

## ACS 2023 Surgeons and Engineers: A Dialogue on Surgical Simulation Meeting

### Research Abstracts

#### Estimating Surgical Instrument Position in Blind 3D Space during Simulated Retropubic Trocar Passage

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**Introduction:** The retropubic midurethral sling surgery involves blind passage of sharp trocars cephalad to the pubic symphysis, with well-documented injuries to the urethra, bladder, bowel, and blood vessels. Our objective was to determine if surgical novices are more likely than experts to be unaware of their instrument location in space.

**Methods:** Expert and novice surgeons performed bilateral retropubic trocar passes of a Gynecare TVT trocar (models #810041B-#810051) on a nontransparent pelvis simulation platform. We tracked the tip of the trocar relative to internal vital organs using 8 mm retroreflective motion capture markers on the trocar and model, and twelve OptiTrack Flex 13 cameras at a frame rate of 120Hz. Participants vocalized when they perceived the trocar tip touching the caudal aspect of the bone and crossing 3 planes (Figure 1). Two observers selected onsets for each waveform, for interrater reliability. For each trial we calculated differences ( $\Delta$ Bone,  $\Delta$ Turn,  $\Delta$ Top,  $\Delta$ Pop) between vocalization times and when the trocar crossed the corresponding plane (Figure 1). We performed Mann-Whitney tests to investigate differences in mean deltas between novices and experts, Chi-Square tests to detect differences in vocalizing early versus late, and Levene's test to assess the equality of variances for subject-level variation.

**Results:** Six subjects performed 38 trials, including 22 expert and 16 novice trials. Interrater reliability for the four vocalization onset times ranged from 0.98 to 0.99.  $\Delta$ Bone was significantly smaller among novice surgeons (1.210 vs. 2.824 seconds,  $p < .05$ ). There were no significant differences between novices and experts in the remaining three deltas or in vocalizing early versus late. Levene's test revealed significant differences in within-subject variability for  $\Delta$ Top ( $p < .001$ ) and  $\Delta$ Pop ( $p < .001$ ).

**Conclusions:** For most blind points, expert and novice surgeons were similar in their estimation of the trocar's location relative to the simulation model's suprapubic bone. We suspect the experts may conceptualize these blind planes differently.

