

Efficacy and safety of central venous catheter placement in the internal jugular vein, using the ultrasound-guided technique versus the anatomical landmark technique, in critically ill pediatric patients: Randomized clinical trial.

Introduction: Central venous catheter placement in paediatric patients is associated with relevant complication rates. Although ultrasound guidance may improve success and safety, evidence in critically ill children remains limited. This study aimed to evaluate the efficacy and safety of ultrasound-guided versus anatomical landmark-guided internal jugular vein catheterisation in critically ill paediatric patients.

Objective: To assess the efficacy and safety of central venous catheter placement in the internal jugular vein using the ultrasound-guided technique versus the anatomical landmark technique in critically ill paediatric patients.

Materials and Methods:

Design: A randomised, controlled, single-blind clinical trial. **Setting:** was conducted in the paediatric Intensive Care Unit (PICU) at UMAE No. 48, Hospital de Gineco-Pediatría (HGP), IMSS. **Patient:** The study population consisted of children aged 1 month to 15 years and 11 months admitted to the PICU of our hospital between September 2019 and August 2020. Patients who met the selection criteria were randomised into two groups: TGUS and ALT. **Interventions:** The procedures were performed by two operators who had been previously standardised in both techniques. **Main Outcome measure:** Effectiveness and safety of central venous catheter (CVC) placement in the internal jugular vein using TGUS versus ALT, in critically ill pediatric patients; Efficacy was assessed according to the following three criteria: 1) Successful placement of the central venous catheter; 2) Fewer than two attempts required for placement; 3) A placement time of less than 20 minutes.

Safety was assessed according to the following criteria: 1) Absence of serious immediate complications; 2) Presence of two or fewer non-serious complications.

Results: A total of 73 patients were included in the study and randomly assigned: 36 patients to the ultrasound-guided technique and 37 patients to ALT. There were no differences between groups in demographic characteristics. The most frequent causes of admission were septic shock 24% (18/73). Compared with ALT, the ultrasound-guided technique was associated with a lower number of attempts for successful cannulation [US 1 (IQR 1–2) vs ALT 2 (IQR 1–3); $p=0.01$] and a shorter CVC placement time [12.5 minutes (IQR 11.2–14.7) vs 16 minutes (IQR 12–26); $p=0.009$]. The use of TGUS was associated with a reduced risk of failed CVC cannulation on the first attempt, 30% vs 60% with ALT [RR=0.51, 95% CI 0.29–0.89; $p=0.019$], and on the second attempt, 5% vs 28% with ALT [RR=0.20, 95% CI 0.04–0.87; $p=0.032$]. TGUS also reduced efficacy failure, 6% vs 30% [RR=0.18, 95% CI 0.04–0.78; $p=0.02$]. Efficacy was higher in the ultrasound group than in the ALT group, 94% vs 70%, respectively ($p=0.01$), with no difference in safety between groups.

Conclusions: The analysis of results demonstrated greater efficacy with TGUS. However, subgroup analysis by age group suggests that the use of ultrasound may benefit only infants and preschool-aged children.

Keywords: Central venous access; internal jugular vein; ultrasound; paediatrics.