ABSTRACT 21

DYNAMICS OF FOLEY CATHETER INSERTION: A CADAVER STUDY

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Introduction: Catheter associated urinary tract infection (CAUTI) is among the most common non-payment hospital acquired conditions. Foley catheter placement has been shown to impact CAUTI rates [PMID20156062]. Notably, inexperienced healthcare providers such as medical students are associated with a 4-fold higher CAUTI rate [PMID30145285]. Little is known about the mechanical dynamics of urinary catheter insertion. Our objective is to characterize the mechanics of Foley catheter insertion to aid the creation of accurate training modules and simulators.

Methods: The mechanics of Foley catheter insertion were characterized with n = 8 unfixed male cadavers (access through University of Minnesota Medical School Anatomy Bequest Program) and n = 4 simulators. 16f Foley catheters were attempted across all 8 donors. A 16f Coude catheter was used when the Foley was unsuccessful due to prostatic obstruction. Custom designed instrumentation, with a calibrated $\pm$ 2 mN accuracy, was used to measure the insertion force [Fig. 1]. OpenCV ArUco markers were used to capture the 3D insertion motion with a GoPro camera.

Catheter Insertion Force Assessment Tool

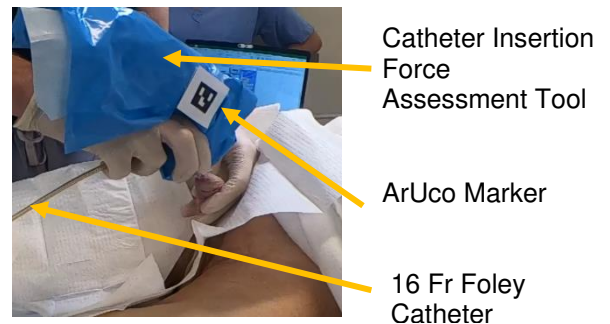ArUco Marker

16 Fr Foley Catheter

Figure 1: Device and motion tracking marker used during cadaveric procedure.

Results: Out of the 8 donors, only 5 yielded successful catheterizations; all simulator insertions were successful. Greater insertion forces were observed in the simulators. Insertions in the prostate region were also correlated with higher force compared to the distal urethra [Fig. 2]. Both results were statistically significant. Additionally, procedure times were found to be longer for simulator catheterizations (75s mean for simulators, 35s for donors) although this was not statistically significant.

Conclusion: The coupled force measurements and computer vision motion capture gives a first-of-its-kind full mechanic assessment of urinary catheter insertion. With future efforts, we plan to replicate this work in living patients to compare to these cadaveric results and to inform the creation of accurate training modules and simulators.
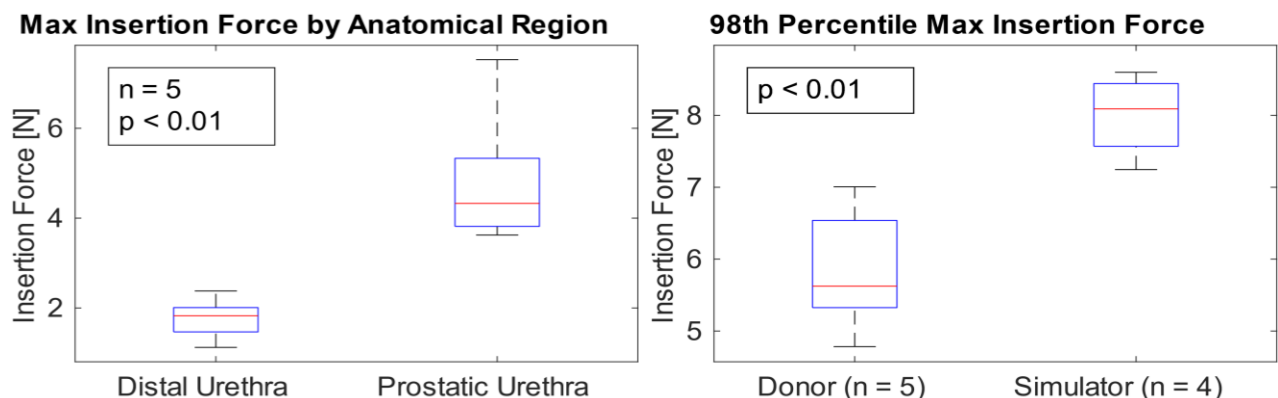
Figure 2: Summary statistics of donor and simulator experiments.