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Advanced Practice Provider  
June 4  
Courtney Lane, M.D.  
Vascular Access

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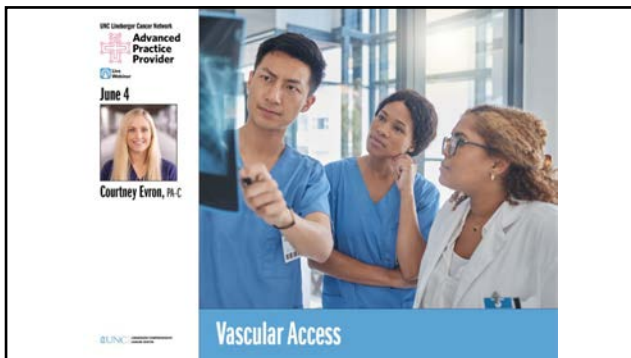
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**Our Presenter**



**Courtney Evron, PA-C**

Courtney Evron, PA-C, has been a PA for 13 years, working in various surgical and procedural subspecialties including labor and delivery, gynecologic oncology, colorectal surgery, and now in vascular interventional radiology here at UNC since 2021.

She was drawn to VIR because of the specialty's ability to treat a diverse range of conditions through minimally invasive procedures spanning nearly every organ system in the body.

Currently, Courtney is the senior APP on the UNC VIR team and performs a wide range of procedures with a primary focus on vascular access.

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**Our Presenter** \_\_\_\_\_

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**Our Presenter** \_\_\_\_\_

**5.** University of Michigan Outstanding Physician Assistant Award  
Recipient 2018-2019

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**Our Presenter** \_\_\_\_\_

**5.** University of Michigan Outstanding Physician Assistant Award  
Recipient 2018-2019

**4.** New York-Presbyterian Hospital PA of the Year Nominee 2016

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5. University of Michigan Outstanding Physician Assistant Award Recipient 2018-2019
4. New York-Presbyterian Hospital PA of the Year Nominee 2016
3. Member of the development committee for the robotic training curriculum for OBGYN residents at New-York Presbyterian Hospital and served as a program facilitator

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3. Member of the development committee for the robotic training curriculum for OBGYN residents at New-York Presbyterian Hospital and served as a program facilitator
2. Member of the development committee for the Enhanced Recovery After Surgery (ERAS) initiative at New York-Presbyterian Hospital
1. UNC Health Excellence in Leadership Award Nominee 2024

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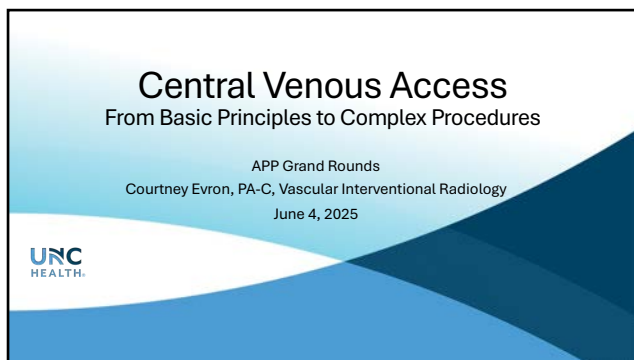
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### Objectives

- Understand anatomy and basic principles of central venous access
- Review and compare types of central venous access devices
- Identify indications and contraindications for each device
- Recognize complications and management strategies
- Explore an advanced/complex central venous access case

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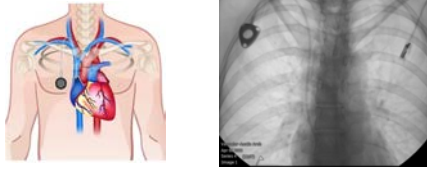
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### What is central venous access?

- Image-guided placement of a catheter with its tip in the region of the cavoatrial junction or right atrium.
- The cavoatrial junction is defined as two vertebral bodies below the carina.



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### Venous Access Anatomy Overview

- Peripheral veins: basilic, cephalic, brachial



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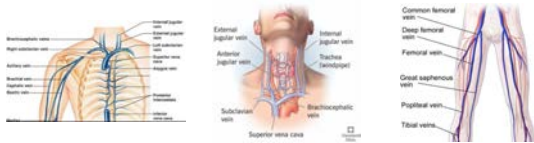
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### Venous Access Anatomy Overview

- Central veins: internal jugular, external jugular, subclavian, femoral



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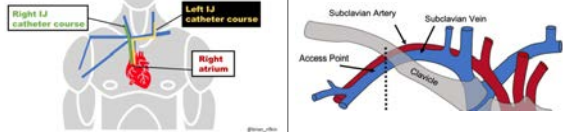
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### Right IJ versus Left IJ catheter



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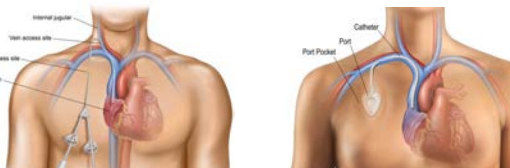
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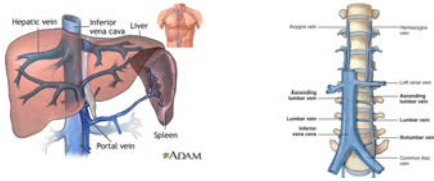
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### Venous Access Anatomy Overview

- Central veins: transhepatic, translumbar



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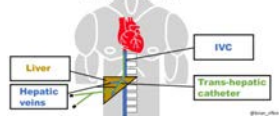
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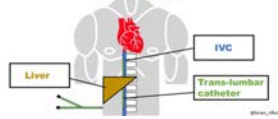
#### Trans-hepatic catheter

Passes through the liver on the right flank or anteriorly into one of the hepatic veins



#### Trans-lumbar catheter

Passes through the dorsal intercostal space of the lumbar region directly into the IVC



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### Types of Central Venous Catheters

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### Peripherally Inserted Central Venous Catheter (PICC)

- Indications: long-term IV medications, TPN, continuous infusions, limited peripheral access
- Contraindications: CKD (GFR <60), small vein size, coagulopathy, prior PICC-associated DVT, crutches, skin infections/burns

- Duration <6 months
- Placement by VAT versus VIR
- Blood cultures negative x 48 hours



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### KDOQI Guidelines for Vascular Access

- Preserve peripheral veins for potential AV access for HD in the future.
- HD catheters carry a much higher risk of infection, dysfunction, and patient mortality when compared to AV fistulas or grafts.

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### Non-Tunneled Central Venous Catheters

- Triple-lumen catheter (TLC)



- Hemodialysis
- Apheresis



- Trialysis



- Duration <14 days
- Inpatient use only
- Can place in bacteremic patients

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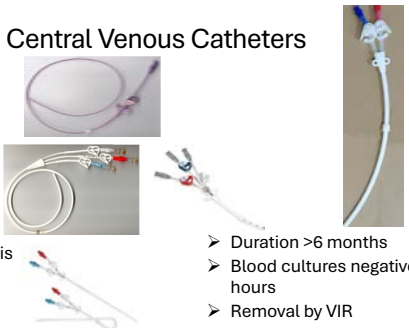
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### Tunneled Central Venous Catheters

- Powerline
- Hickman
- Trifusion
- Hemodialysis
- Apheresis



- Duration >6 months
- Blood cultures negative x 48 hours
- Removal by VIR

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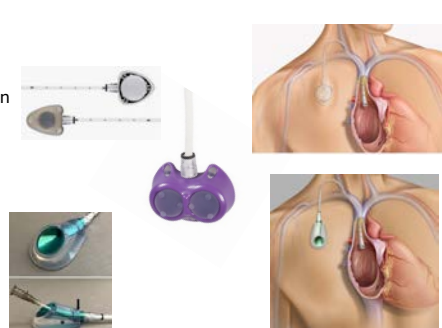
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### Ports

- Single-lumen
- Dual-lumen
- Apheresis



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### Ports

- Indicated for long-term, *intermittent* use
  - Chemotherapy, IV infusions
- Contraindicated in patients requiring continuous or daily infusions



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### Indications for Central Venous Access

- Chemotherapy
- TPN
- Blood products
- IV medications
- IV fluids
- Plasmapheresis
- Hemodialysis
- Diagnostic purposes (establish or confirm a diagnosis or prognosis, monitor response to treatment, repeated blood sampling)

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Device Type	Proposed Duration of Infusion			
	≤5 d	6-14 d	15-30 d	>31 d
Peripheral IV catheter	No preference between peripheral IV and US-guided peripheral IV catheters for use ≤5 d			
US-guided peripheral IV catheter		US-guided peripheral IV catheter preferred to peripheral IV catheter if proposed duration is 6-14 d		
Non-tunneled/acute central venous catheter		Central venous catheter preferred in critically ill patients or if hemodynamic monitoring is needed for 6-14 d		
Midline catheter		Midline catheter preferred to PICC if proposed duration is ≤14 d		
PICC			PICC preferred to midline catheter if proposed duration of infusion is ≥15 d	
Tunneled catheter				PICC preferred to tunneled catheter and ports for infusion 15-30 d
Port				

Legend: Appropriate (Green), Neutral (White), Disagreement (Red), Disagreement (Blue)

Figure 3. Various access device recommendations for infusion of potentially toxic/irritant infusions.

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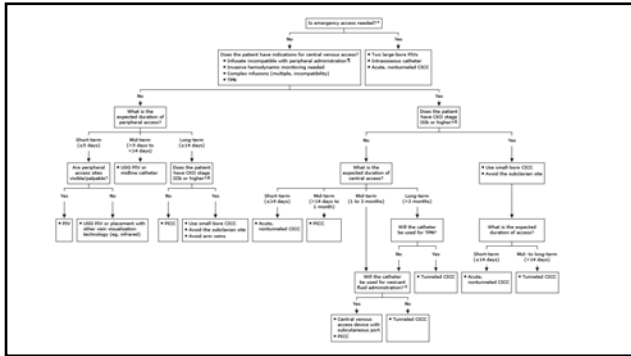
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Poll Question

- 34-year-old female with PMH of IBD s/p multiple abdominal surgeries and bowel resections, now with short gut syndrome requiring long-term TPN for which she will need a catheter to use at home.

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What catheter(s) would be most appropriate for the patient to have at discharge?

- Non-tunneled TLC  0%
- Tunneled CVC  0%
- Port  0%
- PICC  0%
- B and D  0%
- B, C, and D  0%

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### Poll Question

- 67-year-old male with PMH of HTN, CAD, and T2DM who was admitted with sepsis 2/2 MRSA bacteremia and will require several weeks of IV antibiotic treatment.

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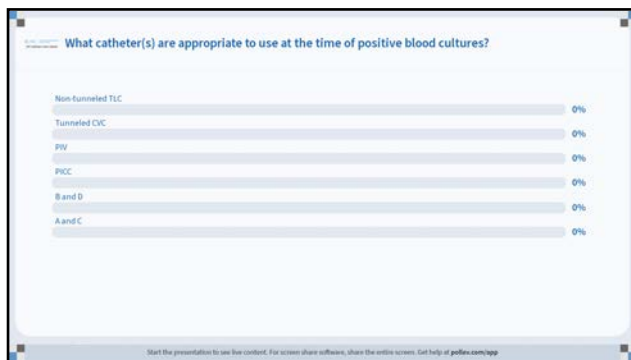
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### Complications

- Procedurally-related (<3%)
  - Injury to surrounding structures
  - Hematoma
  - Perforation
  - Catheter malposition
  - Air embolism
  - Pneumothorax
  - Hemothorax
  - Arrhythmia
- Early and late
  - Infection
  - Catheter malfunction
  - Wound dehiscence
  - Thrombosis/venous occlusion

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**Table 3. Procedure-Associated Bleeding Risk Categorization (L23-38)**

Screening Coagulation Laboratory Test	Procedures
<b>Low bleeding risk</b>	Catheter exchanges (gastrostomy, biliary, nephrostomy, abscess, including gastrostomy/ nephrostomy) (noncontrast)
PT/INR not routinely recommended <sup>1</sup>	Diagnostic arteriography and arterial interventions: peripheral, sheath < 8 F, embolotherapy <sup>2</sup>
Platelet count/Thrombocytopenia: not routinely recommended	Diagnostic venography and select venous interventions: pelvic and extremities
Thrombocytopenia: Thresholds <sup>3</sup>	Dialysis access interventions
• INR corrected to within range of < 2.0-2.5 <sup>4</sup>	Distal joint injections and medial branch nerve blocks (thoracic and lumbar spine) <sup>5</sup>
• Platelet transfusion if < 20 × 10 <sup>9</sup> /L	IVC filter placement and removal <sup>6</sup>
	Lumbar puncture <sup>7</sup>
	Noncontrast chest tube placement for pleural effusion
	Noncontrast venous access and removal (including PICC placement)
	Paracentesis
	Peripheral nerve blocks, joint, and musculoskeletal injections <sup>8</sup>
	Spinal/epidural injection and sacral lateral branch blocks <sup>9</sup>
	Superficial abscess drainage or biopsy (cutaneous, lymph node, soft tissue, breast, thyroid, superficial bone, lig, tendons and bone marrow aspirate)
	Thoracentesis
	Transjugular liver biopsy <sup>10</sup>
	Trigger point injections (including coniforms) <sup>11</sup>
	Unsheathed drainage catheter placement <sup>12</sup>
	Unsheathed venous catheter placement/removal (including ports) <sup>13</sup>

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### Catheter-associated bleeding

- Hold pressure at venotomy (vein entry) site, not at catheter exit site
- Hemostatic agents
  - StatSeal, BloodStop, Gelfoam
- Purse-string suture
- Platelets
- Dialyze



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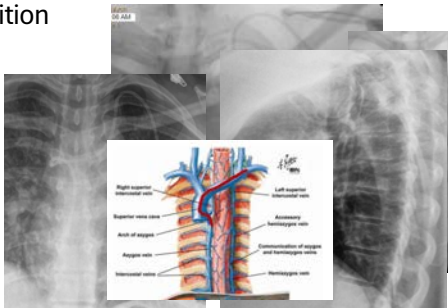
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### Malposition



The diagram labels the following structures: Right superior vena cava, Superior vena cava, Arch of aorta, Azygos vein, Inferior vena cava, Left superior vena cava, Accessory hemiazygos vein, Communication of azygos and hemiazygos vein, and Hemiazygos vein.

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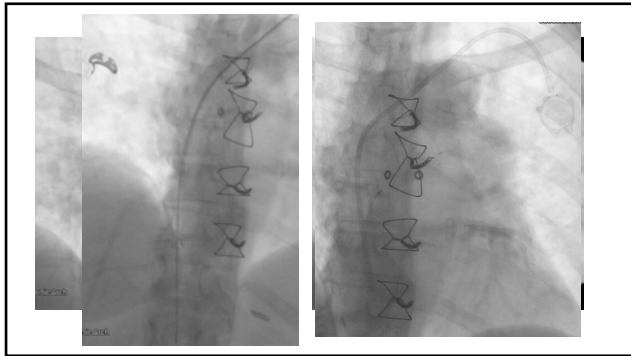
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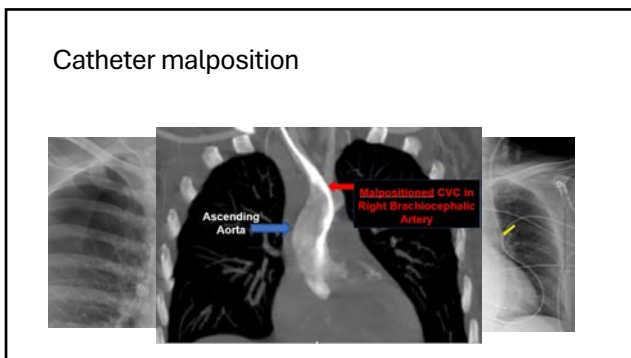
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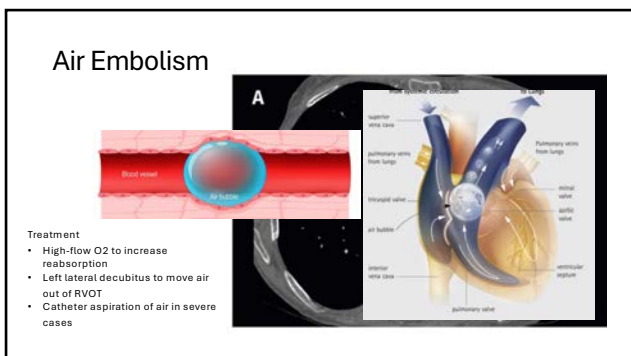
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## Pneumothorax

**Treatment**

- Observation
- Supplemental O2 to increase air reabsorption and lung expansion
- Needle aspiration
- Chest tube placement
- Surgical repair



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## Catheter-related infections

- Bacteremia
- Tunnel site infection
- Port pocket infection

• Catheter tip cultures are generally not recommended.

UNC HEALTH  
Existing Antimicrobial Stewardship Program & Department of Infection Prevention | UNC Hospitals

**Best Practices for Obtaining Blood Cultures in Adults (Stage III)**

**Indications for Blood Cultures**

- Patient has unexplained fever
- New fever in a patient in an Intensive Care Unit
- Suspected endocarditis
- Patient at a high-risk patient
  - No more frequently than every 72 hours for persistent fever unless fever is due to infection
  - Intubation in the patient
- Suspected bacteremia/fungemia
- Consider not obtaining blood cultures in conditions with low probability for bacteremia such as post-op fever after 48 hours in critically ill patient, isolated fever, patients with low severity sepsis, or respiratory pneumonia; in blood cultures in these cases are generally negative.

**Optimal Procedures for Obtaining Blood Cultures**

- The preferred method for obtaining blood cultures is by peripheral venipuncture. These have the lowest rate of false positive cultures.
- **Best practice technique and best practice should be used to obtain blood cultures.** (See [Phlebotomy Services, Blood Culture Collection Policy and Best Practice, Blood Cultures for Adults](#))
- **Always obtain at least 2 sets of blood cultures for adults.**
  - The goal of obtaining a pathogen with blood cultures depends on the volume of blood collected. **At least 10 mL for adults recommended suboptimal volume and significantly decreases sensitivity and the number of blood culture sets performed.** (See [Blood Culture Set Size for Adults](#))
  - If asymptomatic in hospitalized, asymptomatic outpatients at least three sets from different sites recommended for time to treat and time.
  - Obtain blood cultures prior to starting antibiotic therapy.
  - In a hospitalized patient, obtain single blood cultures in a stable patient with persistent fever to help establish source and duration not recommended.
  - Do NOT obtain blood cultures on a peripheral intravenous catheter (PIC) or arterial catheter, even when the catheter is newly placed (PIC is associated with a higher rate of false positive cultures).
  - Higher rate of false positive cultures.
  - A blood culture set consists of two bottles. For the maximum sensitivity, use two bottles. For the lowest rate of false positive cultures, use one bottle.

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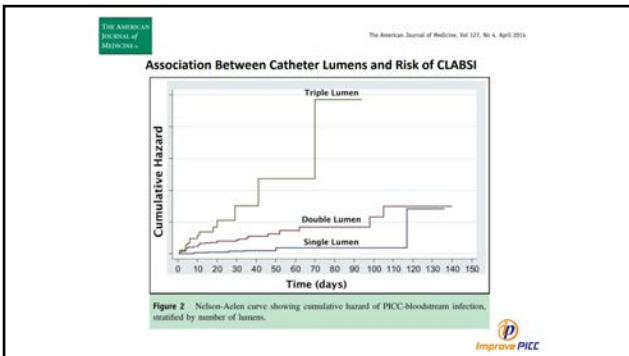
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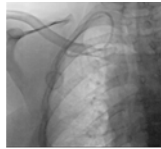
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### Catheter malfunction

- Not flushing
  - Change caps, tPA, CXR to assess position
- No blood return or low flows at dialysis
  - tPA, re-access (port), positional changes (HD catheters), CXR to assess position, exchange catheter +/- fibrin sheath disruption




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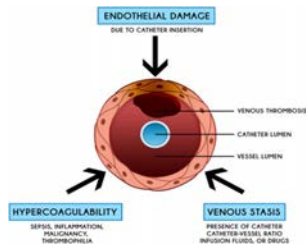
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### Thrombosis

- Placement of a CVC activates venous stasis and endothelial damage involved in Virchow's triad.
- Risk of thrombosis increases with longer catheter dwell times, repeated catheter placements, and size of catheter lumen.




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### Catheter Size and Number of Lumens




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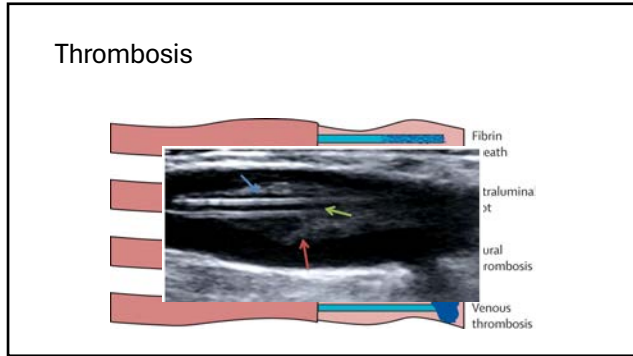
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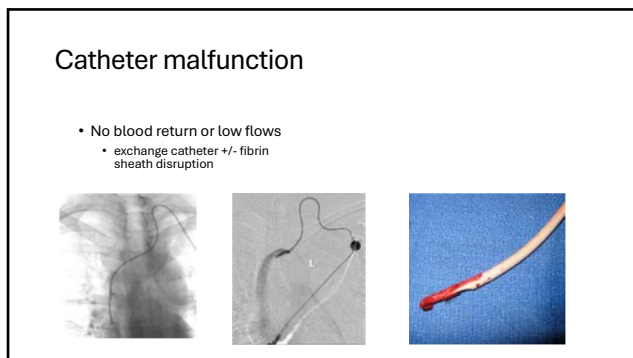
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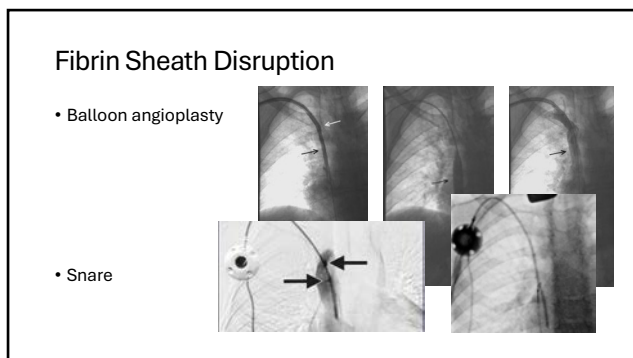
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### Presentation of catheter-related thrombosis

- Asymptomatic (majority)
- Swelling of face/neck/limb
- Erythema of face/neck/limb
- Shortness of breath
- Localized pain/numbness
- Superficial venous distension
- Inflammation/phlebitis
- Difficulty with flushing or aspirating
- Incidental finding on CT imaging

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### SVC Syndrome



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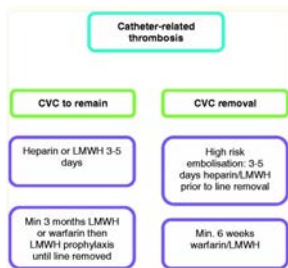
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### Management of catheter-related thrombosis



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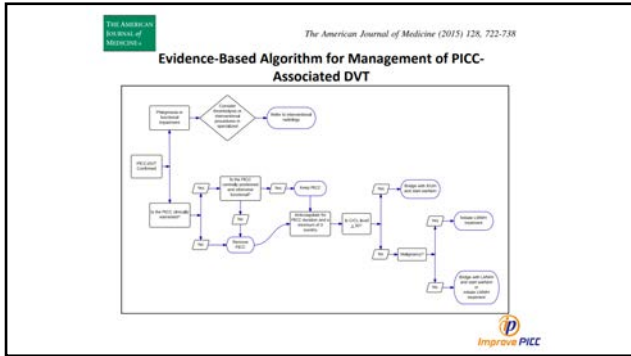
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**Poll Question**

- 51-year-old female with PMH of breast cancer undergoing chemotherapy via a RIJ single-lumen port that was placed in 2022 who presents from the infusion center after multiple nurses were unable to get blood return from the port. The port flushes well without pain or swelling. tPA was given x 2 with no improvement.

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What is the next best step for this patient?

- Administer scheduled infusion since catheter flushes well 0%
- Place order for port removal and new port placement with VIR 0%
- CKR to assess position 0%
- Start therapeutic anticoagulation and administer upcoming scheduled infusions via a PIV for at least 3 months 0%

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### Complex Central Venous Access

- Patients with chronic central occlusions, altered anatomy
- Requires central venous recanalization
  - Angioplasty, stenting, blunt/sharp/laser recanalization
- Diagnostic imaging
  - CT venogram chest (HERO protocol)
  - PVL
  - Venogram

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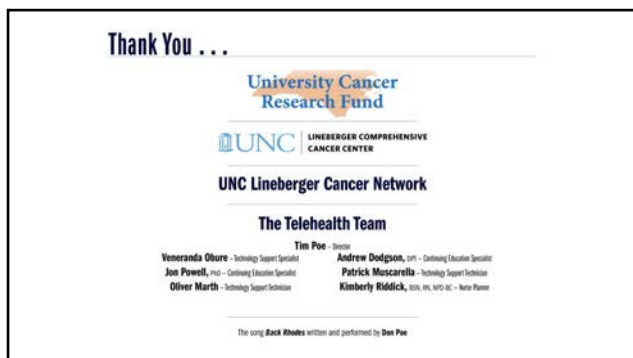
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	<b>Research to Practice</b>	<b>June 25</b> 12:00 PM
<b>Updates on the Management of Early Stage and Metastatic Breast Cancer</b> <b>Jeffrey Aldrich, MD</b>		
	<b>Patient-Centered Care</b>	<b>July 9</b> 12:00 PM
<b>Social Determinants of Health</b> <b>Danielle Rogers, BSN, RN</b>		

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