

The Effect of Intramedullary Nail Entry Point on Postoperative Femoral Shaft Fracture Alignment

Michael Wesley Honeycutt, MD; Kyle Cox, MD; William Tanner Cox, BS; Gregg Delgado, DO; Jeffrey Brewer, MD
University of South Alabama, Mobile, AL, United States

Purpose: Intramedullary femoral nailing technique has evolved and improved since its development in 1939. However, postoperative malalignment continues to be a known complication. The purpose of this study is to determine if there is a postoperative alignment advantage with femoral nail entry point and to determine if fracture location and fracture pattern secondarily affect alignment.

Methods: A retrospective radiographic review was performed from a university hospital database of 530 patients with 552 femoral shaft fractures (AO/OTA 32A1-32C3) treated with intramedullary nailing from October 2007 to November 2018. Three orthopaedists and 1 radiologist independently measured radiographic femoral alignment using immediate postoperative radiographs. Postoperative malalignment was defined as $>5^\circ$ of angulation in any plane. The differences in alignment were assessed based on femoral nail entry point (trochanteric, piriformis, or retrograde), fracture pattern, and fracture location.

Results: The primary independent risk factors for postoperative malalignment in femoral shaft fractures were proximal fracture location and 32C3 fragmentary segmental fractures. In proximal femoral shaft fractures, the overall malalignment percentage was 28.1% (relative risk: 1.74, $P = 0.0015$). Use of a piriformis entry nail significantly decreased the rate of postoperative malalignment. In proximal femur fractures treated with piriformis entry nails, only 4% were malaligned, whereas 39% of proximal femur fractures treated with trochanteric entry nails were malaligned (relative risk: 0.14, $P = 0.048$). Regardless of fracture location, 32A3 fractures had the lowest rate of postoperative malalignment of 5.8% (relative risk: 0.36, $P = 0.0044$) and 32C3 had the highest rate of 27.5% (relative risk: 1.71, $P = 0.0095$). In the combined fracture location and stability subgroup, midshaft femur fractures with stable fracture patterns (32A1, 32A2, and 32A3 subtypes) had the lowest rate of postoperative malalignment of 6.8% ($P = 0.0071$).

Conclusion: Piriformis entry femoral nails may provide an alignment advantage for proximal third femoral shaft fractures as the central and posterior entry point counteracts the characteristic proximal femur deforming forces and there is no proximal lateral bend in the nail. Proximal third and 32C3 segmental type femoral shaft fractures provide an alignment challenge, and increased care should be taken to evaluate intraoperative femoral shaft alignment with these fracture types.