

Clinical Significance of Cortical Perforation During Fixation of Femoral Neck Fractures: Does the “In-Out-In” Screw Matter?

Tayseer Shamaa, MD; **Brandon Yuan, MD¹**; William Aibinder, MD; Joshua Parry; William Wood Cross; Andrew Sems, MD
¹Mayo Clinic, Rochester, Minnesota, USA

Purpose: Cannulated screw fixation (CSF) is commonly utilized in treatment of femoral neck fractures (FNFs). Use of a modified inverted triangle configuration of 3 screws places the posterosuperior screw in close proximity to the lateral epiphyseal artery if cortical perforation were to occur. Intraoperative fluoroscopic evaluation of the posterosuperior femoral neck is difficult. We sought to compare the clinical fate of hips with a confirmed extraosseous screw to those without, and to determine surgeon accuracy in confirming an intraosseous screw pathway based on fluoroscopy.

Methods: All patients who underwent CSF of an FNF from 2005 through 2015 were identified. Postoperative CT scans of the pelvis were reviewed for violation of the cortex of the femoral neck. Radiographic or CT signs of ON (osteonecrosis), and conversion to hip arthroplasty (HA) were recorded. Additionally, a 3.2-mm guide pin was placed into the posterosuperior quadrant of 11 adult-sized foam cortical femora. Five samples were “all-in” and 6 were “in-out-in.” Ten fluoroscopic images (5 AP and 5 lateral views) were obtained at 10° intervals of each model. The images were reviewed in a blinded fashion by 5 attending orthopaedic trauma surgeons and 20 resident surgeons. Accuracy and interobserver reliability were assessed.

Results: 362 patients underwent CSF of an FNF from 2005-2015, and in 104 patients a CT of the pelvis was available at a mean of 32 months postoperatively. Mean age was 73 years. In 55 (53%) of 104 patients the posterosuperior screw was extraosseous. The rate of ON was 5% and 2% ($P > 0.1$) and the rate of conversion HA was 4% and 2% ($P > 0.1$) in patients with and without an extraosseous screw, respectively. In the foam cortical models, accuracy in predicting cortical perforation showed substantial interobserver reliability with $\kappa = 0.70$. Accuracy was 87% among attending surgeons and 86% among residents ($P = 0.50$). Sensitivity and specificity for detecting cortical perforation was 98% and 71%, respectively.

Conclusion: In a cohort of geriatric patients undergoing CSF of an FNF revealed a high rate of cortical perforation of the posterosuperior cortex as assessed by CT. The clinical consequences of this finding remain unknown, as the rates of conversion HA and ON did not correlate with cortical perforation. The surgeon’s ability to determine an extraosseous screw pathway in the posterior superior neck is imperfect, even when utilizing a number of oblique fluoroscopic images.