# Umbilical Catheters and Peripherally Inserted Central Catheters (PICC) Guideline

## Guideline for the Initiation of Vascular Access After Birth (i.e. first few days of life)

<table>
<thead>
<tr>
<th>Gestation</th>
<th>UVC</th>
<th>UAC</th>
<th>PIV</th>
</tr>
</thead>
<tbody>
<tr>
<td>≤ 26 weeks</td>
<td>Recommended</td>
<td>Recommended</td>
<td></td>
</tr>
<tr>
<td>27-29 weeks</td>
<td>Recommended</td>
<td>Selected infants: see B</td>
<td></td>
</tr>
<tr>
<td>≥ 30 weeks</td>
<td>Selected infants: see A</td>
<td>Selected infants: see B</td>
<td>Recommended</td>
</tr>
</tbody>
</table>

### A: UVC use should be considered for the following infants:
1. difficult PIV access
2. hemodynamic instability (e.g. hypotension, inotropes/vasopressors)
   - **Double lumen UVC:** limit use to infants requiring inotropes/vasopressors or glucagon

### B: UAC use should be considered for the following infants:
1. hemodynamic instability (e.g. hypotension, inotropes/vasopressors)
2. frequent blood sampling required (i.e. more than or equal to every 6 hours)
3. altered skin integrity and regular blood sampling required

Adapted from: Shahid et al. PEDIATRICS Volume 133, Number 6, June 2014

## Determining Length of Umbilical Catheter Insertion

- **UAC:** high position: (weight in kg x 3 + 9) + length of umbilical stump (cm)
- **UVC:** [(weight in kg x 3 + 9) ÷ 2] + 1 + length of umbilical stump (cm)

## Umbilical Catheter Size

- < 1.5 kg: 3.5 Fr
- ≥ 1.5 kg: 5 Fr

## Duration of Umbilical Catheter Use

- Remove umbilical catheters as soon as they are no longer required
- Remove UAC if there are signs of vascular insufficiency to the extremities or buttocks
- UAC: limit use to maximum 5 days
- UVC (in proper position): aim to remove after 5-7 days and replace with alternate vascular access depending on infant needs
e.g. PIV if vascular access anticipated to be required < 7 days
   - PICC if vascular access anticipated to be required ≥7 days

## Umbilical Catheter Removal

- **Review NICU Umbilical Catheter Removal Guidelines**
- **Umbilical catheter removal** can be associated with major complications such as significant blood loss. Follow removal procedure closely to minimize risk of removal-related complications
- Most catheters can be removed *without* cutting the suture
- Soak umbilical stump with normal saline for a minimum of 20 minutes
  - Soak for another 10 minutes if still unable to remove catheter
- It is a 2 person procedure and **good lightening** must be available
- To be performed by MD/NP or designated practitioner (e.g. ACTS)
- **Only** use scissors if other measures are unsuccessful

If scissors are used, apply a hemostat below the suture as a safety measure in case the catheter is cut.
### Umbilical Catheter and PICC Target Tip Positions

<table>
<thead>
<tr>
<th>Target</th>
<th>Avoid</th>
<th>Most Important View</th>
</tr>
</thead>
</table>
| **UAC** | T6-9 (preferred)  
L3-4 (acceptable) | T10-L2  
Below L4  
(bifurcation of aorta) | AP |
| **UVC** | Junction of IVC and right atrium  
~T 8-9  
Vertebral levels not accurate, use position of IVC/RA rather than vertebral level | Right atrium ~ T7  
Portal vein ~T11 | Lateral |

#### Guidelines for x-ray after catheter adjustment

- Use only the most important view to assess catheter position after adjustment
- Repeat x-rays are required for ALL catheters pulled by ≥ 1 cm EXCEPT for UVCs repositioned below the liver (see below)
- An x-ray is NOT required for a UVC pulled back to below the liver if:
  - Gestational age ≥ 35 weeks OR ≥ 2.5 kg and UVC pulled to ≤ 4 cm marking at umbilicus
  - Gestational age < 35 weeks AND < 2.5 kg and UVC pulled to ≤ 3 cm marking at umbilicus
  - If UVC marking at umbilicus is deeper than these values, an x-ray is required to ensure that the catheter tip is not in the liver

### Umbilical Catheter Removal

- Umbilical catheter removal can be associated with major complications such as significant blood loss. Follow removal procedure closely to minimize the risk of removal-related complications

### Low-lying UVC

- For UVC’s positioned below the liver (i.e. low-lying UVC)
  - Use should be avoided unless no peripheral access is available
  - Infuse only non-hyperosmolar fluid
  - Use beyond 48 hours of age is not recommended and alternate vascular access should be obtained
  - Obtain central access as soon as possible if:
    - Hyperosmolar fluid or inotropic support required
    - Long-term access is anticipated
  - For preterm infants born < 30 weeks AND < 48 hours of age
    - PICC placement may occur after 48 hours with midline head positioning maintained during insertion
    - Discuss with the staff physician if PICC essential prior to 48 hours (e.g. for inotropic support/hyperosmolar fluid)
    - PIV should be used if there is no UVC and infant does not require inotropes or hyperosmolar fluid
    - Establish PIV prior to removing UVC. If PIV cannot be established after 2 attempts, discuss next steps with staff MD

### Right or Right Scalp PICC

- T4-5  
1 vertebral body below carina
- Right atrium ~ below T5
- AP

### Left Arm or Left Scalp PICC

- T4-5  
1-2 vertebral bodies below carina
- Right atrium ~ below T5
- AP

### Leg PICC

- T9-T11 (preferred)  
Above L4 (acceptable)
- Right atrium ~ T7
- If near renal veins (~L2), check lateral to ensure PICC in IVC and not entering renal vein
- Below L4 (Bifurcation of IVC)
- Lateral

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## Umbilical Artery Catheter (UAC)

<table>
<thead>
<tr>
<th>Target Tip Position</th>
<th>Avoid</th>
<th>Most Important View on X-ray</th>
</tr>
</thead>
<tbody>
<tr>
<td>T6-9 (preferred)</td>
<td>Avoid major branches of aorta</td>
<td>▪ AP view to measure vertebral bodies</td>
</tr>
<tr>
<td>L3-4 (acceptable)</td>
<td>▪ T10- L2</td>
<td>▪ Aorta situated just anterior to vertebral bodies</td>
</tr>
<tr>
<td></td>
<td>▪ Below L4 (bifurcation of aorta)</td>
<td></td>
</tr>
</tbody>
</table>

### Target Tip Position

- **T6-9 (preferred)**
- **L3-4 (acceptable)**

### Avoid

- Avoid major branches of aorta
  - T10- L2
  - Below L4 (bifurcation of aorta)

### Most Important View on X-ray

- AP view to measure vertebral bodies
- Aorta situated just anterior to vertebral bodies

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*Atlas of Procedures in Neonatology 2007*
### Umbilical Venous Catheter (UVC)

<table>
<thead>
<tr>
<th>Target Tip Position</th>
<th>Avoid</th>
<th>Most Important View on X-ray</th>
<th>UVC Positioned Below the Liver (i.e. low-lying UVC)</th>
</tr>
</thead>
</table>
| Junction of IVC and right atrium ~T 8-9 | Right atrium ~ T7 | Lateral | - Use should be avoided unless no peripheral access is available  
- Infuse only non-hyperosmolar fluid  
- Use beyond 48 hours of age is not recommended and alternate vascular access should be obtained  
- Obtain central access as soon as possible if:  
  - Hyperosmolar fluid or inotropic support required  
  - Long-term access is anticipated  
- For preterm infants born < 30 weeks AND < 48 hours of age  
  - PICC placement may occur after 48 hours with midline head positioning maintained during insertion  
  - Discuss with the staff physician if PICC essential prior to 48 hours  
  (e.g. for inotropic support/hyperosmolar fluid)  
  - PIV should be used if there is no UVC and infant does not require inotropes or hyperosmolar fluid  
- Establish PIV prior to removing UVC. If PIV cannot be established after 2 attempts, discuss next steps with staff MD |
| Portal vein ~ T11 | | | |

**Target tip position**

- Right atrium ~ T7
- Portal vein ~ T11

**Junction of IVC and right atrium ~ T 8-9**

Vertebral levels not accurate, use position of IVC/RA rather than vertebral level.
## Right Arm or Right Scalp PICC

<table>
<thead>
<tr>
<th>Target Tip Position</th>
<th>Avoid</th>
<th>Most Important View on X-ray</th>
<th>Considerations</th>
</tr>
</thead>
<tbody>
<tr>
<td>T4-5 1 vertebral body below carina</td>
<td>Right atrium ~ below T5</td>
<td>AP</td>
<td>Catheter tips above the T4 level are NON-CENTRAL</td>
</tr>
</tbody>
</table>

![X-ray images showing the target tip position and important view on X-ray.](image)

*Schuster, WJ American 2000;85:192*
### Left arm or Left Scalp PICC

<table>
<thead>
<tr>
<th>Target Tip Position</th>
<th>Avoid</th>
<th>Most Important View on X-ray</th>
<th>Considerations</th>
</tr>
</thead>
<tbody>
<tr>
<td>T4-5 1-2 vertebral bodies below carina</td>
<td>Right atrium ~ below T5</td>
<td>AP</td>
<td>Catheter tips above the T4 level are NON-CENTRAL</td>
</tr>
</tbody>
</table>

![X-ray Image](image)

**Left Sided PICC-2 vertebral bodies below carina**

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Feb 8, 2018
<table>
<thead>
<tr>
<th>Target Tip Position</th>
<th>Avoid</th>
<th>Most Important View on X-ray</th>
</tr>
</thead>
<tbody>
<tr>
<td>T9-T11 (preferred)</td>
<td>• Right atrium ~ T7</td>
<td>Lateral</td>
</tr>
<tr>
<td>Above L4 (acceptable)</td>
<td>• If near renal veins (~L2) check lateral to ensure PICC in IVC and not entering renal vein</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Below L4 (bifurcation of IVC)</td>
<td></td>
</tr>
</tbody>
</table>

Lateral view according to "N Engl J Med 2014;370:e17"
### NICU Central Line Radiography Protocol

<table>
<thead>
<tr>
<th>Timing of X-Ray</th>
<th>AP</th>
<th>Dorsal Decubitus</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>UAC</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Initial insertion or On admission for pre-existing lines</td>
<td><strong>X</strong></td>
<td><strong>X</strong></td>
</tr>
<tr>
<td>Follow up</td>
<td><strong>X</strong></td>
<td></td>
</tr>
<tr>
<td><strong>UVC</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Initial insertion or On admission for pre-existing lines</td>
<td><strong>X</strong></td>
<td><strong>X</strong></td>
</tr>
<tr>
<td>Follow up</td>
<td><strong>X</strong></td>
<td>Xray field: iliac crest to axilla only</td>
</tr>
<tr>
<td><strong>Arm NICU PICC</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Initial insertion or On admission for pre-existing lines</td>
<td><strong>X</strong> Both shoulders abducted 30°</td>
<td><strong>X</strong> Both arms at patient’s side</td>
</tr>
<tr>
<td>Follow up</td>
<td><strong>X</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Scalp NICU PICC</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Initial insertion or On admission for pre-existing lines</td>
<td><strong>X</strong> Chin and head neutral Both shoulders abducted 30°</td>
<td><strong>X</strong> Chin and head neutral Both arms at patient’s side</td>
</tr>
<tr>
<td>Follow up</td>
<td><strong>X</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Arm IGT PICC</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>At end of procedure, done in IGT suite</td>
<td><strong>X</strong> Both shoulders abducted 30°</td>
<td></td>
</tr>
<tr>
<td><strong>Leg NICU PICC</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Initial insertion or On admission for pre-existing lines</td>
<td><strong>X</strong> Frog leg position</td>
<td><strong>X</strong> Frog leg position</td>
</tr>
<tr>
<td>Follow up</td>
<td><strong>X</strong></td>
<td></td>
</tr>
</tbody>
</table>

### Dorsal Decubitus Positioning

- **Xray field:** iliac crest to axilla only

### Unusual Catheter Positions

If the catheter has an unusual position (e.g. looped or kinked), 2 views are recommended for follow up x-rays.
### Schedule for Follow Up Xrays to Monitor Central Venous Line Tip Positions

Note: Xrays for initial insertion or on admission for pre-existing lines are 2 views (AP and Dorsal Decubitus (i.e. lateral shoot through) and are not included here

<table>
<thead>
<tr>
<th>PICC</th>
<th>First follow up xray AFTER initial 2 views</th>
<th>Subsequent xrays for monitoring AFTER first follow up xray</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Line position concerning</td>
<td>Line position central and acceptable</td>
</tr>
<tr>
<td>NICU PICC-ARM</td>
<td>If major concerns, within 24 hours and frequency of further follow up xrays determined by level of concern</td>
<td>One week</td>
</tr>
<tr>
<td>IGT PICC 1.9 F (not sutured or cuffed)</td>
<td>If concern re: non-central position* to determine if hyperosmolar solutions can be infused: within 1-2 weeks</td>
<td></td>
</tr>
<tr>
<td>IGT/CVL (cuffed and sutured)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Scalp or other location (e.g. jugular)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>NICU PICC-LEG</td>
<td></td>
<td></td>
</tr>
<tr>
<td>UMBILICAL</td>
<td>Within 24 hours</td>
<td>No follow up</td>
</tr>
<tr>
<td>UAC</td>
<td></td>
<td></td>
</tr>
<tr>
<td>UVC</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*All arm PICCs without a cuff or suture (e.g. NICU PICC, uncuffed IGT PICC) with borderline location between the upper SVC and brachiocephalic vein