Umbilical Arterial Catheterization

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CASE

The video shows the technique for placing an umbilical arterial catheter in a newborn. Based on the guidelines recommended by the Centers for Disease Control and Prevention (CDC), what is the ideal maximal length of time that an umbilical arterial catheter should be in place?

A. 5 days
B. 6 days
C. 7 days
D. 8 days
E. 10 days

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AUTHOR DISCLOSURE

Drs Julian, Trivedi, and Vachharajani have disclosed no financial relationships relevant to this article. This commentary does not contain a discussion of an unapproved/investigative use of a commercial product/device.
CORRECT RESPONSE

A. The CDC guidelines recommend that umbilical arterial catheters should not be left in place for more than 5 days after insertion.

CRITIQUE

The video depicts the most common method of inserting an umbilical artery catheter (UAC) in a newborn. An alternative method of inserting a catheter into the umbilical artery is also demonstrated.

Various formulas are used to determine the length of the catheter to be inserted into the umbilical artery. The formula used in the video \((3 \times \text{birthweight in kilograms} + 9 \text{ cm} + \text{distance of external portion of cord in cm})\) was described by Shukla and Ferrera. (1) We have had success using this formula at our institution. Alternate formulas include the Dunn method, which is based on the measurement of the length from the shoulder to umbilicus and uses a nomogram to determine the insertion length. (2) A third method, the Wright method, uses the formula \((4 \times \text{birthweight} \text{[in kilograms]} + 7 \text{[cm]})\) to determine the depth of catheter insertion. (3) After determining the appropriate length, a time-out is required (Note: this technique is not recorded on the video to protect the identity of the neonate).

The location of the tip of the UAC is verified by obtaining a chest and abdominal radiograph. Alternate methods to locate the tip include ultrasonography (4) and echocardiography. (5) A randomized controlled trial concluded that ultrasonography-guided UAC placement is a faster method requiring fewer manipulations and radiographs than conventional catheter placement. (4) However, the ease and speed of obtaining radiographs (particularly in the middle of the night) is unmatched and most departments rely on radiographs for placement confirmation. In our department, the tip of the UAC is preferred at a “high” location between thoracic vertebrae 6 and 10. A “low” tip of the UAC refers to the tip just above the aortic bifurcation. A Cochrane review found no evidence to support the use of low placed UACs and recommends that high catheters should be used exclusively. (6)

Multiple interventions have been recommended to prevent central line-associated bloodstream infections. Aseptic precautions while inserting and maintaining the catheter are important. Limiting central line access for blood draws or injecting medications and enforcing “scrub the hub” before accessing the central line are some of the suggested interventions. Guidelines from the CDC recommend that a UAC should be removed as soon as possible when it is no longer needed and “optimally, UACs should not be left in place > 5 days.”(7) The CDC also emphasizes that topical antibiotic ointment or creams should not be used at umbilical insertion sites because this would increase the risk of fungal infections and antibiotic resistance. (7)

A host of complications have been described with a UAC in a newborn. Transient vasospasm and discoloration of the toes as well as an intra-arterial thrombosis with resultant ischemic injury to end organs are the most common. Gangrene of the legs, buttocks, and spinal cord has been described. (8)(9) If any of these complications are found, the catheter should be removed and should NOT be replaced. One animal study suggested that both short- and long-term UAC use is associated with aortic wall pathological abnormalities compared with control animals. This study emphasized the judicious use and early removal of UACs, if possible, to potentially prevent significant hemostatic and aortic wall vascular complications. (10) Heparin infusion is recommended for UAC maintenance at low doses (0.25–1.0 U/mL) (7) and has been found to decrease the frequency of occlusion of the catheters, but does not change the frequency of aortic thrombosis. (11)

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American Board of Pediatrics Neonatal–Perinatal Content Specification

- Know the pathogenesis and complications of umbilical arterial catheter related thrombi

References


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