

PICCs in the Critical Care Setting



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Objectives

- Demonstrate the advantages of PICCs in the ICU setting
- Understand common misperceptions about PICCs in the ICU and be able to dispel them

Infusion Needs of the Critically-Ill Patient

- **Medications / Solutions**
 - Hypertonic admixtures
 - Parenteral nutrition
 - Concentrated admixtures
 - Vesicants / Irritants
 - Multiple agents
 - Incompatible agents
- **Hemodynamic monitoring**
- **Frequent blood sampling**



The Ideal Features of a Vascular Access Device in an ICU Setting

- Safe and reliable
- High flow rates
- Low risk of infection
- Multi-lumen
- Hemodynamic monitoring capability
- Injection of contrast media
- Inserted at bedside
- Cost effective

Definition: PICC

Peripherally Inserted Central Catheter



- Acceptable for:
 - All infusions
 - Blood sampling
 - Inpatient, outpatient, and home use
- Specialized PICCs for:
 - CVP monitoring
 - Power injection
- Mid to long term dwell

Role of PICCs in ICU

Historically, PICCs viewed with skepticism as a useful tool in ICU¹

- Need for triple or quad lumen
- Need for high flow rates
- Need for reliable Hemodynamic monitoring
- Need for power injection of CT contrast

¹ Santolucito, J.B. (2007). Role of Peripherally Inserted Catheters in the Treatment of the Critically-ill. *Journal of Vascular Access Devices*, 12(4), 208-217.

New Trends for PICCs in ICU

Technologically advanced PICCs¹

- Enhanced catheter flow rates
- Power Injection capability 5 ml/sec
- Ability to perform CVP monitoring
- Larger lumen sizes—up to 17 gauge
- Triple lumen configuration
- Polyurethane material available
 - Thinner wall, larger internal diameter, higher flow than Silicone catheters

Common Misperceptions



Common Misperceptions

- Lack of awareness of the utility of PICCs in the ICU
- Concerns related to PICC efficacy include:
 - Infection
 - DVT
 - CVP Monitoring Capability
 - Lumen Configurations / Flow Rate Capabilities

Infection



CRBSI and Other Catheter Related Infections

Health care facilities are under increasing pressure to show they are taking all measures possible to prevent unnecessary catheter-associated infections

Prevention is Key

Catheter Related Blood Stream Infection (CRBSI)

- Intravascular devices are common causes of local site infection and cause up to 50% of nosocomial bacteremias
- CRBSI's from CVCs account for 80 to 90% of these infections
- 250,000 bloodstream infections associated with CVCs occur each year in the US.
- Attributable mortality is 12 to 25%
- Estimated at a cost of \$25,000 to \$50,000 per episode
 - One third to one half occur in ICU

Medicare Ruling – As of Oct. 2008

11 conditions (serious, preventable events) targeted for reimbursement denial

- Object left in patient after surgery
- Air embolism
- Blood incompatibility
- Catheter-assisted pneumonia
- Blood clots associated with Knee and hip surgeries
- Complications tied to poor glucose control
- **Vascular catheter-associated infection**
- Pressure Ulcers
- Surgical site infection – mediastinitis after coronary artery bypass graft (CABG) surgery
- Hospital-acquired injuries – fractures, dislocations, intracranial injury

JCAHO Initiatives



2009 National Patient Safety Goals, lists “reduce the risk of healthcare-associated infections,” as its Goal #7

- Implement best practices or evidence-based guidelines to prevent central line-associated bloodstream infections. (Note: This requirement covers short and long term central venous catheters and PICC lines.)
- Patient Safety Initiatives require that a risk analysis be performed if a patient dies or has permanent loss due to a nosocomial infection

Other Prevention Initiatives

- SHEA/IDSA Practice Recommendations 2011
 - “Strategies to Prevent Central Line-Associated Bloodstream Infections in Acute Care Hospitals”
- CDC Recommendations
 - “Guidelines for the Prevention of Intravascular Catheter-Related Infections” – published in 2011
- IHI 5 Million Lives Campaign
 - Focus on improving patient care and preventing avoidable patient deaths
 - 6 initiatives
- INS “Standards of Practice” 2011

Infection Rates for Vascular Access Devices

- Do your homework!
 - Educate yourself on current studies surrounding vascular access devices
 - Ask your sales reps for relevant articles on the devices they are promoting
- Key points to consider when reviewing studies:
 - Retrospective vs. Prospective studies
 - Blinded vs. Double Blinded
 - Randomized
 - In-Vivo vs. In-Vitro

Infection Rates for Vascular Access Devices

PICC infection rates are comparable to existing central venous catheter devices with added utility of:

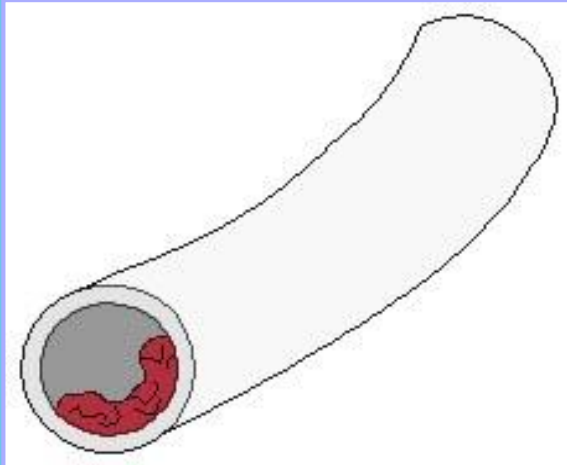
- CVP Monitoring
- Power Injection/High Flow Rates
- Indicated for Longer Dwell Times
- Convenience of bedside placement

Thrombosis

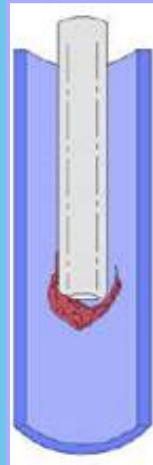


Types of Thrombus

Intraluminal clot

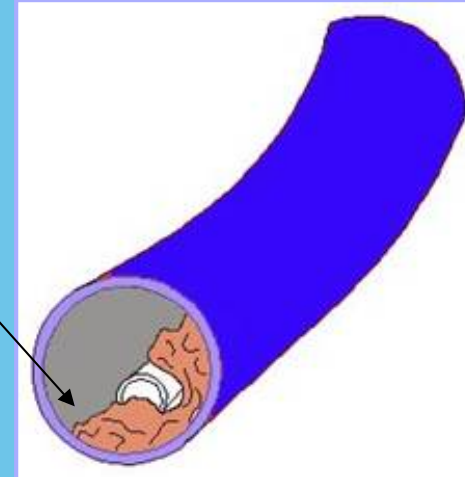


Fibrin tail

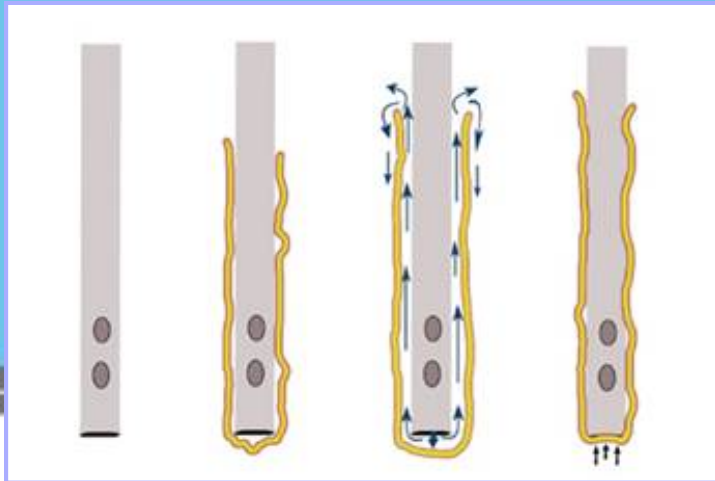


**Mural
Thrombus**

DVT

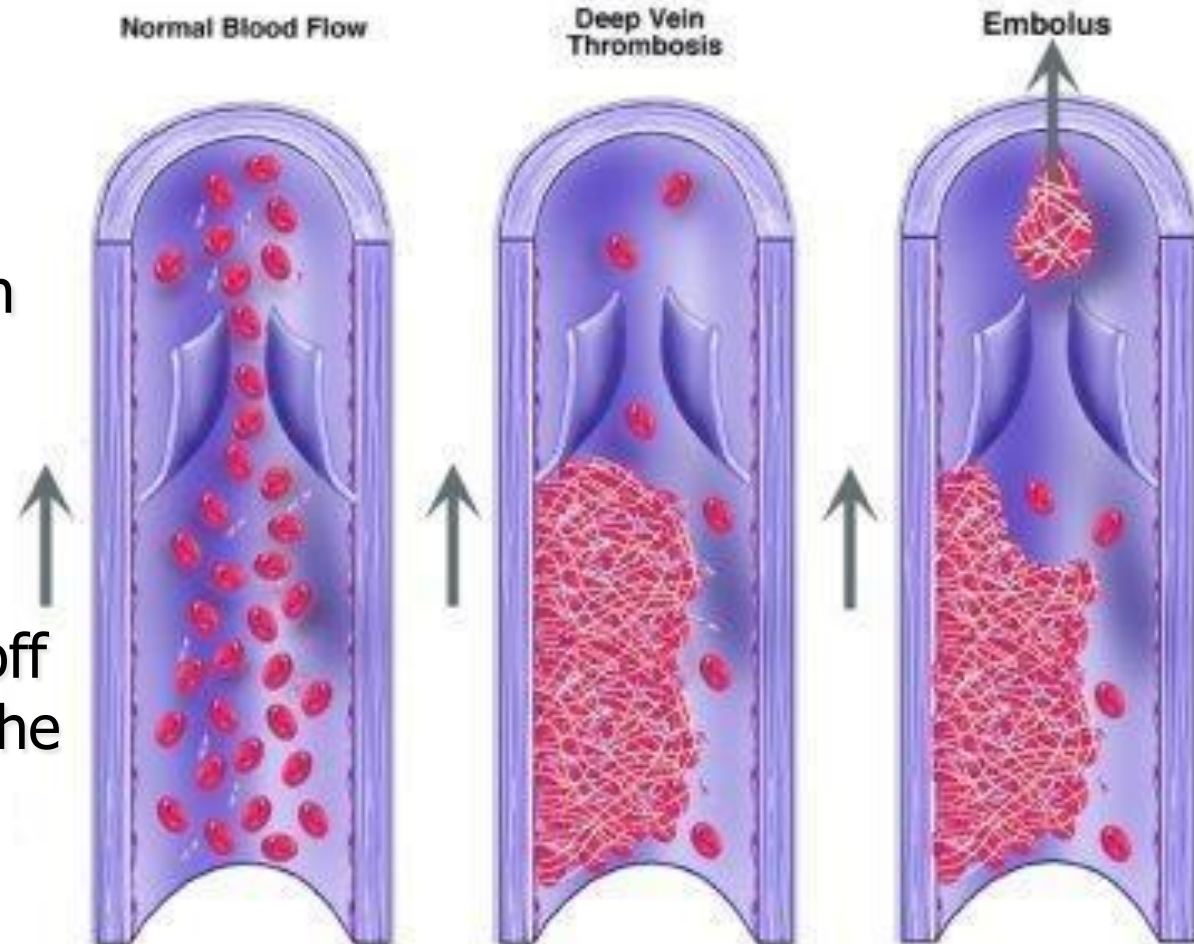


Complete fibrin sheath



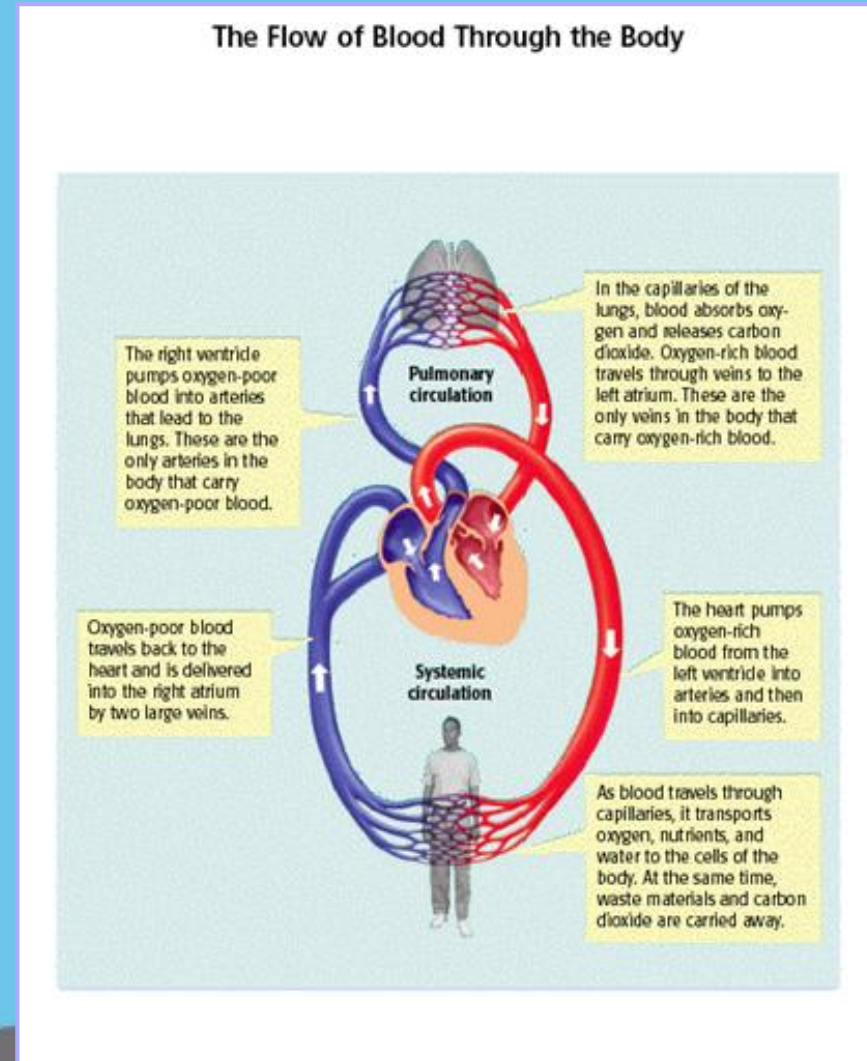
DVTs and Pulmonary Embolism

- DVT forms on the vessel wall
- then grows (propagates)
- then breaks off and travels in the bloodstream (embolizes)



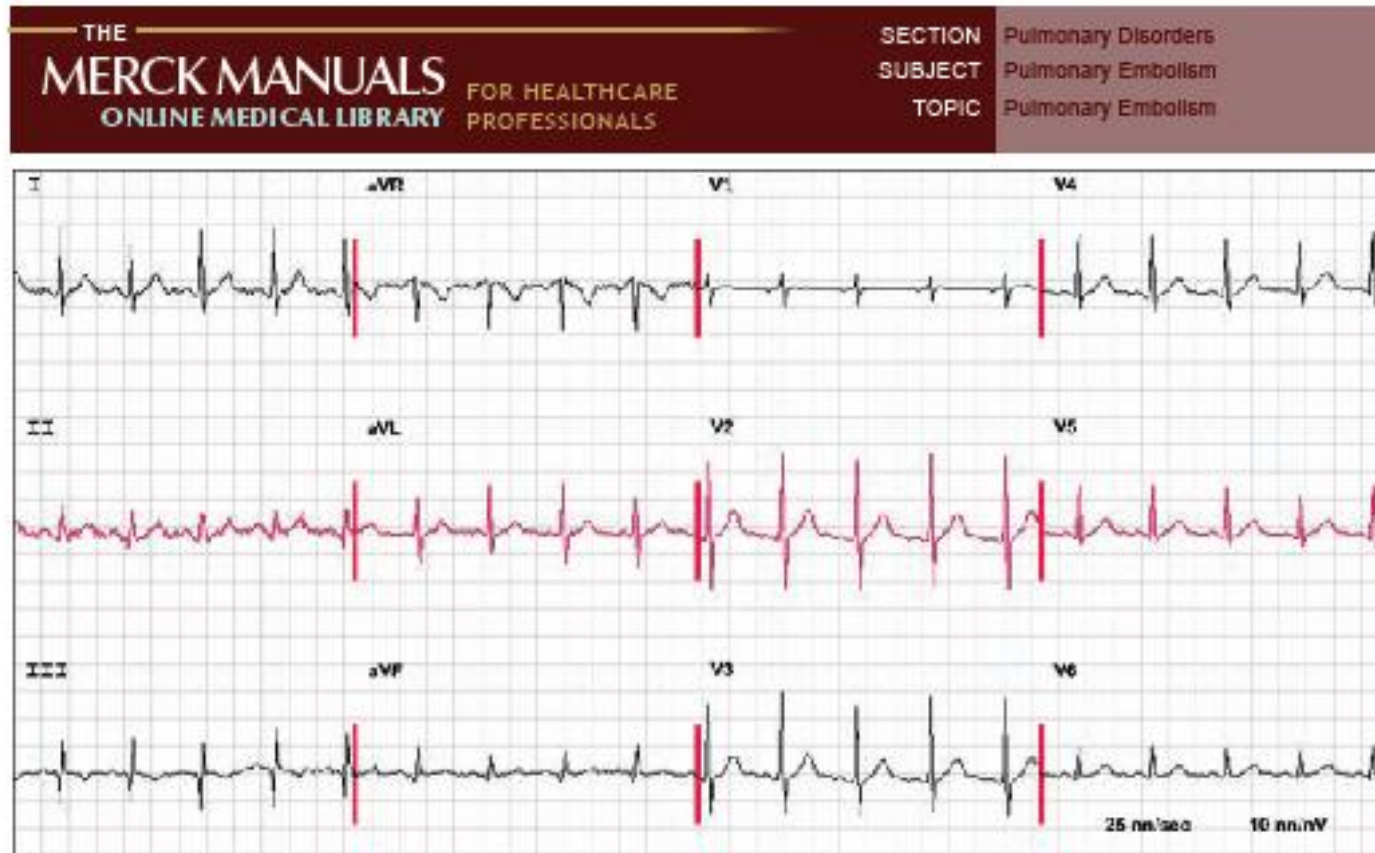
Pulmonary Embolism

- Pulmonary embolism is an occlusion of one of the pulmonary arteries by a thrombus that originates elsewhere (usually from a DVT)
- Can be a serious, life-threatening clinical event. AHA reports 600,000 PE annually, 60,000 deaths¹.



1. www.hmc.psu.edu/healthinfo

EKG Changes with Pulmonary Embolism



ECG in pulmonary embolism. The ECG shows sinus tachycardia at a rate of 111 beats/min, an S1, Q3, T2, and r-S in V1 in a patient with proven acute pulmonary embolism.

Triad of Virchow

Increased Risk of Thrombosis

- **Blood Stasis** (ex: bedrest, immobility after a surgery, anything causing vasoconstriction -> anxiety, smoking, cold)
- **Hypercoagulability** (ex: cancer patients, genetic disorders, pregnancy)
- **Damage to the vein (intimal wall)** (ex: central lines and IVs, surgery) This is the most likely culprit in upper extremity DVTs, esp. in the axillosubclavian vein.

Specific Risk Factors for DVT

- Age > 60
- Extensive surgery
- Previous DVT
- Marked immobility
- Major orthopedic surgery
- Malignancies
- Hypercoagulable states
- Obesity
- Pregnancy
- Estrogen use
- Venulitis
- Sepsis
- Heart failure
- Inflammatory Bowel Disease
- Myocardial Infarction
- Fractures

Summary Points

- DVT is a well-known risk for all central lines, including PICCs
- The rate of symptomatic catheter-related DVT (CRDVT): about 1%-4%*
- DVT is a risk factor for pulmonary embolism, a serious, potentially life-threatening clinical event
- Risk factors have been identified for increased risk of CRDVT
- Primary risk factors for increased CRDVT are cancer diagnosis and treatment, and tip outside the SVC.

*higher for asymptomatic DVT

CVP Monitoring



CVP Monitoring through a PICC

- Polyurethane open-ended PICCs available that are FDA approved for CVP monitoring
- Certain PICCs can be used to measure CVP and to follow trends when used with a pressure infusion device
- CVP recorded via PICCs is slightly higher but the difference is clinically insignificant¹
- No change in current practice



¹Black I, Blosser SA, Murray B. "Central Venous Pressure Measurements: Peripherally Inserted Catheters Versus Centrally Inserted Catheters." *Critical Care Medicine*. 28 (2000): 3833-3836.

Lumen Configurations / Flow Rate Capabilities



Then the nurse asks
“Can I have another line?”



Multiple Lumens

- Single Lumen:
 - Simple single medication course
 - Ideal for Home Use, Easy Care
- Dual Lumen:
 - Infusates requiring a dedicated lumen (TPN, heparin, etc.)
 - Lab draws for antibiotic levels and coagulation studies anticipated
- Triple Lumen:
 - Complex IV therapies
 - Ideal for critical care
 - Need for two dedicated lumens



Bedside Placement

Place at bedside vs transport to IR:

- Moving patients with multiple lines can be problematic
- Vents or monitors must accompany patient to IR
- Safety issue
- RT & secondary nurse needed
- Cost in time and resources



Potential Cost Benefits

Utilizing PICCs may Decrease Costs Related To:

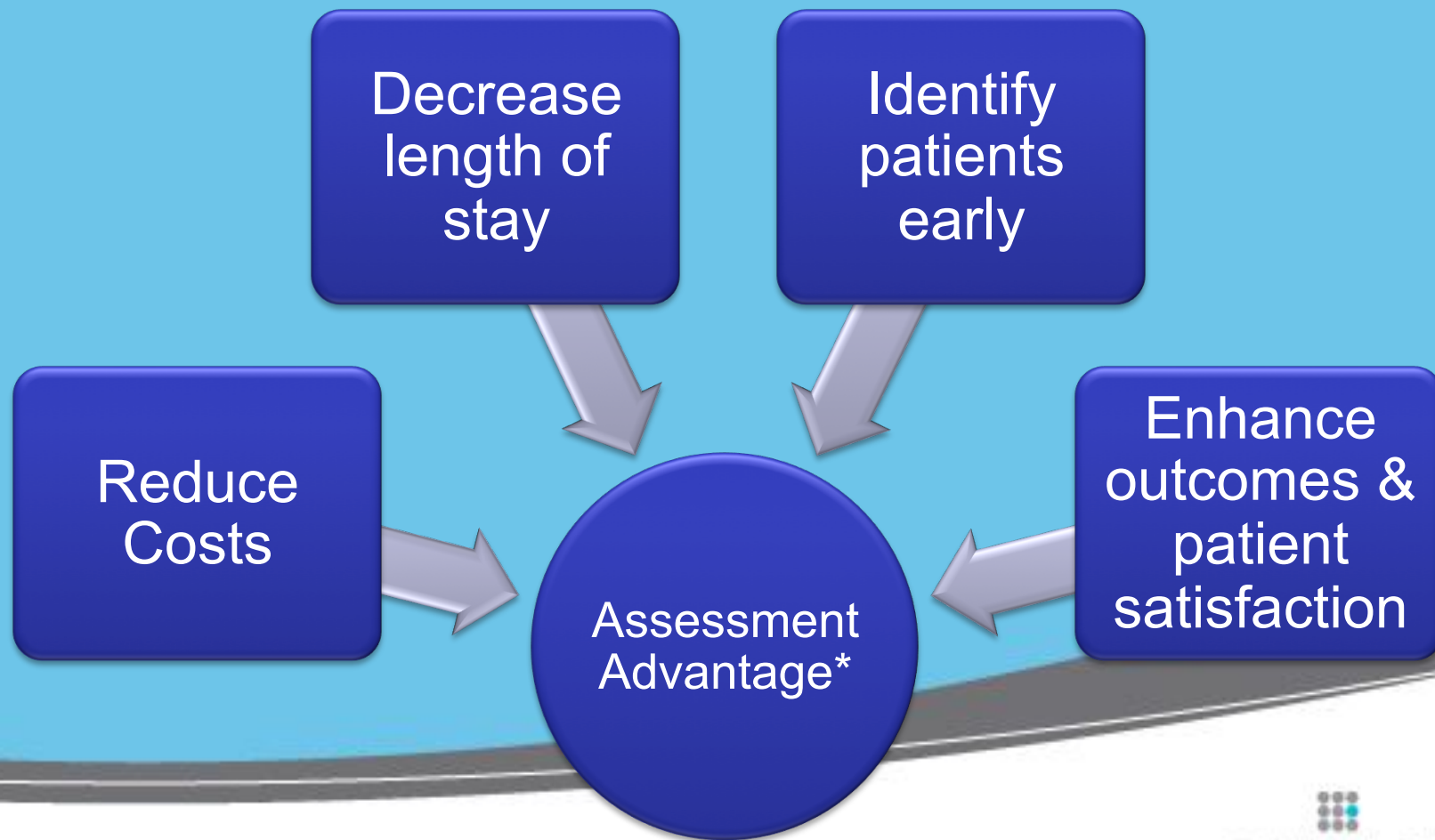
- Multiple PIV attempts
- Delay in therapy
- Treating extravasations, infiltrations, phlebitis
- Transferring patient to IR or to surgery
- LOS by treating and transferring out of ICU
- Treating pneumothorax



Early Patient Vascular Assessment

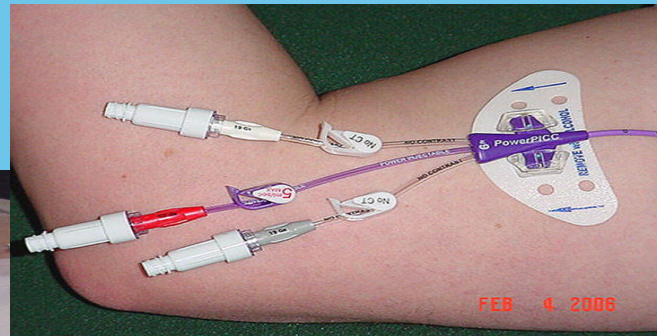


Implementation of Early Vascular Assessment Program



Practice Proactive IV Therapy Early Vascular Assessment

- Assess all admits
- CDC states: Patients receiving 6 days of IV therapy or more should have a PICC line
- Patients receiving IV therapy with dangerous pH and Osmolarity levels that will destroy vasculature and cause complications¹



1. Infusion Nursing Standards of Practice

- pH and osmolarity of infusate
- Length of therapy
- Patient diagnoses
- Patient medical condition



Summary of Benefits of PICCs

- CVP monitoring
- Power injectable
- Saline Care & Maintenance (PowerPICC SOLO* Catheter)
- Designed for multiple infusion therapies as well as blood sampling
- Designed to accommodate high flow rates (999 ml/hr pump flow rate)
- Extended dwell time
- Provides vascular access for patients in the ICU and after transfer out of the ICU
- Lower placement risks (compared to Acute CVCs)
- Can be placed at bedside by a skilled nurse