

GFVeCellT
Gli Accessi Venosi Centrali a Lungo Termine

XII PICC Day

VANTAGGI E LIMITI DELL'UTILIZZO DEI PICC IN TERAPIA INTENSIVA

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FIRENZE



INDICATION FOR A CENTRAL LINE IN ICU

- Solutions with pH <5 or pH>9, osmolarity >600 mOsm/l
 - vasoactive drugs, atb., K⁺, etc.
- High flow rates
- Multiple infusate
- Contrast Media
- Frequent blood samples
- CVP/PAP/SvO₂ Monitoring
- Necessity of Dialysis or Apheresis (CICC or FICC)

INS 2016



Central lines (new **WoCoVA** definitions)

- **PICC - Peripherally inserted central catheters**
 - 'Brachial CVC'
- **CICC – Centrally inserted central catheters**
 - 'Chest CVC'
- **FICC – Femorally inserted central catheters**
 - 'Groin CVC'

In ICU, *the point is*.....

CICC vs PICC

CICC vs PICC

CICC: Drawbacks

- Increased risk at insertion
 - Pneumothorax
 - Hemothorax
- For short term use (days or weeks)
- Non power
- «Occasional line inserters»
- Increased risk of CRBSI (?)

CICC vs PICC

PICC: Drawbacks

- Reduced catheter flow rates
- Single/dual lumen
- Hemodynamic monitoring
- «*Time consuming*» procedure
- Increased risk of malposition
- Increased risk of TVP (?)

PICC = **Lower Risk of Insertion Complications**

- Potential local arterial or nerve injury (<0.01%)
 - No risk of pneumothorax or hemothorax
 - No risk of hemorrhagic complications
 - No risk of hemopericardium
 - No risk of air embolism
 - Etc.

GENERAL ADVANTAGES OF PICCs vs CICC

- **Greater patient acceptance**
- **Long duration**
- **Also for Out of ICU/Out of Hospital Use**
- **Safe insertion**, even in «fragile» patients (cardio-respiratory, altered hemostasis, tracheostomy, neck and thorax abnormalities, etc.)



Wouldn't a PICC have been a better choice?

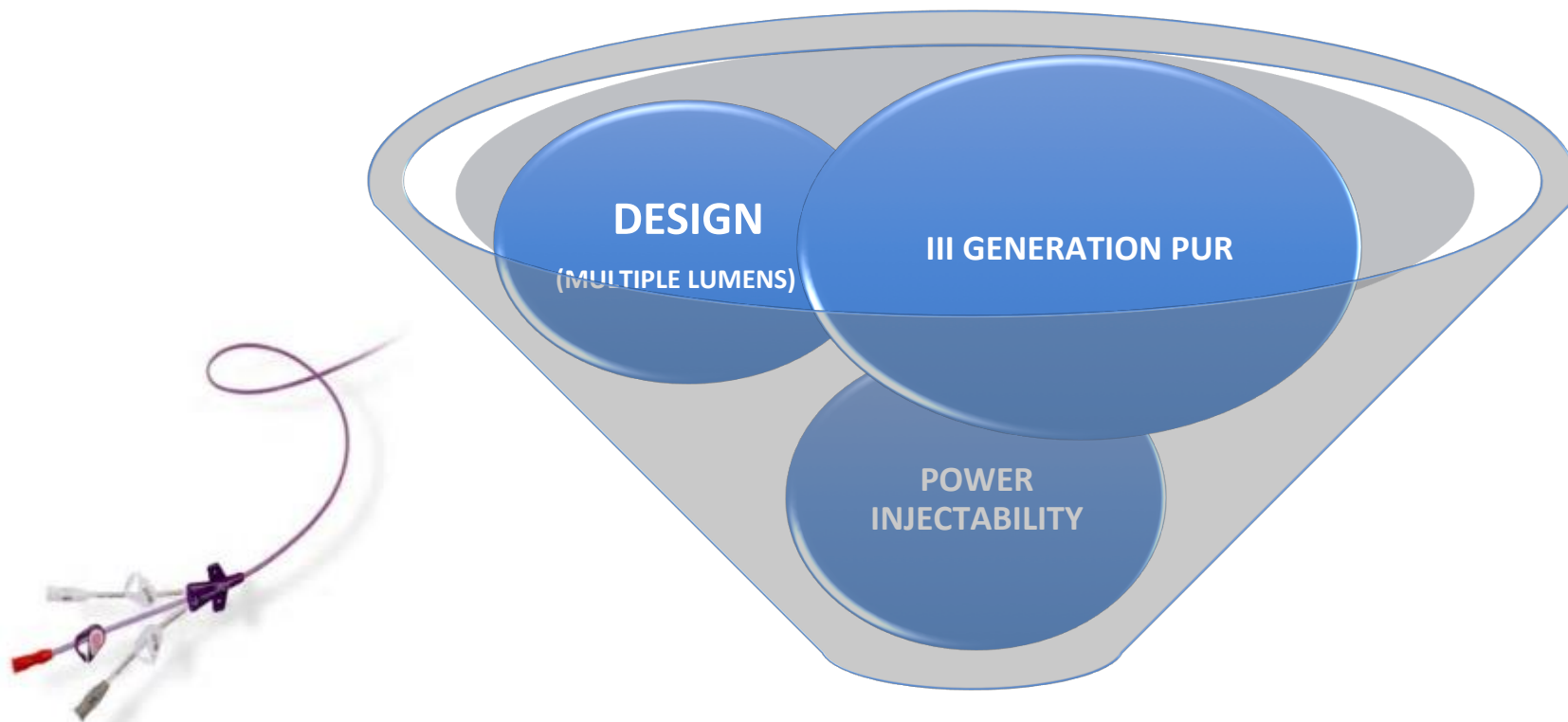


Courtesy of Mauro Pittiruti



Courtesy of Mauro Pittiruti

PICC TECHNOLOGICAL IMPROVEMENTS



PICC = **BETTER MATERIAL**

CICC = old fashioned polyurethane

PICC = Third generation polyurethane

INCREASED RESISTANCE; SOFTNESS; PLIABILITY; THINNER WALLS; LARGER INTERNAL DIAMETER

PICC = **POWER-INJECTABILITY**

CICC = certified only in few CICCs

PICC = certified for most 3rd-generation PICCs

ICU patients often need CT scan

PICC= **HIGH PRESSURE and FLOWS**

Power-injectable polyurethane PICCs

Pressure resistance (**250-325 psi**) = possibility of high flow (2-5 ml/sec => 300 ml/min => **1800 ml/h**)

PICC = **MULTIPLE LUMENS**

CICC = 1 to 5 lumens

PICC = 1 to 3 lumens:

- 3Fr single lumen
- 4Fr single or double lumen
- 5Fr single, double, triple lumen
- 6Fr single, double, triple lumen

ICU patients need multiple lumens



IVAD6 Use a catheter with the minimum number of ports or lumens essential for management of the patient.

Class A

IVAD7 Preferably use a designated single-lumen catheter to administer lipid-containing parenteral nutrition or other lipid-based solutions.

Class D/GPP

EPIC 2014

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Class A

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Class D/GPP

EPIC 2014

PICC INSERTION TECHNIQUE IMPROVEMENTS



- POSITIONING IN DEEP ARM VEINS
- CHOICE OF THE VEIN (diameter, position, depth)
- ASEPTIC TECHNIQUE
- ULTRASOUND GUIDANCE
- INTRAPROCEDURAL TIP LOCATION
- STABILIZATION OF THE DEVICE

ISP PROTOCOL

Pittiruti et al.
Gavecelt 2010

PICC = **VASCULAR ACCESS TEAM**

WHO IS INSERTING +/- INSERTION PROTOCOL (SIP)

- CICC = inserted by *not* properly trained physicians (▬ protocol)
Occasional line inserters...
- PICC = inserted by properly trained nurses or physicians (+ protocol)

PICC = **TUNNEL**



PICC = **COST-EFFECTIVENESS**

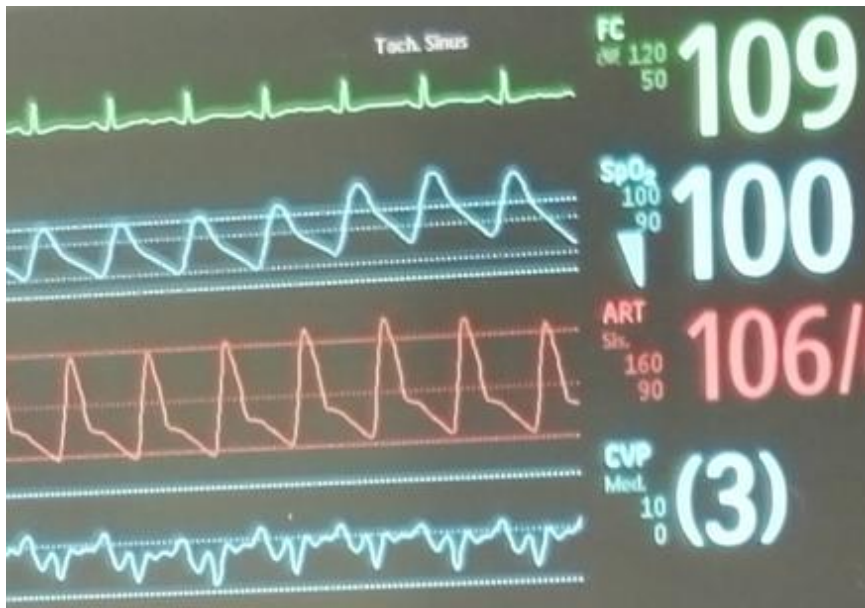
Nurse-driven insertion increases cost-effectiveness

	WHO	WHERE	HOW	
\$ 5000	surgeon	operating room	fluoroscopy	+ nurse
\$ 2800	radiologist	radiology suite	fluoroscopy	+ technician
\$ 1800	anaesthetist	bedside	no fluoro	
\$ 875	nurse	bedside	no fluoro	

Smith, Wisconsin University 2011

PICC = **MONITORING**

CVP



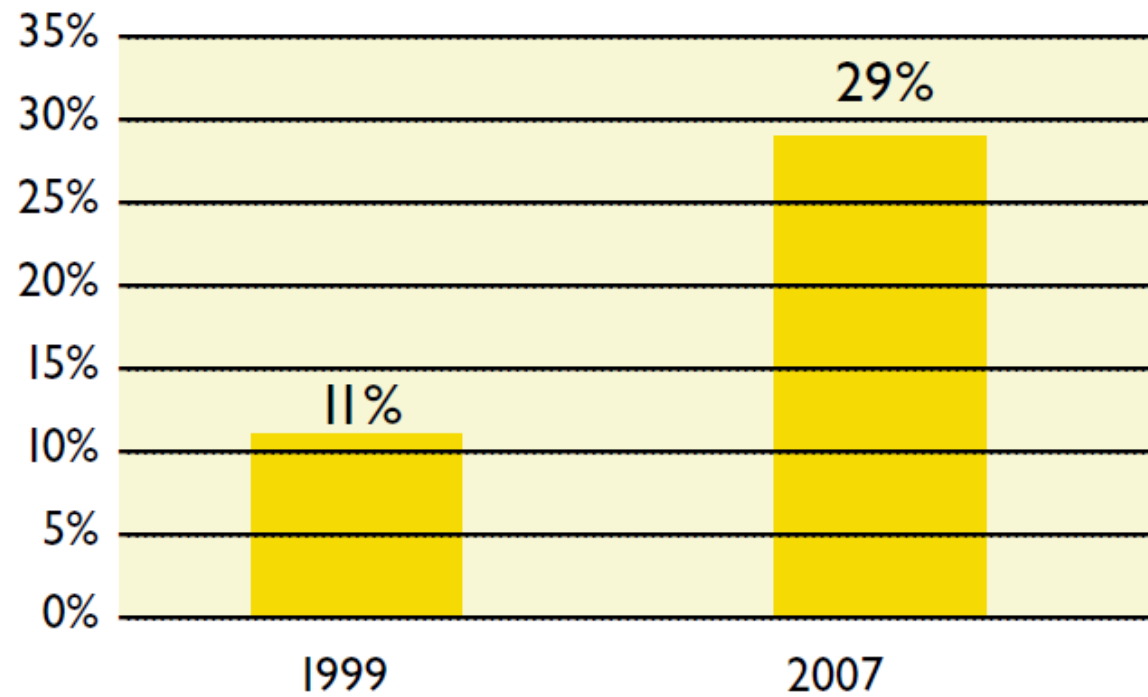
Polyurethane
Open ended catheters



Accurate measurements

Black et al., CCM 2000
McLemore et al., AVS 2006
Sanfilippo et al., JVA 2017

PICC Usage in Critical Care



LIMITS OF PICCs

INSERTION TIME

- CICC = insertion can be very rapid (direct Seldinger; easy tip location)
- PICC = insertion takes more time (modified Seldinger; tip location requires more time)

PICC are not appropriate for emergency

(ARE C/CC INDICATED IN EMERGENCY....??)

LIMITS OF PICCs

NUMBER OF LUMENS

- MORE THAN THREE LUMEN REQUIRED
- *BUT...*IT IS POSSIBLE: CICC 3 LUMENS + PICC 3 LUMENS=
6 LUMENS!

LIMITS OF PICCs

INSERTION

- CICC = almost any patient (choosing internal jugular or subclavian or axillary or brachio-cephalic)
- PICC = may have systemic or local contraindications:
 - Arm plegia;
 - Chronic kidney disease (av fistula);
 - Arm veins unavailable or too small.



INS 2016

LIMITS OF PICCs

INSERTION

- Patients with AV-fistula (or chronic renal failure stage 3b – 5)
- Patients with bilateral local contraindications to deep vein cannulation (axillary node dissection, skin or bone abnormalities, deep venous thrombosis, deep veins < 3mm, etc.)

LIMITS OF PICCs

**TUNNELLING MAY
OVERCOME LIMITATIONS
DUE TO SMALL VEINS...**



CICC vs PICC

☐ **RISK OF INFECTION**

☐ **RISK OF THROMBOSIS**

Literature data difficult to interpret...No RCT...
difficult to draw any conclusions...

Adherence to insertion bundle?

1. Appropriate choice of the vein (patient, exit site, catheter/vessel ratio)
2. Appropriate technique of venipuncture (US, atraumatic needle, microintroducer..)
3. Adequate position of the tip (CAJ)
4. Proper securement (sutureless, transparent dressing, glue..)

= REDUCED COMPLICATIONS

CICC vs PICC

☐ RISK OF INFECTION

Selection of catheter insertion site

IVAD11 In selecting an appropriate intravascular insertion site, assess the risks for infection against the risks of mechanical complications and patient comfort.

Class D/GPP

IVAD12 Use the upper extremity for non-tunnelled catheter placement unless medically contraindicated.

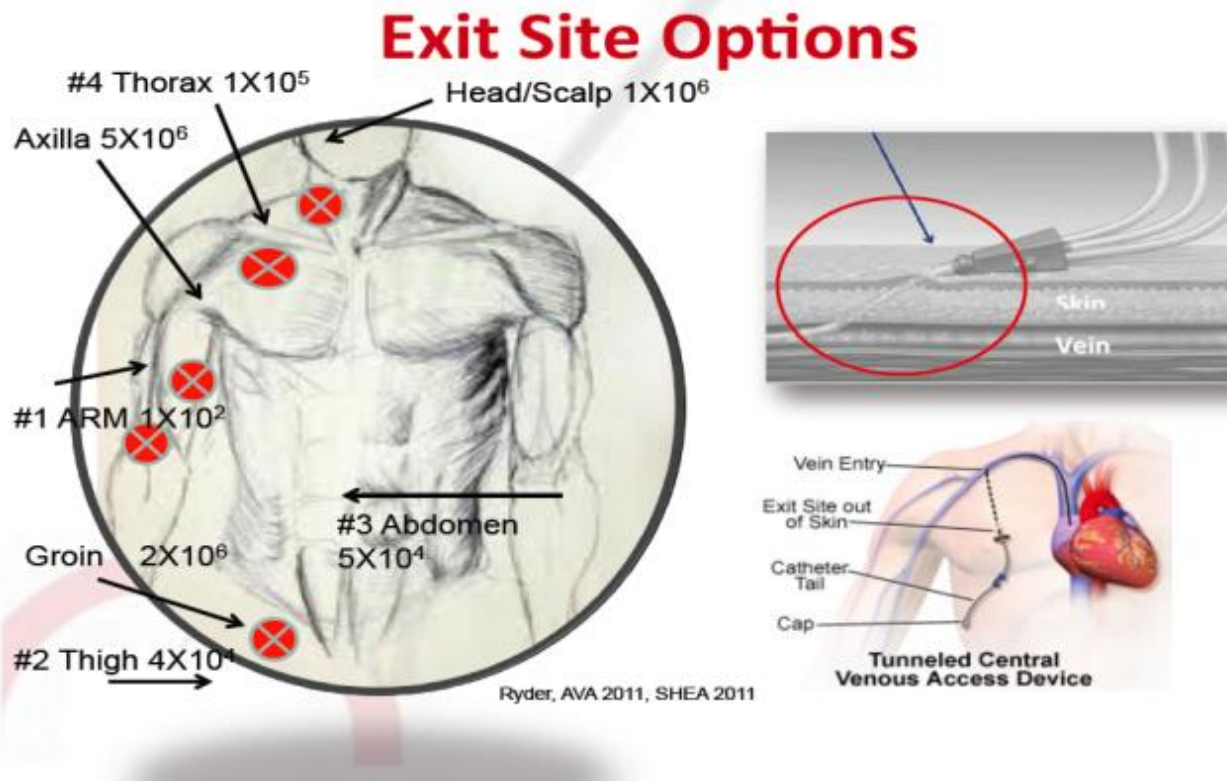
Class C

EPIC 2014

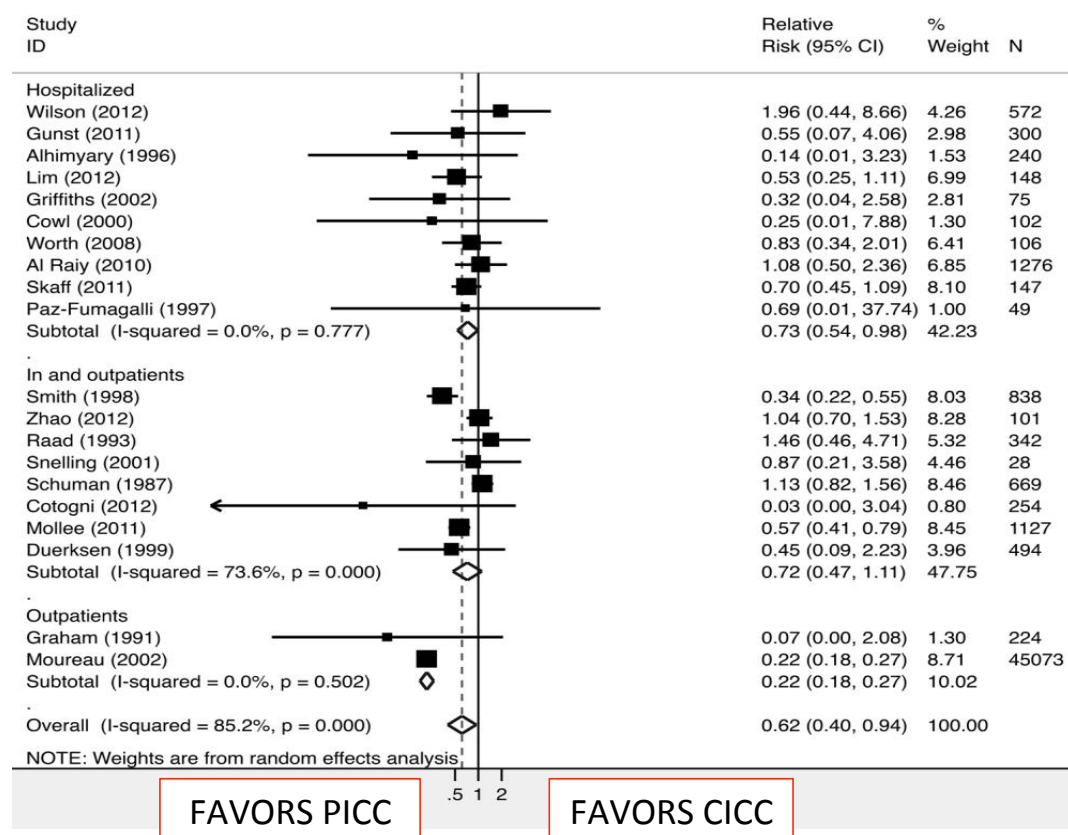
PICC = low risk of CRBSI

- Literature Data
 - No ECO
 - 0.8 – 2 /1000 gg (Maki 2006, Moreau 2007, Garnacho 2009)
 - With ECO
 - 0- 0.4 /1000 gg (Harnage 2006, Scoppettuolo 2010, Cotogni 2011)
- Possible Explanations
 - The distance from tracheal/oral/nasal secretions
 - Stable and clean dressing
 - Physical characteristics of the skin of the arm
 - Low contamination of the skin of the arm

The crucial point is the exit



Chopra V, et al. The Risk of Bloodstream Infection Associated with Peripherally Inserted Central Catheters Compared with Central Venous Catheters in Adults: A Systematic Review and Meta-Analysis. *Infection Control and Hospital Epidemiology*, 2013;34(9):908-18



Wouldn't a PICC have been a better choice?



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Wouldn't a PICC have been a better choice?



RISK OF INFECTIONS
PICC IS PREFERABLE in ICU

Especially:

- in patients with tracheostomy;
- when the emergency site of CICC's neck;
- when the CICC is positioned without adhering to the international recommendations for infection prevention (chlorhexidine 2%- maximum barrier protections– eco-guidance – sutureless fixation: see Protocol ISAC).

CICC vs PICC

☐ RISK OF THROMBOSIS

Chopra V et Al. Risk of venous thromboembolism associated with peripherally inserted central catheters: a systematic review and meta-analysis.

Lancet. 2013;382:311-25

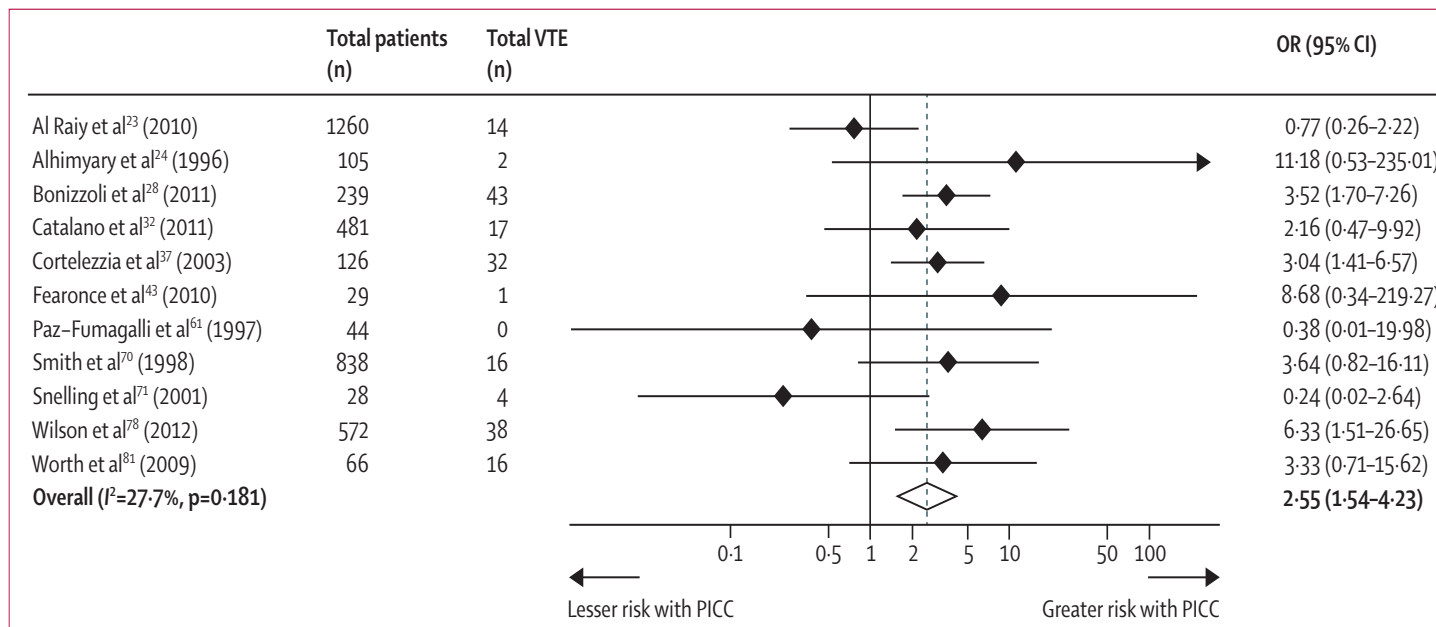


Figure 4: Risk of venous thromboembolism between peripherally inserted central catheters and central venous catheters in studies with a comparison group
 Forest plot showing odds of development of upper-extremity DVT in patients with peripherally inserted central catheters versus central venous catheters.
 VTE=venous thromboembolism. OR=odds ratio. PICC=peripherally inserted central catheter.

Chopra V et Al. Risk of venous thromboembolism associated with peripherally inserted central catheters: a systematic review and meta-analysis.

Lancet. 2013;382:311-25

- At least 6 of the 64 studies report asymptomatic CRT (with obviously high %)
- At least 1 of the 64 studies confuses CRT with lumen occlusion (Worth 2009)
- At least 1 study deals with CRT in pediatric patients (Vidal 2008)
- At least 1 study reports a high rate of not acceptable tip positions (Lobo 2009)
- At least 1 of the 64 studies deals exclusively with CRBSI and does not mention CRT (Mollee 2011)
- At least 2 studies on neurological patients (from the same center) include also PICCs inserted in paretic arms (!) (Wilson 2012, Fletcher 2011)

Chopra V et Al. Risk of venous thromboembolism associated with peripherally inserted central catheters: a systematic review and meta-analysis.

Lancet. 2013;382:311-25

At least 14 of the 64 studies report experience with old-fashioned PICCs inserted without micro-introducer and without US, at the antecubital fussa.

- Bottino 1979, Merrel 1994, Alhimyary 1996, Paz-Fumagalli 1997, Smith 1998, Allen 2000, Grove 2000, Snelling 2001, Strahilevitz 2001, Walshe 2002, Chemaly 2002, Ong 2006, Seeley 2007, Nash 2009
- CRT : 0.5 % - 14.9 %

Chopra V et Al. Risk of venous thromboembolism associated with peripherally inserted central catheters: a systematic review and meta-analysis.

Lancet. 2013;382:311-25

Studies in non-oncological patients

- King 2006	2.1 %
- Evans 2010	3.0 %
- Fearonce 2010 (burns)	2.8 %
- DeLemos 2011 (neuro)	3.0 %
- Pittiruti 2012 (ICU pts)	3.1 %
- Sperry 2012	1.3 %
- Liem 2012	3.0 %

Studies in oncological patients

- Aw 2012	5.9 %
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(Even higher in hematologic malignancies)

Expected risk of symptomatic catheter related thrombosis in ICU

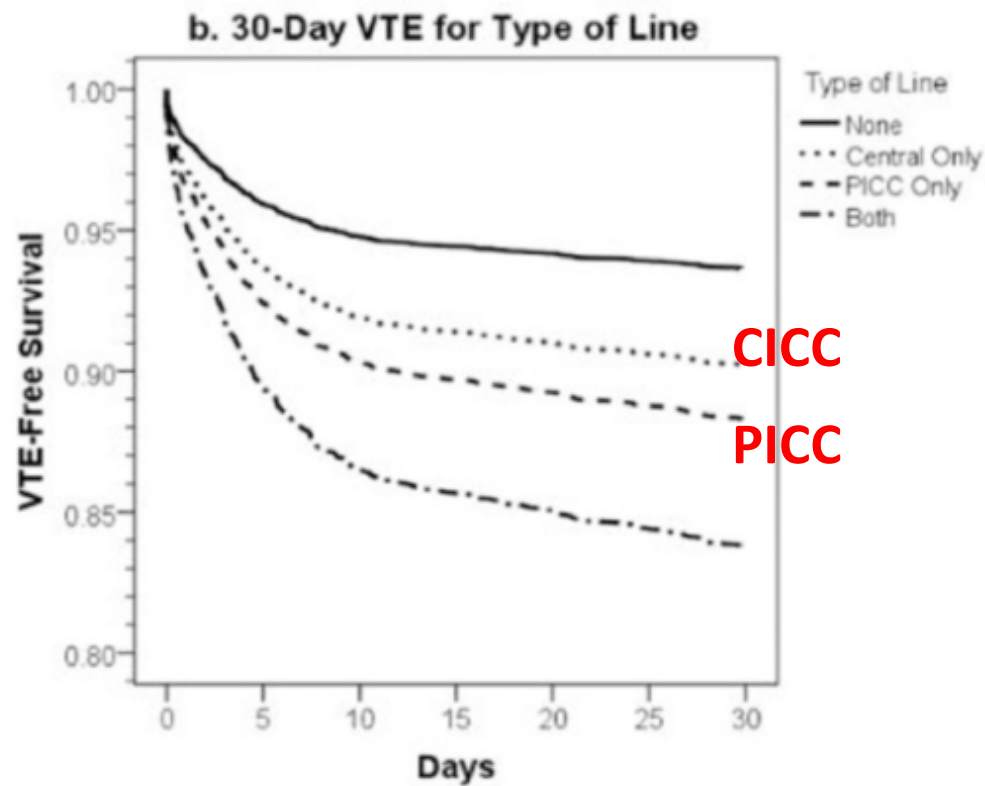
- CICC 1-3%
- PICC 2-5%
- FICC 5-10%

Comparative thrombosis risk of vascular access devices among critically ill medical patients

Darren White^{a,*}, Scott C. Woller^{a,b}, Scott M. Stevens^{a,b}, Dave S. Collingridge^c, Vineet Chopra^d, Gabriel V. Fontaine^{e,f,g,h}



2018



CICC

PICC

HR=1.21 (0.94-1.55); p=0.14 **N.S**

Efficacy and safety of peripherally inserted central venous catheters in acute cardiac care management

JVA | The Journal of
Vascular Access

Poletti et al. 2018

137 PICC were placed

- The rate of symptomatic CRT was 1.4%.
- 80.3% of patients eligible for a PICC;
- CRBSI was diagnosed in one patient (0.7%; 5.7×1000 catheter days);
- All PICC were inserted successfully without other major complications.

RISK OF THROMBOSIS

CICC IS PREFERABLE

- Especially in onco-hematologic patients;
- **When the PICC is positioned without adhering to the international recommendations for the prevention of venous thrombosis...**
 - appropriate ratio between the diameter of the catheter and vein diameter – use of eco-guidance – appropriate placement of the catheter tip position- adequate stabilization
 - emergency site – see *ISP Protocol*

CONCLUSION 1

PICC in ICU...ADVANTAGES:

- Can be used for multiple drugs infusion
- For hemodynamic monitoring;
- Their insertion is feasible and safe in high percentage of acute patients;
- Extremely low rate of infective complications and clinical thrombosis;
- The patient can be transferred with the PICC.



CONCLUSION 2

PICC in ICU...*PARTICULAR* ADVANTAGES:

- Tracheostomy
- High risk of infection of the exit site
- Coagulopathy
- Unavailability of the neck/clavicle area (NIV; collars, etc.)
- Prolonged hospitalization



CONCLUSION 3

PICC in ICU...LIMITS:

- Emergency vascular access
- More than three lumens required
- Arm veins unavailable
- Arm plegia
- Chronic renal failure (AV fistula)





GRAZIE!

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