

Clinical and Radiographic Outcomes Following SIGN Fin Nailing for Femoral Shaft Fractures

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Purpose: The Surgical Implant Generation Network (SIGN) intramedullary nail was designed for use in resource-limited settings that often lack fluoroscopy, specialized fracture tables, and power reaming. A newer design iteration, the SIGN Fin nail, was developed to further simplify retrograde femoral nailing by making proximal interlocking screw placement unnecessary. Instead, the leading end of the Fin nail achieves stability through an interference fit within the proximal femoral canal. While the performance of the traditional SIGN nail has been reported previously, no study has examined long-term clinical and radiographic outcomes of femoral shaft fractures treated with the SIGN Fin nail.

Methods: The SIGN online surgical database was used to identify all adult femoral shaft fractures treated with the SIGN Fin nail since its introduction. Patients with minimum 6-month clinical and radiographic follow-up were included in the analysis. Available demographic, injury, and surgical characteristics were recorded. Fracture alignment was evaluated on both immediate postoperative and final follow-up radiographs using a previously validated on-screen protractor tool. Coronal and sagittal plane alignment measurements were recorded as deviation from anatomic alignment (DFAA), with units in degrees. Fracture healing was assessed on final follow-up radiographs, with union defined as any bridging callus and/or cortical continuity on orthogonal views. Clinical outcomes available in the database included knee range of motion (ROM) greater than 90° and weight-bearing status at final follow-up. Clinical and radiographic outcomes were then compared between patients with united versus nonunited fractures.

Results: The database identified 249 femoral shaft fractures stabilized with the Fin nail in 242 patients who had minimum 6-month clinical and radiographic follow-up. Final follow-up radiographs were performed at an average of 48 weeks postoperatively. Average coronal and sagittal plane alignment measured on final follow-up radiographs were 2.18° and 2.58°, respectively. The rate of malalignment (DFAA >10° in either plane) at final follow-up was 6%. 229 fractures (92%) were united at final follow-up. Overall, 84% of patients achieved full weight bearing and 86% achieved knee ROM >90° at final follow-up. Compared to patients with united fractures, those with nonunion were less likely to achieve full weight bearing (20% vs 90%, $P < 0.001$) and knee ROM >90° (30% vs 91%, $P < 0.001$). There was no significant difference in mean DFAA between united and nonunited fractures on the AP (2.1° vs 3.8°, $P = 0.298$) or lateral (2.5° vs 3.5°, $P = 0.528$) views.

Conclusion: The SIGN Fin nail achieves satisfactory radiographic alignment and clinical outcomes at minimum 6-month follow-up. The overall union rate (92%) is comparable to that achieved with the standard SIGN nail. Ease of implantation makes the Fin nail an attractive option in resource-limited settings.