

Femur Deformity Correction using an Intramedullary Nail

Sarah Hébert, Zachary Glassband, Jason Shih Hoellwarth, Taylor Reif, Austin Thomas Fragomen, S Robert Rozbruch

INTRODUCTION:

The femur, as a major weight-bearing long bone, can exhibit a diverse array of deformities. These deformities may be discrete and angular or broadly bowed and multiapical. They can occur in a single plane or span multiple planes (coronal, sagittal or axial). Such complexity makes surgical correction particularly challenging. However, intramedullary nailing (IMN), when combined with meticulous pre-operative planning and techniques such as the fixator-assisted blocking screw method (FABS), serves as an effective approach. The purpose of this study was to critically assess the safety, precision, and efficacy of IMN as a method for achieving accurate femoral deformity correction.

METHODS:

We conducted a retrospective review of patients who underwent acute femoral deformity correction using an intramedullary nail (IMN) between April 2016 and April 2024, with a minimum of one year of follow-up. Patients treated with lengthening nails were excluded from this study. Preoperative deformity correction goals were established for each patient, and postoperative accuracy in achieving these goals was assessed. Radiographic outcomes measured included mechanical axis deviation (MAD), mechanical lateral distal femur angle (mLDFA), and overall deformity magnitude. In cases involving simultaneous tibial correction, MAD was excluded as an accuracy metric to avoid confounding results.

RESULTS:

We evaluated 194 femurs from 135 patients who underwent femoral deformity correction with IMN. Of these, 154 femurs had purely rotational corrections and were excluded to focus on coronal or combined coronal and rotational deformities, leaving 29 femurs for analysis. The average patient age was 40.9 years, with 65.5% female patients. Deformities were predominantly congenital (17 femurs, 58.6%), with post-traumatic deformities accounting for 8 femurs (27.6%). Fourteen femurs demonstrated isolated angular deformities in the coronal and/or sagittal planes, while 15 exhibited combined angular and rotational abnormalities.

On average, corrections achieved were $30.4 \text{ mm} \pm 21.3 \text{ mm}$ in MAD, $6.9^\circ \pm 4.3^\circ$ in mLDFA, $13.8^\circ \pm 7.0^\circ$ in focal deformity, and $20.6^\circ \pm 16.4^\circ$ in femoral rotation. Preoperative goals were met with accuracies of $98.1\% \pm 2.1\%$ for mLDFA, $95.5\% \pm 9.0\%$ for MAD, and $84.4\% \pm 12.6\%$ for focal deformity. Three patients (10.3%) experienced complications requiring additional intervention: one patient underwent exchange nailing due to delayed union, subsequently achieving healing, and two patients (6.9%) required secondary osteotomies for residual deformities. No infections requiring oral antibiotics or surgical intervention were reported.

DISCUSSION AND CONCLUSION: Acute femoral deformity correction using intramedullary nailing is a safe and precise technique for managing complex multiplanar deformities. The approach demonstrated high accuracy in achieving planned corrections, with a low rate of complications that were effectively managed.