

# ***A Novel Device for Training and Evaluating Ultrasound-Guided Procedures in Anesthesia***

## **Impact Statement**

This study evaluates Clear Guide EDU, a device used to assist the training of SRNAs as they learn ultrasound-guided infraclavicular (IC) and thoracic paravertebral (TPV) peripheral nerve blocks.

## **Introduction**

Currently, the method of evaluating a student's skill is a professor's observation of the student performing the intervention. The novel system developed here (EDU) provides quantitative metrics by continuously tracking the position of the probe and the instrument [1].

EDU provides artificial intelligence-based instrument guidance. The device allows students to select a target and receive guidance about the orientation of the needle required to reach that target prior to insertion. The device also provides continuous visual overlay of the needle trajectory and the needle tip location at all times during the procedure. EDU can operate under a *with-guidance* and *without-guidance* mode, with the ability to evaluate the same performance metrics in both modes. A total of 5 different scoring criteria were identified for use in assessing student performance [1, 3].

## **Methods**

35 SRNAs were assessed performing IC and TPV blocks. The aim was to assess performance once with and without EDU's guidance. The target to be achieved was preselected by the instructor. The following metrics were evaluated:

- *Distance to Target (DT)*: Distance in millimeters (mm), final needle-tip position to target.
- *Total Procedure Time (TPT)*: Time between the start of the procedure and the needle-tip reaching the target in minutes (min).
- *Phantom Penetration Time (PPT)*: Time between the instrument penetrating the phantom surface and the needle-tip reaching the target in minutes.
- *Number of Attempts (NOA)*: Number of times the needle was redirected/withdrawn.
- *Image Stability (IS)*: Amount of time the target remained at the center of the screen (percentage of total procedure duration), a summary across all attempts irrespective of guidance.

A two-way repeated measures ANOVA for mean differences was conducted with Guidance (with and without) and Procedure Type (IC vs TPV) as the two within-subjects variables.

## **Results**

In the guidance compared to the without guidance conditions, statistically significant differences were seen for number of attempts. For the IC procedure, attempts ranged from 2 to 10 ( $M = 5.00$ ) without guidance and from 1 to 2 ( $M = 1.04$ ) with guidance. Those who performed without guidance had a significantly ( $p < .001$ ) higher mean difference of 3.957. For the TPV procedure, attempts ranged from 1 to 10 ( $M = 1.96$ ) without guidance and 1 ( $M = 1.00$ ) with guidance. Those who performed without guidance has a significantly ( $p = .023$ ) higher mean difference of 0.96. Significant main effects of procedure on time to puncture was discovered, with the time to puncture taking significantly ( $p = .013$ ) longer for the IC ( $M = 4.18$ ) compared to the TPV ( $M = 2.43$ ). Overall, DT, TPT, PPT, and NOA were all enhanced with the utilization of guidance in both the IC and TPV procedures. For the IC block, students showed improved

image stability [75.55 to 100 (M=96.13, SD = 5.43) %] compared to the TPV [49.47 to 100 (M=86.25, SD=15.06) %].

### **Discussion/Conclusion**

The preliminary results from this study confirm the effectiveness of our approach in a live educational environment, specifically: (1) the computation of standardized student performance assessment metrics on ultrasound usage, benchmarking against expert usage in both *with-instrument-guidance* and *without-instrument-guidance* modes; (2) the provision of instrument targeting cues to the student which assist them in targeting faster and more accurately with fewer number of attempts and needle redirections. The preliminary results were particularly striking in exhibiting a decreased number of attempts when SRNAs utilized the guidance mode of the EDU unit during both the IC and the TPV procedures. This study is ongoing, with additional nerve block procedures and scoring metrics planned over the course of the semester-long curriculum. This work was funded by NIH grant 1R43GM144333-01.

### **Conflict of Interest**

None.

### **References**

1. "Standards for Accreditation of Nurse Anesthesia Programs" available at [www.coacrna.org](http://www.coacrna.org).
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