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GAVePed
Gruppo Accessi Venosi Pediatrici

PERSEUS- PERIOPERATIVE USE OF ULTRASOUND

Paediatric Vascular access

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ESAIC Research Committee - APAGBI Council Member

ESAIC

#EA22

Eur J Anaesthesiol 2020; **37**:344–376

European Society of Anaesthesiology guidelines on peri-operative use of ultrasound-guided for vascular access (PERSEUS vascular access)

Massimo Lamperti, Daniele Guerino Biasucci, Nicola Disma, Mauro Pittiruti, Christian Breschan, Davide Vailati, Matteo Subert, Vilma Traškaitė, Andrius Macas, Jean-Pierre Estebe, Regis Fuzier, Emmanuel Boselli and Philip Hopkins

Methodology applied

PICOS 10-14

- P: children requiring a vascular access
- I: US-guided
- C: any other technique
- O: first pass success, time to achieve cannulation, complications, etc
- S: operating room, intensive care, emergency setting

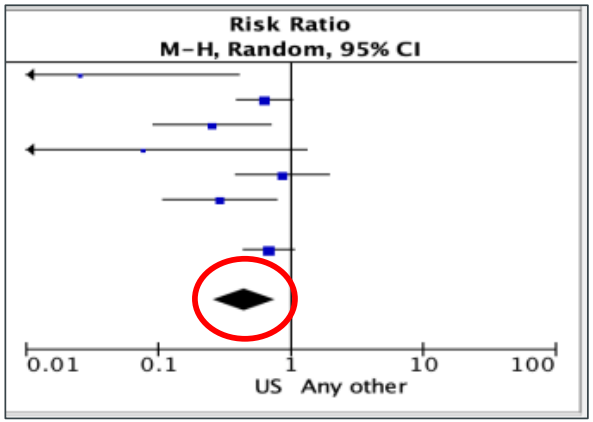
1705 abstracts/articles retrieved, 92 papers screened, 30 articles included

Paediatric PICOs

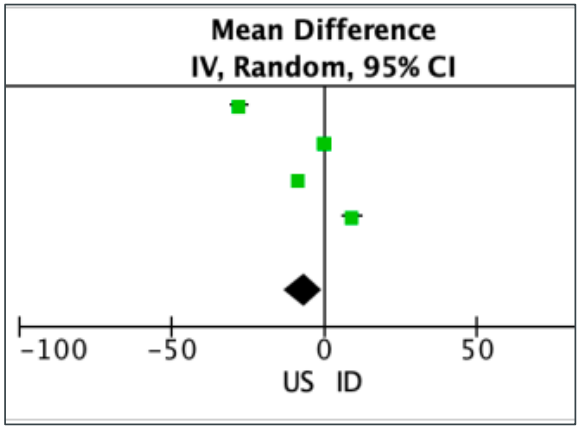
- Is USG better that “any other technique” for
  - IJV
  - FV
  - AxV, BCV, SCV
  - Arterial cannulation
  - Peripheral veins (DIVA)

US-guided cannulation of the IJV in children

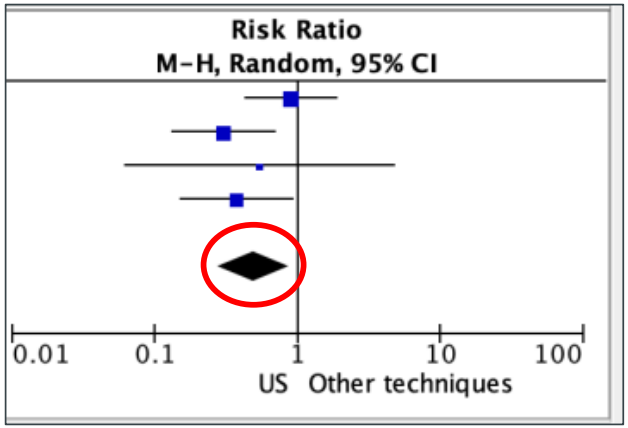
Overall success



Time



Complications

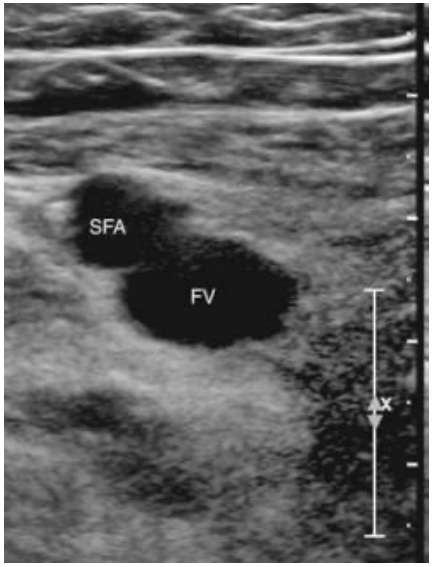


US-guided cannulation of the IJV in children

Recommendations

- We recommend the use of USG for IJV in children as it increases the success rate, reduces the time of successful cannulation (**GoR 1B**).
- We recommend the use of USG for IJV in children as it reduces the occurrence of complications (**GoR 1B**).

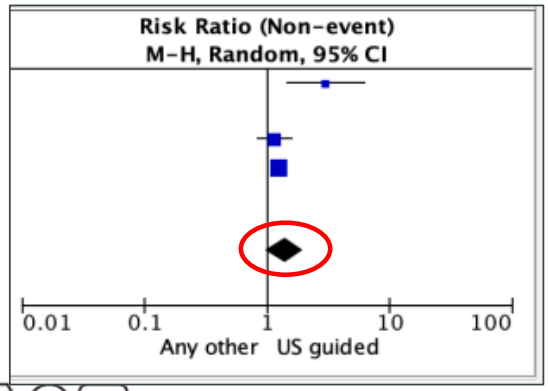
US-guided cannulation of the femoral vein (FV)



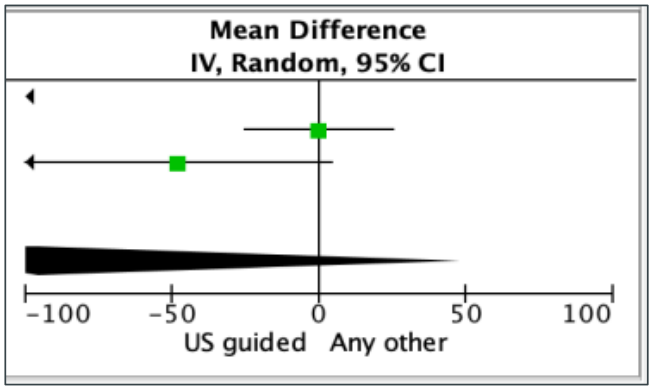
Recommendation

- We recommend the use of USG for FICC in children as it increases the success rate and reduces the risk of complications (**GoR 1B**), even if the time of successful cannulation is not reduced.

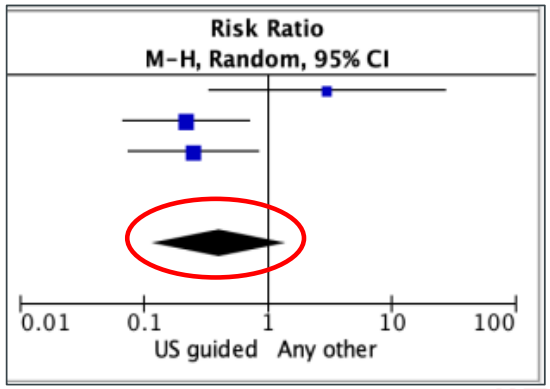
Overall success



Time



Complications



US-guided cannulation of the radial artery in children

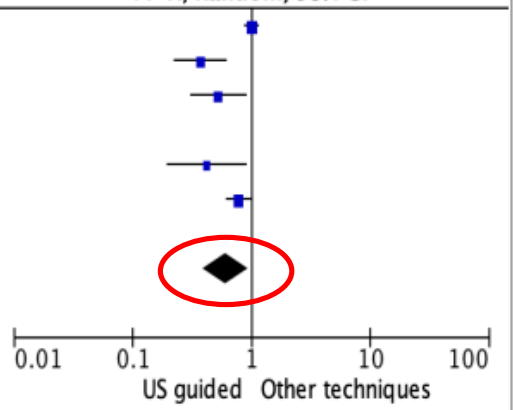
Recommendation

- We recommend the use of USG for arterial cannulation in children as it increases the **success rate** (**GoR 1B**).

Study or Subgroup	US guided Events	Total	Any other technique Events	Total	Weight	Risk Ratio M-H, Random, 95% CI
Ganesh_2009	62	72	69	80	24.7%	1.00 [0.88, 1.13]
Ishii_2013	14	59	38	59	19.0%	0.37 [0.22, 0.60]
Min_2018	12	37	23	37	18.4%	0.52 [0.31, 0.89]
Schwemmer_2006	0	0	0	0		Not estimable
Schwemmer_2006	5	15	12	15	14.3%	0.42 [0.20, 0.89]
Ueda_2013	34	52	44	52	23.6%	0.77 [0.61, 0.97]
Total (95% CI)		**235**		**243**	**100.0%**	**0.61 [0.39, 0.94]**
Total events	127		186			

Heterogeneity: $Tau^2 = 0.20$; $Chi^2 = 37.10$, df = 4 ($P < 0.00001$); $I^2 = 89\%$

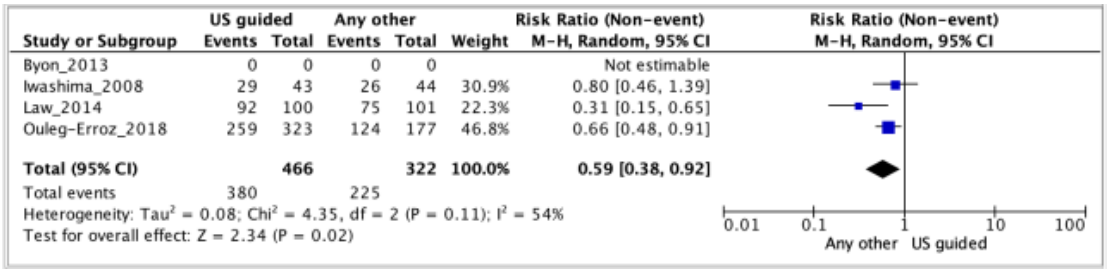
Test for overall effect: Z = 2.22 (P = 0.03)

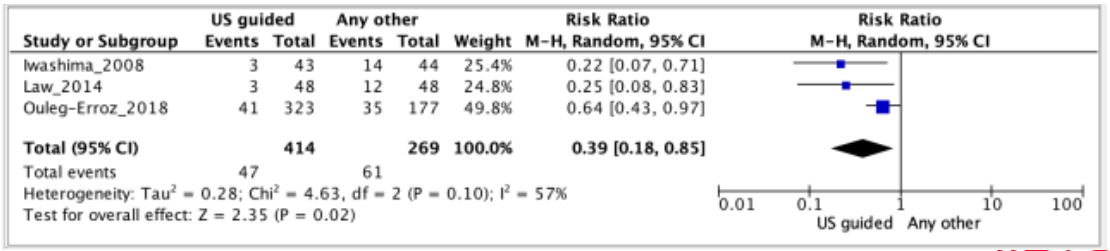


US-guided cannulation of the brachio-cephalic vein (BCV), AxV and SBC in children

Recommendation

- We recommend USG for BCV cannulation only in expert hands (**GoR 1C**).





US-guidance cannulation of peripheral veins in children

Recommendation

- Due the **paucity of well-conducted studies**, we cannot recommend the routine use of US for peripheral veins cannulation in paediatric patients.
- **Some evidence** suggests the use of USG improves the success rate of difficult peripheral cannulation in children (DIVA) and in experienced hands; its application might be of some benefit (GoR 2B).

Will PERSEUS change our daily clinical practice?

Intensive Care Med
DOI 10.1007/s00134-012-2597-x

Before PERSEUS

Massimo Lamperti
Andrew R. Bodenham
Mauro Pittiruti
Michael Blaivas
John G. Augoustides
Mahmoud Elbarbary
Thierry Pirotte
Dimitrios Karakitsos
Jack LeDonne
Stephanie Doniger
Giancarlo Scoppettuolo
David Feller-Kopman
Wolfram Schummer
Roberto Biffi
Eric Desruennes
Lawrence A. Melniker
Susan T. Verghese

International evidence-based recommendations on ultrasound-guided vascular access

Table 3 Recommendations on ultrasound vascular access in neonates and children

Ultrasound vascular access in neonates and children		
Domain code	Suggested definition	Level evider
D4.SD1.S1–2	Ultrasound guidance should be routinely used for short- and long-term central venous access in children and neonates	A
D4.SD1.S3	Ultrasound vessel imaging with ultrasound assistance as "a minimum" should be routinely performed before internal jugular vein puncture in neonates	A
D4.SD1.S4	In neonates, ultrasound screening should be used before subclavian vein puncture. Ultrasound-guided puncture should be considered for catheterization using the supra-clavicular route, but this technique requires experienced operators	C
D4.SD1.S5	Ultrasound vessel screening should be routinely used before femoral vein puncture. Ultrasound-guided femoral puncture is recommended to decrease inadvertent arterial puncture	B
D4.SD1.S6	Ultrasound guidance can be considered when difficult peripheral venous access is required in areas such as the antecubital fossa and ankle. Blind deep antecubital fossa puncture should disappear	C
D4.SD1.S7	Ultrasound-guided arterial catheterization improves first-pass success and should be used routinely in children and neonates	A
D4.SD1.S8	After central venous catheter placement in paediatric patients including neonates, the ultrasound equipment should remain easily accessible at the patient's bedside to detect early life-threatening catheter-related complications such as pneumothorax, cardiac tamponade and hemothorax	B
D4.SD1.S9	There is no ideal site for cannulation in children; the best site should be determined after ultrasound examination	A

PERSEUS and “Grey areas”

- New USG approaches in children
- Improve accuracy, reduce Rx exposure for tip location
- Detect early and late complications
- Change education and teaching

British Journal of Anaesthesia **106** (5): 732–7 (2011)
Advance Access publication 17 March 2011 · doi:10.1093/bja/aer031

BJA

REGIONAL ANAESTHESIA

Consecutive, prospective case series of a new method for ultrasound-guided supraclavicular approach to the brachiocephalic vein in children

C. Breschan[1*], M. Platzer[1], R. Jost[2], H. Stettner[3], A.-S. Beyer[3], G. Feigl[4] and R. Likar[1]


IST.G.GASLINI
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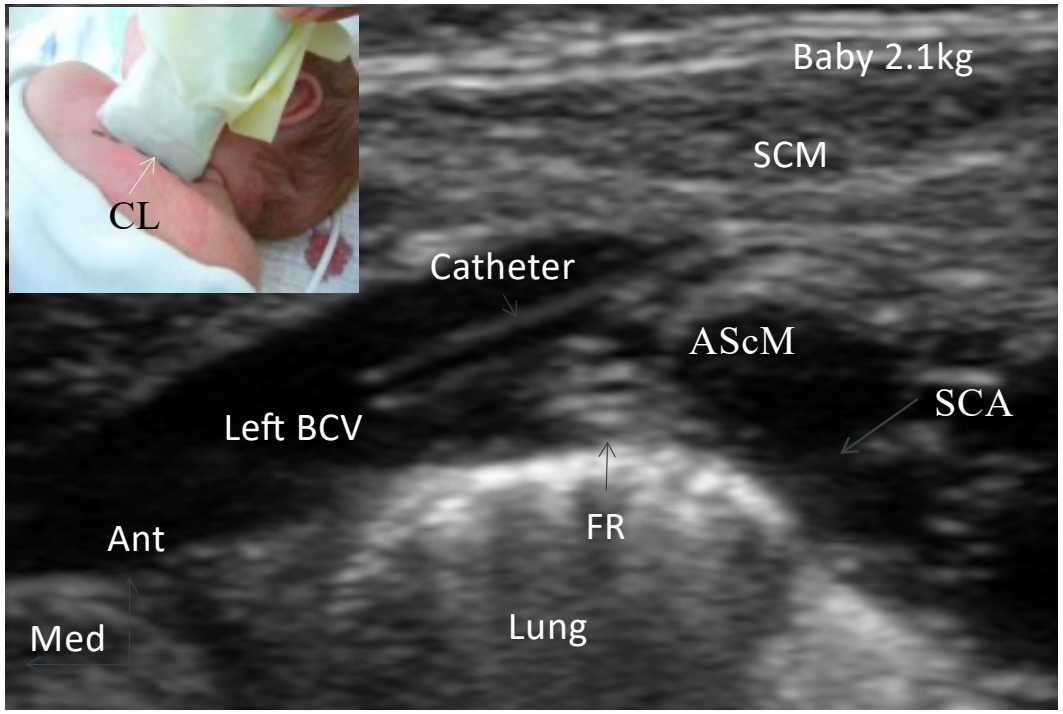
ADM 040615-104616
MI 0.6 TIs 0.3 12L-RS
Adulto
B
Frq 10.0 MHz
Gn 58
E/A 1/3
Mapp A/0/0
D 4.0 cm
DR 90
FR 29 Hz
AO 100 %
XBeam On
190:190 (19.4:19.4 s)
Cardiaco
(Z) Dimensione
(X) Area
(C) Volume
(V) Massa
(B) Shunt
(N) PISA
(,) LA/Ao
(.) Valvola mitrale
(/) RVILV
AVA
Worksheet

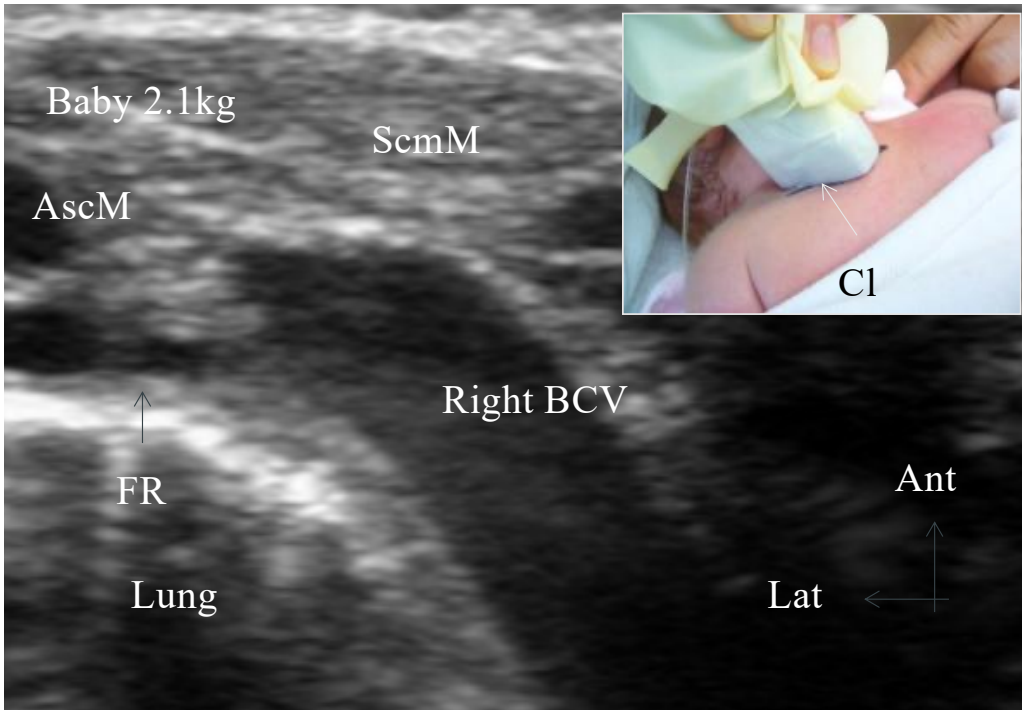
BCV in “tiny” neonates

4.5 kg

800 grams

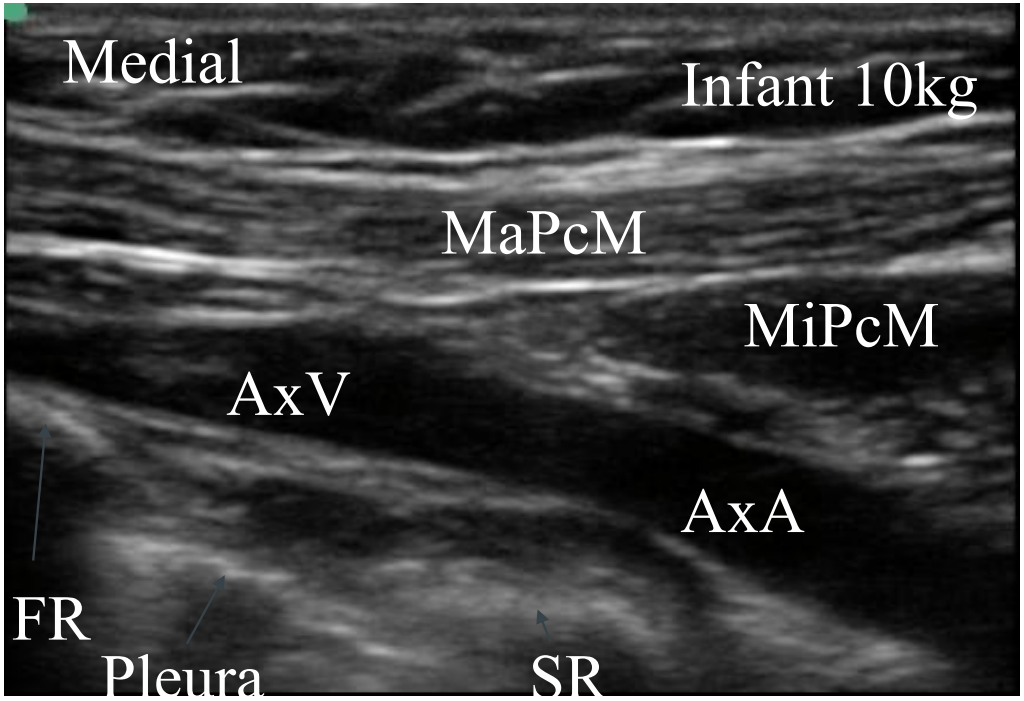
Left vs right BCV





Breschan *et al.* Anesthesiology 2018; 128:38-43

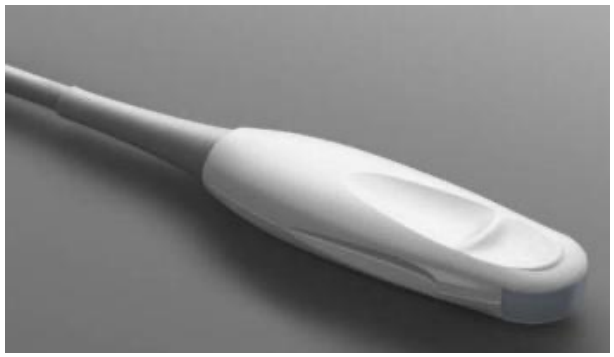
AxV and SCV



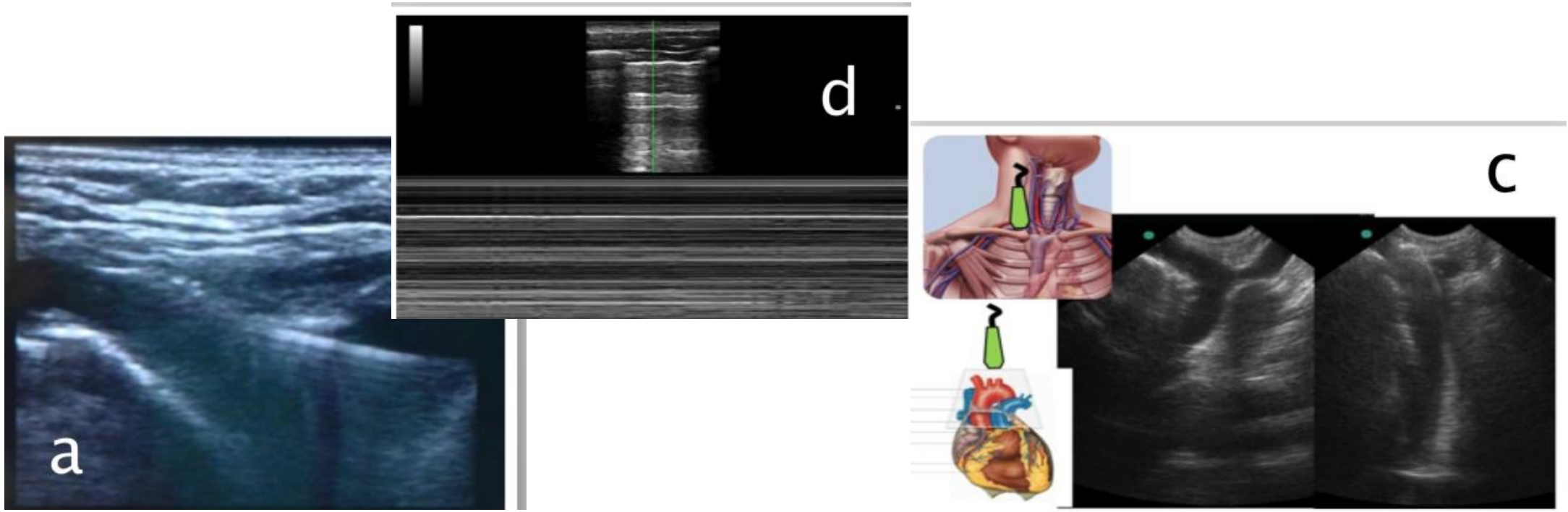
US-guided tip navigation and location

- There is a **growing evidence** that ultrasound may be an **accurate**, inexpensive and **non-invasive** methodology for tip navigation (ultrasound scan of central veins during catheter progression) and for tip location (echocardiographic visualization of the catheter tip).

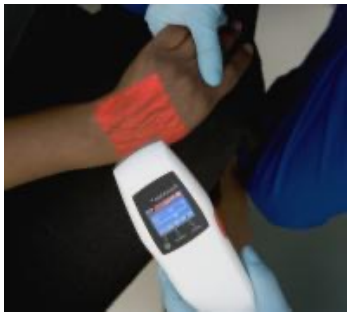
- Different echocardiographic approaches have been used yielding a sensitivity of 83,3% ([95% CI]: 78.1; 87.5) and a 100% specificity (95% CI: 98.2; 100).

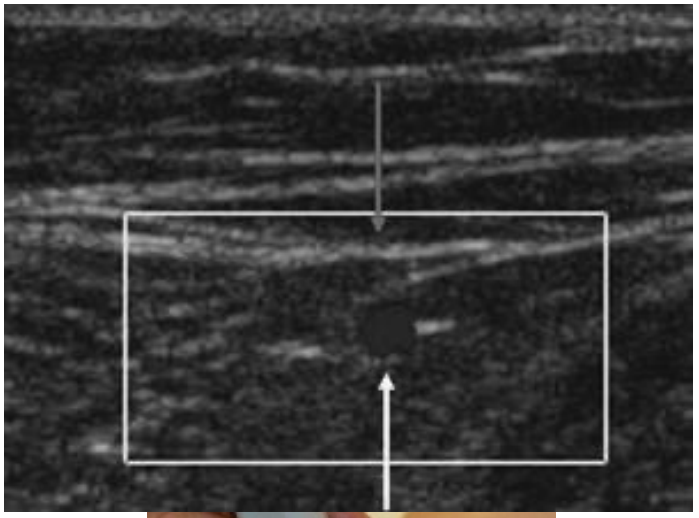


US confirmation of early and late complications



Difficult peripheral veins (DIVA)





Pediatr Emerg Care 2001; 17: 130

Training

1. *Generic learning/training objectives*
   - Machine setting, OOP/IP, cross infections, etc.
2. *Learning & assessment methods for generic competencies*
   - Assessment and certification of competencies, etc.
3. *Specific learning/training objectives*
   - Assessment and certification of specific competencies (i.e. diagnosis of complications)
4. *Training & assessment methods*
   - Observing procedures, performing under supervision, maintaining competencies, etc.
5. *Performance indicators*
   - Success rate, complications rate, patient's satisfaction, etc.
6. *Criteria for defining an expert trainer*
   - Independent practice, certified as instructor, etc.

Training

3. Training & assessment methods

To be eligible for completion of competency-based training in paediatric US-guided vascular access the practitioner should have performed:

30 US guided vascular access procedures of any type in a **12 months period**.

6. Criteria for defining an expert trainer in US guided vascular access

For paediatric practice, **should meet relevant national criteria for maintaining practice privileges as specialist paediatric anaesthesiologist in children from the relevant age group (neonate, infant, toddler, older child)**

Conclusions

PERSEUS guidelines recommend:

- US-guided cannulation for ”ALL” central venous access in children is no more questionable
- BCV as a suitable approach in neonates and infants
- The use of US-guided for elective arterial line cannulation
- US-guided access performed by “experienced hands”
- Maintenance of competencies on an outcome-based model