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The Sonic Flashlight Is Faster To Learn And Use Compared To Conventional Ultrasound Guidance: A Comparison Of Ultrasound Guided Vascular Access Devices In Phantoms

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Category:
Vascular/Interventional

Objective:
To compare learning curves of novice ultrasound (US) users performing Sonic Flashlight (SF) and conventional ultrasound (CUS) guided vascular access (VA), as well as compare SF vs CUS guided VA times in proficient CUS users.

Materials and Methods:
While real-time US guidance greatly enhances the safety of VA, learning this skill can be a great challenge for the novice user, one major obstacle being the displaced sense of hand-eye coordination that occurs when the operator must look away from the operating field to view the CUS monitor. The SF is a novel handheld US display system under development at our institution. It works by using a half-silvered mirror to reflect real-time US images so that they appear to float beneath the surface of the skin, merging the patient, US image, instrument, and operator's hands into the same visual field. The current SF prototype uses a 10MHz US system (Terason, Burlington, MA) modified by attaching a small flat-panel display (AM550L OLED, Kodak, Rochester, NY) and a 20x50x1mm half-silvered mirror to the probe. An unmodified Terason US served the CUS used in both studies. Study A subjects consisted of 16 medical students with no US experience, randomized to either the SF or CUS group. Over the course of 2 sessions, each subject performed 60 VAs. Study B subjects, consisting of 14 IV nurses experienced in placing CUS guided PICCs, were randomly assigned to begin with the SF or CUS, perform 18 VAs, switch devices, and repeat 18 more VAs. In both studies, subjects used a 21ga needle to gain access in 3 vessels of a custom VA phantom (Blue Phantom, Kirkland, WA). Time from probe touching the phantom to needle flash was recorded.

Results:
Study A subjects recorded significantly faster times using the SF than CUS throughout their learning curves, and achieved significantly lower asymptote times at all 3 tasks (SF vs CUS asymptote times with 1-tailed t-test. Task 1: 4.9±0.8s vs 6.2 ± 0.8s, p=0.0008. Task 2: 5.4±1.4s vs 9.0±1.9s, p=0.0003. Task 3: 3.4±0.8s vs 5.1±0.6s, p=0.0007). Study B subjects recorded significantly faster VA times using the SF compared to CUS in 2 out of the 3 tasks (Mean CUS-SF time difference with 1-tailed t-test. Task 1: 0.3s, SEM = 0.5s, p=0.258. Task 2: 5.4s, SEM = 2.0s, p=0.009. Task 3: 1.7s, SEM = 0.9s, p=0.047).

Conclusion:
These results lead us to conclude that the SF is significantly easier to learn than CUS, and that even users already proficient in CUS guidance perform VA faster with the SF, despite having no prior experience with the SF.

Keywords: Interventional Radiology, Sonography, Biomedical Engineering