



Congresso GAVeCeLT

FIRENZE
FLORENCE
2017

Quale accesso venoso in emergenza/urgenza? *Which access in emergency?*

Daniele G. Biasucci, M.D.

Fondazione Policlinico Universitario "A. Gemelli"

Università Cattolica del Sacro Cuore di Roma



Gemelli



Fondazione Policlinico Universitario A. Gemelli
Università Cattolica del Sacro Cuore

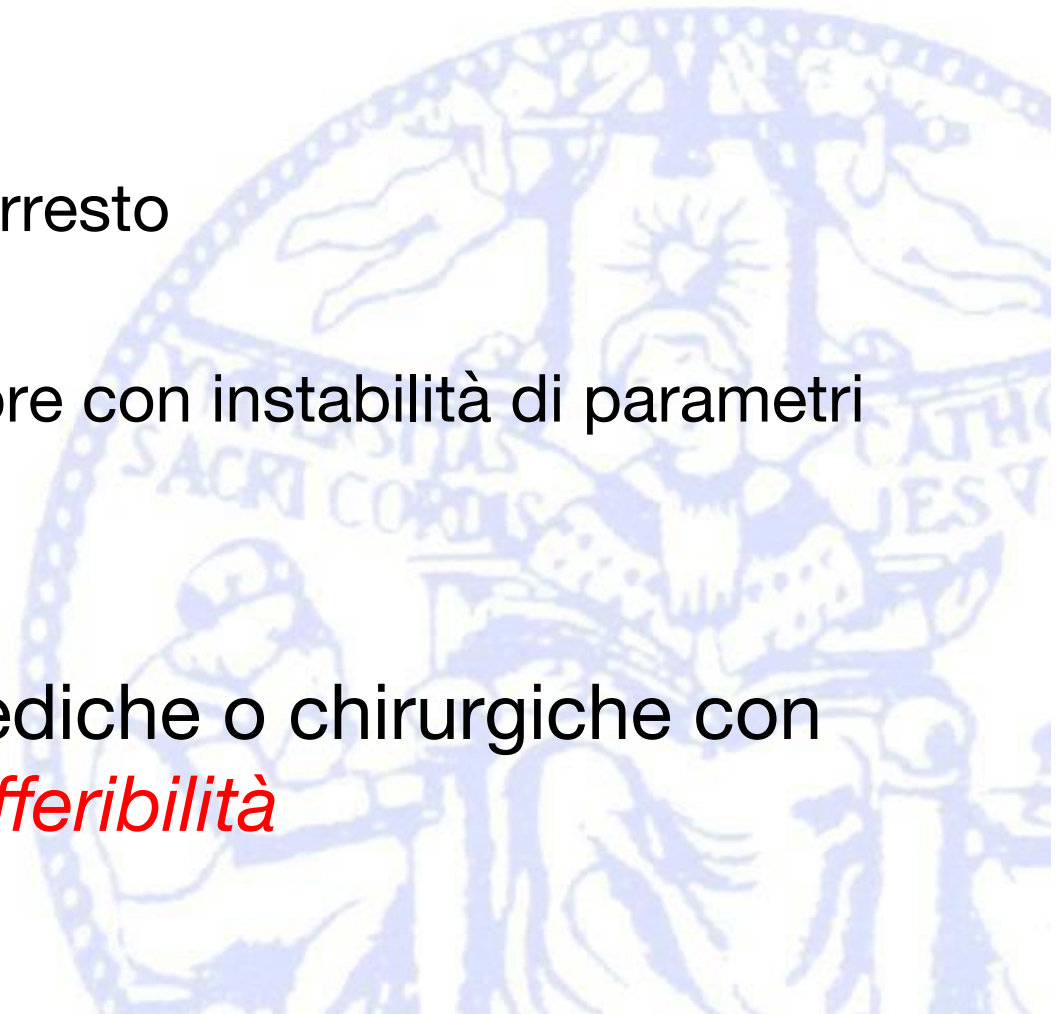
- ***Emergenza***

- condizione che pone il paziente in *imminente pericolo di vita* e richiede un *intervento immediato*

- Arresto Cardiaco
 - Condizioni di periarresto
 - Stati di Shock
 - Politrauma Maggiore con instabilità di parametri vitali

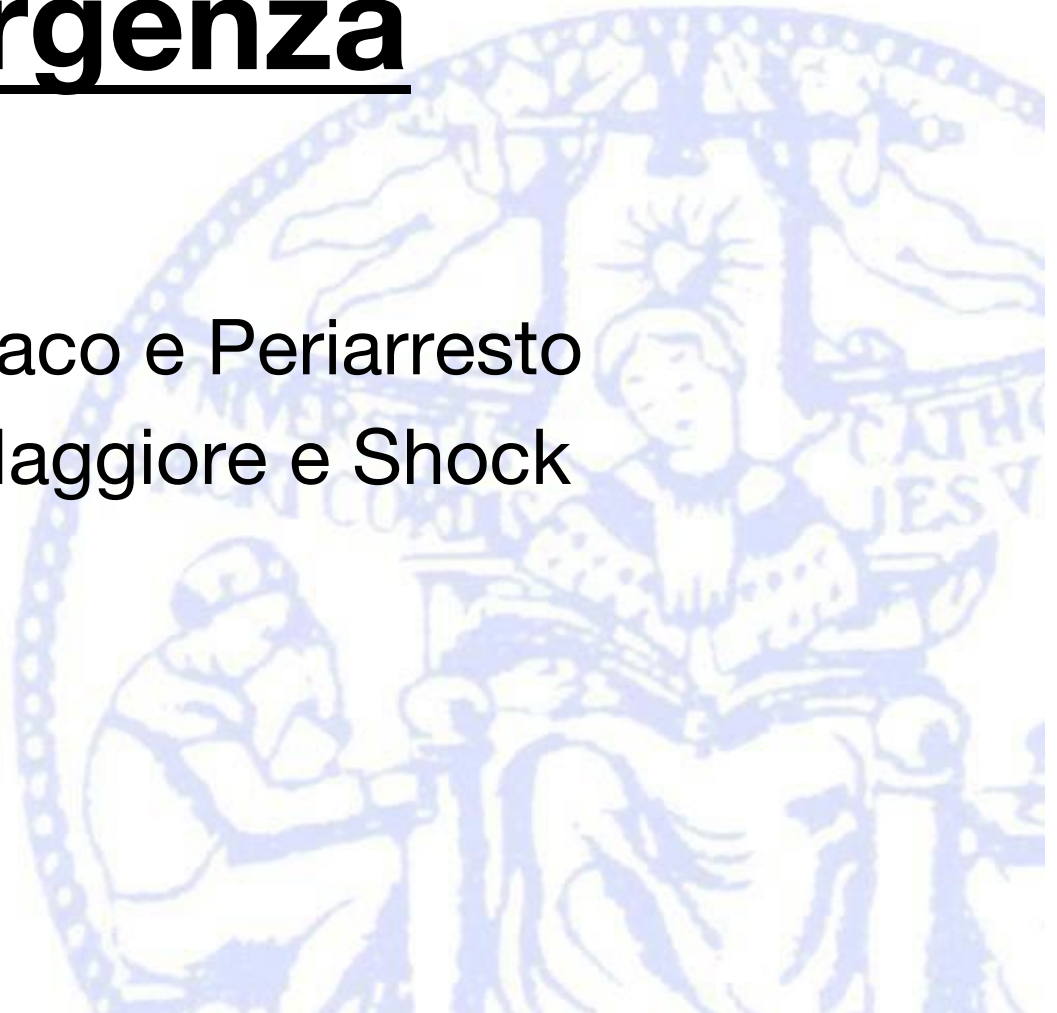
- ***Urgenza***

- altre condizioni mediche o chirurgiche con carattere di *non differibilità*



Emergenza

Arresto Cardiaco e Periarresto
Politrauma Maggiore e Shock





Contents lists available at ScienceDirect

Resuscitation

journal homepage: www.elsevier.com/locate/resuscitation



European Resuscitation Council Guidelines for Resuscitation 2015 Section 3. Adult advanced life support



- *Establish intravenous access ...*
- *... peak drug concentrations are higher and circulation times are shorter when drugs are injected into a CVC compared with PIVs...*
- *... insertion of a CVC requires interruption of CPR and can be technically challenging and associated with complications...*
- *... PIV is quicker, easier to perform and safer...*
- *If intravenous access is difficult or impossible, consider the IO...*
- *Delivery of drugs via a tracheal tube is no longer recommended...*
- *IO injection of drugs achieves adequate plasma concentrations in a time comparable with injection through a vein*

Accesso Venoso Difficile o Impossibile...

- ...if IV access is not possible or associated with *more than 3 attempts or a delay in the first 90-120 s of resuscitation*

Comparison of intraosseous versus central venous vascular access in adults under resuscitation in the emergency department with inaccessible peripheral veins[☆]

Bernd A. Leidel^{a,c,*}, Chlodwig Kirchhoff^b, Viktoria Bogner^b, Volker Braunstein^b, Resuscitation 83 (2012) 40–45
Peter Biberthaler^b, Karl-Georg Kanz^b

- during resuscitation of *an infant or child*: if attempts at establishing IV access are unsuccessful *after one minute*



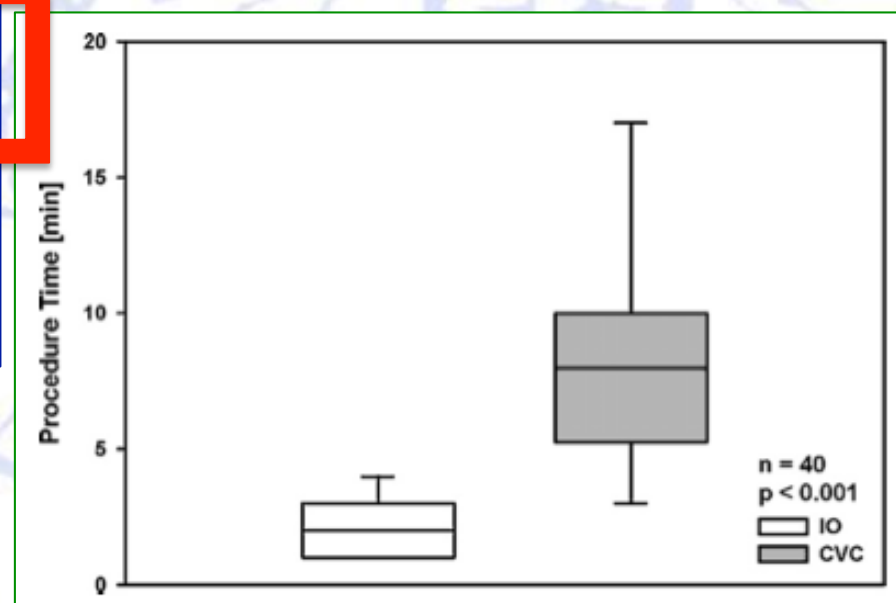
European Resuscitation Council Guidelines for Resuscitation 2015
Section 6. Paediatric life support

Resuscitation 95 (2015) 223–248

Table 2
Success rate and procedure time.

	IO (n = 40)	CVC (n = 40)	n
Success rate on first attempt (%)	34/40 (85)	24/40 (60)	0.024
95% CI, percentage	74–96	45–75	
Procedure time median, min	2.0	8.0	<0.001
Procedure time IQR, min	2.0	4.5	
Procedure time, min–max, min	1.0–4.0	3.0–17.0	
95% CI, min	1.0–3.0	4.0–13.0	

IO: intraosseous, CVC: central venous catheterisation; Q_{0.25}: lower quartile, 25%, Q_{0.75}: upper quartile, 75%, IQR: inter quartile range.



- **ATLS & ALS**
- **Però... tecnica 'blind'**

...dunque, l'accesso venoso centrale...

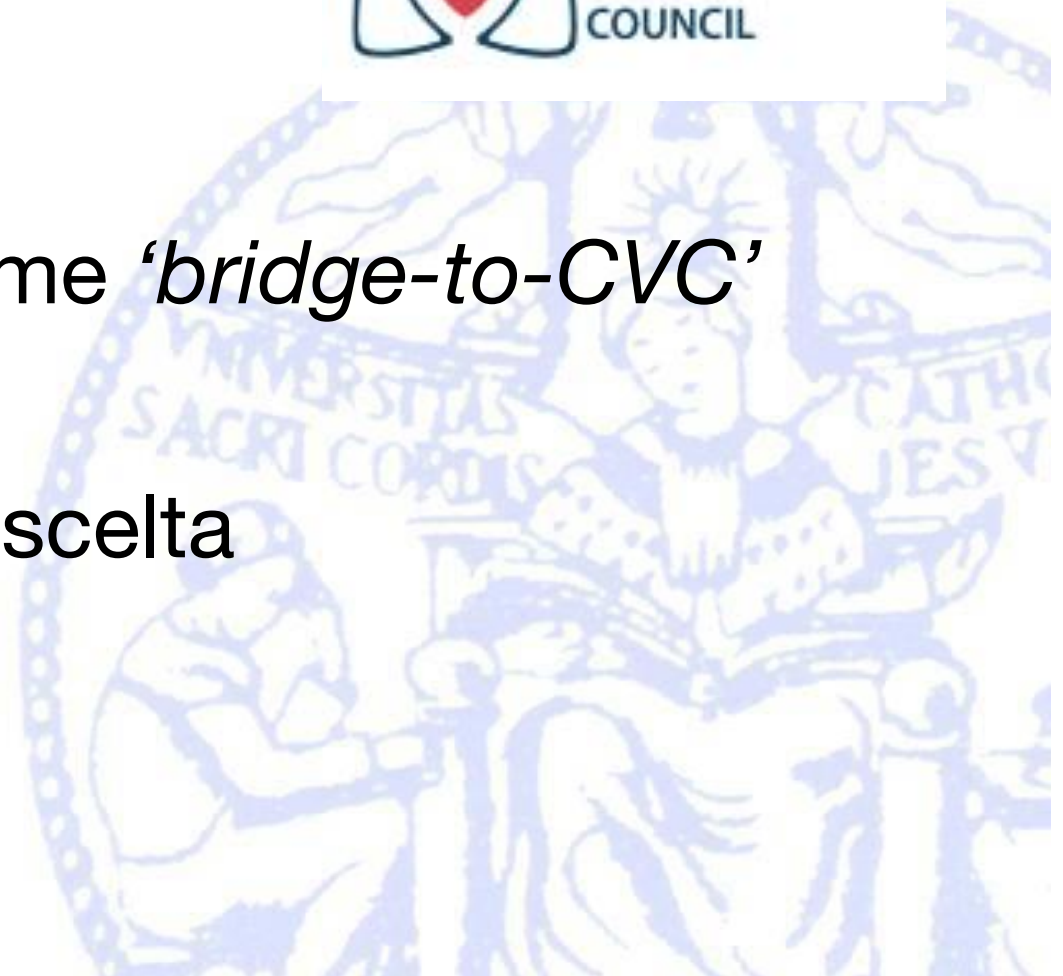
- richiede tempo e può interferire con le manovre di CPR
- non sono stati dimostrati vantaggi nell'arresto cardiaco rispetto a IO in caso di PIV difficile o impossibile



Linee guida ERC

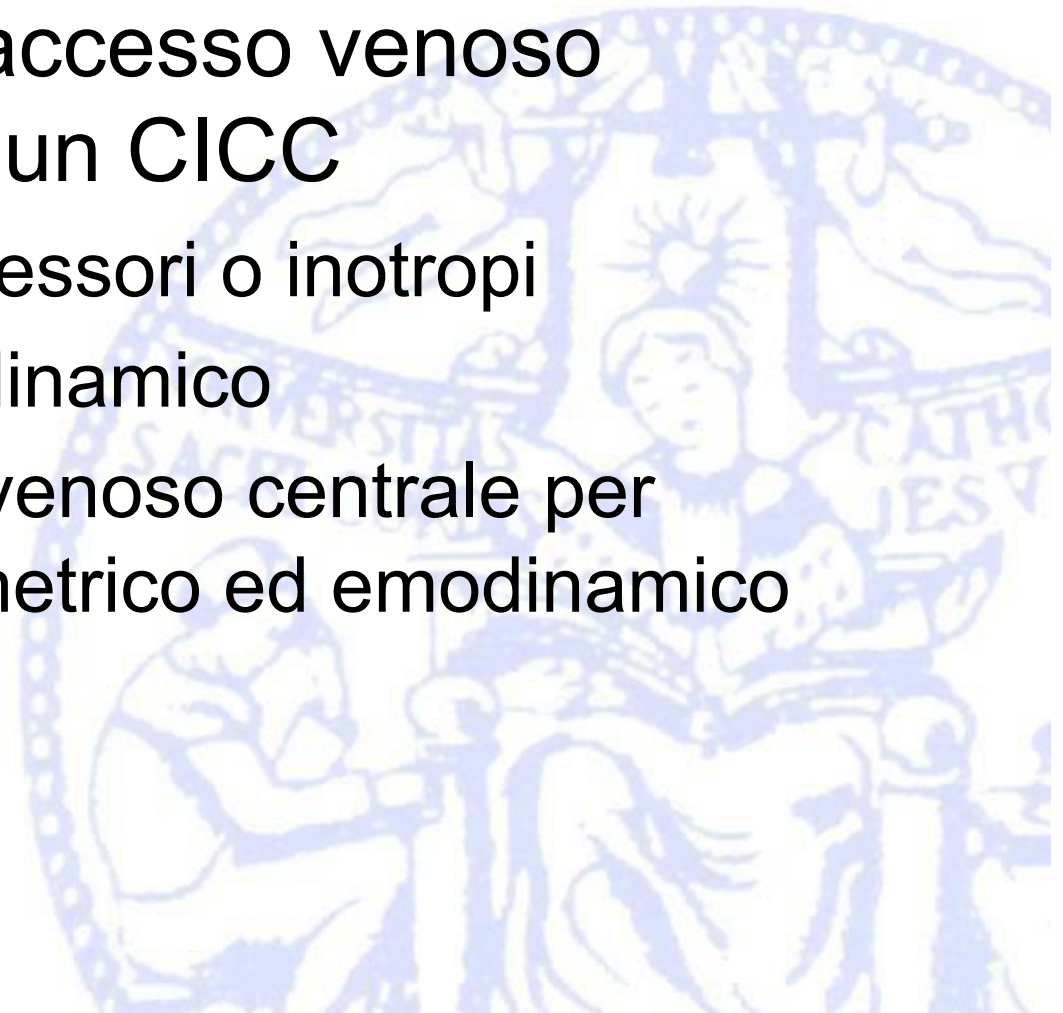


- PIV → I scelta
- IO → II scelta o come *'bridge-to-CVC'*
- CICC o FICC → III scelta



Post - ROSC

- Nel post-ROSC, al contrario, i pazienti necessitano di un accesso venoso centrale, ovvero di un CICC
 - Infusione di vasopressori o inotropi
 - Monitoraggio emodinamico
 - Prelievi di sangue venoso centrale per monitoraggio ossimetrico ed emodinamico
 - ...





AMERICAN COLLEGE OF SURGEONS

Trauma Programs

- Lo stato emorragico espone il traumatizzato alla cosiddetta "triade letale", costituita da ipotermia, coagulopatia e acidosi metabolica.
- Una strategia basata sul mantenimento di target pressori predefiniti, anche ricorrendo all'espansione volemica, può limitare e prevenire gli effetti della triade letale e migliorare.
- *Stabilire un accesso venoso può tuttavia risultare difficoltoso; dati di letteratura riportano che in alcuni casi sono necessari dai 3 ai 12 minuti, con una percentuale di insuccesso che va dal 10 al 40%.*
- Le cause di tale insuccesso possono essere correlate, ad esempio, al quadro di **shock** (collasso delle vene periferiche) o a *peculiarità anatomiche del paziente (es. paziente pediatrico o obeso).*

- Access to the vascular system must be obtained promptly
- This is best accomplished by inserting *two large-caliber (minimum of 16-gauge in an adult) PIV* before placement of a CVC is considered
- *If circumstances prevent the use of peripheral veins, CVC or saphenous vein cutdown* is indicated, depending on the clinician's skill and experience
- Frequently in an emergency situation, CVC is *not* accomplished under tightly controlled or *completely sterile conditions*. Therefore, *these lines should be changed in a more controlled environment as soon as the patient's condition permits*

- *In children younger than 6 years, the placement of an intraosseous needle should be attempted before inserting a central line*
- *The important determinant for selecting a procedure or route for establishing vascular access is the clinician's experience and skill*
- *Intraosseous access with specially designed equipment is possible in all age groups, and is being used with increasing frequency*
- *As in the pediatric population, this access may be used in-hospital until intravenous access is obtained*

- Adulto
 - 2 PIVs → almeno 16 G
 - Se accesso periferico difficile o impossibile → CVC oppure venolisi della safena
 - Sostituire CVC oppure il device impiantato mediante venolisi appena le condizioni del paziente lo permettono
- Paziente pediatrico
 - 2 PIV → calibro maggiore possibile
 - Intraossea prima di ricorrere a CVC o venolisi

Proximal Humerus Intraosseous Infusion: A Preferred Emergency Venous Access

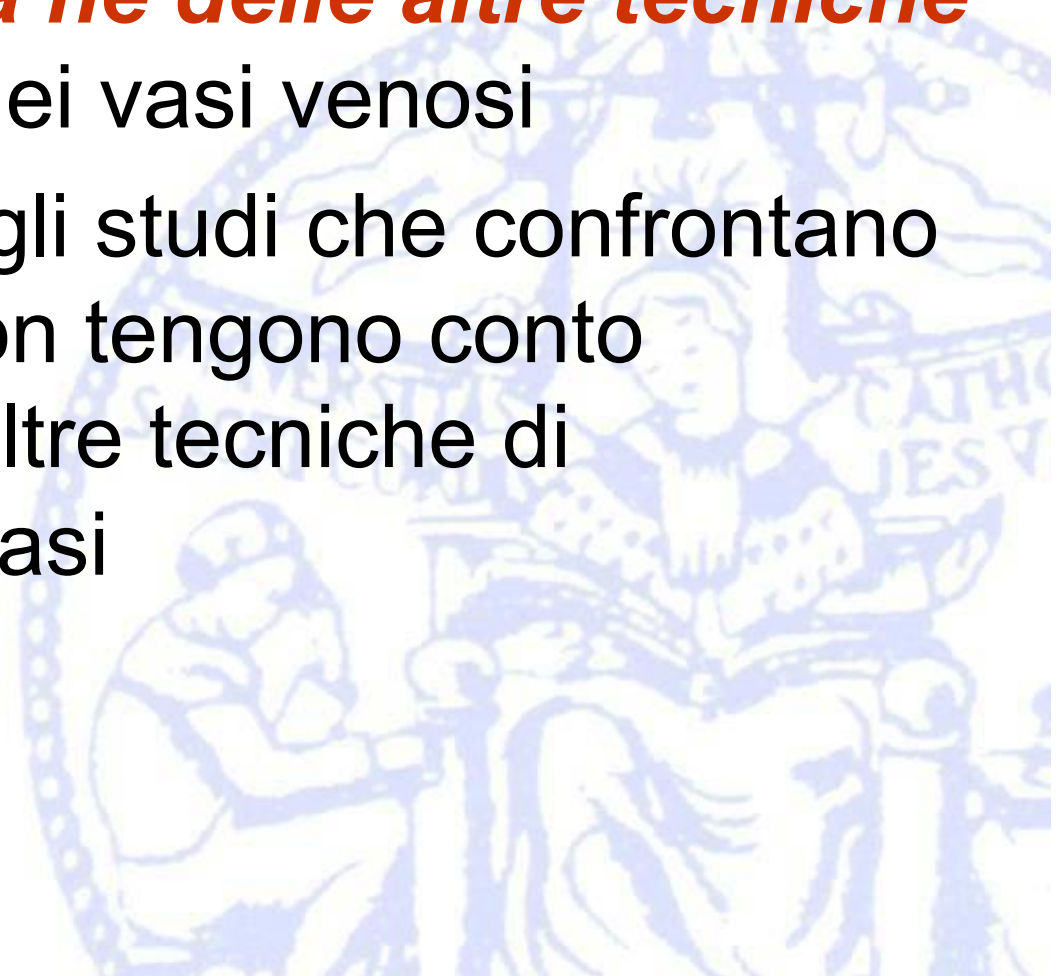
James H. Paxton, MD, MBA, Thomas E. Knuth, MD, MPH, and Howard A. Klausner, MD

TABLE 1. Comparative Data for Phase I and Phase II Venous Access Methods

	PIV	CVC	IO
Number of patients	57	5	30
Number of line attempts	86	17	31
First-attempt success rate (%)	73.7	20.0	80.6
Mean time to good flow (min)	3.6	15.6	1.5
Mean pain score (insertion)	0.9	Unable	4.5
Mean pain score (infusion)	0	Unable	3.8
Extravasation in Resus Bay (%)	33.7	70.6	44.0
Percent died in Resus Bay (%)	5.3	0	6.7

Tecniche di visualizzazione

- Le linee guida ILCOR e ACS ***non tengono conto dell'ecoguia né delle altre tecniche di visualizzazione*** dei vasi venosi
- La maggior parte degli studi che confrontano CVC vs PIV vs IO non tengono conto dell'ecografia né di altre tecniche di visualizzazione dei vasi



Tecniche di visualizzazione

- Tecniche di visualizzazione dei vasi venosi
 - Ecografia
 - NIR
 - Transilluminazione



22. VASCULAR VISUALIZATION

Standard

22.1 To ensure patient safety, the clinician is competent in the use of vascular visualization technology for vascular access device (VAD) insertion. This knowledge includes, but is not limited to, appropriate vessels, size, depth, location, and potential complications.

22.2 Vascular visualization technology is used in patients with difficult venous access and/or after failed venipuncture attempts.

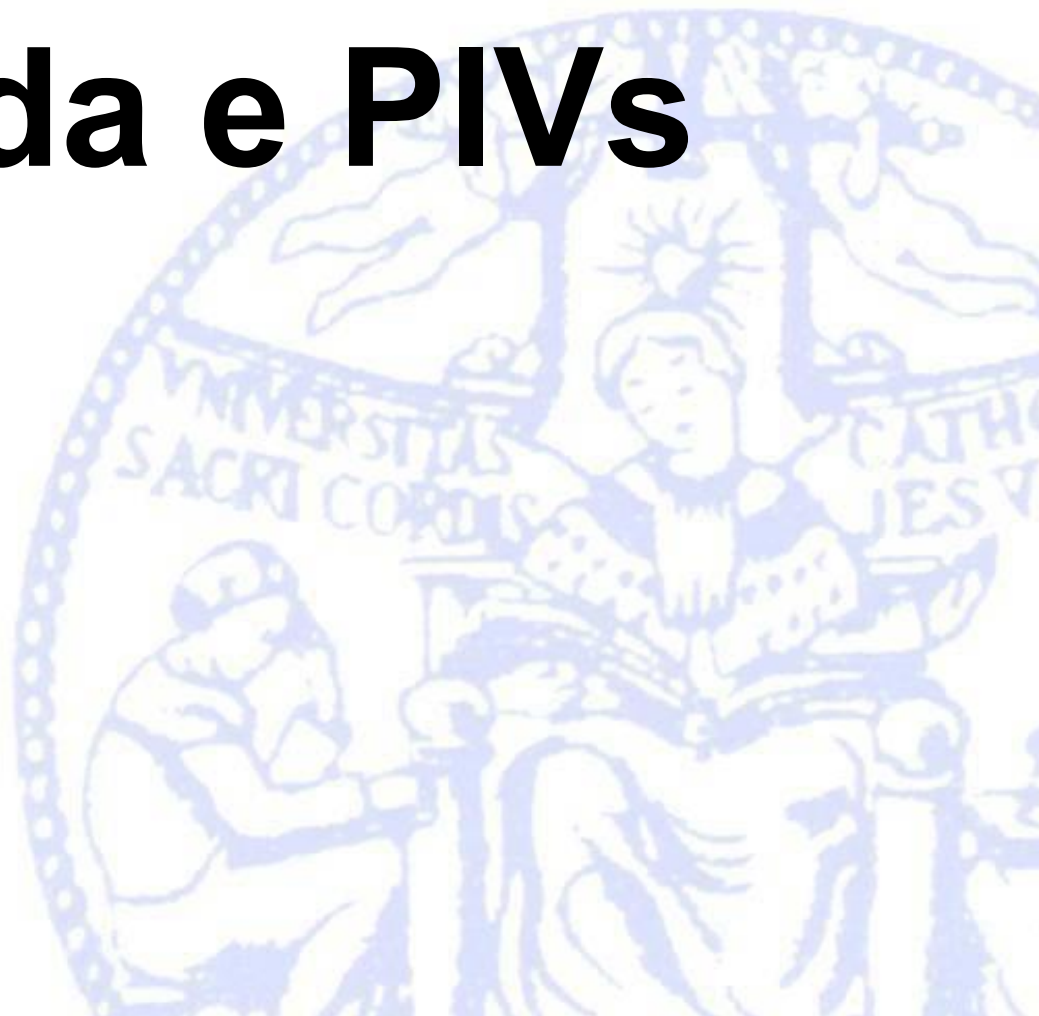
22.3 Vascular visualization technology is employed to increase the success with peripheral cannulation and decrease the need for central vascular access device (CVAD) insertion, when other factors do not require a CVAD.

Tecniche di Imaging

- Vene profonde (> 7 mm)
 - Visualizzazione ecografica
- **Vene superficiali (< 7 mm)**
 - Visione in trasparenza e/o Palpazione
 - **Visualizzazione con tecnologie specifiche**
 - Transilluminazione
 - Riflessione di raggi infrarossi (**NIR**)



Ecoguia e PIVs



Ecoguida e cannule periferiche in emergenza: RIDUZIONE CVC DIRETTI !!

Ultrasonography-guided peripheral intravenous catheter survival in ED patients with difficult access[☆]

James M. Dargin MD*, Casey M. Rebholz MPH, Robert A. Lowenstein MD,
Patricia M. Mitchell RN, James A. Feldman M American Journal of Emergency Medicine (2010) 28, 1–7

Department of Emergency Medicine, Boston Medical Center, Boston, MA 02118, USA

- 75 pazienti provenienti dal PS arruolati
- Tutti incannulati perifericamente, 88% per via ecoguidata
- 47 / 75: previsione di CVC in caso di fallito incannulamento
- Solo 5 pazienti avviati a CVC

Ecoguida e CANNULE PERIFERICHE: FUNZIONA !!

IMAGING/ORIGINAL RESEARCH

Ultrasonography-Guided Peripheral Intravenous Access Versus Traditional Approaches in Patients With Difficult Intravenous Access

Volume 46, NO. 5 : November 2005

Annals of Emergency Medicine 457

Thomas G. Costantino, MD

Aman K. Parikh, MD

Wayne A. Satz, MD

John P. Fojtik, MD

From the Drexel University College of Medicine, Department of Emergency Medicine

Table. Patient demographics and variables

Patient Data

IVDA, No. (%)

Chronic medical condition, No. (%)

Obesity, No. (%)

Success, No. (%)

Total time, minutes, median

Time of attempt, minutes, median

No. of sticks

Patient satisfaction

IVDA, Intravenous drug abuse.

- 51 pazienti con fallito incannulamento periferico convenzionale (medico/infermiere)
- ECO: 46/51 incannulati con successo, 43 al primo tentativo
 - 4 in vena brachiale
 - I restanti in basilica, cefalica, antecubitale, o vene dell'avambraccio
 - Tempo medio impiegato 2.5 minuti
 - 5 pazienti restanti: via centrale
 - 1 complicanza (puntura arteria brachiale)

Ecoguida e CANNULE PERIFERICHE IN EMERGENZA: FUNZIONA !!!

U ltrasound-Guided Brachial and Basilic Vein Cannulation in Emergency Department Patients With Difficult Intravenous Access

Linda E Keyes, MD
Bradley W Frazee, MD
Eric R Snoey, MD
Barry C Simon, MD
David Christy, MD

DECEMBER 1999 34:6 ANNALS OF EMERGENCY MEDICINE

711

- 101 pazienti (50 TD, 21 obesi, 30 vari) con 2 tentativi falliti di accesso venoso periferico convenzionale
- Vena brachiale profonda o vena basilica ECOGUIDATA
- Catetere 2-inch - 18 o 20 gauge
- Risultati
 - Rapida visualizzazione ed incannulamento della vena con successo in 91 casi (91%),
 - Tempo medio 77"
 - Successo al 1° tentativo in 73 casi (73%)
 - 2 casi di puntura arteria brachiale
- 8% dei casi: perdita dell'accesso venoso nella prima ora

Ecoguida e INFERMIERI in emergenza

Emergency Nurses' Utilization of Ultrasound Guidance for Placement of Peripheral Intravenous Lines in Difficult-access Patients

ACAD EMERG MED • December 2004, Vol. 11, No. 12 • www.aemj.org

Larry Brannam, MD, RDMS, Michael Blaivas, MD, RDMS,
Matthew Lyon, MD, RDMS, Michael Flake, RN

- 23 Infermieri, 321 pazienti con almeno 2 fallimenti “blind”
- 280 (87%) incannulati con successo
- 4 (1.2%) punture arteriose
- 41 (fallimenti
 - 12 (29%) CVC
 - 9 (22%) giugulare esterna
 - 20 (49%) successo ecoguidato da parte di un secondo operatore (medico/infermiere)

ORIGINAL ARTICLE

Ultrasound guidance allows faster peripheral IV cannulation in children under 3 years of age with difficult venous access: a prospective randomized study

Mehdi Benkhadra, Mathieu Collignon, Isabelle Fournel,
Christian Oeuvarard, Patricia Rollin, Murielle Perrin, François Volot,
Claude Girard

- ...anche in età pediatrica...
 - Maggior % di successo al primo tentativo
 - Minor tempo impiegato
 - Minor numero di punture ripetute

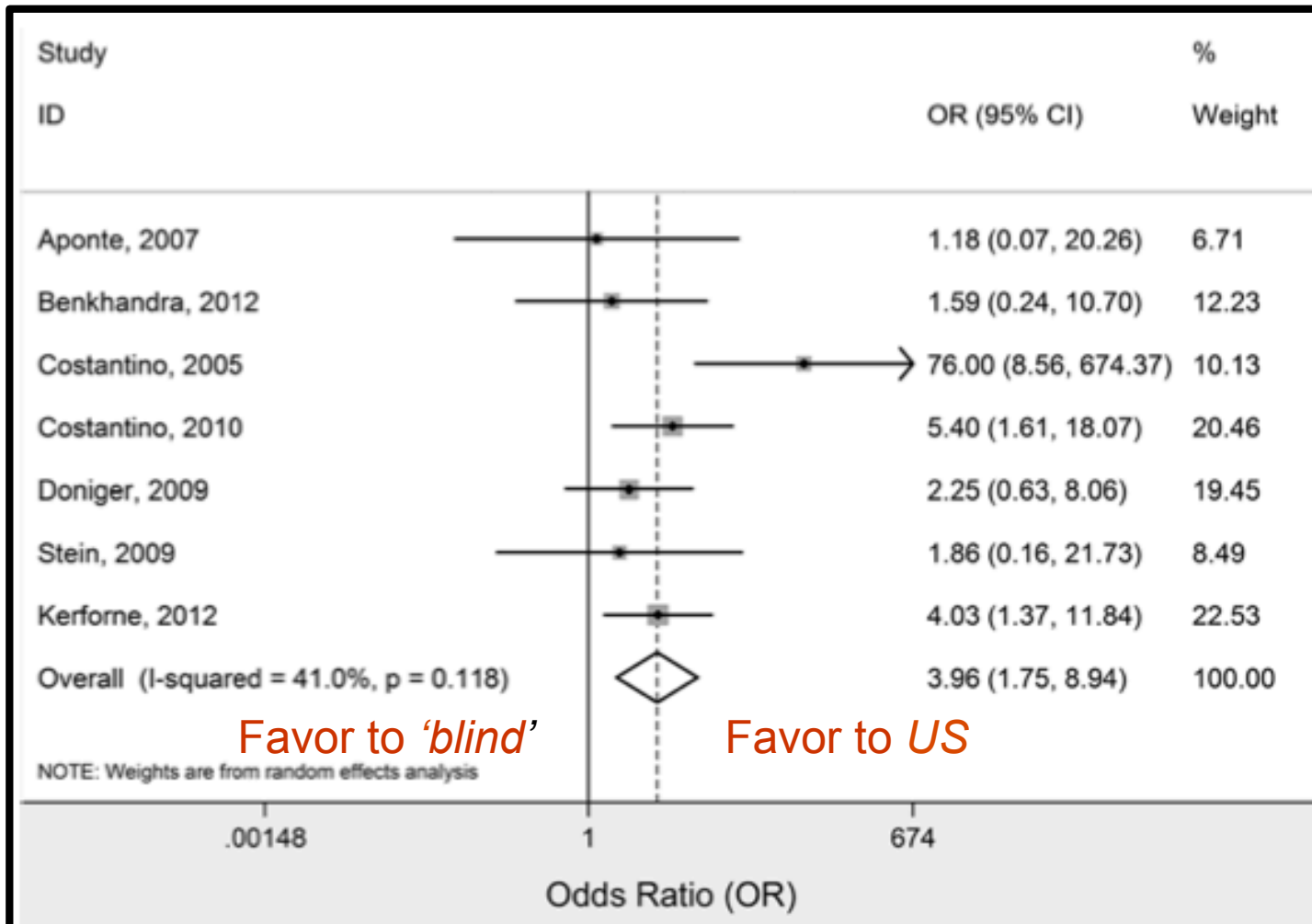
Ultrasound-guided peripheral venous access: a meta-analysis and systematic review

Lori A. Stolz¹, Uwe Stolz¹, Carol Howe², Isaac J. Farrell¹, Srikar Adhikari¹

¹ Department of Emergency Medicine, University of Arizona Medical Center, Tucson, AZ - USA

² Information Services, Arizona Health Sciences Library, University of Arizona, Tucson, AZ - USA

Conferma la maggiore % di successi al primo tentativo



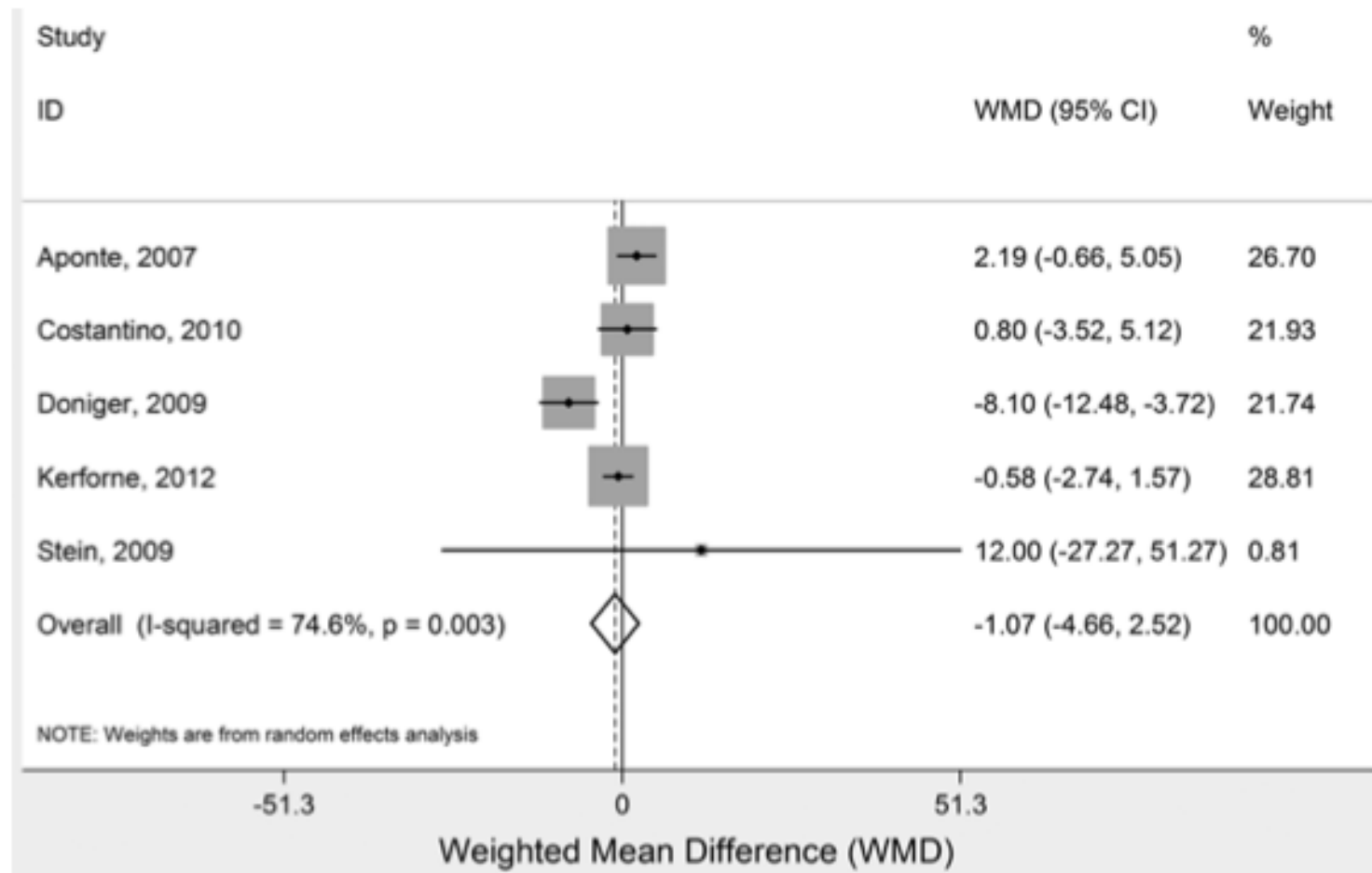
Ultrasound-guided peripheral venous access: a meta-analysis and systematic review

Lori A. Stolz¹, Uwe Stolz¹, Carol Howe², Isaac J. Farrell¹, Srikar Adhikari¹

¹ Department of Emergency Medicine, University of Arizona Medical Center, Tucson, AZ - USA

² Information Services, Arizona Health Sciences Library, University of Arizona, Tucson, AZ - USA

- ***Non significativa
la riduzione del
tempo impiegato***



Ultrasound guidance for difficult peripheral venous access: systematic review and meta-analysis

Grace Egan^{1,2}, Donagh Healy¹, Heidi O'Neill², Mary Clarke-Moloney¹, Pierce A Grace², Stewart R Walsh^{1,2}

[Author affiliations+](#)

Emergency Medicine Journal

Abstract

Background Establishing intravenous access is often vital in an acute hospital setting but can be difficult. Ultrasound-guided cannulation increases success rates in prospective studies. However, these studies have often lacked a comparative group. This systematic review and meta-analysis aimed to determine the clinical effectiveness of Ultrasound-guided peripheral intravenous cannulation compared with the standard technique in patients known to have difficult access.

Methods Electronic abstract databases, trial registries, article reference lists and internet repositories were searched using the following search terms: 'peripheral venous cannulation', 'peripheral venous access'. Studies meeting the following criteria were included: randomised controlled trial patients of all ages who required peripheral intravenous access; interventions were Ultrasound-guided versus standard cannulation technique; patients were identified as having difficult venous access; inclusion of at least one defined outcome (procedural success time to cannula placement; number of attempts).

Results 7 trials were identified (289 participants). Ultrasound guidance increases the likelihood of successful cannulation (pooled OR 2.42; 95% CI 1.26 to 4.68; $p=0.008$). There were no differences in time to successful cannulation, or number of percutaneous skin punctures.

Conclusion Ultrasound guidance increases the likelihood of successful peripheral cannulation in difficult access patients. We recommend its use in patients who have difficult venous access, and have failed venous cannulation by standard methods. Further randomised controlled trials (RCTs) with larger sample sizes would be of benefit to investigate if Ultrasound has any additional advantages in terms of reducing the procedure time and the number of skin punctures required for successful venous cannulation.



Use ultrasonography (US) for short peripheral catheter placement in adult and pediatric patients with difficult venous access.² (II)



Ann Emerg Med. 2013 Apr;61(4):444-454.e1. doi: 10.1016/j.annemergmed.2012.11.014. Epub 2013 Feb 15.

Ultrasonographically guided peripheral intravenous cannulation of children and adults: a meta-analysis.

Heinrichs J¹, Fritze Z, Vandermeer B, Klassen T, Curtis S.

⊕ Author information

Abstract

STUDY OBJECTIVE: Peripheral intravenous cannulation is a common procedure in emergency departments (ED) and operating rooms. We performed a systematic review to evaluate the effectiveness of ultrasonographic guidance as an aid to peripheral intravenous cannulation.

METHODS: We searched MEDLINE, Cochrane Central Register of Controlled Trials, EMBASE, Cumulative Index to Nursing and Allied Health Literature (CINAHL), Web of Science, and ClinicalTrials.gov. We included randomized trials evaluating ultrasonographically guided peripheral intravenous cannulation. Outcomes included cannulation failure, number of attempts, procedure time, or time from randomization to cannulation. We separately analyzed pediatric and adult data and emergency department (ED), ICU, and operating room settings. We used the Cochrane Risk of Bias Tool.

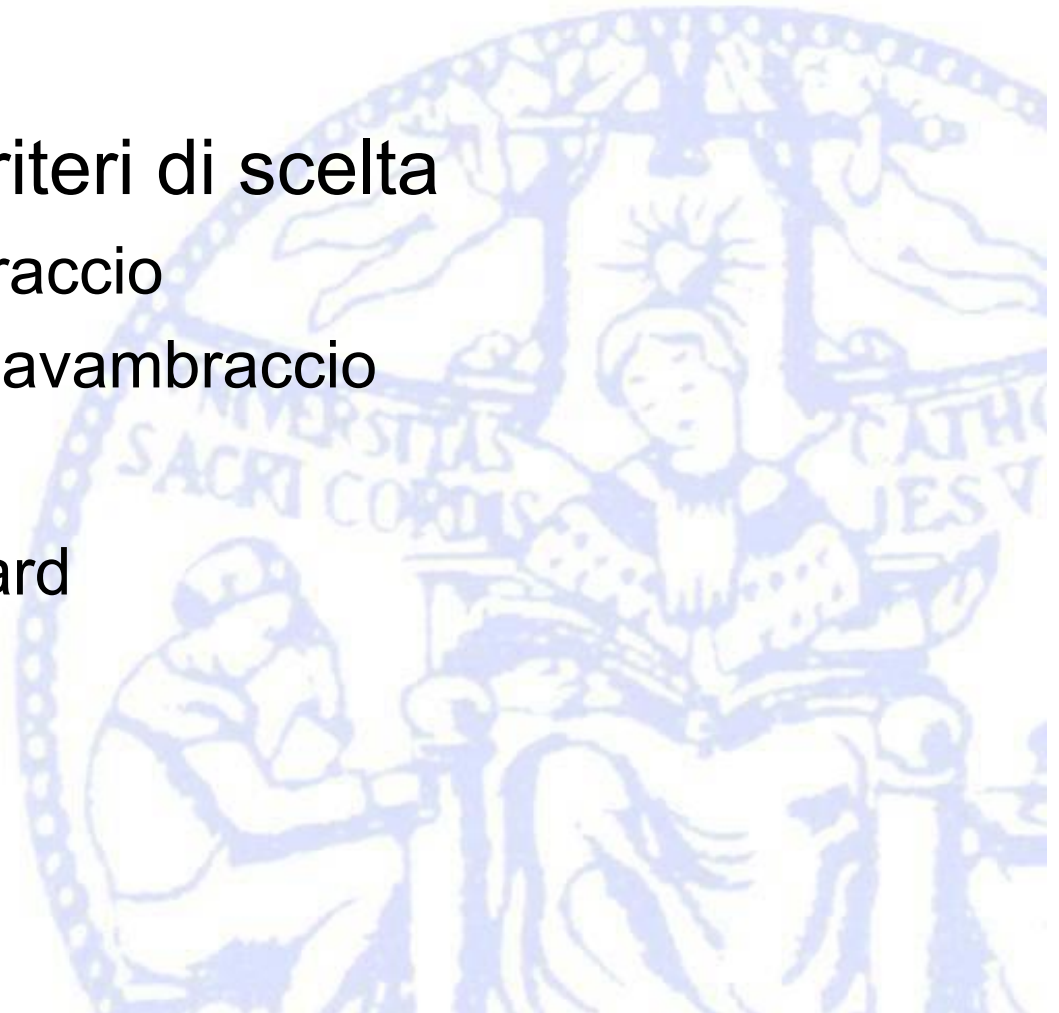
RESULTS: We assessed 403 full texts for eligibility, and included 9 trials. Five had low risk, 1 high risk, and 3 unclear risk of bias. Meta-analysis of all trials suggested that ultrasonography decreased mean difference (MD) in the number of attempts (MD -2.00; 95% CI -3.27 to -0.73) and procedure time (MD -8.10 minutes; 95% CI -12.48 to -3.72 minutes). In an operating room pediatric trial, ultrasonography decreased risk of first-attempt failure (risk ratio 0.23; 95% CI 0.08 to 0.69), number of attempts (MD -1.50; 95% CI -2.52 to -0.48), and procedure time (MD -5.95; 95% CI -10.21 to -1.69). Meta-analysis of adult ED trials suggests that ultrasonography decreases the number of attempts (MD -0.43; 95% CI -0.81 to -0.05). Ultrasonography decreased risk of failure (risk ratio 0.47; 95% CI 0.26 to 0.87) in an adult ICU trial.

CONCLUSION: Ultrasonography may decrease peripheral intravenous cannulation attempts and procedure time in children in ED and operating room settings. Few outcomes reached statistical significance. Larger well-controlled trials are needed.

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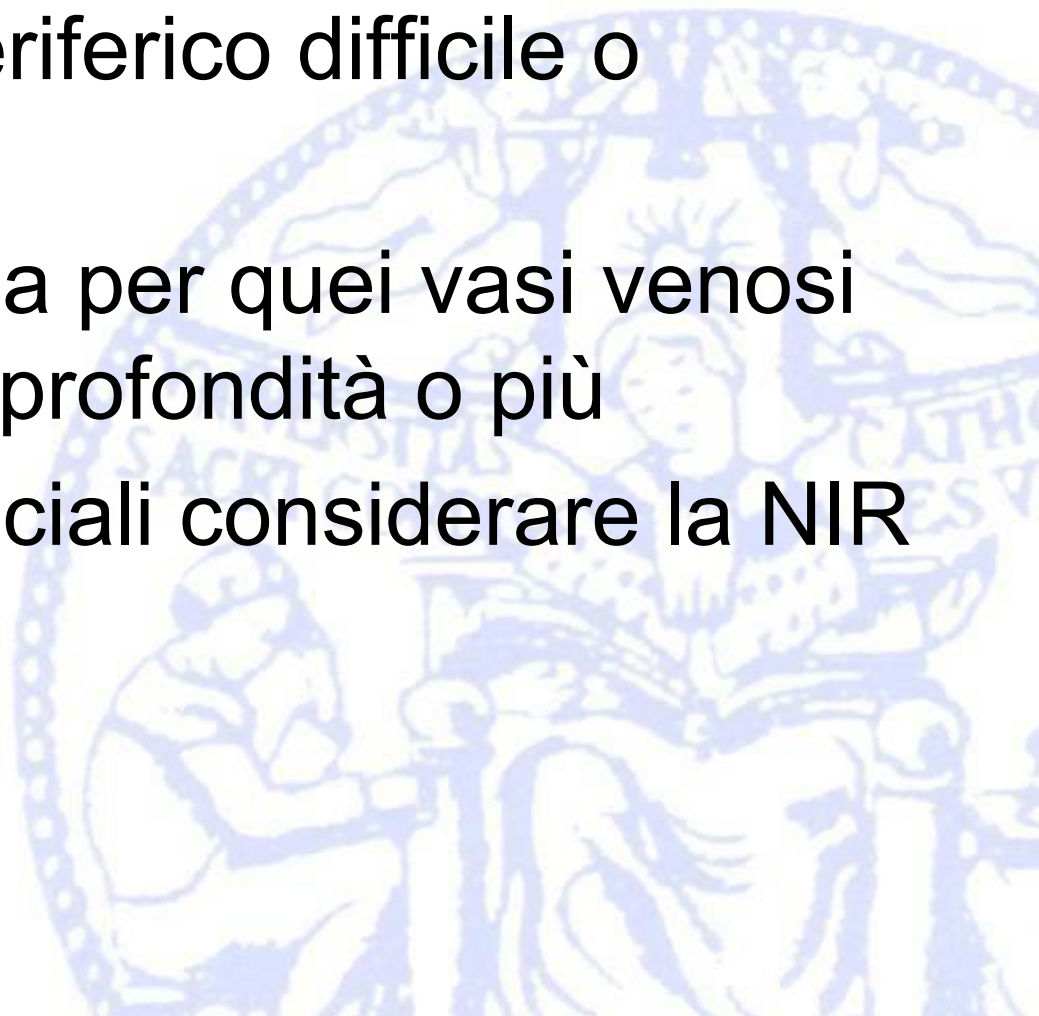
Eterogeneità degli studi

- Studi molto eterogenei riguardo a:
 - Tecniche
 - Vasi target e loro criteri di scelta
 - Vene profonde di braccio
 - Vene superficiali di avambraccio
 - Devices utilizzati
 - Ago cannule standard
 - Cannule lunghe
 - *Training*



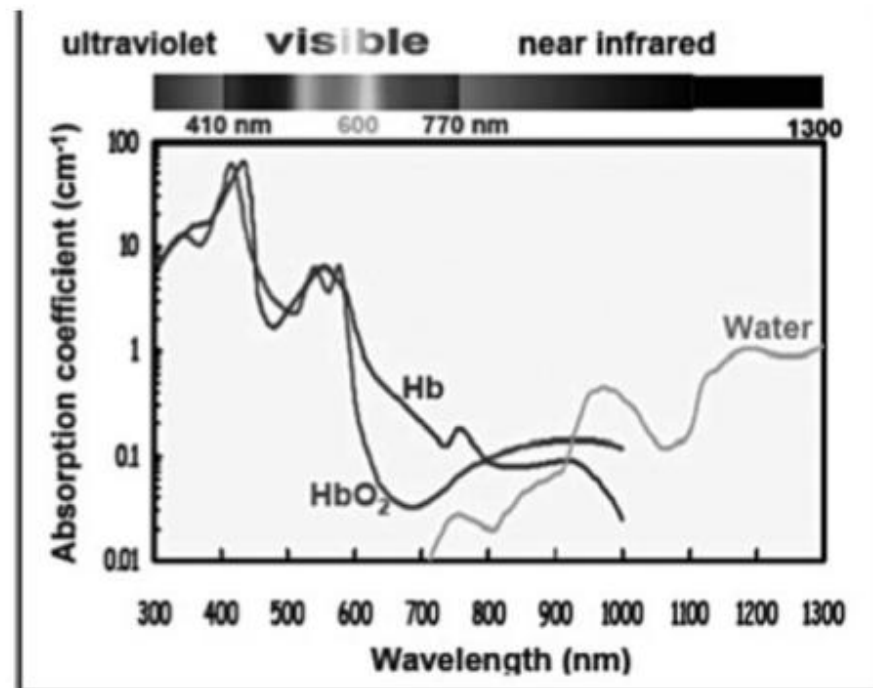
Ecoguida

- Considerare sempre l'ecoguida in caso di accesso venoso periferico difficile o impossibile
- Riservare l'ecoguida per quei vasi venosi situati a 7-8 mm di profondità o più
- Per vasi più superficiali considerare la NIR



NIR

- Vasi superficiali
 - 7-8 mm di profondità o meno
- Neonati, bambini, donne, anziani



Diversi metodi permettono la venipuntura avvalendosi della tecnologia NIR

- Diretto (Veinsite): visualizzazione diretta della vena da parte dell'operatore
- Indiretto (Accuvein, Veinviewer): la luce infrarossa permette la visualizzazione indiretta della vena sulla pelle del paziente



NIR Devices

- VeinViewer – Vision



- AccuVein



- Vasculuminator



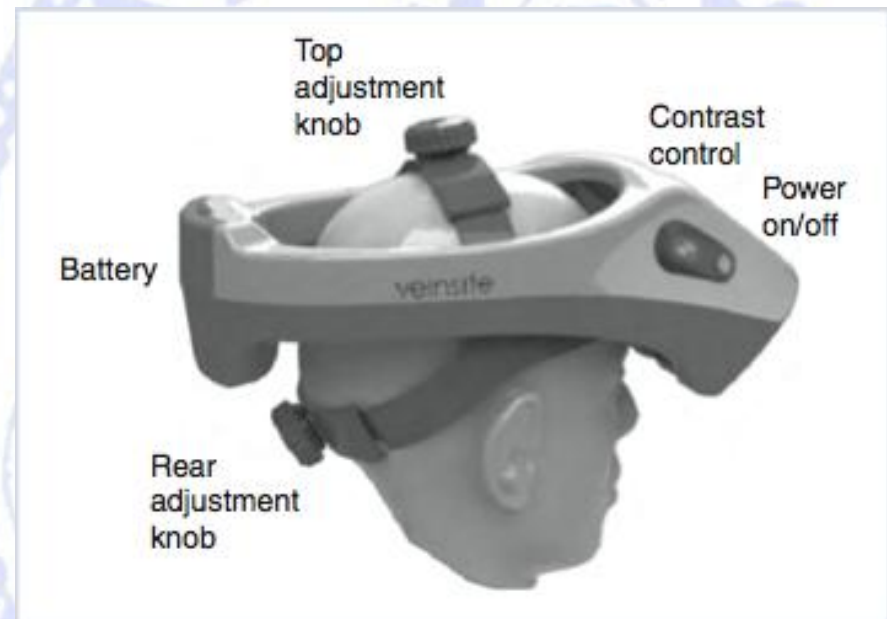
- Veinsite



NIR TECHNOLOGY



Veinsite



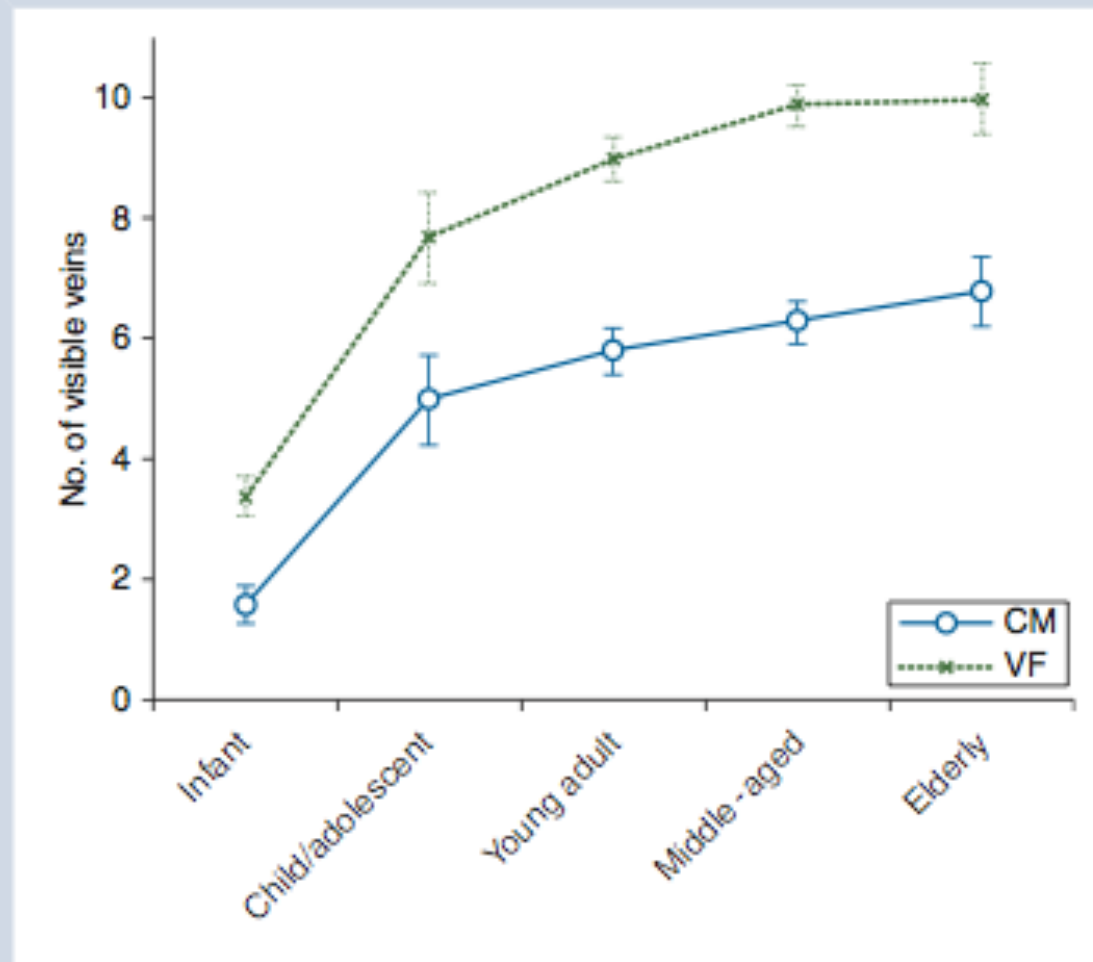


Fig 4 Comparison of VF and CM visible sites [mean (SE)] across age groups.

British Journal of Anaesthesia 110 (6): 966–71 (2013)
Advance Access publication 5 February 2013 · doi:10.1093/bja/aet003

BJA

CLINICAL PRACTICE

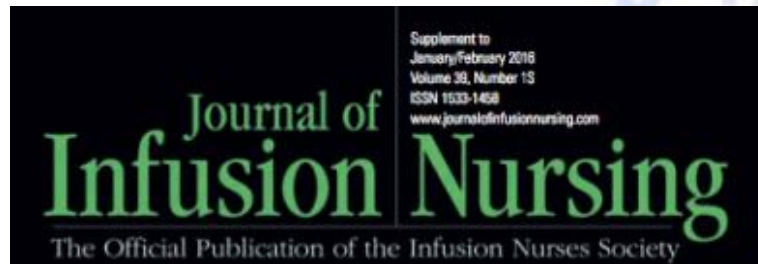
Vein visualization: patient characteristic factors and efficacy of a new infrared vein finder technology†

F. B. Chiao*, F. Resta-Flarer, J. Lesser, J. Ng, A. Ganz, D. Pino-Luey, H. Bennett, C. Perkins Jr and B. Witek

Visualizzazione mediante fasci di infrarossi

Near-infrared technology (NIR)

Consider the use of near-infrared (nIR) light technology to aid in locating viable superficial peripheral venous sites and decreasing procedure time for short peripheral catheter insertion.



1. Available technology includes hands-free devices that capture an image of the veins and reflect it back to the skin's surface or to a screen and transillumination projected to a screen. The clinician may choose to use a static process by imaging and marking the vein location on the skin or a dynamic process of using the image to guide catheter insertion. No studies have compared these various methods of device use, leaving this decision to the discretion of the clinician.^{1,6,12}

Consider nIR light technology to identify peripheral venous sites and facilitate more informed decisions about vein selection (ie, bifurcating veins, tortuosity of veins, palpable but nonvisible veins). Two nonrandomized studies have shown improvement in first-attempt success for peripheral catheter insertion using nIR; however, other studies have not shown this same outcome. Additional research is needed to address the reason(s), which could include differences in nIR devices, patient-related factors, and skill level of the inserters before using the nIR devices.¹¹⁻¹⁹ (I)



A systematic review and meta-analysis of new interventions for peripheral intravenous cannulation of children.

Heinrichs J¹, Fritze Z, Klassen T, Curtis S.

- To synthesize and evaluate the best evidence for novel **interventions** designed to improve pediatric PIVC
- A **meta-analysis** of 3 RCTs found that use of a transilluminator was associated with a decreased risk of first-attempt PIVC failure
 - Transilluminators modestly improve pediatric PIVC, but the clinical significance of this benefit is questionable
- **Meta-analysis** of 3 other RCTs found that near-infrared light devices do not impact the risk of first-attempt PIVC failure
 - *Near-infrared light devices might be efficacious in selected subpopulations, but the available evidence does not support an overall benefit in the pediatric population*

British Journal of Anaesthesia **110** (6): 888–91 (2013)
doi:10.1093/bja/aet078

EDITORIAL II

Difficult peripheral veins: turn on the lights

M. Lamperti^{1*} and M. Pittiruti²

¹ Department of Neuroanaesthesia, National Neurological Institute Besta, Via Celoria, 11, 20136 Milan, Italy

² Department of Surgery, Catholic University, Rome, Italy

* Corresponding author. E-mail: doclampmd@gmail.com



There are three main unresolved issues regarding the use of NIR technology that makes its application still far from real life and clinical practice in our hospitals.

First: what about training? It is not clear how operators should be trained in the use of this new technology. Most of the studies do not report how many procedures the operators had to perform before being considered proficient with this new method. To define an operator proficient in a new technology or procedure, two main outcomes should be satisfied: goal achieved and time to success. Considering these devices, first-time successful cannulation should be considered the main goal and a learning curve should be calculated on this parameter;¹² this would suggest the average number of procedures required before obtaining a minimal training for getting proficiency.

Cannulation time is not less important, if we consider that these portable devices should also be used in the emergency room to obtain a prompt venous access. It is mandatory to define a training curriculum on the use of NIR devices, if we want to use them properly every time, those superficial veins are not easily visible, palpable, or both.



Second: cost-effectiveness. In other words, is this technology affordable in this period of international financial crisis? New technologies may be difficult to be accepted by our hospital managers, if not supported by a proper economical and clinical rationale. A budget impact analysis¹³ of this technology should include not only the raw cost of the device (from \$4500 up to \$25 000) and the cost of training vs the time-saving benefit, but also the advantage of a convincing improvement in the quality of venous cannulation in terms of perception of pain by

patients and handiness of the device by operators. Should the results of this analysis show a significant cost-effectiveness, the technique should be progressively introduced in the clinical practice, with the clinical goals of (i) preserving the peripheral vein patrimony of the patients and (ii) avoiding the risks associated with a potentially unnecessary central vein cannulation.¹⁴

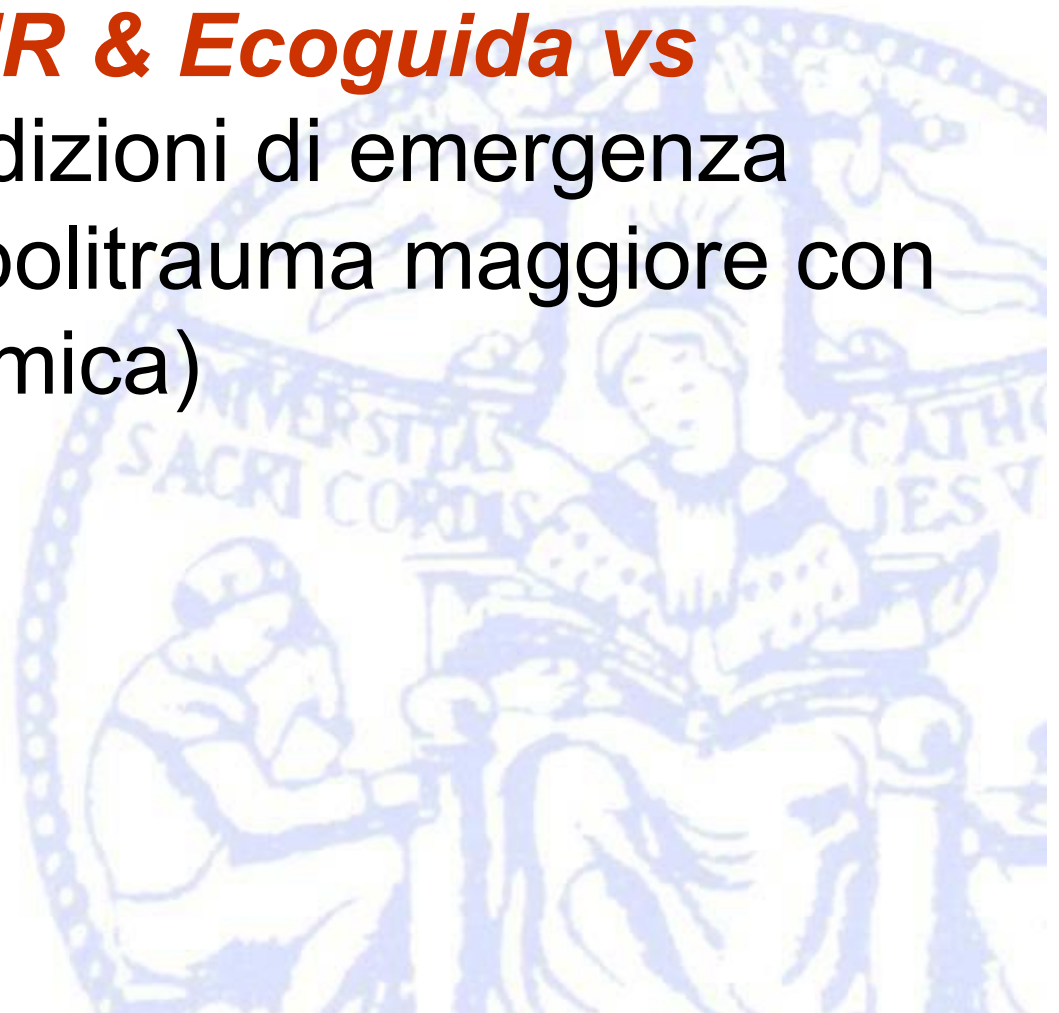


Finally, there is a technical concern about vein visualization. Difficult venous cannulation may be related to the small diameter of the vein (as in infants) or to their deep location (as in obese patients) or to poor visibility or palpability due to other factors (oedema, pigmentation, etc.). It is still not clear whether NIR devices can be effective not only in venous visualization but also in venous cannulation; more specifically, since NIR technology does not provide a depth of field, accidental puncture of the posterior wall of the vein, and extravasation may easily occur. Ultrasound guidance has been proposed in recent years¹⁵ ¹⁶ to improve the visualization of difficult superficial veins in paediatric patients, but the results of these studies are controversial in terms of improved success rate, first-time success, and overall time to cannulation.



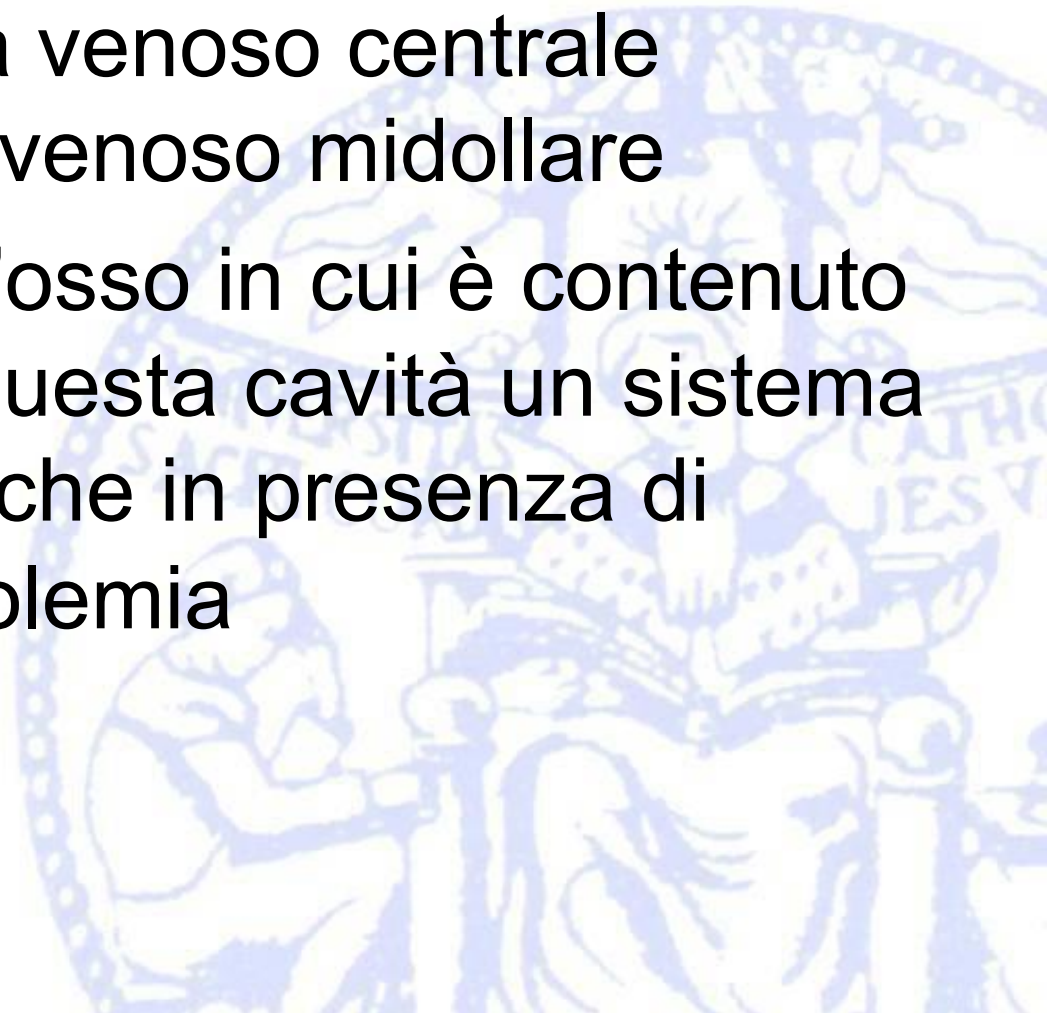
Necessità di RCTs

- Non ci sono studi che confrontino l'efficacia e la sicurezza di **NIR & Ecoguida vs accesso IO** in condizioni di emergenza (arresto cardiaco, politrauma maggiore con instabilità emodinamica)



Accesso IO: basi anatomiche

- Il midollo osseo è molto vascolarizzato ed è collegato al sistema venoso centrale attraverso il plesso venoso midollare
- La consistenza dell'osso in cui è contenuto il midollo rendono questa cavità un sistema non-collassabile anche in presenza di shock o grave ipovolemia



ORIGINAL RESEARCH

Open Access



Intraosseous blood samples for point-of-care analysis: agreement between intraosseous and arterial analyses

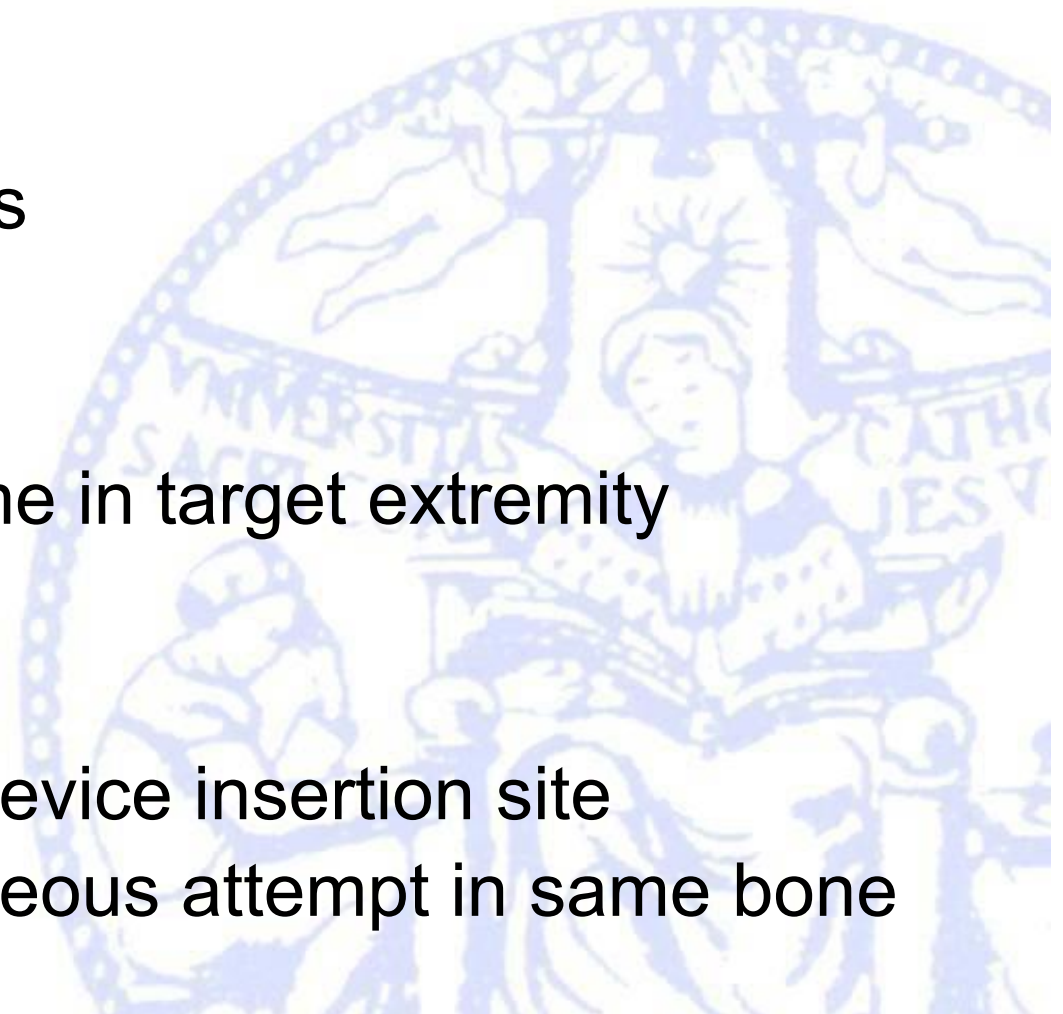
Table 1 The point-of-care results for the analyses of IO1 (initial intraosseous sample), IO2 (second intraosseous sample after 2 ml of waste blood), arterial blood, and venous blood

	IO1	IO2	Artery	Vein
Na (mmol/l)	132 (123–137) <i>n</i> = 29	131.5 (125–138) <i>n</i> = 30	138 (131–140)	138 (132–142)
K (mmol/l)	5.8 (4.0–7.7) <i>n</i> = 27	6.9 (4.5–8.8) <i>n</i> = 26	3.7 (3.5–4.2)	3.7 (3.3–4.2)
iCa (mmol/l)	1.12 (0.95–1.2) <i>n</i> = 29	1.07 (0.91–1.24) <i>n</i> = 30	1.21 (1.13–1.26)	1.23 (1.18–1.3)
pH	7.420 (7.363–7.614) <i>n</i> = 29	7.433 (7.379–7.679) <i>n</i> = 30	7.408 (7.356–7.789)	7.377 (7.298–7.463)
BE (mmol/l)	1.0 (–3.0–5.0) <i>n</i> = 29	1.0 (–3.0–6.0) <i>n</i> = 30	–1.0 (–6.0–9.0)	–1.0 (–5.0–4.0)
HCO ₃ (mmol/l)	25.1 (20.9–29.3) <i>n</i> = 29	25.0 (20.7–30.6) <i>n</i> = 30	22.6 (18.0–27.8)	24.4 (20.8–28.7)
pO ₂ (kPa)	7.35 (4.7–13.4) <i>n</i> = 28	7.55 (4.1–13.7) <i>n</i> = 30	12.35 (9.5–15.5) <i>n</i> = 30	4.3 (2.6–10.5)
pCO ₂ (kPa)	5.12 (2.97–6.16) <i>n</i> = 29	4.96 (2.44–6.16) <i>n</i> = 30	4.82 (2.25–5.36)	5.55 (4.07–7.29)
Hb (g/l)	153 (68–204) <i>n</i> = 28	139.5 (92–190) <i>n</i> = 30	153 (116–228)	150 (119–241) <i>n</i> = 30
Hct (%)	45 (20–60) <i>n</i> = 28	41 (27–56) <i>n</i> = 30	45 (34–67)	44 (35–71)
Gluc (mmol/l)	5.5 (4.4–7.0) <i>n</i> = 27	5.5 (4.6–6.8) <i>n</i> = 29	5.5 (4.4–7.0)	5.4 (3.8–6.6)
Lact (mmol/l)	1.03 (0.58–2.42) <i>n</i> = 26	1.04 (0.68–2.11) <i>n</i> = 26	1.15 (0.56–2.0) <i>n</i> = 30	1.44 (0.74–2.58)

Data are presented as median (range). The number of results is indicated only if it differed from 31. Potassium values over 9.0 mmol/l were excluded from the analysis as outliers (the upper limit of measurement for the used method, IO1 *n* = 2, IO2 *n* = 4)

IO: Controindicazioni

- Skin infection at insertion site
- Fractured bone
- Severe bone diseases
- Imperfect osteogenesis
- Osteoporosis
- Osteomyelitis
- Compartment syndrome in target extremity
- Prior surgery
- Burns
- Localized cellulitis at device insertion site
- Recent failed intra-osseous attempt in same bone





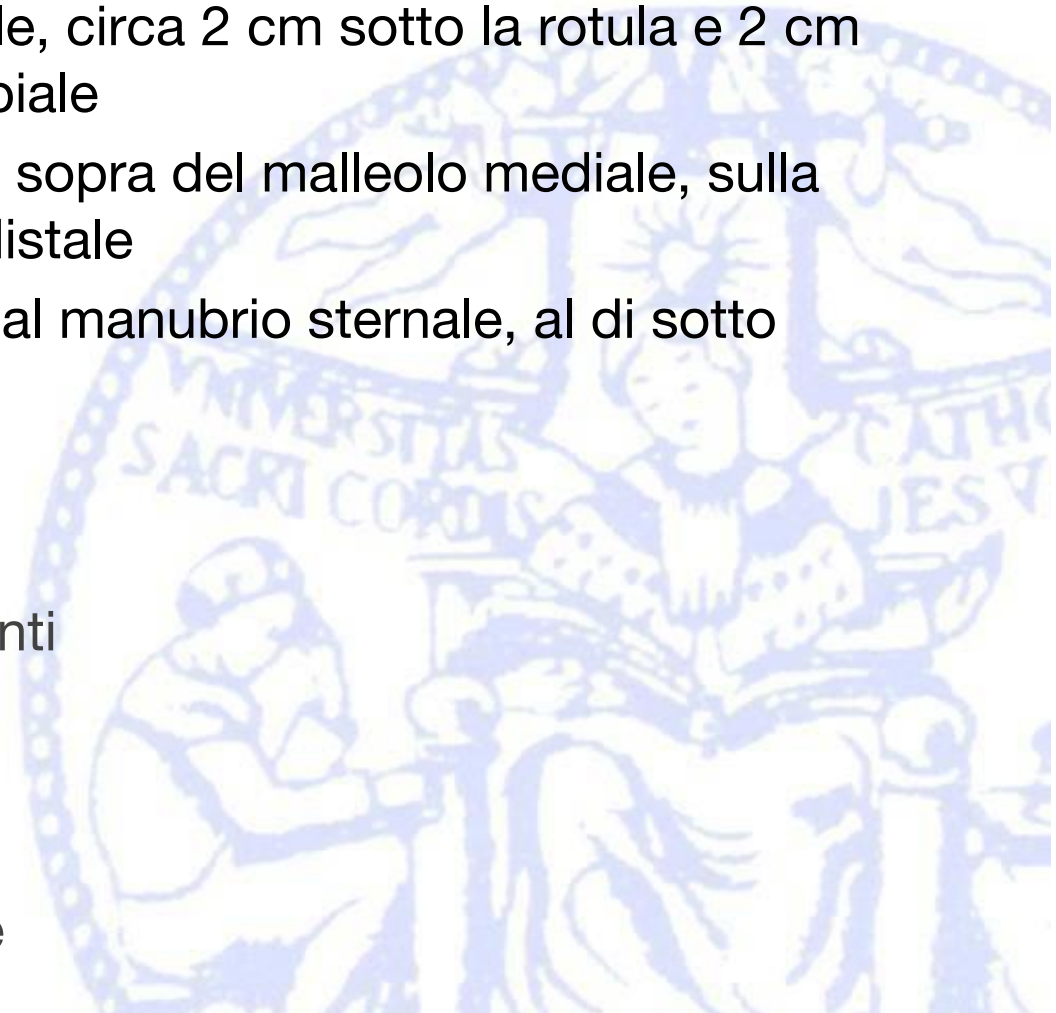
Accesso IO

I principali punti di inserzione sono:

- **Omerale:** parte più prominente del trochite omerale al di sopra di circa 1 cm del collo chirurgico
- Tibiale prossimale: piatto tibiale, circa 2 cm sotto la rotula e 2 cm medialmente alla tuberosità tibiale
- Tibiale distale: circa 3 cm al di sopra del malleolo mediale, sulla superficie mediale della tibia distale
- Sternale: perpendicolarmente al manubrio sternale, al di sotto dell'incisura giugulare

Selezione del sito

- Nessun IO nelle 48 ore precedenti
- Assenza di controindicazioni
- Accessibilità
- Capacità di fissare e monitorare



Accesso IO

Portata

- La portata dei fluidi infusi (ml/h) è diversa da sito a sito ed è correlabile a quella di cannule di diversa misura
- A parità di pressione d'infusione, un **accesso omerale o sternale** sono paragonabili in termini di portata ad un 16 Gauge, mentre un accesso tibiale è paragonabile a un 21 Gauge



Clinical paper

EZ-IO® intraosseous device implementation in a pre-hospital emergency service: A prospective study and review of the literature☆

30 papers su EZ-IO

- 12 case reports
- 12 studi prospettici
- 3 studi retrospettivi
- 3 RCTs

5. Conclusion

The EZ-IO device was shown to be effective in achieving vascular access in the pre-hospital setting. The 90% success rate, the localisation of insertion and the reasons for inserting an intraosseous device were similar to what is described in the literature. The intraosseous route can be used to administer a wide range of drugs and fluids.

Further studies are needed to evaluate the impact of the intraosseous route, particularly on the patient's survival, and on the occurrence of delayed complications.

Soltanto 1 studio aveva come outcome la sopravvivenza alla dimissione: studio di coorte, 13 pazienti (5.4%) sopravvissuti alla dimissione

... nell'intraospedaliero?

Letter to the Editor

Need of intraosseous access in advanced life support in the in-hospital setting
Evaluation of difficult vascular access in cardiac arrest

Resuscitation 112 (2017) e7

Table 1

Access available at arrival of resuscitation team.

Access available at arrival of resuscitation team	
Single peripheral venous access	78
Single intraosseous access	5
Single central venous access	1
Peripheral venous AND intraosseous access	4
Peripheral venous AND central venous access	1
No intravascular access	5
Total	94

Reasons for not using intraosseous access in critical illness

PDF

Peter Hallas, Mikkel Brabrand, Lars Folkestad

[Author affiliations+](#)

Emergency Medicine Journal

Abstract

Aim To identify reasons for not using intraosseous access (IO) when intravenous access is difficult during resuscitation.

Methods Questionnaire made available to members of selected Scandinavian medical societies.

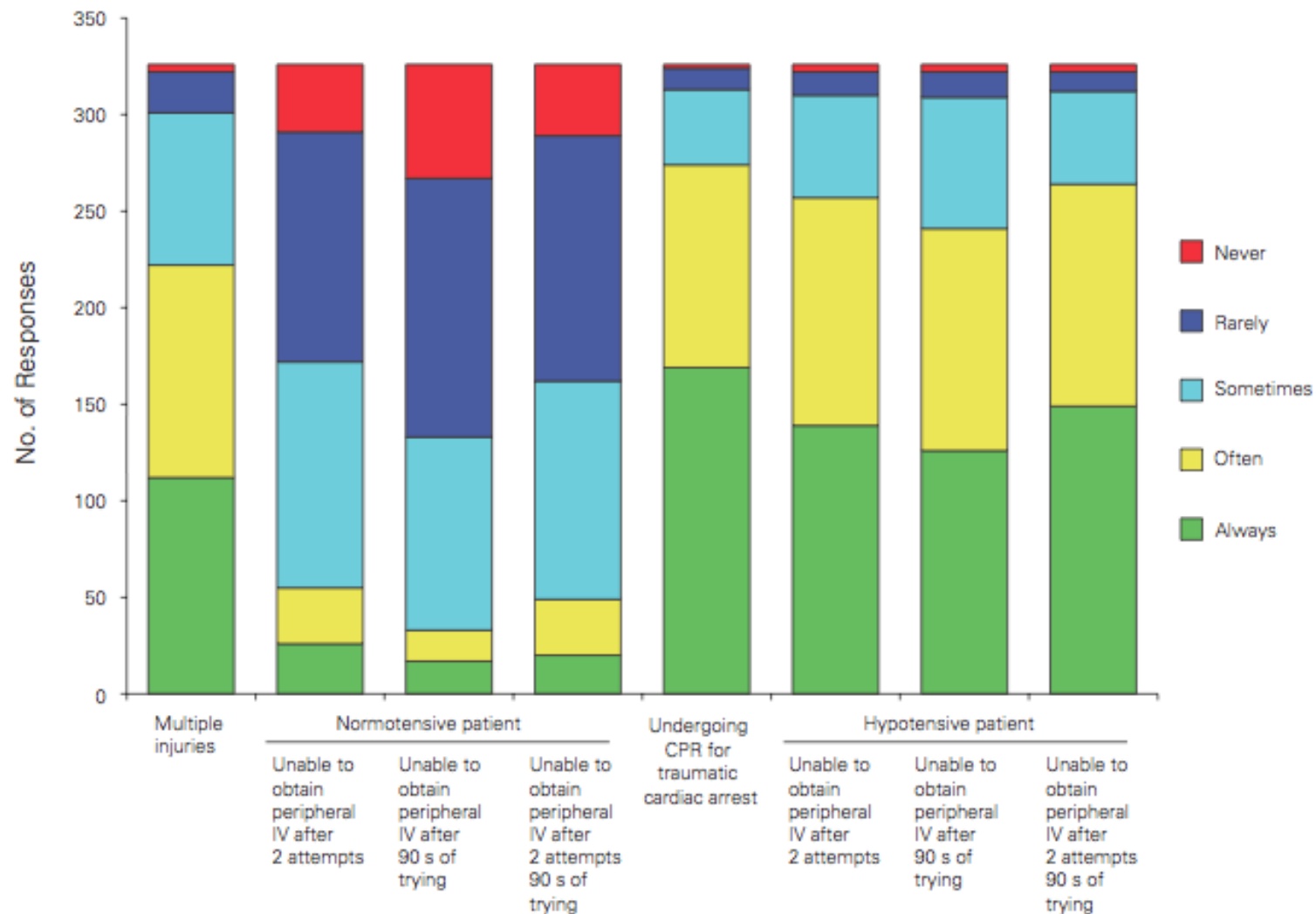
Results Of 759 responders to the questionnaire, 23.5% (n=178) had experienced one or more situations where there was a need for IO but none was placed. The most common stated reasons for not performing IO were a lack of equipment (48.3%), a lack of knowledge about the procedure (32.6%), and intravenous access preferred over IO (23.0%).

Conclusions The main reasons for not using IO were lack of equipment and lack of training. The authors recommend increased training in IO use and greater availability of IO equipment for front-line staff in Scandinavian countries. The use of non-purpose-designed needles for IO should be evaluated.

- Necessità di training adeguato!
- Riduzione dei costi e maggiore diffusione dei dispositivi automatici che appaiono più sicuri

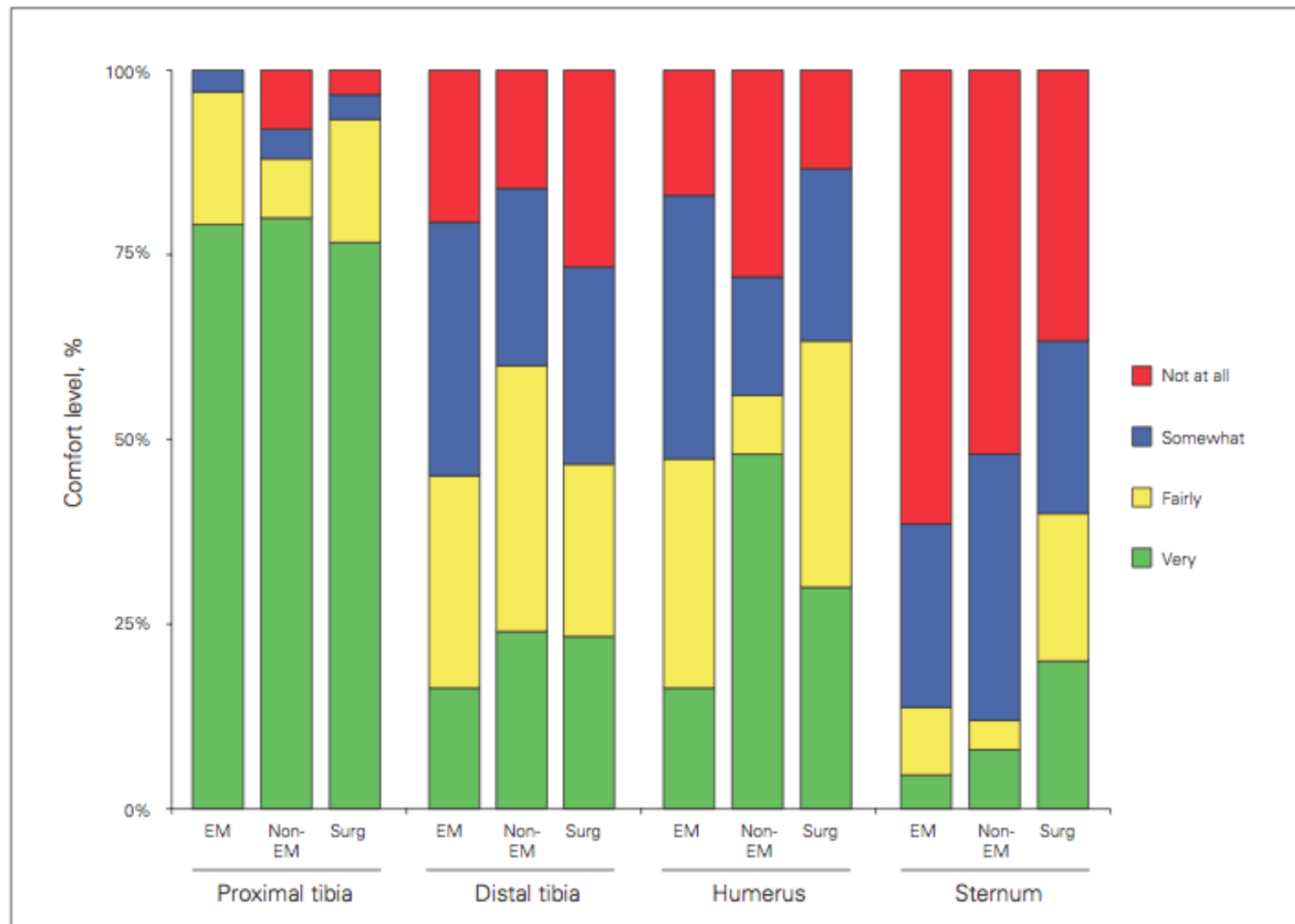
Use of intraosseous devices in trauma: a survey of trauma practitioners in Canada, Australia and New Zealand

J can chir, Vol. 59, N° 6, décembre 2016



Use of intraosseous devices in trauma: a survey of trauma practitioners in Canada, Australia and New Zealand

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Accesso IO: complicanze

Complication With Intraosseous Access

Inquiry of Scandinavian Users' Experiences

Peter Hallas, MD, Mikkel Brabrand, MD, Lars Folkestad, MD |
Western J Emerg Med. 2013;14(5):440-443.

www.medscape.com



IO-equipment used	All	%	EZ-IO	B.I.G	Cook	Others	p-value*
Cases reported	1,802	100.0	861	255	418	268	

Prima dell'uso...

Start complications							
Equipment difficult to assemble	36	2.0	4	21	5	6	< 0.0001
Difficult to identify correct anatomical site	57	3.2	28	17	5	7	0.0013
Bended or broken needle	72	4.0	11	17	20	24	< 0.0001
Patient discomfort/pain	128	7.1	73	13	20	22	0.0663
Difficult to penetrate the periosteum	186	10.3	18	56	51	61	< 0.0001
Difficult to aspirate bone marrow	221	12.3	92	51	38	40	< 0.0001

Nell'utilizzo...

Complications in use							
Difficult to inject fluid and drugs	133	7.4	59	33	27	14	0.0026
Slow infusion despite use of pressure bag	159	8.8	77	32	34	16	0.0610
Displacement after insertion	153	8.5	47	50	38	18	< 0.0001
Extravasation	66	3.7	25	12	17	12	0.4089



Complicanze Tardive

Late complications							
Compartment syndrome	10	0.6	6	1	1	2	0.796
Osteomyelitis	7	0.4	4	1	1	1	1.000
Skin infection	6	0.3	4	1	1	0	0.829

Conclusion

In users' recollection of real-life IO use, the overall rate of complications was higher than usually reported from model and cadaver studies. The relatively high rate of difficulties after insertion should be addressed when the procedure is taught. Research on IO devices should focus on all stages of IO use. Focus only on "penetration through cortex" as a measure of IO success rate could miss clinically relevant complications.

Difficoltà Prevista

- Obesità
- Depauperamento del patrimonio venoso
- Abuso di droghe
- Chemioterapia
- Ipovolemia
- Neonati e Bambini



*Blavias & Lyon, 2006; Chinnock, Thornton, & Hendey, 2007;
Costantino, Parikh, Satz, & Fojtik, 2005;
Miles, Salcedo, & Spear, 2011;
Nafiu, Burke, Cowan, Tutuo, Maclean, & Tremper, 2010*

Cateterismo Venoso Periferico

- Limiti:
 - pH compreso tra 5 e 9: no farmaci eccessivamente acidi (es. dopamina) o basici;
 - Osmolarità < 600 mOsm/L (INS)
 - Osmolarità < 500 mOsm/L (AVA)
 - Farmaci lesivi per l'endotelio: flebite chimica (es. K^+)

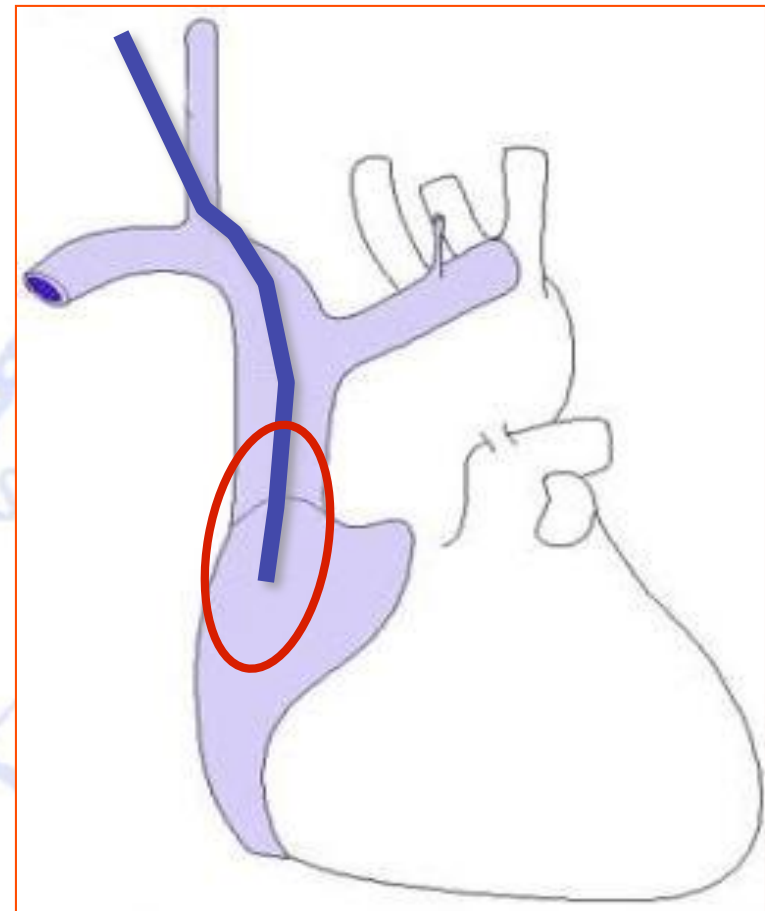
Dobutamine HCL	NS@ 4mg/ml	5,5)	280	SI	DOBUTAMINA
Docetaxel	NS 0,3-0,9mg/ml	4-4,3	503	SI	TAXOTERE
Dolasetron	SW@20mg/ml	3,2-3,8	285	SI	ANZEMET
Dopamine HCL	D5W	3,3(2,5-4,5)	277	SI	REVIVAN
Potassium chloride premix	0,4mEq/ml	5	800	SI	
Potassium chloride premix	0,3mEq/ml	5	600	SI	

Cateterismo Venoso Centrale

- **Definizione:**

- Catetere di materiale biocompatibile inserito mediante puntura percutanea di una vena tributaria (diretta o indiretta) in modo tale che la sua punta raggiunga:

- 1/3 distale di VCS
 - Giunzione cavo-atriale
 - 1/3 prossimale di atrio dx

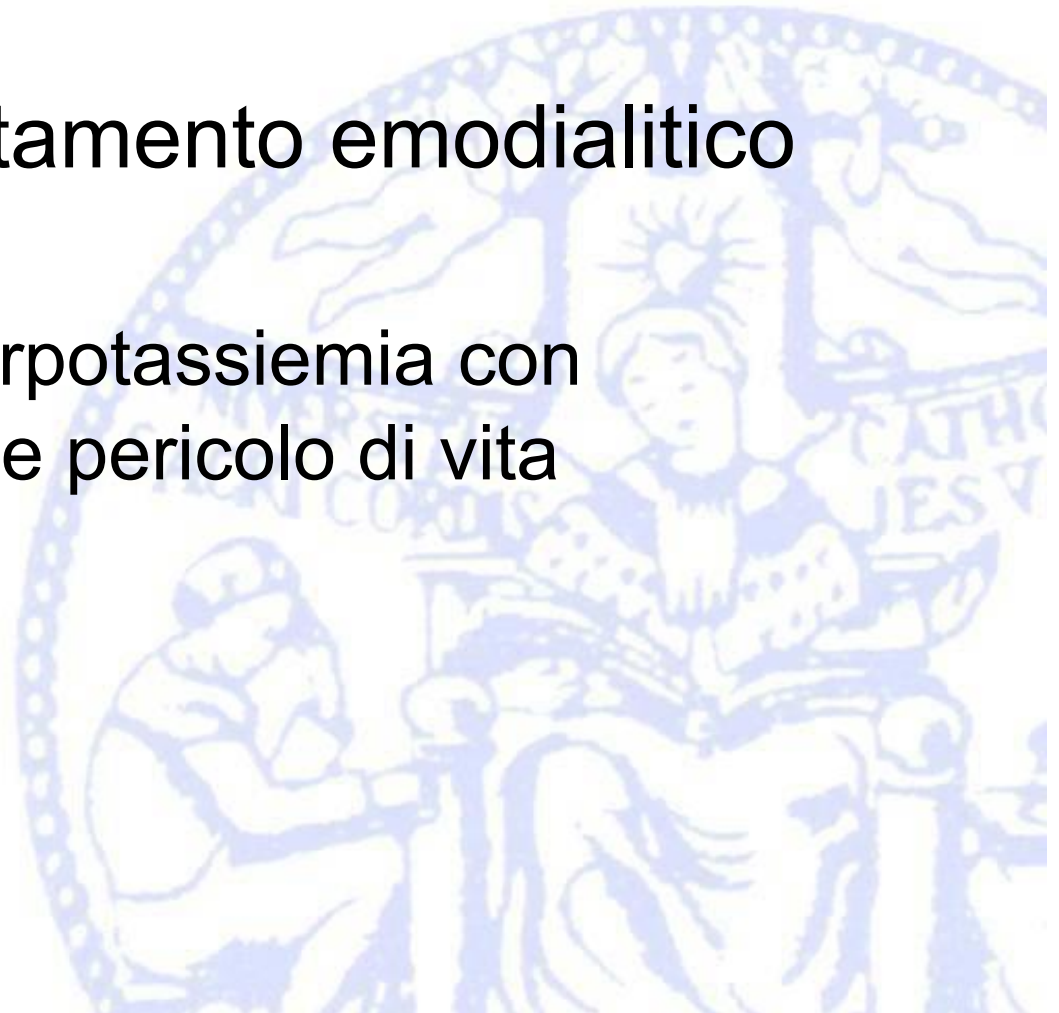


Cateterismo Venoso Centrale

- Possibilità di infondere qualsiasi tipo di farmaci e liquidi di varia natura:
 - Farmaci lesivi per l'endotelio vasale ed in qualsiasi range di pH (anche <5 e >9): es. amiodarone, potassio, dopamina etc.
 - Liquidi di varia natura: colloidi, cristalloidi, sangue ed emoderivati etc.
 - Soluzioni di qualsiasi osmolarità
 - Monitoraggio emodinamico e ossimetrico

Cateterismo Venoso Centrale

- Necessità di trattamento emodialitico urgente
 - Ad es. grave iperpotassiemia con alterazioni ECG e pericolo di vita



Ultrasound-guided cannulation of the femoral vein for acute hemodialysis access with silicone catheters

The Journal of Vascular Access 2001; 2: 56-59

A. ZOLLO, F. CAVATORTA, S. GALLI

Division of Nephrology and Dialysis, General Hospital, Imperia - Italy

Nephrol Dial Transplant (1997) 12: 1009-1012

Technical Report

Ultrasound-guided cannulation of the femoral vein for acute haemodialysis access

T. H. Kwon, Y. L. Kim and D. K. Cho

Nephrol Dial Transplant (1997) 12: 1234-1237

Technical Report

Ultrasound-guided cannulation *versus* the landmark-guided technique for acute haemodialysis access

J. Farrell and M. Gellens

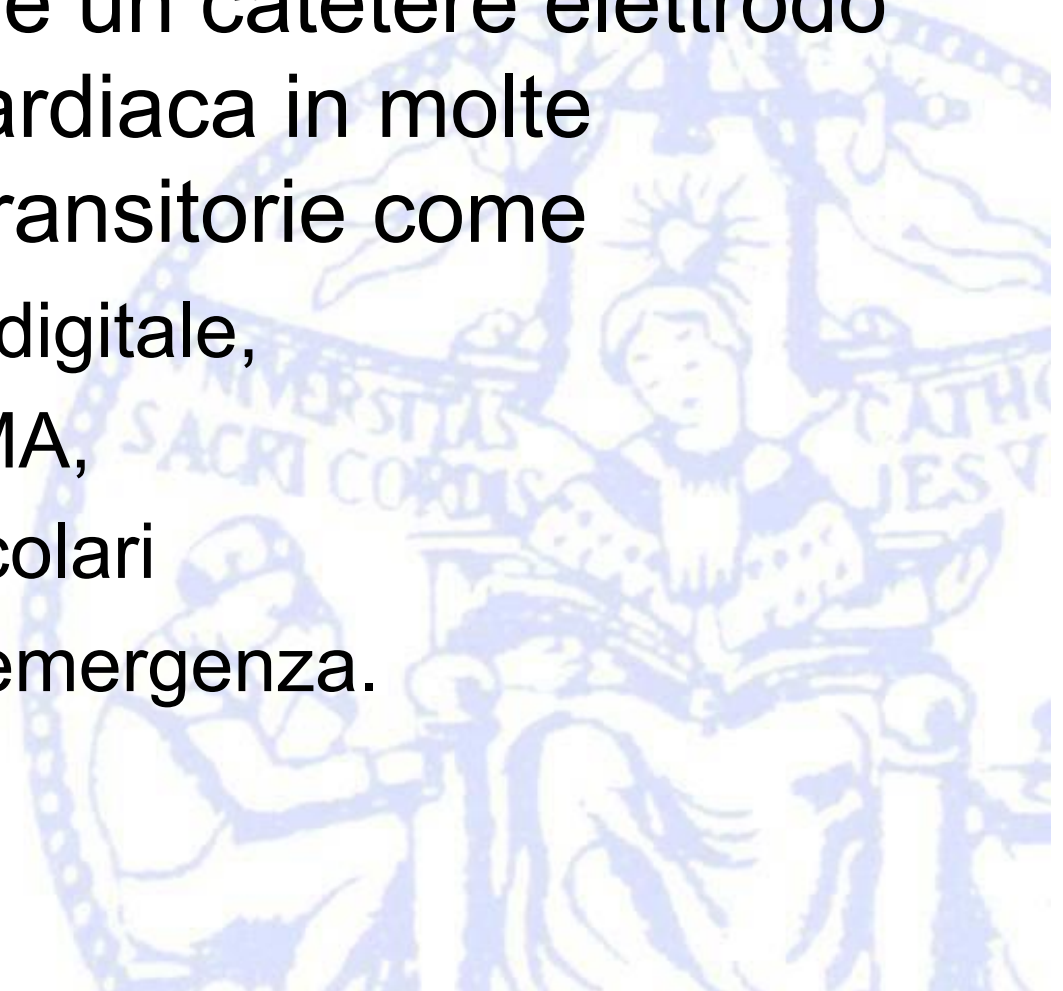
Division of Nephrology, St Louis University Health Sciences Center, St Louis, USA

**Nephrology
Dialysis
Transplantation**

**Nephrology
Dialysis
Transplantation**

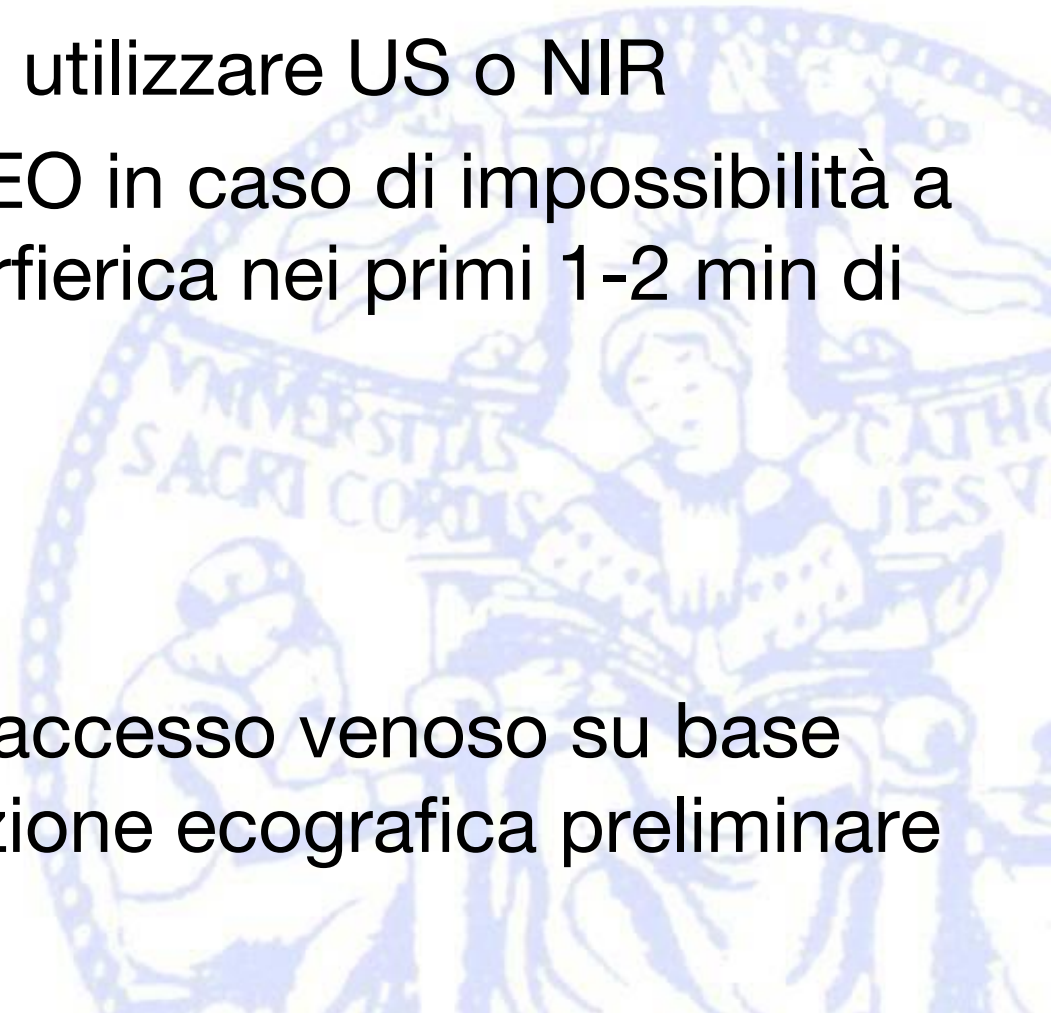
Cateterismo Venoso Centrale

- Necessità di inserire un catetere elettrodo per stimolazione cardiaca in molte patologie ritenute transitorie come
 - l'intossicazione da digitale,
 - complicanze dell'IMA,
 - blocchi atrio-ventricolari
 - Altre condizioni di emergenza.

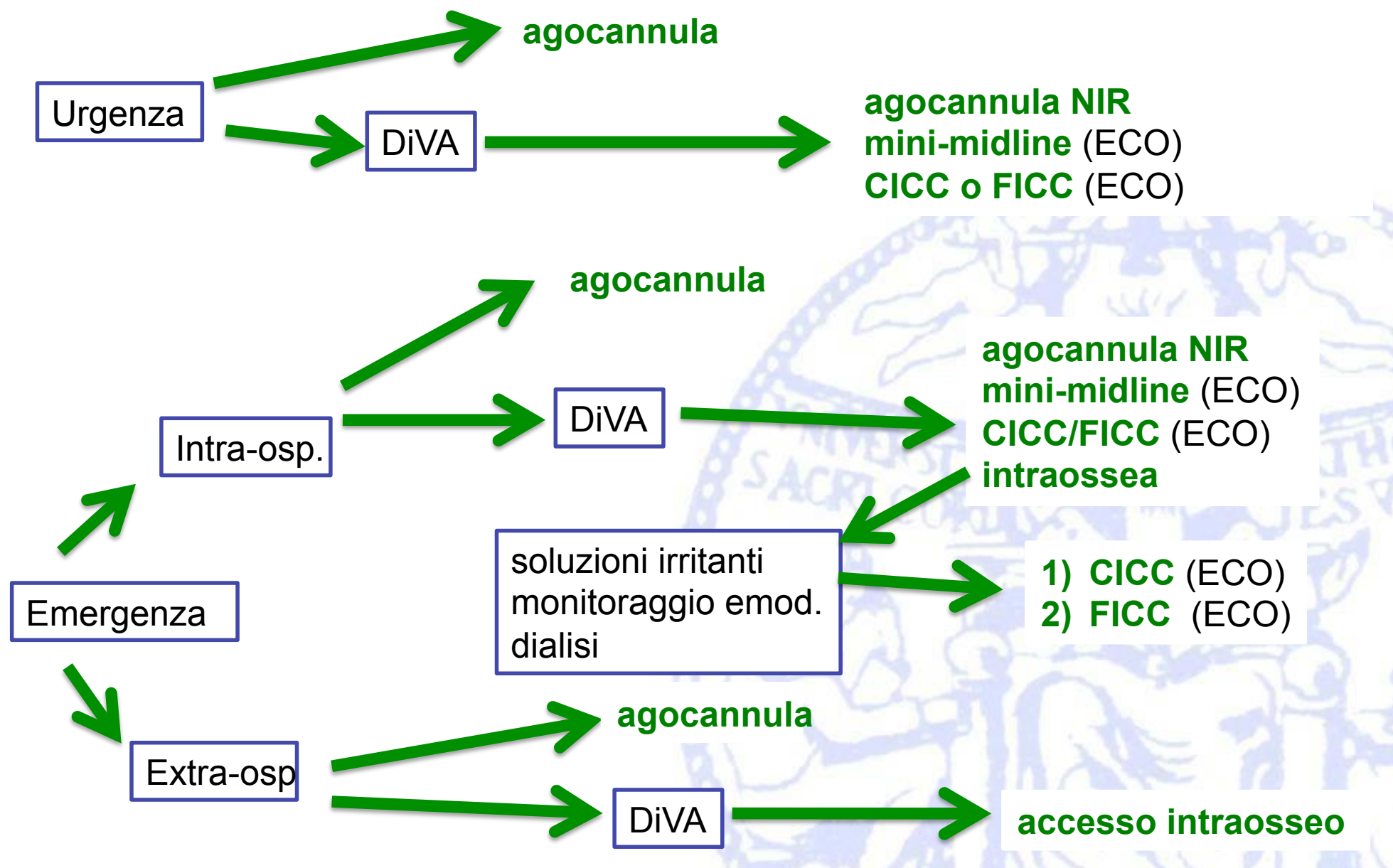


Conclusioni

- Emergenza (es. ACC o Grave stato di shock)
 - Accesso Venoso Periferico
 - Se prevista difficoltà: utilizzare US o NIR
 - Accesso INTRAOSSEO in caso di impossibilità a reperire una vena periferica nei primi 1-2 min di 'life support'
- Urgenza
 - Scelta razionale dell'accesso venoso su base clinica e della valutazione ecografica preliminare



Accesso Venoso in Emergenza/Urgenza



Grazie!

