

Predictors of Cephalomedullary Nail Failure in the Treatment of Pertrochanteric and Intertrochanteric Hip Fractures

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Purpose: Intertrochanteric and pertrochanteric hip fractures are common injuries that affect elderly patients. Failure of fixation for these fractures leads to devastating complications with significant effects on the patient. The current study evaluates radiographic parameters that may be predictive of cephalomedullary nailing failure in pertrochanteric and intertrochanteric hip fractures.

Methods: A retrospective review was performed of all pertrochanteric and intertrochanteric femur fractures (AO/OTA31-A1,2,3) treated with a trochanteric entry cephalomedullary nail from January 2007 through January 2014 at our institution. Inclusion criteria were patients 55 years or older, low-energy fracture mechanism, and a minimum of 3 months radiographic follow-up. Pathologic and periprosthetic fractures were excluded. Injury radiographs were assessed for greater trochanter comminution, unstable posteromedial fragment, gapping at the basicervical component after fixation, malreduction of the femoral neck-shaft angle defined as $>5^\circ$ varus or $>15^\circ$ valgus compared to contralateral, tip-apex distance (TAD) >25 mm, and surgeon fellowship training. Each parameter was assessed for failure, and multivariate regression analysis and odds ratios (ORs) were performed among variables.

Results: Of 932 charts reviewed, 362 met inclusion criteria. Average patient age was 83 years and 95.9% were from a low-mechanism injury. The average length of follow-up was 11.5 months. A total of 22 (6%) cutouts occurred. Cutout was significantly more frequent in patients presenting with comminution of the greater trochanter ($P < 0.01$), loss of the medial calcar ($P = 0.01$), gapping at basicervical component after fixation ($P < 0.01$), malreduction in varus $>5^\circ$ or valgus $>15^\circ$ of contralateral ($P = 0.01$), and screw above mid-neck ($P = 0.01$). There was no significant difference in failure rate with TAD >25 mm ($P = 0.46$). Multivariate regression analysis was performed to isolate the effect of individual risk factors. Presence of greater trochanter comminution was associated with the greatest risk of fixation failure (OR = 8.7, $P > 0.01$). Angular malreduction was the next most predictive (OR = 4.9, $P < 0.01$) followed by residual gapping at a basicervical component (OR = 3.8, $P = 0.04$). Lag screw placement above mid-neck (OR = 2.9, $P = 0.08$), presence of a posteromedial fragment (OR = 1.8, $P = 0.49$), and fixation performed by non-trauma fellowship-trained surgeons (OR = 1.8, $P = 0.21$) trended towards increased cutout but were not statistically significant.

Conclusion: Preoperative assessment of intertrochanteric femur fractures can help provide further prognostic information based on fracture pattern. Preoperative presence of greater trochanteric comminution or involvement of posteromedial fragment was shown to be of significant risk to lag screw/helical blade cutout. Postoperative parameters of basicervical gapping, malreduction, and superior screw placement were also associated with hardware

failure. This suggests that fracture pattern, reduction, and hardware placement are each associated with postoperative patient prognosis. The presence of multiple radiographic predictors further compounds the chances of lag screw/helical blade cutout. The use of a cephalomedullary nail did not have an increased failure rate based on a TAD >25 mm. This information could be useful in the surgical planning / technique and preoperative counseling of patients with this fracture presentation.