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Sex-Based Differences in Depth of Soft Tissue at the Proximal Tibia Intraosseous Catheter Insertion Site

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Title

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Background

Intraosseous (IO) catheters are commonly used to rapidly obtain vascular access for critically-ill patients in the emergency department (ED). Although the proximal tibia (PT) is a standard IO insertion site for adult subjects, little is known about sex-based variation in the proper depth of insertion.

Methods

A retrospective cohort study was performed, utilizing CT scans obtained from DMC over a ten-year period (2009-2018) to estimate soft tissue depth overlying the recommended PT-IO insertion site. Depths of soft tissue from skin surface to bone surface (Measurement A) and from skin surface to the opposite bony cortex (Measurement B) were measured using standard radiologic software.

Results

A total of 217 subjects were enrolled, including 106 (48.9%) males. Body mass index (BMI) was not significantly different between sexes ($p=0.188$). Measurement A for females ($\bar{x}=21.65$ mm, $\sigma=8.17$) was significantly greater than for males ($\bar{x}=13.64$ mm, $\sigma=5.52$) ($p<0.0001$). Measurement A was >25-mm in 5.7% of males and 27.0% of females ($p<0.001$). Measurement B was <45-mm in 24.5% of males and 21.6% of females.

Conclusion

Our results suggest that sex-based differences exist in soft tissue depth at the PT site, despite similar BMI values. Since common IO needle lengths are 25-mm and 45-mm, these results have profound implications. The 25-mm needle would have been too short for more than one-fourth of female subjects. However, a 45-mm catheter would have been too long for almost one-fourth of all subjects. Further study is needed to determine whether this sex difference exists in a larger cohort of patients.