

Costal Emergency Medicine Conference

**“You have a what, inside you?”**

Less than mainstream  
medical devices  
encountered in the ED.

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Associate Professor  
Duke University Medical Center

**Objectives**

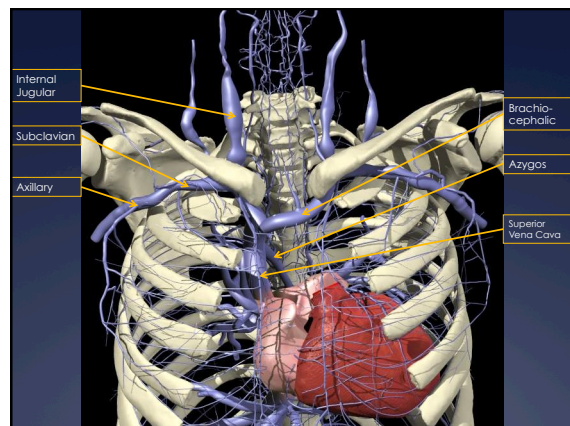
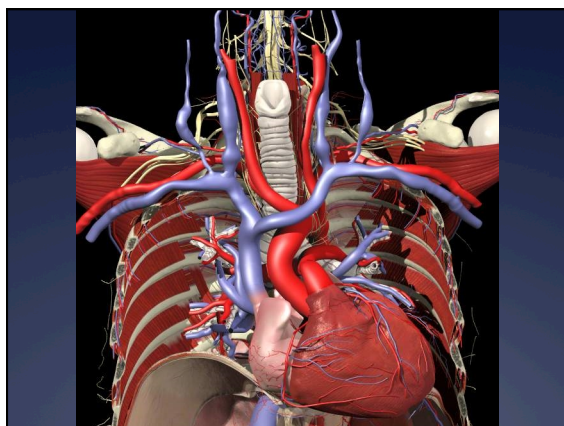
- \* Review short, medium and long term vascular access devices
- \* Understand common complications associated with vascular access devices
- \* Understand how to appropriately utilize a vascular access device in an emergency
- \* Review the function of Pacemakers and AICD devices
- \* Understand common complications associated with pacemakers and AICD devices

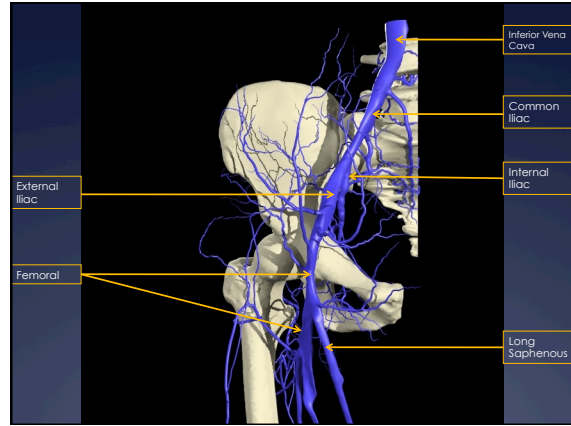
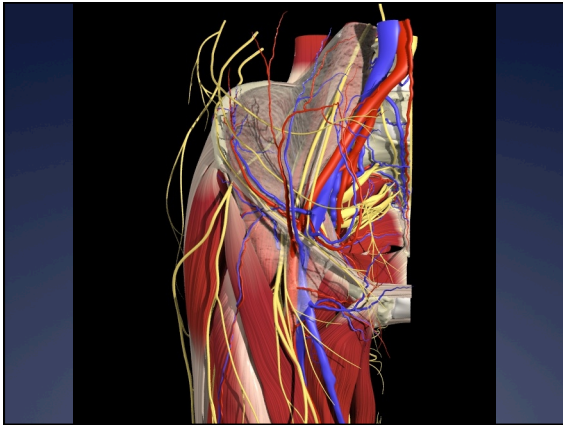
**Deciphering Medical Devices**

- \* **What does it do?**
  - \* Basic description
  - \* Typical use
  - \* Basic description of function
- \* **What does it look like?**
- \* **What can go wrong?**
- \* **How do I fix it?**

**Vascular Access Devices**

<b>Short Term</b> <ul style="list-style-type: none"><li>• Peripheral IV</li><li>• Percutaneous Multilumen Central Catheters</li></ul>	<b>Medium Term</b> <ul style="list-style-type: none"><li>• Midline Catheters</li><li>• PICC Lines</li></ul>	<b>Long Term</b> <ul style="list-style-type: none"><li>• Tunneled RA Catheters</li><li>• Implantable Ports</li></ul>
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### Percutaneous Multiflumen Central Catheters

- Short Term Use (< week)
  - IV medications
  - Blood products
  - CVP monitoring
  - Hyperalimentation
- Description
  - Silicone or polyurethane
  - Over the wire insertion
  - 1 to 5 lumens
  - 15 to 30 cm in length
- Complications
  - Overall = 3.5%
  - Pulmonary
  - Vascular/Bleeding
  - Infectious
  - Neurologic

### Percutaneous Multiflumen Central Catheters

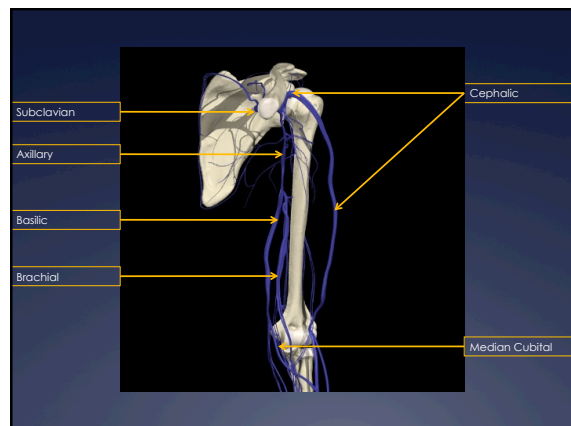
#### Emergency Access

- Swab catheter/cap junction with povidone-iodine
- Clamp catheter
- Replace cap if needed using aseptic technique
- Attach 10 cc syringe with saline flush
- Open clamp
- Aspirate 5 cc and discard then flush with 5 cc of normal saline
- Administer medication
- Flush with 5 cc of normal saline after every use
- After use heparin flush if available
- Close clamp
- Notify ED staff that catheter was accessed and type of flush used

Double Lumen			
Lumen No./Hub Color	Port	Suggested Utilization	
1	Distal	whole blood or blood product delivery and sampling; any situation requiring greater flow rate; CVP monitoring; medication delivery	
2	Proximal	medication delivery; acute hyperalimentation	
Triple Lumen			
Lumen No./Hub Color	Port	Suggested Utilization	
1	Distal	whole blood or blood product delivery and sampling; any situation requiring greater flow rate; CVP monitoring; medication delivery	
2	Mid	medication delivery; acute hyperalimentation	
3	Proximal	medication delivery	


### Percutaneous Multiflumen Central Catheters

- Catheter Dislodgement
  - Stop on-going infusions
  - Clamp all lumens
  - Do not remove catheter if still in place
  - Cover insertion site with sterile gauze
  - Apply direct pressure at site for 10 minutes if bleeding
  - Transport to ED
- Catheter Sheared / Cut
  - Apply clamp proximal to the cut
  - Cover insertion site with sterile gauze
  - Apply direct pressure at site for 10 minutes if bleeding
  - Transport to ED
- Infection at Catheter Site
  - Do not use catheter unless life threat is present
  - Do not remove catheter
  - Provide supportive care
  - Transport to ED



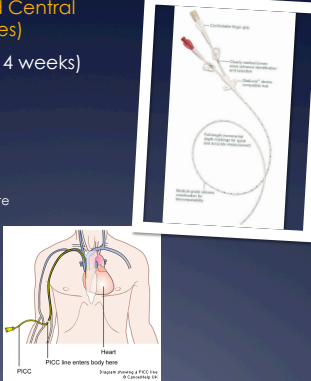
### Midline IV Catheters

- Medium Term (2 to 4 weeks)
- Limited IV medications
- Not used for:
  - Chemotherapy
  - Hyperalimentation
  - High osmolality medications
- Description
  - Silicone or polyurethane
  - Open tip or Groshong
  - Introduced with a stylet via introducer sheath
  - Tip rests in proximal arm veins
  - 1 to 2 lumens
  - 20 cm in length
- Complications
  - Vascular/Bleeding
  - Infectious



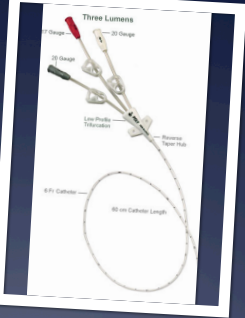
### Peripherally Inserted Central Catheters (PICC Lines)

- Medium Term (2 to 4 weeks)
- IV medications
- Chemotherapy
- Hyperalimentation
- Description
  - Silicone or polyurethane
  - Open tip or Groshong
  - Introduced via guide wire
  - Tip rests in SVC
  - 1 to 3 lumens
  - 50 to 60 cm in length
- Complications
  - Vascular/Bleeding
  - Infectious



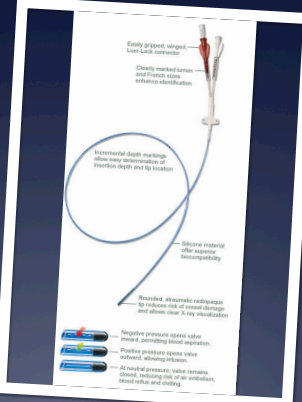
### Midline IV Catheters & PICC Lines

- Emergency Access
  - Swab catheter/cap junction with povidone-iodine
  - Clamp catheter (open tip only)
  - Replace cap if needed using aseptic technique
  - Attach 10 cc syringe with saline flush
  - Open clamp (if present)
  - Aspirate 5 cc and discard then flush with 5 cc of normal saline
  - Administer medication
  - Flush with 5 cc of normal saline after every use
  - After use flush with 10 cc normal saline
  - Close clamp
  - Notify ED staff that catheter was accessed and type of flush used

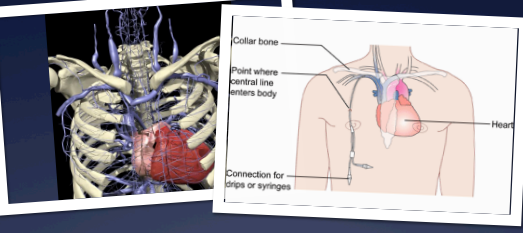


### Groshong Tip Catheters

- No clamping
- No Heparin
- Use 10 cc syringe and normal saline flush
- Aspirate & flush 20 cc of normal saline




### Tunneled Central Venous Catheters



• Broviac	• Hickman	• Hemocath/Permacath
• single lumen	• 1 or 2 lumen	• 2 lumen
• 1.0 mm ID	• 1.6 mm ID	• 2.2 mm ID

### Tunneled Central Venous Catheters

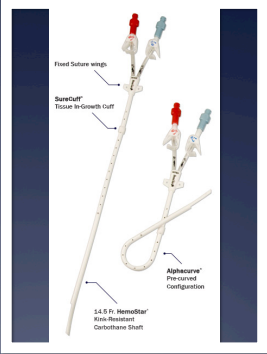
- Long Term (1 year)
- IV medications
- Blood products
- Chemotherapy
- Dialysis
- Hyperalimentation
- Description
  - Silicone
  - Over the wire insertion
  - 1 to 3 lumens
  - Open ended or Groshong
- Complications
  - Pulmonary
  - Vascular/Bleeding
  - Infectious
  - Neurologic



### Tunneled Central Venous Catheters

**Emergency Access**

- Swab catheter/cap junction with povidone-iodine
- Clamp catheter
- Replace cap if needed using aseptic technique
- Attach 10 cc syringe
- Open clamp
- Aspirate 5 cc and discard then flush with 5 cc of normal saline
- Administer medication
- Flush with 5 cc of normal saline after every use
- After use heparin flush if available
- Notify ED staff that catheter was accessed and type of flush used



### Implantable Vascular Access Devices

**Long Term (1 year)**


- IV medications
- Blood products
- Chemotherapy
- Dialysis
- Hyperalimentation

**Description**

- Silicone catheter
- Port
- 1 to 2 lumens
- Open ended or Groshong

**Complications**

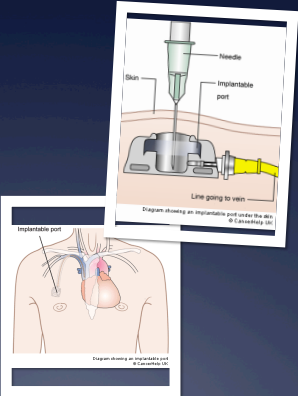
- Pulmonary
- Vascular/Bleeding
- Infectious
- Neurologic



### Implantable Vascular Access Devices

**Emergency Access**

- Clean skin with povidone-iodine solution
- Attach 19 or 22 gauge Huber (non-coring) needle to extension tube with clamp and 10 cc syringe
- Access port at 90 degree angle
- Open clamp
- Aspirate 5 cc and discard then flush with 5 cc of normal saline
- Apply antibiotic ointment to puncture site and stabilize Huber needle with gauze dressing
- Administer medication
- Flush with 5 cc of normal saline after every use
- After use heparin flush if available
- Notify ED staff that catheter was accessed and type of flush used



### Flushing Vascular Access Devices

	After Medication	After Use
Percutaneous Multilumen CVC	5 cc saline	5 cc heparin (100 U/ml)
Midline or PICC	5 cc saline	10 cc saline
Tunneled CVC	5 cc saline	5 cc heparin (100 U/ml)
Groshong Catheters	5 cc saline	10 cc saline
Implantable Venous Access Devices	10 cc saline	5 cc heparin (100 U/ml)

- Always use a 10 cc syringe to flush
- Flush gently
- Notify ED staff immediately of VAD use, type and quantity of flush

### Cardiac Pacemakers

**Function**

- Provide an electrical stimulus to initiate mechanical contraction

**Description**

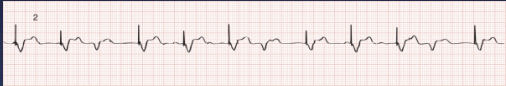
- Implanted in the chest wall
- Weigh < 30 gm
- Components
  - Pulse Generator
  - Battery
  - Leads
- Life span = 4 to 10 years
- Leads may go to the atrium, ventricle or both chambers
- Rate is usually set between 60 and 80 beats per minute



### Cardiac Pacemakers

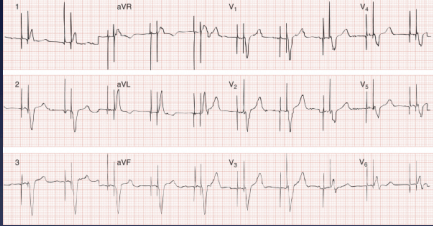
I	II	III	IV	V
Chamber Paced	Chamber Sensed	Response to Sensing	Rate Modulation Programmability	Antifibrillation Features
0 - None	0 - None	0 - None	0 - None	0 - None
A - Atrium	A - Atrium	I - Inhibited	I - Inhibited	P - Pacing
V - Ventricle	V - Ventricle	T - Triggered	M - Multiple	
D - Dual	D - Dual	D - Dual	C - Communicating	S - Shock
			R - Rate Modulation	D - Dual





**Normal VVI Pacemaker**

- Pacemaker is set at 75 beats/min
- Pacemaker spike precedes QRS
- Note intrinsic QRS complexes

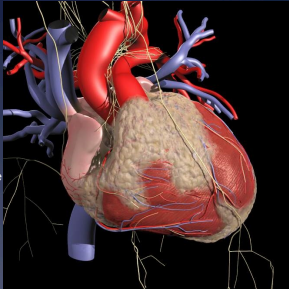


**Normal DDD Pacemaker**

- Note each QRS is preceded by 2 pacer spikes
- Pacing of the RV produces QRS with left bundle branch morphology

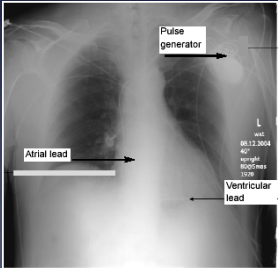
**Pacemaker Complications**

- Failure to Pace
- Failure to Sense
- Failure to Capture
- Inappropriate Pacemaker Rate
- Other



**Failure to Pace**

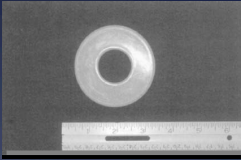

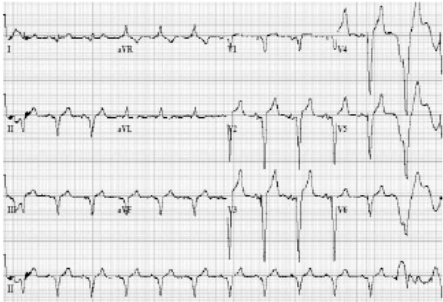
- No pacemaker spikes despite an intrinsic rate below threshold
- Common Causes
  - Lead disconnection or fracture
  - Battery depletion
  - Component failure
  - Oversensing



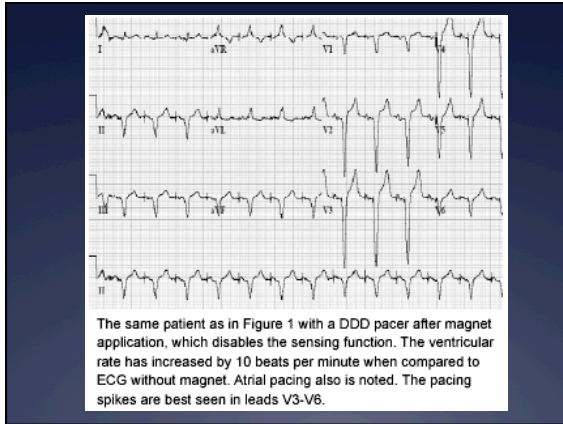
Chest radiograph of a 68-year-old male after a DDD pacemaker is placed for complete heart block.

**Magnet Use to Evaluate Failure to Pace**

- Magnet is used to turn on asynchronous mode
- Ring magnet triggers reed switch
- May also use magnet to reset runaway pacer

A 68-year-old male with ventricular pacing after placement of a DDD pacemaker. Note the pacer spikes that precede the wide QRS complex. The pacing spikes are best seen in leads V3-V6.



### Failure to Sense

- Constant pacemaker spikes despite intrinsic cardiac activity
- Common Causes
  - Lead dislodgement or fracture
  - Fibrosis at the lead tip
  - Battery depletion
  - External interference
  - Low amplitude cardiac signal

Pacemaker, dual-chamber  
Dual-chamber pacemaker device

### Failure to Capture

- Appropriate pacemaker spikes without subsequent cardiac activity
- Common Causes
  - Lead dislodgement or fracture
  - Fibrosis at the lead tip
  - Battery depletion
  - Metabolic abnormalities
  - Antiarrhythmic medications

Lidocaine  
Flecainide  
Hyperkalemia

### Inappropriate Pacemaker Rate

- Extremely rare event with modern devices
- Usually in DDD type pacers
- Endless loop reentry tachycardia

MailOnline  
How listening to an iPod could stop your pacemaker working

### Other Complications

- Infections
  - 1 to 15%
  - S. aureus
- Cardiac perforation
- Pericarditis
- Vessel injury
- Venous thrombosis

### Automatic Implantable Cardiac Defibrillator


**Function**  
• Automatic defibrillation of malignant ventricular arrhythmias

**Description**  
• Implanted in the chest wall  
• Weigh 40-70 gm  
• Components  
    • Pulse Generator  
    • Battery  
    • Leads  
• Life span = 4 to 10 years  
• Leads go to the ventricle and in some cases also the atrium

MARQUIS DR  
Medtronic  
MARQUIS DR  
MODEL 7274  
VVE-DDDR

### AICD Complication

- Inappropriate Shock
  - 35%
  - Misinterpretation
- Pacemaker Interference
- Lead Dislodgement / fracture
- Infection
- Inadvertent Inactivation



### AICD Skin Erosion

Site Infection  
Pressure Necrosis

Questions?