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PICC in ICU: when and how?



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PICC in ICU: when and how?



Mmm, I am not so sure doc...!

No no, they've high thrombotic risk !!

No no, they increase the risk of infection!!

No no, I can't use them for hemodynamic monitoring!

No no, they're too time consuming!



PICC in ICU: some data

942

INFECTION CONTROL AND HOSPITAL EPIDEMIOLOGY

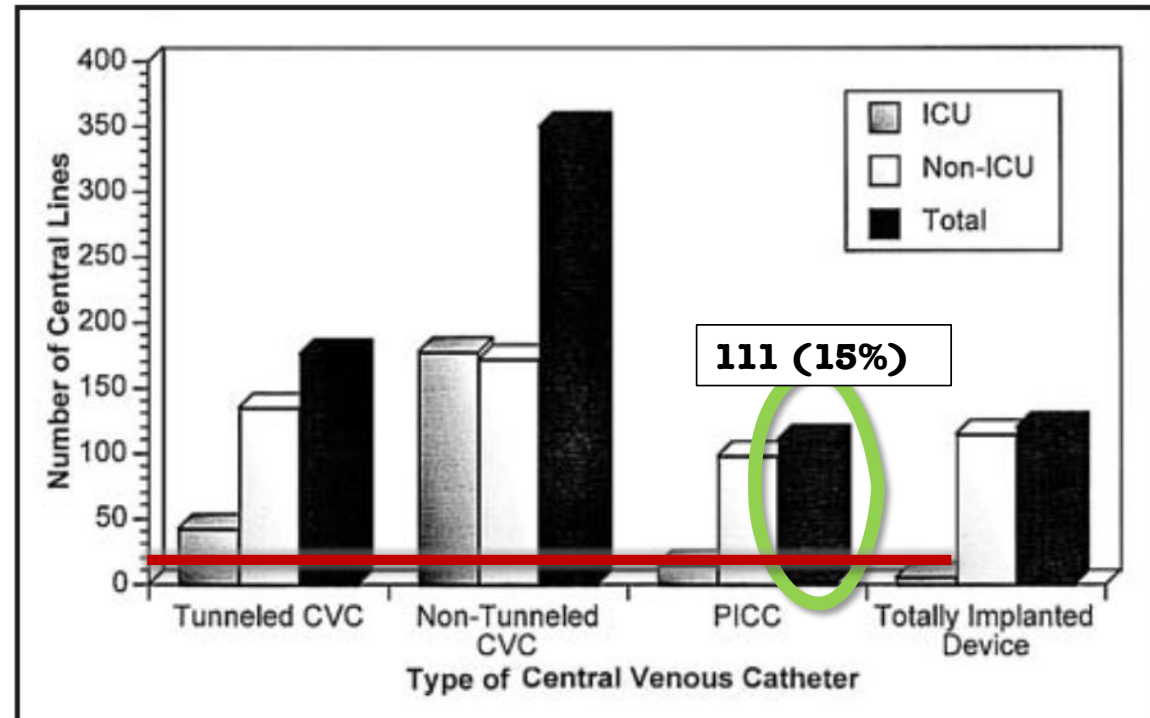
December 2003



PREVALENCE OF THE USE OF CENTRAL VENOUS ACCESS DEVICES WITHIN AND OUTSIDE OF THE INTENSIVE CARE UNIT: RESULTS OF A SURVEY AMONG HOSPITALS IN THE PREVENTION EPICENTER PROGRAM OF THE CENTERS FOR DISEASE CONTROL AND PREVENTION

55.4% of ICU vs 24.4% hospital ward patients received CVADs

30% of ICU vs 70% hospital ward total CVADs placed



PICC in ICU: some data

Main findings

Patients enrolled	89
Adult	65
<i>Pediatric</i>	24
Dwell time (days)	25±12
Insertion complications	
Major complications	0
Minor complications	
<i>Local hematoma</i>	3 (3.4%)
<i>Repeated punctures</i>	5 (5.6%)
<i>Difficulties in progression</i>	4 (4.5%)
<i>Tip malposition</i>	1 (1.1%)
CRBSI	0
Thrombosis	1 (1.1%)
Occlusion	0
Dislodgments	0



CRITICAL CARE

RESEARCH

Open Access

Clinical experience with power-injectable PICCs in intensive care patients

- Rate of complications at insertion has been extremely low, especially considering the anatomical difficulties expected in acutely ill patients
- PICCs are associated with a lower rate of infection if compared with CVCs
- Dislodgement has been described as a problem only in studies not using ultrasound-guided insertion in the upper mid-arm and/or not using sutureless devices for PICC securement

Contraindications to PICC insertion are few, such as the need for an **emergency central line**, need for a central line with **more than three lumens**, and **lack of availability of a vein > 4 mm** in the upper mid-arm

PICC in ICU: when and how?

No no, they've high thrombotic risk !!

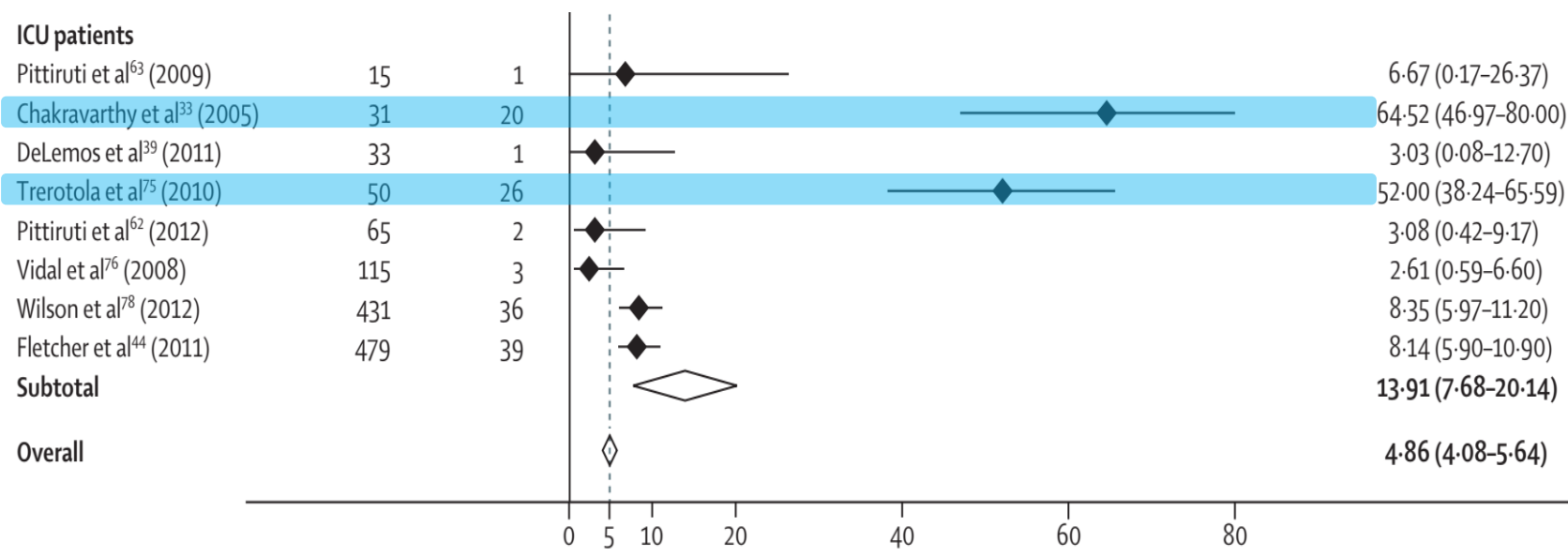


PICC in ICU: thrombotic risk

Risk of venous thromboembolism associated with peripherally inserted central catheters: a systematic review and meta-analysis



Vineet Chopra, Sarah Anand, Andy Hickner, Michael Buist, Mary A M Rogers, Sanjay Saint, Scott A Flanders



PICC in ICU: thrombotic risk

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ICU patients

Pittiruti et al⁶³ (2009)

15

1



6.67 (0.17-26.37)

No information regarding appropriate vein selection,
number of punctures and management of implanted
device!



PICC in ICU: thrombotic risk



Contents lists available at ScienceDirect

Journal of Critical Care

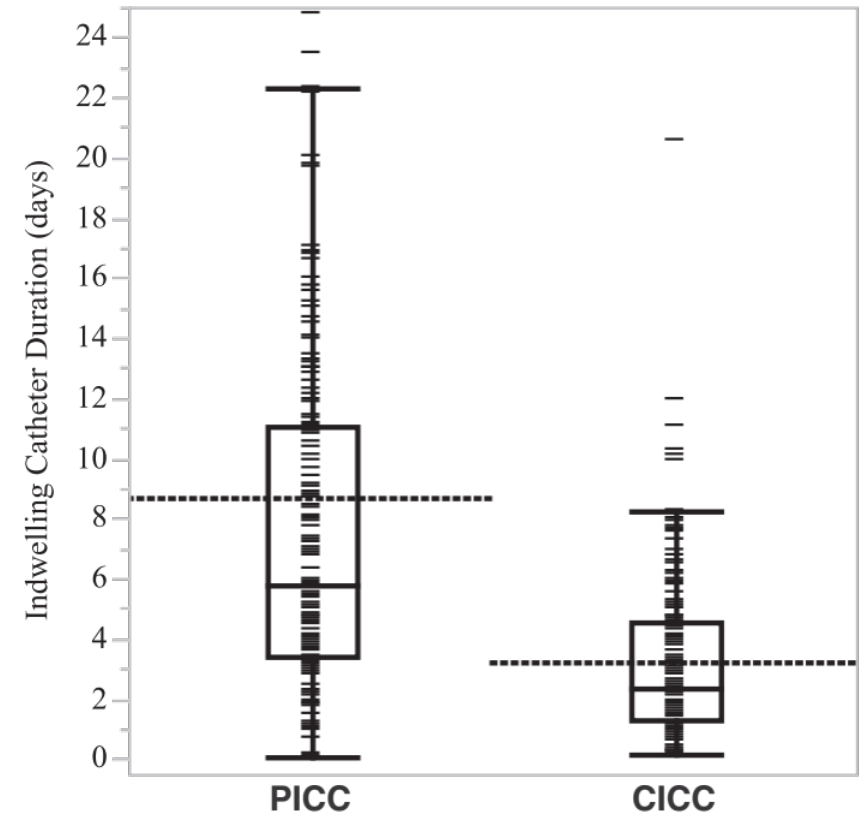
journal homepage: www.jccjournal.org



Complication rates among peripherally inserted central venous catheters and centrally inserted central catheters in the medical intensive care unit[☆]

Matthew E. Nolan, MD^a, Hemang Yadav, MBBS^a, Kelly A. Cawcutt, MD^b, Rodrigo Cartin-Ceba, MD^{a,*}

		PICC (n = 200)	CICC (n = 200)	P value
Indwelling MICU catheter days	Total days	750	535	
	Median days (IQR)	2.3 (1.0-4.5)	2.0 (1.1-3.8)	.266
CRDVT	n (%)	4 (2%)	2 (1%)	.685
	Per 1000 MICU catheter-days	5.3	3.7	
	Median time-to-DVT (range), d	6.1 (2.3-18.8)	3.3 (1.7-4.8)	
CLABSI	n (%)	0	0	–
	Per 1000 MICU catheter-days	0	0	



PICC in ICU: thrombotic risk



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Complication rates among peripherally inserted central venous catheters and central catheters in intensive care units

Matthey

Thrombotic and infectious complications were uncommon following PICC and CICC insertion, with no significant difference in complication rates observed. Half of PICC DVTs occurred on the general floor, and like all central catheters placed in the ICU, PICCs should be aggressively discontinued when no longer absolutely needed.

CLABSI

n (%)
Per 1000 MICU
catheter-days

0
0

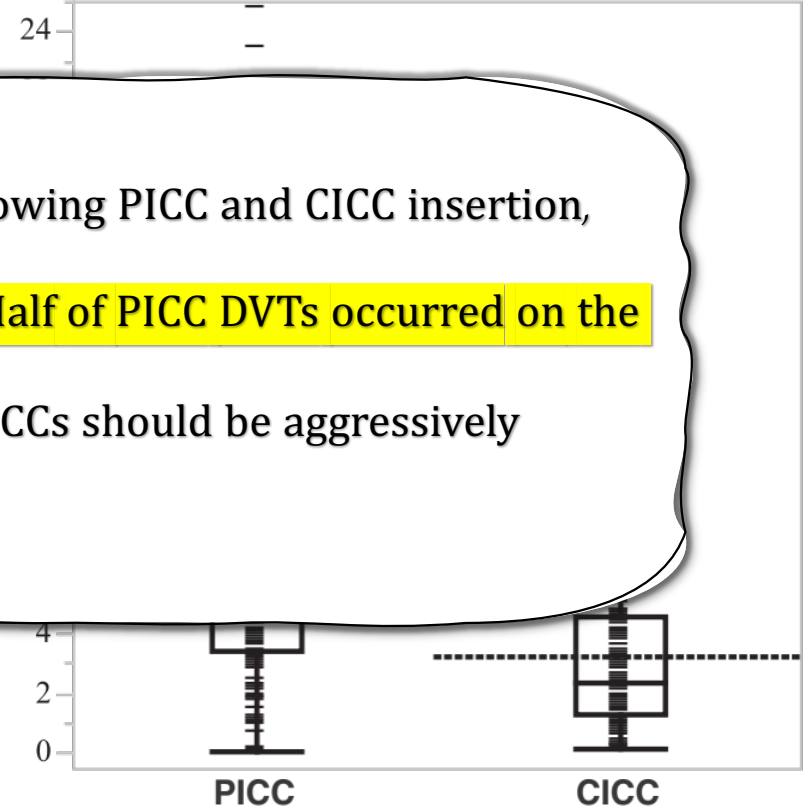
0
0

—

4
2
0

PICC

CICC



PICC in ICU: when and how?

No no, they
increase the risk
of infection!!



PICC in ICU: risk of infection

SCIENTIFIC REPORTS

OPEN The microbiological characteristics and risk factors for PICC-related bloodstream infections in intensive care unit

Received: 8 November 2016

Accepted: 20 January 2017

Published online: 08 November 2017

Shumin Zhang¹, Xiaofeng Sun² & Yan Lei³

Zhang, Scientific REPORTS | 7: 15074

Manipulation
- reducible

Patient's
factors

Parameters	Logistic analysis		Cox analysis	
	OR (95%CI)	<i>P</i>	OR (95%CI)	<i>P</i>
Power PICC	4.239 (1.857–9.678)	0.001	4.197 (1.932–9.119)	0.000
Charison scores	1.137 (1.004–1.287)	0.044	1.120 (1.001–1.253)	0.048
Diabetes mellitus	2.663 (1.293–5.482)	0.008	2.370 (1.224–4.588)	0.011
Lumens				
1	Reference		Reference	
2	3.352 (1.343–8.368)	0.010	2.939 (1.233–7.010)	0.015
3	8.018 (2.771–23.202)	0.000	6.352 (2.433–16.580)	0.000

PICC in ICU: risk of infection

RESEARCH

Open Access

Lower risk of bloodstream infections for peripherally inserted central catheters compared to central venous catheters in critically ill patients

Vassiliki Pitiriga¹, John Bakalis², Kalliopi Theodoridou¹, Petros Kanellopoulos², George Saroglou² and Athanasios Tsakris^{1*}



	PICCs	CVCs	P-value
No of catheters	639	1187	
Total catheter-days	11,110	9774	
No of CLABSI	18	59	$\chi^2 = 4.74$ $P = 0.029$
CLABSI incidence rate (per 1000 cath-days)	1.62	6.03	T -test, $p < 0.001$
No of CLABSI-MDRO	4	31	$\chi^2 = 8.7$ $P = 0.003$
CLABSI-MDRO incidence rate (per 1000 cath-days)	0.36	3.17	T -test, $p < 0.001$

Pitiriga et al. Antimicrobial Resistance & Infection Control (2022) 11:137

ORIGINAL WORK

A Randomized Trial of Complications of Peripherally and Centrally Inserted Central Lines in the Neuro-Intensive Care Unit: Results of the NSPVC Trial

Nicholas J. Brandmeir^{1,2,3*}, Justin R. Davanzo⁴, Russell Payne⁴, Emily P. Sieg⁵, Ashiya Hamirani⁶, Annie Tsay⁶, Jeffrey Watkins⁶, Sprague W. Hazard^{4,7} and J. Christopher Zacko⁴



Variable	PICC	CICC	P value
Classic complications	4 (5.5%)	1 (1.3%)	0.14
Thrombosis	4	0	0.07
CLABSI	0	0	-
Insertional trauma	0	1	0.64
Discharge with line	30 (37%)	10 (12.3%)	<0.001

Brandmeir et al. Neurocrit Care <https://doi.org/10.1007/s12028-019-00843-z>

PICC in ICU: when and how?

No no, I can't use them for hemodynamic monitoring!



Central venous pressure monitoring via peripherally or centrally inserted central catheters: a systematic review and meta-analysis

Filippo Sanfilippo¹, Alberto Noto², Gennaro Martucci¹, Marco Farbo¹, Gaetano Burgio¹, Daniele G. Biasucci³

Although limited, the available evidence support that CVP monitoring is feasible with PICC lines and that the possibility of monitoring CVP should not be a criteria to prefer a CICC over a PICC line. Open-ended non-valved PICCs coupled with a continuous infusion device can be considered an accurate alternative for CVP monitoring.

PICC in ICU: hemodynamics

RESEARCH

Open Access



Are single-lumen 5Fr and triple-lumen 6Fr PICCs suitable for hemodynamic assessment by trans-pulmonary thermodilution? A pilot study

Variables	6 Fr triple-lumen PICC	CICC	<i>p</i> value	Bias [LoA]
Measurements, <i>n</i>	40	40	—	—
CI, L/min/m ²	3.3 (0.8)	3.0 (0.7)	0.107	0.28 [− 0.32; 0.88]
GEDVI, mL/m ²	685 (133)	632 (102)	0.05	52.8 [− 75.7; 181]
EVLWI, mL/kg	14.0 (5.1)	12.2 (4.9)	0.178	1.5 [− 2.2; 5.2]
SVI, mL/m ²	44.4 (10.4)	40.6 (8.5)	0.077	3.8 [− 4.2; 1.8]
CVP, mmHg	11.3 (4.8)	11.7 (5.5)	0.764	—
Δ <i>T</i> , °C	0.33 (0.07)	0.34 (0.08)	0.514	− 0.01 [− 0.06; 0.03]

PICC in ICU: hemodynamics

RESEARCH

Open Access



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SVI, mL/m ²	44.4 (10.4)	40.6 (9.5)	0.077	3.8 [− 4.2; 11.8]
CVP, mmHg	11.3 (3.5)	11.5 (3.5)	0.933	− 0.2 [− 2.5; 2.1]
Δ <i>T</i> , °C	0.33 (0.05)	0.33 (0.05)	0.999	0.0 [− 0.1; 0.1]

Our study showed that power injectable PICCs of adequate lumen size can be used as an alternative to CICCs for hemodynamic assessment using TPTD in adult ICU patients

PICC in ICU: when and how?

No no, they're too time consuming!



PICC in ICU: time consuming?

Original research article

JVA | The Journal of
Vascular Access

Peripherally inserted central catheter placement in a multidisciplinary intensive care unit: A preliminary study demonstrating safety and procedural time in critically ill subjects

The Journal of Vascular Access
2021, Vol. 22(1) 101–106
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DOI: 10.1177/1129729820928618
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Insertion time Median time (IQR) min	Shock	No shock	P value
	31 (25,44)	30 (24.3, 39.8)	0.71
	APACHE $\geq$ 55	APACHE $<$ 55	
	29 (21,40.5)	33 (26,45)	0.25
	BMI $\geq$ 30	BMI $<$ 30	
	29 (25.5,40)	30.5 (23.5,42.4)	0.89

PICC in ICU: time consuming?

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Insertion time Median time (IQR) min	Shock			
	31 (25,44)			
	APACHE ≥ 55			
	29 (21,40.5)			
	BMI ≥ 30	BMI < 30		
	29 (25.5,40)	30.5 (23.5,42.4)	0.89	

Considering the aforementioned benefits of PICCs over CIOs, concerns of delayed vascular access in critically ill patients should not deter a physician from selecting a PICC to provide vascular access when it would otherwise be appropriate.

PICC vs CICC in ICU



CICC and risk of bleeding



REVIEW

CME/SAM

Central venous catheter placement in coagulopathic patients: risk factors and incidence of bleeding complications

*Emma K. van de Weerd,¹ Bart J. Biemond,² Bart Baake,¹ Ben Vermin,¹ Jan M. Binnekade,¹
Krijn P. van Lienden,³ and Alexander P.J. Vlaar¹*

OBSERVATIONAL STUDY

OPEN

Contribution of Coagulopathy on the Risk of Bleeding After Central Venous Catheter Placement in Critically Ill Thrombocytopenic Patients

CICC and risk of bleeding



REVIEW

CME/SAM

Central venous catheter placement in coagulopathic patients: risk factors and incidence of bleeding complications

Emma C. van de Weyerdt,¹ Bart J. Hiemstra,² Bart Baskin,¹ Ben Voorn,¹ Jan M. Binnekade,¹ Krijn P. van Lienden,³ and Alexander de Vries¹

- ✓ The 22 included studies indicated that major bleeding complications are rare in patients with thrombocytopenia and/or prolonged bleeding time
- ✓ A major shortcoming of the current literature on bleeding complications after CVC placement in the presence of coagulopathy is study design
- ✓ Except for one, all included studies had an observational cohort design. The rationale for correction of coagulopathy

TRANSFUSION Volume 57, October 2017

OBSERVATIONAL STUDY

OPEN

Contribution of Coagulopathy on the Risk of Bleeding After Central Venous Catheter Placement in Critically Ill Thrombocytopenic Patients

In our study, we found no relation between severe coagulopathy and CVC-related bleeding complications in critically ill patients with severe thrombocytopenia and/or severe coagulopathy.

- ✓ In our study, an overall bleeding rate of 15% was found with a frequency of grade 3 bleeding events of 0.7%, which is higher than most of the studies mentioned
- ✓ In this cohort, the preprocedural use of plasma products was very low and prophylactic platelet transfusion before CVC placement was used more

van Baarle, Critical Care Explorations Jan 22, Vol 4 • No 1

CICC and risk of bleeding



REVIEW

OBSERVATIONAL STUDY

Observational data

Heterogeneity of thrombocytopenia and coagulopathy definition

Heterogeneity of bleeding (major and minor) definition

Heterogeneity of pre-procedural treatment (plasma and/or PLT transfusion)

CME/SAM

Central venous catheter placement in coagulopathic patients: risk of bleeding complications

✓ Emma C. van de Walle, et al., 2022

indicate that CVC placement in the presence of coagulopathy and/or prolonged bleeding time

✓ A major current complication of CVC placement in the presence of coagulopathy

✓ Except for a few studies, most of the studies had an observational cohort design. The rationale for correction of coagulopathy

study on the Risk of Bleeding Associated with Central Venous Catheter Placement in Thrombocytopenic Patients. Our study, we found no relation between CVC placement and severe bleeding events

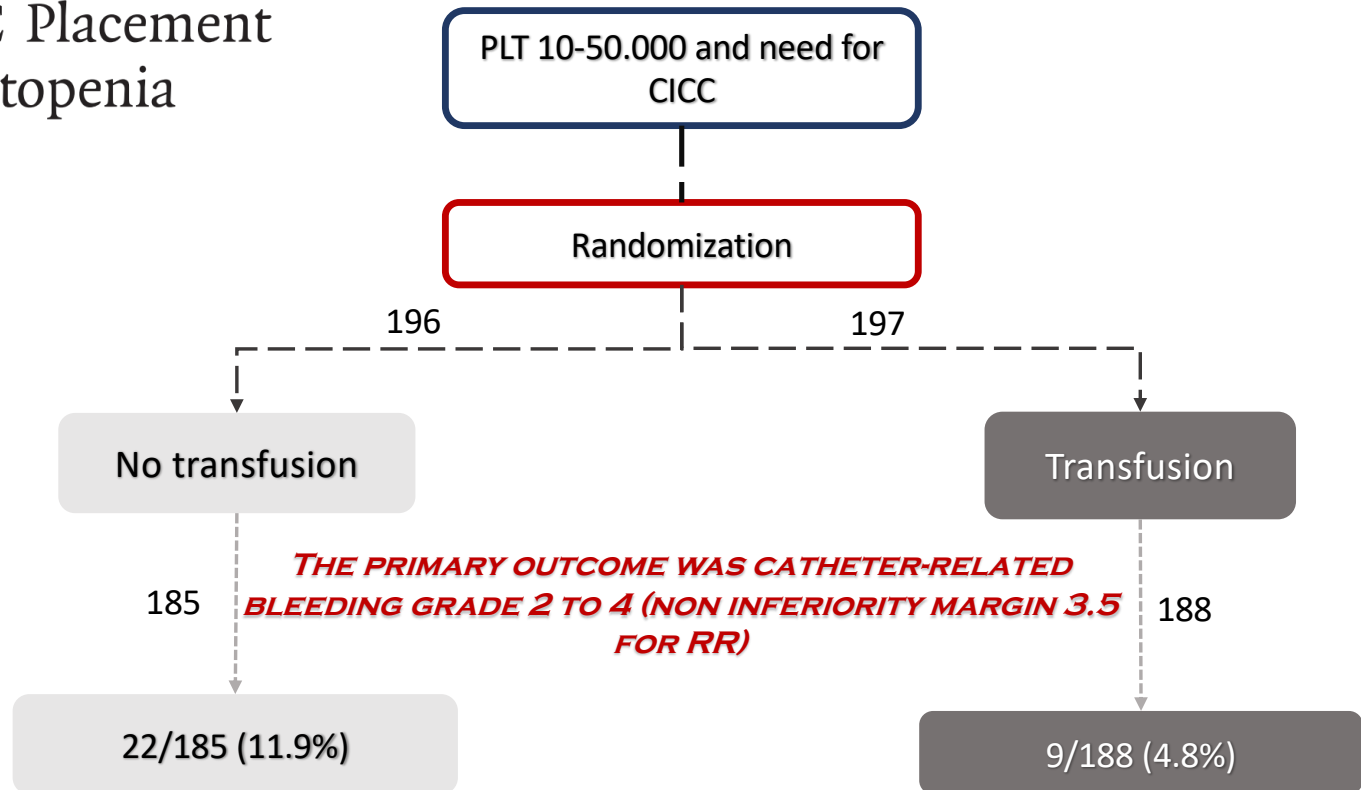
6.9-7% of patients had bleeding events most of which were minor. The use of plasma products was very low and prophylactic platelet transfusion before CVC placement was used more

CICC and risk of bleeding



ORIGINAL ARTICLE

Platelet Transfusion before CVC Placement in Patients with Thrombocytopenia



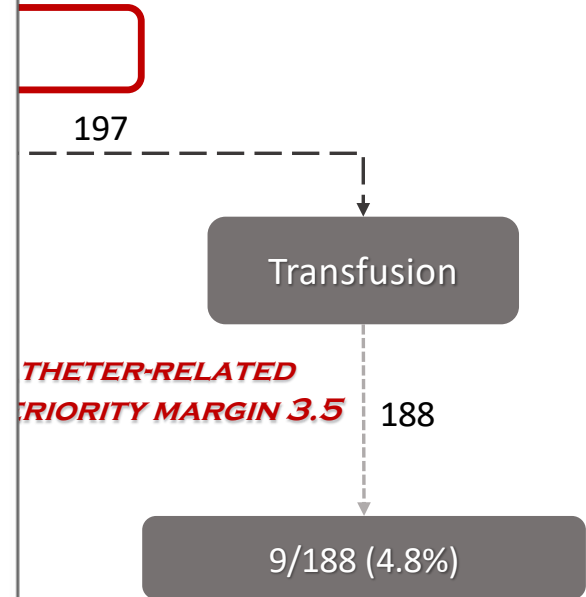
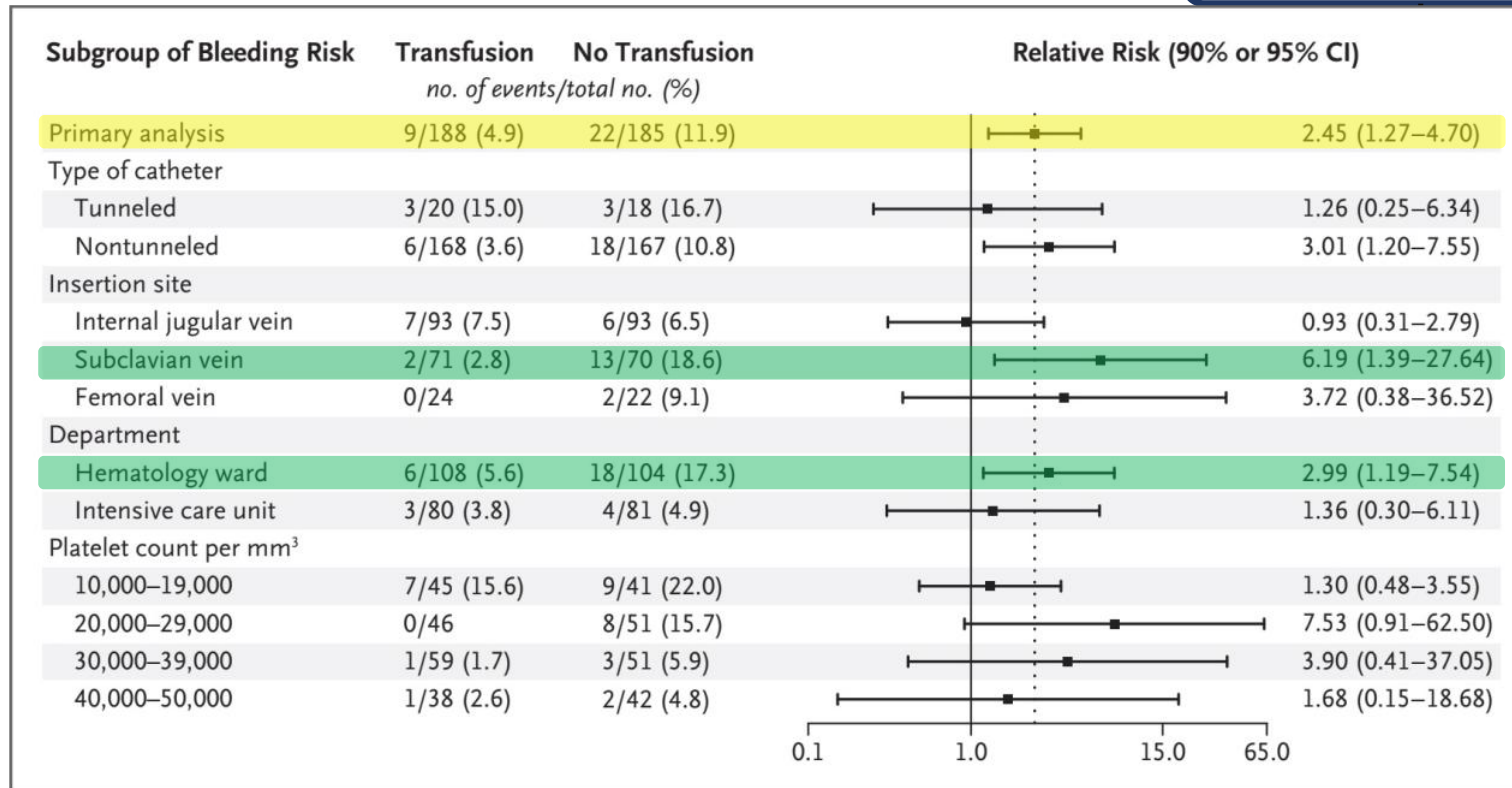
CICC and risk of bleeding



ORIGINAL ARTICLE

Platelet Transfusion before CVC Placement in Patients with Thrombocytopenia

PLT 10-50.000 and need for CICC



van Baarle, N ENGL J MED 388;21

PICC and risk of bleeding



Review

Management of antithrombotic treatment and bleeding disorders in patients requiring venous access devices: A systematic review and a GAVeCeLT consensus statement

JVA | The Journal of
Vascular Access

The Journal of Vascular Access
2022, Vol. 23(4) 660–671
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Q1. Which is an appropriate classification of VAD-related procedures based on the specific bleeding risk?

Q2. Which is the appropriate management of the patient with bleeding disorders candidate to VAD insertion/removal?

Q3. Which is the appropriate management of the patient on antithrombotic treatment candidate to VAD insertion/removal?

PICC and risk of bleeding



Review

JVA | The Journal of
Vascular Access

Management of antithrombotic treatment and bleeding disorders in patients requiring venous access devices: A systematic review and a GAVeCeLT consensus statement

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Type of venous access procedure

Minimally invasive (all peripheral VADs, nontunneled PICCs, nontunneled FICCs at mid-thigh)

Moderately invasive (nontunneled CICC, nontunneled FICCs at the groin, tunneled PICCs, nontunneled dialysis catheters)

Highly invasive (tunneled CICCs, tunneled FICCs, tunneled-cuffed dialysis catheters, ports and PICC-ports)

Bleeding disorder

PT/INR > 1.5 and/or
aPTT ratio > 1.3

Platelet < 50 × 10⁹/L

Antithrombotic treatment

VKA

No contraindication

No contraindication

Do not withhold

Relative contraindication (see text)

Relative contraindication

Aim for PT/INR < 3 (see text)

Absolute contraindication

Absolute contraindication (see text)

Maintain PT/INR in the low therapeutic range (see text)

PICC in ICU: the last update

Review

JVA | The Journal of
Vascular Access

A GAVeCeLT consensus on the indication, insertion, and management of central venous access devices in the critically ill

The Journal of Vascular Access
1–19
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DOI: 10.1177/11297298241262932
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Sage

Fulvio Pinelli¹, Mauro Pittiruti², Maria Giuseppina Annetta³,
Francesco Barbani¹, Sergio Bertoglio⁴, Daniele G Biasucci⁵, Denise Bolis⁶,
Fabrizio Brescia⁷, Giuseppe Capozzoli⁸, Sonia D'Arrigo³, Elisa Deganello⁹,
Stefano Elli¹⁰, Adam Fabiani¹¹, Fabio Fabiani⁷, Antonio Gidaro¹²,
Davide Giustivi¹³, Emanuele Iacobone¹⁴, Antonio La Greca²,
Ferdinando Longo¹⁵, Alberto Lucchini¹⁶, Bruno Marche¹⁷, Stefano Romagnoli¹,
Giancarlo Scoppettuolo¹⁸, Valentina Selmi¹⁹, Davide Vailati²⁰, Gianluca Villa¹
and Gilda Pepe²

Question 2: Which are the criteria for choosing the type of central venous access (CICC vs PICC vs FICC)?

Panel recommendation. The choice between CICC, PICC, and FICC should be based on the **availability and patency of the deep veins** (as evaluated by ultrasound scan), as well as on some key clinical considerations, which include—for example—the **location of the exit site**, the **risk of puncture-related complications**, the presence of **chronic renal failure**, the expected **duration** of the access, and whether the device is inserted in **emergency** or not.
(Strong agreement: 26 agree, 0 uncertain, 0 disagree)

PICC in ICU: take home message



No data argue for an increased thrombotic and infectious risk ✓

PICC are suitable for CVP and TPTD monitoring ✓

PICC may require higher skill for vein choice and cannulation !

PICC are not time-consuming and with low bleeding risk ✓

PICC in ICU



GAVeCeLT
Gli Accessi Venosi Centrali a Lungo Termine
XIII Congresso

XVII PICC Day



Bologna 9 – 11 dicembre 24

PICC in ICU: when and how?



Thank you!

Gemelli



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