

Intraoperative Multidimensional (3D) Fluoroscopy Leads to Surgeon Modification of Reduction and Implant Fixation

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Purpose: Conventional fluoroscopy is the current standard for measuring reduction during pelvis and acetabular surgery, but it has limited ability to quantify small fracture displacements, identify intraarticular fragments, and permit safe insertion of implants in narrow bone corridors. Most complications are identified on postoperative CT scans, potentially leading to unplanned reoperation. Recent studies have highlighted potential advantages of intraoperative multidimensional fluoroscopy (IMF; 3D), which may resemble CT. This prospective study hypothesized that a provisional IMF "spin" would lead to intraoperative surgeon decision to improve reduction and/or implant fixation in more than 10% of cases.

Methods: This is a prospective observational study of patients older than age 17 years undergoing pelvis and/or acetabular fracture surgery from 2023 to 2025. Seven fellowship-trained trauma surgeons participated. A provisional IMF spin was performed at least once after reduction was achieved with temporary and/or partial definitive fixation, and a final spin was performed after final implant insertion. All patients had a postoperative CT scan. The primary outcome was incidence of surgeon modification of fracture malreduction or implant malposition (prospectively recorded) based on provisional IMF spin. Secondary outcomes included final spin reduction/implant modification and radiation dosage of fluoroscopy, IMF, and CT.

Results: In total, 62 patients with 67 surgeries were enrolled (mean age: 65.7 years, body mass index [BMI]: 28.0, injury severity score [ISS]: 20.2, male: 48). There were 26 pelvis fractures, 36 acetabular fractures, and five combined injuries. After the provisional spin, the surgeon chose to improve the reduction (n = 13), modify fixation (n = 23), or both (n = 10) in 36 of 67 surgeries (53.7%). Implant fixation was modified in seven cases (10.4%) and reduction in zero after the final IMF spin. The mean fluoroscopy total dose-area-product (DAP) was 21,263 mGy-cm² and mean air kerma dose was 62.6 mGy, which was significantly less than IMF DAP 40,560 mGy-cm² and air kerma 217.4 mGy (p<0.001). Mean postoperative CT dose-length-product was 803.9 mGy-cm.

Conclusion: This prospective study demonstrated that IMF utilization resulted in the surgeon decision to improve pelvis/acetabular fracture reduction or modify fixation in more than half of all surgeries. Overall patient radiation dose may be decreased if postoperative CT was not obtained in lieu of IMF.