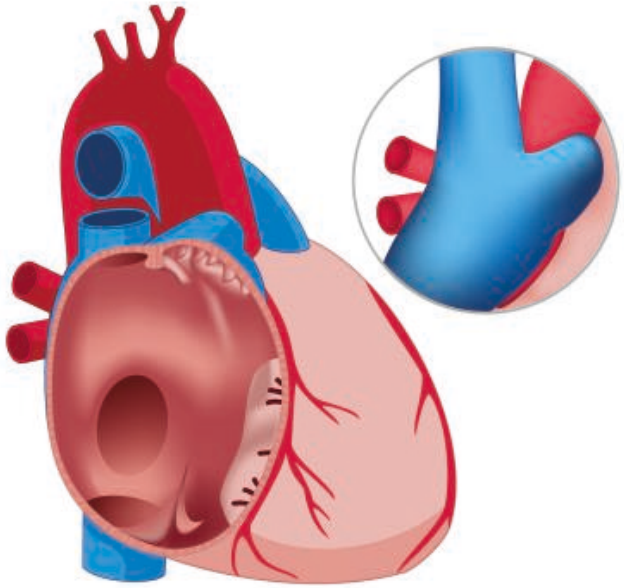


Azienda Ospedaliera di Rilievo Nazionale
SANTOBONO PAUSILIPON

GAVePed
Gruppo Accessi Venosi Pediatrici

ECHOTIP nel bambino
Il protocollo ECHOTIP-Ped

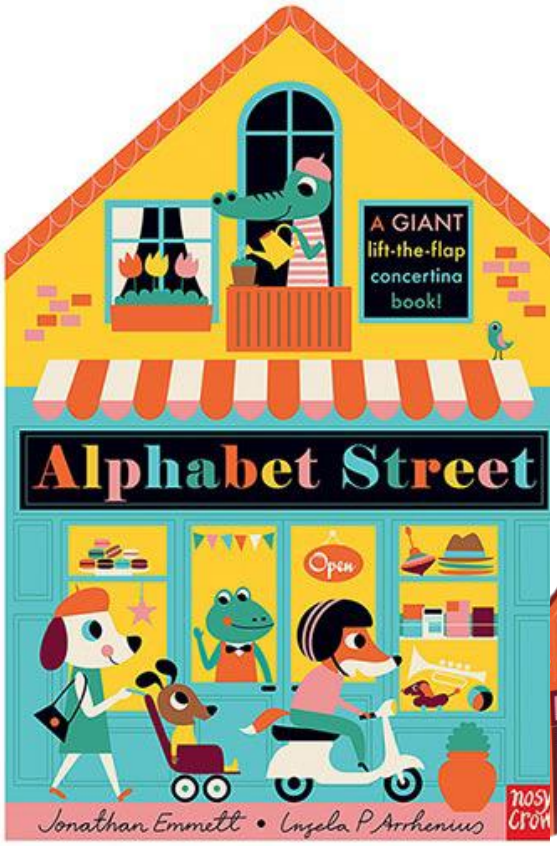
Geremia Zito Marinosci
Terapia Intensiva Pediatrica
AORN SANTOBONO-PAUSILIPON Napoli

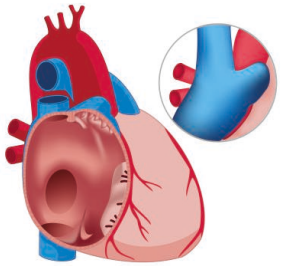
GAVePed
Gruppo Accessi Venosi Pediatrici

ECHOTIP

The Alphabet Street

Global Use

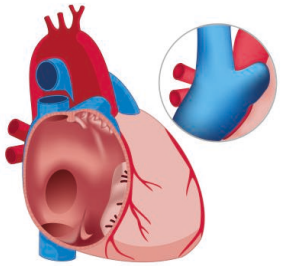




ECHOTIP-Ped

2021

ECHOTIP-Ped: A structured protocol for ultrasound-based tip navigation and tip location during placement of central venous access devices in pediatric patients



ECHOTIP-Ped

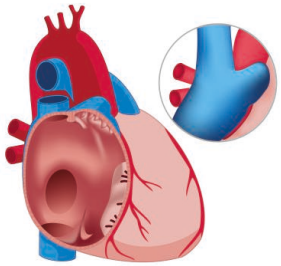
Ultrasound-based choice of the vein and ultrasound-guided venipuncture have been shown to increase the safety and the success of CVC

Ultrasound has been shown to be a reliable, fast, and accurate technique to diagnose potential life-threatening complications such as pneumothorax, hemothorax and cardiac tamponade

Interesting field of application of ultrasound:

- **'TIP NAVIGATION':** assessment that the guidewire and/or the catheter are threaded in the right direction inside the vasculature.

- **'TIP LOCATION':** verification that the tip of the central venous access device is in the proper final position i.e., in the proximity of the cavo-atrial junction



ECHOTIP-Ped

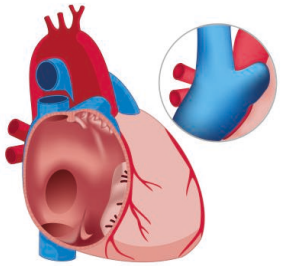
TAKE A PEEK AT THE TIP

You Cannot See Properly on Chest X-Rays:

Standard radiologic imaging is, at least superfluous.
Chest x-ray is not absolutely safe, since it implies x-ray exposure.

Chest x-ray is not really accurate; in fact, since the cavo- atrial junction (CAJ) cannot be directly identified at chest x-ray , the correct placement of the catheter tip is estimated indirectly on the basis of radiological landmarks

Such landmarks are largely unreliable, since MR studies have shown a high degree of variability in the length of the lower third of the superior vena cava and in its relationship with the surrounding structures



ECHOTIP-Ped

TAKE A PEEK AT THE TIP

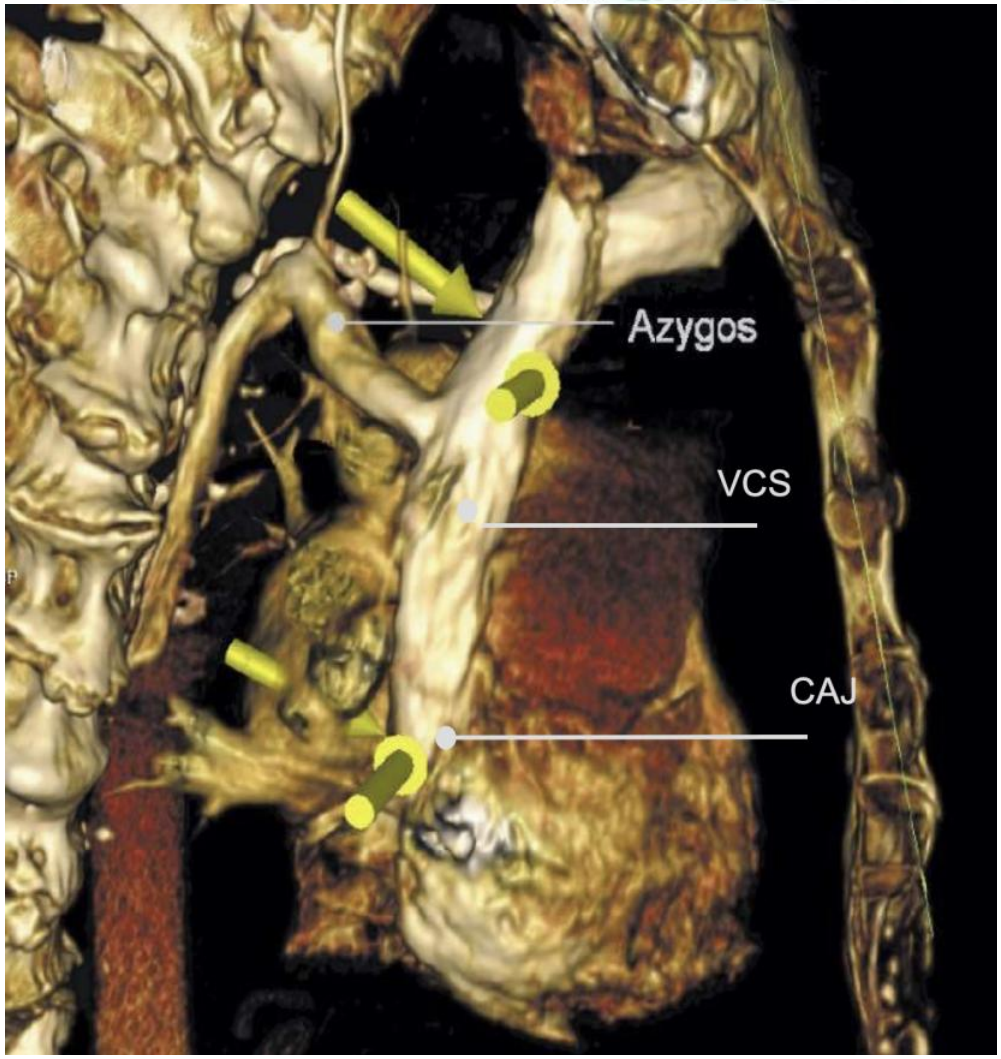
You Cannot See Properly on Chest X-Rays:

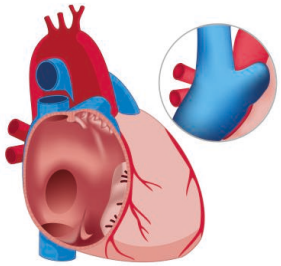
La vena cava superiore si impianta dorsalmente e non cranialmente sull'atrio destro, tra terzo medio e terzo prox. dell'atrio stesso e tangenzialmente ad esso

La punta di cateteri con punta ben posizionata all'imbocco in sede giunzionale appare sul radiogramma proiettata all'interno dell'ombra cardiaca.

A Study of the Relationship of the Superior Vena Cava to the Bony Landmarks of the Sternum in the Supine Adult: Implications for Magnetic Guidance Systems

Antonia A. Claasz, BSc (Hons), PhD, and Don P. Chorley





ECHOTIP-Ped

TAKE A PEEK AT THE TIP

JVA
ISSN 1129-7298

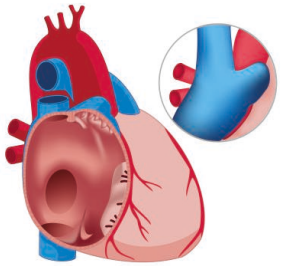
J Vasc Access 2015; 16 (2): 137-143
DOI: 10.5301/jva.5000281

ORIGINAL ARTICLE

The intracavitary ECG method for positioning the tip of central venous access devices in pediatric patients: results of an Italian multicenter study

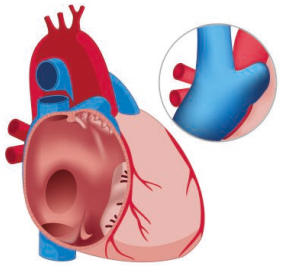
Francesca Rossetti[1], Mauro Pittiruti[2], Massimo Lamperti[3], Ugo Graziano[4], Davide Celentano[5], Giuseppe Capozzoli[6]

[1] Department of Anesthesia, Children's Hospital 'Meyer', Firenze - Italy
[2] Department of Surgery, Catholic University Hospital, Roma - Italy
[3] Department of Neuroanesthesia, Neurological Institute 'Besta', Milano - Italy
[4] Department of Surgery, Children's Hospital 'Santobono', Napoli - Italy
[5] Pediatric Intensive Care Unit, Catholic University Hospital, Roma - Italy
[6] Department of Anesthesia and Intensive Care, Ospedale Civile di Bolzano, Bolzano - Italy



ECHOTIP-Ped

STUDY	SAMPLE SIZE	PROTOCOL	PROBE	WINDOWS
LANZA 2006	107	Tip navigation Tip location + 'bubble' test	Linear Convex Convex	Short axis of neck veins Coronal view of SVC Subcostal 4-chambers view
PARK 2014	106	Tip location, no 'bubble'	Small Sectorial	Right parasternal in long and short axis
ALONSO-QUINTELA 2015	40	Tip navigation Tip location	Linear Small Sectorial Small Sectorial	Short and long axis view of IJV, SV, BCV and FV Coronal view of SVC (for CICC) Subcostal Longitudinal View of IVC (for FICC) Subcostal bi-caval or right parasternal (as alternative)
YESILBAS 2018	77	Tip location + 'bubble' test	Small Sectorial	Subcostal 4-chambers or apical 4-chambers (as alternative)
KORSTEN 2018	100	Tip location + 'bubble' test	Small Sectorial	Subcostal 4-chambers or apical 4-chambers (as alternative)
OLIVEIRA 2020	21	Tip location + 'bubble' test	Convex	Apical 4-chambers

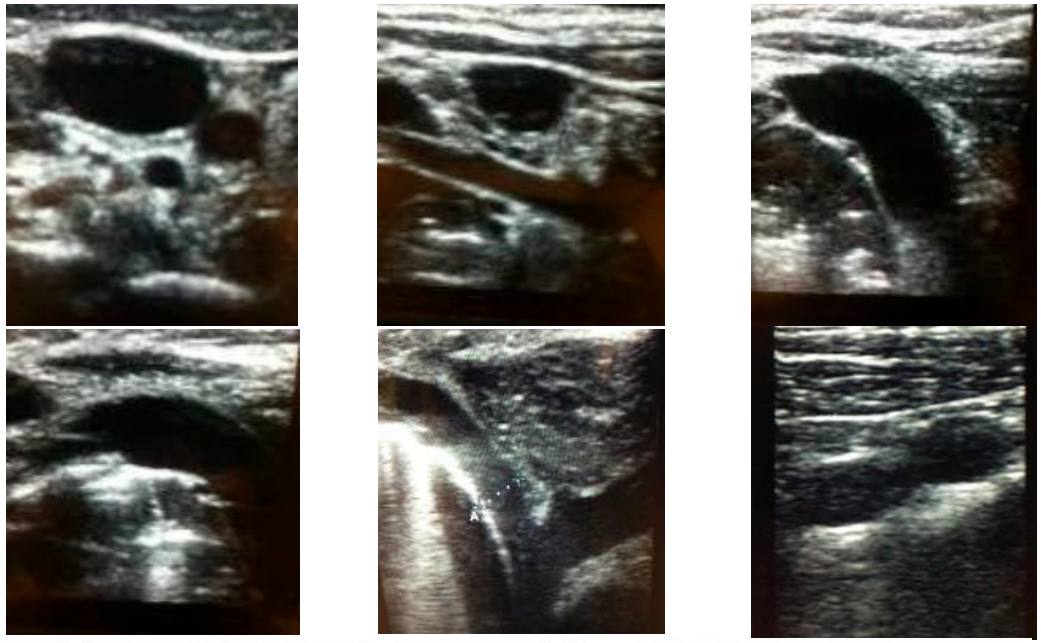


ECHOTIP-Ped

- **<u>CICC Tip Navigation Protocol</u>**:
- **Probe**: linear 'hockey-stick' probe, preferably 10-14 MHz; micro-convex probe 4-8 MHz (optional)
- **Acoustic windows.** using the same linear probe used for ultrasound-guided puncture, the supraclavicular view provides a proper visualization of the internal jugular, subclavian and brachiocephalic veins, as described in the RaCeVA protocol.
- Rule out any wrong direction of the guidewire and/or of the catheter (i.e. in the internal jugular vein after axillary venipuncture) and confirm that the guidewire and/or the catheter are directed towards the SVC. Visualization of the guidewire and/or the catheter inside the SVC is also possible using a coronal view of the SVC with a micro-convex probe 4-8 MHz
- **Procedure**: after visualization of the needle inside the vein during ultrasound-guided venipuncture, the guidewire is visualized as it passes and progresses into the brachio-cephalic vein (please note that 0.018" wires might be more difficult to visualize than 0.035" wires); the micro-introducer can also be visualized inside the vasculature; the catheter can also be easily visualized inside the brachiocephalic vein and – in small infants – even inside the SVC.

RACEVA

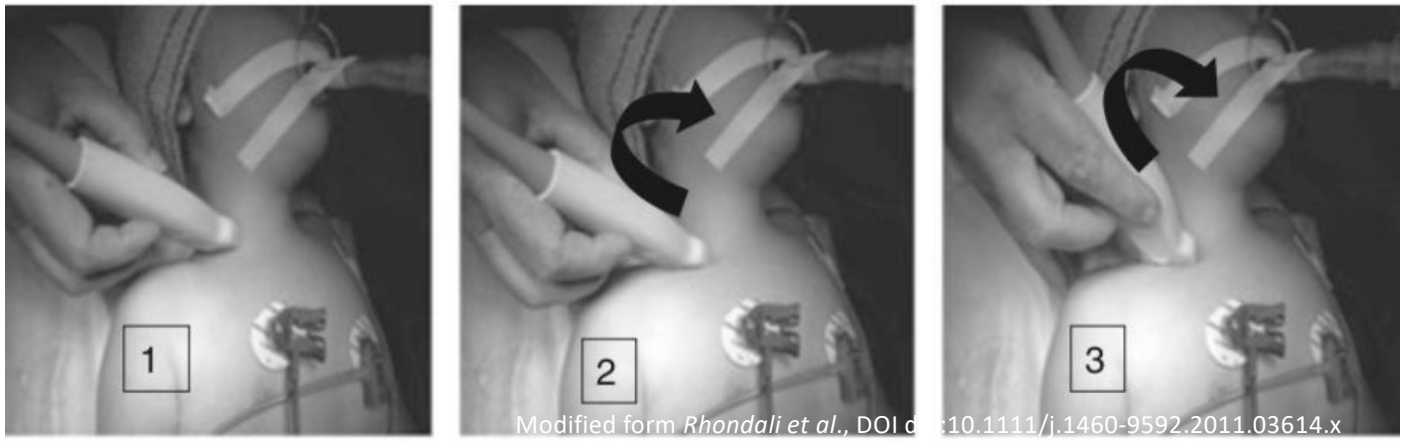
APPROPRIATE VEIN



A APPROPRIATENESS

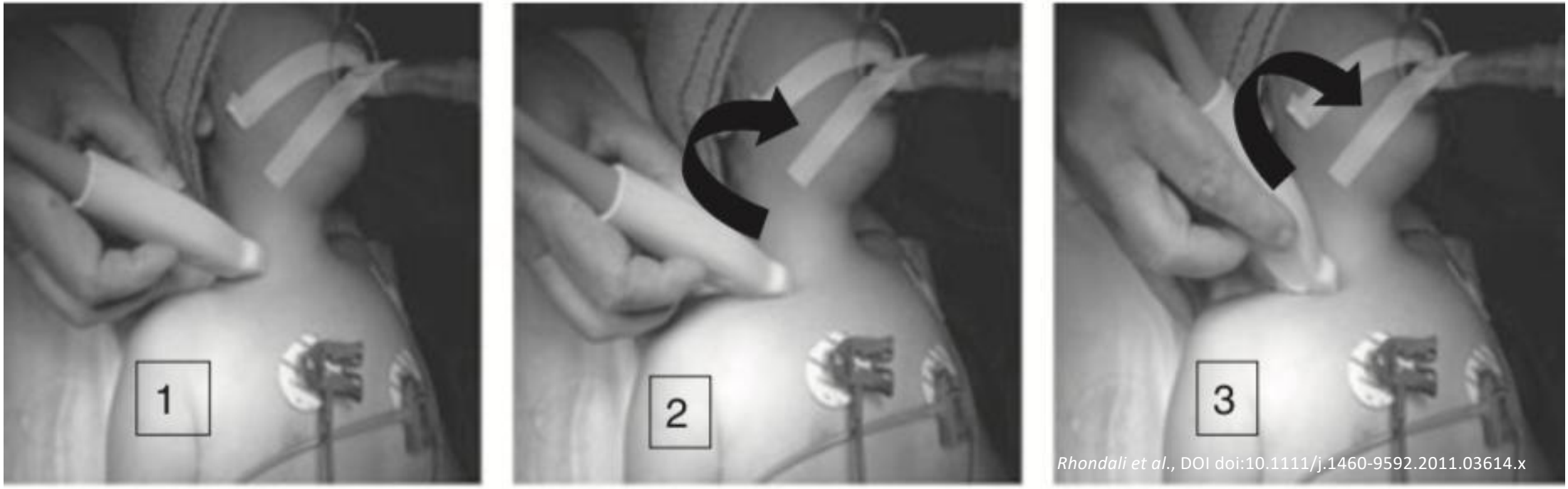
RATIONAL CHOICE

APPROPRIATE APPROACH



Modified form *Rhondali et al.*, DOI d :10.1111/j.1460-9592.2011.03614.x

Ultrasound-guided subclavian vein cannulation in infants: supraclavicular approach

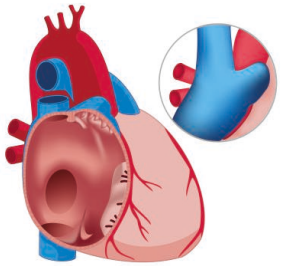


Rhondali et al., DOI doi:10.1111/j.1460-9592.2011.03614.x



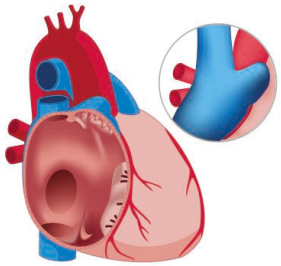
Ult **nts:**
sup


Ris
S
MB
2018Set15 10:41
Mus
HFL
89%
IM
0,7
ITT
0,1
A
B
DVD
2,7
Ris
0
Guida
MB On
Duale
Pag. 1/2



ECHOTIP-Ped

- **<u>CICC Tip location Protocol</u>**:
- **Probe**: micro-convex probe 4-8 MHz or small sectorial probe 2-8 MHz
- **Acoustic windows**: a subcostal bi-caval or 4-chambers view is recommended as first option, since this view is easy to obtain and requires minimal training; an apical 4-chambers view may be an alternative option, when subcostal visualization of the heart is not obtained.
- **Procedure**: as the catheter has entered the SVC and is in the proximity of the CAJ, a quick flush of saline (2 or 5 ml) is injected, so to confirm the location of the tip: the flush of saline arriving in the RA is visualized as a sudden cloud of ‘bubbles’, coming from the tip of the catheter; even if the tip of the catheter is not directly visualized, the immediate appearance of the bubbles soon after injection proves that the tip is in the proximity of the CAJ

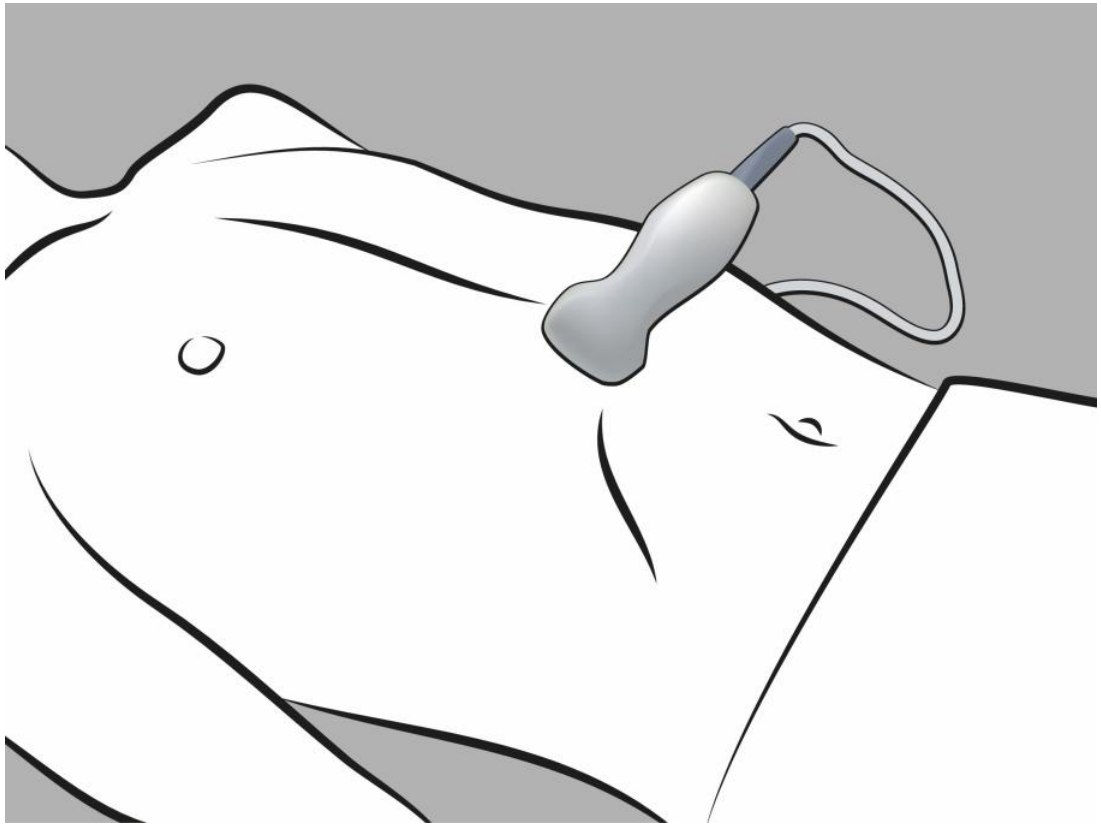


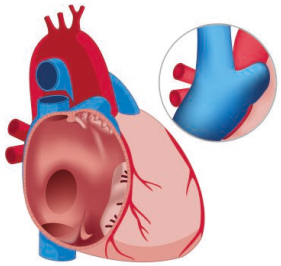
ECHOTIP-Ped

Cardiac Imaging

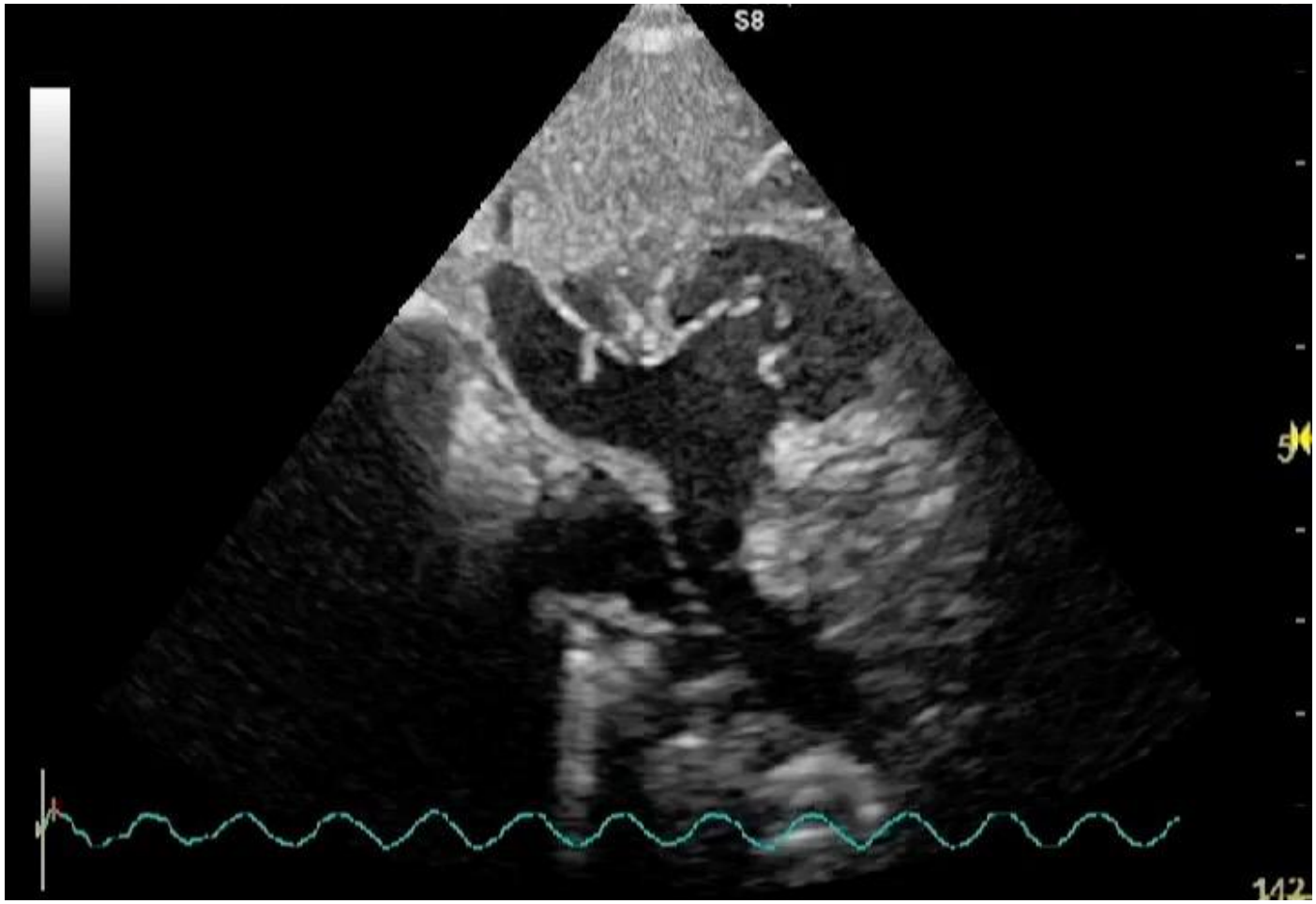
Echocardiography

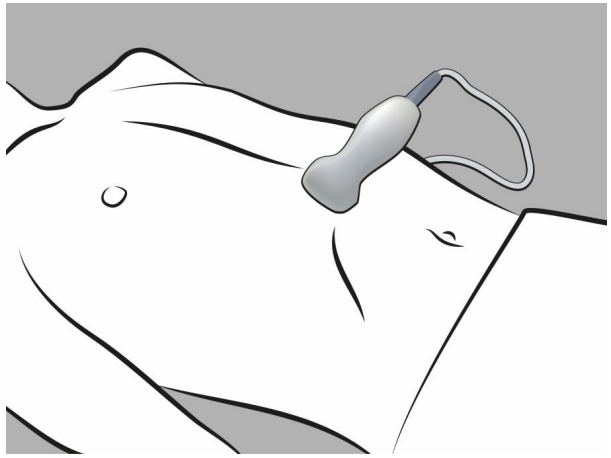
Subcostal Bicaval



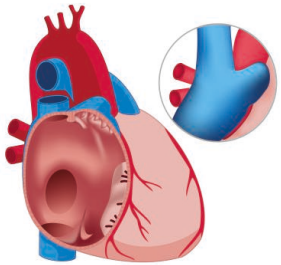


ECHOTIP-Ped

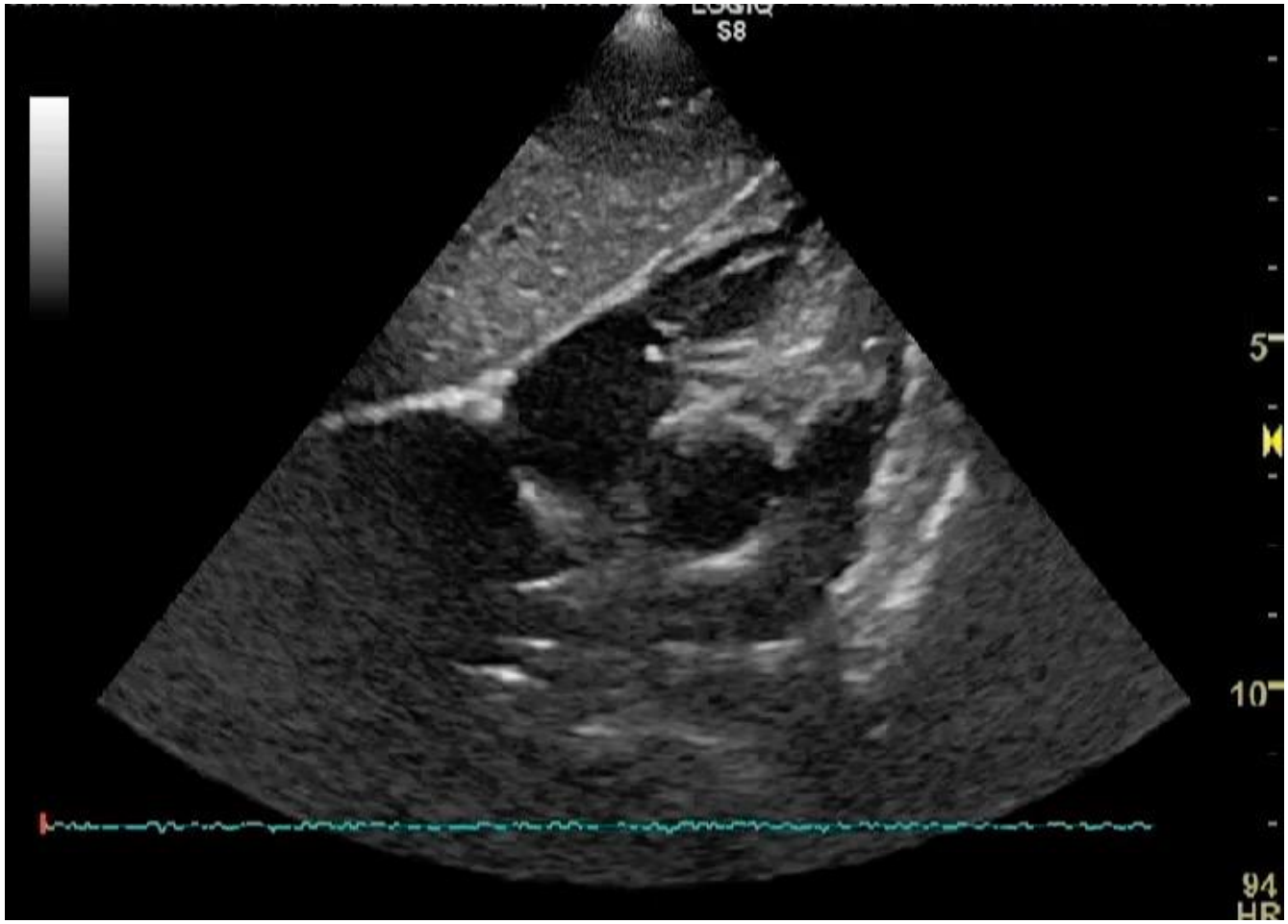


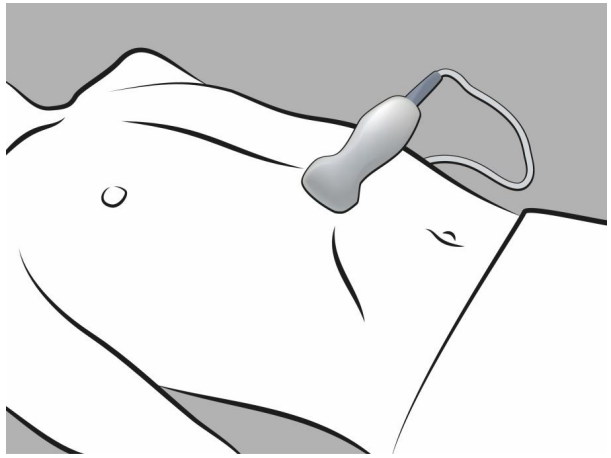


Subcostal Bicaval

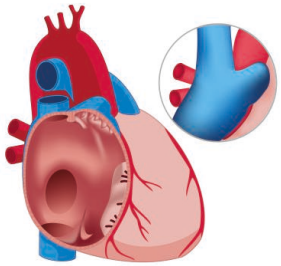


ECHOTIP-Ped

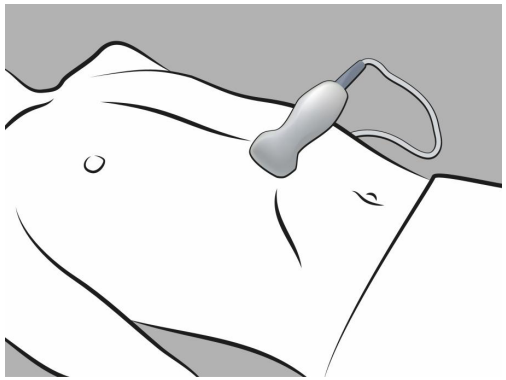




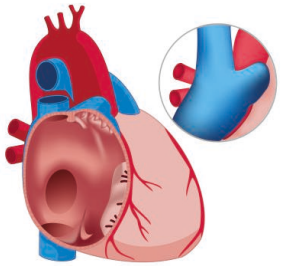
Subcostal Bicaval



ECHOTIP-Ped



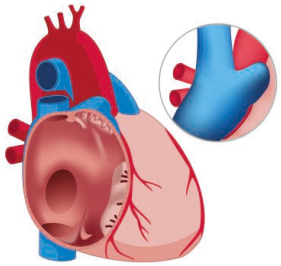
Subcostal 4C



ECHOTIP-Ped

PICC

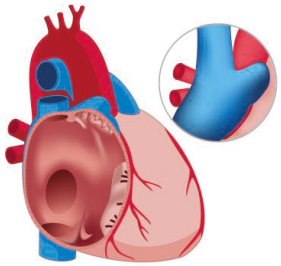
- **ECHOTIP-Ped protocol for PICC insertion:**
- Tip Navigation Protocol:
- **Probe**: linear hockey-stick probe 10-14 MHz; micro-convex probe 4-8 MHz (optional)
- **Acoustic windows**: same windows as described in RaPeVA and RaCeVA the deep veins of the arm up to the axilla, the axillary vein in the infraclavicular area, as well as the subclavian, the internal jugular and the brachiocephalic veins in the supraclavicular area are all easily visualized, with the same linear probe used for venipuncture: this will confirm the proper direction of wires and catheters, ruling out any wrong direction, for example into the ipsilateral internal jugular vein. The confluence between the two brachiocephalic veins and the SVC can also be visualized with a suprasternal/supraclavicular coronal view using a micro-convex probe 4-8 MHz (optional).
- **Procedure** After venipuncture, the presence of the guide wire inside the brachial tract of the axillary vein can be assessed with the linear probe; with this same probe, the operator can visualize the trajectory of the catheter into the thoracic tract of the axillary vein (infraclavicular view), and then into the subclavian vein and the ipsilateral brachiocephalic vein (supraclavicular view), ruling out misdirection to the ipsilateral internal jugular vein. A coronal view of the SVC – using the micro-convex probe – may allow to visualize the catheter inside the SVC, ruling out its misdirection into the contralateral brachiocephalic vein



ECHOTIP-Ped

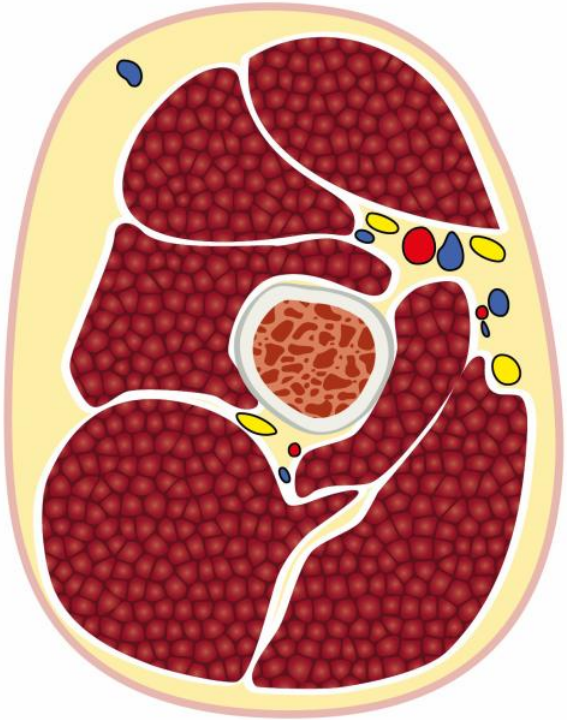
PICC

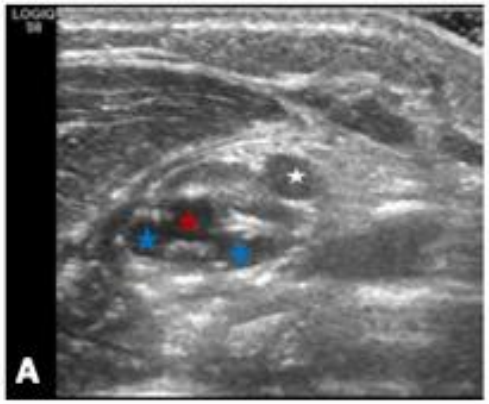
- **ECHOTIP-Ped protocol for PICC** Tip location:
- **Probe**: micro-convex probe 4-8 MHz, or small sectorial probe 2-8 MHz
- **Acoustic windows**: a subcostal bi-caval or 4-chambers view is recommended as first option, since this view is easy to obtain and requires minimal training; an apical 4-chambers view may be a secondary option, when subcostal visualization of the heart is not obtained.
- **Procedure**: as the catheter has entered the SVC and is in the proximity of the CAJ, a quick flush of saline (2 or 5 ml) is injected, so to confirm the location of the tip: the flush of saline arriving in the RA is visualized as a sudden cloud of 'bubbles', coming from the tip of the catheter; even if the tip of the catheter is not directly visualized, the immediate appearance of the bubbles soon after injection proves that the tip is in the proximity of the CAJ

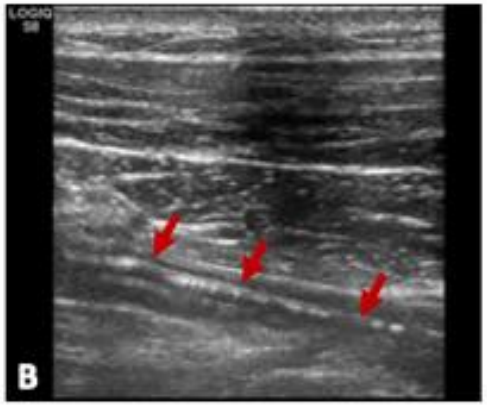


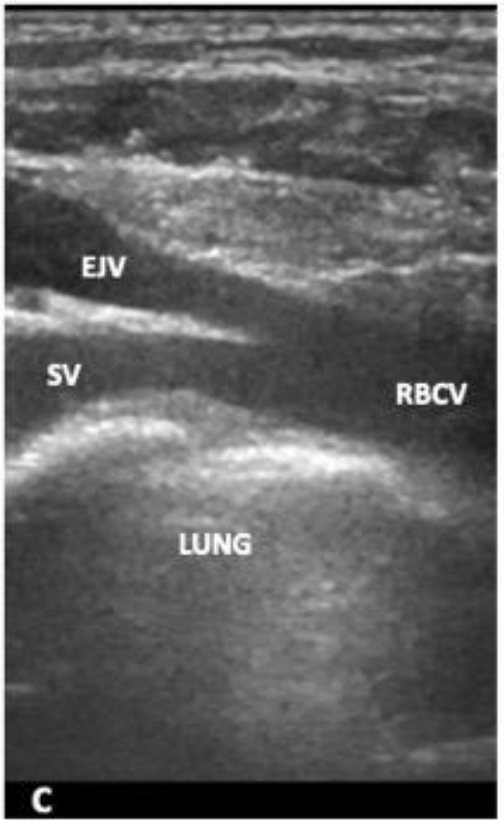
ECHOTIP-Ped

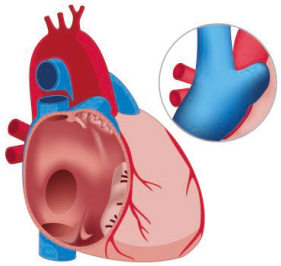
PICC







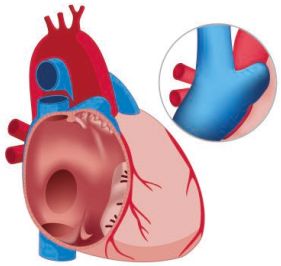




ECHOTIP-Ped

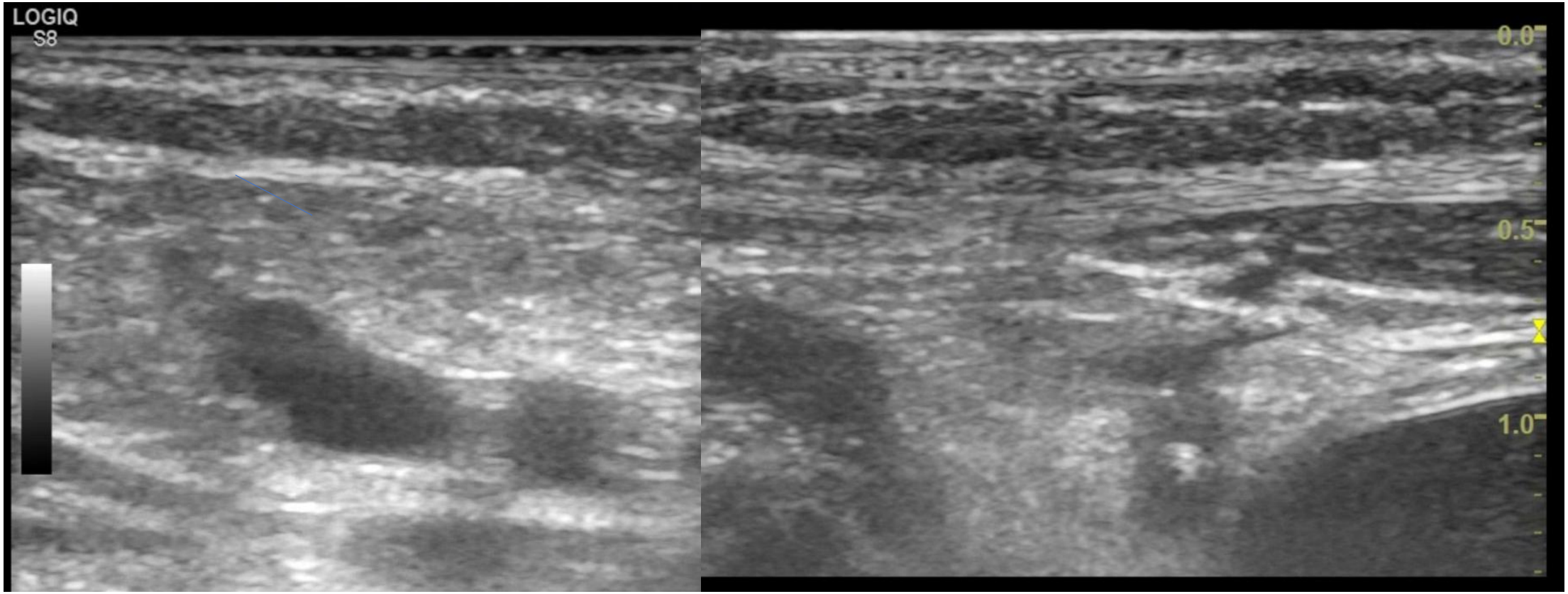
FICC

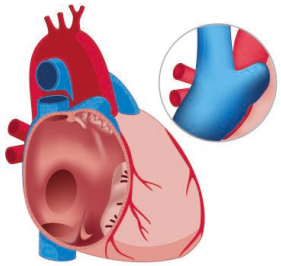
- **ECHOTIP-Ped for FICC insertion:**
- Tip Navigation Protocol:
- **Probe**: linear hockey-stick probe 10-14 MHz; micro-convex probe 4-8 MHz (optional)
- **Acoustic windows**: short and long axis view of the common femoral vein; long axis view of the external iliac vein.
- **Procedure**: After venipuncture, the guide wire is visualized inside the common femoral vein and inside the external iliac vein, using a long axis view. The progression of the catheter from the common femoral vein towards the external iliac vein can be assessed with the linear probe. In small children, the trajectory of the catheter inside the inferior vena cava (IVC) can also be assessed using the micro-convex probe, visualizing the IVC in transverse and longitudinal view at the level of the umbilicus.



ECHOTIP-Ped

FICC

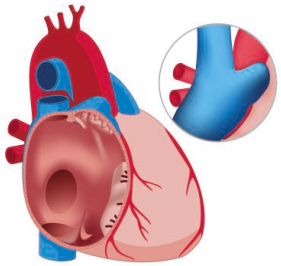




ECHOTIP-Ped

FICC

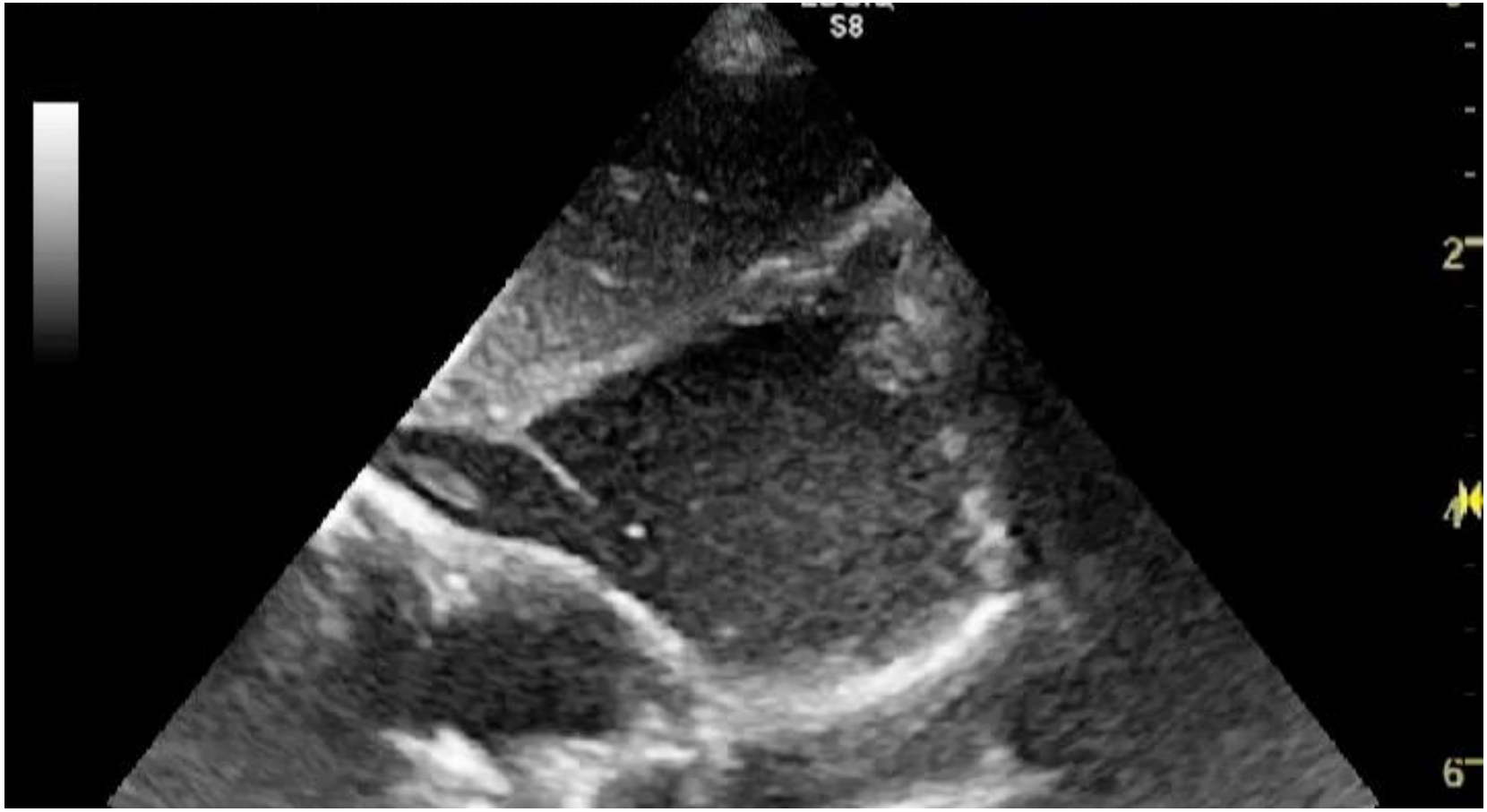
- **ECHOTIP-Ped for FICC TIP Location**
- **Probe**: micro-convex 4-8 MHz probe
- **Acoustic windows**: short and long axis view of the IVC above the confluence of the common iliac veins, below the confluence of the hepatic veins; a subcostal bi-caval view is recommended to visualize the junction between IVC and the RA, above the confluence of the hepatic veins.
- **Procedure**: a quick flush of saline (2 or 5 ml) is injected, so to confirm the position of the tip: the immediate appearance of the bubbles of injected saline in the IVC allows to confirm that the tip is inside this vein, while a delayed appearance of the bubbles indicates that the tip is still far from the confluence of the iliac veins. The appearance of the bubbles in the RA immediately after injection confirms that the catheter tip is at the junction between IVC and right atrium, above the confluence of the hepatic veins

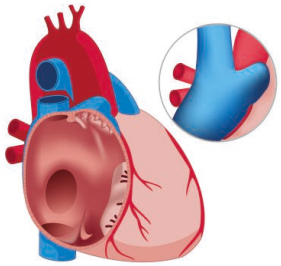


ECHOTIP-Ped

FICC

- ECHOTIP-Ped for FICC TIP Location

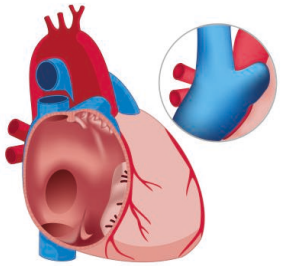




ECHOTIP-Ped

ECHOTIP-Ped Protocol

CVC	Protocol	Probe	Windows
CICC	Tip navigation	linear 'hockey stick' probe, 10-14 MHz	Same acoustic windows as RaCeVA
	Tip location	micro-convex probe, 4-8 MHz, or small sectorial probe, 2-8 MHz	Subcostal bi-caval view (recommended) or 4-chambers apical view (as alternative option)
PICC	Tip navigation	linear 'hockey stick' probe, 10-14 MHz	Same acoustic windows as RaPeVA and RaCeVA
	Tip location	micro-convex probe, 4-8 MHz, or small sectorial probe, 2-8 MHz	Subcostal bi-caval view (recommended) or 4-chambers apical view (as alternative option)
FICC	Tip navigation	linear 'hockey stick' probe, 10-14 MHz, or micro-convex probe, 4-8 MHz	Short + long axis views of the femoral vein and external iliac vein; and short + long axis views of IVC
	Tip location	micro-convex probe, 4-8 MHz	Subcostal longitudinal view of the IVC



ECHOTIP-Ped

ECHOTIP-Ped Protocol