

Optimizing Fluid Resuscitation: Balancing Access efficiency and Infusion Speed in Trauma Care

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Study Objective

Time is a critical resource during the initial treatment of an injured patient. Fluid resuscitation is also a critical component of trauma care. Clinicians are faced with the need to actively resuscitate an injured patient while simultaneously working to provide them operative or procedural hemorrhage control as quickly as possible. In these circumstances, physicians must balance perceived flow efficiency with time required to place certain types of access devices, though little data exists to guide this decision process. This study aims to evaluate the infusion times of different sizes of peripheral and central venous catheters to optimize fluid administration in emergency settings.

Design

This is an experimental study assessing fluid infusion times across various peripheral and central venous access devices.

Methods

To eliminate extraneous influence, infusion times by gravity alone were compared across catheter types. We measured the time required to infuse crystalloid fluid (Lactated Ringer’s solution) through different cannula and catheter sizes.

The infusion was performed in a standardized manner using gravity flow, with the fluid bag placed at a height of 3.5 feet from the catheter. The completion time for one liter of fluid to drain by gravity was recorded independently by two observers. The findings are presented in the table below.

Table

Catheter gauge/Fr	Time (seconds)
14G	456
16G	534
18G	785
20G	1174
Triple lumen 7Fr	1675
Cordis 9Fr	544

Results

While an increase in catheter size generally correlated with improved flow rates, notable variations were observed between peripheral and central venous access devices. The study found that while 14G and 16G cannulas outperformed 18G in terms of infusion times, the 16G demonstrated a marginal advantage over a 9 Fr Cordis catheter.

Conclusion

Understanding the flow time of various intravenous access devices is essential to making timely clinical decisions for fluid resuscitation in trauma patients. Based on our data, the time required to place a Cordis catheter is not justified for volume resuscitation alone if the patient has amenable anatomy for the timely placement of 14G or 16G peripheral IVs. Further research comparing the rapid infuser and the infusion times of blood products is warranted.

References

1. Khoyratty SI, Gajendragadkar PR, Polisetty K, Ward S, Skinner T, Gajendragadkar PR. Flow rates through intravenous access devices: an in vitro study. J Clin Anesth. 2016 Jun;31:101-5. doi: 10.1016/j.jclinane.2016.01.048. Epub 2016 Apr 12. PMID: 27185686.
2. Atanda O, West J, Stables T, Johnson C, Merrifield R, Kinross J. Flow rate accuracy of infusion devices within healthcare settings: a systematic review. Ther Adv Drug Saf. 2023 Jul 21;14:20420986231188602. doi: 10.1177/20420986231188602. PMID: 37492690; PMCID: PMC10363896.
3. Milne A, Teng JJ, Vargas A, Markley JC, Collins A. Performance assessment of intravenous catheters for massive transfusion: A pragmatic in vitro study. Transfusion. 2021 Jun;61(6):1721-1728. doi: 10.1111/trf.16399. Epub 2021 Apr 13. PMID: 33846984.

This research was supported (in whole or in part) by HCA Healthcare and/or an HCA Healthcare affiliated entity. The views expressed in this publication represent those of the author(s) and do not necessarily represent the official views of HCA Healthcare or any of its affiliated entities.

