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**Comparison of low-cost interventions for pain during radial arterial blood gas sampling in the emergency department: a three-arm randomised controlled trial**

Ahmet Nurhak akır

Department of Emergency Medicine, Rize State Hospital, Rize, Türkiye

**Correspondence:** Ahmet Nurhak akır, Department of Emergency Medicine, Rize State Hospital, İslampaşı, Kıy1 St., No: 8/A, 53020, Rize, Türkiye. E-mail: [dr.ahmetnurhakcakir@gmail.com](mailto:dr.ahmetnurhakcakir@gmail.com)

**Key words:** arterial blood gas, emergency department, pain management.

Dear Editor,

I read with great interest the recent article by Taveekijakarn *et al.* evaluating the efficacy of 10% lidocaine spray and cryo-analgesia compared to standard chlorhexidine preparation for pain management during radial Arterial Blood Gas (ABG) sampling in the Emergency Department (ED).<sup>1</sup> The authors should be commended for conducting a well-designed, pragmatic, three-arm randomized controlled trial in a high-volume ED setting, addressing a clinically relevant yet frequently overlooked issue in procedural care.

While the study offers valuable insight into real-world ED workflows, several methodological and pharmacodynamic aspects warrant further discussion before concluding that ultra-brief non-invasive interventions lack clinical efficacy:

First, the primary limitation of the intervention protocol lies in the 2-minute application window.

While pragmatically aligned with the fast-paced ED environment, topically applied 10% lidocaine spray requires sufficient contact time to penetrate the stratum corneum and achieve effective sensory block at dermal and periarterial nociceptors. A 2-minute exposure is likely pharmacodynamically insufficient for adequate transdermal absorption. Consequently, the observed absence of statistical superiority over standard care may reflect under-dosing in terms of application duration rather than a true absence of analgesic capability.

Second, the control group received an application of 2% chlorhexidine, which inherently involves mechanical contact and skin rubbing prior to puncture. As highlighted by the gate control theory of pain, tactile sensory stimulation mediated by large-diameter A $\beta$  fibers can attenuate pain signal transmission along A $\delta$  and C fibers.<sup>2</sup> This active mechanical interaction, combined with contextual provider-patient communication, likely induced a meaningful placebo/tactile response, thereby narrowing the measurable pain delta between groups and diluting the observable intervention effect.

Third, an intriguing finding was the higher first-attempt success rate in the cryo-analgesia group (83.3% vs. 71.4% in control).<sup>1</sup> Although statistically non-significant ( $p = 0.42$ ), cryotherapy typically induces local vasoconstriction, which theoretically reduces radial artery caliber and could complicate blind palpation. The observed trend toward improved success suggests that brief cooling might stabilize superficial soft tissue or suppress local muscle twitching without compromising arterial pulsation. Further investigation using ultrasonographic vessel diameter assessment during cryo-application would clarify these anatomical dynamics.

Fourth, the Numeric Rating Scale (NRS) remains a widely accepted tool, yet its sensitivity to transient, sharp procedural pain—such as an arterial puncture lasting only seconds—is subject to significant inter-individual variance. In acute ED settings, underlying anxiety and physiological

stress can obscure subtle differences in acute pain perception. Incorporating objective neurophysiological parameters, such as the Perfusion Index (PI) or autonomic reactivity measures, could provide a more granular evaluation in future trials.<sup>3</sup>

In summary, Taveekijakarn et al. provide a high-quality contribution emphasizing that ultra-brief, 2-minute non-invasive strategies do not yield added pain reduction over routine skin preparation in rapid ED workflows.<sup>1</sup> However, these findings should be interpreted strictly as an absence of evidence for superiority under tight temporal constraints, rather than proof of equivalence or lack of intrinsic efficacy when longer, pharmacodynamically optimized contact times are feasible.

## References

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