



ORIGINAL ARTICLE

## Catheter tip position and risk of mechanical complications in a neonatal unit<sup>☆,☆☆</sup>



Jose Maria Lloreda-García\*, Ana Lorente-Nicolás, Francisca Bermejo-Costa, Jose Ramón Fernández-Fructuoso

Unidad de Neonatología y UCI Neonatal, Hospital Universitario Santa Lucía, Complejo Hospitalario Universitario de Cartagena, Cartagena, Murcia, Spain

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### KEYWORDS

Central catheters;  
Complications;  
Catheter tip position;  
PICC: peripherally inserted central catheter;  
Umbilical vein catheterisation

### Abstract

**Introduction:** The use of central catheters (CC) is associated with mechanical complications (MC).

**Objective:** Our objective was to determine the relationship between CC positions and associated MC in neonates.

**Material:** A descriptive analytical study was performed over a six year period in the NICU of the University Hospital Santa Lucía de Cartagena. Details were collected on the CC used, indication, reason for withdrawal, position in the imaging, MC, and treatment arising from them, as well as epidemiological data.

**Results:** Of the total of 604 CC studied, the majority (347) were via the umbilical vein, followed by epicutaneous (193), and femoral vein (34). There were MC in 14.2% of catheters. Incorrect position of the tip was associated with greater MC (21.1 vs 8.2%;  $P < .001$ ), including withdrawal due to MC (8.4 vs 3.1%;  $P < .01$ ), extravasation (4.9 vs 1.9%;  $P < .05$ ), pleural and pericardial effusions (1.4 vs 0.0%;  $P < .05$ ), liver haematomas (4.6 vs 0.6%;  $P < .01$ ), and ascites (2.8 vs 0.0%;  $P < .01$ ). The midclavicular epicutaneous position of the tip was associated with greater MC (18.5 vs 6.8%;  $P < .05$ ) than the brachiocephalic (0 vs 6.8%; NS). The low and ductal position of the umbilical vein catheter was also associated with higher rates of MC (24.5 vs 6%;  $P < .001$  and 27 vs 6%;  $P < .001$ ) due to the position of the tip. The most common complication was accidentally dislodged catheter.

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\* Corresponding author.

E-mail addresses: [jmlloreda@gmail.com](mailto:jmlloreda@gmail.com), [jmlloreda@yahoo.es](mailto:jmlloreda@yahoo.es) (J.M. Lloreda-García).

**PALABRAS CLAVE**

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Catéterización vena  
umbilical

**Conclusions:** The incorrect location of the tip was associated with more MC. The midclavicular epicutaneous had more risk than centrally or brachiocephalic locations. The low and ductal positions of the umbilical vein catheter were associated with higher rates of MC.

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### Complicaciones mecánicas asociadas a la localización de la punta de catéteres centrales en una unidad neonatal

**Resumen**

**Introducción:** El uso de catéteres centrales (CC) está asociado a complicaciones mecánicas (CM). Nuestro objetivo fue conocer si la posición incorrecta de la punta se asociaba con mayor incidencia de CM.

**Material:** Estudio descriptivo de 6 años en la UCIN del Hospital Universitario Santa Lucía de Cartagena. Se recogieron los CC, la indicación, el motivo de retirada, la posición en las pruebas de imagen, las CM y el tratamiento derivado.

**Resultados:** Se estudiaron 604 CC, la mayoría (347) de vena umbilical, epicutáneos (193) y de vena femoral (34). El 14,2% tuvo CM. La posición incorrecta de la punta se asoció a mayores CM (21,1 vs. 8,2%;  $p < 0,001$ ), retirada por problemas mecánicos (8,4 vs. 3,1%;  $p < 0,01$ ), extravasación (4,9 vs. 1,9%;  $p < 0,05$ ), derrames pleurales y pericárdicos (1,4 vs. 0,0%;  $p < 0,05$ ), hematomas hepáticos (4,6 vs. 0,6%;  $p < 0,01$ ) y ascitis (2,8 vs. 0,0%;  $p < 0,01$ ). Los epicutáneos medioclaviculares se asociaron a mayores CM (18,5 vs. 6,8%;  $p < 0,05$ ) que los localizados en posición braquiocefálica (0 vs. 6,8%; NS) respecto a las localizaciones correctas. La posición baja o en ductus del catéter venoso umbilical se asoció a mayores CM respecto a la posición correcta (24,5 vs. 6%;  $p < 0,001$ . y 27 vs. 6%;  $p < 0,001$ ). La complicación más frecuente fue la salida accidental.

**Conclusiones:** Las localizaciones incorrectas de la punta de los CC se asociaron a más CM. Los epicutáneos medioclaviculares tuvieron más riesgo que los localizados en cavas o braquiocefálicos. La posición baja o en ductus del catéter venoso umbilical se asoció a mayores CM.

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**Introduction**

The use of central catheters (CCs) in neonatal units is widespread, and is one of the most frequently used invasive procedures. From the moment umbilical venous catheterisation (UVC) was first described in the late 1940s,<sup>1</sup> this technique has allowed the management of children with more complex pathologies. The description of peripherally inserted central catheters (PICCs) by Shaw in 1973<sup>2</sup> was another milestone, allowing the management of infants with progressively lower weights and gestational ages that require longer hospitalisations and in many cases several central lines during their stay.

They can be used for a wide variety of purposes, such as the delivery of drugs, fluids, parenteral nutrition or medications with irritant properties or high osmolarities. In other cases, they prevent multiple painful stimuli associated to the repetition of venipuncture or invasive measurements, for instance of central venous pressure or arterial pressure.

The use of CCs is associated with various complications, such as accidental dislodgment, occlusion, phlebitis, thrombosis, infection or extravasation and others that are less

frequent, such as pleural and pericardial effusion, ascites and even death.<sup>3</sup>

There are no validated international consensus guidelines on the use of different types of catheters, and different units have their own management guidelines, which show considerable variability.

Although the association between infection and CC use has been investigated extensively, fewer studies have analysed mechanical complications (MCs), their impact and their risk factors. Most of these studies consist in the enumeration of individual cases, which are very frequent, to the point that Garden and Laussen<sup>4</sup> referred to the use of CCs as "an unending supply of unusual complications."

There is evidence that malposition of the catheter tip is associated with increased morbidity.<sup>5</sup> It is recommended that the catheter tip be placed in a central position. This placement, which should be the norm, is not always achieved, leading to the management of children with catheters that are by definition not placed in the midline.

The primary objective of our study was to determine whether different final positions, whether correct or incorrect, are associated with different rates of MCs. The

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