

The Route to Survival: Intravenous or Intraosseous Access in Cardiac Arrest

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Editorial referring to the article: *Intraosseous Versus Intravenous Vascular Access for Out-Of-Hospital Cardiac Arrest: A Meta-Analysis of Randomized Clinical Trials*

Out-of-hospital cardiac arrest (OHCA) continues to be one of the major challenges in emergency cardiovascular care. Despite advances in cardiopulmonary resuscitation (CPR) and defibrillation, overall survival rates remain low worldwide. Current international guidelines recommend the establishment of intravenous (IV) access as the first-line route for drug administration, while intraosseous (IO) access is suggested as an alternative when IV access cannot be promptly achieved.^{1,2} In this context, every minute counts, and establishing vascular access for drug delivery is often a race against time. However, a long-standing question still persists: does the route of administration – intravenous or intraosseous – truly impact outcomes?

In this issue of the *International Journal of Cardiovascular Sciences*, Cavalcante et al. present a comprehensive meta-analysis comparing IO and IV access in adults with OHCA. Pooling data from more than 9,000 patients across three major randomized clinical trials,³⁻⁵ the authors demonstrate that both routes yield similar results in terms of survival, with favorable neurological outcomes, the return of spontaneous circulation (ROSC), and survival to hospital discharge.⁶ Moderate heterogeneity was limited to the ROSC outcome, likely due to differences in its definition among studies. Beyond this, the evidence is consistent in showing that time to drug delivery, rather than the route of administration, determines patient outcomes.⁶

Similar conclusions were reported by a previous systematic review, which also found no significant differences between IV and IO routes when vascular access was established promptly.⁷ Taken together, these findings confirm that the effectiveness of drug administration during cardiac arrest depends mainly on minimizing delays to access rather than on the route itself. In this context, the American Heart Association (2020) and European Resuscitation Council (2021) guidelines underscore that, although rapid vascular access is necessary for drug delivery, attempts to establish it must not delay high-quality CPR or early defibrillation, the interventions that truly determine survival.^{1,2}

Beyond these practical considerations, the pharmacokinetic and hemodynamic profiles of each access route provide further insight into their clinical performance. IO administration enables rapid systemic absorption through the medullary sinusoids, which connect directly to central circulation. Nevertheless, in low-flow states, such as cardiac arrest, reduced medullary perfusion may delay drug delivery, particularly when the tibial site is used (Figure 1).⁸ Experimental data suggest that humeral IO access achieves faster drug delivery than does tibial insertion, owing to its proximity to central circulation. By contrast, early intravenous access provides more predictable pharmacokinetics, but it is often harder to establish during resuscitation.⁸ The humeral IO route, therefore, may represent an optimal balance between speed and efficacy when IV cannulation fails.

Translating these findings into real-world practice, however, continues to be a considerable challenge. Despite the clear evidence supporting IO access as an alternative to intravenous administration, its use in emergency care is still limited. Proficiency in the technique varies widely among healthcare professionals, and many report minimal exposure or confidence in performing the procedure during cardiac arrest. Regular simulation-based training and structured refresher programs are crucial to maintaining competence, yet such opportunities are scarce in most prehospital and in-hospital systems.⁹

Beyond the educational gap, economic and logistic barriers also restrict the widespread implementation of IO access. The devices are substantially more expensive than standard IV equipment, and their availability often depends on institutional resources and procurement policies. This challenge is even more pronounced in low- and middle-income countries, where emergency medical systems frequently operate under budgetary constraints and lack standardized protocols for advanced resuscitation.¹⁰ For these regions, including Brazil, expanding the use of IO access demands not only investment in equipment but also coordinated efforts in training, evaluations of cost-effectiveness, and integration into local emergency care frameworks. Adopting such strategies could ensure equitable access to this potentially life-saving technique while maintaining feasibility within resource-limited settings.

Taken together, the available evidence, corroborated by the observations of Cavalcante et al., reinforces the view that the best vascular access is that established without delay. The message is simple yet powerful: in cardiac arrest, time, not the route, is the true pathway to survival. Whether through vein or bone, what truly matters is how quickly effective resuscitation is applied.

Keywords

Catheters; Intravenous Administration; Out-of-Hospital Cardiac Arrest

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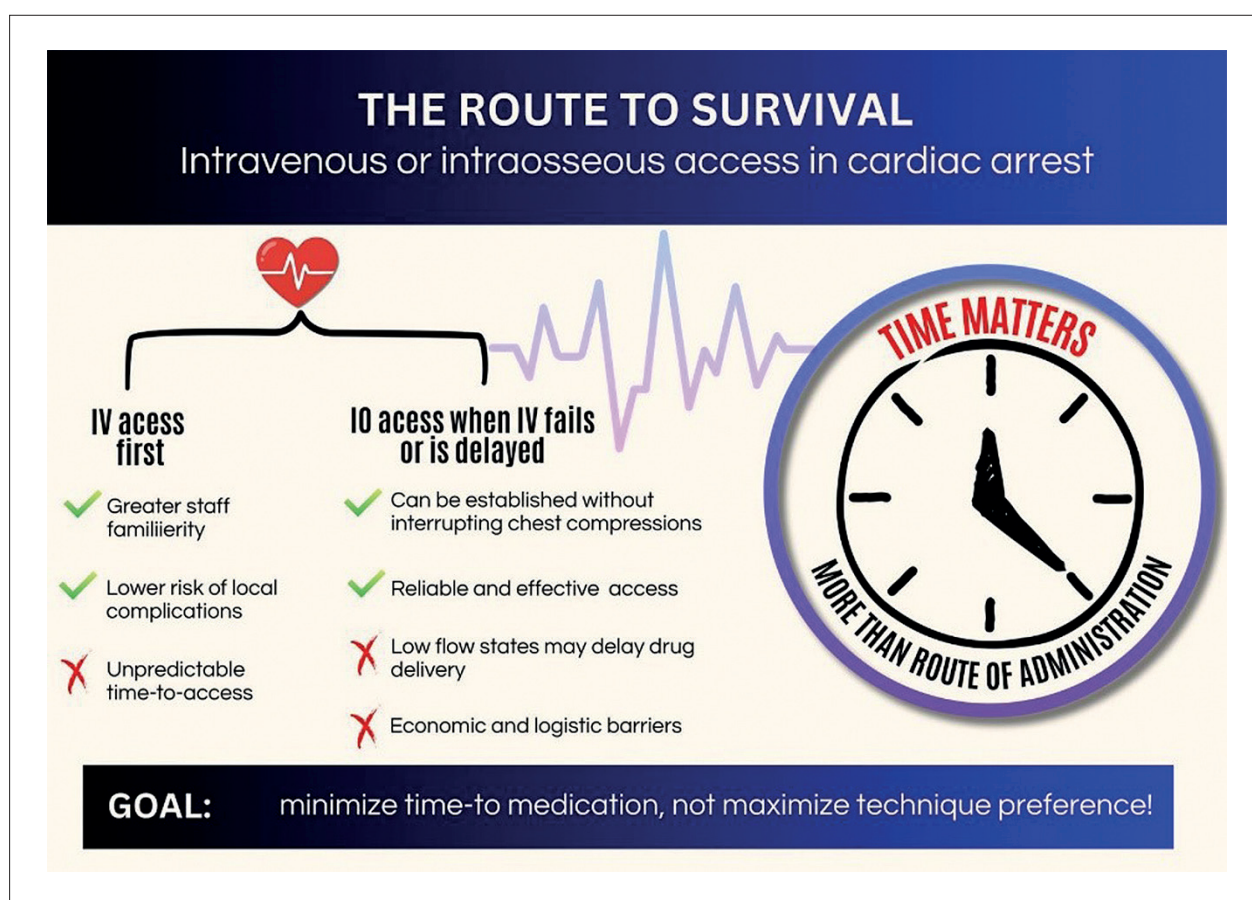


Figure 1 – Intravenous vs. Intraosseous Access in Cardiac Arrest. IO: intraosseous, IV: intravenous.

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