



GUIDELINE

Central Line Imaging in Neonates: Radiographic Views, and Acceptable Line Positions

Scope (Staff):	Nursing and Medical Staff
Scope (Area):	NICU KEMH, NICU PCH, NETS WA

Child Safe Organisation Statement of Commitment

CAHS commits to being a child safe organisation by applying the National Principles for Child Safe Organisations. This is a commitment to a strong culture supported by robust policies and procedures to reduce the likelihood of harm to children and young people.

This document should be read in conjunction with this [disclaimer](#)

Radiographic Views:

Table 1: Views and patient positioning for imaging of central lines in neonatal patients.

		AP	Dorsal decubitus
UVC/ UAC	At initial insertion	X (CXR/AXR)	X (CXR/AXR)
	Follow-up	X	
	Positioning	Legs straight/ arms above head	Legs straight/ arms above head
Arm PICC	At initial insertion	X	
	Follow-up	X	
	Positioning	Both shoulders abducted to 30°	
Scalp PICC/ internal jugular CVC	At initial insertion	X	
	Follow-up	X	
	Positioning	Chin and head neutral	
Lower limb PICC/ femoral CVC	At initial insertion	X	X
	Follow-up	X	
	Positioning	Frog leg position	Frog leg position

NB. If there is a question of line position on a single view, a further view should be requested.

Two views / lateral view

There are occasions when 2 radiographic views/ an additional lateral view are helpful in determining line position.

This is especially true for lower limb PICCs when a lateral view may more easily reveal an aberrant course e.g. lines in spinal veins.

A lateral view is also useful for UVC placement as it gives a more accurate view of the IVC/RA junction and shows lines which are intrahepatic more clearly.

A second view for any type of line may also reveal coiled/ turned lines, clues that the line is erroneously arterial and may show difficult to visualise lines better.

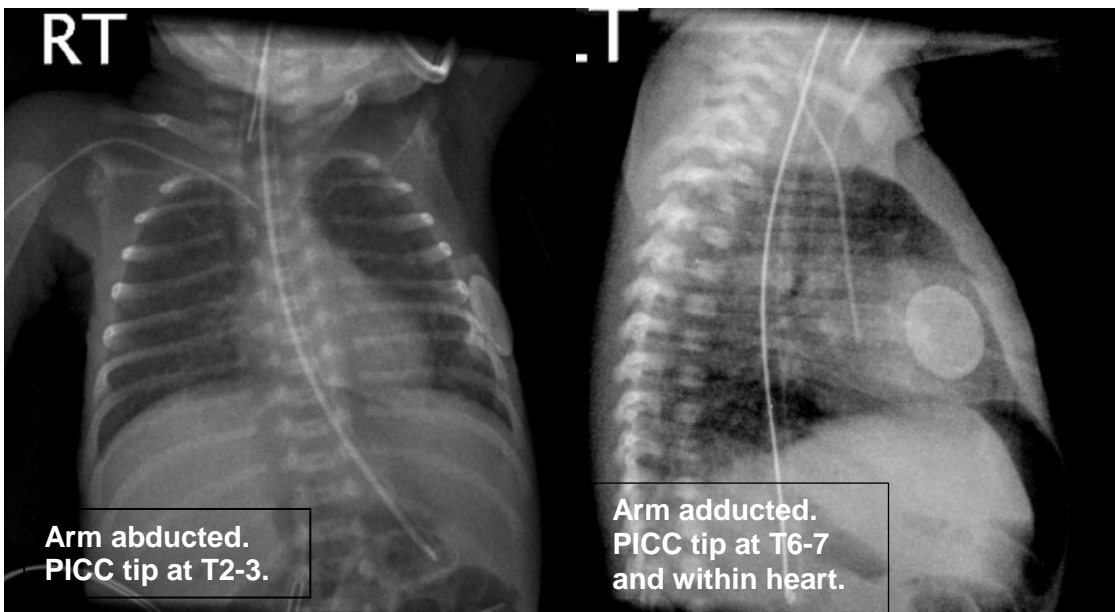
If there is ever any doubt of line tip positioning, a further view should be taken.

Limb positioning

Upper limb PICCs:

It has been shown that upper limb PICC line tips can move up to 2-3 vertebral bodies on abduction/ adduction of the arm (see figure 1).

Figure 1: Example of how line tip moves depending upon whether arm is abducted or adducted in upper limb PICCs.



The direction of tip movement depends upon which arm vein of the line has been inserted into (see table 2).

Table 2: Movement of line tips depending upon the vein of insertion.

	Basilic	Cephalic	Axillary
Shoulder adduction	Toward heart	Away from heart	Toward heart
Shoulder abduction	Away from heart	Toward heart	Away from heart
Elbow flexion	Toward heart	Toward heart	No effect
Elbow extension	Away from heart	Away from heart	No effect

Lower limb PICCs

The tips of lower limb PICCs move deeper upon hip flexion.

For the above reasons, radiographs for PICC line placement should be taken with the infant’s limbs in the position that they will be in for most of the day (see [table 1](#)).

Line Positioning – Ideal and Acceptable Positions

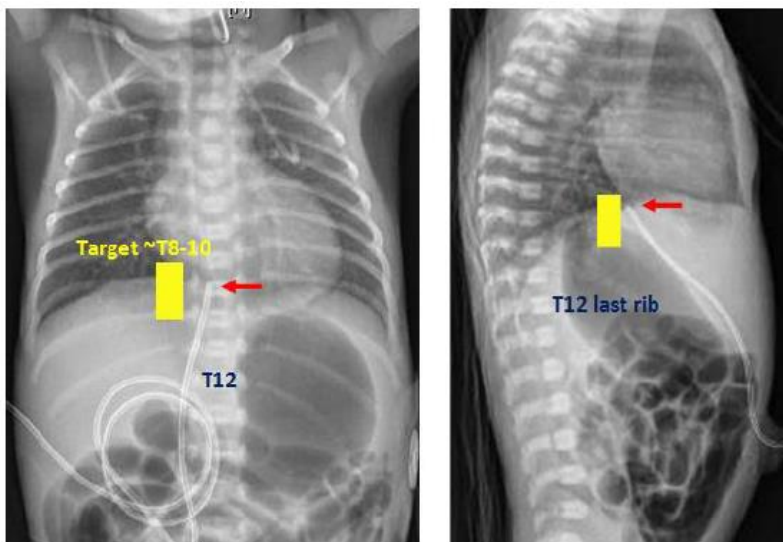
Table 3: Ideal and acceptable central line tip positioning in neonates.

	Ideal position	Notes
UVC	T8-T9, outside of the cardiac silhouette	Lines with tips in the ductus venosus can be used (~T10). Intracardiac (higher than ~T7) lines should be pulled back. Lines with tips in the liver should not be used. Lines may be pulled back 1-2cm to a low lying level and used until alternative access is gained within 24-48hrs. In order to use, it is essential that the line bleeds back and flushes easily.
UAC	T6-T9 (preferable) L3-L4 (acceptable)	Low lying lines more likely to cause vascular compromise. Monitor lower limbs and buttocks closely.
Upper limb PICC	T4-T5, at level/ 1 vertebral body below carina, outside of the cardiac silhouette	Lines with tips in brachiocephalic/ subclavian veins can be used. Lines with tips at axilla/ shoulder should not be used. These lines may be pulled back to the level of the mid-humerus and used as a peripheral line for 4-5 days until alternative access is available.

		Watch carefully for signs of infiltration.
Scalp PICC	T4-T5, outside of the cardiac silhouette	Line tips within the neck should not be used.
Lower limb PICC	T9-T10, outside of the cardiac silhouette	Lower positions may be used but avoid renal veins at L2. Lines with tips at groin should not be used. These lines may be pulled back to the level of mid-femur and used as a peripheral line for 4-5 days until alternative access is gained. Watch carefully for signs of infiltration.
Internal jugular CVC	T4-T5, outside of the cardiac silhouette	
Femoral CVC	Tip in lower IVC/ iliac vein acceptable	Line must bleed back and flush easily.
<ul style="list-style-type: none"> • Best check for line being intravascular is that it bleeds back and flushes easily. However, 1F (28G) PICC lines do not always bleed back and are stiff to flush. • Any line which has come to a stop and would not advance further should not be used. Pull back to a position where bleeds back prior to imaging. • Lines being used as 'peripheral lines' should not have hyperosmolar fluids/ vasoconstricting vasopressors through. 		

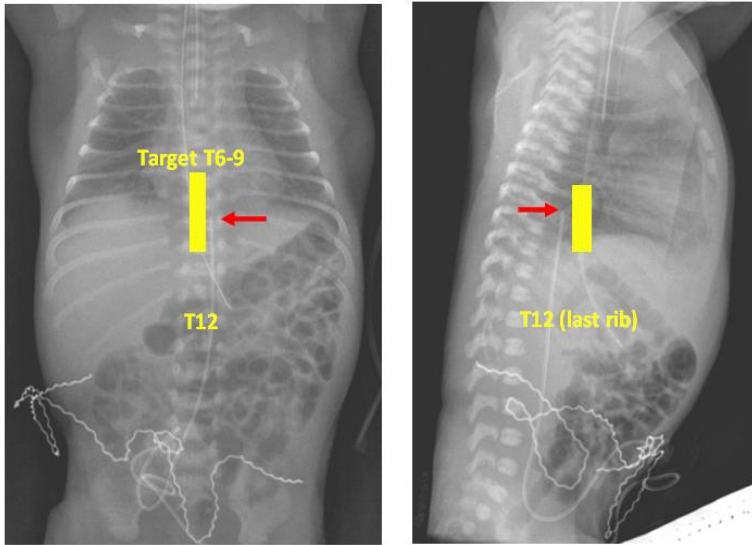
Examples of ideal line placements

UVC (ideal position):

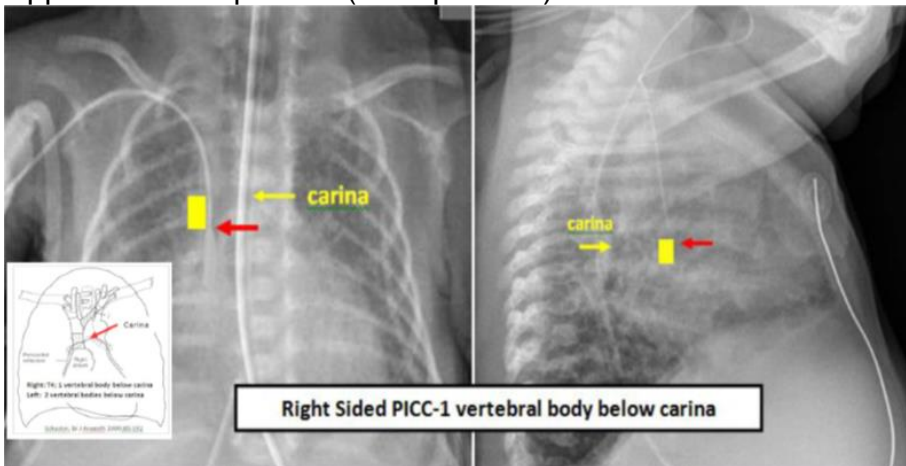


Central Line Imaging in Neonates: Radiographic Views, and Acceptable Line Positions

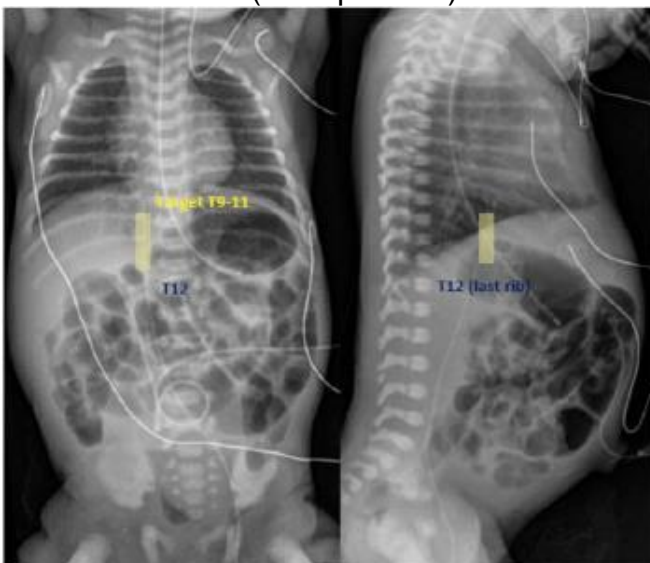
UAC (ideal position):



Upper limb/ scalp PICC (ideal position):

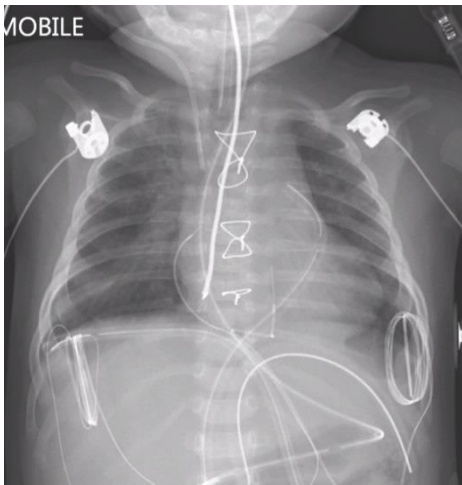


Lower limb PICC (ideal position):

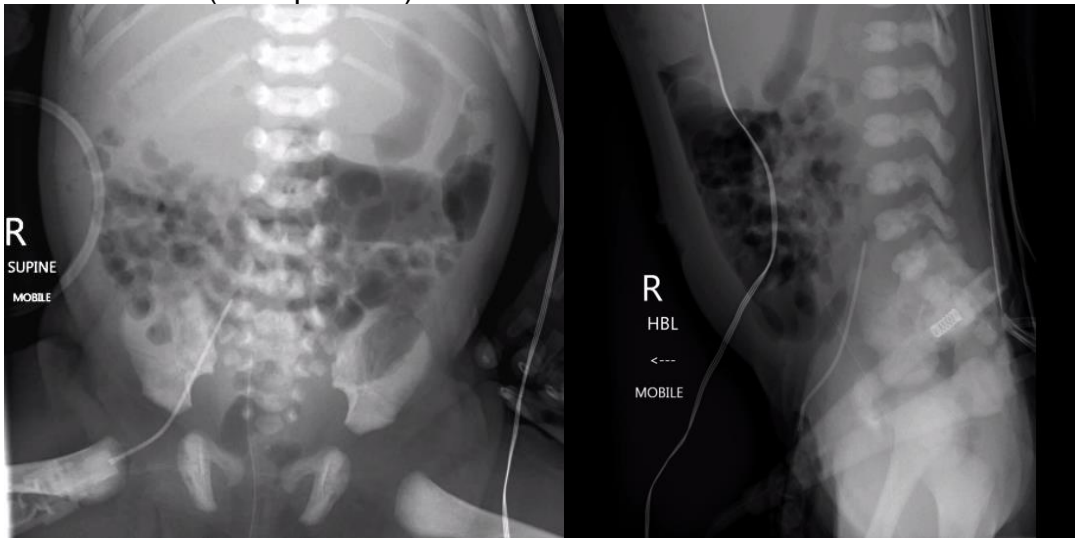


Central Line Imaging in Neonates: Radiographic Views, and Acceptable Line Positions

Internal jugular CVC (ideal position):



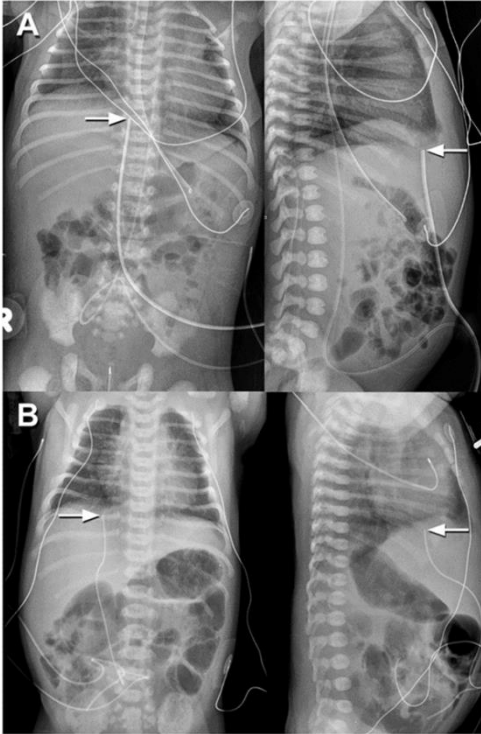
Femoral CVC (ideal position):



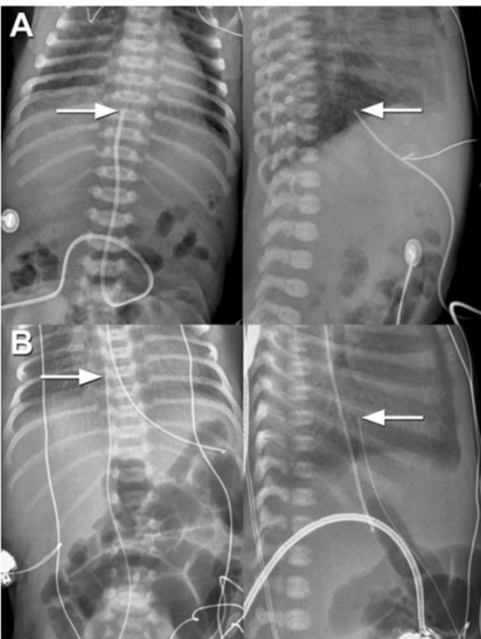
Examples of malposition lines highlighted by a second radiographic view

UVCs

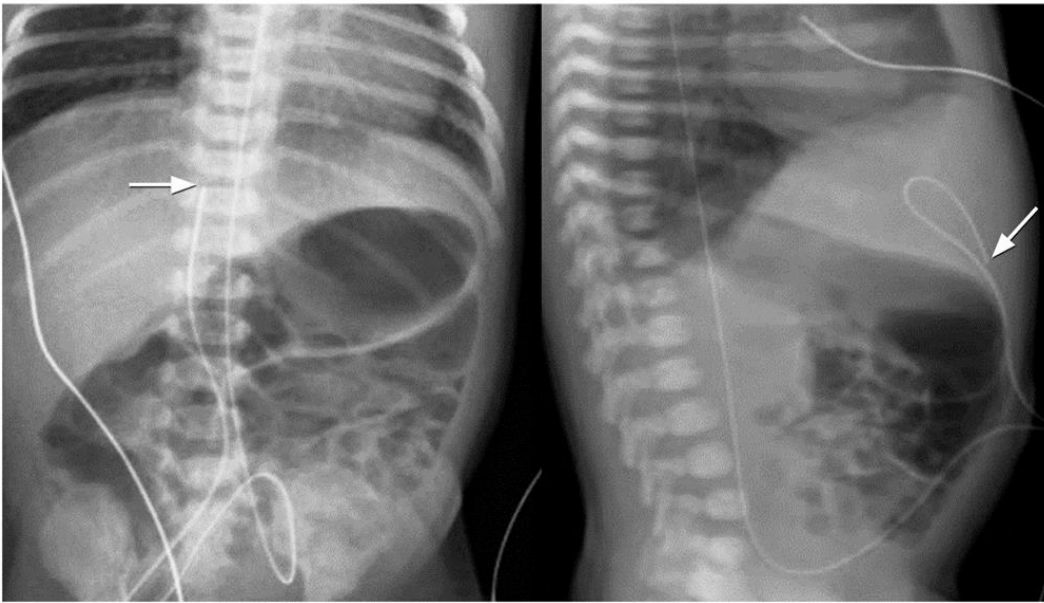
Lines which look in UVC on AP but are intraparenchymal within liver (malposition):



Diaphragm and RA/IVC junction easier to see on lateral:

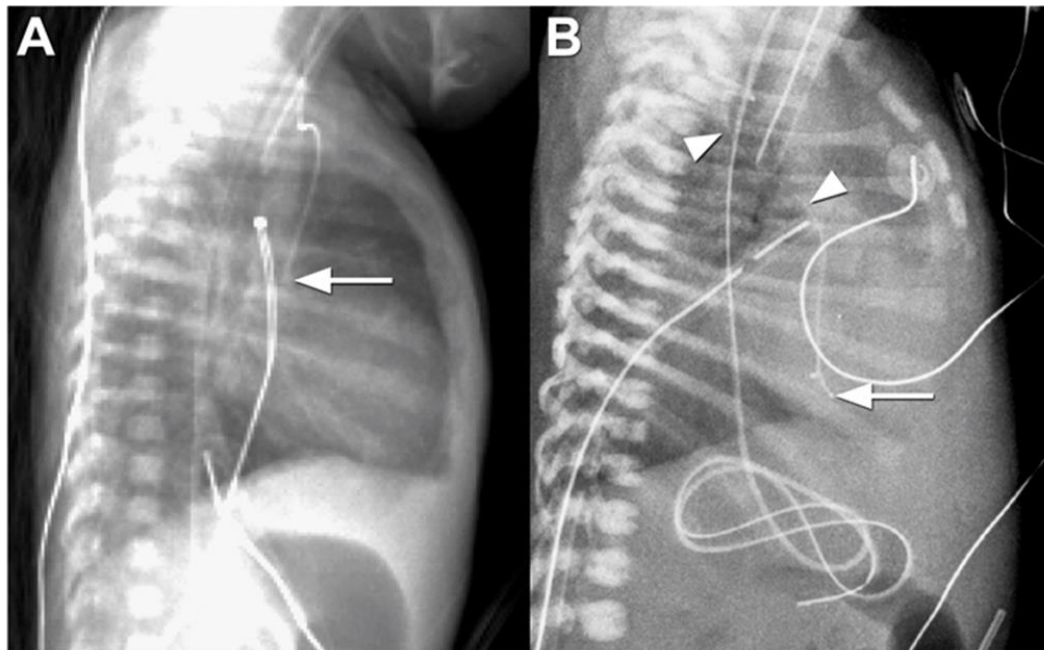


Lines which are looped/ coiled and not seen in single view:

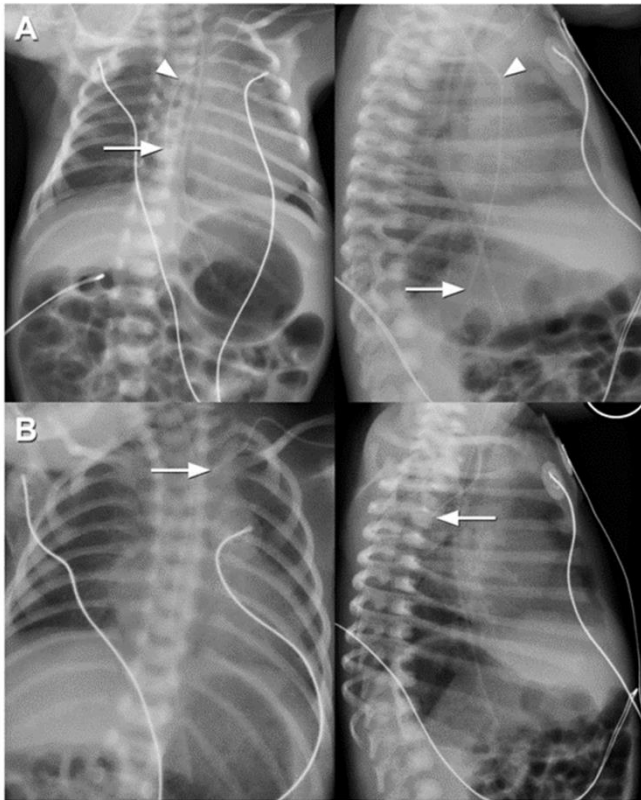


Upper limb PICCs

Posterior entrance of erroneous intra-arterial catheters (malpositioned):

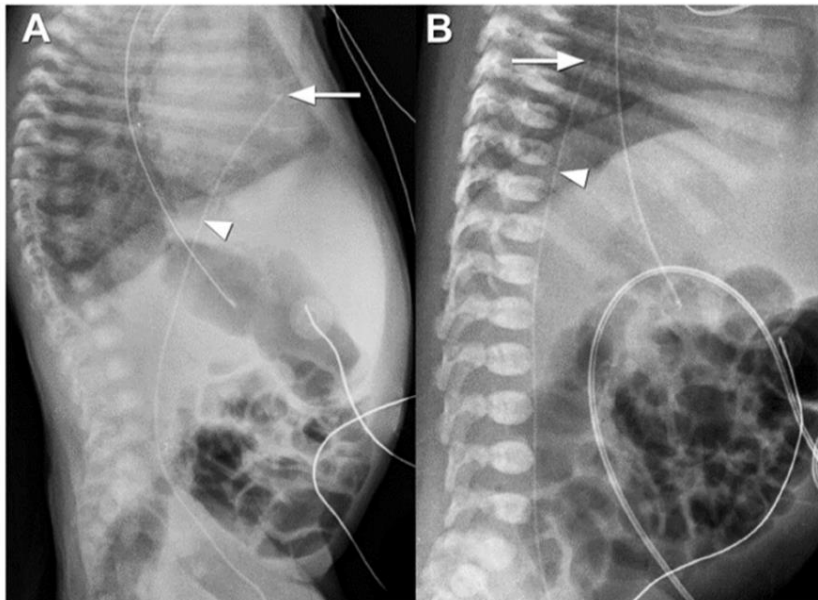


Difficult to visualise tips (malpositioned):

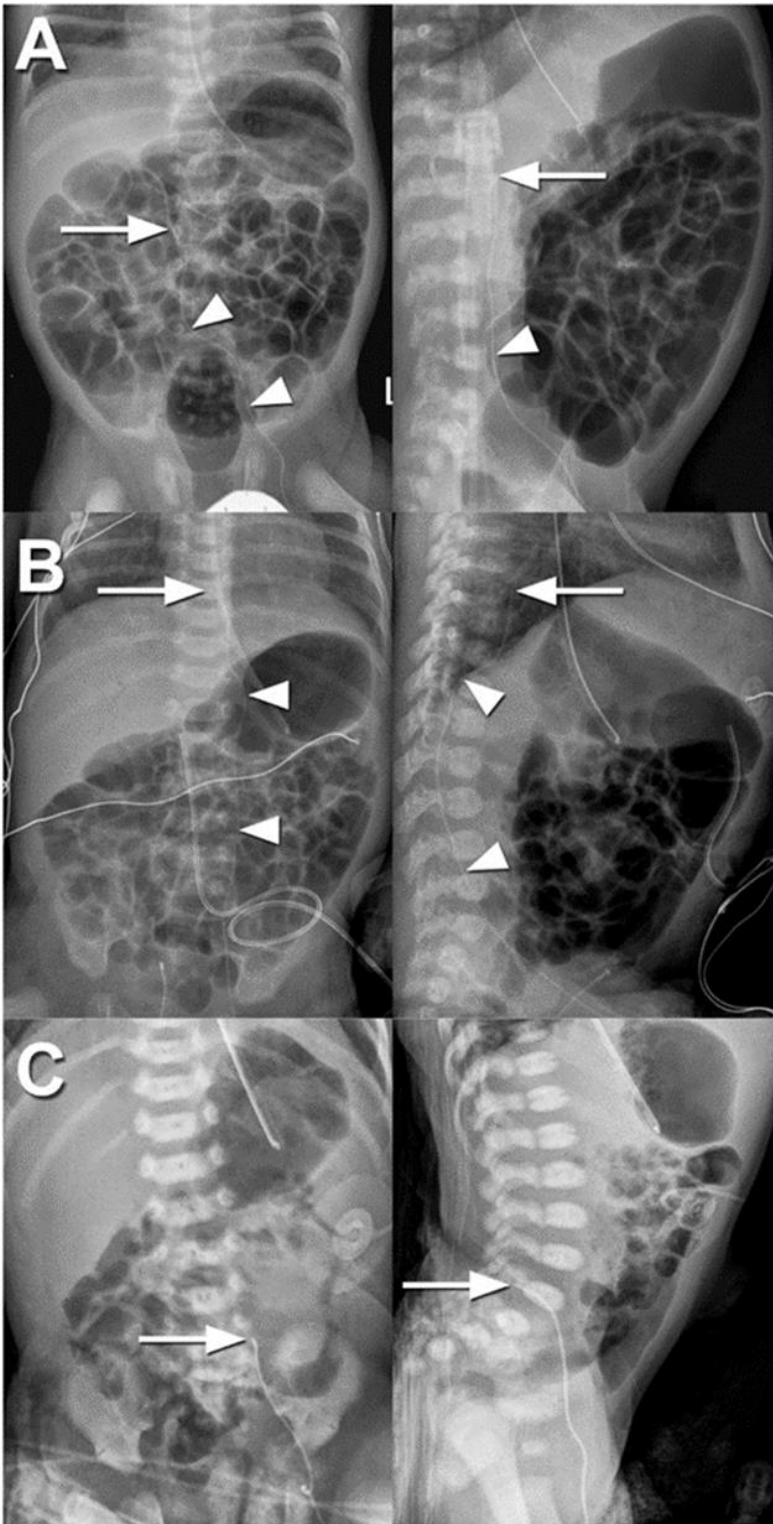


Lower limb PICCs

Normal v aberrant course:

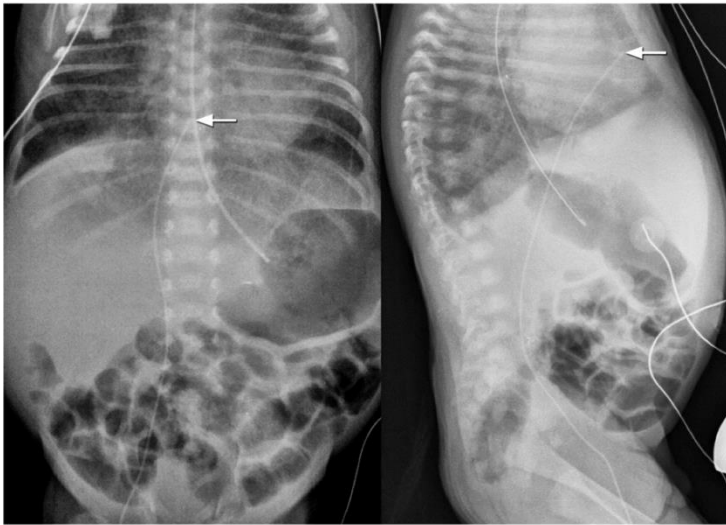


Lines in spinal veins (malpositioned):

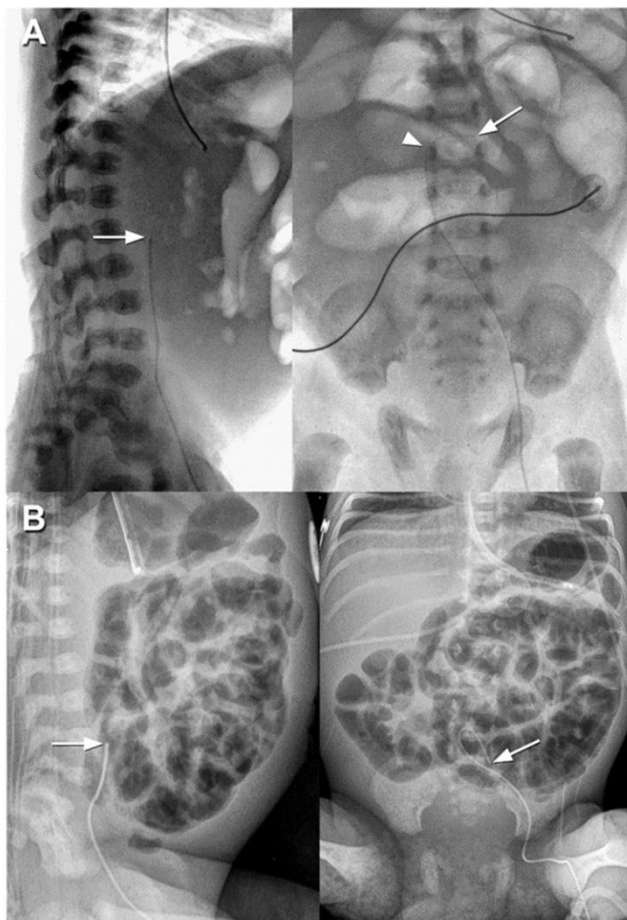


Central Line Imaging in Neonates: Radiographic Views, and Acceptable Line Positions

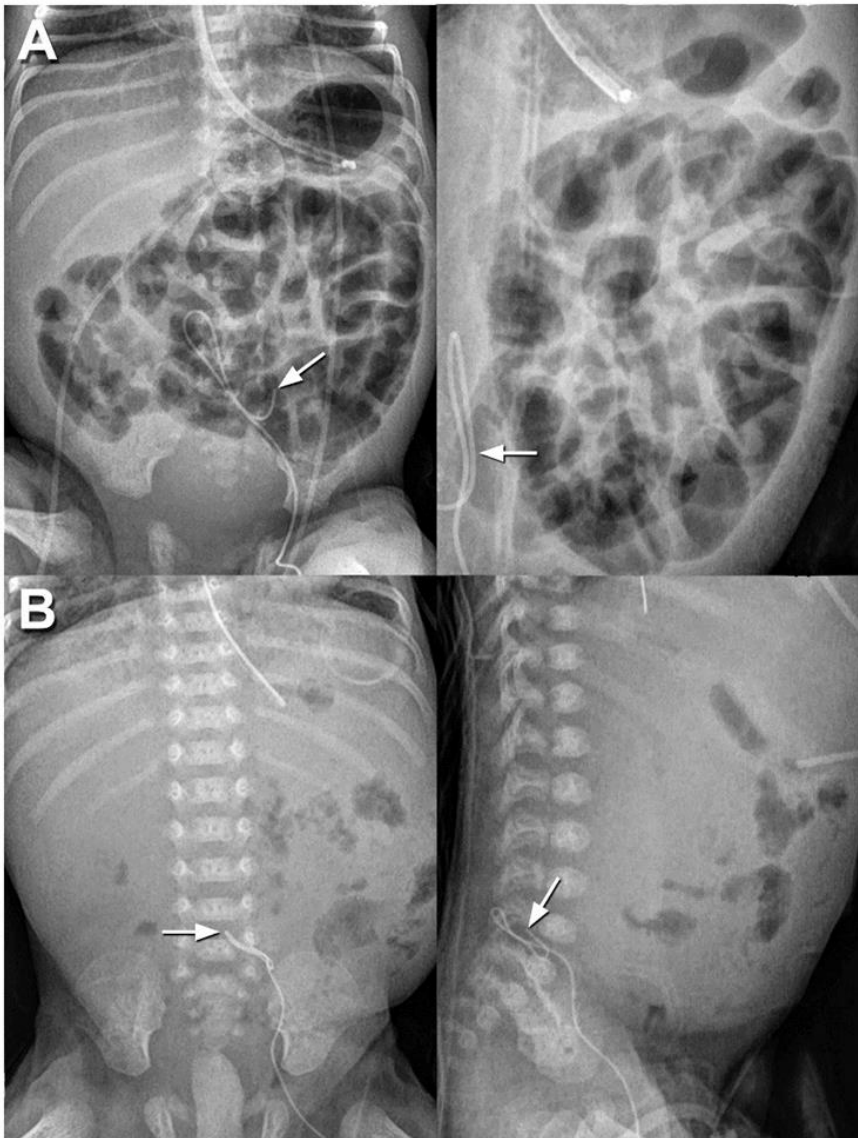
Projection (malpositioned):



Coiled/ turned lines (malpositioned):



Lateral view showing extent of malposition:



Related CAHS internal policies, procedures and guidelines

Neonatology Guidelines


- [Central Venous Access Devices \(Longlines, PICC Lines\)](#)
- [Umbilical Arterial and Venous Catheters \(UAC/UVC\) Insertion, Management and Removal](#)

References and related external legislation, policies, and guidelines

1. Pettit J. Neurologic complications from malpositioned or malfunctioning central venous catheters. *Newborn Infant Nurs Rev.* 2006(6):121-224.
2. Pettit J. Assessment of infants with peripherally inserted central catheters: Part 1. Detecting the most frequently occurring complications. *Advances in neonatal care : official*

- journal of the National Association of Neonatal Nurses. 2002;2(6):304-15.
3. Pettit J. Assessment of infants with peripherally inserted central catheters: Part 2. Detecting less frequently occurring complications. *Advances in neonatal care : official journal of the National Association of Neonatal Nurses*. 2003;3(1):14-26.
 4. Racadio JM, Doellman DA, Johnson ND, Bean JA, Jacobs BR. Pediatric peripherally inserted central catheters: complication rates related to catheter tip location. *Pediatrics*. 2001;107(2):E28.
 5. Karber BC, Nielsen JC, Balsam D, Messina C, Davidson D. Optimal radiologic position of an umbilical venous catheter tip as determined by echocardiography in very low birth weight newborns. *Journal of neonatal-perinatal medicine*. 2017;10(1):55-61.
 6. Coit AK, Kamitsuka MD, Pediatrix Medical G. Peripherally inserted central catheter using the saphenous vein: importance of two-view radiographs to determine the tip location. *Journal of perinatology : official journal of the California Perinatal Association*. 2005;25(10):674-6.
 7. Stark DD, Brasch RC, Gooding CA. Radiographic assessment of venous catheter position in children: value of the lateral view. *Pediatric radiology*. 1984;14(2):76-80.
 8. Oestreich AE. Umbilical vein catheterization--appropriate and inappropriate placement. *Pediatric radiology*. 2010;40(12):1941-9.
 9. Schlesinger AE, Braverman RM, DiPietro MA. Pictorial essay. Neonates and umbilical venous catheters: normal appearance, anomalous positions, complications, and potential aid to diagnosis. *AJR American journal of roentgenology*. 2003;180(4):1147-53.
 10. Connolly B, Mawson JB, MacDonald CE, Chait P, Mikailian H. Fluoroscopic landmark for SVC-RA junction for central venous catheter placement in children. *Pediatric radiology*. 2000;30(10):692-5.
 11. Schuster M, Nave H, Piepenbrock S, Pabst R, Panning B. The carina as a landmark in central venous catheter placement. *British journal of anaesthesia*. 2000;85(2):192-4.
 12. Ali M, Nadroo, Ronald B. Glass, Jing Lin, Robert S. Green, Ian R. Holzman Changes in Upper Extremity Position Cause Migration of Peripherally Inserted Central Catheters in Neonates *Pediatrics* Jul 2002, 110 (1) 131-136; DOI: 10.1542/peds.110.1.131

This document can be made available in alternative formats on request.

Document Owner:	Neonatology		
Reviewer / Team:	Neonatology		
Date First Issued:	June 2018	Last Reviewed:	October 2021
Amendment Dates:		Next Review Date:	26 th October 2024
Approved by:	Neonatology Coordinating Group	Date:	26 th October 2021
Endorsed by:	Neonatology Coordinating Group	Date:	
Standards Applicable:	NSQHS Standards:  Child Safe Standards: 1,10		

Printed or personally saved electronic copies of this document are considered uncontrolled



Healthy kids, healthy communities

Compassion Excellence Collaboration Accountability Equity Respect

Neonatology | Community Health | Mental Health | Perth Children's Hospital