Picc Line : Revue des indications et introduction pratique

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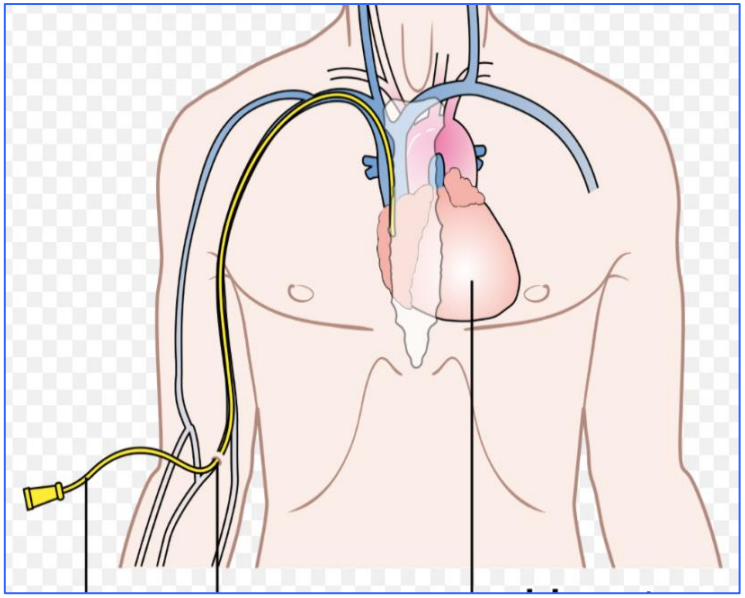
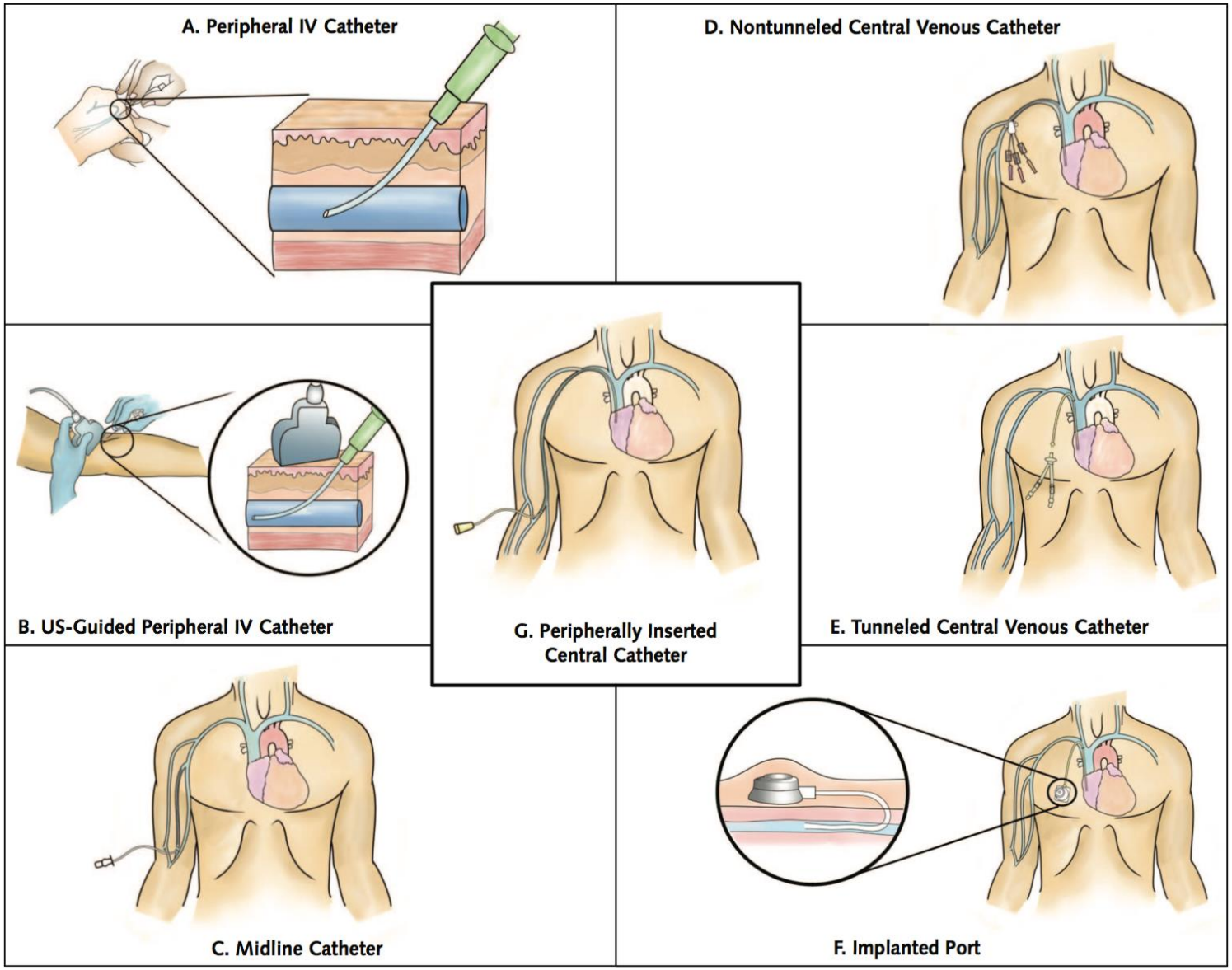
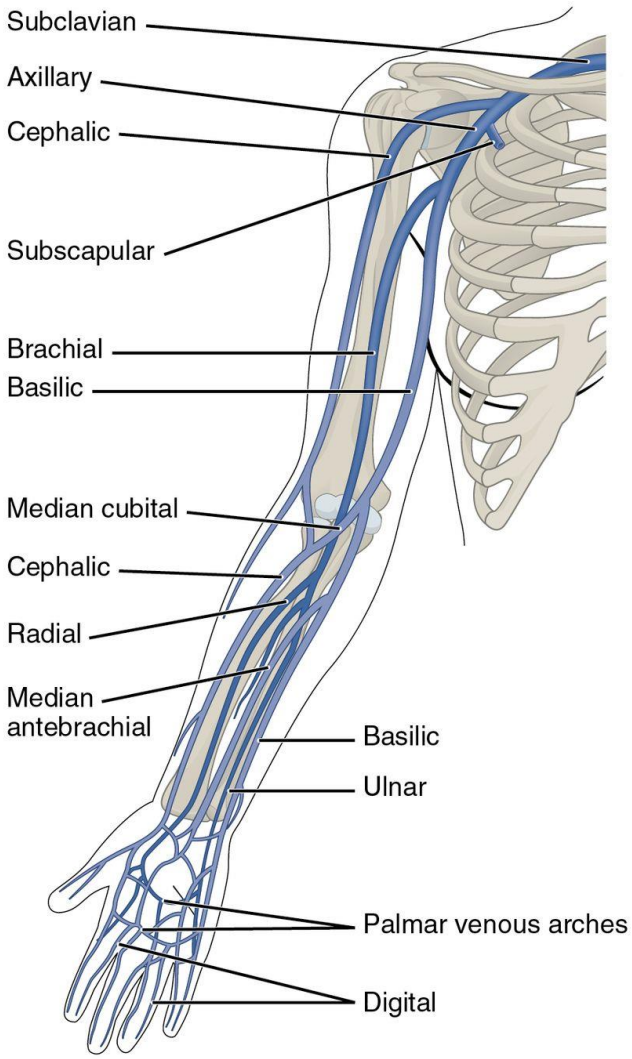
PICC line Peripherally inserted central catheter

Is a central venous catheter inserted into a vein in the arm rather than a vein in the neck or chest; its tip terminate ideally in the SVC/right atrial junction (cavoatrial junction) or in the right atrium.




A. Peripheral IV Catheter
D. Nontunneled Central Venous Catheter
B. US-Guided Peripheral IV Catheter
G. Peripherally Inserted Central Catheter
E. Tunneled Central Venous Catheter
C. Midline Catheter
F. Implanted Port



Vaisseau	Diamètre	Débit
V.Cephalique	**6mm**	**46ml/min**
V.Basilique	**10mm**	**95ml/min**
V.axillaire	16mm	333ml/min
V.Sousclavière	19mm	800ml/min
VCS	20mm	2000ml/min

Basilic: better :

- Bigger
- Follows a straight trajectory

CHARACTERISTICS

Catheter types: Single lumen
Double lumen
Triple lumen

Catheter sizes : 2F to 7 F

Catheter lengths: (20-60cm) cut to specific patient lenght

Catheter materials Polyurethane
Silicone

Catheter ended styles

Open-ended: usually have a clamp system

Closed-ended has a valve system at the end,

Advantages ▼ blood reflux
▼ Risk of air entering so ▼ risk of gas embolisme

ADVANTAGES

-Easy. Where.. Who..

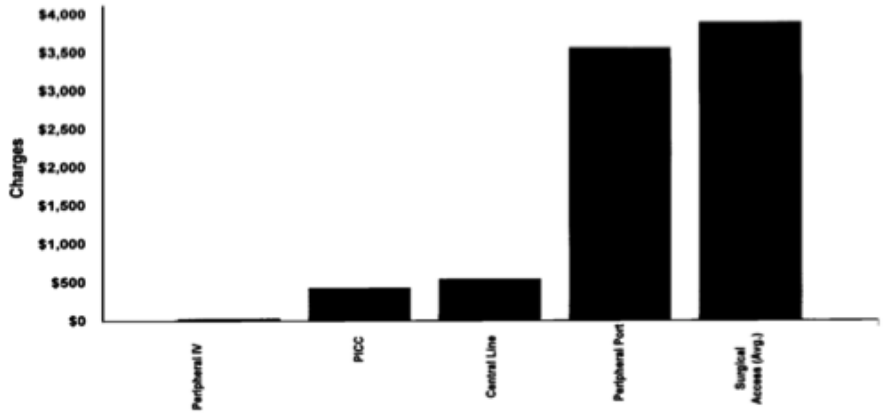
-Safer : Theoretically less complications , even in patients with patients coagulopathy and thrombocytopenia

-Longterm (can be > one year)

-Outpatients

-Greater patient acceptance High degree of satisfaction 97% reduced needle punctures, reduce pain, more comfort.

-Cost-effective PICC $401 , $3870 for radiologically placed peripheral ports and $3532 to $4296 for surgically placed catheters.



Significant cost savings

AJIC Am J Infect Control 2001;29:32-40)

Despite these advantages, PICCs are central venous catheters that may lead to important complications

No method of establishing central venous access is without possible complications

Selecting the intravenous device with the lowest risk that most effectively supports the patient's treatment and ensuring appropriate use of PICCs is thus vital to preventing these costly and potentially adverse events.

INDICATIONS

-**Infusate . Treatment characteristics**

- pH ≤ 5 ou pH ≥ 9.
- Osm >600 mOsm.l-1.

-Longterm ≥ 3 weeks . can be > one year. If therapy exceeds 1 year, consideration may be given to placement of an alternative longterm central venous Access

- Long term antibiotic treatmen is the most common indication
- Chemotherapy,
- Parenteral nutrition,
- Blood draws
- Palliative Care: pain management , fluid therapy ...

-Therapies in the outpatient setting

Annals of Internal Medicine SUPPLEMENT
The Michigan Appropriateness Guide for Intravenous Catheters (MAGIC): Results From a Multispecialty Panel Using the RAND/UCLA Appropriateness Method
Ann Intern Med. 2015;163:S1-S39.

INDICATIONS

Poor or difficult Venous Access.

Ultrasond-guided peripheral iv catheter
Another optcion : oral treatment !? !?

Critical patients

Given the risk for insertion complications, rexperts preferred use of PICCs to CVCs in critically ill patients with coagulopathies (such as disseminated intravascular coagulation…), especially if use for more than 15 days was proposed.

Picc allows accurete measurements of PVC

Black CCM 2000.
McLemore AVS 2006,
Larham BMC 2010, Yun Korean J Anesth 2011,
Sanfilippo JVA 2017

CONTRAINDICATIONS

- Local infection
- Oedema
- Lymphedema
- Thrombosis
- Arm plegia
- Emergency situation Inconvenient time consuming
- Kidney Disease: Recommendations is upper extremity veins preservation for future vascular access placement
  - FAV GFR less 44ml/min,
  - Stage 3b or greater ,
  - Kidney transplant,
  - Solitary kidney.

COMPLICATIONS

No method of establishing central venous access is without posible complications

Insertion Complication

Oclusion

Migration

Infection

Catheter related thrombosis (CRT)

INSERTION COMPLICATION

Central Venous Catheter:

Risk many serious life –theatering complications

- Pneumothorax, 0,2%
- Tension Pneumothorax,
- Hemothorax 0,2%
- Carotid punctures .
- Carotid cannulation 0,2%
- Hydrothorax, /Pleural effusion
- Hydromediastinum,
- Tracheal puncture

Picc Line :

Life-theatering complications are virtually nonexistent, even with altered hemostasys.

Very limited risk of arterial or nerve puncture thanks of ultrasound technologie.

Greater length and smaller diameter:

- Catheter tip malpositioning
- Thrombophlebitis
- Catheter dysfunction

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OCLUSION

Most common complication . It is NOT THROMBOSIS

Important Consequence: treatment disruption

Development of an intraluminal clot because

- Blood withdrawal
- Infusion of blood products,
- Accidental blood reflux into the catheter while disconnecting the line;
- Intraluminal precipitation of drugs, due to simultaneous infusion of non-compatible drugs and/or occlusion by lipid aggregates or by highly viscous drugs or contrast media,

Most likely to occur if an appropriate saline flushing is not adopted.

FLUSHING IS THE MAIN STRATEGY FOR PREVENTING OCLUSION

MIGRATION

The external part of the line is longer than usual,

X Ray

- If the termination point is outside the SVC, it is no longer a central line and should not be used to administer therapies meant for central delivery.
- Increased risk of developing a thrombosis.

CATHETER STABILIZATION decrease the risk for catheter migration, dislodgement, risk for phlebitis and CRBSIs.

INFECTION

Most common severe complication

Theoretically PiCC has lower risk of infection :

-It is believed that there are reduced colony-forming units of bacteria in the antecubital region in comparison to the neck and chest wall región

-Physical characteristics of arm skin Dry and Thin.

-Injection site far from nasal/oral/tracheal secretions. Certainly CICC has hifg risk of infection especially in patients with tracheostomy.

-Exit site allows best nursing: better cleaning and better stabilization of the dressing.

INFECTION

There are divergent resultats : may relate to variations in the definition , different patients (ICU, inpatients, outpatients, phatology……)

There is no clear evidence based difference (No RCT) between CICCs and PiCCs

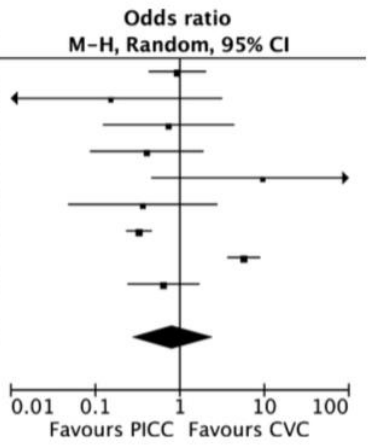
Complications associated with peripheral or central routes for central venous cannulation

Anaesthesia 2012, 67, 65–71

A. Pikwer,[1] J. Åkeson[2] and S. Lindgren[3]

Study	PICC catheter days Events	Total	CVC catheter days Events	Total	Weight%	Odds ratio M-H, Random, 95% CI
Al Raiy	13	5703	12	4917	13.5	0.93 (0.43–2.05)
Alhimyary	0	1381	2	1056	6.9	0.15 (0.01–3.18)
Cowl	2	482	3	533	10.5	0.74 (0.12–4.42)
Duerksen	2	2209	8	3597	11.2	0.41 (0.09–1.92)
Giuffrida	2	2313	0	4421	6.9	9.56 (0.46–199.30)
Gunst	1	455	13	2167	9.7	0.36 (0.05–2.80)
Mollee	76	41876	53	9638	14.3	0.33 (0.23–0.47)
Smith	45	11814	33	49365	14.1	5.72 (3.65–8.96)
Worth	12	1815	6	583	13.0	0.64 (0.24–1.71)
Total	153	**68 048**	130	**76 277**		**0.83 (0.28–2.50)**

Heterogeneity: $\tau^2 = 2.17$; $\chi^2 = 102.44$, d.f. = 8 ($p < 0.00001$); $I^2 = 92\%$
Test for overall effect: Z = 0.33 (p = 0.74)



Forest plot of peripheral (PICC) vs centrally placed (CVC) lines for catheter-associated infection.

Prevention of infection complication

Central line bundle

Guidelines for the Prevention of Intravascular Catheter-Related Infections, 2011
https://www.cdc.gov/infectioncontrol/guidelines/bsi/index.html

Adherence to the principles of asepsis are vital when managing any central catheter

Maximum sterile technique: Hand hygiene; mask, cap, full gown, and gloves; patient draping; Alcohol-based chlorhexidine antiseptic skin preparation (0.5 to 2 % chlorhexidine and 70 % alcohol) to dry before needle insertion.

Utilization least number of lumen as appropriate

Insertion of multilumen PICCs to separate obtaining blood samples from giving infusions or to ensure a "backup" lumen was available was rated as really inappropriate.

Ultrasound-guided venipuncture ↓ risk of CRBSI ($P < .04$)

Sutureless devices securement ↓ risk of CRBSI and dislocation ($P < .001$).

CATHETER RELATED THROMBOSIS (CRT)

Second major complication.

Different reviews have reported a variable incidence (4–36 %).

In the last 10 years, thanks to ultrasonographic techniques the rate of thrombosis has decreased significantly (2–5 %).

The American Journal of medicine (2015 128,986-993 Lancet (2013) 382:311-325

A/ PICCs are usen often in High-Risk patients (those inherently predisposed to thrombosis; cancer patients…) These include oncology patients with solid tumours, and those undergoing chemotherapy.

B/ Occupy much of the cross-sectional diameter of vein. Longer

C/ The overall indwelling time is longer

Journal of Hospital Medicine 2009;4(7):417–22.

Peripherally inserted central catheter (PICC)-related thrombosis in critically ill patients

JVascAccess 2014;15(5): 329-337

Study	Risk Factor	0dds Ratio (95%CI)	Size/type of study
Ahn et al (2013)	Erythropoietin	10.60 (2.25-50.5)	237/Retrospective
	Hospitalization	2.38 (1.05-2.39)	
	PICC infection	2.46 (1.03-5.85)	
Yi XL et al (2013	Diabetes mellitus	1.12 (0.89-4.57)	89/Prospective
	Chemotherapy	3.19 (1.07-9.77)	
Liem et al (2012)	Diabetes mellitus	2.50 (0.98-6.30)	690/Retrospective
	Malignancy	4.10 (1.90-8.90)	
	PICC caliber (>5F)	3.90 (1.10-13.90)	
Wilson et al (2012)	Surgery >1 hour	3.01 (1.50-6.06)	431/Retrospective
	Heart failure	2.62 (1.01-6.83)	
	History of VTE	6.66 (2.38-18.62)	
	Mannitol use	3.27 (1.27-8.43)	
	Place paretic arm	9.85 (4.42-21.95)	
Evans et al (2010)	Previous DVT	9.92 (5.08-21.25)	1728/Prospective
	Triple- vs single-lum	19.50 (3.54-100)	
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Lumen	Odds Ratio	P-value
1	1	Ref
2	2,5	0,01
3	3,3	0,02

French (gauge)	Odds Ratio	P-value
4	1	Ref
5	2,2	0,03
6	2,7	0,04

Patients with 5Fr and 6Fr develop VT earlier

PICC resulted ↓ in laminar flow within the center of the vessel lumen by as much as 93%
↑ in turbulent flow.

Therefore, the larger the PICC, the less the central flow and greater the turbulence and the subsequent risk of UEVT

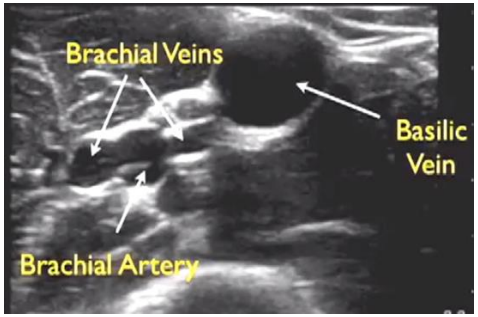
Decreasing the luminal size may decrease the thrombosis complications.

Prevention of Thrombotic Complications

Vein diameter .

Maybe is the most important factor .
Risk is Inversely proportional to vein diameter. Basilique / Better .

Ultrasond-guided insertion



Careful choice of the vein of an appropriate diameter and choosing a **catheter–to–vein ratio** of 45% or less, reduce incidence of trhombosis from 2,9% to 1,4% ($P < .001$).

Reducing puncture attemps, technical failure rates and mechanical complications has to be preferred because of a reduced incidence of catheter related thrombosis.

Prevention of Thrombotic Complications

Catheter Diameter: The smallest catheter gauge

Least number of lumen as appropriate

Proper stabilization of the catheter

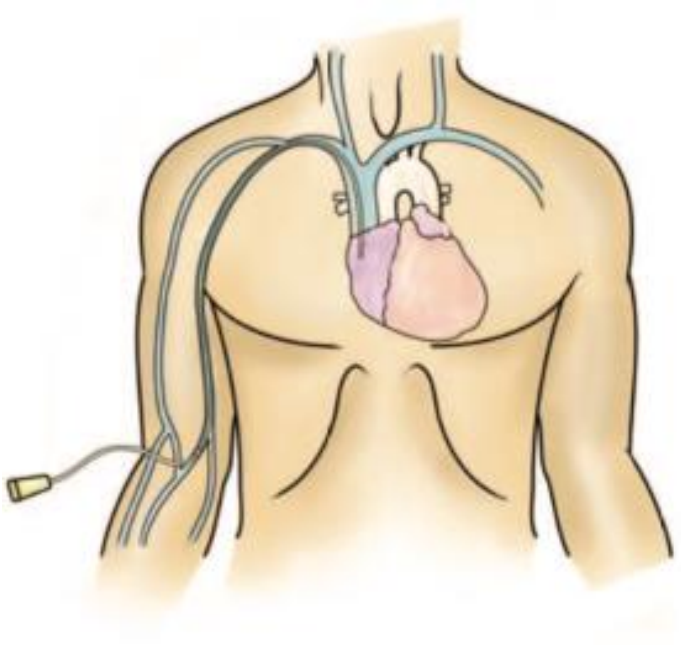
Anti-Coagulation the use of pharmacologic prophylaxis in preventing catheter thrombosis is **NOT** suggested in existing guidelines

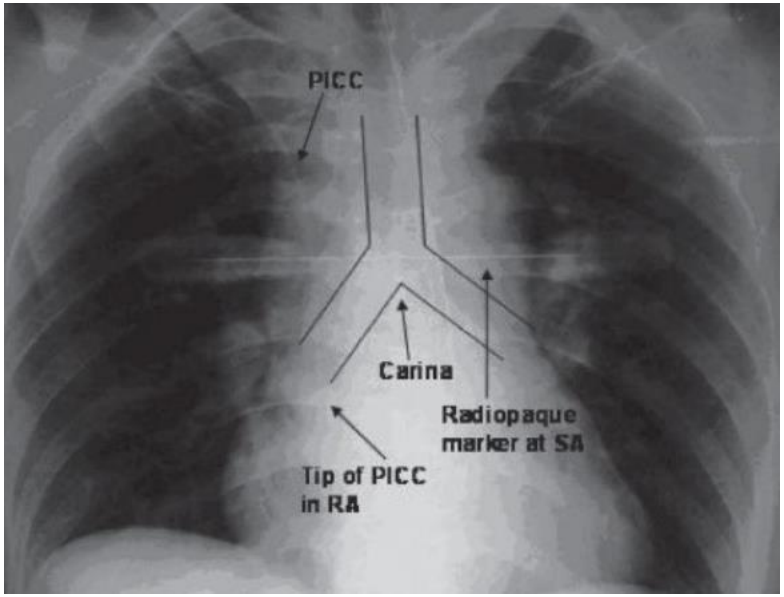
Catheter Material. There is **NO** evidence that any material treated with specific substances may reduce thrombotic risk.

Prevention of Thrombotic Complications

Correct catheter Tip Location ; at the **lower third of the superior vena cava**, a region of high blood flow, so is associated with less UE-DVT for PICC.

↓ incidence from 4,8% to 2,9%.





TECHNIQUE

Correct instalation

Measure the trajectory of the catheter and cut it if necessary depends on patient size

Record length of line insertion, anatomical site

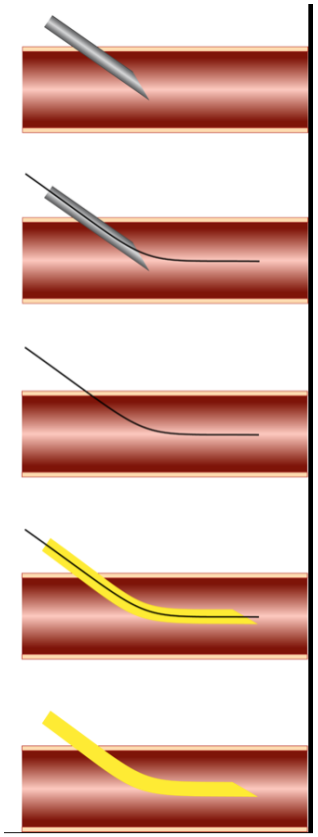
Sterile technique. Maximal barrier precautions

Ultrasond guided insertion was associated with a decreased

- ↓ risk of CRBSI ($P < .04$)
- ↓ risk of thrombosis ($P < .001$)
- ↓ risk of arterial or nerve puncture

TECHNIQUE

Seldinger technique



Verify correct catheter tip position at the lower third of the SVC

- **Rx Thorax**
- **ECG** The catheter's tip location is confirmed by an increase in P wave amplitude.(P-wave deflections) However, for this system to be effective, the patient needs a normal sinus rhythm
- **Echocardio**

TECHNIQUE

Stabilize the catheter

Cyanoacrylate glue

Sutureless device

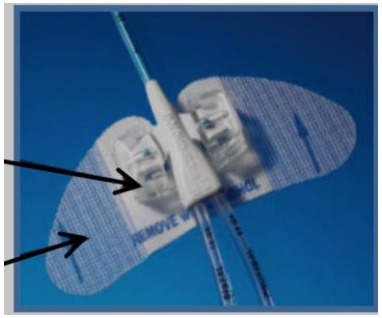
It is not usual practice to secure PICCs to the skin by suturing because the catheter normally remains in place for many weeks/months. Skin suturing would not be appropriate for this length of time

Adhesive devices to hold the PICC firmly in place are becoming increasingly available,..

Sutureless securement devices should be used in accordance with manufacturer's instructions.

<u>Advantages</u>

- ↓ Risk of CRBSI ($P < .001$)
- More comfort,



StatLock stabilization device
Power PICC SOLO

Exit site protection with semipermeable transparent membrane

MAINTENANCE

Flushing

- Is vital to keep the lumen of the catheter clean and to maintain patency.
- Before and after every use, or at least weekly when not in use.
- With a minimum of 10 ml of **0.9% sodium chloride**. **No heparin**, *in accordance with the most recent studies*
- When infusing TPN and after blood sampling, Flush the catheter with 20 ml of 0,9% sodium chloride
- Push-pause or start-stop-start . The method of flushing is also important. A push-pause turbulent flush technique should always be performed; creating turbulence within the catheter helps to keep the catheter lumen(s) clean and free from debris.

Goodwin and Carlson, 1993

MAINTENANCE

Use of clear, transparent dressings That permit site examination

- Dressing must be changed every 7 days or more frequent if needed when the dressing becomes damp, loosened, no longer occlusive or adherent, soiled, if there is evidence of inflammation, or excessive accumulation of fluid

The stabilization device must be changed once a week

- Manufacturer’s recommendations should be followed

Recording accurate documentation and reporting to monitor patient's conditions and to communicate with other caregivers, which help maintain effective care , ensure patient safety and prevent potential PICC associated complications.

IVD requirements should be constantly reassessed and any non-essential intravenous devices should be promptly removed.

REMOVAL

- Clean the site thoroughly with alcoholic chlorhexidine and allow to dry.
- Apply simple slow, steady traction when sliding catheter out.
- Have patient perform Valsalva maneuver.
- Digital pressure should be applied by the clinician until haemostasis is achieved.
- On removal the clinician should visually check the integrity of the line to ensure that the tip is present, the complete line has been removed and no breakage has occurred.
- The removed line should be measured and its length documented and checked against the length documented on insertion.

CONCLUSIONS

- Need to individualize treatment: Best choice for the best outcome at the least cost for each patient

- Each nurse plays a fundamental role in the management of PICC line . High level of education, qualification, knowledge and strict adherence to institutional guidelines or protocols may effectively reduce catheter-related complications.

  JPEN J Parenter Enteral Nutr. 2013;37:375-383

- All VADs have a risk for the patient and should be removed as soon as no longer medically necessary.

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