



GAVePed 2025



Stato dell'arte della visualizzazione delle vene superficiali nel neonato tecniche di Near–Infra-Red

Vito D'Andrea

Tecnologia NIR ed ecografia

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.

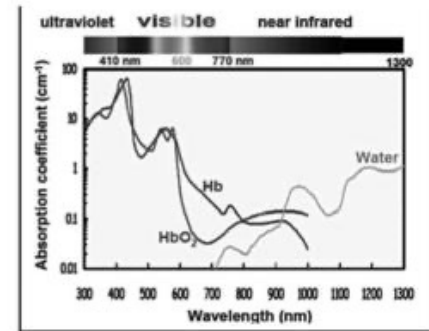
22.2 Vascular visualization technology is used in patients with difficult venous access and/or after failed venipuncture attempts.

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.

Sono le due tecniche di imaging che hanno completamente cambiato il mondo degli accessi vascolari, in particolare nel neonato e nel bambino.

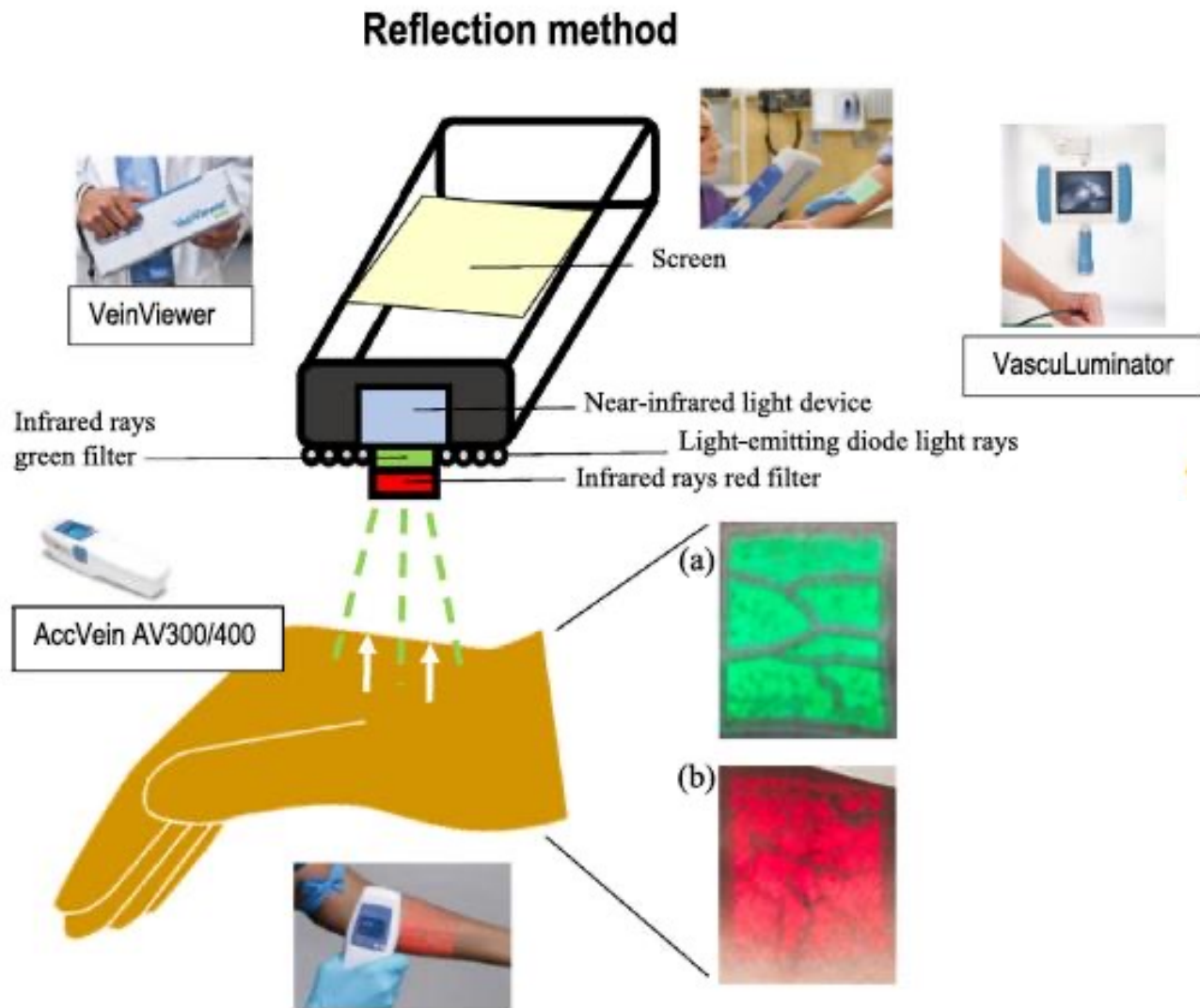


NIR



- La luce emessa dall'apparecchio attraverso diodi con picco di **lunghezza d'onda di 760nm** è in grado di penetrare ad angolo retto **fino a max. 7-8 mm** di profondità da una distanza di 61cm.
- Questi fasci di luce vengono **assorbiti dall'emoglobina**, presente nelle vene superficiali, e **riflessa** dai tessuti circostanti come il grasso sottocutaneo.
- I vasi superficiali si evidenziano quindi direttamente sulla cute del paziente, apparendo come immagini in negativo su fondo chiaro.

NIR DEVICES



VeinViewer – Vision

AccuVein

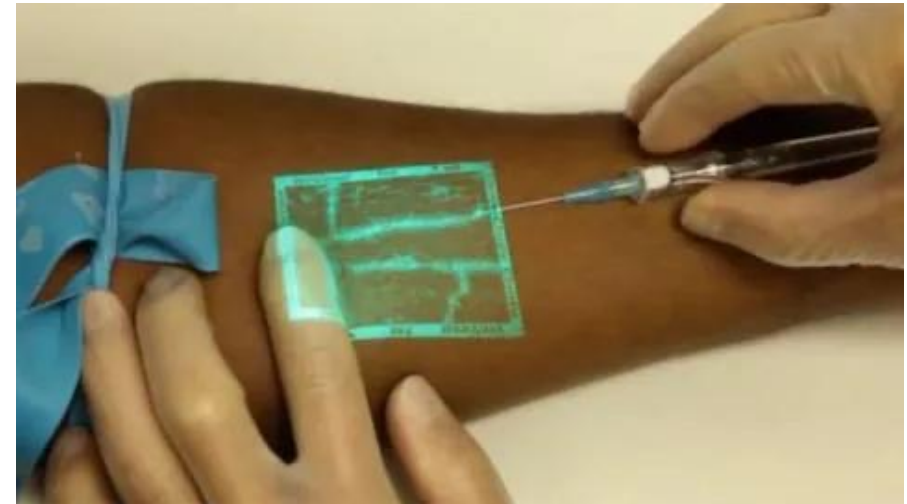
Vasculuminator

Veinsite

VEINVIEWER - VISION

VeinViewer utilizza la tecnologia NIR prodotta da diodi ad emissione che consente di vedere le strutture venose fino a 7-8 mm di profondità.

L'immagine prodotta viene **proiettata** sotto forma di luce verde direttamente sulla cute del paziente.



ACCUVEIN

The AccuVein utilizza la luce ad infrarosso e proietta l'immagine elaborata sotto forma di luce rossa direttamente sulla cute del paziente



VASCULUMINATOR

Vasculuminator utilizza la tecnologia NIR prodotta da diodi ad emissione e l'immagine elaborata appare su uno schermo sopra il sito di venipuntura

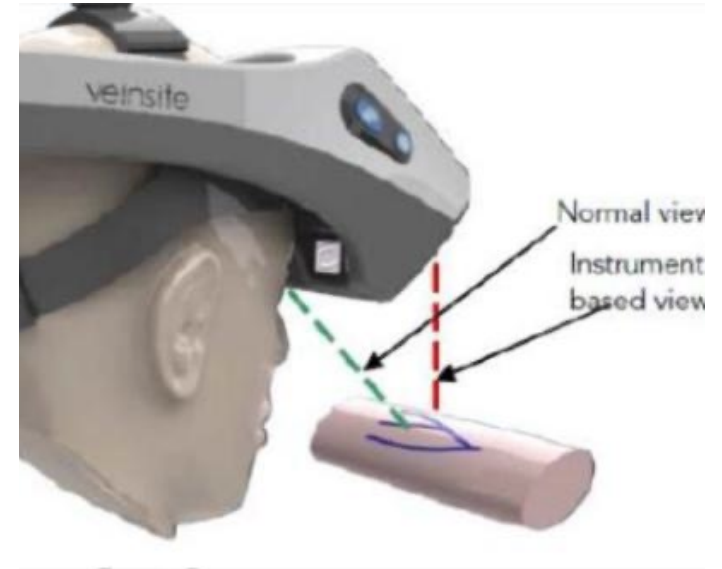
“The system is used for imaged guided vessel puncture similar to a car navigation system: you look at the display when you don't know the way (don't see vessels)”



VEINSITE

Il sistema ottico trasforma la differenza tra assorbito e diffuso dei fasci NIR in un'immagine delle vene che è visualizzata su uno schermo a cristalli liquidi posto nel caschetto





VANTAGGI SPECIFICI DELLA TECNOLOGIA A RIFLESSIONE DI INFRAROSSI

- Utilizzabile su qualunque paziente, di qualunque età o etnia
- Non invasivo, innocuo, non riscalda
- Non rischio di contaminazione
- Permette di individuare in modo dettagliato il tragitto delle vene, le biforcazioni, le valvole, etc.
- Mantiene libere le mani dell'operatore

POTENZIALI VANTAGGI DELLA NIR

Diminuzione tentativi venipuntura

- Successo al primo tentativo

Riduzione dei tempi

Riduzione dei costi

Maggior comfort del paziente

Preservare il patrimonio venoso!!!!



ORIGINAL RESEARCH CONTRIBUTION

Validation and Refinement of the Difficult Intravenous Access Score: A Clinical Prediction Rule for Identifying Children With Difficult Intravenous Access

Michael W. Riker, MD, Chris Kennedy, MD, Brad S. Winfrey, RN, Kenneth Yen, MD, MS, and M. Denise Dowd, MD, MPH

Predictor Variable	Scores		
Visibility	Visible = 0		Not visible = 2
Palpability	Palpable = 0		Not palpable = 2
Age	≥36 months = 0	12–35 months = 1	< 12 months = 3
Prematurity	Not premature = 0		Premature = 3
Skin shade	Light = 0	Dark = 1	

DIVA4^{Yen}: vein palpability, vein visibility, age, history of prematurity

DIVA5^{Yen}: vein palpability, vein visibility, age, history of prematurity, skin shade

DIVA4^{Riker}: vein palpability, vein visibility, age, history of NICU admission

DIVA3^{Riker}: vein palpability, vein visibility, age.

EDITORIAL II

Difficult peripheral veins: turn on the lights

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- **TRAINING**
- **COSTO-EFFICACCIA**
- **VISUALIZZAZIONE 2D**

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

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Editor's key points

- Factors contributing to difficult venous cannulation and the impact of new vein imaging technologies are important to safe and effective medical therapy.
- The numbers of potential i.v. cannulation sites were compared using the conventional visual method and a new infrared vein finding technology.
- Infrared vein visualization increased the number of potential cannulation sites in all subgroups.

Background. We investigated the patient characteristic factors that correlate with identification of i.v. cannulation sites with normal eyesight. We evaluated a new infrared vein finding (VF) technology device in identifying i.v. cannulation sites.

Methods. Each subject underwent two observations: one using the conventional method (CM) of normal, unassisted eyesight and the other with the infrared VF device, VueTek's Veinsite™ (VF). A power analysis for moderate effect size ($\beta=0.95$) required 54 samples for within-subject differences.

Results. Patient characteristic profiles were obtained from 384 subjects (768 observations). Our sample population exhibited an overall average of 5.8 [95% confidence interval (CI) 5.4–6.2] veins using CM. As a whole, CM vein visualization were less effective among obese [4.5 (95% CI 3.8–5.3)], African-American [4.6 (95% CI 3.6–5.5 veins)], and Asian [5.1 (95% CI 4.1–6.0)] subjects. Next, the VF technology identified an average of 9.1 (95% CI 8.6–9.5) possible cannulation sites compared with CM [average of 5.8 (95% CI 5.4–6.2)]. Seventy-six obese subjects had an average of 4.5 (95% CI 3.8–5.3) and 8.2 (95% CI 7.4–9.1) veins viewable by CM and VF, respectively. In dark skin subjects, 9.1 (95% CI 8.3–9.9) veins were visible by VF compared with 5.4 (95% CI 4.8–6.0) with CM.

Conclusions. African-American or Asian ethnicity, and obesity were associated with decreased vein visibility. The visibility of veins eligible for cannulation increased for all subgroups using a new infrared device.

Keywords: catheterization; veins

VEINSITE

Accepted for publication: 21 December 2012

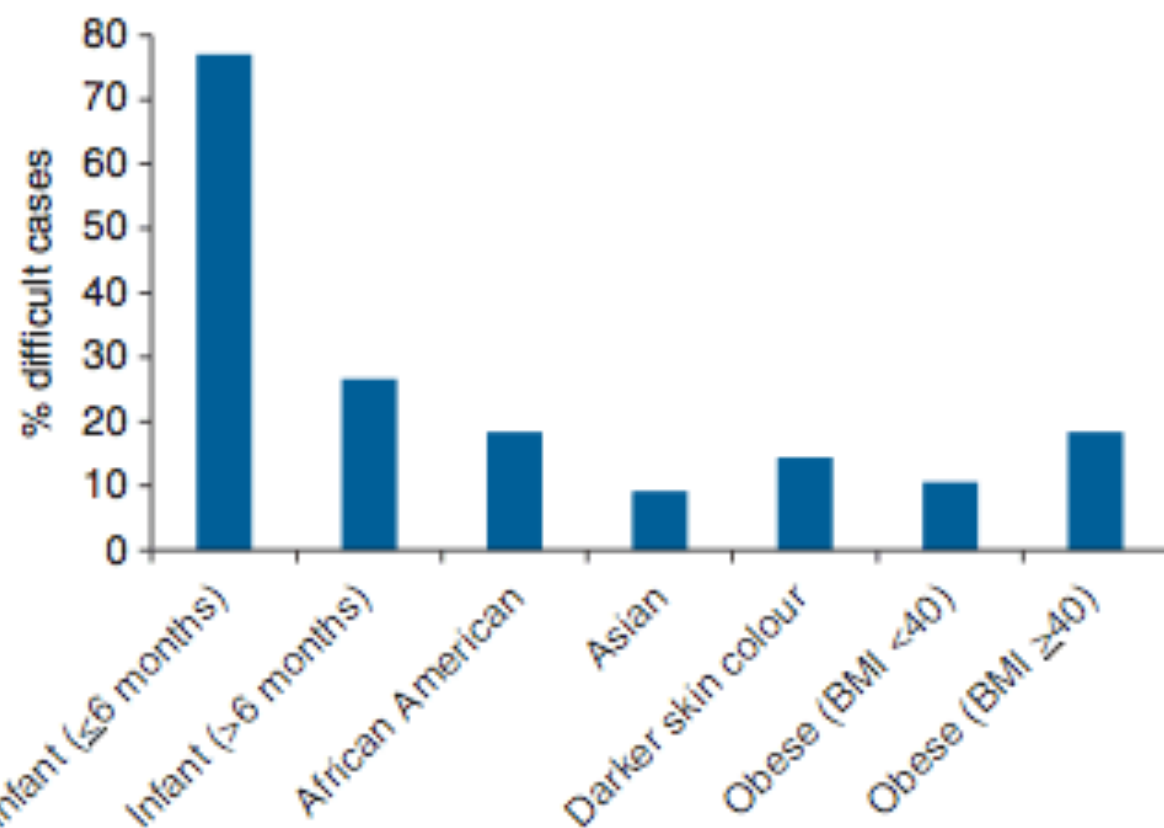


Fig 5 Patient characteristic percentages of difficult cases within populations of interest. See [Table 3](#) for difficult case definition.

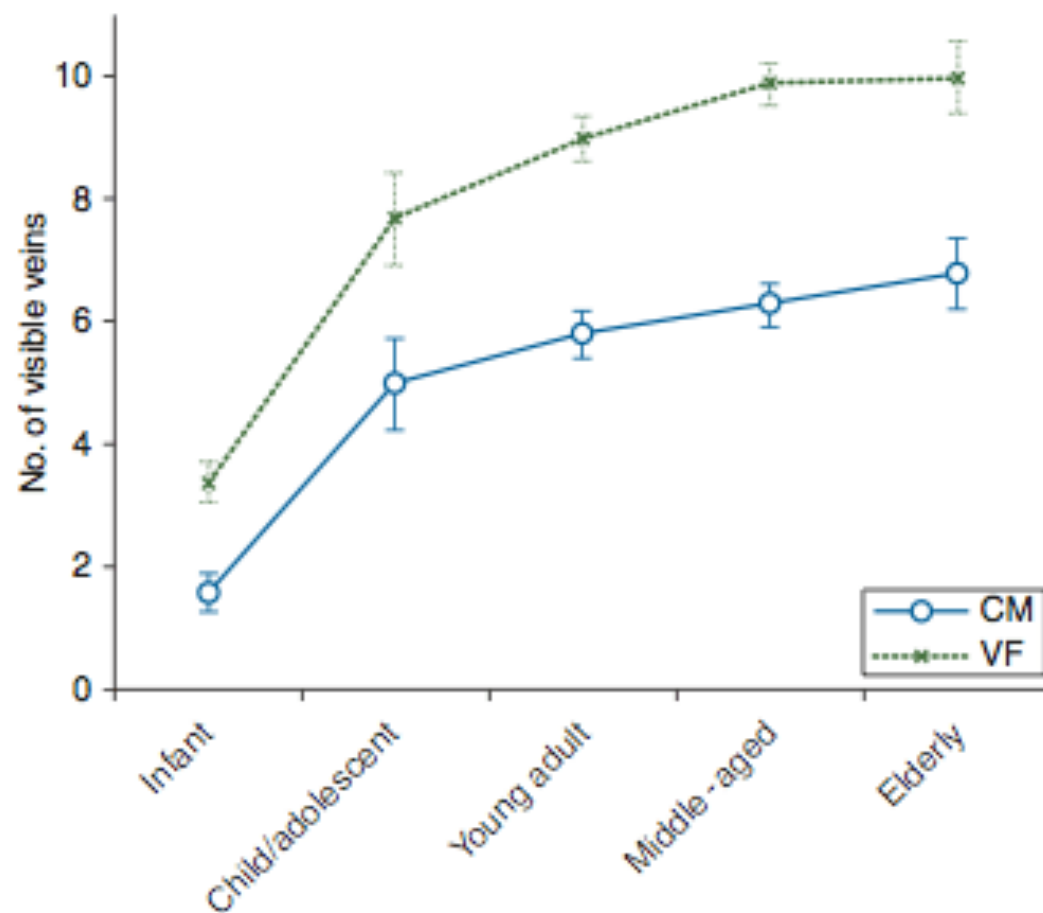


Fig 4 Comparison of VF and CM visible sites [mean (SE)] across age groups.

Numero addizionale di vene in

- bambini 1,7
- obesi 4

CLINICAL PRACTICE

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

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

Near-Infrared Imaging in Intravenous Cannulation in Children: A Cluster Randomized Clinical Trial

Natascha J. Cuper, Jurgen C. de Graaff, Rudolf M. Verdaasdonk and Cor J. Kalkman

Pediatrics 2013;131:e191; originally published online December 10, 2012;

DOI: 10.1542/peds.2012-0968



TABLE 2 Success at First Attempt (%) and Risk Difference With a 95% Confidence Interval in Both Groups

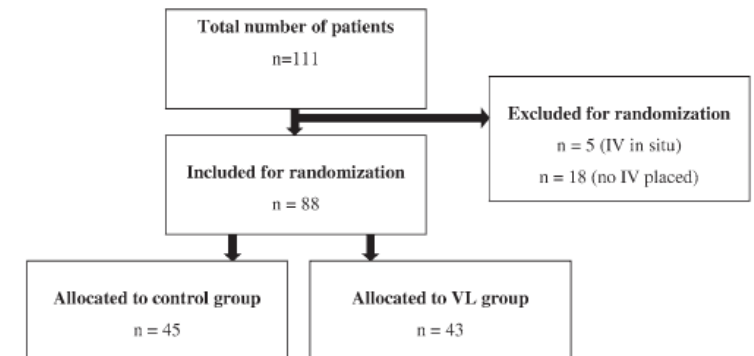
	Control Group Ratio/Total (%)	NIR Group Ratio/Total (%)	Risk Difference (95% Confidence Interval)
All patients	175/245 (71.4)	171/246 (69.5)	1.9% (−6.1 to 9.9)
Patients <3 y	52/99 (52.5)	47/86 (54.7)	2.1% (−12.1 to 16.2)
Patients ≥85th percentile ^a	21/28 (75.0)	28/40 (70.0)	5.0% (−16.9 to 24.8)

TABLE 3 Time to Cannulation in Seconds (±SD) and Hazard Ratio with a 95% Confidence Interval in Both Groups

	Control Group Mean (±SD)	NIR Group Mean (±SD)	Hazard Ratio (95% Confidence Interval)
All patients	143 (±15)	162 (±14)	0.90 (0.75 to 1.08)
Patients <3 y	228 (±35)	257 (±33)	0.78 (0.65 to 1.17)
Patients ≥85th percentile ^a	118 (±23)	179 (±36)	0.74 (0.45 to 1.21)

The Effectiveness of a Near-Infrared Vascular Imaging Device to Support Intravenous Cannulation in Children with Dark Skin Color: A Cluster Randomized Clinical Trial

Olga C. P. van der Woude, MD,* Natascha J. Cuper, DVM,† Chavalleh Getrouw, MD,‡
Cor J. Kalkman, MD, PhD,* and Jurgen C. de Graaff, MD, PhD*§



- **Bambini con pelle scura (0-15 anni) in SO.**
- **VascuLuminator (V) vs Gruppo di controllo**
 - **Successo al primo tentativo** 63% usando il V vs 51% nel gruppo di controllo
 - Tempi mediano per posizionamento accesso venoso era 53 sec nel gruppo V vs 68 sec nel gruppo di controllo
- VL ha una efficacia limitata nel migliorare il successo di incannulamento al primo tentativo nei bambini con pelle scura.

Near-infrared light to aid peripheral intravenous cannulation in children: a cluster randomised clinical trial of three devices*

J. C. de Graaff,¹ N. J. Cupper,² R. A. A. Mungra,³ K. Vlaardingerbroek,⁴ S. C. Numan⁴ and C. J. Kalkman⁵

ClIn SO i neonati venivano randomizzati per l'utilizzo di **VeinViewer**, **AccuVein** AV300, **VascuLuminator** vs un gruppo di controllo.

1913 bambini (< 18 anni) e neonati

Vene idonee per accessi venosi erano più facilmente visibili con il Viewer 307/322 (95.3%) e l'AccuVein 239/ 254 (94.1%) piuttosto che con il VascuLuminator 229/257 (89.1%)

Il successo al primo tentativo non è diverso tra i vari gruppi.

Conclusioni:

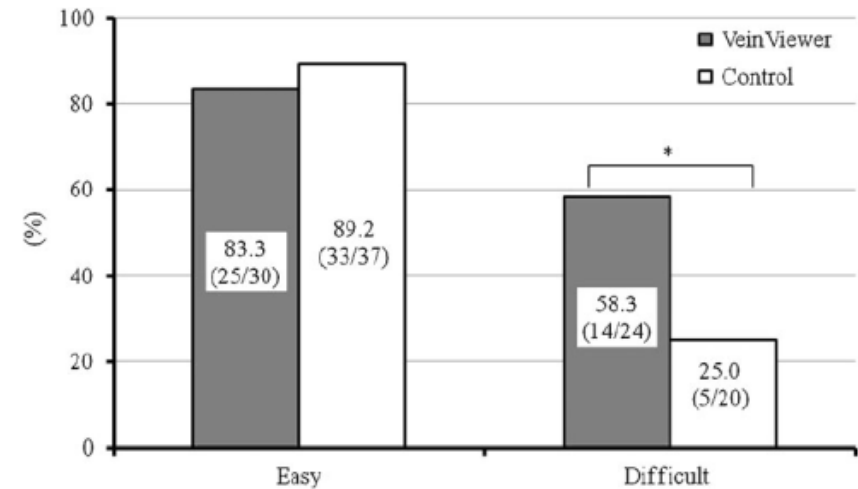
«although vein visibility is enhanced, near-infrared devices do not improve cannulation»

SHORT COMMUNICATION

Efficacy of VeinViewer in pediatric peripheral intravenous access: a randomized controlled trial

Min Joung Kim • Joon Min Park • Nuga Rhee •
Sang Mo Je • Seong Hee Hong • Young Mock Lee •
Sung Phil Chung • Seung Ho Kim

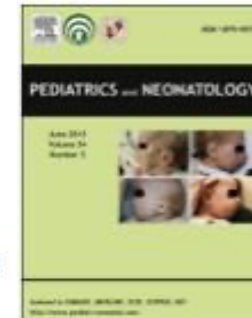
- Pazienti con età < 16 aa (<1 17)
- RCT VeinViewer vs Gruppo di Controllo.
- Outcome % successo al primo tentativo
- 111 pz
- Nessuna differenza tra i due gruppi
- **Nei pazienti con DIVA > 4 25% vs 58% (0.0026)**



Near-infrared Light Device Can Improve Intravenous Cannulation in Critically Ill Children

Pediatrics and Neonatology (2013) 54, 194–197

Ching-Yun Sun ^{a,b,†}, Kuan-Chiao Lee ^{c,d,†}, I-Hsiu Lin ^{a,b}, Chin-Ling Wu ^{a,b},
Hsiao-Ping Huang ^{a,b}, Yi-Yu Lin ^{a,b}, Ya-Fen Hsu ^{a,b}, Hong-Ren Yu ^{b,e,*}



- RCT
- 60 pazienti pediatrici ricoverati in TIP
- VeinViewer vs gruppo di controllo

Table 2 Comparison between the patients with and without use of the VeinViewer.

Items	Study group	Control group	<i>p</i>
Mean time to find the first available vessel (s)	126.37 ± 26.33	383.61 ± 112.14	0.027
First-attempt success rate	56.7 % (17/30)	33.3 % (10/30)	0.059
Median of attempts per patient (range)	1 (1–5)	2 (1–5)	0.004
Total time of attempts per patient (s)	186.16 ± 38.82	497.23 ± 123.31	0.014

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Efficacy of Vein Visualization Devices for Peripheral Intravenous Catheter Placement in Preterm Infants

A Randomized Clinical Trial

Seda Çağlar, PhD, RN; Funda Büyükyılmaz, PhD, RN; İlkay Bakoğlu, RN; Sevil İnal, PhD, RN; Özgül Salihoğlu, MD



Figure 2. AccuVein AV400.



Figure 3. Wee-Sight Transilluminator.

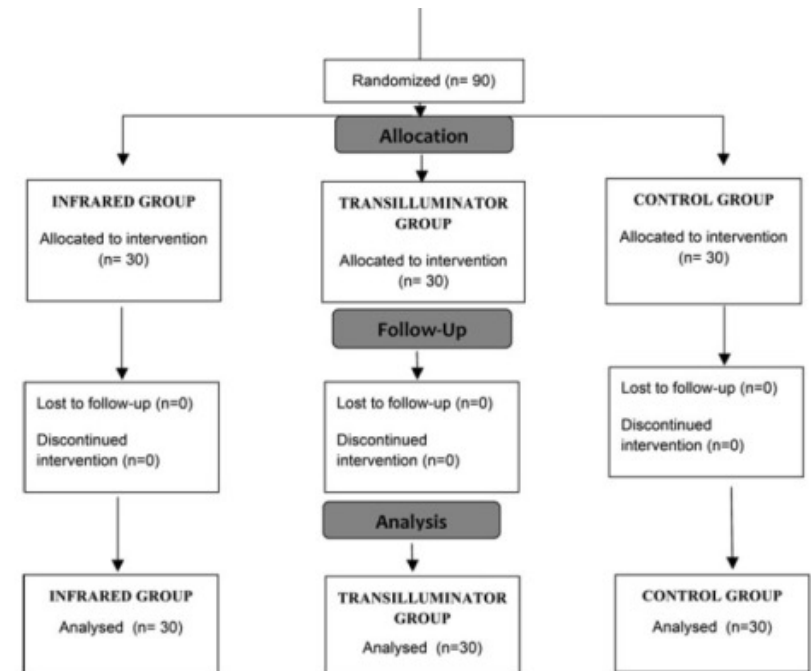


Table 2. Comparison of the physical parameters and cannulation success of preterm infants (N = 90)

Variables	Transilluminator group (n = 30)	Infrared group (n = 30)	Control group (n = 30)	Statistical test; P value
Body temperature, °C				
Preintervention	36.37 ± 0.17	36.46 ± 0.11	36.14 ± 1.78	$F = 0.773; P = .465$
Postintervention	36.39 ± 0.17	36.46 ± 0.11	36.44 ± 0.14	$F = 1.605; P = .207$
Pulse rate				
Preintervention	142.20 ± 12.75	136.70 ± 14.34	138.93 ± 17.90	$F = 0.999; P = .372$
Postintervention	148.00 ± 13.33	139.43 ± 13.57	143.63 ± 16.41	$F = 2.615; P = .079$
Respiratory rate				
Preintervention	53.73 ± 8.45	50.13 ± 5.08	50.37 ± 5.80	$F = 2.789; P = .067$
Postintervention	58.03 ± 10.56	51.93 ± 5.12	55.27 ± 8.50	$F = 3.991; P = .022$
Time to successful cannulation mean ± SD, s	45.27 ± 30.83	8.70 ± 2.56	17.30 ± 8.40	$F = 32.01; P = .000$
Success of the first attempt, n (%)				
Yes	18 (60)	24 (80)	26 (86.7)	$\chi^2 = 6.26; P = .04$
No	12 (40)	6 (20)	4 (13.3)	

Impact of Peripheral Venous Catheter Placement With Vein Visualization Device Support on Success Rate and Pain Levels in Pediatric Patients Aged 0 to 3 Years

Sevil Inal, PhD,* and Duygu Demir, MSc†

TABLE 2. Comparison of the Study and Control Groups for Success of Procedure (n = 54)

	Study Group (n = 27)	Control Group (n = 27)	Z, χ^2	P
 Pain level				
Min-max (median)	1–8 (3)	2–10 (5)	Z = -4.088	0.001*
Avg ± SD	3.44 ± 2.03	6.07 ± 2.23		
 No. attempts				
Min-max (median)	1–4 (1)	1–9 (2)	Z = -2.398	0.016†
Avg ± SD	1.44 ± 0.85	2.41 ± 1.99		
 Duration of attempts, se				
Min-max (median)	15–180 (40)	37–723 (112)	Z = -5.075	0.001*
Avg ± SD	44.37 ± 32.22	168.89 ± 171.54		
 Success in first attempt, n (%)				
Yes	20 (74.1)	11 (40.7)	$\chi^2 = 4.847$	0.028†
No	7 (25.9)	16 (59.3)		

ORIGINAL ARTICLE

A randomized trial of the Vein Viewer versus standard technique for placement of peripherally inserted central catheters (PICCs) in neonates

K Phipps, A Modic, MA O’Riordan and M Walsh

Division of Neonatology, Department of Pediatrics, Rainbow Babies and Children’s Hospital, University Hospitals of Cleveland Case Medical Center, Cleveland, OH, USA



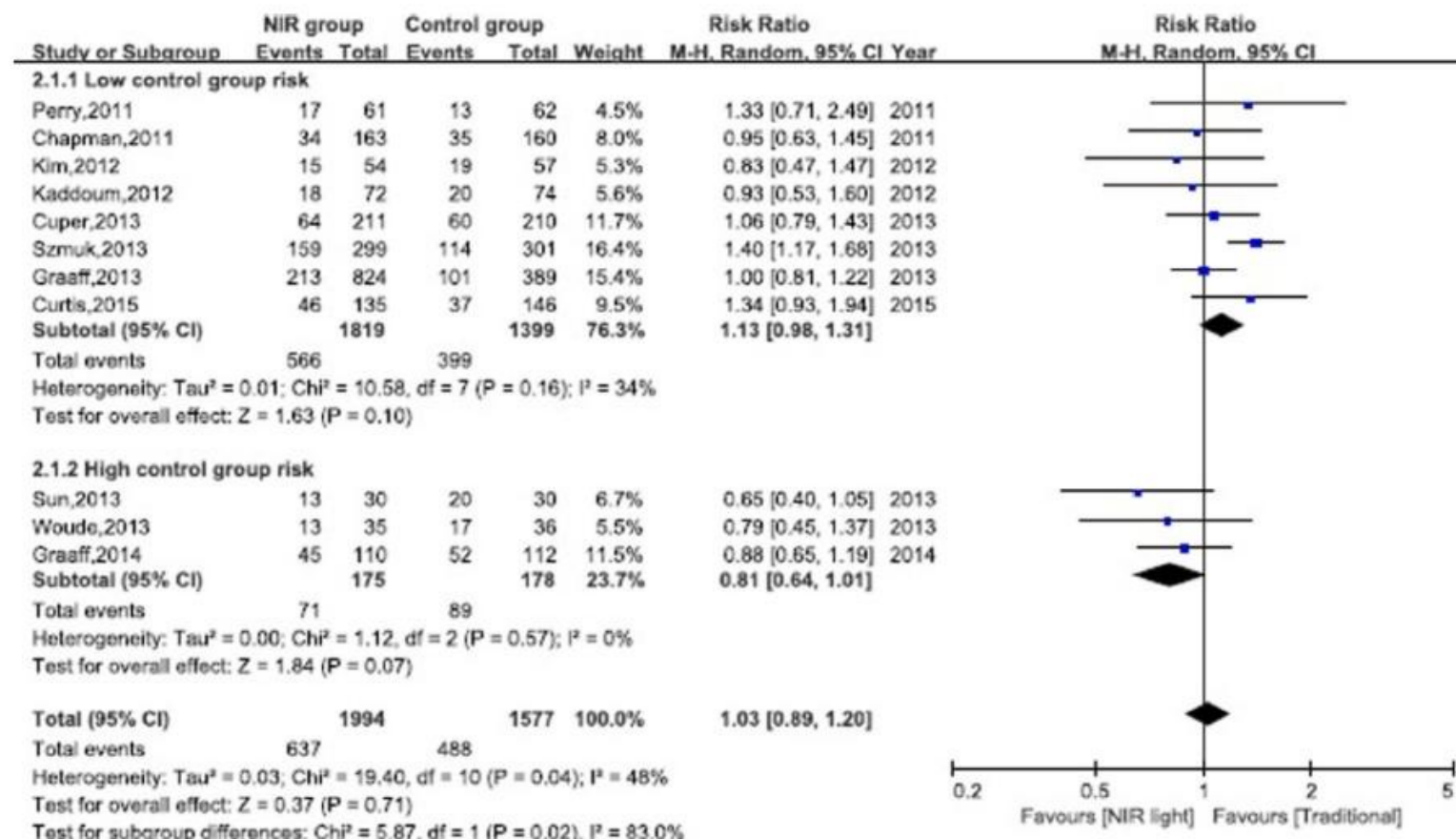
	<i>Standard</i> (N = 56)	<i>Vein Viewer</i> (N = 59)	P
Gestational age (weeks)	28.0 (23–40)	30.0 (23–40)	0.08
Birthweight (g)	1030 (320–4160)	1160 (300–4700)	0.06
Gender, male, N (%)	35 (62.5)	32 (54.2)	0.37
African American, N (%)	29 (51.8)	27 (45.8)	0.52

showed a trend to more successful placement 86 versus 75%; unadjusted odds ratio 2.33 (0.90, 6.04; $P = 0.08$). Infants randomized to the Vein Viewer were more mature (30 ± 2 weeks gestational age (GA) versus 28 ± 2 weeks GA; $P = 0.08$). After adjusting for GA, use of the Vein Viewer was significantly more likely to lead to successful line placement (adjusted odds ratio 3.05 (1.10, 8.82)).

	<i>Unadjusted odds ratio</i> (95% CI)	<i>Adjusted odds ratio</i> (95% CI)
Success on first attempt	1.26 (0.59, 2.68)	1.57 (0.71, 3.50)
Any success	2.33 (0.90, 6.04)	3.05 (1.10, 8.42)

Utility of near-infrared light devices for pediatric peripheral intravenous cannulation: a systematic review and meta-analysis

Joon Min Park¹ · Min Joung Kim² · Hyeon Woo Yim³ · Won-Chul Lee³ · Hyunsuk Jeong⁴ · Na Jin Kim⁴



Infrared vein visualisation devices for ease of intravenous access in children: hope versus hype

Varuna Vyas, Ankur Sharma, Shilpa Goyal, Nikhil Kothari

All India Institute of Medical Sciences, Jodhpur, India

Peripheral intravenous placement can be difficult in children. Vein finder devices are vascular access devices that delineate veins lying in the subcutaneous tissues to identify potential venipuncture sites. In this narrative review, we highlight the currently available literature on this device to analyse the hope that this device has to offer vs. the unnecessary hype. The search of the databases (Cochrane Library, Google Scholar, and PubMed) was limited to studies on the paediatric population and in English language between 2011 and 2019. Twenty-three relevant articles were found. Most of the articles did not demonstrate a major impact of these modalities in the general paediatric population. However, they may be beneficial in children with difficult intravenous access. Appropriate simulator mannequins should be utilised to train healthcare providers in using these vein finder devices.



Near-infrared system's efficiency for peripheral intravenous cannulation in a level III neonatal intensive care unit: a cross-sectional study

Silvia Ferrario¹ · Gabriele Sorrentino¹ · Giacomo Cavallaro¹ · Ivan Cortinovis² · Silvia Traina¹ · Salvatore Muscolo¹ · Alessandro Agosteo¹ · Germana Santini¹ · Elisa Lagostina¹ · Fabio Mosca^{1,2} · Laura Plevani¹

	NIR group (<i>n</i> = 124)	Control group (<i>n</i> = 101)	<i>p</i>
Gestational age (weeks), median (Q1–Q3)	34.6 (33.8–35.2)	34.4 (34.6–36.2)	0.136
Birth weight (g), median (Q1–Q3)	2471 (2300–2641)	2624 (2440–2808)	0.229
Weight at the study (g), median (Q1–Q3)	3943 (3724–4162)	3668 (3504–3833)	0.058
Ethnic group (Caucasian), <i>n</i> (%)	102 (82.3)	87 (86.1)	0.8359
Drugs taken, <i>n</i> (%)	60 (48.4)	48 (47.5)	0.8975
Years of nurses' experience, <i>n</i> (%)			0.4124
<1 year	22 (17.7)	13 (12.9)	
1–5 years	35 (28.2)	25 (24.7)	
>5 years	67 (54.1)	63 (62.4)	
Proportion of one attempt (CI 95%)	64.5 (56.1; 72.9)	55.5 (45.8; 65.1)	0.2136
Proportion of one attempt based on the nurses' years of experience (CI 95%)			
<1 year	72.7 (54.1; 91.3)	23.1 (0.2; 46.0)	0.0125
1–5 years	60.0 (43.8; 76.2)	52.0 (32.4; 71.6)	0.7246
>5 years	64.2 (52.7; 75.7)	63.5 (51.6; 75.4)	0.9206
Average pain score (CI 95%)	5.5 (4.9–6.1)	4.9 (4.3–5.4)	0.147
Average pain score based on the nurses' years of experience (CI 95%)			
<1 year	5.8 (4.0; 7.8)	4.1 (2.4; 5.7)	0.191
1–5 years	5.6 (4.7; 6.4)	5.3 (3.8; 6.9)	0.756
>5 years	5.3 (4.8; 6.2)	4.8 (4.2; 5.2)	0.366

The efficacy of technology-based devices on the first-attempt success rate for difficult intravenous access in pediatrics: A systematic review and network meta-analysis

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Seyed Javad Hosseini¹ , Mahbobeh Firooz², Khadijeh Yazdi²,
Masoud Abdollahi³, Seyed Reza Hosseini⁴ and Monir Ramezani⁵

Abstract

Introduction: Previous studies have compared various technology-based devices, such as ultrasonography (USG), near-infrared (NIR), and transilluminator (TI), with standard care (SC) to facilitate peripheral intravenous cannulation (PIVC) in pediatric patients. This study aims to investigate the efficacy of these interventions on the first-attempt success rate (FASR) of PIVC in pediatric patients with difficult intravenous access (DIVA) using network meta-analysis (NMA).

Methods: We conducted a comprehensive literature search in databases to identify randomized clinical trials comparing the effects of different devices on the FASR of PIVC from inception until August 2023. Pooled relative risks with 95% credible intervals were estimated using pairwise and network meta-analysis with random effects. To rank the efficacy of devices, we calculated the probabilities of the surface under the cumulative ranking curve (SUCRA).

Results: A total of 18 studies were included in the final analysis. The results of pairwise meta-analysis showed that the use of devices increased the FASR for PIVC by 13% (RR: 1.13, 95% CI: [0.98, 1.30]) compared to SC. The ranking of interventions based on efficacy from highest to lowest was as follows: USG (SUCRA: 1), NIR (SUCRA: 0.6), SC (SUCRA: 0.3), and TI (SUCRA: 0.1), with a very low confidence estimate.

Conclusion: Based on our findings, the prioritization of device usage to increase the FASR of PIVC in pediatric patients with DIVA is as follows: USG, NIR, SC, and TI, respectively. However, due to inconsistencies in the network, existence of an overall high risk of bias in the included studies, and very low confidence estimate, further clinical trials are required.

IN CONCLUSIONE

- Necessità di training appropriato
- Limiti tecnici della visione 'a piatto'
- La NIR permette la corretta visualizzazione e la valutazione di vene superficiale non visibili e/o palpabili
- La NIR può essere di aiuto nei DIVA come tecnica elettiva

IN CONCLUSIONE

- Indietro rispetto agli ultrasuoni
- Non basta solo la visualizzazione

Rapid Superficial Vein Assessment (RaSuVA): A pre-procedural systematic evaluation of superficial veins to optimize venous catheterization in neonates

Vito D'Andrea¹ , **Giorgia Prontera**¹, **Lucilla Pezza**¹,
Giovanni Barone² , **Giovanni Vento**¹
and **Mauro Pittiruti**³ 

The Journal of Vascular Access

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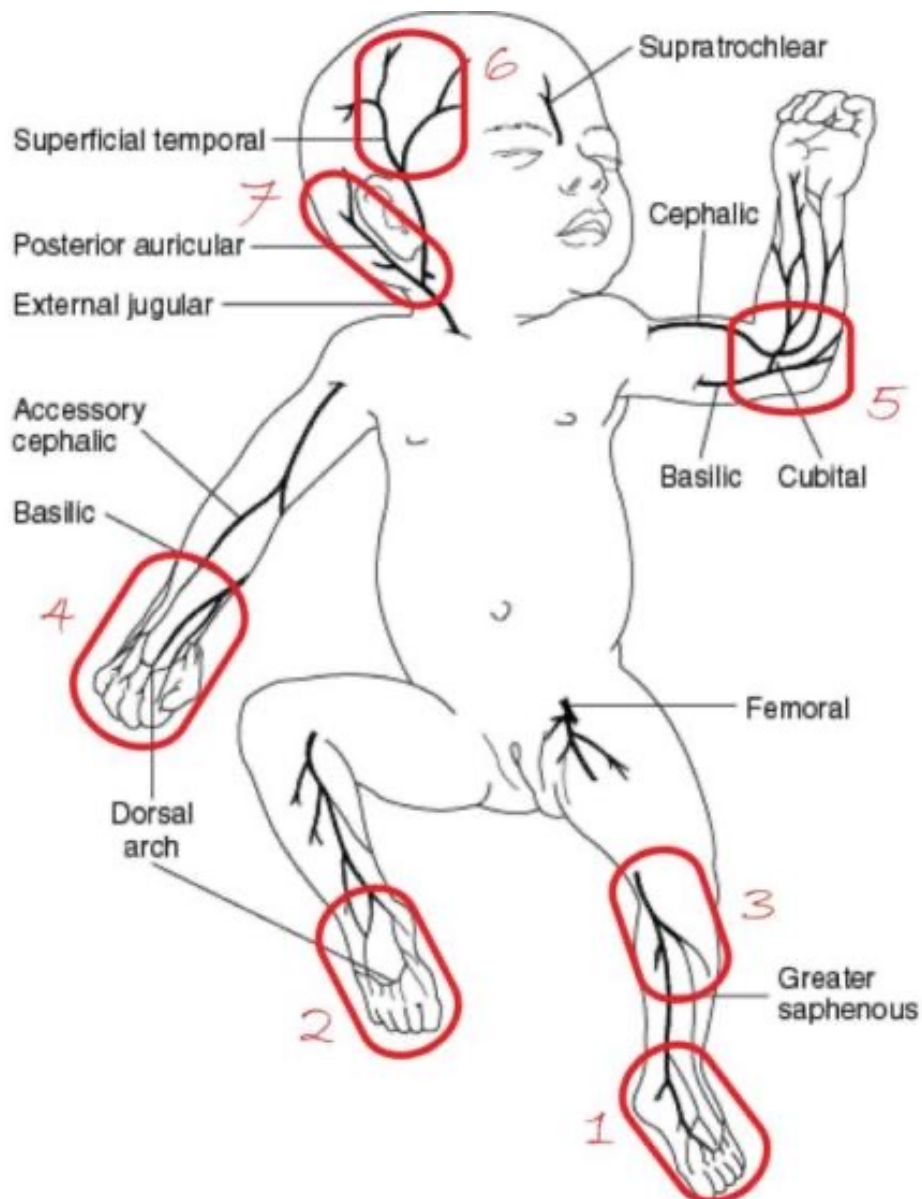
DOI: 10.1177/11297298221098481

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RASUVA: UNO STRUMENTO AMBIZIOSO

- ❑ Mappatura delle vene del neonato
- ❑ Scelta delle vena più idonea (AVP vs ECC)
- ❑ Aumentare la probabilità di successo della prima venipuntura
- ❑ Preservare le vene del neonato



- (1) medial malleolus,
- (2) lateral malleolus,
- (3) popliteal fossa,
- (4) back of the hand and wrist,
- (5) antecubital fossa,
- (6) anterior scalp veins,
- (7) posterior scalp veins.

«from foot to head»

(1) — MALLEOLO MEDIALE



Medial malleolus



(2) – MALLEOLO LATERALE



Lateral malleolus

(3) — FOSSA POPLITEA



Popliteal Fossa

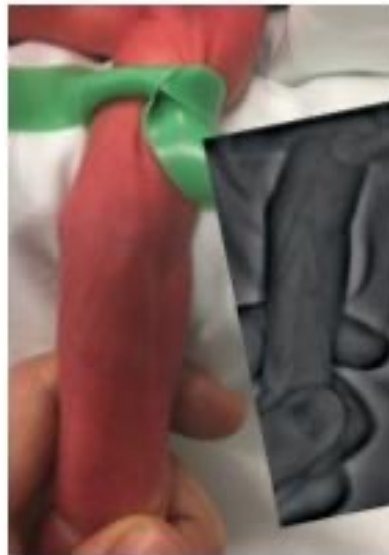
(4) — MANO E POLSO



Back of the hand and wrist



(5) – FOSSA ANTECUBITALE



Antecubital fossa

(6) + (7) – VENE DELLO SCALPO



Take Home Messages

- Aumentare la consapevolezza del patrimonio venoso
- Mappare le vene dei neonati (RaSuVa)
- Fare una scelta ragionata delle vene (quale per AVP, quale per ECC)
- Utilizzo della NIR come tecnica elettiva o comunque nei casi difficili dopo appropriato training
- Ricordare la regola “three strikes and you’re out”

THANK YOU

GRACIAS

ARIGATO

SHUKURIA

GOZAMASHITA

EFCHARISTO

DANKSCHEEN

TASHAKKUR ATU

VAQHUYELAY

SUKSAMA

TERIMET

BIYAN

SHUKRIA

TINGGI

GRAZIE

MEHRBANI

PALDES

BOLZİN

MERCI

JUSPAXAR

KOMAPUSUNDA

MAKKE