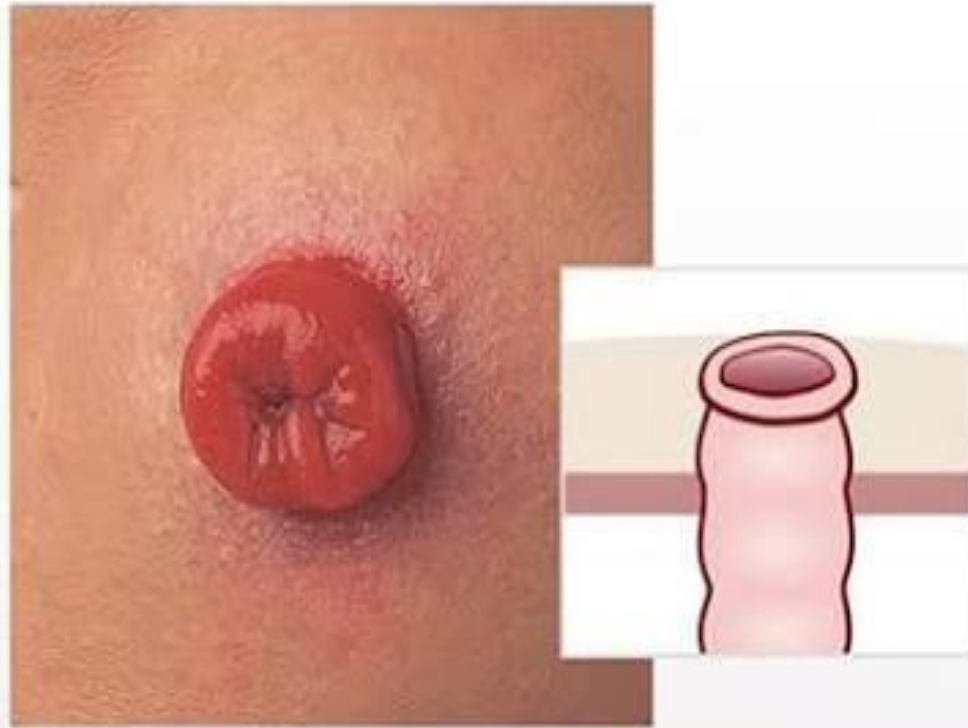
An ostomy reroutes flow to protect, bypass, or decompress bowel

The stoma is an engineered outlet with a defined upstream and downstream physiology





End Colostomy Formation

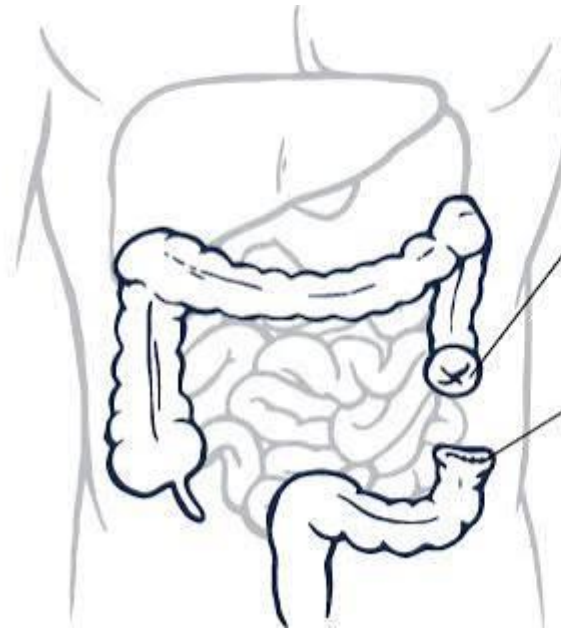


An end colostomy is generally permanent.
An end colostomy has only one opening.

Loop Colostomy Formation

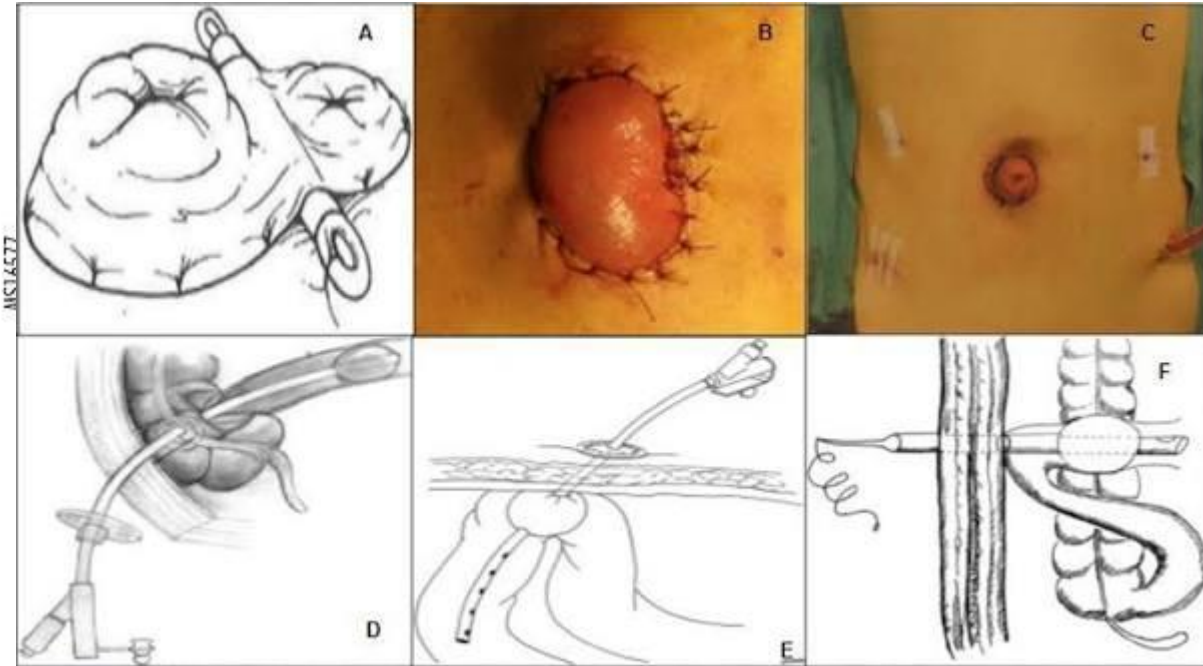


A loop colostomy is generally temporary and can be reversed later when no longer required. A loop colostomy has two openings.

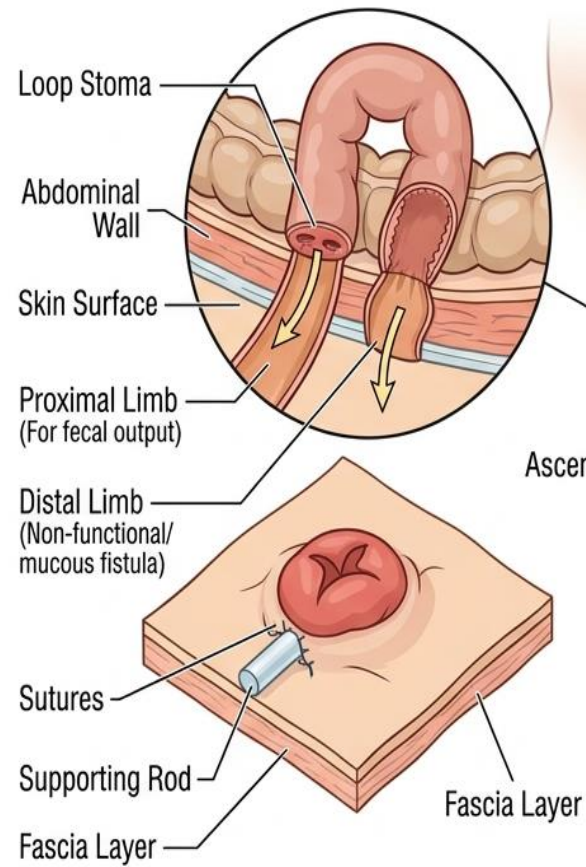


Proximal, or afferent, bowel limb is brought to the surface of the abdomen to create a stoma.

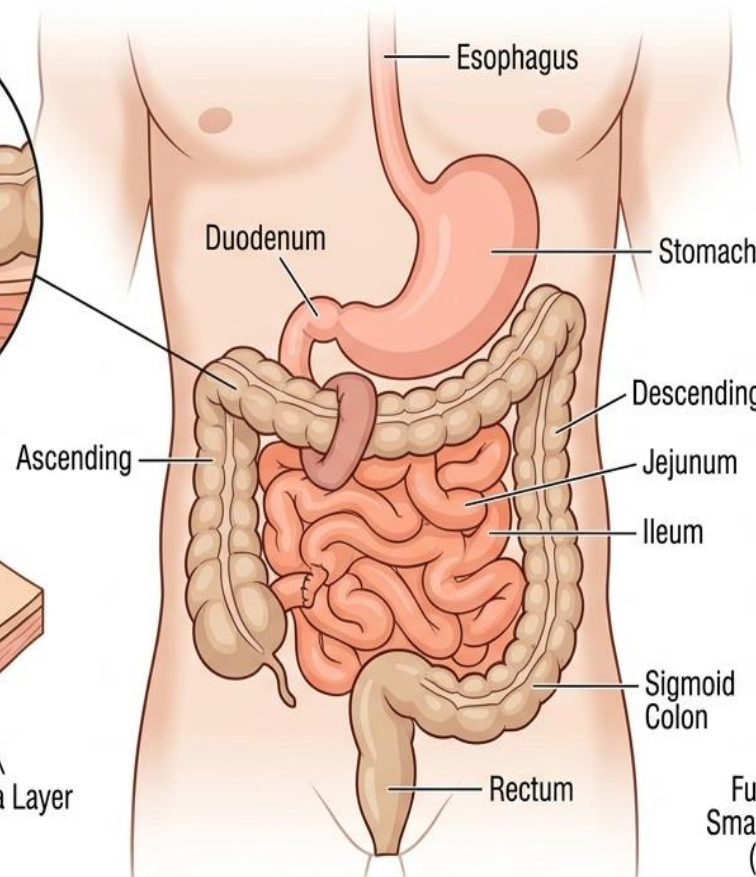
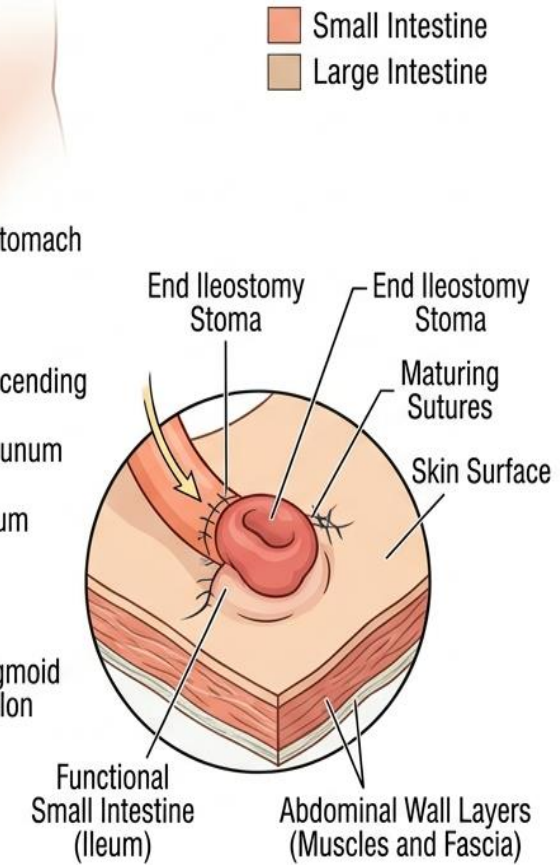
Distal, or efferent, bowel limb is closed and left inside the abdomen.



DIVERTING LOOP COLOSTOMY



TERMINAL ILEOSTOMY



A healthy stoma is a monitored organ—not just an appliance site

Early recognition protects bowel, skin, hydration, and quality of life

WOC



Specialist partnership

Wound, ostomy, and continence nurses support planning, pouch fit, skin protection, and adaptation.

01

Ischemia / necrosis

Dusky, gray, or black tissue is urgent

02

Retraction / leakage

Poor seal exposes skin and can worsen the problem

03

Hernia / prolapse / stenosis

Bulge, telescoping, or narrowing changes function

04

High output

Track effluent and hydration; escalate early



Peristomal skin and hydration are core physiology, not aftercare.

Access. Drainage. Diversion. Reassess the interface every day.

The safest device is the one that matches the physiology—and is removed or revised when the physiology changes.

Ask at the bedside: Why this device? Is it working? What harm is emerging?