Il DAV expert e la scelta del catetere centrale nel neonato: CVO, ECC e CICC

Il 2ND Convegno GAVePed Conference

3 Dicembre December 3rd

GdS Accessi Vascolari Neonatali

Giovanni Barone
Ospedale Infermi di Rimini

Il DAV expert e la scelta del catetere centrale nel neonato: CVO, ECC e CICC

I have no actual or potential conflict of interest in relation to this presentation

PERCHÉ UN ALGORITMO DI SCELTA?

- Come strumento educazionale
- Come guida alla definizione di protocolli per la scelta del dispositivo nella singola unità operativa
- Come 'binario' per la discussione di singoli casi clinici

UNA NOVITÀ

Sul sito GAVeCeLT è disponibile una guida (commentata) alla scelta del dispositivo più appropriato (**Neonato – Bambino – Adulto**)

Vedi home page di www.gavecelt.info

ACCESSI VENOSI NEL NEONATO 1998

AGOCANNULE

- Vene superficiali arto superiore, arto inferiore, scalpo

CATETERI VENOSI OMBELICALI

- Vena ombelicale

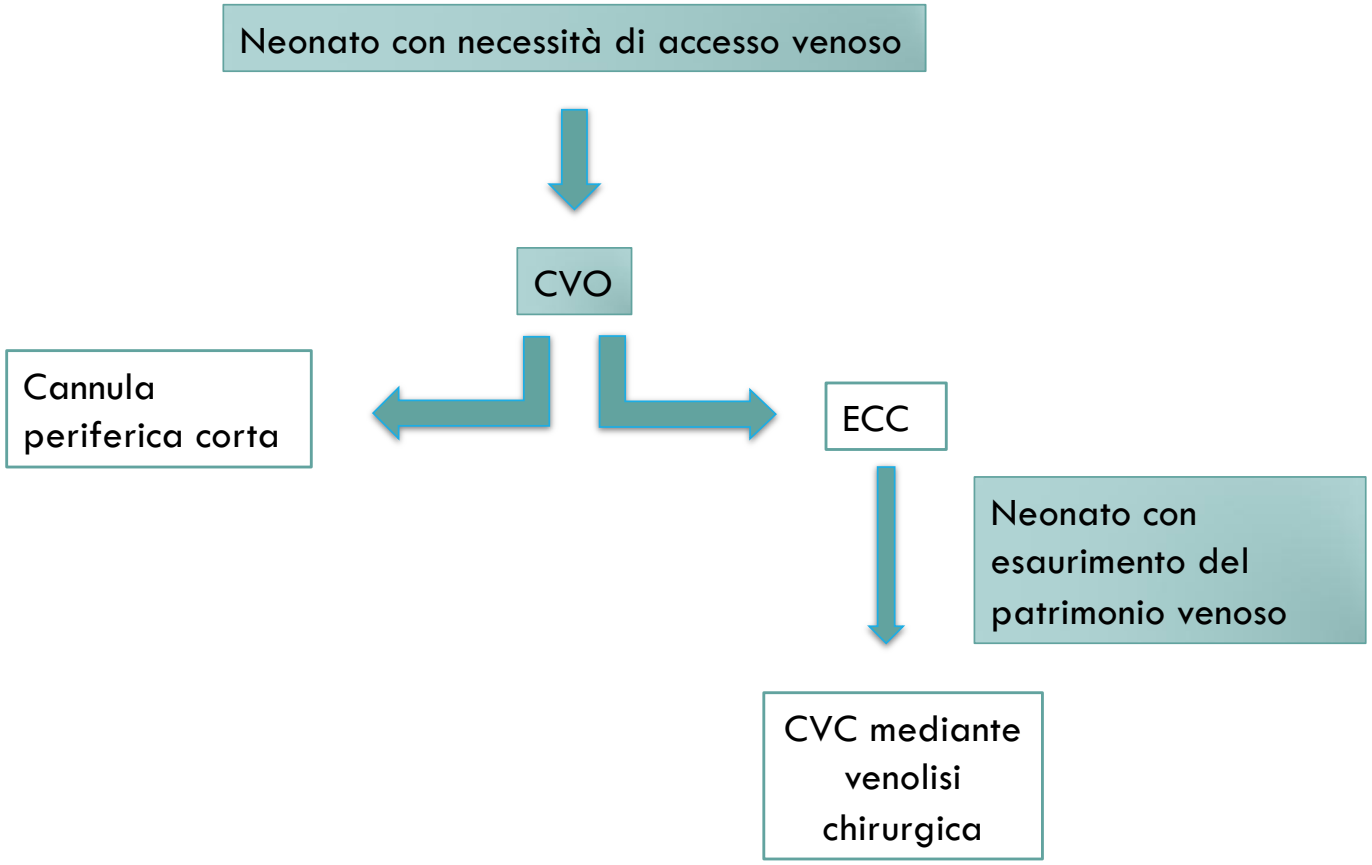
CATETERI EPICUTANEO-CAVALI

- Vene superficiali arto superiore, arto inferiore, scalpo

CATETERI VENOSI CENTRALI

- Posizionati mediante venolisi chirurgica (safena, giugulare)

ALGORITMO DI SCELTA 1998



ACCESSI VENOSI NEL NEONATO 2019

AGOCANNULE **NIR**
- Vene superficiali arto superiore, arto inferiore, scalpo

CATETERI VENOSI OMBELICALI
- Vena ombelicale

CATETERI EPICUTANEO-CAVALI **NIR**
- Vene superficiali arto superiore, arto inferiore, scalpo

CATETERI VENOSI CENTRALI **ECO**
- Vene profonde dell'area sopra/sottoclaveare o inguinale

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ACCESSI VENOSI NEL NEONATO 2019

AGOCANNULE **NIR**
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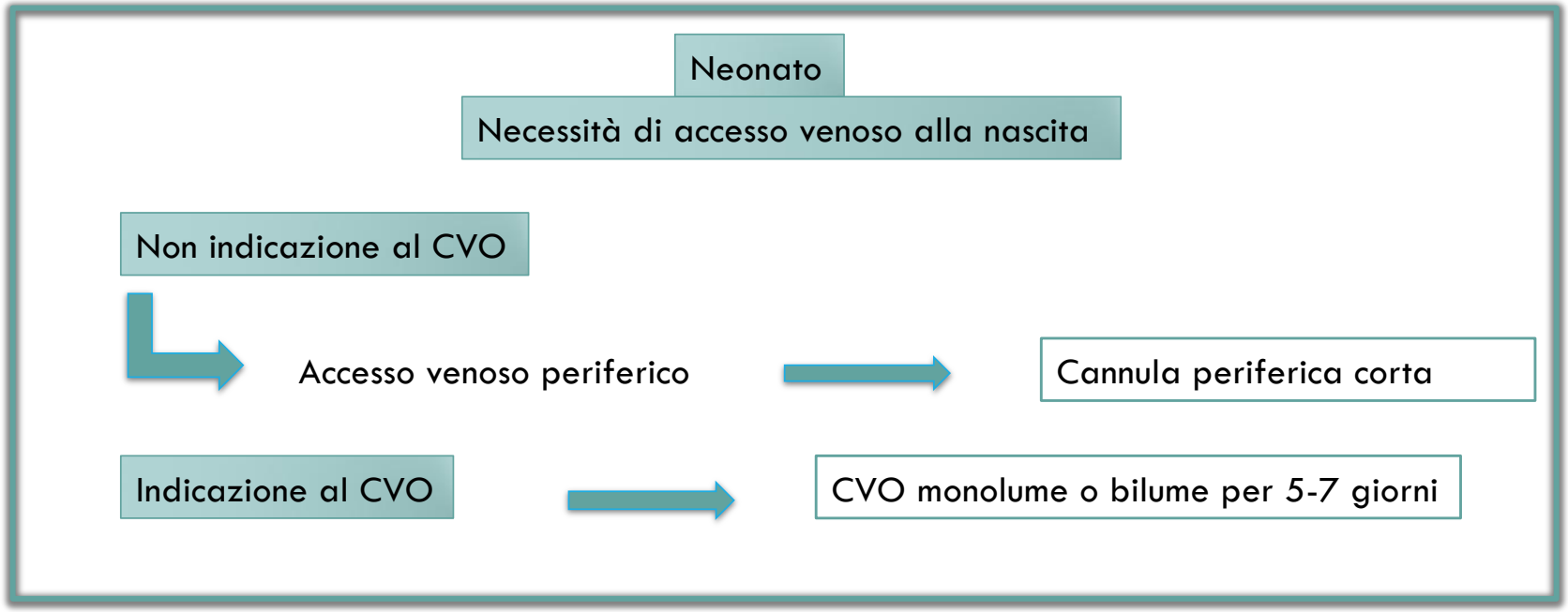
- Posizionati mediante [illegible] chirurgica (safena, giugulare)

FATTORI CHE INFLUENZANO LA SCELTA TRA CVO, ECC, CICC, FICC

- Timing (necessità alla nascita vs. necessità dopo la nascita)
- Stato del paziente (neonato acuto grave vs. neonato stabile)
- Età gestazionale (prematuro vs. a termine)
- Patologia di base (malformazioni, patologia chirurgica, etc.)
- Indicazione alla via centrale (semplice infusione vs. infusioni + prelievi + monitoraggio emodinamico)
- Durata prevista del trattamento endovenoso
- Difficoltà/complicanze nel posizionamento di ECC o CVO
- Anatomia delle vene profonde
- ……..


Neonato
Necessità di accesso venoso alla nascita
Non indicazione al CVO
Accesso venoso periferico
Cannula periferica corta
Indicazione al CVO
CVO monolume o bilume per 5-7 giorni

VANTAGGI CVO

- Facilità di posizionamento
- Stabilità rispetto ad AVP
- Possibilità di infusioni ad alta osmolarità
- Idoneo per prelievi
- Idoneo per emoderivati
- Misurazione PVC
- Poliuretano
- Flussi elevati

LIMITI CVO

- Alta incidenza di CRBSI
- Complicanze precoci e tardive, anche gravi
- Durata massimo 5-7 giorni

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LIMITI CVO

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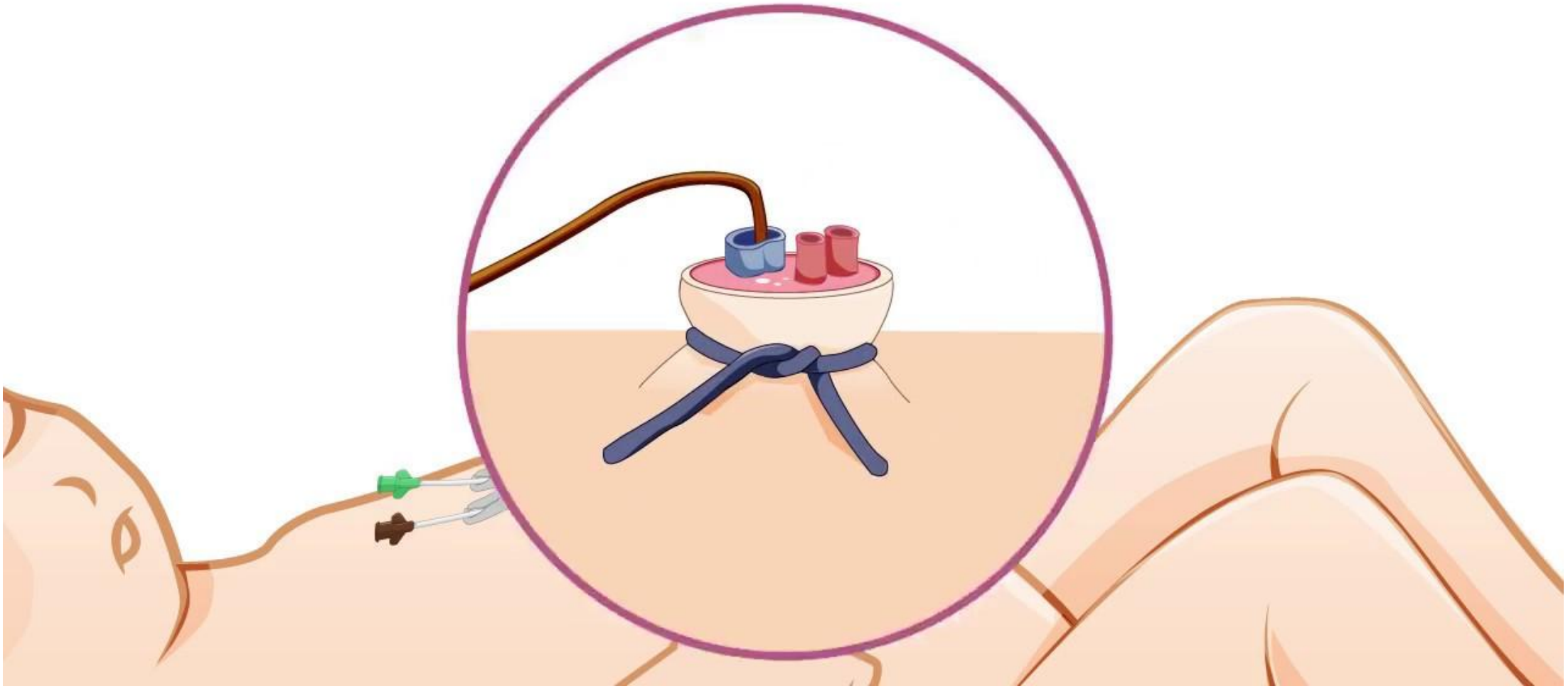
CVO e CRBSI

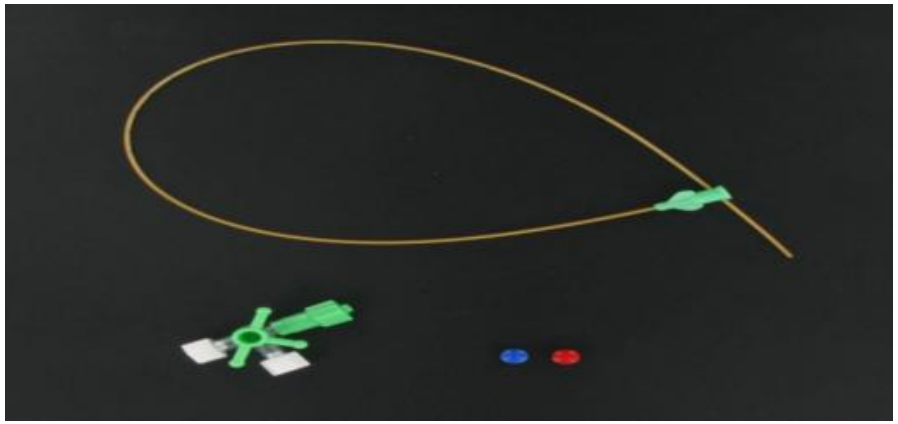


CVO e CRBSI

Catetere
Ag ION

expert
umbilical catheters

VYGON
Value Life



Ø est. Fr.	2.5	3.5	4	5	8

Da preferire in neonati con età gestazionale < 30 W

La scelta del CVO

- RCT
- Non-cieco
- Catetere impregnato vs Catetere in poliuretano
- EG $\leq$ 30
- Definite CRBSI: EMO + da v. periferica e catetere + punta del catetere positiva+ segni clinici+ catetere in sede o entro 48 h dalla rimozione
- Probable CRBSI: EMO negativa; punta del catetere positiva; segni clinici; catetere in sede o entro 48 h dalla rimozione
- BSI without source: EMO positiva; punta del catetere negativa; segni clinici; catetere in sede o entro 24 h dalla rimozione

Table 1
Characteristics of study groups. Mean ± (SD) or rate (%).

	Polyurethane catheter group (n = 41)	AgION catheter group (n = 45)	p
Gestational age (weeks)	26.2 ± 1.5	26.2 ± 2.0	0.99
Birth weight (g)	796 ± 203	840 ± 190	0.40
Stay in hospital (days)	85 ± 35	70 ± 33	0.04
Case fatality rate for CRBSI	4 (7)	0	0.04
Mortality	5 (10)	4 (9)	0.73
Duration of UVC (days)	8.5 ± 4.4	10.8 ± 4.7	0.02

Table 2
Occurrence of catheter colonization and catheter-related bloodstream infection (CRBSI), and blood-stream infection (BSI) in study groups. Rate (%).

	Polyurethane catheter group (n = 41)	AgION catheter group (n = 45)	p
Colonization, n (%)	2 (5)	2 (2)	0.66
CRBSI	9 (22)	1 (2)	0.005
• Definite, n (%)	8 (20)	1 (2)	0.01
• Probable, n (%)	1 (2)	0 (0)	NA
BSI without a source	1 (2)	1 (2)	0.48

Reduction of catheter-related bloodstream infections in preterm infants by the use of catheters with the AgION antimicrobial system. EHD 2013

La scelta del CVO

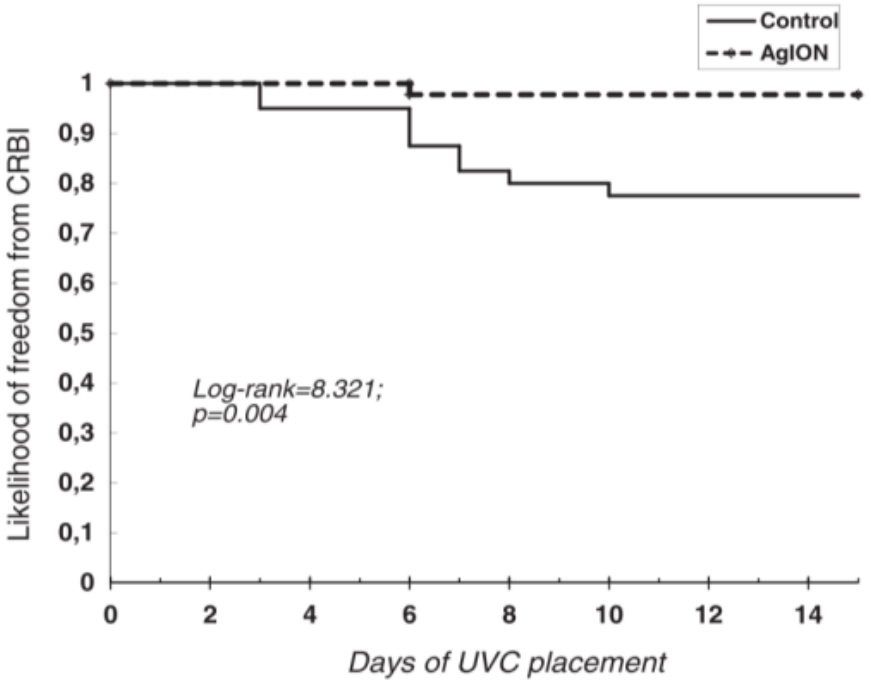


Fig. 2. Kaplan–Meier estimates of the cumulative likelihood of freedom from CRBSI in the 2 study groups.

CRBSIs were caused by *Enterobacter aerogenes* in the patient in the AgION group and CoNS in the control group patients (n = 9); BSI without a source was caused by *P. aeruginosa* in the AgION group (n = 1) and by CoNS in the control group (n = 1).

Multivariate analysis demonstrated that non-impregnated catheter use (OR 12.5, 95% CL 2.06–75.9) and catheter placement for more than 7 days (OR 5.1, 95% CL 1.13–23.6) increased the risk of developing a CRBSI in our population.

There was no case of intolerance to the AgION catheters and none of these catheters had to be removed due to a local skin infection.

Cochrane Library

Cochrane Database of Systematic Reviews

2015

Reduction of catheter-related bloodstream infections in preterm infants by the use of catheters with the AgION antimicrobial system. EHD 2013

Quello che non ti aspetti...

Table 1. Hepatic Complications of Umbilical Venous Catheter in 244 Neonates

	%
Air in the portal vein	20.1% (n=49/244)
Left portal vein thrombosis	6.1% (n=15/244)
Liver parenchymal lesions	7.4% (n=18/244)
Single echogenic lesion	4.1% (n=10/244)
Multiple small branching echogenic lesions	2.1% (n=5/244)
Large heterogeneous lesion with laceration and effusion	1.2% (n=3/244)

- 60% delle trombosi con CVO in sede; 40% post rimozione
- 70% delle trombosi ipotrofia del lobo sinistro al FU

Journal Ultrasound Medicine 2017

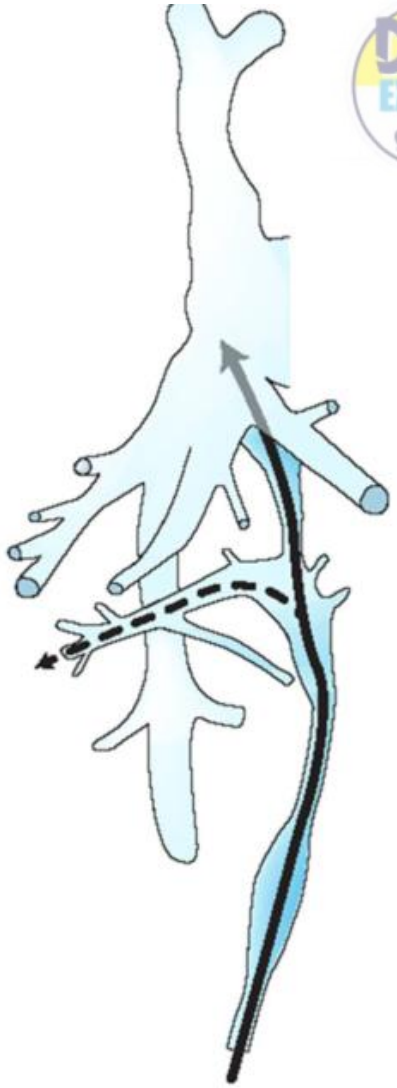


Fig. 7 Incorrect course of the UVC in cases of hepatic collections. The solid line indicates the appropriate pathway of the UVC through the umbilical vein whereas the dotted line shows the UVC entering the portal venous system. (This figure has been modified from Richter and Lierse [1991]. Imaging atlas of the newborn) [13]

Quello che non ti aspetti....

Original article

Thrombosis after umbilical venous catheterisation: prospective study with serial ultrasound

Table 1 Patient characteristics of infants with UVC (study group) and infants without UVC (control group)

Variable	Study group (n=40)	Control group (n=20)	P value
Gestational age at birth (weeks)	27 (24–41)	29 (27–41)	0.06
Birth weight (grams)	1052 (600–3925)	1464 (1020–3300)	0.07
SGA, n (%)	6 (15)	0 (0)	0.07
Duration of hospital admission (days)	18 (3–102)	13 (3–44)	**0.04**
PICC received after UVC, n (%)	12 (30)	3 (15)	0.21
NEC, n (%)	5 (12.5)	1 (5)	0.36
Culture-proven sepsis, n (%)	11 (27.5)	2 (10)	0.12
Mortality, n (%)	4 (10)	1 (5)	0.51

In this study, thrombosis in the UVC route was detected with screening by ultrasonography in 75% of infants after umbilical catheterisation, whereas no thrombi were demonstrated in the investigated location in infants without UVCs. This result

UVCs is not advised. However, given the high risk of thrombus formation in UVCs, these catheters should be used with caution and removed promptly if the clinical indication is no longer present.

Dubbink-Verheij GH. ADC 2019

TVP

- Studio retrospettivo su TVP nel primo anno di vita
- SK Toronto
- 133 casi di trombosi (95 CVO (71%), 36 NO CVO, 2 non noto)
- TVP è associata al CVO, alla sua malposizione e alla sua durata

TABLE 3.—Outcome in Relation to UVC (n = 133)

	UVC (n = 95)	No UVC (n = 36)	Unknonw UVC Placement (n = 2)
PVT grade 1	41	18	1
PVT grade 2	33	10	1
PVT grade 3	21	8	–
Lobar atrophy	24	6	–
PHTN	2	4	–

(Courtesy of Morag I, Epelman M, Daneman A, et al. Portal vein thrombosis in the neonate: risk factors, course, and outcome. *J Pediatr*. 148:735-739. Copyright 2006 by Elsevier.)

TABLE 4.—Outcome in Relation to Grade of Thrombus

	Grade 1 (n = 60)	Grade II (n = 44)	Grade III (n = 29)	*P*
Complete or partial resolution	46 (77%)	25 (56%)	10 (34%)	.0005
No change	8	7	1	.2571
Progression to lobar atrophy or PHTN	6 (10%)	12 (27%)	18 (62%)	.0001

(Courtesy of Morag I, Epelman M, Daneman A, et al. Portal vein thrombosis in the neonate: risk factors, course, and outcome. *J Pediatr*. 148:735-739. Copyright 2006 by Elsevier.)

Portal vein thrombosis in the neonate: risk factors, course, and outcome. J Pediatr 2006

TVP

that sets the stage for complications. Portal hypertension is the most serious long-term complication but presents 5 to 6 years later and thus may not be apparent at the time of the original PVT diagnosis. Long-term follow-up is therefore indicated. Another clinical clue associated with poor outcome is atrophy of the left hepatic lobe, which also presents later. All neonatologists should consider the risks of inserting a UVC and reserve this intervention for those infants who are most likely to require it or, better yet, for those who actually do require it in order to ensure the safest transition after birth and, in particular, ensure that the risk that a baby faces with a UVC is not greater than the risk without it.

D. K. Stevenson, MD

Portal vein thrombosis in the neonate: risk factors, course, and outcome. J Pediatr 2006

Neonatology

Original Paper

Neonatology 2017;111:337–343
DOI: 10.1159/000451022

Received: June 12, 2016
Accepted after revision: September 24, 2016
Published online: January 17, 2017

Umbilical Venous Catheter Malposition Is Associated with Necrotizing Enterocolitis in Premature Infants

Mustafa Sulemanji[a, d] Khashayar Vakili[a] David Zurakowski[a, b]
Wayne Tworetzky[c] Steven J. Fishman[a] Heung Bae Kim[a]

Table 1. Descriptive and univariate characteristics of the cohort based on NEC as the outcome

	Prospective cohort (n = 132)		Subset cohort ≤1,500 g (n = 62)	
	no NEC (n = 120)	NEC (n = 12)	no NEC (n = 50)	NEC (n = 12)
Birth weight, g	1,644±533	868±289*	1,168±277	868±289*
Gestational age, weeks	31.5±2.8	28.0±2.1*	29.2±2.6	28.0±2.1
SGA status (<10 percentile)[a]			9 (18)	4 (33)
Gender				
Male	54 (45)	4 (33)	26 (52)	4 (33)
Female	66 (55)	8 (67)	24 (48)	8 (67)
Median Apgar score (25–75 quartile)				
1 min	7.0 (6.0–8.0)	6.5 (5.0–8.0)	7.0 (5.0–8.0)	6.5 (5.0–8.0)
5 min	8.0 (8.0–9.0)	8.0 (7.0–9.0)	8.0 (7.0–8.0)	8.0 (7.0–9.0)
Maternal GBS status (+GBS/total)	20 (17)	3 (25)	7 (16)	3 (25)
Prenatal steroid use (+use/total)	95 (79)	11 (92)	44 (88)	11 (92)
PDA status (+PDA/total)	22 (18)	5 (42)	21 (42)	5 (42)
Respiratory status at 48 h (on ventilator)	38 (32)	10 (83)[+]	30 (60)	10 (83)
History of blood transfusion	8 (7)	4 (33)[+]	8 (16)	4 (33)
Time to full feeds, days	8.5±4.0	11.5±5.0*	8.5±4.0	11.5±5.0
UVC discontinuation (n = 69), days	6.6±2.9	3.4±2.5*	6.9±2.7	3.4±2.5*
UVC status at discontinuation				
No UVC (n = 63)	63 (52)	0 (0)		
Routine removal (n = 44/39)[b]	42 (35)	2 (17)	37 (74)	2 (17)
Failure to insert (n = 10/9)[c]	7 (6)	3 (25)[+]	6 (12)	3 (25)[+]
Malposition (n = 15/14)[d]	8 (7)	7 (58)[+]	7 (14)	7 (58)[+]
NEC grade				
No NEC	120	–	50	–
Medical NEC (>grade II)	–	9 (7)	–	9 (15)
Surgical NEC (necrotic bowel +)	–	3 (3)	–	3 (5)
Time to diagnosis of NEC, days	–	9.5±9.3 (3.0–30.0)	–	9.5±9.3 (3.0–30.0)

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SGA status (<10 percentile)[a]			9 (18)	4 (33)
Gender				
Male	54 (45)	4 (33)	26 (52)	4 (33)
Fem				
Media				
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Matern				
Prenat				
PDA s				
Respir				
Histor				
Time t				
UVC c				
UVC s				
No UVC (n = 63)	63 (52)	0 (0)		
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Failure to insert (n = 10/9)[c]	7 (6)	3 (25)+	6 (12)	3 (25)+
Malposition (n = 15/14)[d]	8 (7)	7 (58)+	7 (14)	7 (58)+
NEC grade				
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Medical NEC (>grade II)	–	9 (7)	–	9 (15)
Surgical NEC (necrotic bowel +)	–	3 (3)	–	3 (5)
Time to diagnosis of NEC, days	–	9.5±9.3 (3.0–30.0)	–	9.5±9.3 (3.0–30.0)

dependent of birth weight and respiratory status. The odds of NEC were over twice as high for each 250-g decrease in birth weight (OR 2.2, 95% CI 1.2–4.7, $p = 0.001$). In addition, the odds of NEC were estimated to be over 6 times higher given UVC malpositioning (OR 6.9, 95% CI 1.6–35.3, $p = 0.007$). The predictive accuracy of the

La durata del Catetere

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Guidance for the Clinician in Rendering Pediatric Care

CLINICAL REPORT

Strategies for Prevention of Health Care–Associated Infections in the NICU

TABLE 4 Guidelines for the Prevention of Intravascular Catheter-related Infections

1. Remove and do not replace umbilical artery catheters if any signs of central line–associated bloodstream infection, vascular insufficiency in the lower extremities, or thrombosis are present (Category II).
2. Remove and do not replace umbilical venous catheters if any signs of central line–associated bloodstream infection or thrombosis are present (Category II).
3. Cleanse the umbilical insertion site with an antiseptic before catheter insertion. Avoid tincture of iodine because of the potential effect on the neonatal thyroid. Other iodine-containing products (eg, povidone-iodine) can be used (Category IB).
4. Do not use topical antibiotic ointment or creams on catheter insertion sites because of the potential to promote fungal infections and antimicrobial resistance (Category IA).
5. Add low doses of heparin (0.25–1.0 U/mL) to the fluid infused through umbilical arterial catheter (Category IB).
6. Remove umbilical catheters as soon as possible when no longer needed or when any sign of vascular insufficiency to the lower extremities is observed. Optimally, umbilical artery catheters should not be left in place for more than 5 d (Category II).
7. Umbilical venous catheters should be removed as soon as possible when no longer needed but can be used up to 14 d if managed aseptically (Category II).
8. An umbilical catheter may be replaced if it is malfunctioning and there is no other indication for catheter removal and the total duration of catheterization has not exceeded 5 d for an umbilical artery catheter or 14 d for an umbilical vein catheter (Category II).

2012

La durata del Catetere

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CLINICAL REPORT

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2. Remove and do not replace umbilic[illegible] of [illegible] bloodstream infection or thrombosis are present (Category II).
3. Cleanse the umbilical insertion site with a[illegible] of iodine because of the potential effect on the neonatal thyroid. Other iodine-containing products (eg, povidone-io[illegible]
4. Do not use topical antibiotic ointment or creams o[illegible] of the potential to promote fungal infections and antimicrobial resistance (Category IA).
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6. Remove umbilical catheters as soon[illegible] nger needed o[illegible] ular insufficiency to the lower extremities is observed. Optimally, umbilical artery catheters [illegible] in place for more than 5 [illegible]
7. Umbilical venous catheters should be r[illegible] as soon as possible when no longer nee[illegible] can be used up to 14 d if managed aseptically (Category II).
8. An umbilical catheter may be replaced if it is malfunctioning and there is no other indication for catheter removal and the total duration of catheterization has not exceeded 5 d for an umbilical artery catheter or 14 d for an umbilical vein catheter (Category II).

2012

Un catetere a vita breve

Clinical Bottom Lines

1 Dedicated teams should be used to maintain central lines within the neonatal intensive care unit as part of an overall CLABSI prevention strategy (Level 4 evidence).
2 If longer term (>5–7 days) central venous access is required, replacement of a UVC with a PICC may be beneficial, if combined with a PICC maintenance team (Level 4 evidence).
3 A large multi-centre randomised trial is needed to clearly answer the question of whether routine replacement of UVCs and PICCs at days 5–7 or earlier will result in lower rates of CLABSIs in neonates that require longer term central access.
4 The most effective way to minimise CLABSIs in neonates is not to have a central line in situ. Need for central lines should be assessed on a daily basis and removed as soon as no longer required.

Remove umbilical catheters promptly when no longer needed or if a complication occurs.

1. Consider limiting UVC dwell time to 7 to 14 days; risks of infection are increased with longer dwell times. UVC removal at 7 days followed by insertion of a peripherally inserted central catheter (PICC) for continued infusion therapy is one strategy to reduce central line-associated bloodstream infection.[4,30,32,33] (III)

How long should umbilical venous catheters remain in place in neonates who require long-term (≥5–7 days) central venous access JPCH 2014
Infusion therapy standard of practice. Journal of infusion nursing 2016

Indicazioni ai CVO

Practice Criteria

A. Establish organizational guidelines for appropriate use of UACs and UVCs based on gestational age, birth weight, and severity of illness in an effort to decrease their unnecessary use and associated complications.[1-3] (IV)

30.2 The clinical need for the umbilical catheter is assessed on a daily basis and promptly removed when no longer indicated.

Infusion therapy standard of practice. Journal of infusion nursing 2016

Standardizing Umbilical Catheter Usage in Preterm Infants

abstract

BACKGROUND AND OBJECTIVE: Absence of guidelines on umbilical arterial catheter (UAC) and umbilical venous catheter (UVC) use and inability to predict the hospital course may sway the frontline staff to overuse umbilical catheters in preterm infants. Our objective was to evaluate the feasibility of implementing guidelines standardizing the use of umbilical catheters and its impact on the incidence of sepsis and resource use.

Standardizing umbilical cathether usage in preterm infants. Pediatrics 2015

TABLE 1 Guidelines for Vascular Access in Preterm Infants <33 Weeks' Gestation

Gestation	UVC	UAC	PIV
≤26 wk	Recommended	Recommended	
27–28 wk	Recommended	Recommended for selected cases[a]	
≥29 wk	Avoid except in selected cases[a,b]	Recommended for selected cases[a]	Recommended

Nurses were to inform the staff neonatologist if PIV could not be established after 4 attempts.

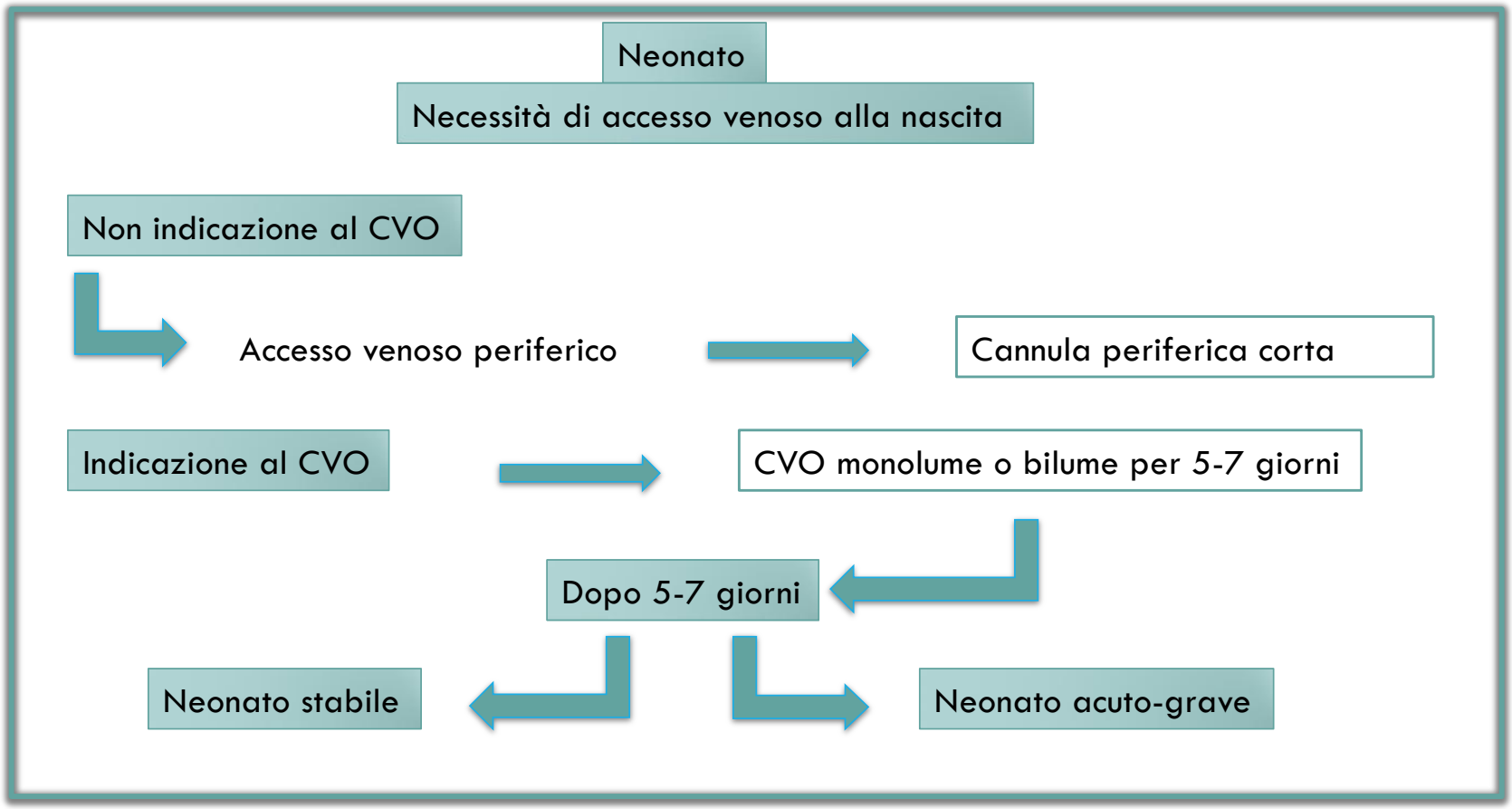
[a] Use only if the patient is intubated and ventilated, or $F_{IO_2} > 40\%$ on continuous positive airway pressure, or the patient is hemodynamically unstable, needing fluid bolus or inotropes.

[b] Difficulty establishing PIV access.

Indicazioni

EG (sett)	Vena Omb.	Arteria Omb.	Vena Perif.
<26	SI	SI, se A o B	NO
27 - 28	SI	SI, se B	NO
29 - 31 + A o B o C o D o E o G	SI	NO	NO
29 - 31	NO	NO	SI
32 –33 + A o B o C o D o E	SI	NO	NO
32 –33 + F	NO	NO	SI
32 –33	NO	NO	NO
≥ 34 + A o B o C o D o E	SI	NO	NO
≥ 34 + F	NO	NO	SI
≥34	NO	NO	NO

A. *Ventilazione assistita con tubo OT*
B. *Instabilità emodinamica*
C. *CPAP con Fio2 >30%*
D. *Difficoltà reperire accesso periferico*
E. *SGA + centralizzazione del circolo/AED/ARED*
F. *PN < 1500 g*
G. *PN ≤ 1000 g*


Neonato
Necessità di accesso venoso alla nascita
Non indicazione al CVO
Accesso venoso periferico
Cannula periferica corta
Indicazione al CVO
CVO monolume o bilume per 5-7 giorni
Dopo 5-7 giorni
Neonato stabile
Neonato acuto-grave

QUALE ACCESSO SCEGLIERE?

La vera scelta cruciale è tra :

- AVP – Accesso venoso periferico
- ECC – epicutaneo cavale in vene superficiali
- CICC o FICC – catetere venoso in vene profonde

QUALE ACCESSO SCEGLIERE?

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INDICAZIONI AVP

Percutaneous central venous catheters versus peripheral cannulae for delivery of parenteral nutrition in neonates (Review)

Ainsworth S, McGuire W

Summary of Findings

Neonates with PICCs received higher proportions of prescribed volumes of parenteral nutrition compared with short peripheral cannulas (96.8% vs 89.7%, respectively; mean difference, 7.1% [95% CI, 3.2% to 11.0%]). No trials reported growth parameters. There were no associations of catheter type with in-hospital mortality (10/196 [5.1%] vs 8/203 [3.9%]; risk ratio [RR], 1.31 [95% CI, 0.36 to 4.81]), or extravasation injury (1/102 [1.0%] vs 5/106 [4.7%]; RR, 0.36 [95% CI, 0.07 to 1.75]) or invasive infection (67/271 [24.7%] vs 72/278 [25.9%]; RR, 0.95 [95% CI, 0.72 to 1.25]) (**Figure**). PICC use was associated with fewer subsequent catheters or cannulas inserted during the trial period (mean difference, −3.1 [95% CI, −4.1 to −2.06]).

Comparison of Findings With Current Guidelines

In 2011, the US Centers for Disease Control and Prevention Healthcare Infection Control Practices Advisory Committee guidelines[2] recommended PICC instead of a short peripheral cannula "when the duration of intravenous therapy will likely exceed six days." The findings of this meta-analysis support this.

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LIMITI ECC

- Non Power
- 1-2 Fr
- Bassi flussi (Premicath 1 ml/min; Twinflow 1.45 ml/min)
- Impossibilità di prelievo (SvO2)
- Non idoneo per emoderivati
- Durata incerta

VANTAGGI ECC

- Facilità di posizionamento
- Stabilità rispetto ad AVP
- Possibilità di infusioni ad alta osmolarità
- Idoneo soprattutto per funzioni nutrizionali nel pretermine

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NON IDONEI NEL PAZIENTE CRITICO

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DURATA ECC

ECC duration: tempo tra inserzione e rimozione o CLABSI
EG 31 W PN 1600 gr
ECC duration mediana 12 giorni (IQR: 6 –21)

TABLE 4 Risk Factors for CLA-BSIs in NICU Patients With PICCs

Risk Factor	Univariate			Multivariable		
	IRR[a]	95% CI	*P*	IRR	95% CI	*P*
Gestational age, wk						
<32	1.00			1.00		
≥32	0.40	0.14–1.19	.10	0.50	0.08–3.18	.46
Birth weight, g						
<1500	1.00			1.00		
≥1500	0.45	0.16–1.22	.12	0.94	0.17–5.18	.94
Chronological age, d						
≤7	1.00			1.00		
>7	1.44	0.59–3.46	.42	1.34	0.56–3.25	.51
Days since PICC insertion						
<19	1.15[b]	1.05–1.26	<.01	1.14[b]	1.04–1.25	<.01

Tempo mediano di infezione 18 giorni (IQR 9-21)

Catheter Duration and Risk of CLA-BSI in Neonates With PICCs. Pediatrics 2009

DURATA ECC

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≥32				0.08–3.18	.46
Birth weight,					
<1500					
≥1500				0.17–5.18	.94
Chronologica					
≤7					
>7				0.56–3.25	.51
Days since PI					
<19				1.04–1.25	<.01

TABLE 3 Incidence of CLA-BSIs Over 10-Day Time I

	Days 1–10	Days 11–20
No. of events	6	8
No. of catheters[a]	315	192
No. of catheter-days[b]	5563	2883
Incidence rate per 1000 catheter-days	1.08	2.77

[a] Number of catheters at the end of the time bin.
[b] Catheter-days for catheters extending beyond 60 days are

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Catheter Duration and Risk of CLA-BSI in Neonates With PICCs. Pediatrics 2009

DURATA ECC

DWELL Time: tempo tra inserzione e rimozione o CLABSI
CLABSI: Emocoltura positive senza evidenza di infezione in altro sito

TABLE 2 Effect of Dwell Time on CLABSI

Week of Dwell Time	PICCs, *N*	CLABSI, *N* (%)	PICCs, HR[a] (95% CI)	Ca
1	14 451	82 (0.6)	Reference	
2	8250	56 (0.7)	1.2 (0.9–1.7)	
3	4061	31 (0.8)	1.3 (0.8–1.9)	
4	2209	5 (0.2)	0.4 (0.1–0.9)	
5	1290	7 (0.5)	0.9 (0.4–1.9)	
6	765	7 (0.9)	1.5 (0.7–3.2)	
7	453	4 (0.9)	1.4 (0.5–4.0)	
8	278	3 (1.1)	1.6 (0.5–5.2)	
9	183	2 (1.1)	1.5 (0.4–6.3)	
10	125	0		

CI, confidence interval; HR, hazard ratio.
[a] HRs are adjusted for PMA, year of catheter insertion, and site.

TABLE 3 Effect of PMA on CLABSI

PMA, wk	PICCs, *N*	PICCs, HR[a] (95% CI)	Tunneled Catheters, *N*	Tunneled Catheters, HR[a] (95% CI)
≥37	1835	Reference	314	Reference
34–36	1340	1.0 (0.3–3.8)	193	0.6 (0.1–2.8)
30–33	3315	1.3 (0.4–3.6)	130	0.3 (0.04–3.0)
26–29	5251	3.9 (1.6–9.7)	203	1.5 (0.5–5.0)
<26	2707	6.1 (2.5–15.2)	274	1.3 (0.4–3.8)

Sample sizes indicate number of patients with each type of catheter at each PMA. CI, confidence interval; HR, hazard ratio.
[a] HRs are adjusted for line week, year of catheter insertion, and site.

TABLE 1 Catheter Dwell Time

Dwell Time, d	PICCs, Median (IQR)
Overall	11 (7–18)

Effect of Catheter Dwell Time on Risk of Central Line–Associated Bloodstream Infection in Infants. Greenberg. Pediatrics 2015

DURATA ECC

DWELL Time: tempo tra inserzione e rimozione o CLABSI
CLABSI: Emocoltura positive senza evidenza di infezione in altro sito
ECC duration mediana 14 giorni (IQR: 7 –23)

TABLE 4 Unadjusted and Adjusted Risk Factors for CLABSIs in Neonates With PICCs

Variable	CLABSI, *n* = 149, *n* (%)	No CLABSI, *n* = 4648, *n* (%)	Unadjusted IRR (95% CI)	*P* Value	aIRR[a] (95% CI)
Age at line insertion, d			1.00 (0.99–1.00)	.19	1.00 (0.99–1.00)
Birth weight, 100 g			0.98 (0.96–0.99)	.006	0.97 (0.95–0.99)
Concurrent PICCs					
No	134 (89.9)	4413 (94.9)	1.0 (reference)		1.0 (reference)
Yes	15 (10.1)	235 (5.1)	1.66 (0.97–2.84)	.06	2.04 (1.12–3.71)
CLABSI from previous PICC					
No	143 (96.0)	4577 (98.5)	1.0 (reference)		1.0 (reference)
Yes	6 (4.0)	71 (1.5)	2.21 (1.00–4.90)	.05	1.66 (0.69–3.98)
Catheter dwell time					
≤7 d	25 (16.6)	1071 (23.0)	1.0 (reference)		—
8–13 d	32 (21.2)	1257 (27.1)	2.02 (1.21–3.38)	.007	—
14–22 d	39 (25.8)	1090 (23.5)	3.27 (2.04–5.24)	<.001	—

Catheter Dwell Time and CLABSIs in Neonates With PICCs: A Multicenter Cohort Study Pediatrics 2013

DURATA ECC

DWELL Time: tempo tra inserzione e rimozione o CLABSI
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Birth weight, 100 g			0.98 (0.96–0.99)	.006	0.97 (0.95–0.99)
Concurrent PICCs					
No	13		(reference)		1.0 (reference)
Yes	1		(0.97–2.84)	.06	2.04 (1.12–3.71)
CLABSI from previous PICC					
No	14		(reference)		1.0 (reference)
Yes			(1.00–4.90)	.05	1.66 (0.69–3.98)
Catheter dwell time					
≤7 d	2		(reference)		—
8–13 d	32 (21.2)	1257 (27.1)	2.02 (1.21–3.38)	.007	—
14–22 d	39 (25.8)	1090 (23.5)	3.27 (2.04–5.24)	<.001	—

DISCUSSION

These data confirm that the daily risk of infection is higher in PICCs that have been in place for >2 weeks as compared with those that have been in place for <2 weeks. However, we found no

Catheter Dwell Time and CLABSIs in Neonates With PICCs: A Multicenter Cohort Study Pediatrics 2013

DURATA ECC

EG 27 W PN 900 gr

ECC rimossi elettivamente ad un tempo mediano di193 h (142–287) 8 giorni

ECC rimossi non elettivamente ad un tempo mediano 154 h (102–260) 6.5 giorni

Australia

Table 3 The odds ratios for non-elective PICC removal per tip position, correcting for birth weight, gestational age and sex, using the tip in the SVC as reference position

Tip position	Odds for non-elective removal	*p* value
SVC	1	Reference
Brachiocephalic vein	0.88	0.67
Subclavian vein	1.46	0.069
Axillary vein	2.08	0.041
Cephalic vein	8.93	<0.001
IVC	1.24	0.38
Common iliac vein	1.59	0.24
External iliac vein	4.99	<0.001
Femoral vein	10.31	<0.001

Dwell times and risk of non-elective removal of 1-French peripherally inserted central catheters according to catheter tip position in very preterm infant. Eur J of Pediatrics 2017

DURATA ECC

Canada

TABLE 1 Demographic Characteristics of the 3 Study Groups

Characteristics	PICC Group (n = 180)	UVC Group (n = 180)	UVC + PICC Group (n = 180)	P		
				PICC Versus UVC	PICC Versus UVC + PICC	UVC Versus UVC + PICC
Gestational age, mean (SD), wk	27.2 (1.5)	27.2 (1.5)	27.2 (1.5)	.99	.99	.99
Birth weight, mean (SD), g	1019 (244)	1023 (250)	1023 (243)	.88	.88	.99
Boy, n (%)	106 (59)	106 (59)	106 (59)	.99	.99	.99
Small for gestational age, n (%)	22 (12)	18 (10)	16 (9)	.50	.30	.72
Apgar at 5 min < 7, n (%)	54 (31)	67 (39)	53 (30)	.18	.82	.12
SNAP-II score >20, n (%)	26 (20)	55 (40)	49 (32)	<.01	.03	.17
Mechanical ventilation on day 1, n (%)	89 (49)	116 (64)	126 (70)	<.01	<.01	.26
Duration of mechanical ventilation, median (IQR), d	2 (0–10)	2 (0–6)	5 (1–13.5)	.34	.02	<.01
Duration of CPAP, median (IQR), d	7 (1–18)	10 (1–29)	18 (5–29)	.05	<.01	<.01
Duration of UVC, median (IQR), d	NA	8 (6–10)	7 (5–9)	NA	NA	<.01
Duration of PICC, median (IQR), d	13 (9–19)	NA	13 (8–22)	NA	0.49	NA

CPAP, continuous positive airway pressure; IQR, interquartile range; NA, not applicable.

Risk of Infection Using Peripherally Inserted Central and Umbilical Catheters in Preterm Neonates. Pediatrics 2015

DURATA ECC

Svezia

Table 3
Reasons for the removal of PICCs prior to completion of treatment

Complications	Lower extremities *n* (%)	Upper extremities/Scalp *n* (%)	Total *n* (%)	*p*-value*
Mechanical	11 (26)	52 (42)	63 (38)	0.061
Swelling/leakage	16 (38)	39 (32)	55 (33)	0.429
Sepsis/presumed sepsis	8 (19)	14 (11)	22 (13)	0.692
Thrombophlebitis	5 (12)	18 (15)	23 (14)	0.200
Other reasons #	2 (5)	1 (1)	3 (2)	0.096
TOTAL	42	124	166	

*P-values for the differences between lower and upper extremities, derived from the chi-square or Fisher's exact test. # of other reasons indicated: renal vein thrombosis ($n = 1$), need for only one PICC ($n = 2$).

Peripherally inserted central catheter in extremely preterm infants: Characteristics and influencing factors. Journal of Neonatal perinatal Medicine 2017

SURVEY ACCESSI VASCOLARI IN TIN IN EMILIA ROMAGNA

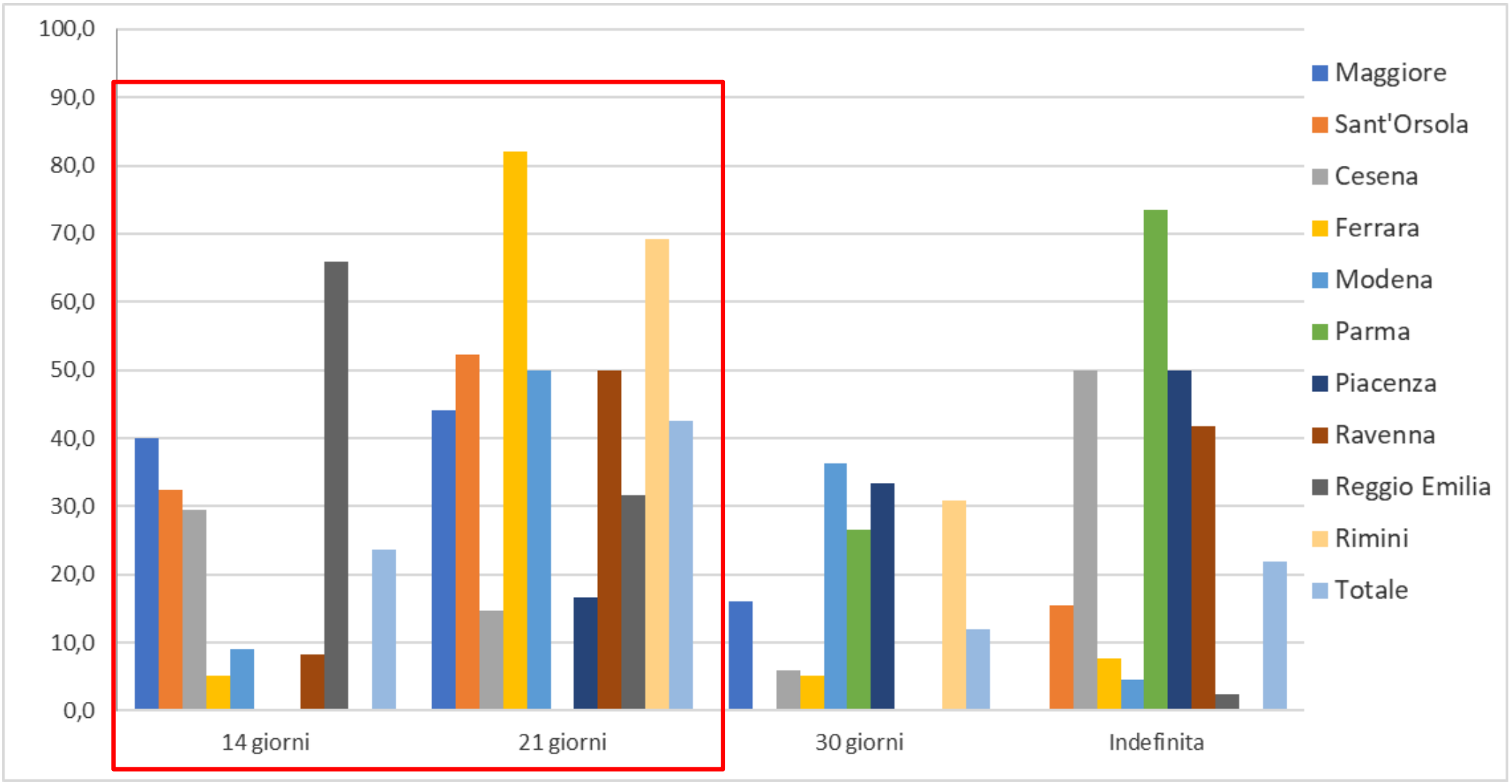
- Task force medico e infermieristica
- 20 componenti dalle UO TIN/Neonatologia dell'Emilia Romagna.
- Ambito di lavoro: accessi venosi neonatali
- Obiettivo: favorire la standardizzazione dei processi assistenziali relativamente al mondo degli accessi venosi neonatali.

SURVEY ACCESSI VASCOLARI IN TIN

Centro	Medici	Infer.	Totale
Bologna Maggiore	70 %	64 %	66 %
Bologna Sant'Orsola	73 %	100 %	95 %
Cesena	100 %	96 %	97 %
Ferrara	100 %	83 %	87 %
Modena	90 %	67 %	73 %
Parma	33 %	62%	59%
Piacenza	77 %	85 %	81 %
Ravenna	60 %	83 %	76 %
Reggio Emilia	100 %	100 %	100 %
Rimini	100 %	94 %	95 %

400 questionari

PERMANENZA ECC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Maggiore
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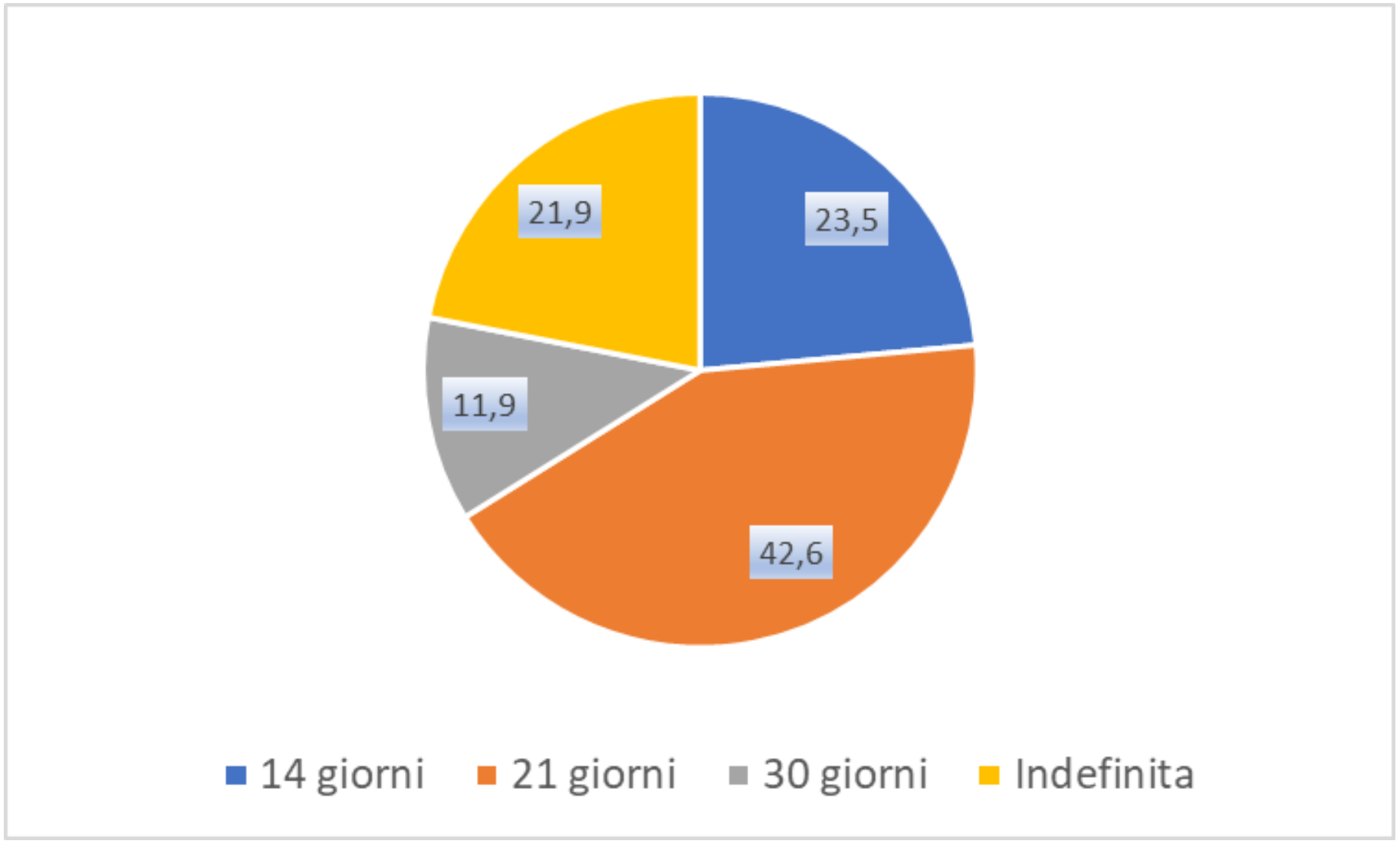
Cesena
Ferrara
Modena
Parma
Piacenza
Ravenna
Reggio Emilia
Rimini
Totale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23,5
11,9
42,6
14 giorni
21 giorni
30 giorni
Indefinita

QUALE ACCESSO SCEGLIERE?

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Supraclavicular Approach to Ultrasound-Guided Brachiocephalic Vein Cannulation in Children and Neonates

Zied Merchaoui[1†], Ulrik Lausten-Thomsen[1,2†], Florence Pierre[1], Maher Ben Laiba[1], Nolwenn Le Saché[1] and Pierre Tissieres[1,2]*

[1] Pediatric and Neonatal Intensive Care Unit, Paris South University Hospitals, Le Kremlin-Bicêtre, Assistance Publique Hôpitaux de Paris, Paris, France, [2] Institute of Integrative Biology of the Cell, CNRS, CEA, University of Paris Sud, Paris Saclay University, Gif-sur-Yvette, France

Supraclavicular Ultrasound-Guided Catheterization of the Subclavian Vein in Pediatric and Neonatal ICUs: A Feasibility Study

Anne-Sophie Guilbert, MD[1]; Lorenço Xavier, MD[1]; Clément Ammouche, MD[1]; Philippe Desprez, MD[1]; Dominique Astruc, MD[2]; Pierre Diemunsch, PhD[3]; Jocelyne Bientz, MD[1]

Pediatr Surg Int (2010) 26:815–818
DOI 10.1007/s00383-010-2616-3

ORIGINAL ARTICLE

Ultrasound-guided percutaneous insertion of 2.7 Fr tunnelled Broviac lines in neonates and small infants

G. S. Arul · H. Livingstone · P. Bromley · J. Bennett

Pediatric Anesthesia

Pediatric Anesthesia ISSN 1155-5645

ORIGINAL ARTICLE

Ultrasound-guided supraclavicular cannulation of the brachiocephalic vein in infants: a retrospective analysis a case series

Christian Breschan[1], Manuela Platzer[1], Robert Jost[2], Haro Stettner[3], Georg Feigl[4] & Rudolf Lik

1 Department of Anaesthesia, Klinikum Klagenfurt, Klagenfurt, Austria
2 Department of Anaesthesia, Krankenhaus Spittal/Drau, Spittal/Drau, Austria
3 Department of Statistics, University of Klagenfurt, Klagenfurt, Austria
4 Department of Anatomy, Medical University of Graz, Graz, Austria

Ultrasound-Guided Subclavian Vein Cannulation in Low Birth Weight Neonates

Ulrik Lausten-Thomsen, MD, PhD[1]; Zied Merchaoui, MD[1]; Cécile Dubois, MD[1,2]; Sergio Eleni Dit Trolli, MD[1,3]; Nolwenn Le Saché, MD[1]; Mostafa Mokhtari, MD[1,4]; Pierre Tissières, MD, PhD[1–3]

Centrally inserted central lines in neonates by ultrasound guided access to the brachio-cephalic vein.

Mauro Pittiruti[1], Davide Celentano[2], Lidia Muscheri[2], Giovanni Barone [3], Vito D'Andrea [3]

[1]Department of Surgery, Catholic University Hospital 'A.Gemelli', Rome – Italy

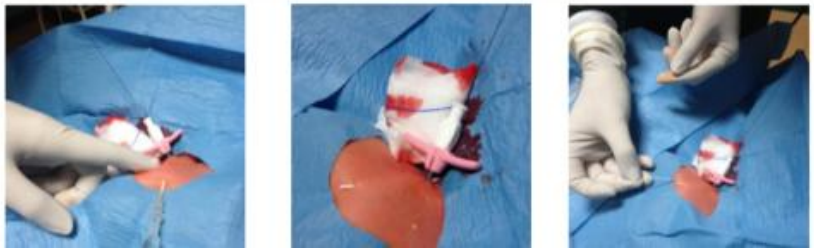
[2] Pediatric Intensive Care Unit, Catholic University Hospital 'A.Gemelli', Rome – Italy

[3] Neonatal Intensive Care Unit, Catholic University Hospital 'A.Gemelli', Rome – Italy

1. Background

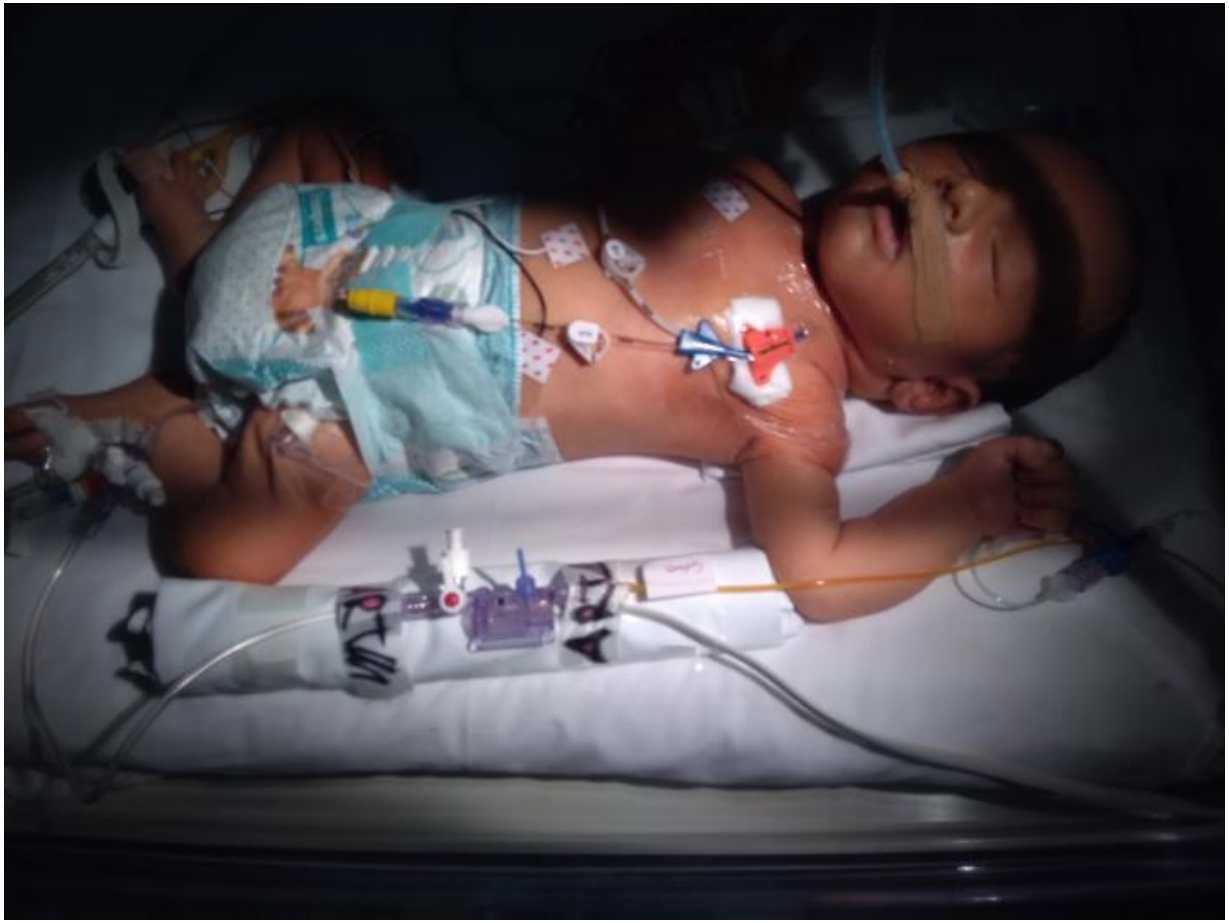
- Critically ill neonates often require a central line for hemodynamic monitoring, repeated blood sampling, infusion of high volumes of fluids, and/or infusion of drugs and solutions not appropriate for the peripheral route.
- Small bore silicone or polyurethane catheters (1 - 2.7 Fr) inserted via superficial veins of the limbs and the scalp (epicutaneo-caval catheters – ECC) may not be appropriate for these purposes.
- The placement of a large bore polyurethane catheter (3-4 Fr) in the brachio-cephalic vein – centrally inserted central catheters (CICC) - may be particularly useful in these situations.
- The adoption of power injectable polyurethane allows a high-flow delivery of the intravenous infusions (up to 1 ml/sec) and a reduced risk of lumen occlusion.

4. Tunneling of the catheter to the infraclavicular area



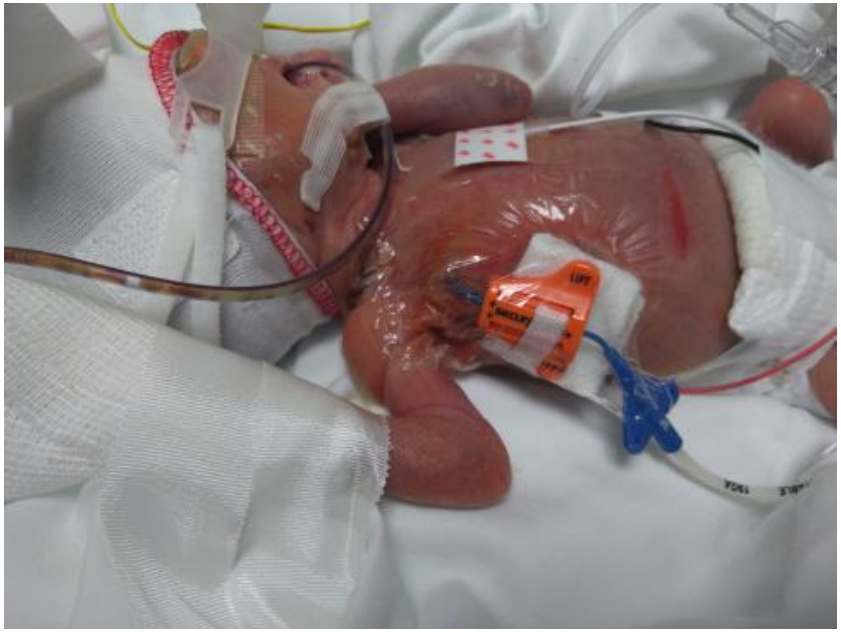
….IN TIN

Dal neonato a termine

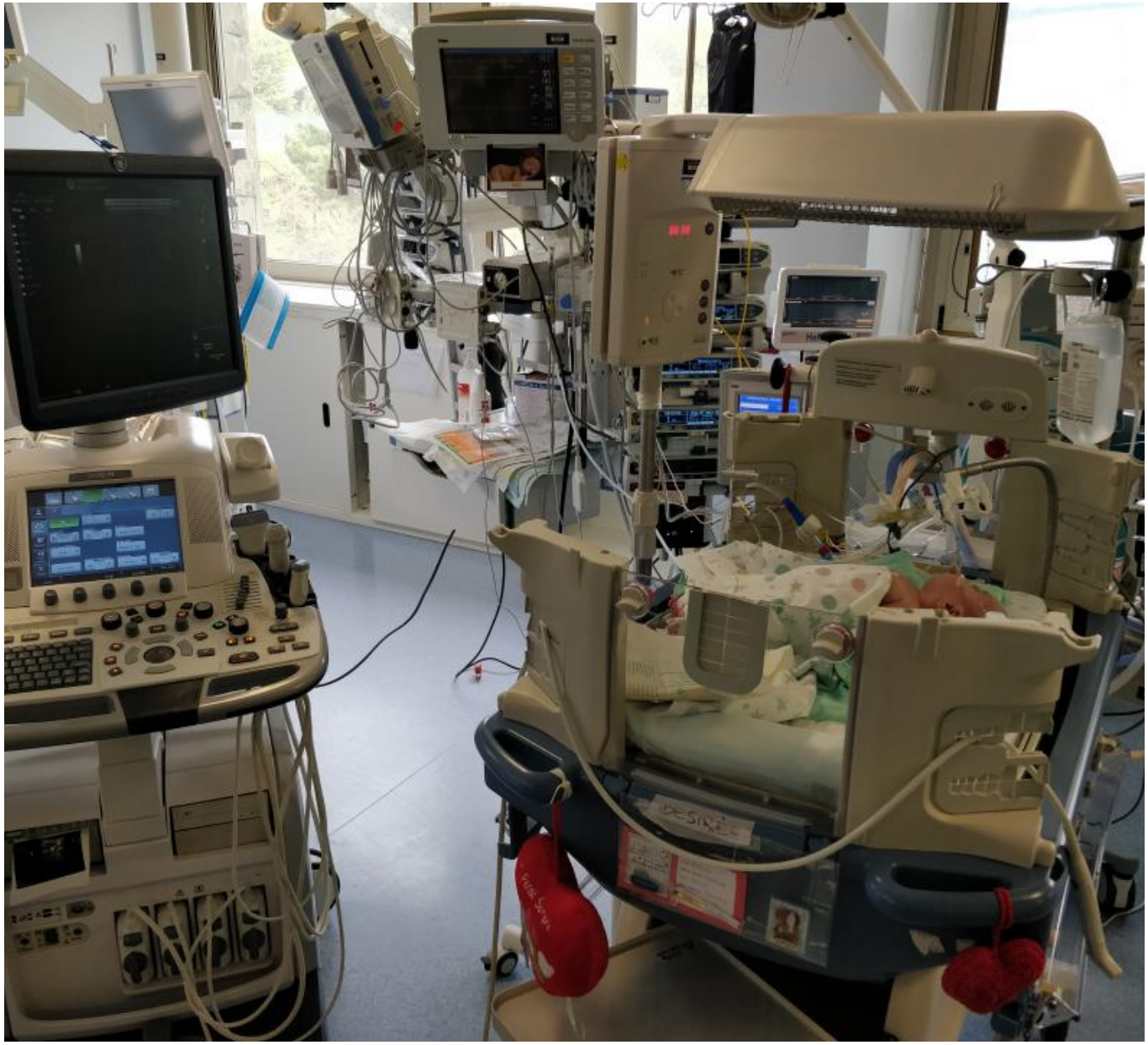


....IN TIN

Al neonato prematuro



....IN TIN



EEC

- Vene superficiali
- Venipuntura diretta o con tecnologia NIR
- 1-2.7 fr
- Richiedono analgesia
- Cateteri in silicone o PUR, non-power
- Bassi flussi
- Non idonei per i prelievi
- Non idonei per la misurazione della PVC
- Non idonei per il monitoraggio SvO2
- Non idonei per infusione di emoderivati
- Tip location incerta (ECO, Rx, ECG?)
- Mai tunnellizzati
- Durata 2-3 settimane
- Diagnosi di CLABSI
- Maggiori complicanze durante il mantenimento (es migrazione)

CICC/FICC

- Vene profonde
- Venipuntura ecoguidata
- 3-4fr
- Richiedono sedoanalgesia profonda
- Cateteri in poliuretano, power
- Alti flussi
- Idonei per i prelievi
- Idonei per la misurazione della PVC
- Idonei per il monitoraggio SvO2
- Idonei per infusione di emoderivati
- Tip location certa, mediante ECG o ECO
- Possono essere tunnellizzati
- Durata a lungo termine
- Possibilità di diagnosi di CRBSI
- Minori complicanze durante il mantenimento (es migrazione)

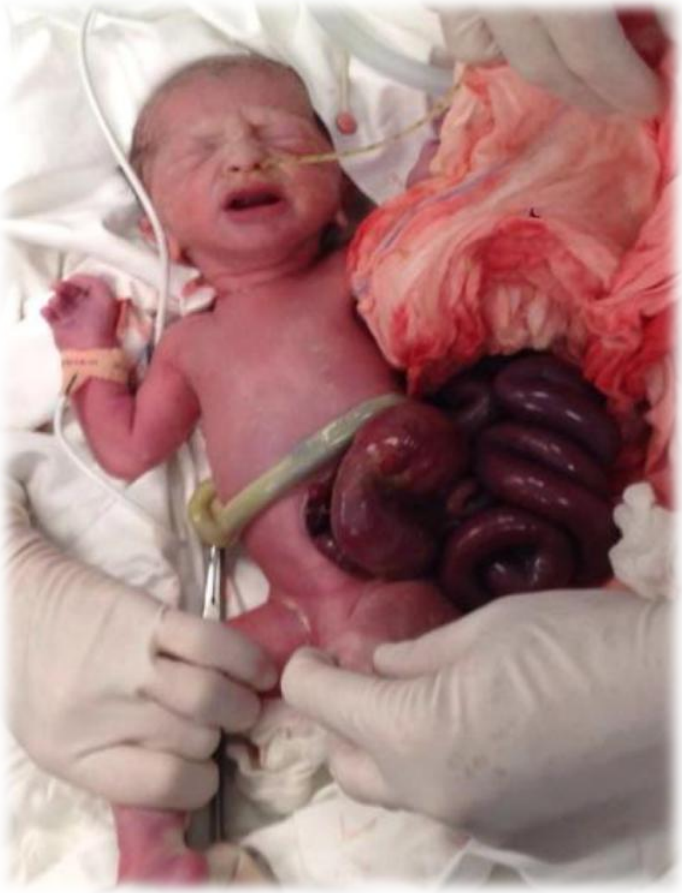
INDICAZIONI AL CICC NEL NEONATO

Nel neonato acuto/grave:

Neonati con instabilità emodinamica e necessità di monitoraggio della PVC e della SvO2 a qualunque età di vita (nell'impossibilità a posizionare un CVO o in caso di CVO malposizionato).

Neonato con patologia malformativa maggiore prima dell'intervento chirurgico (es atresia esofagea, onfalocele, gastroschisi etc).

Necessità di accesso centrale per rapida replezione volemica (in emergenza e/o in vista di interventi di chirurgia maggiore).



INDICAZIONI AL CICC NEL NEONATO

<u>Nei neonati pretermine stabile:</u>

Neonati pretermine con previsione di NP e terapia endovenosa prolungata (> 14 giorni).

Neonato pretermine con patologia gastrointestinale chirurgica (NEC o perforazione intestinale).

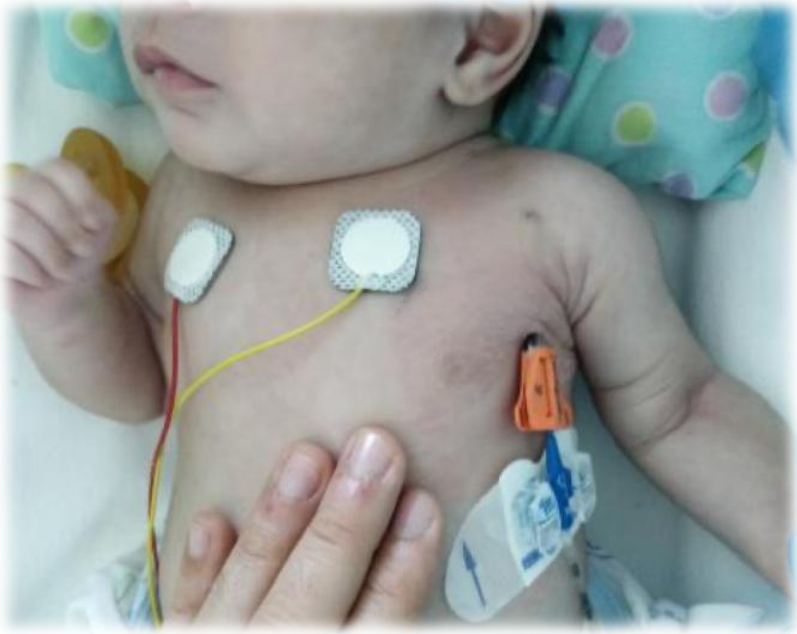
INDICAZIONI AL CICC NEL NEONATO

Altre situazioni particolari:

Neonati con BPD severa di tipo 2 (necessità di VM a 36 settimane di EPM) e necessità di terapia endovenosa.

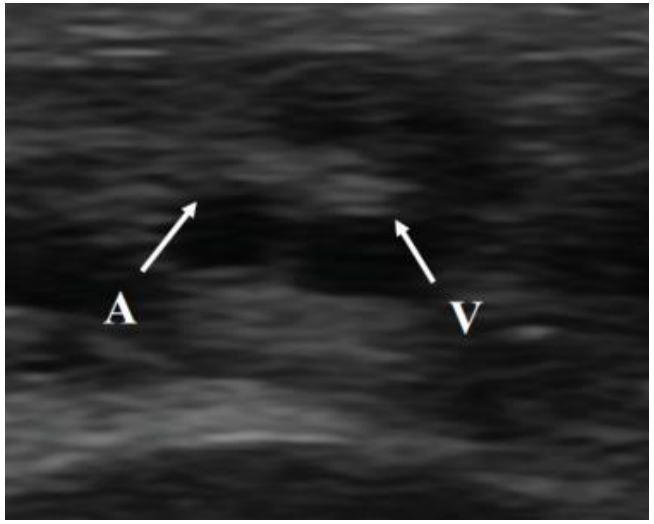
Esaurimento del patrimonio venoso superficiale (es nel caso di necessità di ricorrere alle vene dello scalpo per esaurimento delle vene ai 4 arti).

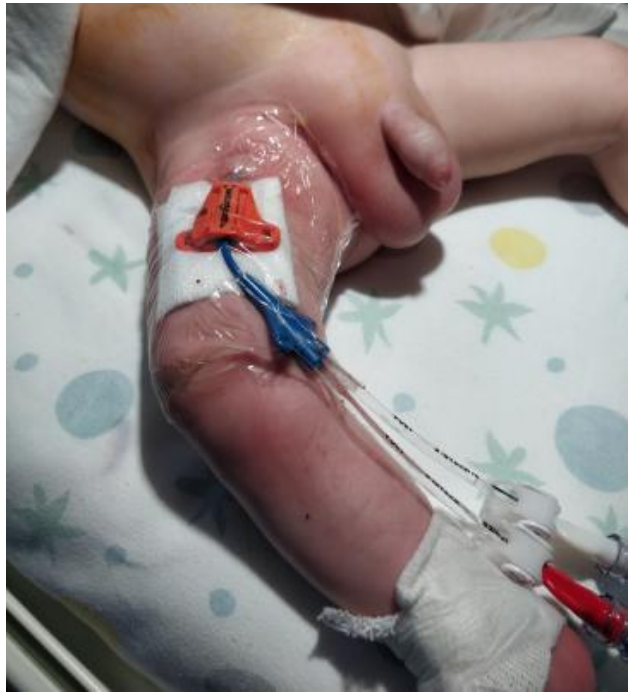
Neonati nei quali - pur essendovi vene periferiche superficiali disponibili - la inserzione di un catetere epicutaneo cavale incontra difficoltà ripetute di posizionamento della punta.

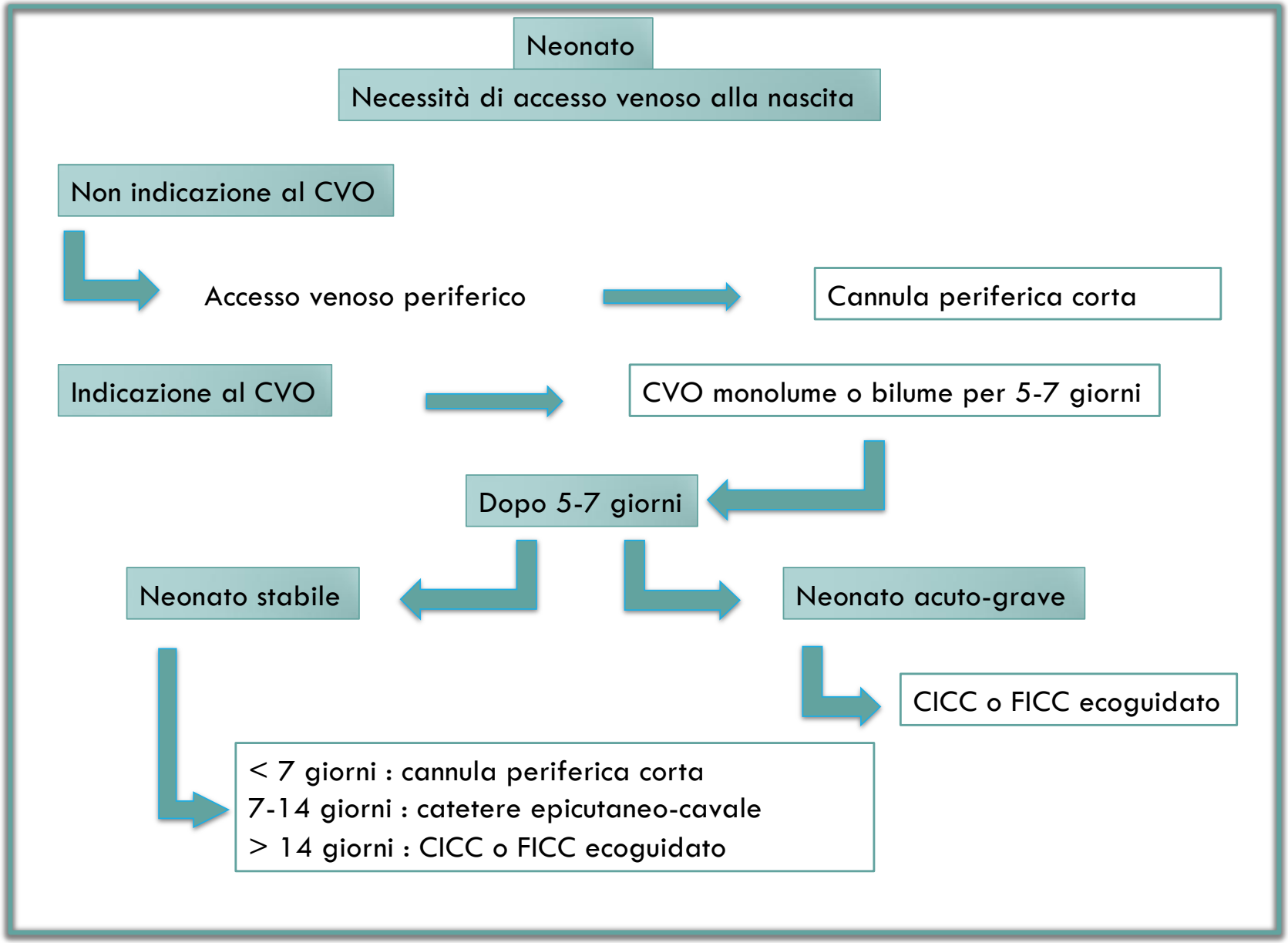


INDICAZIONI AL FICC NEL NEONATO

Non è mai la prima scelta per gli accessi a medio e lungo termine (*solo se controindicati i CICC, es malformazioni latero cervicali)*






Neonato
Necessità di accesso venoso alla nascita
Non indicazione al CVO
Accesso venoso periferico
Cannula periferica corta
Indicazione al CVO
CVO monolume o bilume per 5-7 giorni
Dopo 5-7 giorni
Neonato stabile
Neonato acuto-grave
CICC o FICC ecoguidato
< 7 giorni : cannula periferica corta
7-14 giorni : catetere epicutaneo-cavale
> 14 giorni : CICC o FICC ecoguidato

Neonato

Necessità di accesso venoso dopo la nascita (> 24h)

Neonato acuto-grave

→ CICC o FICC ecoguidato

Neonato stabile

→ < 7 giorni: cannula periferica corta
7-14 giorni: catetere epicutaneo-cavale
> 14 giorni: CICC o FICC ecoguidato


THANK
YOU
GRACIAS
ARIGATO
ŞUKURIA
MERCI
BOLZİN
DANKSCHEEN
TASHAKKUR ATU
SUKSAMA
MEHRBANI
GRAZIE
ЈUSPAXAP
GOZIMASHTA
EFCHARISTO
KOMAPSUMIDA
YAQHANYELAY
SHUKRIA
BİYAN
TINGKI