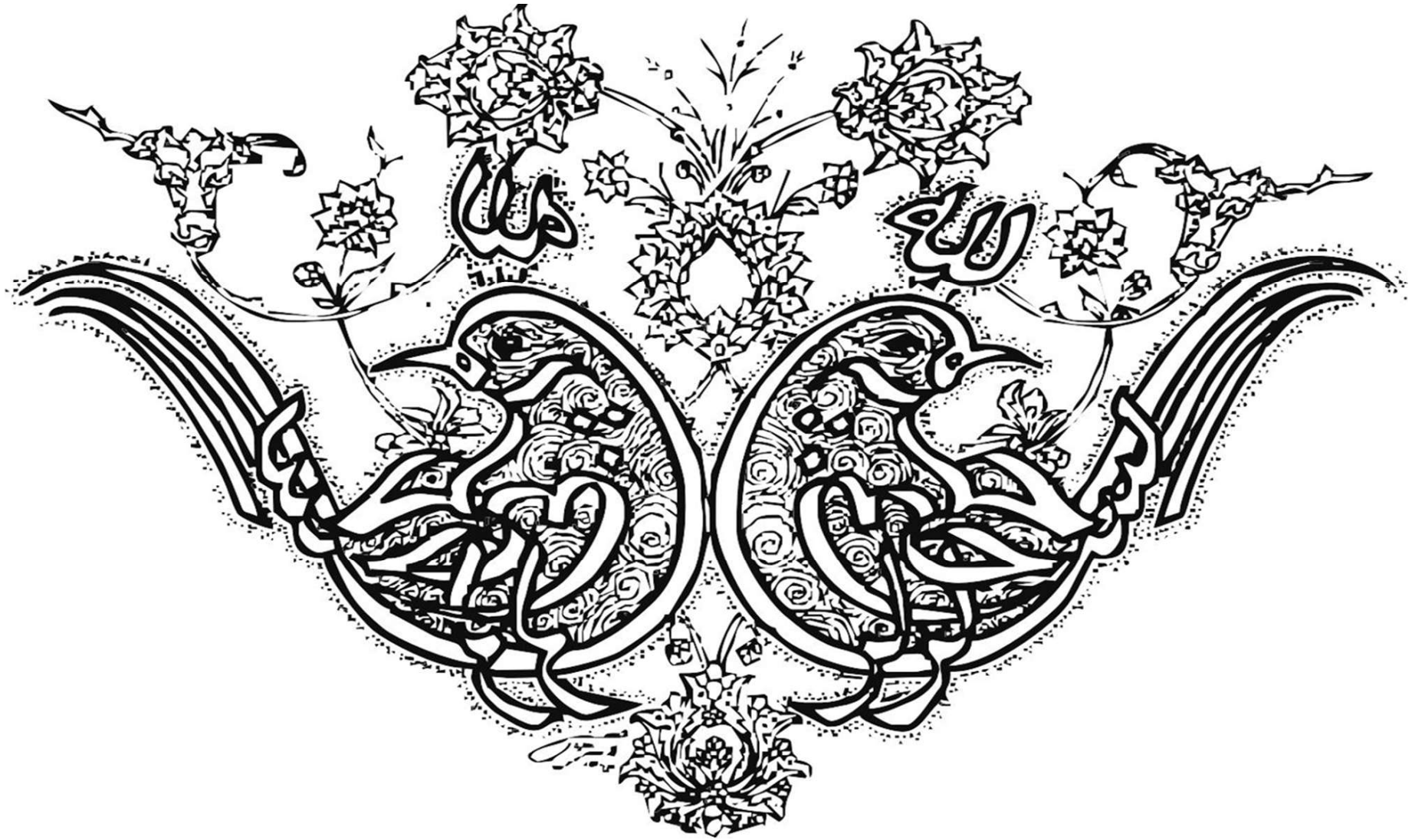

VASCULAR ACCESS COMPLICATIONS

Presenting by:

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History

- **1924**

In October 1924, Georg Haas (Giessen, Germany) performed the first haemodialysis treatment in humans which lasted 15 min.

- **He first used glass cannulae to obtain arterial blood from the radial artery, which he returned to the cubital vein.**
- **Later he performed a surgical cut-down to place a cannula into the radial artery and into an adjacent vein.**

History

1961

- **Shaldon introduced hand-made catheters into the femoral artery and vein by the percutaneous Seldinger technique for immediate vascular access.**
- (*Stanley Shaldon (London, UK) faced the problem of finding a surgeon willing to operate on the radial artery and cephalic vein to introduce cannulae for circulatory access).*

History

- **The first** surgically created fistula for the purpose of haemodialysis was placed on *19 February 1965*, followed by further 14 operations as of 21 June 1966.

- Dr Appel had performed a side-to-side-anastomosis between the radial artery and the cephalic antebrachial vein at the wrist after a 3–5 mm incision had been made in the corresponding lateral surfaces of the artery and the vein. The suture was achieved using arterial silk in continuous fashion.

DIALYSIS ACCESS TYPE

Types :

- Acute access
- Semi acute Access
- Long term Access

Access Type:

- **Acute Access**

  short term catheter

  non cuffed catheter

- **Semi acute Access**

  double lumen cuffed, TCCs and TPCs or Tunneled cuffed catheter (permanent!) catheter

- **long term access**

  AVF ,AVG

Acute and SemiAcute Catheters:

Basic Principles:

- Short term catheters should be used in emergency setting or need to hemodialysis for no more than one week

- Long term catheter systems should be used in patients would require
  - ✓ *hemodialysis for more 3 weeks*
  - ✓ *patients has exhausted all other options for long term access*
  - ✓ *HD is required while an AA matures*

Basic priciples :

- TCC or TPC should have their tips within the Rt atrium confirmed by fluoroscopy for optimal flow

- Short term catheter tips should be in the SVC and confirmed by using CXR at the time of placement before initiating dialysis therapy

- There should be a plan to :

  convert any short term catheter to a long term catheter within one week

Basic priciples :

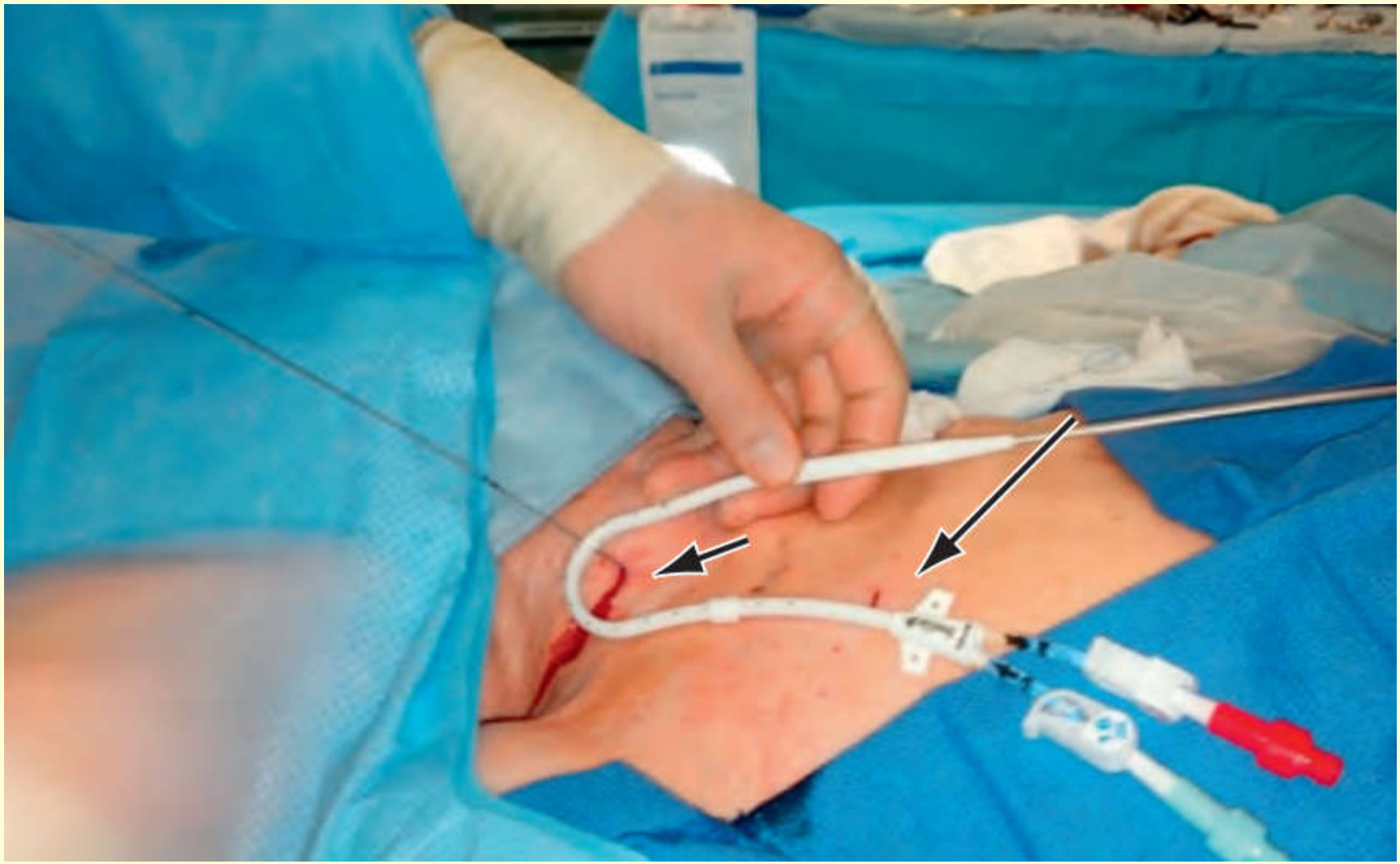
- Cuffed catheter and port catheter systems ,if possible, should not be placed on the same side as a maturing AV access.

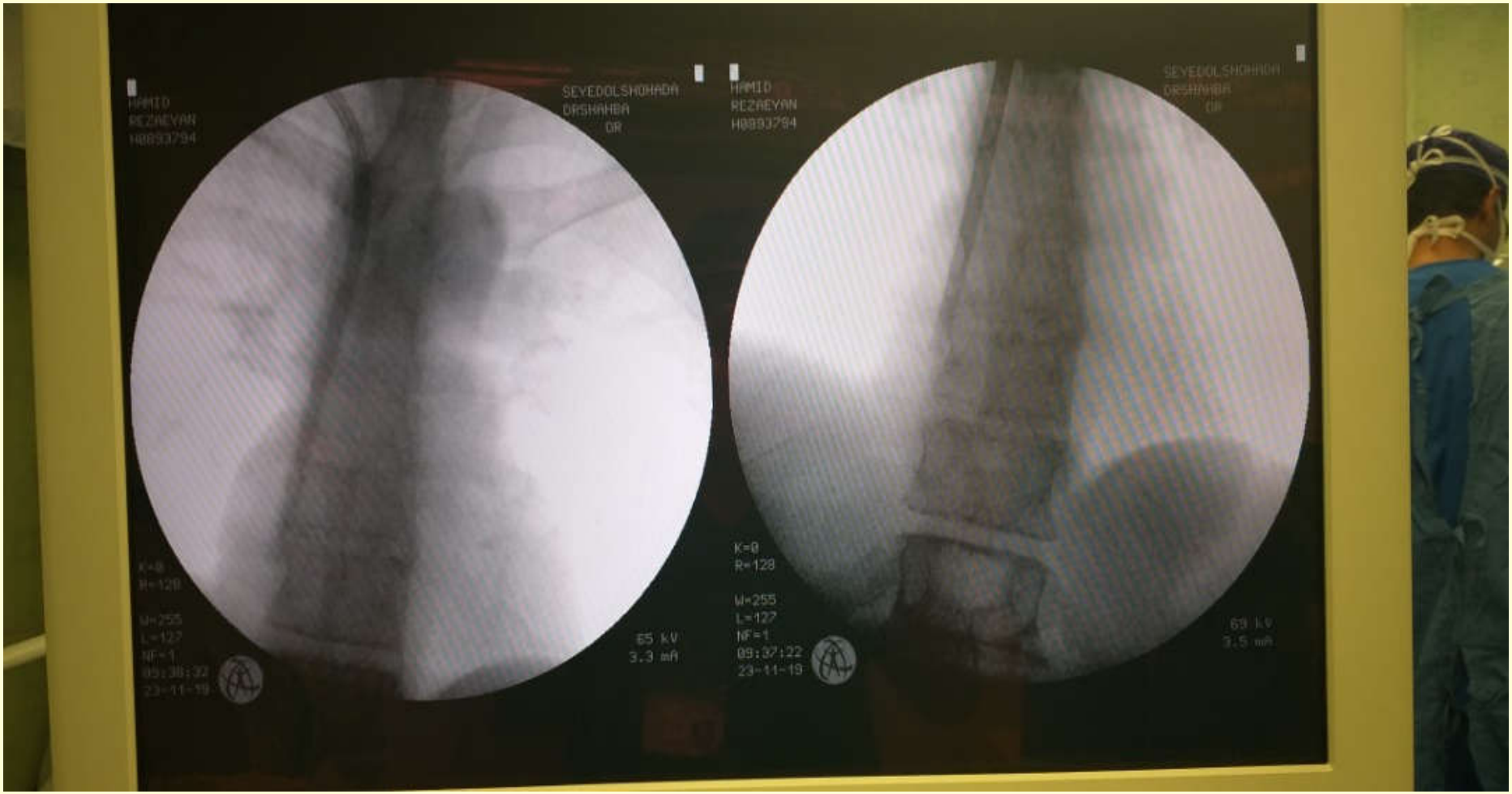
- The preferred site is the Rt internal jugular vein because this site offers a more direct route to the Rt atrium than the Lt side and lower risk for complications compared with other potential sites.

Note:

Special attention should be paid to consideration of avoiding femoral catheter access in HD patients who are candidates for current or future Kidney Transplantation.

Operative Technique

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3.3 mA
69 kV
3.5 mA

Complication

Early

Late

- ***Failure to place the central line and arterial puncture were the most common mechanical complications, followed by pneumothorax.***

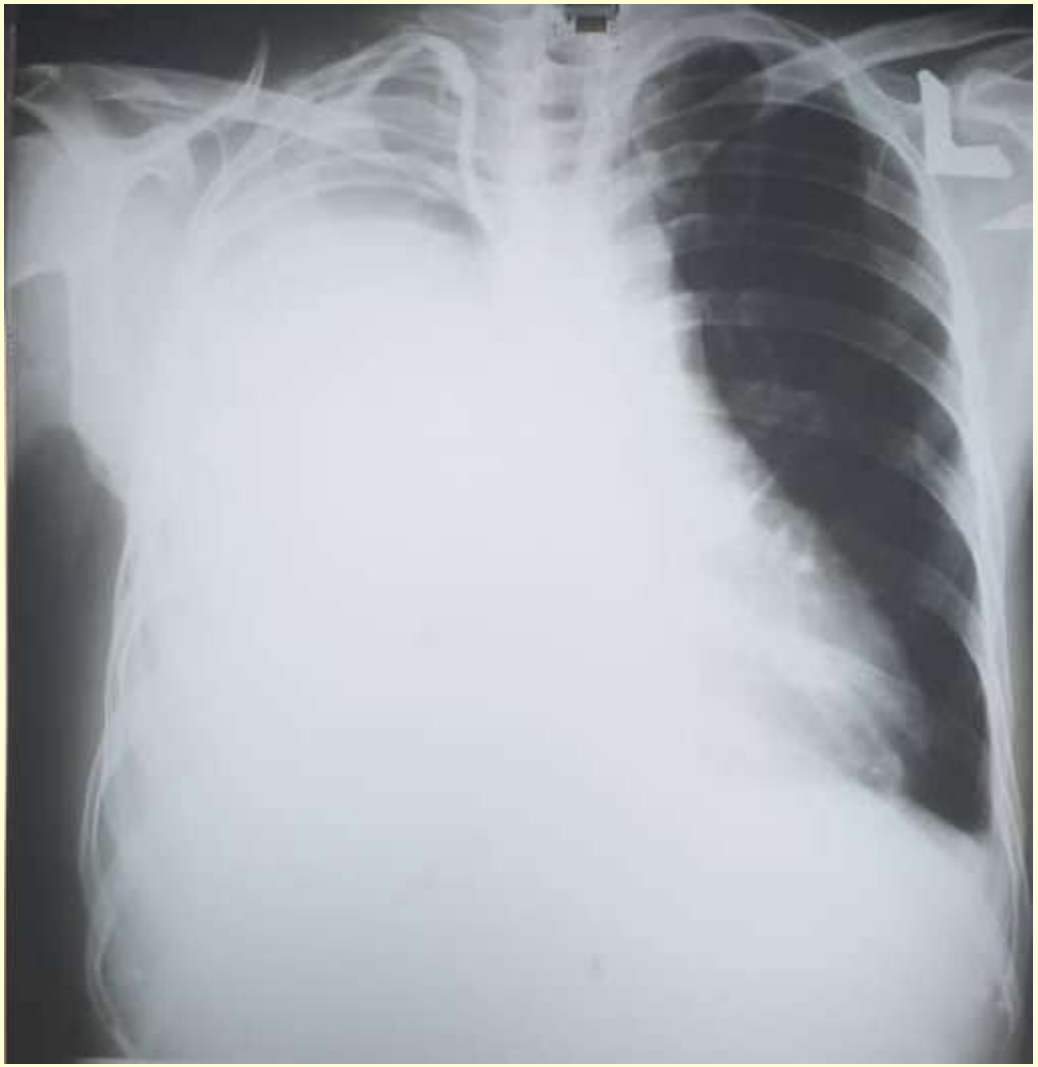
Early Complication

- ***Pneumothorax** from watchful waiting to tube thoracostomy*

- ***Hemothorax***

can develop when the back wall of vein or artery and parietal pleura are perforated by an advancing needle tip, dilator, or sheath.

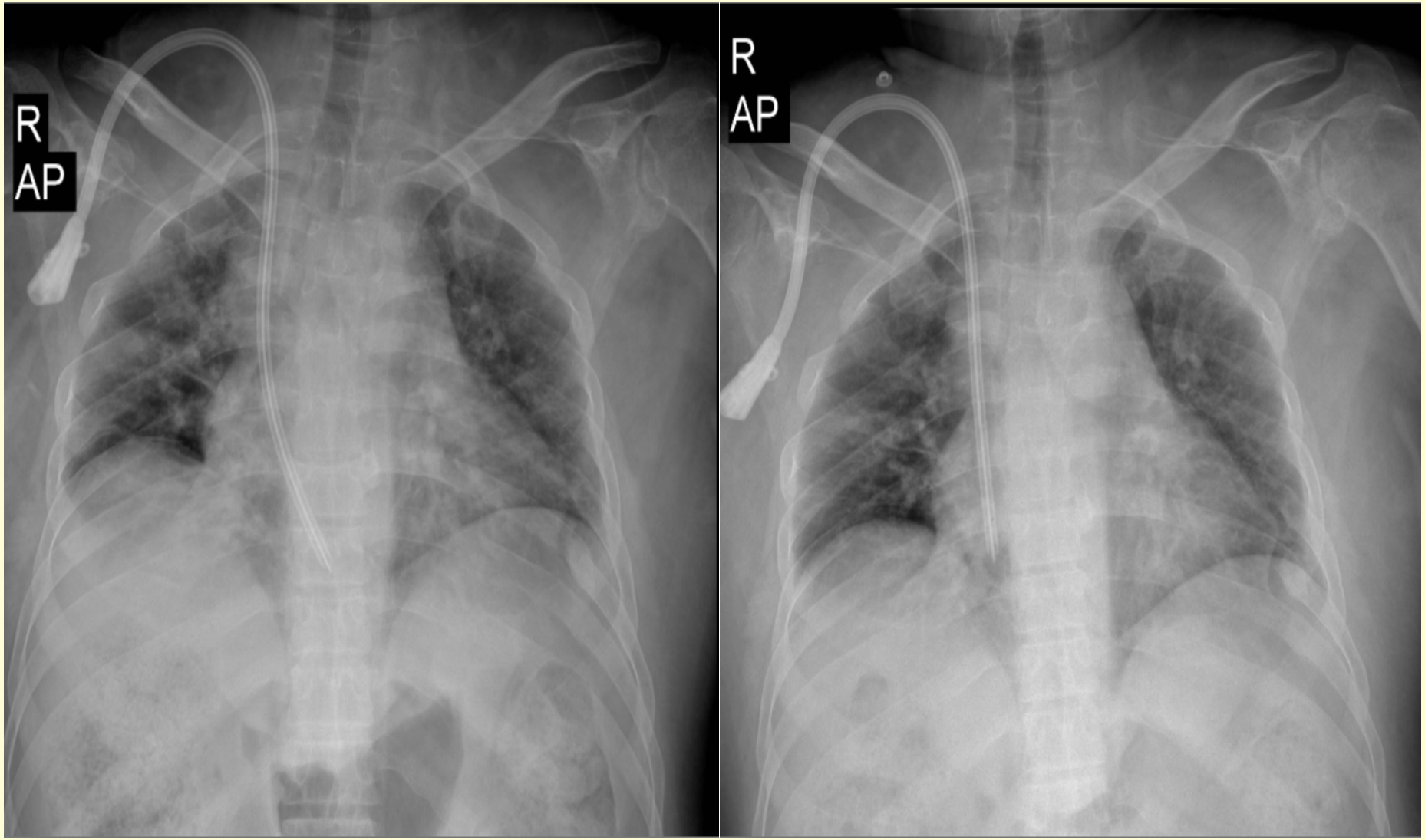
Drainage of the pleural space with a tube thoracostomy is generally adequate therapy and should be performed for significant hemothorax to prevent entrapment of the lung.



- ***Cardiac perforation***
- ***Cardiac Arrhythmia***

If cardiac arrhythmias develop after the placement of a tunneled hemodialysis catheter, the catheter position should be checked fluoroscopically or with a chest radiography and the catheter tip should be withdrawn if the tip is near or traversing the tricuspid valve.

- ***Catheter Misplacement***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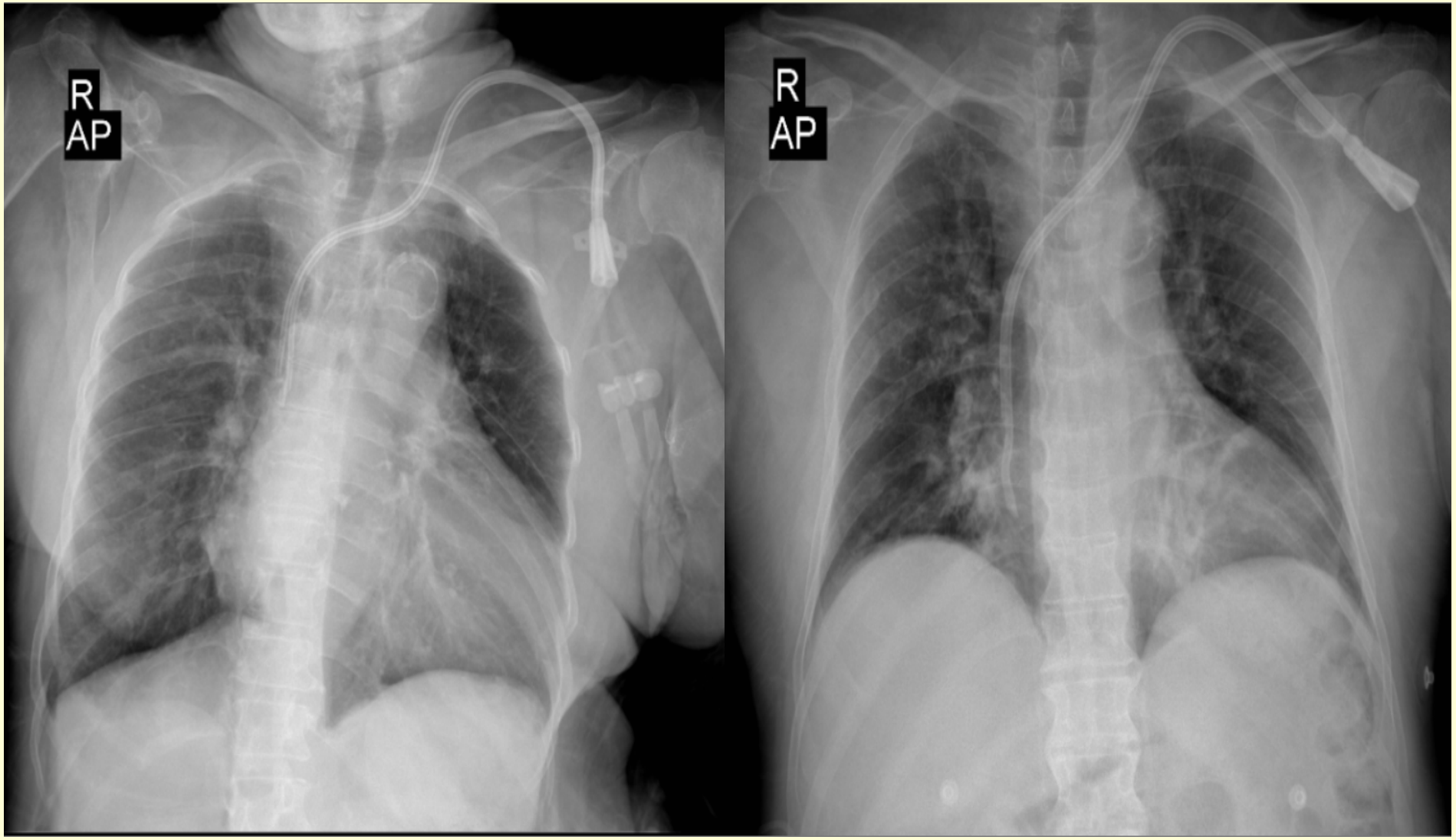
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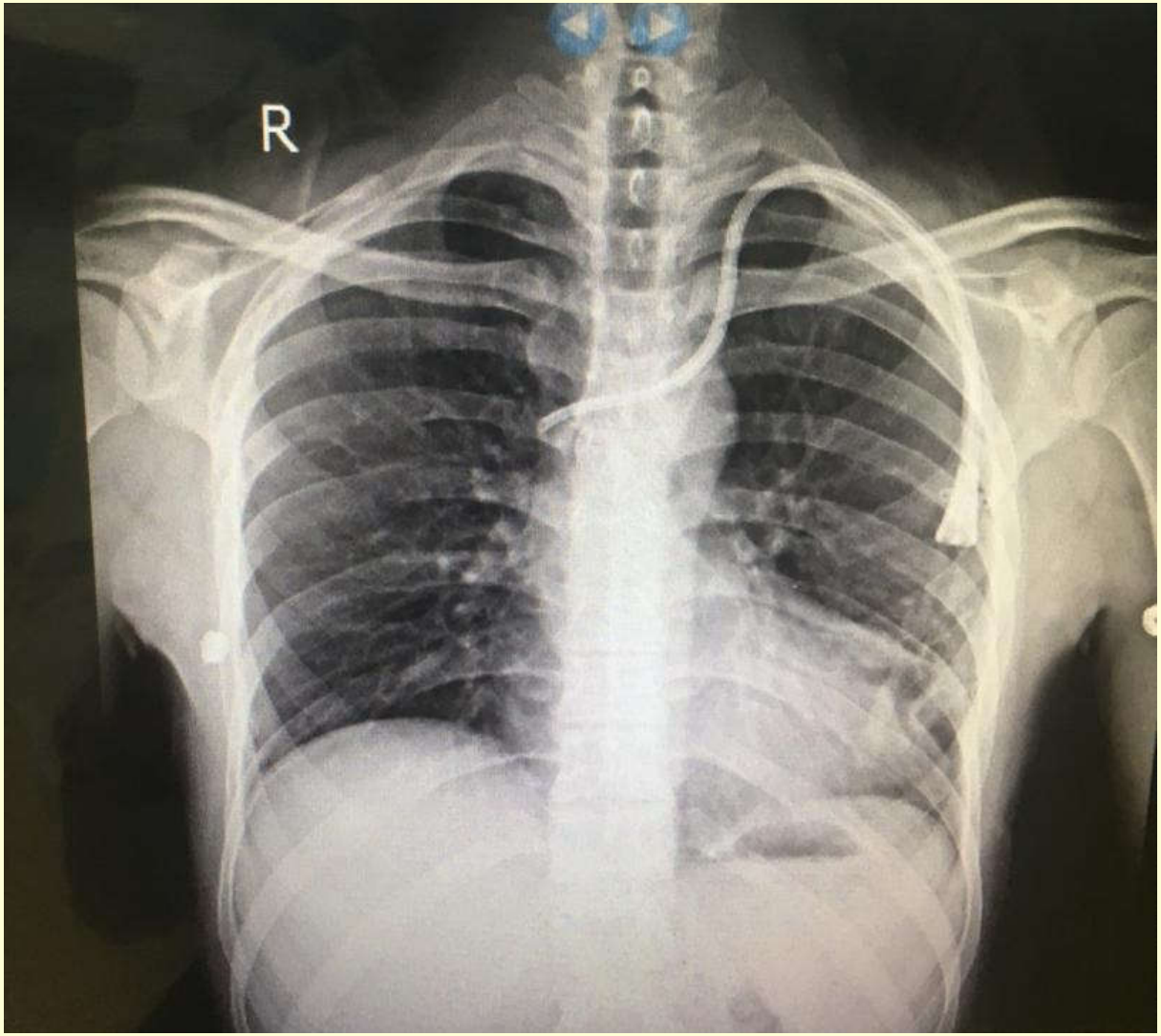
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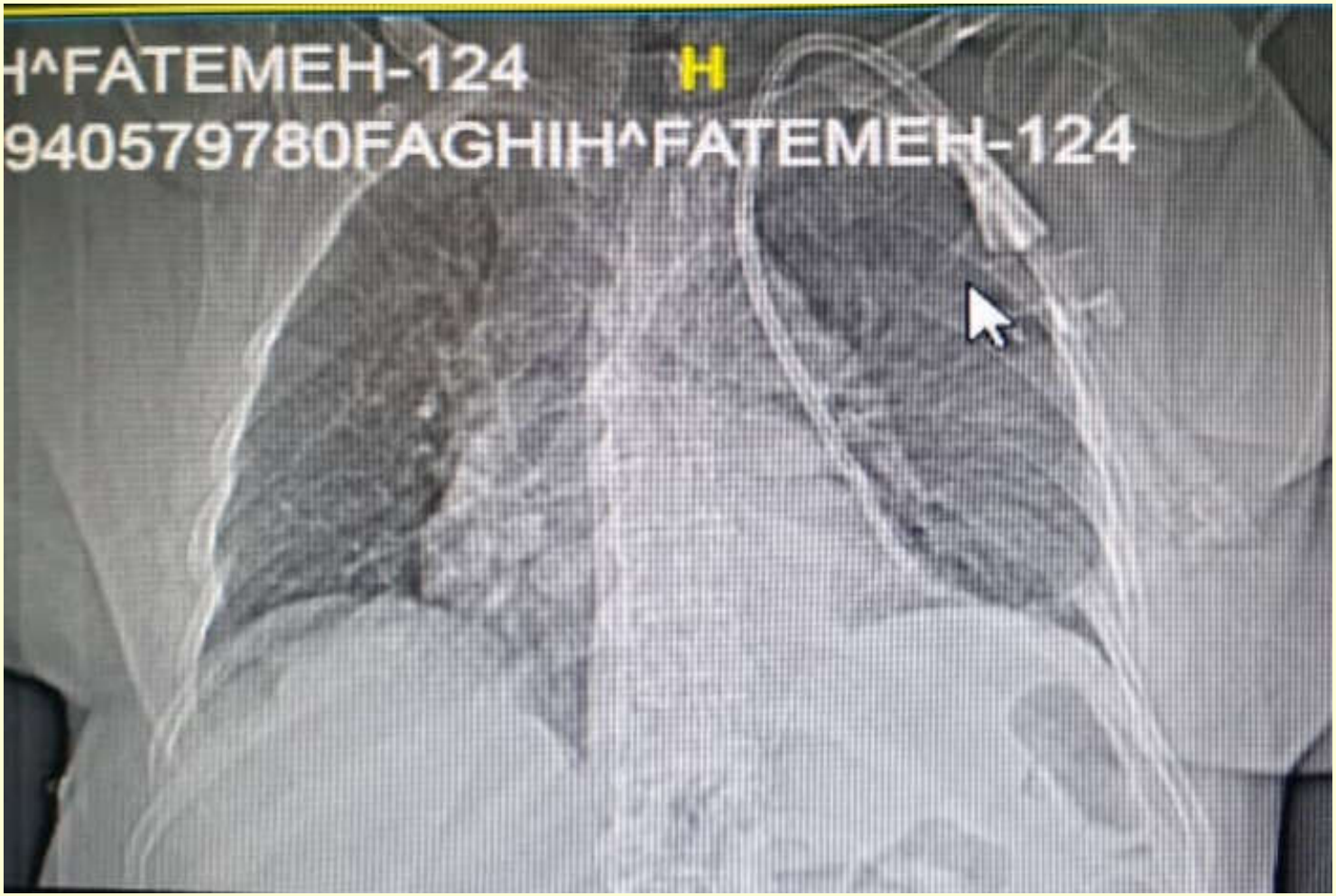
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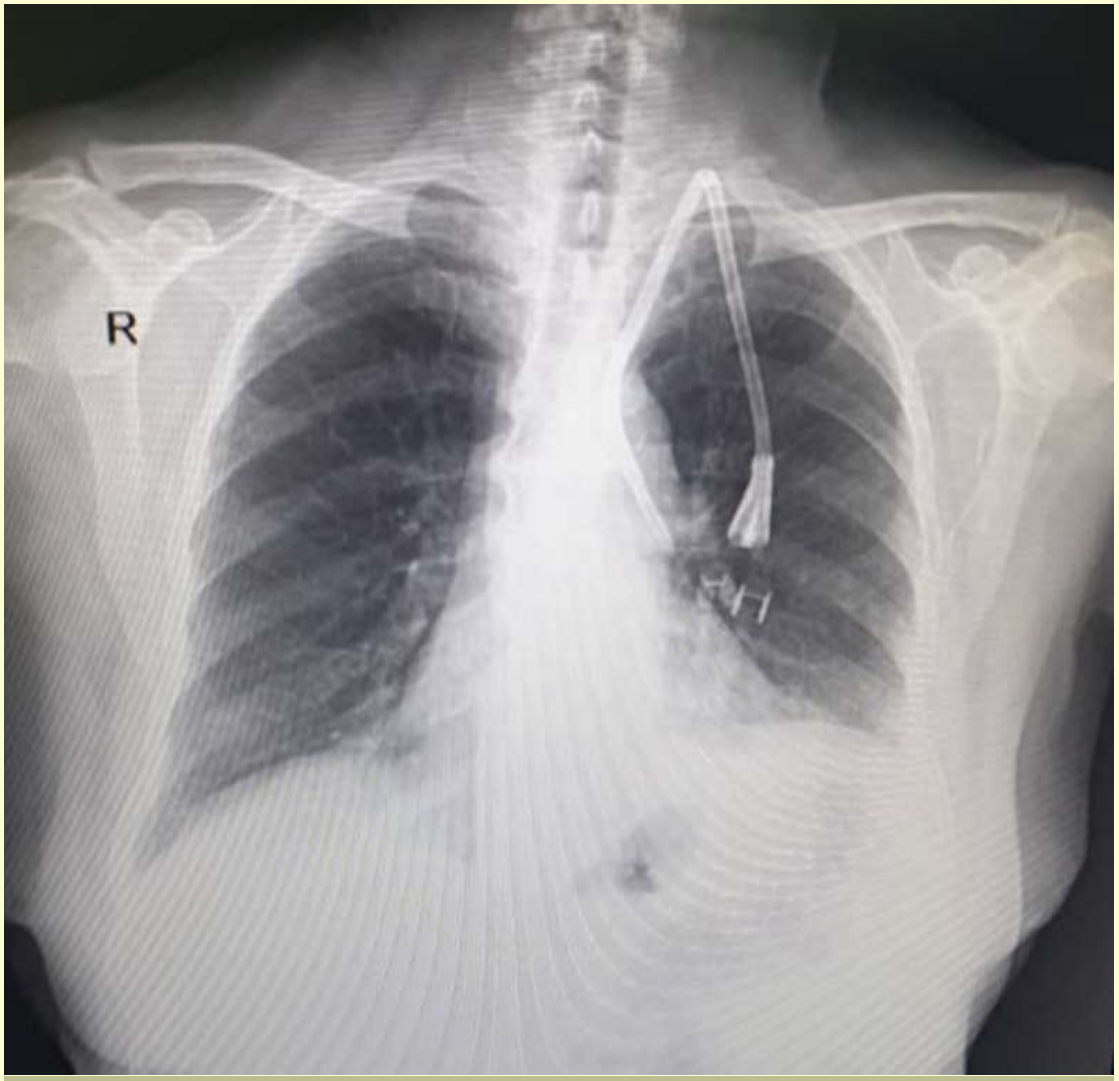


Catheter Tip in Descending Aorta

- ***Nerve injury*** *The brachial plexus is the nerve structure that is most vulnerable during percutaneous catheterization by its large size and proximity to the subclavian vein and artery.*
- ***Guide Wire Embolization***
- ***Air Embolization***

- ***Lymphatic duct Injury***

Cirrhotic patients are more prone to the development of this complication. If a lymphatic leak becomes apparent, the catheter should be removed and a pressure dressing should be applied. Nearly all such leaks resolve spontaneously.

Late Complication

- ***Central venous thrombosis***

  Catheter-associated thrombosis is correlated with the following factors:

  - ***Placement site*** ***The incidence of thrombosis or stenosis is as high as 38% with subclavian vein catheters but less than 10% with internal jugular vein catheters.***
  - ***The more clinically significant implication of catheter-related thrombosis is its association with infection.***

Venous thrombosis should be suspected in patients with tunneled hemodialysis catheters who present

- *arm, neck, or facial swelling, prominent collateral venous patterns*
- *signs or symptoms of embolic complications*
- *unexplained fever*

- *Duplex scanning generally is diagnostic, although venography is required on occasion.*

- ***Central Venous Stenosis***

  Catheter-associated central vein stenosis develops as a result of injury to the intima of the vein by the catheter.
- ***Central vein stenosis can be completely asymptomatic***
- ***Elevation and compression of the upper extremity can occasionally be enough to relieve the edema associated with central venous stenosis***
- ***Angioplasty***

Late Complication

- ***Catheter malfunction***

- ***Catheter malfunction is the most common noninfectious complication of central venous catheterization.***
- ***Malfunction is defined as either (1) failure to achieve a blood flow rate of at least 300 ml/min on two consecutive occasions or (2) failure to achieve a blood flow rate of 200 ml/min on a single occasion***

- ***Prevention*** *no ideal agent was found*
- ***Treatment*** *Local infusion of fibrinolytic agents has been used in the salvage of occluded central venous catheters.* ***Alteplase*** *is the only fibrinolytic agent that is approved for treatment of occluded central venous catheters*

  Techniques developed to mechanically eliminate the fibrin sheath
  - *insertion of a wire snare*
  - *remove the catheter over a wire ,use an angioplasty balloon to rupture the sheath, and replace the catheter over the wire*

Late Complication

- ***Cuffed catheter infection***

Infection is the most common complication of venous catheterization for vascular access, occurring in as many as 30% to 40% of patients:

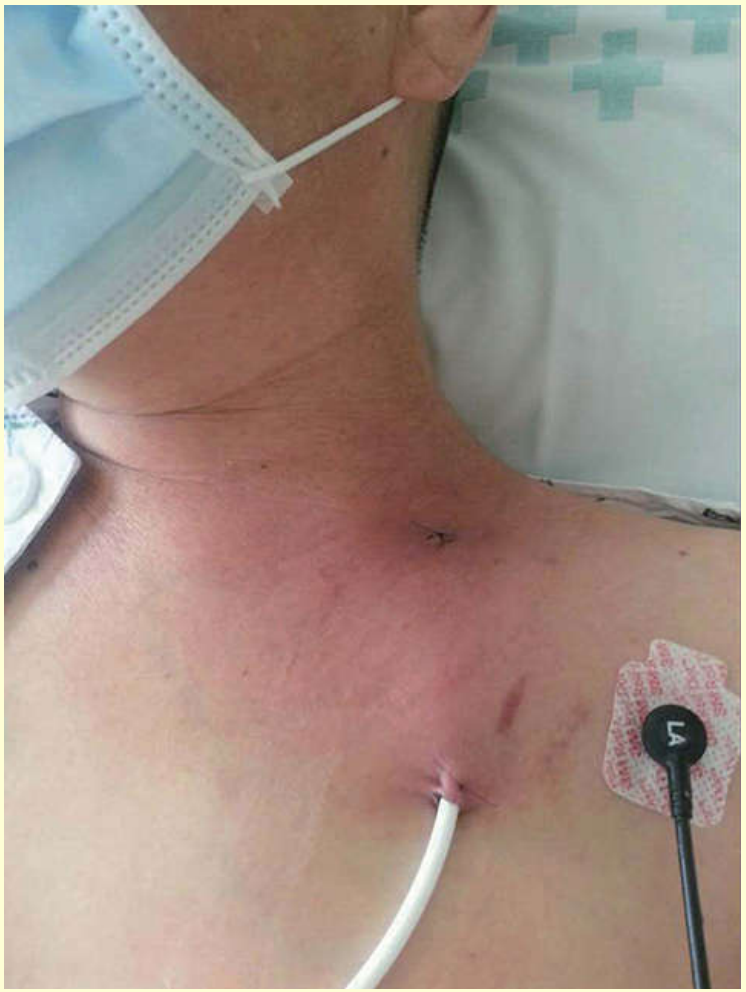
Exit-site infection

Tunnel infection

Systemic line sepsis

Suppurative thrombophlebitis

Exit Site Infection



Tunnel Infection

- ***S. aureus 21% to 43%***
- ***Initial empirical AB therapy → Culture results → Tailored AB therapy***
- ***Evidence of disseminated fungal infection***
- ***Persistent fungemia after catheter removal***

Amphotericin B or Caspofungin

- ***Catheter exit site infections :***

salvaged with topical and systemic antibiotics without the need for catheter replacement.

- ***Tunnel infection or catheter related bacteremia:***

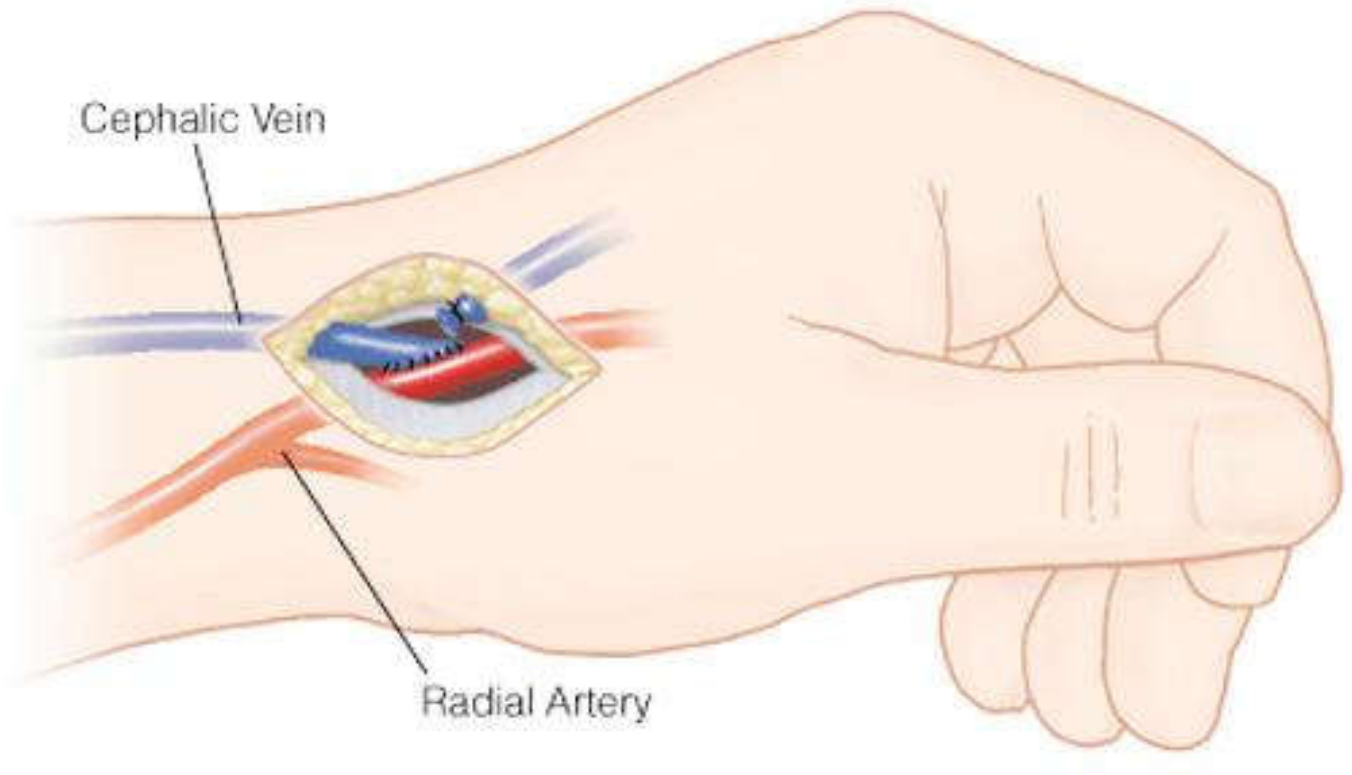
catheter removal with delayed placement of a permanent access.

Long Term Access

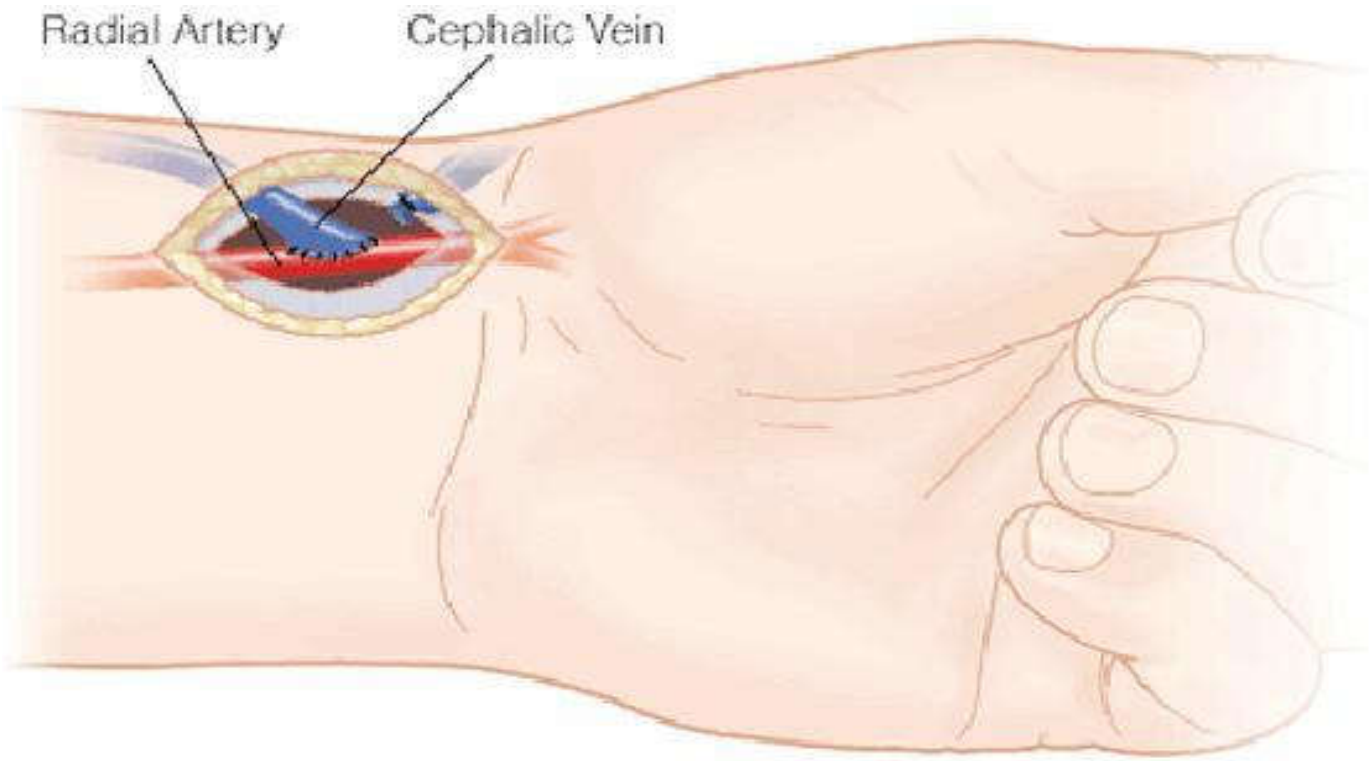
- **Preferred**: ***<u>Autogenous direct Fistulae</u>.***
  wrist (radiocephalic) primary fistula.
  elbow (brachiocephalic) primary fistula.
  transposed brachial basilic vein fistula

- **Acceptable:** ***<u>AVG</u> such as***
  Forearm graft
  Upper-arm graft
  lower-extremity graft
  Chest wall or "necklace" prosthetic graft

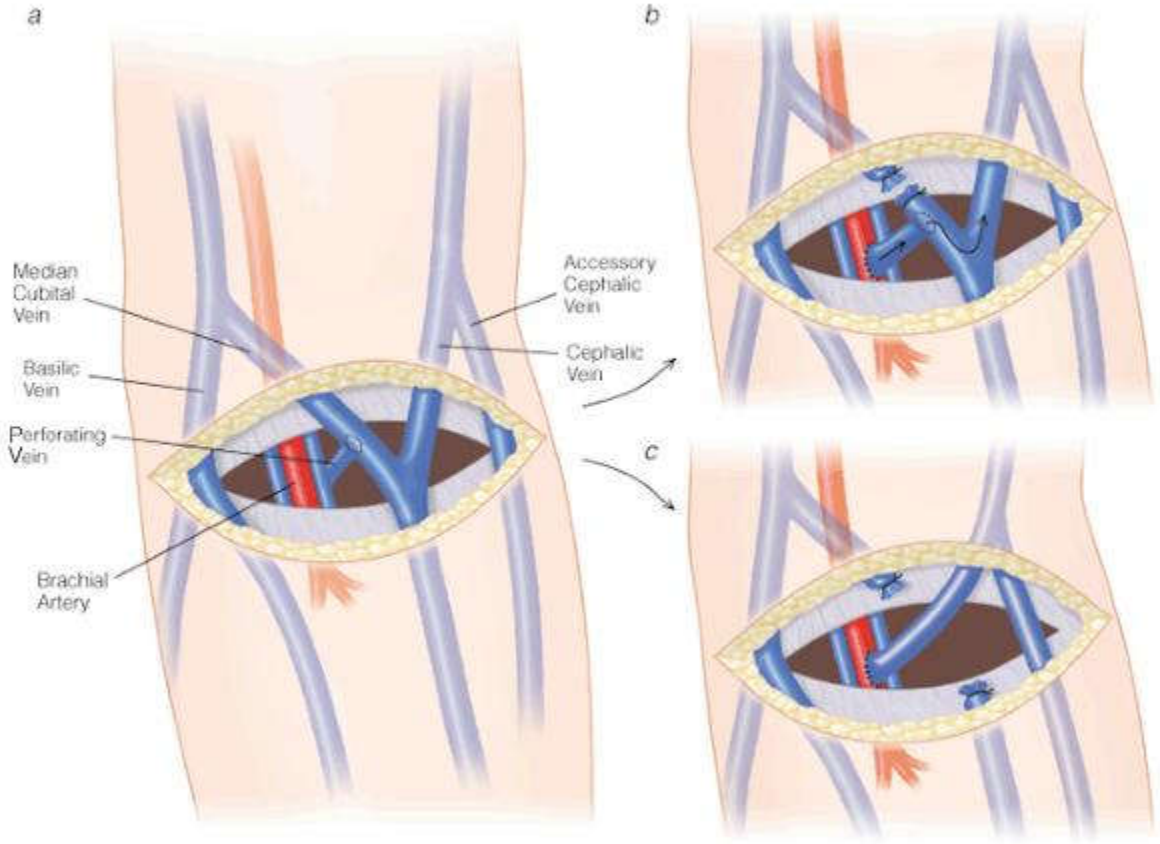
Snuff box Fistula



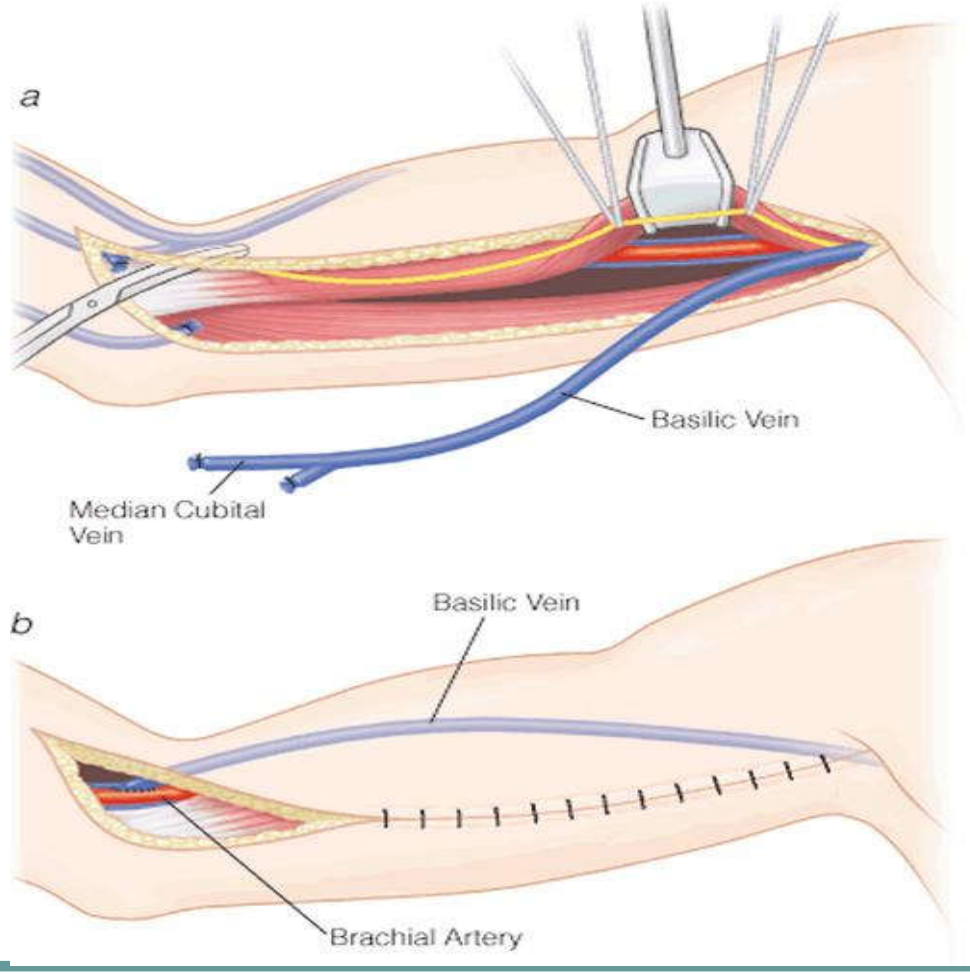
Brescio-Cimino Fistula



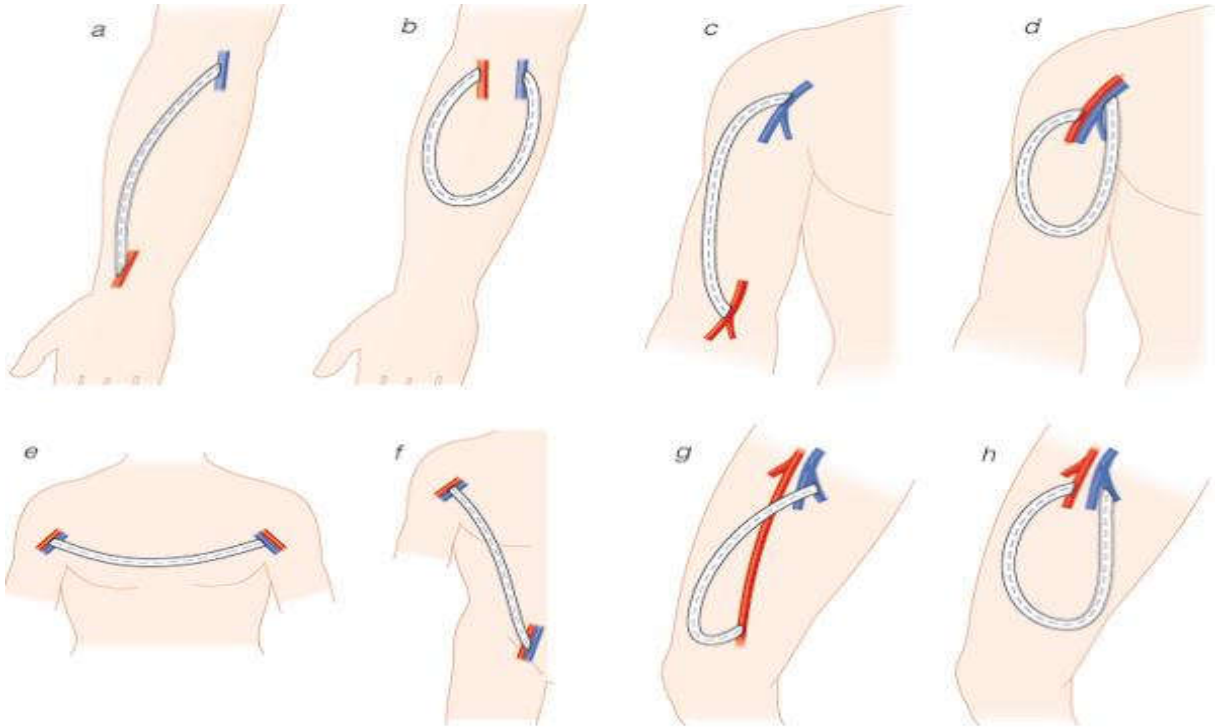
Cubital Brachio-Cephalic Fistula



Brachial-Basilic upper Arm Transposition



Variations Of AV Graft



Basic Principles

- ***A fistula should be placed at least 6 months before the anticipated start of HD treatments.***
- ***A graft should, in most cases, be placed at least 3 to 6 weeks before the anticipated start of HD therapy.***
- ***In patients with CKD stage 4 or 5, forearm and upper-arm veins suitable for placement of vascular access should not be used for venipuncture or for the placement of intravenous catheters, subclavian catheters, or peripherally inserted central catheter lines***

Basic Principles

- ***Non dominant Arm OVER the Dominant Arm***
- ***Distal Location BEFORE Proximal Location***
- ***Autogenous Access is PREFERRED to Prosthetic Access***

Pre Op Evaluation

- **Imaging**

Duplex ultrasound is the preferred method for preoperative vascular mapping. refers to the evaluation of vessels, both arterial and venous, and it should be performed in all patients before placement of an access.

A study using the duplex ultrasound criteria showed a fistula increase from 34% in historical controls to 64%.

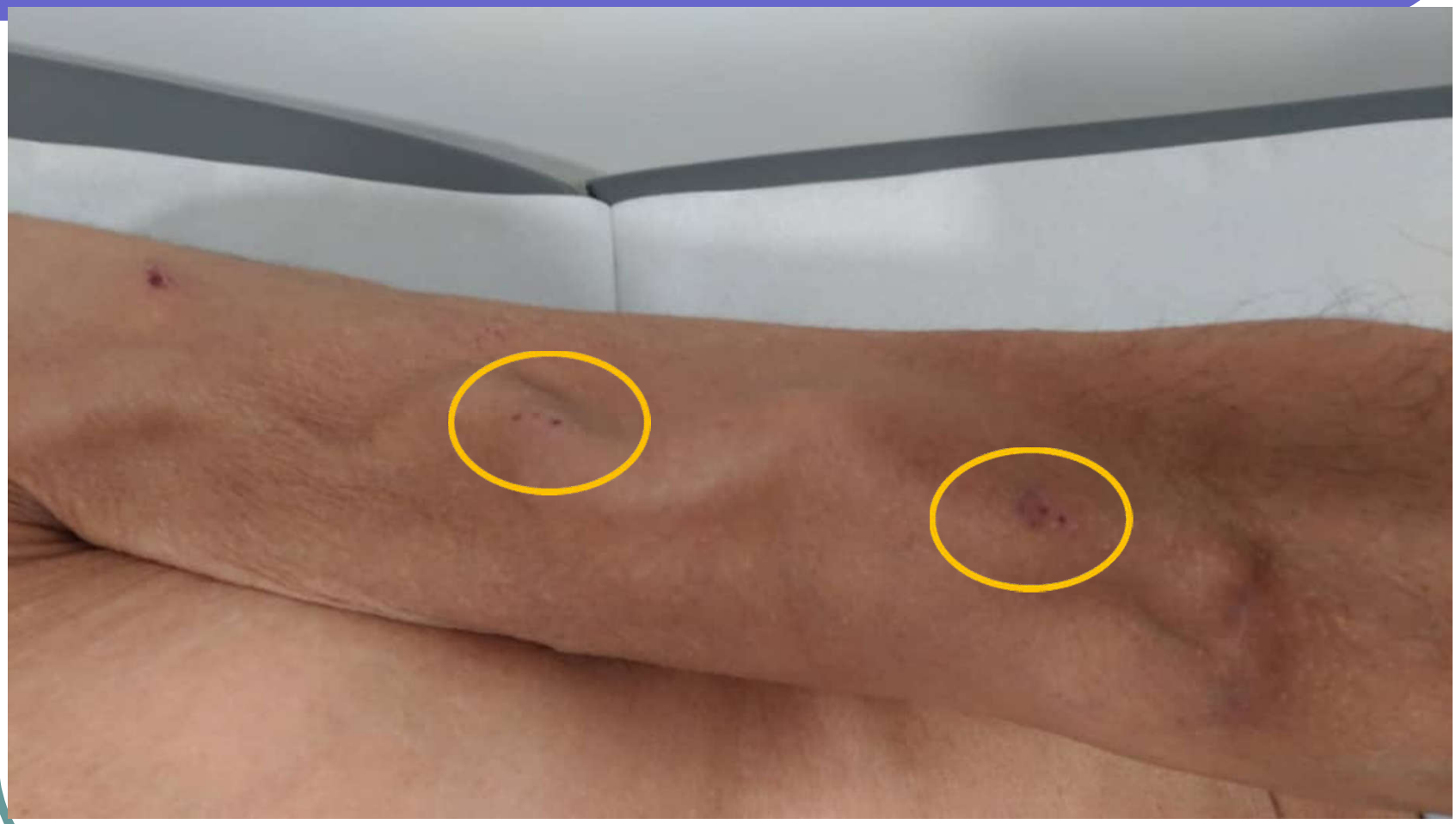
Duplex ultrasound altered the surgical plan based entirely on the surgeon's clinical evaluation, resulting in increased placement of fistulae.

AV ACCESS COMPLICATIONS

- ***Although placement of arteriovenous (AV) hemodialysis access is an important step in the management of patients with end stage renal disease (ESRD), the maintenance and remediation of a failing or thrombosed AV access is almost as important.***
  Dialysis access is a lifeline for ESRD patients, so access maturation and continued function are critical for these patients.

- ***Access Failure***
  - ***Flow Limitation***
    Venous Outflow Stenosis
    Arterial Inflow Stenosis
    Cannulation Location
  - ***Conduit Access Limitation***

- ***Failure to Maturity***



- ***THROMBOSED ACCESS***
  AVF
  AVG

- BLEEDING

- INFECTION

Grade 0: None
Grade 1: Resolved with antibiotic treatment
Grade 2: Loss of AV access because of ligation, removal, and bypass
Grade 3: Loss of limb

- Pseudoaneurysm

- True Aneurysm

- ARHI or steal syndrome

- ***VENOUS HYPERTENSION***

- ***NEUROPATHY***

  Grade 0: Asymptomatic
  Grade 1: Mild—intermittent changes (pain, paresthesia, numbness with sensory deficit)
  Grade 2: Moderate—persistent sensory changes
  Grade 3: Severe—sensory changes, progressive motor loss
  (motion, strength, muscle wasting)

از توجه شما سپاسگزارم

پیروز باشید

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