

Costal Emergency Medicine Conference

“You have a what, inside you?”

Less than mainstream
medical devices
encountered in the ED.

Eric Ossmann, MD, FACEP
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

Short Term

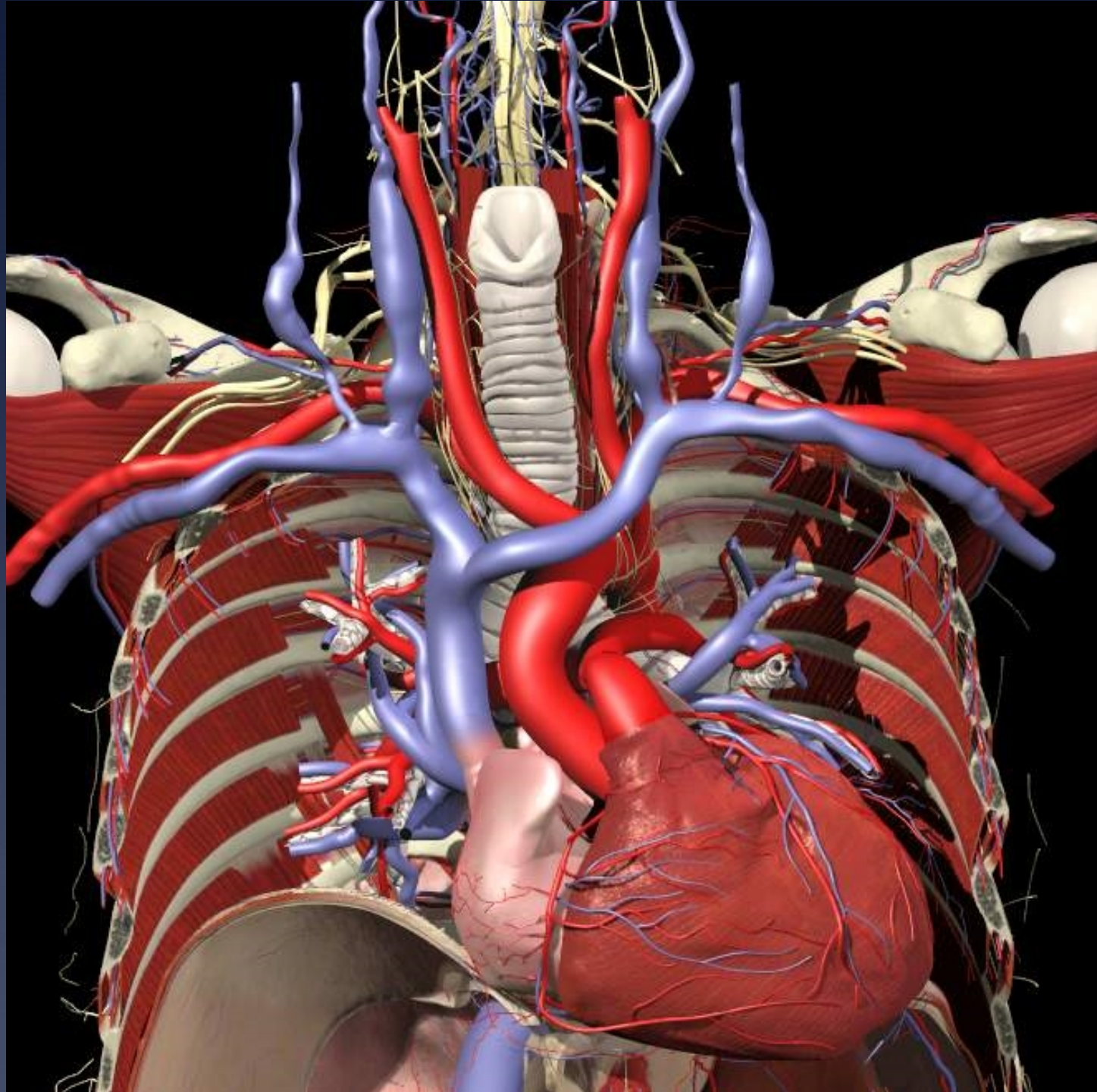
- Peripheral IV
- Percutaneous Multilumen Central Catheters

Medium Term

- Midline Catheters
- PICC Lines

Long Term

- Tunneled RA Catheters
- Implantable Ports



Internal
Jugular

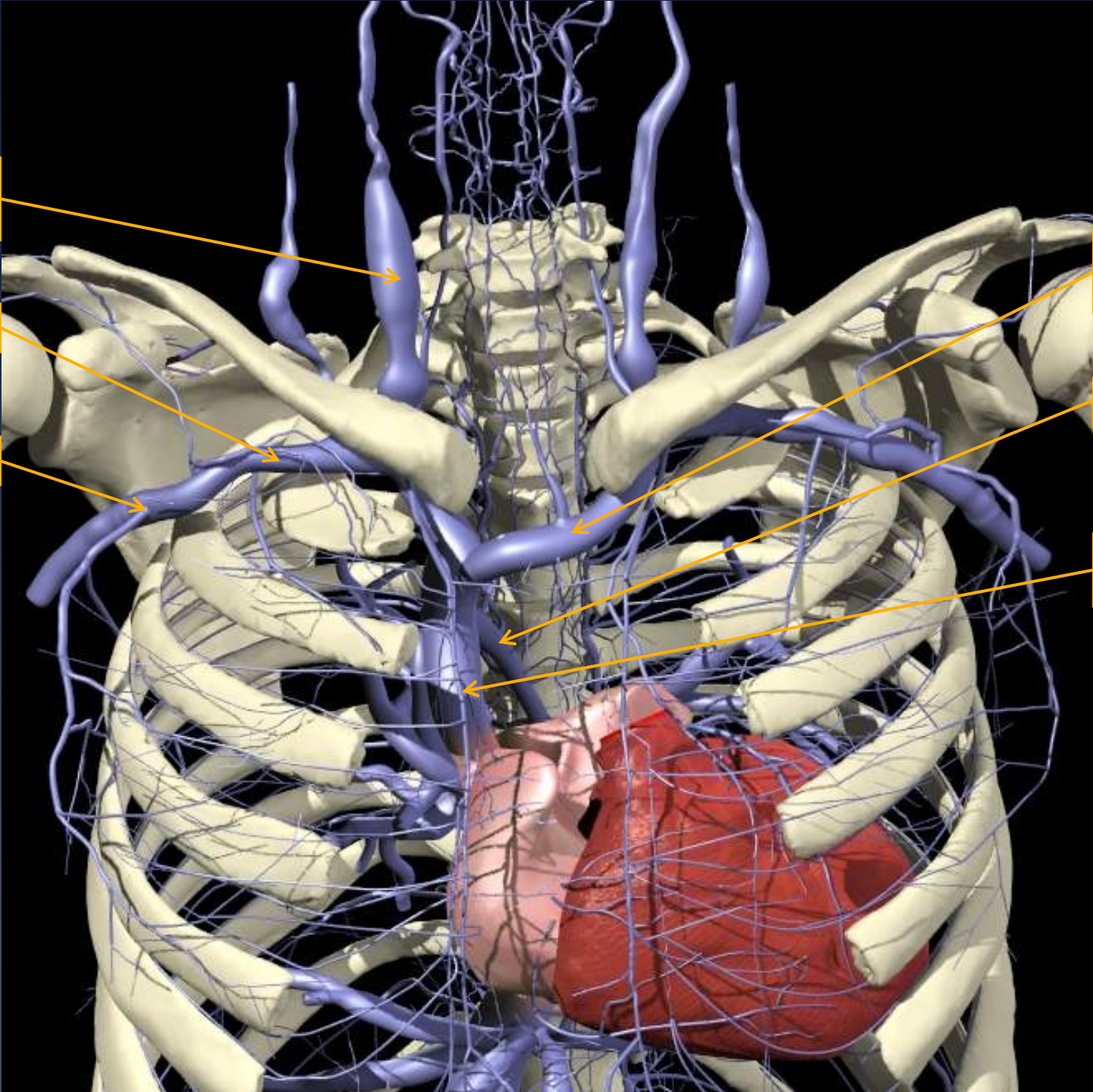
Subclavian

Axillary

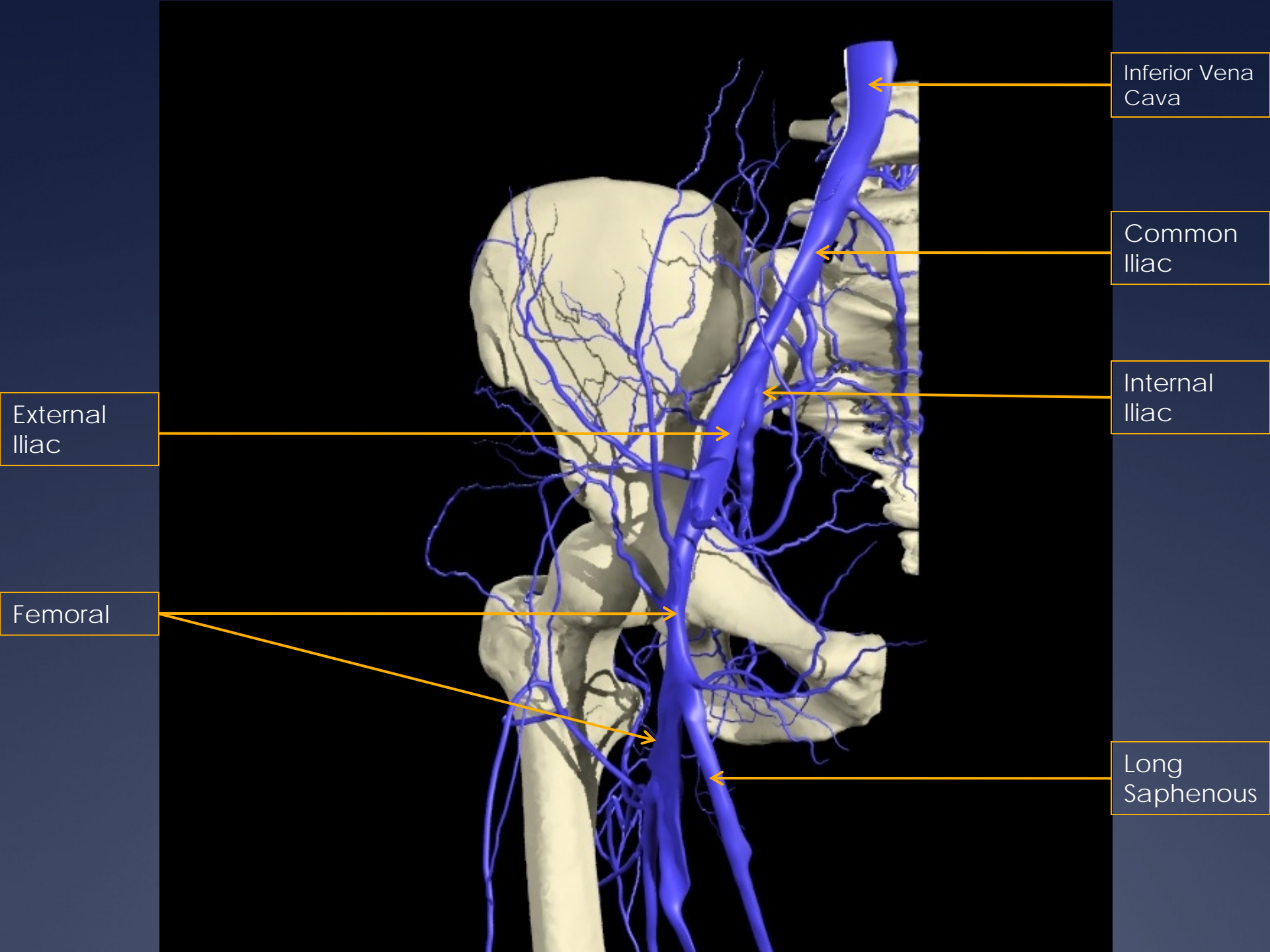
Brachio-
cephalic

Azygos

Superior
Vena Cava







Inferior Vena Cava

Common Iliac

Internal Iliac

Long Saphenous

External Iliac

Femoral

Percutaneous Multilumen Central Catheters

■ Short Term Use (< week)

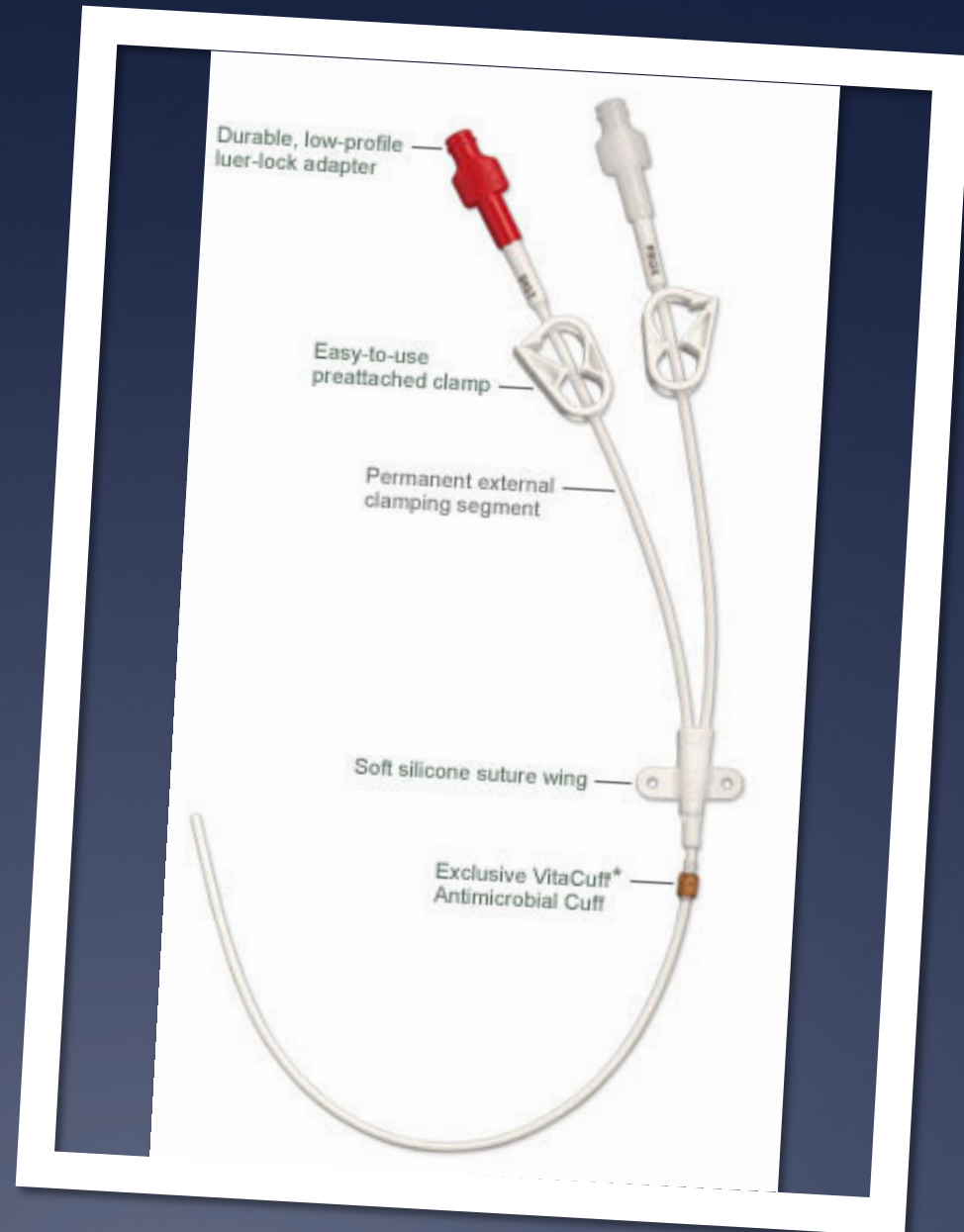
- IV medications
- Blood products
- CVP monitoring
- Hyperalimentation

■ 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 Multilumen 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 Multilumen 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



Subclavian

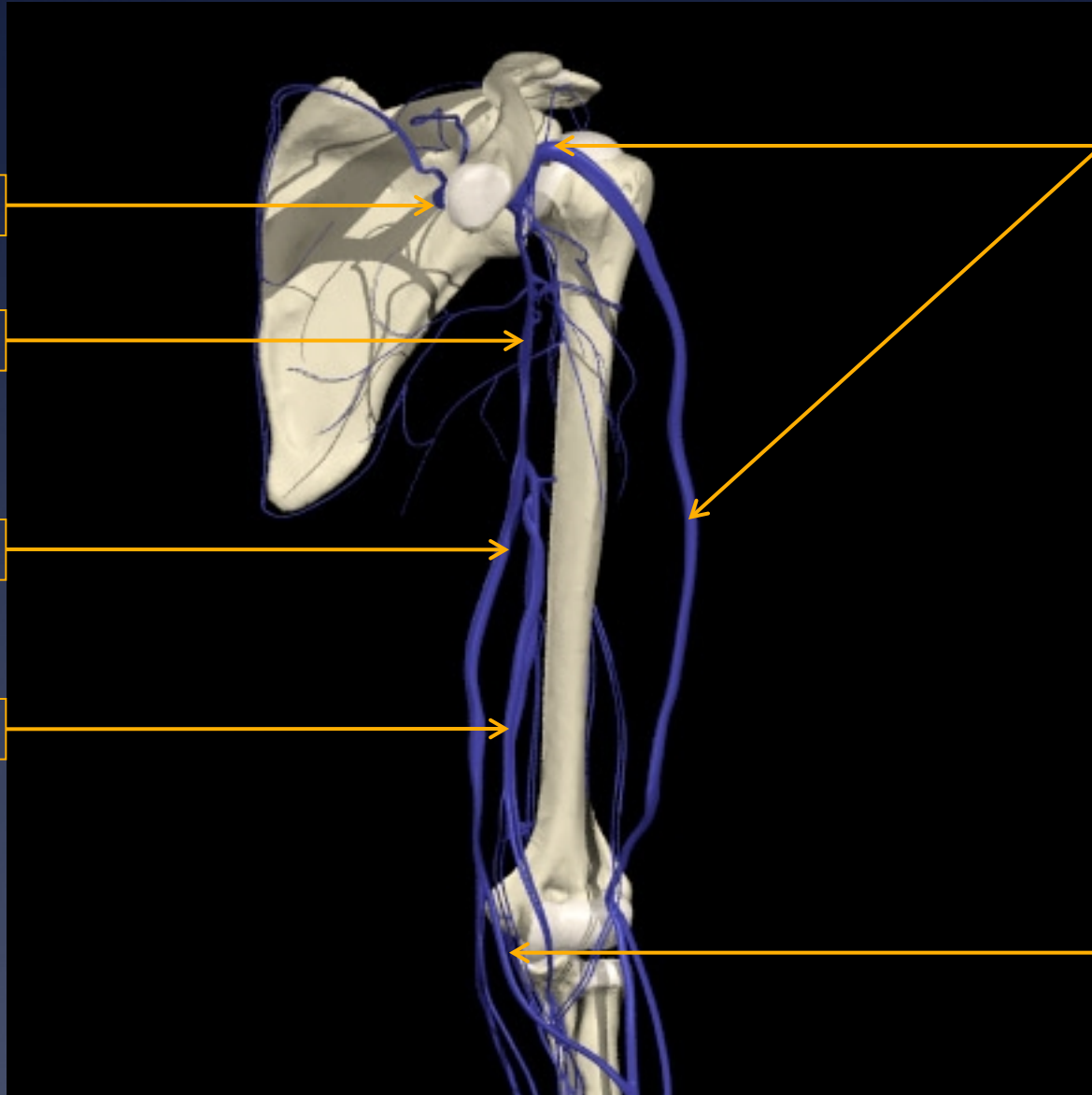
Axillary

Basilic

Brachial

Cephalic

Median Cubital



Midline IV Catheters

- Medium Term (2 to 4 weeks)

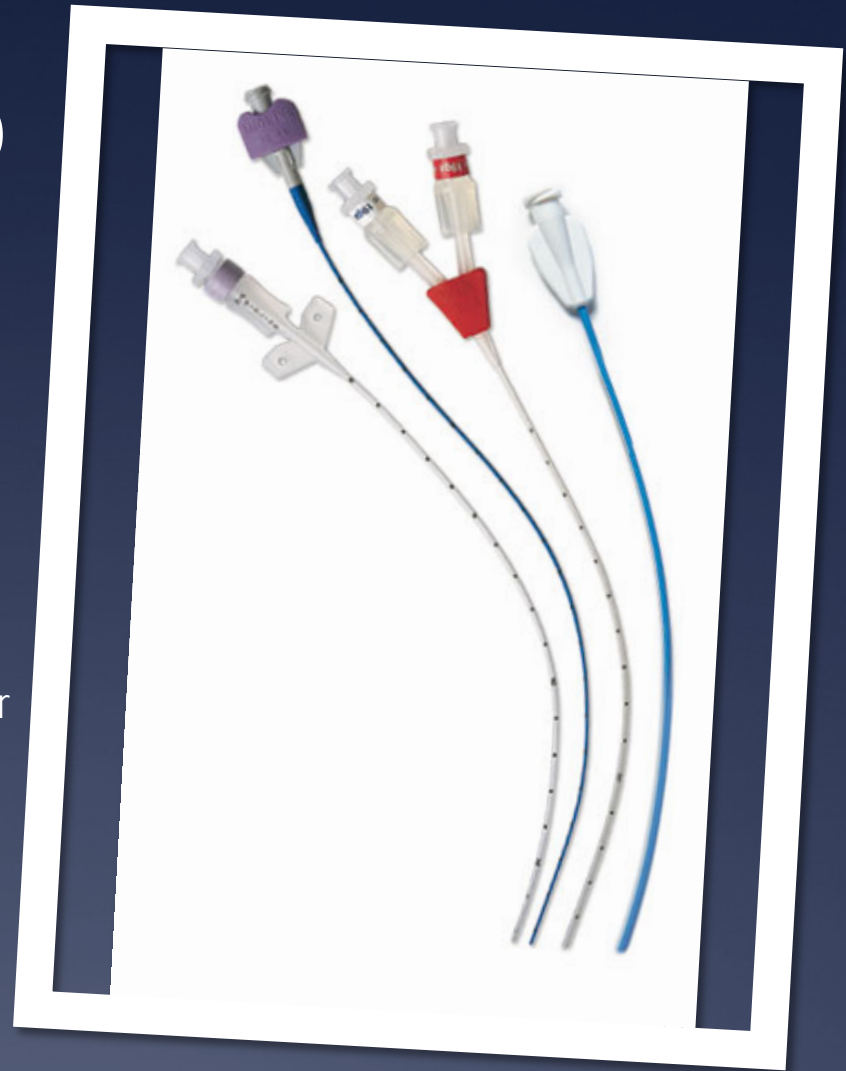
- Limited IV medications
- Not used for:
 - Chemotherapy
 - Hyperalimentation
 - High osmolality medications

- 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)

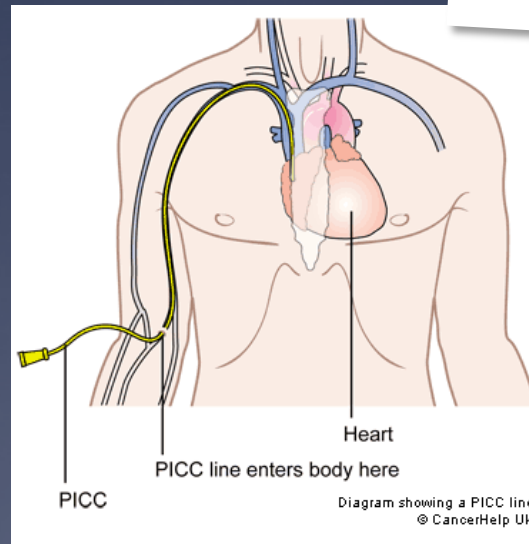
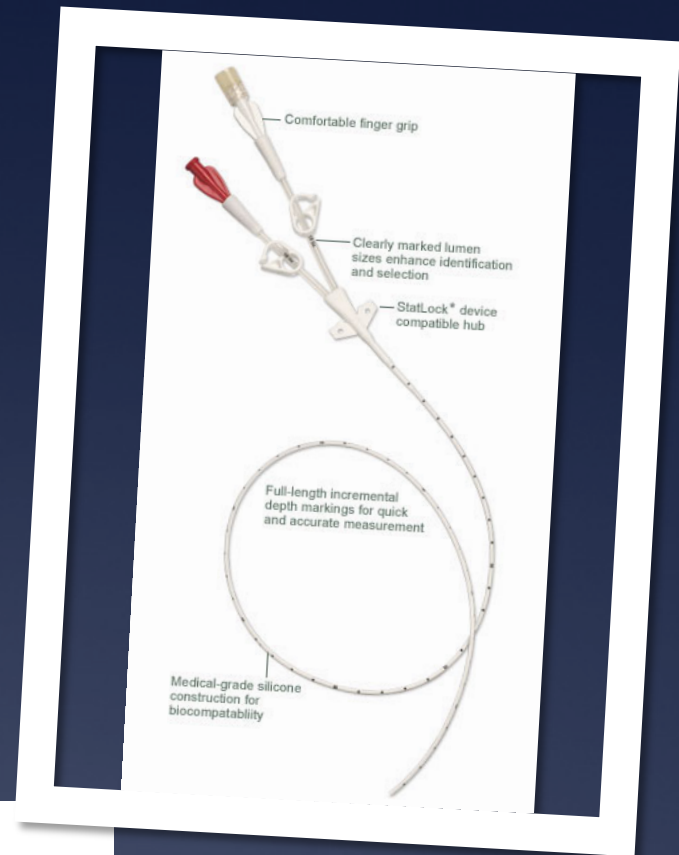
- IV medications
- Chemotherapy
- Hyperalimentation

■ 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

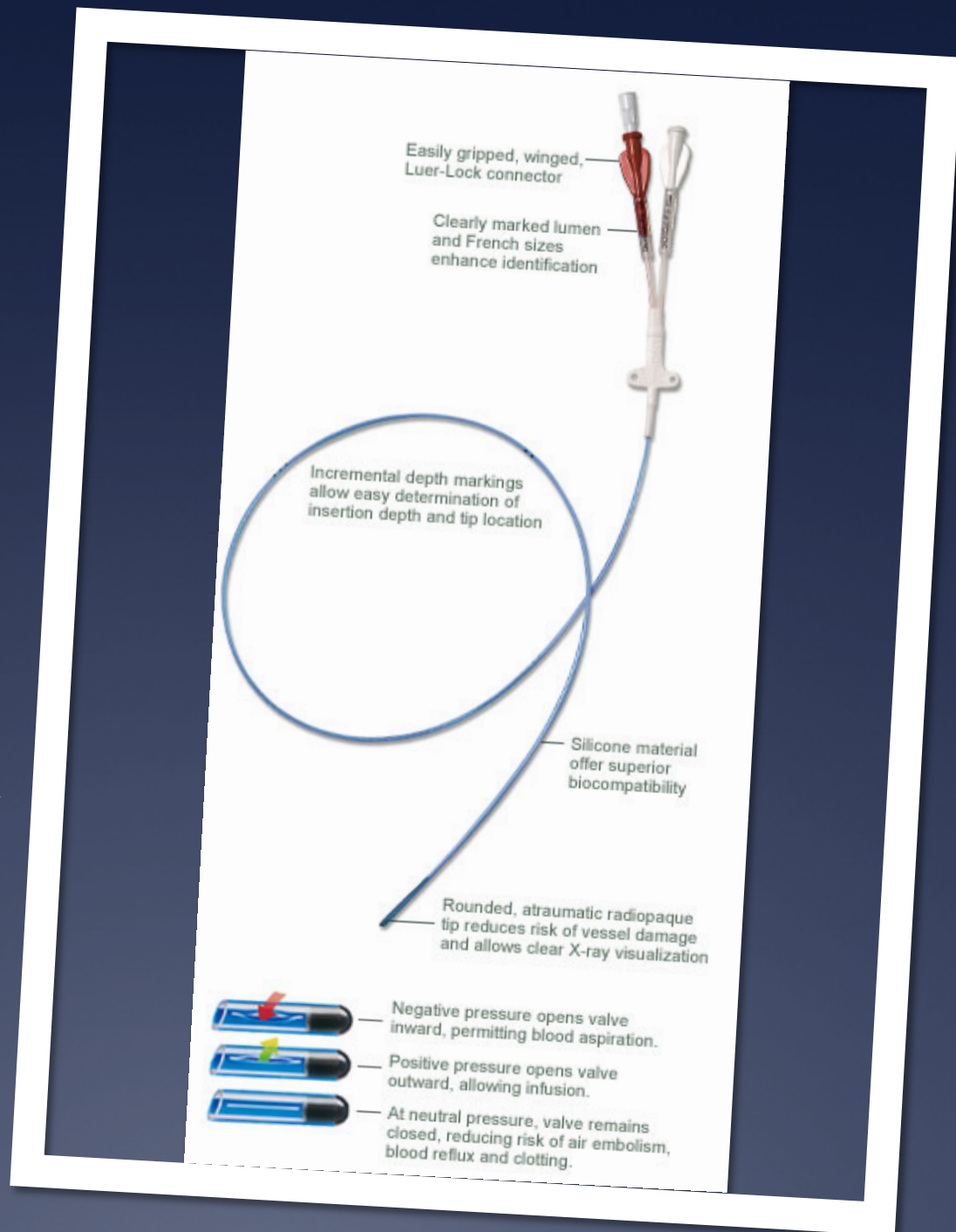
Emergency Access

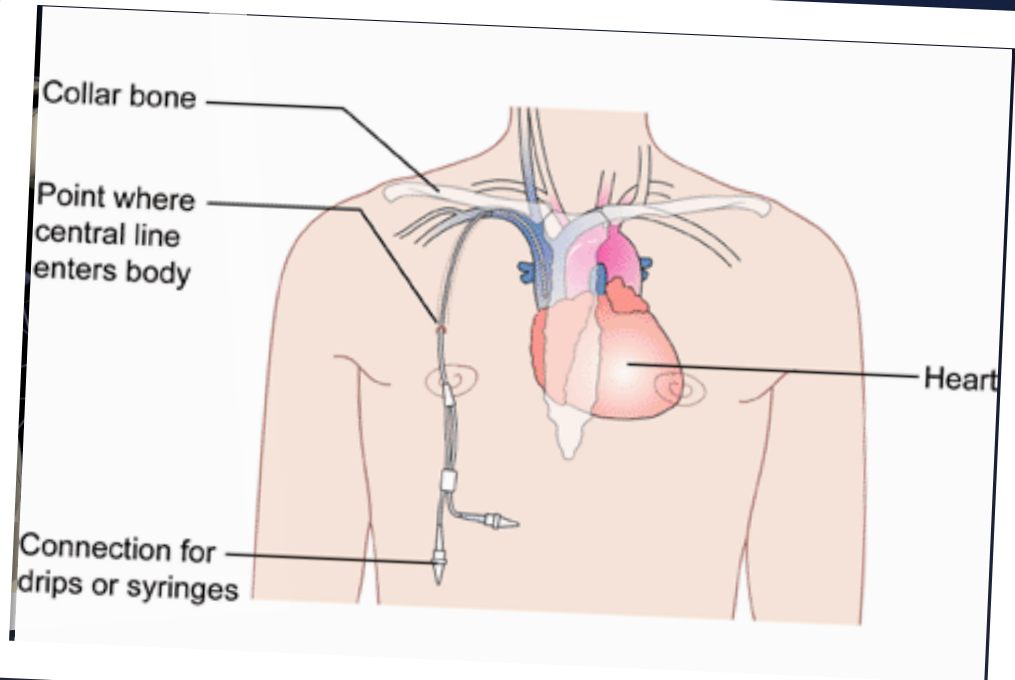
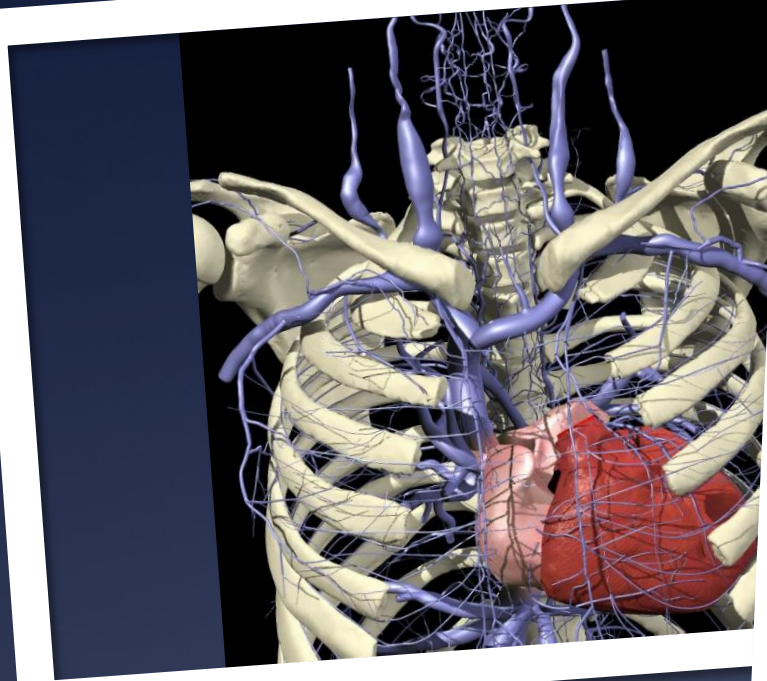
- Swab catheter/cap junction with povidone-iodine
- Clamp catheter (open tip only)
- Replace cap if needed using aseptic technique
- Attach 10 cc syringe with saline flush
- Open clamp (if present)
- Aspirate 5 cc and discard then flush with 5 cc of normal saline
- Administer medication
- Flush with 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**
- single lumen
- 1.0 mm ID
- **Hickman**
- 1 or 2 lumen
- 1.6 mm ID
- **Hemocath/Permacath**
- 2 lumen
- 2.2 mm ID

Tunneled Central Venous Catheters

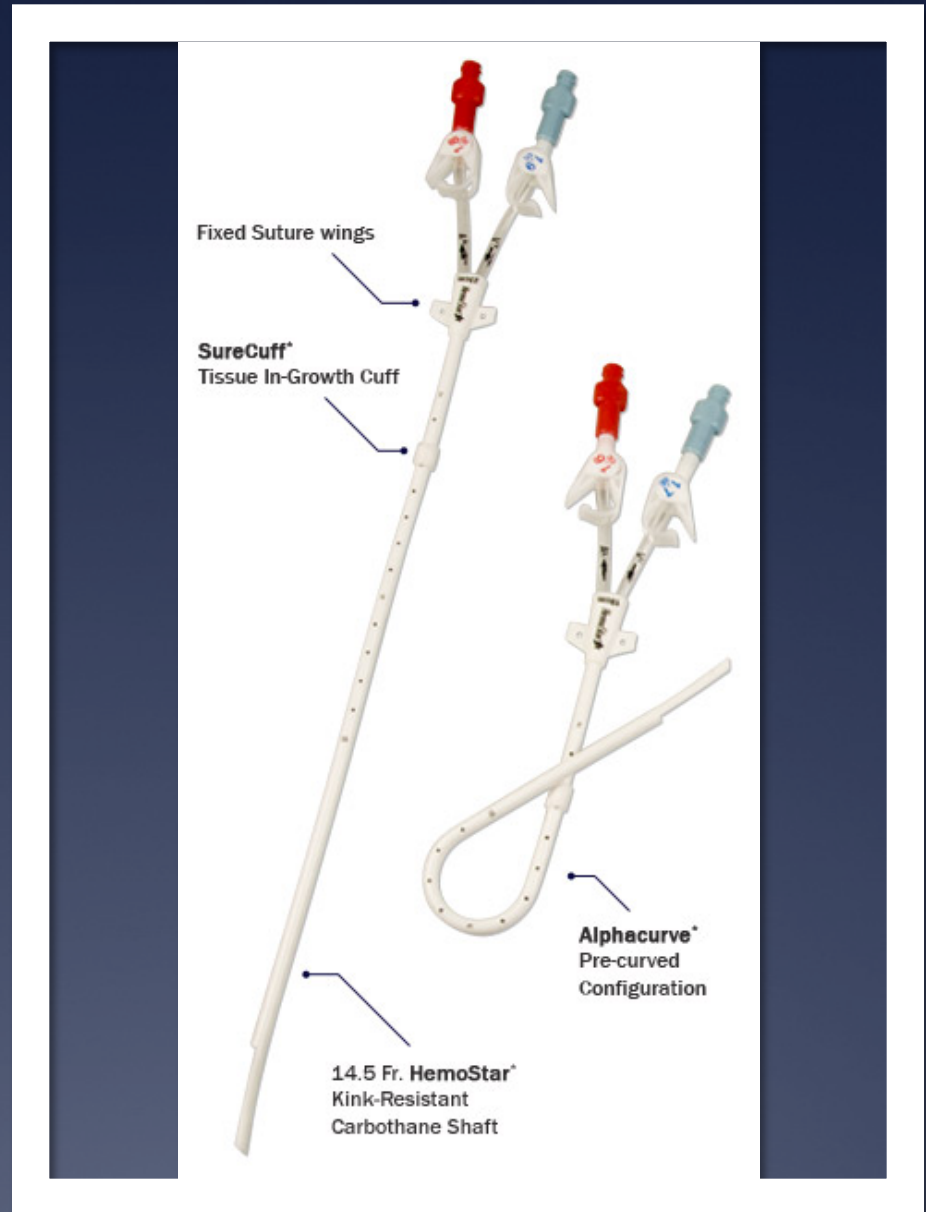
- Long Term (1 year)
 - IV medications
 - Blood products
 - Chemotherapy
 - Dialysis
 - Hyperalimentation
- Description
 - Silicone
 - Over the wire insertion
 - 1 to 3 lumens
 - Open ended or Groshong
- Complications
 - Pulmonary
 - Vascular/Bleeding
 - Infectious
 - Neurologic



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

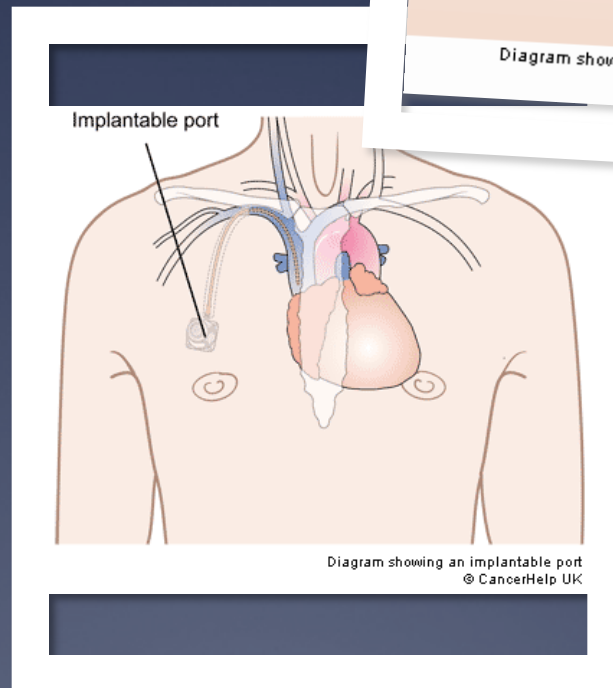
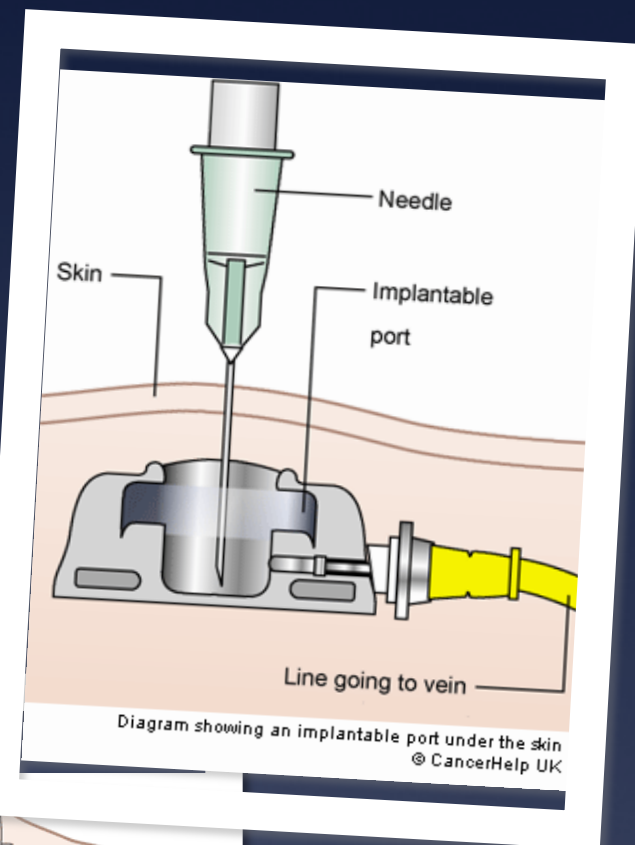
- Pulmonary
- Vascular/Bleeding
- Infectious
- Neurologic



Implantable Vascular Access Devices

Emergency Access

- Clean skin with providone-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



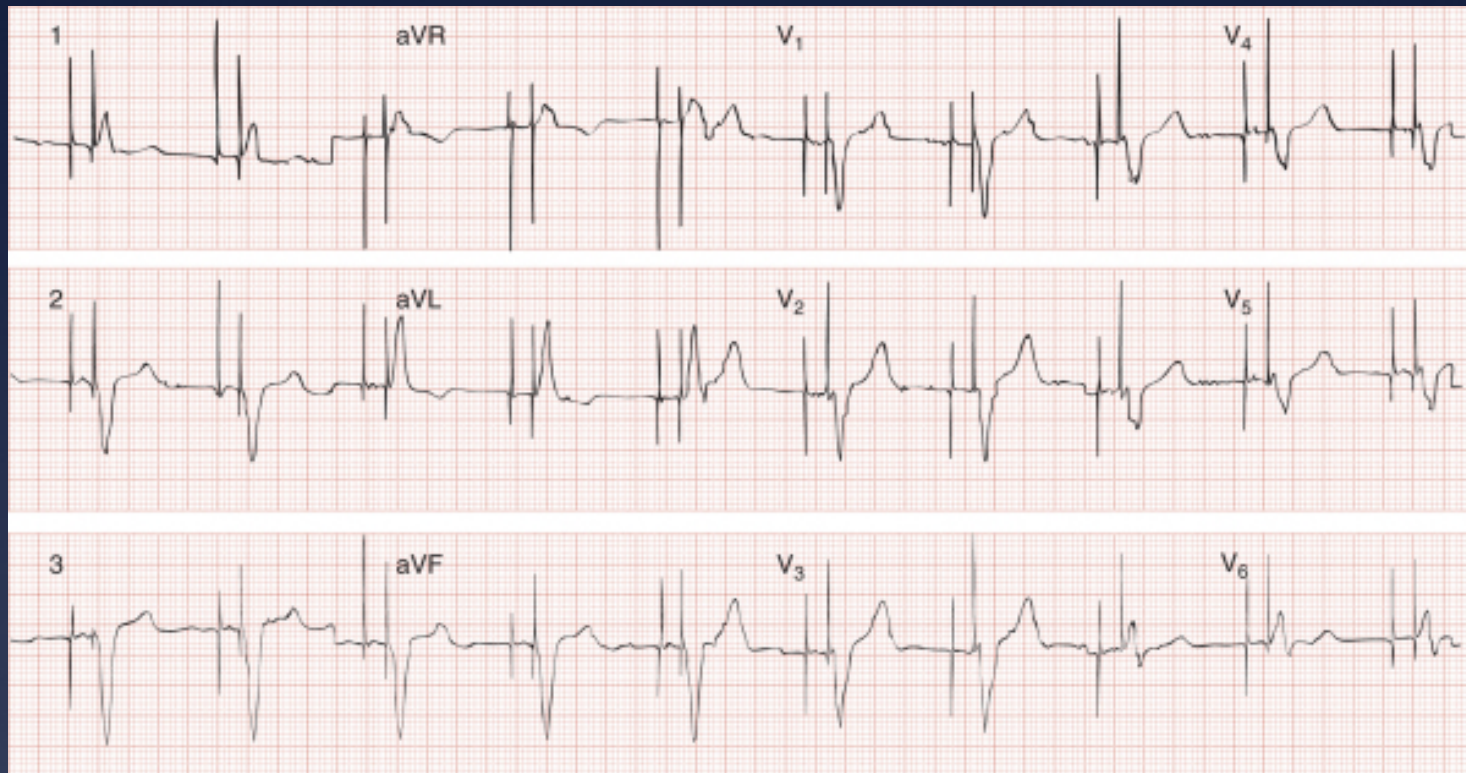
Cardiac Pacemakers

I	II	III	IV	V
Chamber Paced	Chamber Sensed	Response to Sensing	Rate Modulation Programmability	Antitachycardia Features
0 - None	0 - None	0 - None	O- None	O - 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

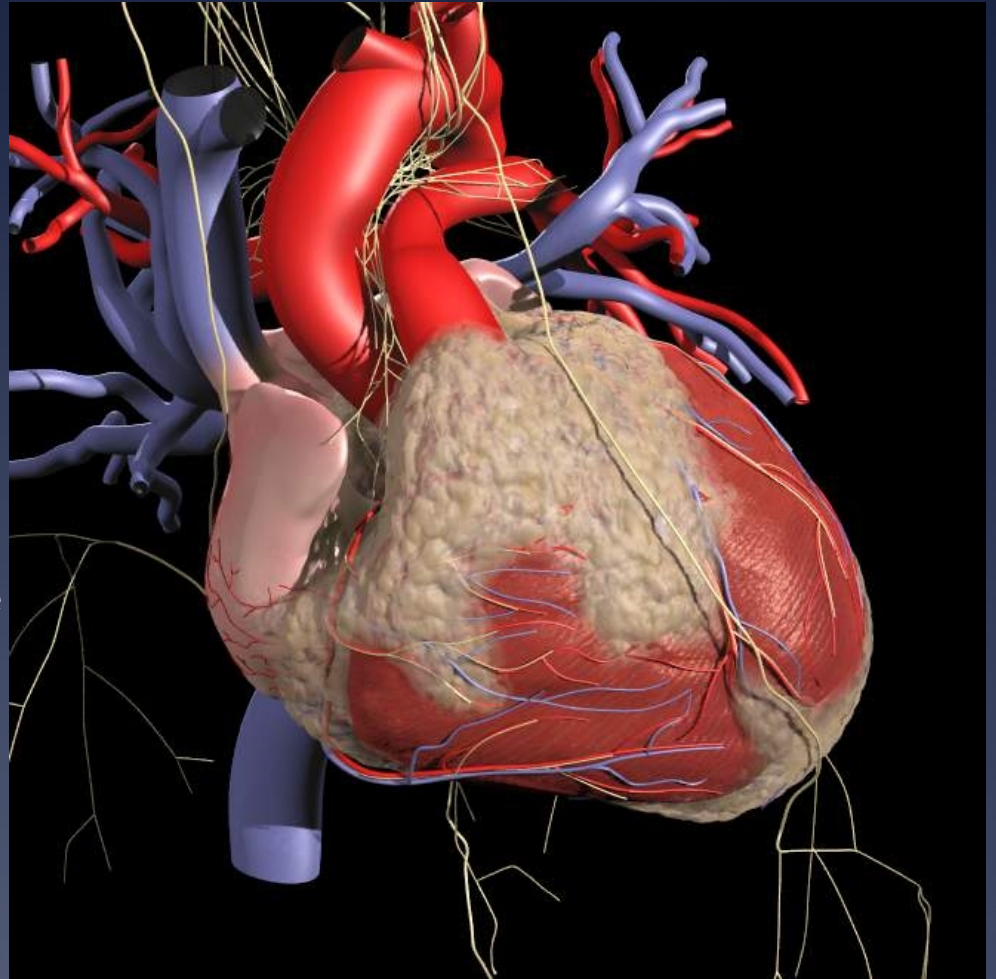
Failure to Pace

Failure to Sense

Failure to Capture

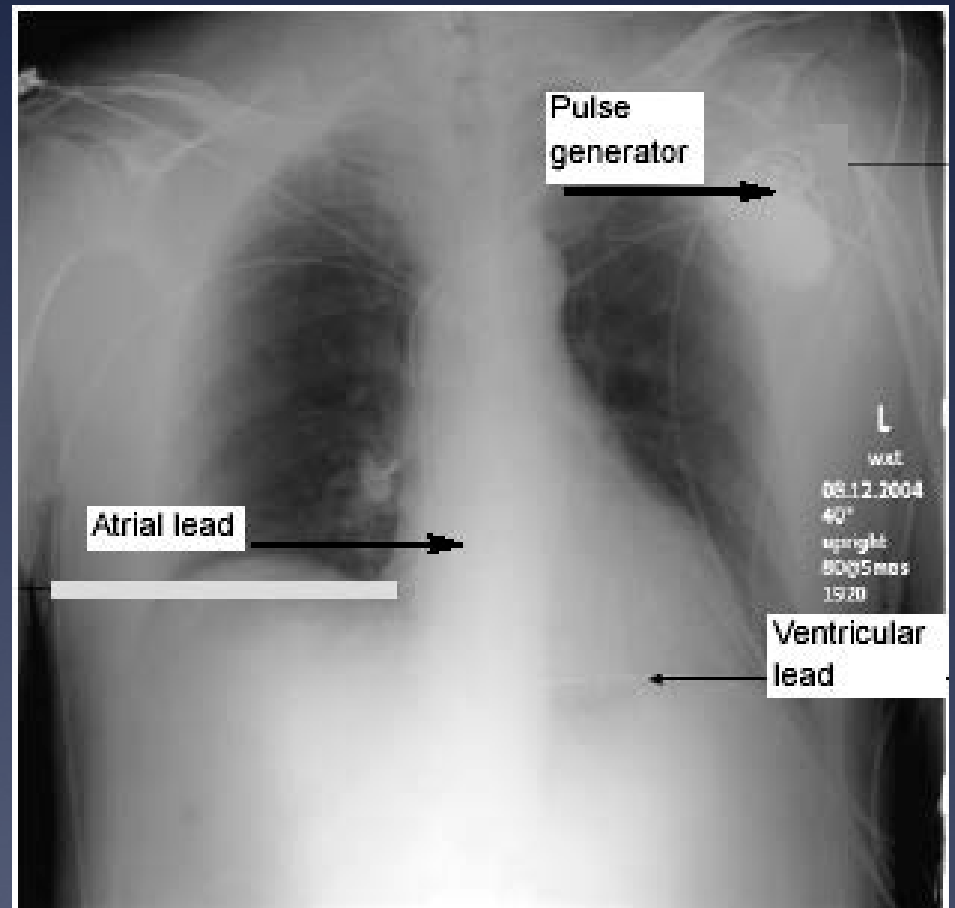
Inappropriate Pacemaker Rate

Other



Failure to Pace

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

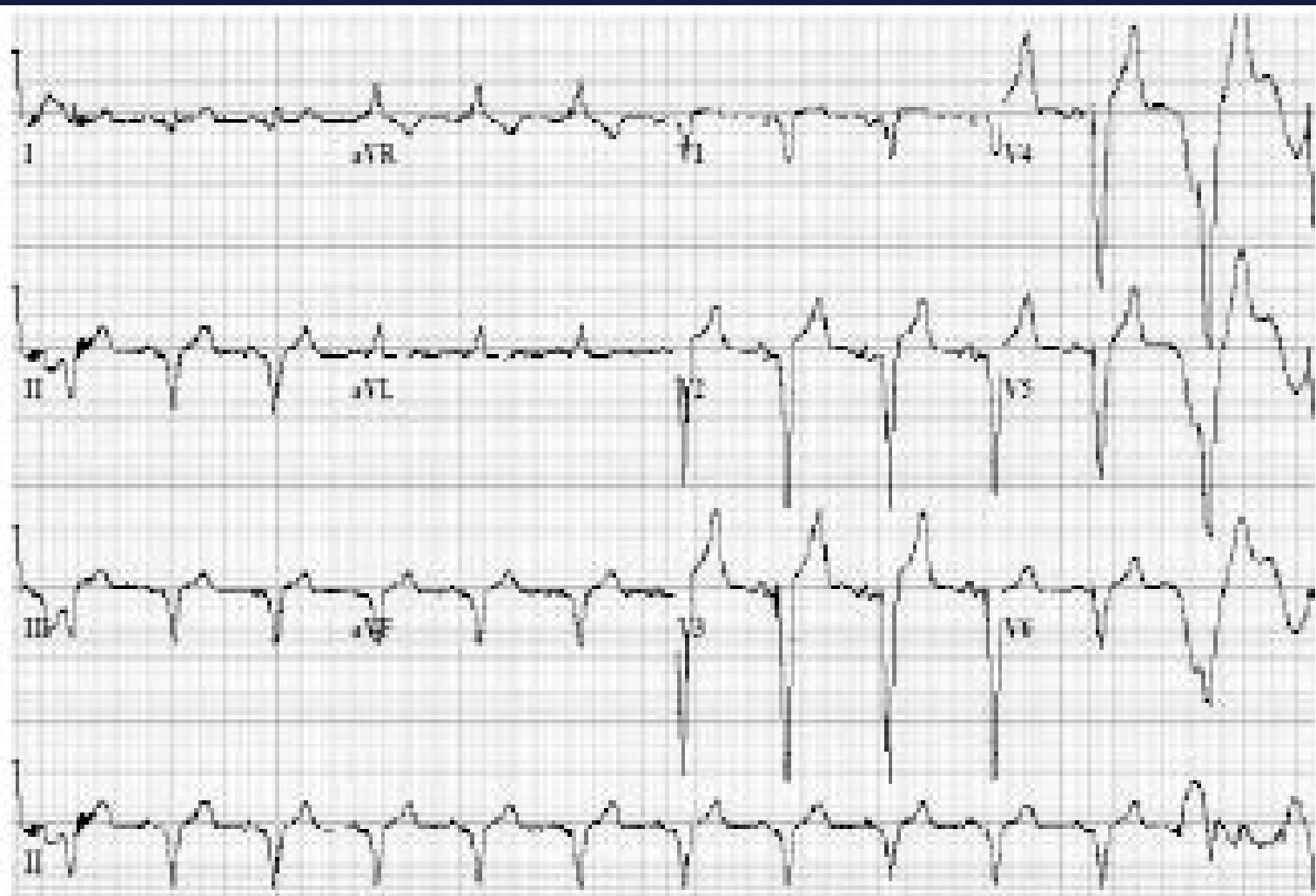


Chest radiograph of a 68-year-old male after a DDD pacemaker is placed for complete heart block.

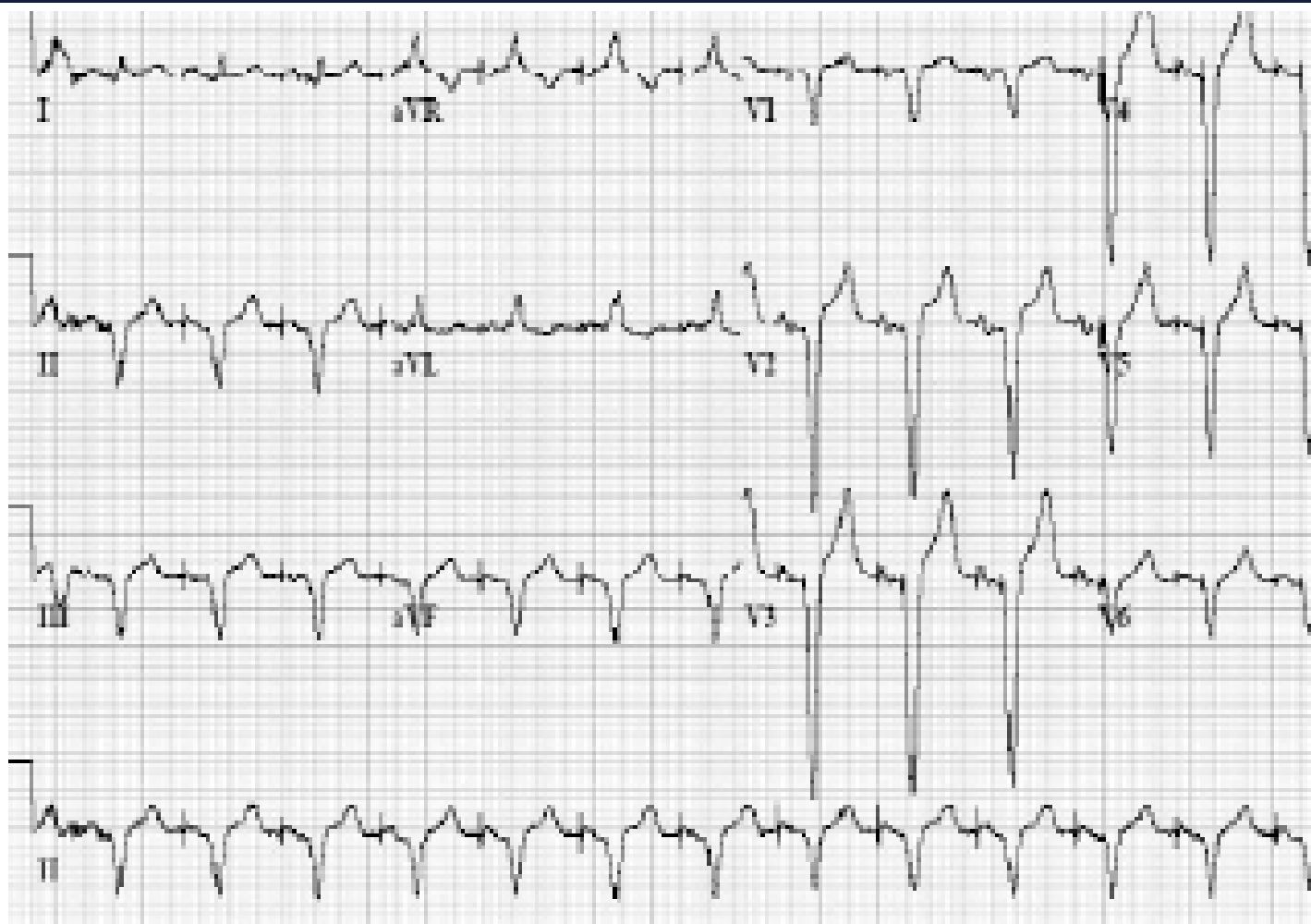
Magnet Use to Evaluate Failure to Pace

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





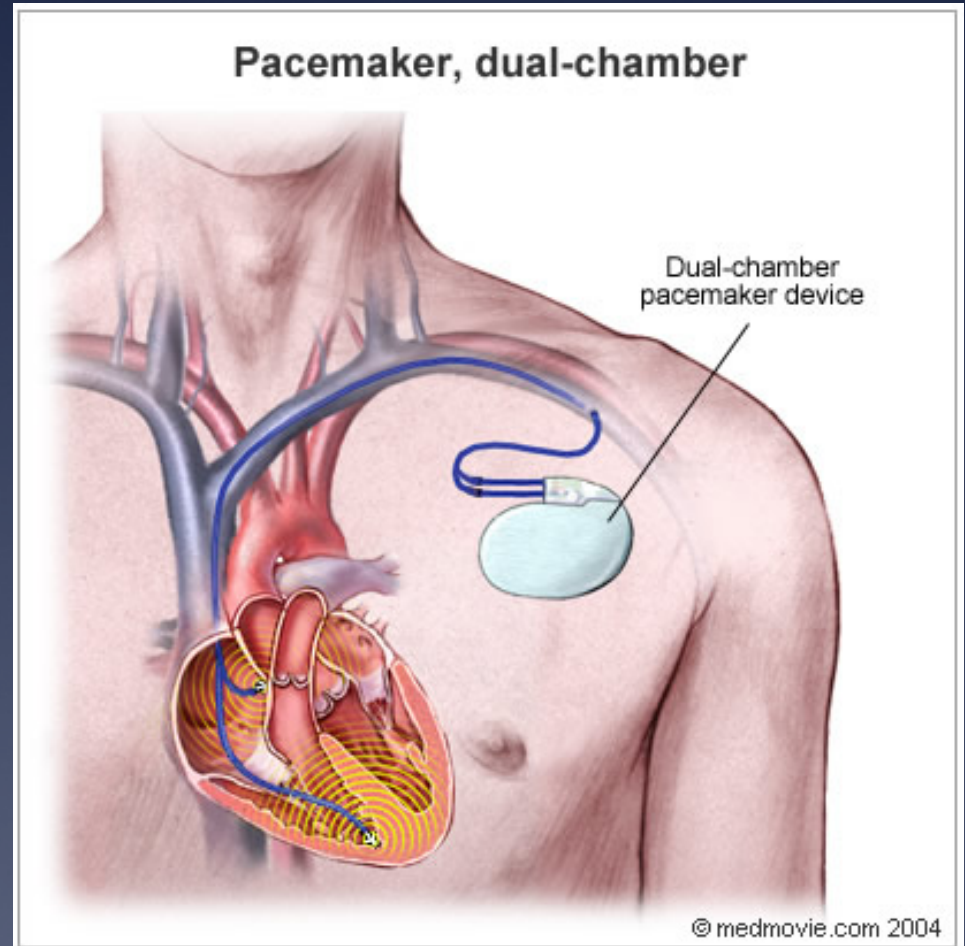
A 68-year-old male with ventricular pacing after placement of a DDD pacemaker. Note the pacer spacer spikes that precede the wide QRS complex. The pacing spikes are best seen in leads V3-V6.



The same patient as in Figure 1 with a DDD pacemaker after magnet application, which disables the sensing function. The ventricular rate has increased by 10 beats per minute when compared to ECG without magnet. Atrial pacing also is noted. 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



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

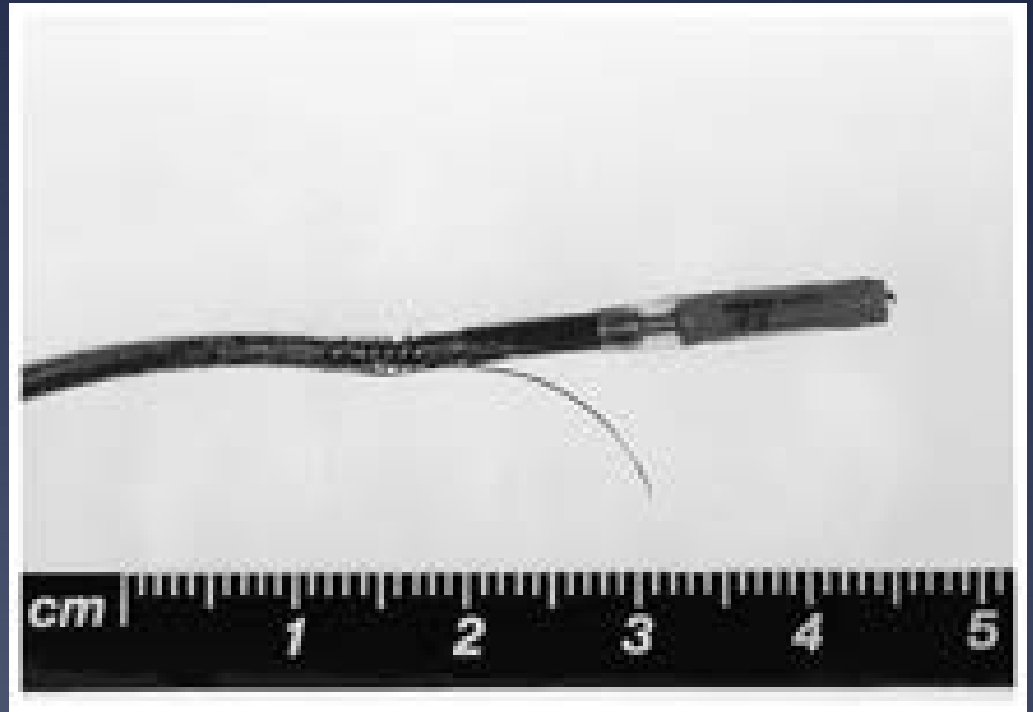
Inappropriate Pacemaker Rate

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



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 60-70 gm
- Components
 - Pulse Generator
 - Battery
 - Leads
- Life span = 4 to 10 years
- Leads go to the ventricle and in some cases also the atrium



AICD Complication

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





AICD Skin Erosion

- Site Infection
- Pressure Necrosis

Questions?