Difficult Cannulations in Neonatal and Pediatric ECMO: Illuminating an Obstruction to Timely Therapy

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Background and Objective: ECMO is a vital intervention for neonatal and pediatric patients requiring cardiorespiratory support, yet unanticipated difficulties with peripheral cannulation can hinder timely therapy. Research concerning challenging cannulations is limited, and protocols guiding surgeons to consider alternative approaches in cases of potential difficulty are lacking. The purpose of this study was to identify reasons for cannulation difficulty and pinpoint predisposing diagnostic, anatomical, and operative features of this population.

Methodology: We conducted a single-center, five-year retrospective review of neonatal and pediatric patients encountering challenging peripheral cannulations or multiple cannulations for ECMO. Variables included patient demographics, ECMO indications, prior cannulation attempts, surgical challenges encountered, alternative vascular anatomy, and outcomes from cannulation to discharge.

Results: An analysis of 65 cannulations (38 subjects, median cannulations per subject=1, range 1-4) revealed that venous cannulations posed challenges more often (n=28) than arterial cannulations (n=11). Intraoperative cannulation challenges were predominantly attributed to small vessel size (43.5%) and unspecified catheter advancement obstructions (23.1%). A substantial proportion of patients in this cohort exhibited congenital heart anomalies (81.6%), and 50.8% of cannulations occurred in the setting of post-procedural support, often post-cardiotomy. Alternate neck or groin vascular anatomy was identified in 19 cannulations. The rate of unsuccessful peripheral cannulation was 20.5% (n=8) and patient mortality associated with difficulty cannulating onto ECMO was 15.4% (n=6).

Conclusions and Impact: These findings suggest that neonatal and pediatric patients with congenital heart anomalies or a history of recent surgery may face an increased risk of challenging cannulations and poorer ECMO outcomes. Pre-operative neck and groin ultrasound could help surgeons better anticipate and address difficulties like small vessel size or obstruction. Early evaluation of risk factors for challenging cannulations will enhance surgical decision-making regarding cannulation approach and ultimately improve outcomes for children requiring ECMO.