TRACKING MOTION DEVICES AS ASSESSMENT TOOLS IN ANESTHESIA PROCEDURES: HAVE WE BEEN USING THEM WELL?

To the editor: We read with interest the recent article by McGraw et al.[1] in which they developed a simulation-based curriculum for residents to learn ultrasound-guided central venous catheter (CVC) insertion. They assessed the residents' progress during training using a Global Rating Scale (GRS) and hand motion analysis.

Hand motion analysis through specific devices has been successfully used for years in the surgical field.[2-5] More recently, they have been used in anesthesia as assessment tools for procedural skills, as well.

Two different devices using electromagnetic fields have been described in the literature. The Imperial College Surgical Assessment Device (ICSAD)[6] is a device that tracks operator's hand motion. It uses an electromagnetic tracking system (Isotrak II; Polhemus Inc., Colchester, VT, USA) consisting of an electromagnetic field generator and sensors placed on the back of the operator's hands. Three dexterity scores can be measured: total distance travelled by each hand, number of movements, and total time.[7] The ICSAD has demonstrated construct validity in many surgical procedures, including open, laparoscopic, and microsurgery.[3] Additionally, in the anesthesia field, its construct and concurrent validity has been established in labor epidural placement,[6] ultrasound-guided supraclavicular block,[8] and jugular CVC placement.[9]

The hand motion analysis (HMA) hardware consisted of a driveBAY electromagnetic field generator and control box (Ascension, VT, USA), one reference sensor, and two hand sensors (Model 800, 7.9 mm, 6-DOF). Three-dimensional position data from the electromagnetic sensors are registered using an open-source software. Metrics used to evaluate motion efficiency are the same: total time of procedure, total path length (distance travelled), and number of translational motions.

This device is the one used by the authors in the present study, and it has been previously validated by Clinkard for ultrasound-guided jugular CVC placement[10] but not by Chin who used ICSAD.[8]

Both systems collect the x, y, z Cartesian coordinate information from each sensor at a determined resolution and frequency. Most reports of ICSAD use an accuracy of 1 mm at 20 Hz.[6,8] On the other hand, driveBAY device reports an accuracy of 1.4 mm at 50 Hz.[10]

Additionally, the number of hand movements is determined based on a calibration process of translational and rotational velocity thresholds. Therefore, the number of movements registered is highly dependent upon the thresholds that the researchers have pre-defined. In the present study, McGraw registered the total number of hand motions when translational or rotational velocity exceeded 50 mm/second and 50 degrees/second, respectively.[1] Chin used a velocity tolerance threshold of 20 mm/second[8] in supraclavicular blocks, and Hayter used 7.5 mm/second[6] in lumbar epidurals.

Clearly, evidence supports that tracking motion devices are valid assessment tools for procedural skills. Nevertheless, given those technical calibration processes, careful interpretation should be taken in consideration while extrapolating these types of data. Both accuracy and movement thresholds should be the same if we want to compare numbers, such as number of movements or meters travelled (total path length). These considerations are of paramount importance if these devices are becoming part of routine assessment tools in residency programs.

The three parameters delivered by these devices have proved validity (i.e., time, total path length, and number of hand movements).[5] Specifically for CVC placement, ICSAD was validated because total path length discriminates between expert and novices and correlates with a previous, validated GRS.[9] The number of movements was not reported in this study. On the other hand, the driveBAY device was validated because motion parameters discriminate between expert and novice and correlate to a previously published modified GRS.[10] Total path length was not reported in this study. Although both devices have been validated for this procedure, the parameter used to evaluate validity was different.

Finally, the use of this motion device in the evaluation of motor skills allows obtaining quantitative data complementing previous validated visual scales. Having as many instruments as possible for evaluating motor skills could improve the learning process. In the future, if we want to set up metrics or cut-off scores to be achieved with motor skills training,

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a previous standardization of both parameters to be used and calibration thresholds should be established for each setting.

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