



IL RUOLO ATTUALE DELLA ECOGRAFIA NELLA INSERZIONE E MANTENIMENTO DELLE CANNULE PERIFERICHE CORTE

INF. D. GIUSTIVI, POST ANESTHESIA CARE UNIT, SERVIZIO ACCESSI VENOSI, ASST LODI

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Dichiaro assenza di conflitto di interessi

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- Takahashi T, Murayama R, Abe-Doi M, Miyahara-Kaneko M, Kanno C, Nakamura M, Mizuno M, Komiyama C, Sanada H. Preventing peripheral intravenous catheter failure by reducing mechanical irritation. Sci Rep. 2020 Jan 31;10(1):1550. doi: 10.1038/s41598-019-56873-2. PMID: 32005839; PMCID: PMC6994694. © the Authors, This article is licensed under a Creative Commons Attribution 4.0 International License, To view a copy of this license, visit <http://creativecommons.org/licenses/by/4.0/>.
- Yabunaka, Koichi & Murayama, Ryoko & Tanabe, Hidenori & Takahashi, Toshiaki & Oe, Makoto & Oya, Maiko & Fujioka, Masayuki & Sanada, Hiromi. (2016). Ultrasonographic Classification of Subcutaneous Edema Caused by Infusion via Peripheral Intravenous Catheter. Journal of Medical Ultrasound. 24. 10.1016/j.jmu.2016.02.001. a 2016, Elsevier Taiwan LLC and the Chinese Taipei Society of Ultrasound in Medicine. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).
- Foor JS, Moureau NL, Gibbons D, Gibson SM. Investigative study of hemodilution ratio: 4Vs for vein diameter, valve, velocity, and volumetric blood flow as factors for optimal forearm vein selection for intravenous infusion. J Vasc Access. 2024 Jan;25(1):140-148. doi: 10.1177/11297298221095287. Epub 2022 May 7. PMID: 35531766; PMCID: PMC10845825. © the Authors, This article is licensed under a Creative Commons Attribution 4.0 International License

Le immagini contenute nell'articolo: Giustivi D, Celano R, Cattalani M, Camilli C, Trombetta L, Facchinetti P, Bartoli A, Bizzi E, Urso F, Donadoni M, Quici M, La Cava L, Calloni M, Martini E, Taino A, Cogliati C, Gidaro A. Ultrasound assessment of short peripheral catheter failure. J Vasc Access. 2024 Aug 3:11297298241261146. doi: 10.1177/11297298241261146. Epub ahead of print. PMID: 39096211. possono essere riprodotte per la formula Green Open Access fornita da Sage.

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OUTLINE

- INSERZIONE
- MONITORAGGIO

INSERZIONE

Berlanga-Macías et al. *BMC Nursing* (2022) 21:307
<https://doi.org/10.1186/s12912-022-01077-9>

BMC Nursing

RESEARCH

Open Access

Ultrasound-guided versus traditional method for peripheral venous access: an umbrella review



Carlos Berlanga-Macías^{1,2}, Ana Díez-Fernández¹, José Alberto Martínez-Hortelano^{1,3*}, Irene Sequí-Domínguez¹, Alicia Saz-Lara¹, Diana Pozuelo-Carrascosa¹ and Vicente Martínez-Vizcaíno^{1,4}

INSERZIONE

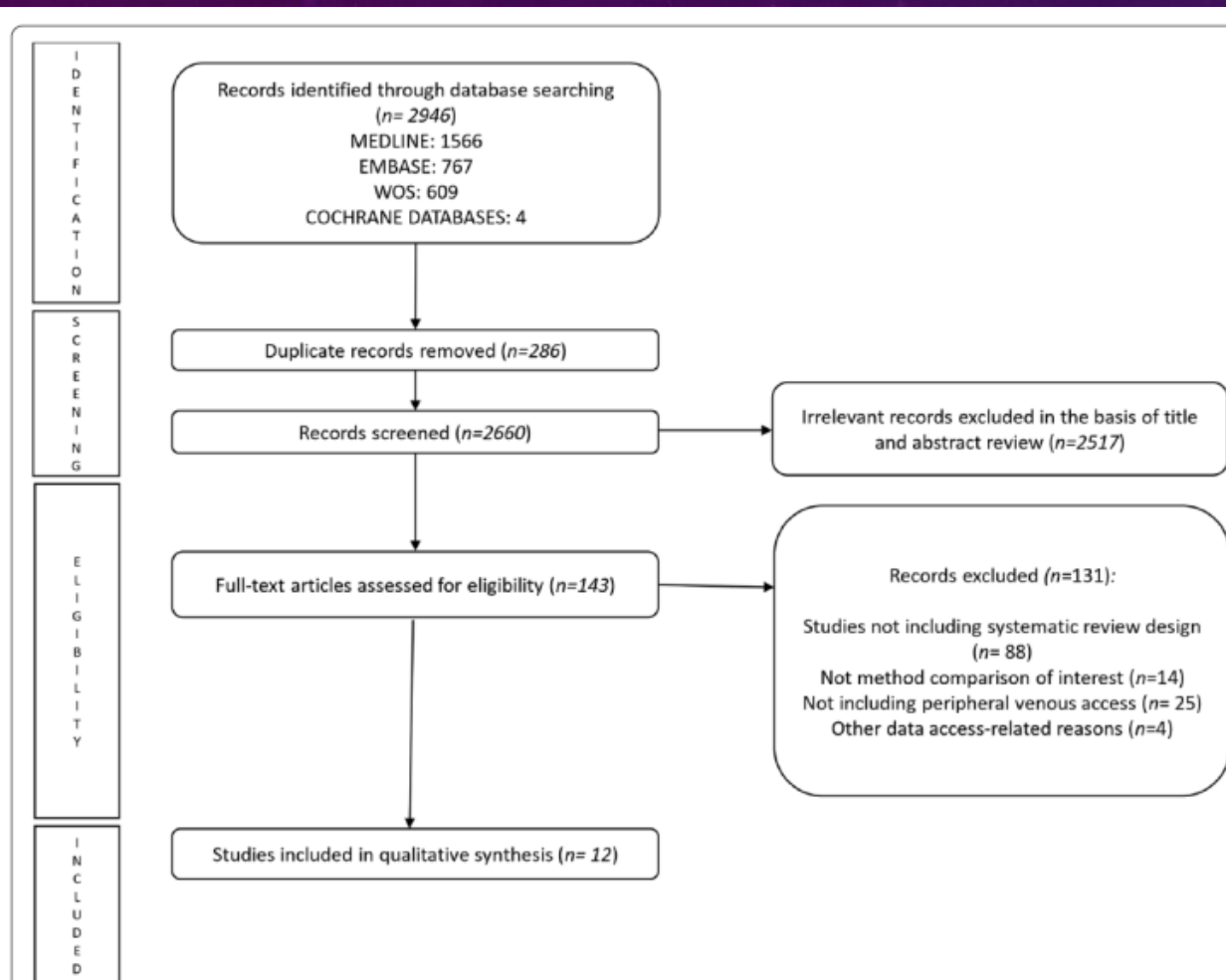
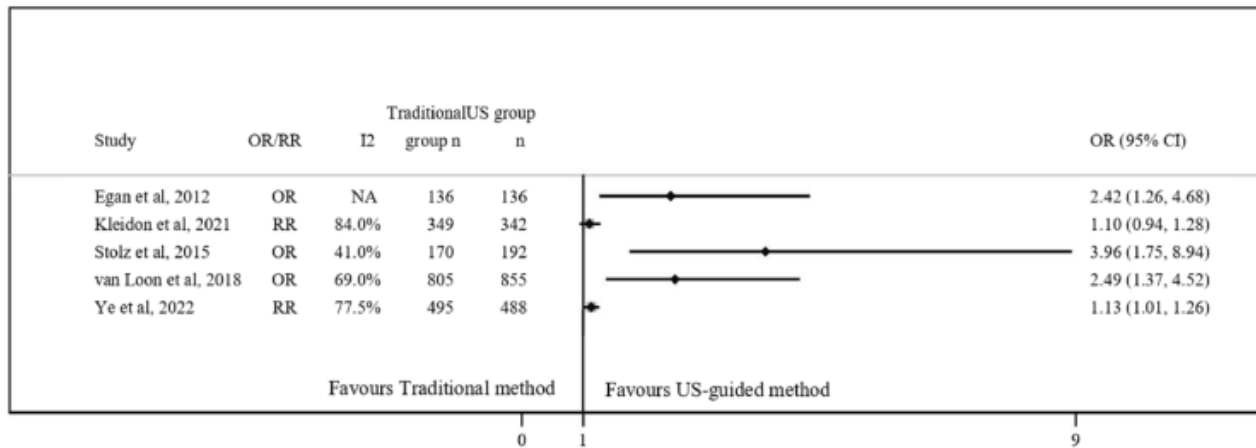


Fig. 1 Preferred reporting items for systematic reviews and meta-analyses flow diagram of identification, screening, eligibility and inclusion of studies. WOS, Web of science

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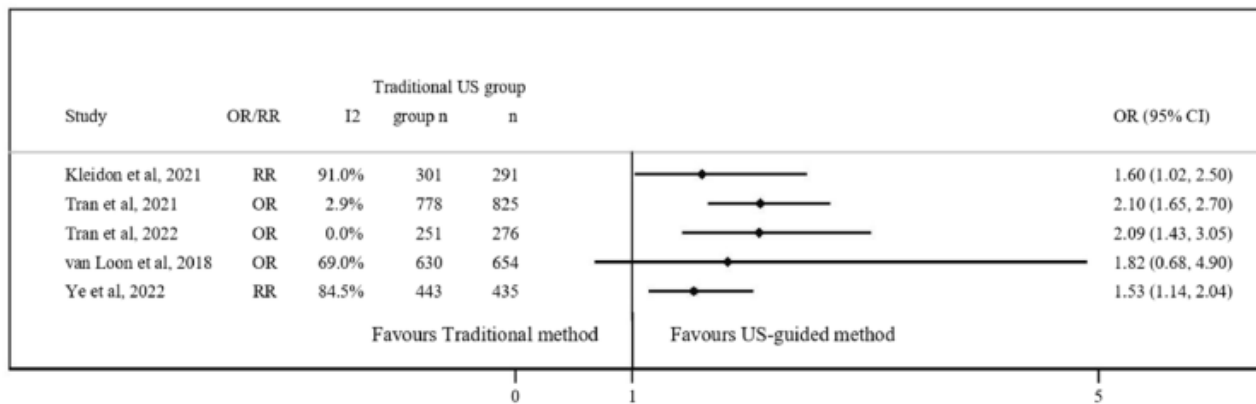
A

Overall success



B

First-attempt success rate



INSERZIONE

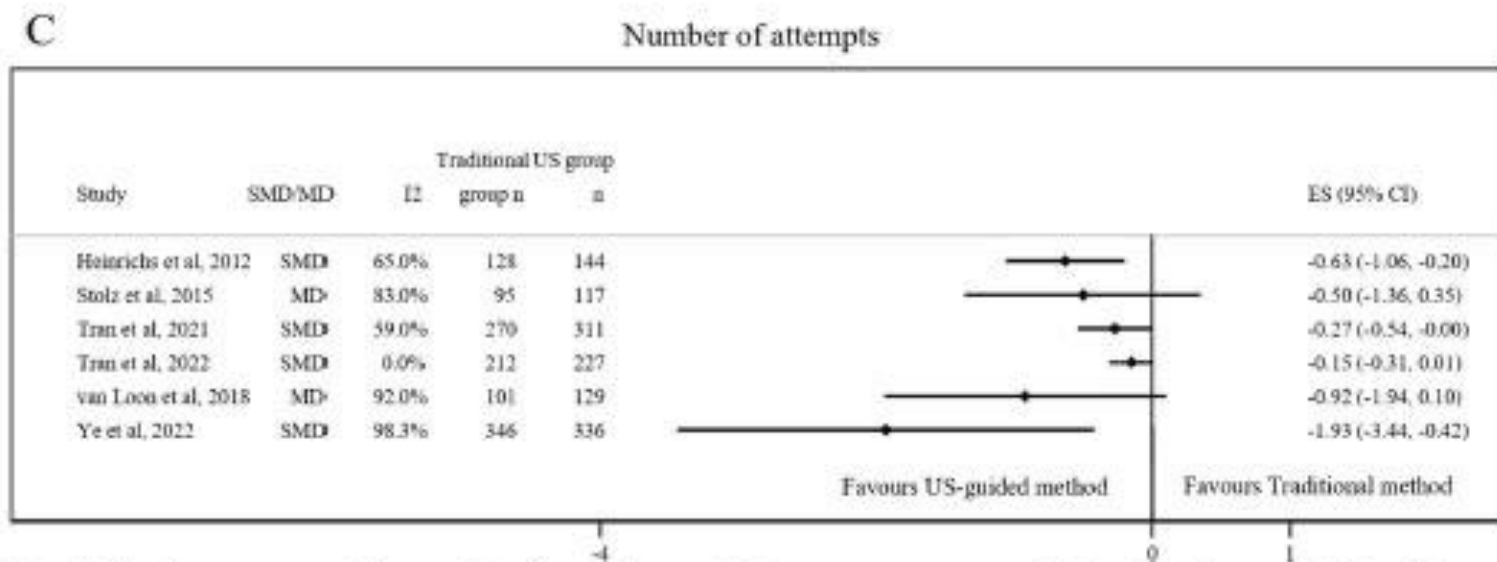


Fig. 2 Graphical representation of data regarding (A) overall success, (B) first-attempt success rate and (C) number of attempts of US-guided method compared to the traditional method. CI, Confidence interval; MD, Mean difference; NA, Not available; OR, Odds ratio; RR, Relative risk; SMD, Standardized mean difference; US, Ultrasound

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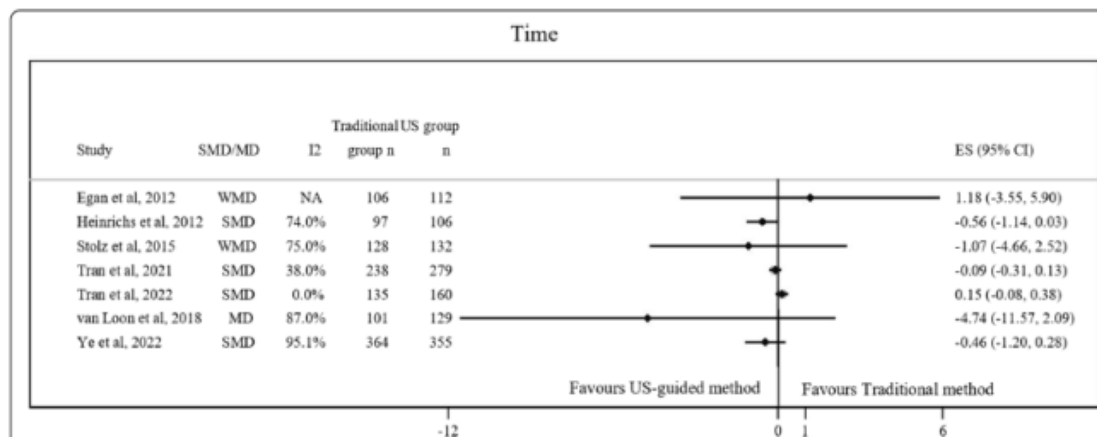


Fig. 3 Graphical representation of data regarding time spent using US-guided method compared to the traditional method. CI, Confidence interval; MD, Mean difference; NA, Not available; SMD, Standardized mean difference; US, Ultrasound; WMD, Weighted mean difference

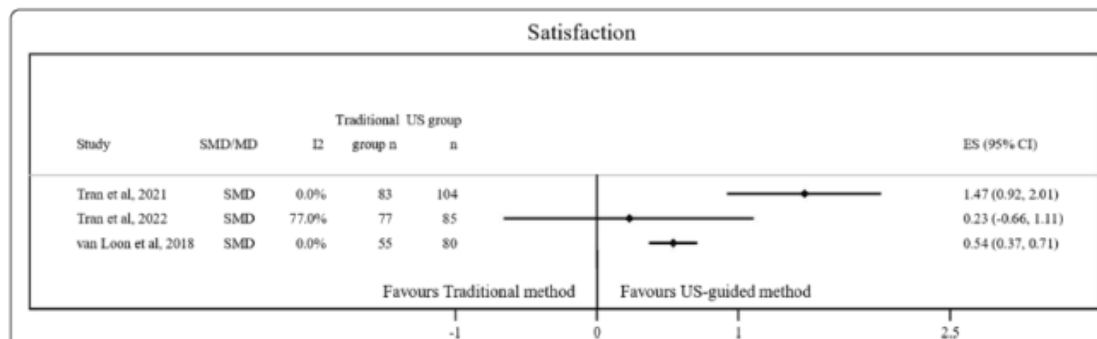


Fig. 4 Graphical representation of data regarding patient's satisfaction using US-guided method compared to the traditional method. CI, Confidence interval; MD, Mean difference; SMD, Standardized mean difference; US, Ultrasound

INSERZIONE

Table S4. Methodological quality assessment by AMSTAR-2 (a critical appraisal tool for systematic reviews of healthcare interventions)

Reference	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	Overall confidence
Egan 2012	Yes	No	No	Yes	Yes	Yes	Partial Yes	Partial Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Critically low
Heinrichs 2012	Yes	No	Yes	Partial Yes	Yes	Yes	Yes	Partial Yes	Yes	No	Yes	Yes	Yes	Yes	No	Yes	Critically low
Kleidon 2021	Yes	Partial Yes	Yes	Partial Yes	Yes	Yes	Partial Yes	Partial Yes	Yes	Yes	Yes	Yes	Yes	No	No	Yes	Critically low
Liu 2014	Yes	No	Yes	Yes	Yes	Yes	Yes	Partial Yes	No	No	No MA	No MA	No	No	No MA	Yes	Critically low
Parker 2017	Yes	Partial Yes	No	Yes	Yes	No	Yes	Partial Yes	Yes	Yes	No MA	No MA	Yes	Yes	No MA	Yes	Critically low
Parker 2017	Yes	Partial Yes	No	Yes	Yes	No	Yes	Partial Yes	Yes	Yes	No MA	No MA	Yes	Yes	No MA	Yes	Critically low
Stolz 2015	Yes	No	No	Partial Yes	Yes	Yes	No	Partial Yes	No	No	Yes	No	No	Yes	No	Yes	Critically low
Tran 2021	Yes	No	No	Partial Yes	No	Yes	Yes	Partial Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Critically low
Tran 2022	Yes	No	No	Partial Yes	Yes	Yes	Yes	Partial Yes	Yes	No	Yes	Yes	No	Yes	Yes	Yes	Critically low
van Loon 2018	Yes	No	No	Partial Yes	Yes	Yes	No	Partial Yes	No	No	Yes	No	No	Yes	No	Yes	Critically low
Varndell 2018	Yes	No	No	Partial Yes	Yes	Yes	Yes	Partial Yes	Yes	No	No MA	No MA	Yes	No	No MA	Yes	Critically low
Ye 2022	Yes	No	Yes	Partial Yes	Yes	Yes	Yes	Partial Yes	Yes	No	Yes	Yes	No	Yes	No	Yes	Critically low

MA, Meta-analysis; RoB, Risk of bias.

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Table S5. Certainty of evidence according to Grading of Recommendation Assessment, Development, and Evaluation (GRADE).



Reference	Population	Number of studies	Number of participants (Imprecision)	Risk of bias (Trial quality)	Heterogeneity (Inconsistency)	Methodological quality*	Certainty
Overall success							
Egan et al. 2012	Adult and pediatric	6	272	Serious limitations	Serious limitations	Very serious limitations	⊕⊕ Low
Kleidon et al. 2021	Pediatric	4	691	Serious limitations	Serious limitations	Very serious limitations	⊕⊕ Low
Stolz et al. 2015	Adult and pediatric	7	362	Serious limitations	No serious limitations	Very serious limitations	⊕⊕ Low
van Loon et al. 2018	Adult	8	1660	Serious limitations	No serious limitations	Very serious limitations	⊕⊕ Low
Ye et al. 2022	Pediatric	7	983	Serious limitations	Serious limitations	Very serious limitations	⊕⊕ Low
First-attempt success rate							
Kleidon et al. 2021	Pediatric	4	592	Serious limitations	Serious limitations	Very serious limitations	⊕⊕ Low
Tran et al. 2021	Adult	7	1603	Serious limitations	No serious limitations	Serious limitations	⊕⊕⊕ Moderate
Tran et al. 2022	Adult	7	527	Serious limitations	No serious limitations	Very serious limitations	⊕⊕ Low
van Loon et al. 2018	Adult	3	1284	Serious limitations	No serious limitations	Very serious limitations	⊕⊕ Low
Ye et al. 2022	Pediatric	7	878	Serious limitations	Serious limitations	Very serious limitations	⊕⊕ Low
Number of attempts							
Egan et al. 2012	Adult and pediatric	4	160	Serious limitations	Serious limitations	Very serious limitations	⊕ Very low
Heinrichs et al. 2012	Adult and pediatric	7	272	Serious limitations	No serious limitations	Very serious limitations	⊕⊕ Low

INSERZIONE

Stolz et al. 2015	Adult and pediatric	4	212	Serious limitations	Serious limitations	Very serious limitations	⊕⊕ Low
Tran et al. 2021	Adult	8	581	Serious limitations	No serious limitations	Serious limitations	⊕⊕⊕ Moderate
Tran et al. 2022	Adult	6	439	Serious limitations	No serious limitations	Very serious limitations	⊕⊕ Low
van Loon et al. 2018	Adult	4	230	Serious limitations	Serious limitations	Very serious limitations	⊕⊕ Low
Ye et al. 2022	Pediatric	5	682	Serious limitations	Serious limitations	Very serious limitations	⊕⊕ Low
Time							
Egan et al. 2012	Adult and pediatric	5	218	Serious limitations	Serious limitations	Very serious limitations	⊕⊕ Low
Heinrichs et al. 2012	Adult and pediatric	5	203	Serious limitations	No serious limitations	Very serious limitations	⊕⊕ Low
Stolz et al. 2015	Adult and pediatric	5	260	Serious limitations	No serious limitations	Very serious limitations	⊕⊕ Low
Tran et al. 2021	Adult	8	517	Serious limitations	No serious limitations	Serious limitations	⊕⊕⊕ Moderate
Tran et al. 2022	Adult	4	295	Serious limitations	No serious limitations	Very serious limitations	⊕⊕ Low
van Loon et al. 2018	Adult	4	230	Serious limitations	Serious limitations	Very serious limitations	⊕⊕ Low
Ye et al. 2022	Pediatric	6	719	Serious limitations	Serious limitations	Very serious limitations	⊕⊕ Low
Satisfaction							
Tran et al. 2021	Adult	3	187	Serious limitations	No serious limitations	Serious limitations	⊕⊕ Low
Tran et al. 2022	Adult	2	162	Serious limitations	Serious limitations	Very serious limitations	⊕ Very low
van Loon et al. 2018	Adult	2	135	Serious limitations	No serious limitations	Very serious limitations	⊕⊕ Low

MONITORAGGIO

The relationship between the tip position of an indwelling venous catheter and the subcutaneous edema.

Murayama R, Takahashi T, Tanabe H, Yabunaka K, Oe M, Oya M, Uchida M, Komiyama C, Sanada H

Biosci Trends. 2015 Dec;9(6):414-9. doi: 10.5582/bst.2015.01114. PMID: 26781800.

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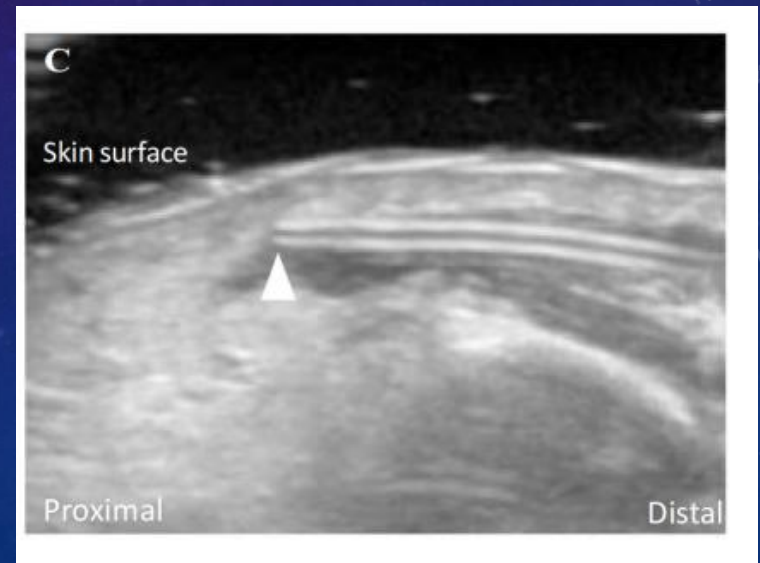
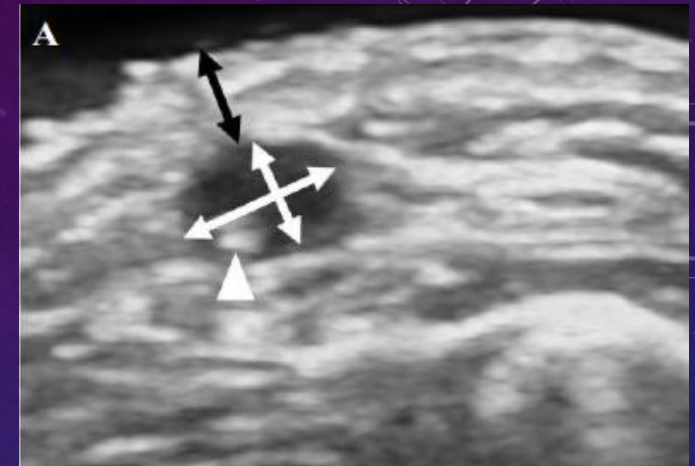
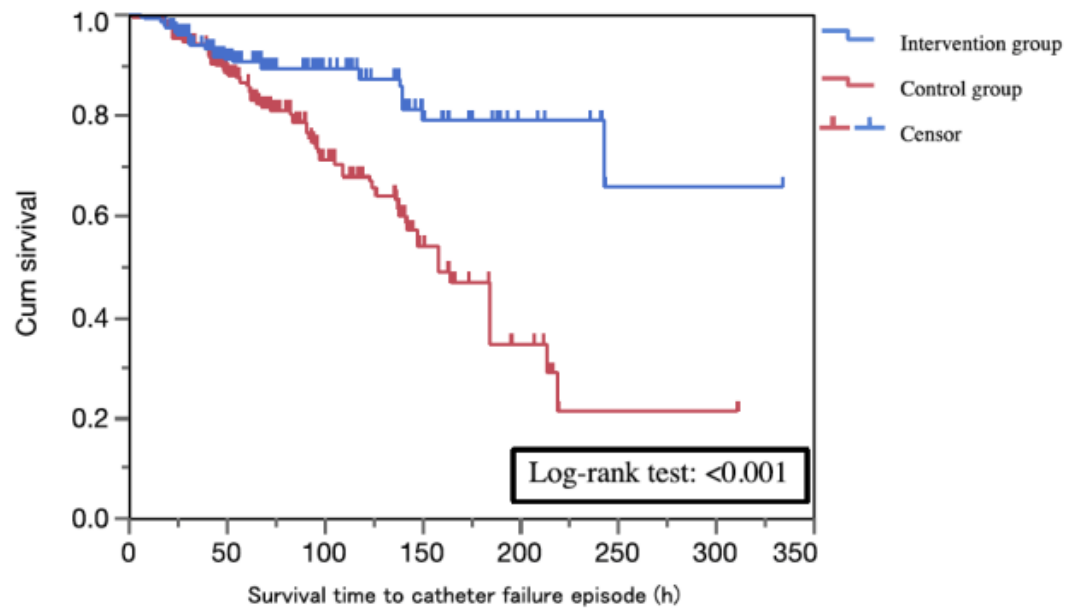
Preventing peripheral intravenous catheter failure by reducing mechanical irritation

Toshiaki Takahashi¹, Ryoko Murayama^{2,3}, Mari Abe-Doi², Maki Miyahara-Kaneko⁴, Chiho Kanno⁴, Miwa Nakamura⁵, Mariko Mizuno⁵, Chieko Komiyama⁵ & Hiromi Sanada^{3,4*}

Bundle di inserzione

- Scansione eco preinserzione
- Scansione eco post inserzione
- Utilizzo di SPC in poliuretano

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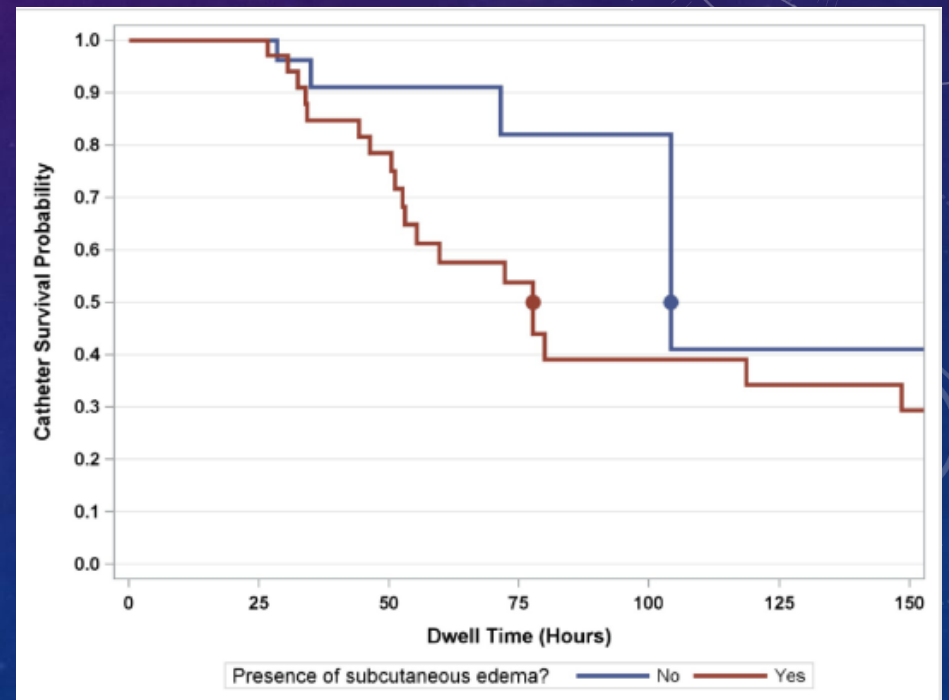
PLOS ONE

RESEARCH ARTICLE

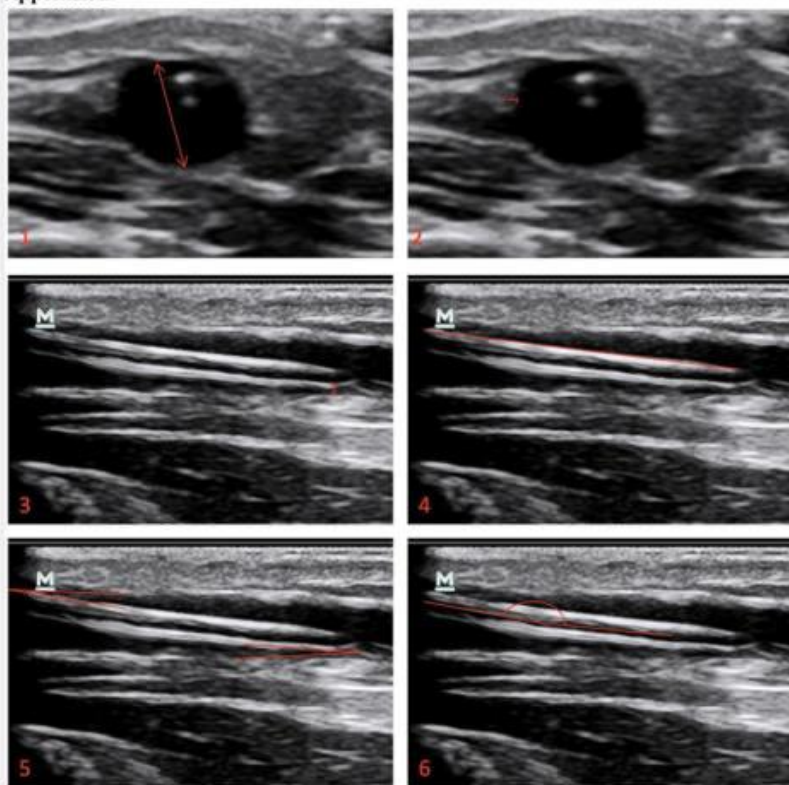
Early recognition of peripheral intravenous catheter failure using serial ultrasonographic assessments

Amit Bahl^{1*}, Steven Johnson¹, Nicholas Mielke², Patrick Karabon³

1 Department of Emergency Medicine, Beaumont Hospital, Royal Oak, Michigan, United States of America, **2** Department of Emergency Medicine, Oakland University William Beaumont School of Medicine, Rochester, Michigan, United States of America, **3** Department of Statistics, Oakland University William Beaumont School of Medicine, Rochester, Michigan, United States of America



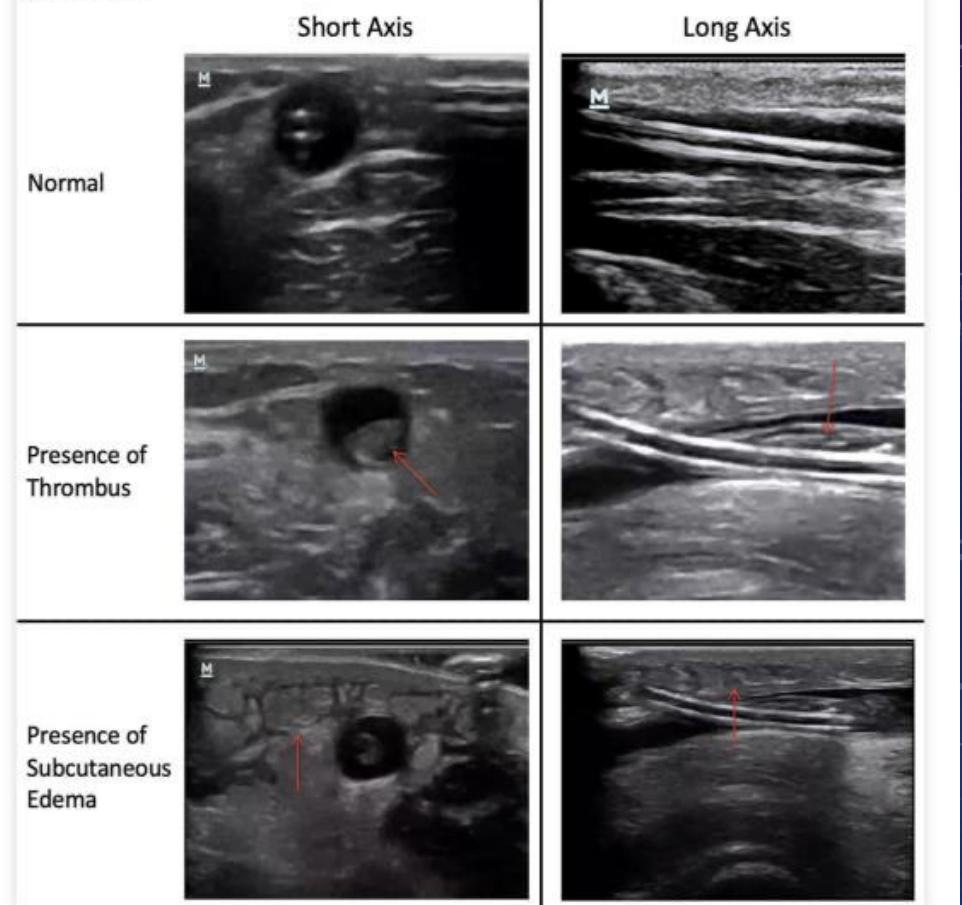
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Ultrasound measurements

- 1 = vein diameter (short axis)
- 2 = vein wall width (short axis)
- 3 = distance of distal catheter tip to vein wall (long axis)
- 4 = length of catheter in vein (long axis)
- 5 = insertion angle (left) and angle of distal tip to vessel wall (right) (long axis)
- 6 = degree of kink/bend (long axis)

Appendix C



MONITORAGGIO

- 62 SPC osservati
- 54 (84,1%) presenza di CRT
- 22 (40,74%) CRT asintomatica
- CVR > 33% statisticamente associato a CRT
- Tip del catetere $\geq 5^\circ$ dalla parete vascolare statisticamente associato a CRT

Original research article

JVA | The Journal of
Vascular Access

A prospective sonographic evaluation of peripheral intravenous catheter associated thrombophlebitis

The Journal of Vascular Access
2022, Vol. 23(5) 754–763
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**Nicholas Mielke¹, Steven Johnson²,
Patrick Karabon¹ and Amit Bahl²** 

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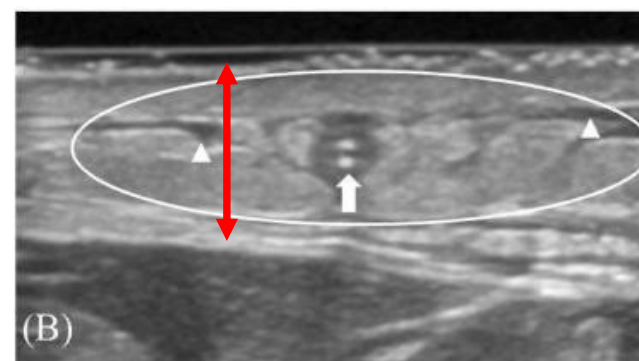
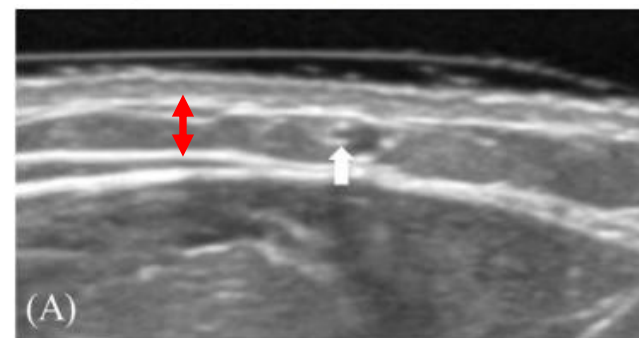
Table 2 Comparison of the Infusion Nurses Society infiltration scales and classification of the subcutaneous edema in ultrasonographic images ($N = 64$).

Classification of the subcutaneous edema	INS Infiltration scales			
	Grade 0	Grade 1	Grade 2	Total
Normality	15	0	0	15
Mild subcutaneous edema	35	1	5	41
Severe subcutaneous edema	3	1	4	8
Total	53	2	9	64

ORIGINAL ARTICLE

Ultrasonographic Classification of Subcutaneous Edema Caused by Infusion via Peripheral Intravenous Catheter

Koichi Yabunaka¹, Ryoko Murayama², Hidenori Tanabe^{2,3}, Toshiaki Takahashi¹, Makoto Oe², Maiko Oya¹, Masayuki Fujioka⁴, Hiromi Sanada^{1*}



MONITORAGGIO



Objective: This study aims to evaluate the sensitivity and specificity of US and VIP score = 1 in identifying and recognizing early signs of SPC failure. The time to positivity for US and VIP scores was assessed as a secondary outcome.

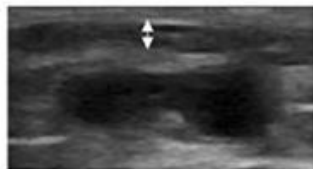
Methods: An observational prospective study was conducted. In each patient, US (subcutaneous edema; fibroblastic sleeve; thrombophlebitis) and VIP of the exit site were performed every 24h until 96h after insertion. Compared to catheter failure, Sensitivity, Specificity, and Predictive values in both US and VIP were calculated.

Results: Two hundred patients were enrolled. The presence of ultrasonic pattern suggestive of edema at 72 h ($p = 0.018$), fibroblastic sleeve at 24, 48, 72, and 96 h ($p < 0.001$), thrombosis at 48 ($p < 0.001$) and 72 h ($p = 0.005$), and at least one of an abovementioned US at all checkpoints ($p < 0.001$) were highly significant predictors of complications. Both US and VIP effectively detect inflammatory events; however, the US showed better sensitivity in overall checkpoints and earlier predictive ability than VIP (1.9 vs 0.47 days).

Conclusions: An ultrasound inflammatory pattern is correlated with SPC failure. An ultrasound protocol—requiring minimal training—is more effective than VIP in recognizing early signs of device failure.

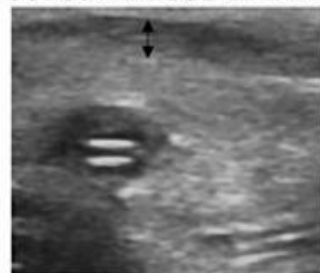
SUBCUTANEOUS TISSUE EVALUATION

NORMAL



<2.5 mm

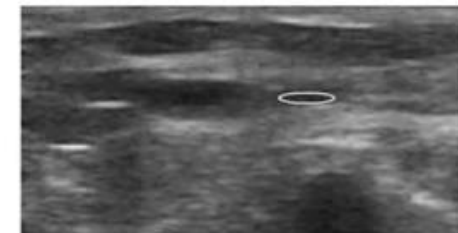
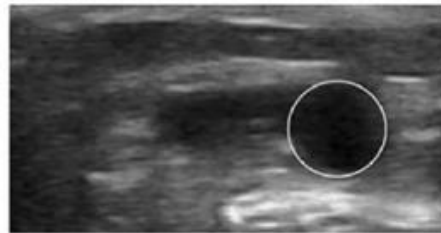
SUBCUTANEOUS EDEMA



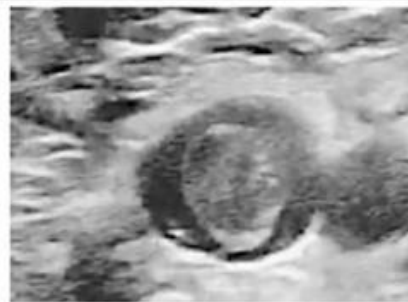
>2.5 mm
or presence
of fluid

VEIN COMPRESSIBILITY

NORMAL VEIN



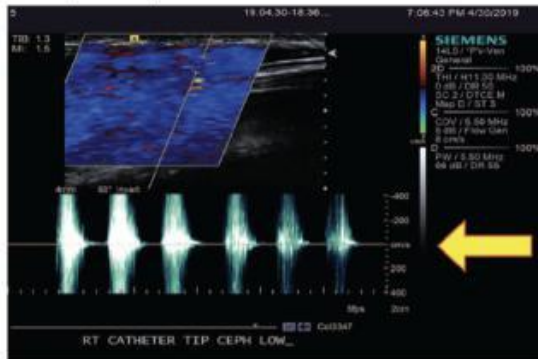
FIBROBLASTIC SLEEVE



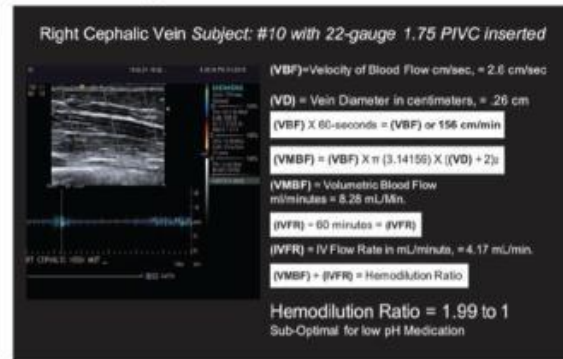
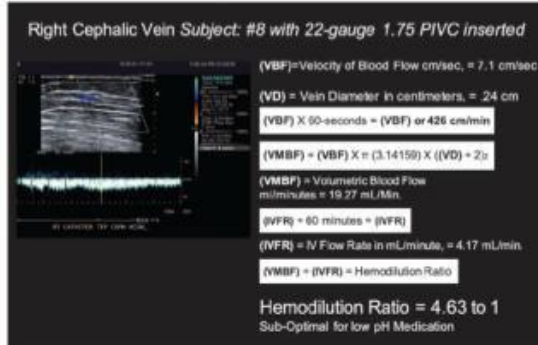
TROMBOPHLEBITIS



MONITORAGGIO



Patient 8: 22-gauge 1.75" PIVC placed in the Right Upper Cephalic Vein with a Vein Diameter of .24 cm and a blood flow velocity = 7.1 cm/sec. and an **Optimal Hemodilution Ratio** of (4.63 – 1) or 4.63 mL/minute of Volumetric Blood Flow to 1mL/Minute of IV Flow Rate of low pH IV Medication running at 250 mL/hour.



Patient 6: 22-gauge 1.75" PIVC placed in the Right Upper Cephalic Vein with a Vein Diameter of .29 cm, 7.13 Minute of IV Flow Rate of low pH IV Medication running at 250 mL/hour. Note, Venous Valve distal 1.2 cm from PIVC Tip, with turbulence and retrograde blood flow when venous valve was in the closed position.



Original research article

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Investigative study of hemodilution ratio: 4Vs for vein diameter, valve, velocity, and volumetric blood flow as factors for optimal forearm vein selection for intravenous infusion

John S Foor¹, Nancy L Moureau², David Gibbons³ and S Matthew Gibson⁴

MONITORAGGIO PZ PEDIATRICI

	Tecnica US	Comparazione	Sensibilità	Specificità	Concordanza
Takeshita et Al	RASS	RASS vs Flush	100% vs 89% (p=0.001)	100% vs 64% (p=0.017)	
Good et Al	CEUS/CD	Us vs flush			83% , Kappa Cohen 0.47 (95% CI 0.28– 0.66)

CONCLUSIONI

- L'inserzione ecoguidata di SPC si dimostra una metodologia efficace
- L'efficacia è particolarmente provata nel pz DIVA
- L'ecoguida (i cui i vantaggi sono indubbi) si confronta con i limiti del dispositivo
- Il monitoraggio ecoscopico di dimostra superiore a quello clinico per la valutazione di flebite (US vsVIP)
- Il monitoraggio ecoscopico appare superiore nella descrizione dell'infiltrato (US vs Infiltration Scale)
- Il monitoraggio ecoscopico di presta all'ottenimento di nuove informazioni che potrebbero modificare radicalmente l'approccio alle SPC

I reperti ecografici di particolare importanza sono:

- CVR (>33% aumento rischio trombotico)
- Angolo tip/parete vascolare ($\geq 5^\circ$ aumento rischio trombotico)
- Presenza di guaina fibroblastica (significativo predittore di fallimento SPC)
- Presenza di trombo intravascolare
- Edema tissutale (significativo predittore di fallimento SPC/ descrizione delle dimensioni dell'infiltrato)



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