

## Clinical Efficacy, Accuracy, and Radiation Reduction Using Instrument Tracking and Ultra-low Radiation Imaging in Minimally Invasive Surgery

Timothy Y. Wang MD; Vikram Mehta MPH, MD; Eric W. Sankey MD; Elizabeth P Howell BS; Chester Yarbrough MD MPHS; Muhammad M Abd-El-Barr MD PhD

[Institution]

#### Introduction

Image-guided surgery (IGS) reduces blood loss, morbidity, and pain associated with open spine surgery, but it is associated with a substantial increase in patient radiation, operating room time, and a change in surgeon workflow. The principle of ultra-low radiation imaging with image enhancement, coupled with simultaneous instrument tracking (ULRI-IE/IT) is an IGS principle that can be used to reduce procedural radiation exposure, increase surgeon accuracy, and reduce operative time; however, there is currently a lack of clinical data to support or refute this claim.

### Methods

A randomized study was performed evaluate radiation exposure, accuracy, and operative time of ULRI-IE/IT compared to conventional fluoroscopy. Consecutive spine procedures involving multiple levels or left and right-sides were included so that each level could be randomized to either ULRI-IE/IT or standard c-arm fluoroscopy. Number of images taken, radiation, and time to perform each task with or without ULRI-IE/IT were recorded. Given that this was a limited trial, identical cases that did not utilize the technology had similar data recorded in order to supplement the control arm.

# Results

Ten study patients and three control patients were enrolled in this trial. The tasks studied included skin marking, placement of an initial dilator, and instrument localization for hardware placement. Forty-one total levels had internal controls. Overall. ULRI-IE/IT resulted in radiation reduction of 86% (p<0.001), as well as an 80% overall reduction in localizing images (p<0.001). Overall time reduction was 74% (p<0.001). Cumulatively, ULRI-IE/IT resulted in 123 minutes of saved operating room time. Statistical significance was seen for each procedure type and each surgeon studied.

### Conclusions

ULRI-IE/IT drastically reduced operating room radiation, x-rays required, and procedural time. To date, this is the first clinical study showing that IGS technology using ULRi-IE/IT can make a surgeon safer and more efficient in the OR without significantly impacting preoperative or interoperative time.

## Learning Objectives

By the conclusion of this session, participants should be able to: 1) Describe the importance of imageguided surgery, 2) Discuss, in small groups, the clinical utility of ultra-low radiation imaging with image enhancement and instrument tracking, and 3) Identify effective applications for ultra-low radiation imaging with image enhancement and instrument tracking within spine surgery.

### References

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