

Management of Distal Metaphyseal Tibia Fractures with the SIGN Intramedullary Nail in Three Developing Countries

Kyle R. Stephens, DO¹; Faseeh Shahab, MBBS²; Daniel Galat, MD³; Duane Anderson, MD⁴; Shahab Ud Din, MBBS, FCPS (Ortho)²; Paul S. Whiting, MD⁵;

Douglas W. Lundy, MD⁶;

¹Henry Ford Macomb Hospital, Clinton Township, Michigan, USA;

²Lady Reading Hospital, Peshawar, Pakistan;

³Tenwek Hospital, Bomet, Kenya;

⁴Soddo Christian Hospital, Soddo, Ethiopia;

⁵Tufts University, Boston, Massachusetts, USA;

⁶Resurgens Orthopaedics, Marietta, Georgia, USA

Purpose: The Surgical Implant Generation Network (SIGN) intramedullary nail is designed for use in low-resource settings without fluoroscopy, power instrumentation, or special operating tables. Our purpose was to evaluate its use in distal metaphyseal tibia fractures in three developing countries.

Methods: Data from the SIGN online surgical database was reviewed for all AO/OTA 43A distal tibia fractures treated with the SIGN nail at three hospitals in developing countries. Patient demographics, clinical information about the fracture and surgery, and postoperative outcome information were collected. Patient follow-up in the developing world is an extremely challenging issue, so only patients with a minimum of one postoperative visit were included.

Results: Between February 2009 and October 2013, 160 patients with 162 fractures were included. Average age was 35.3 years \pm 13.1. 79% were male. Mean time to surgery was 4.1 days. Rate of fracture union was 97.3%. Average time to union was 105 days (15 weeks). 60% of fractures were closed. Patients with open fractures accounted for 63% of total complications ($P = 0.001$) and 86% of infections ($P = 0.0004$). Open reduction of closed fractures was performed in 53% ($n = 51$) of cases. 151 fractures (93%) had an associated fibula fracture, but only 12 fractures (7.4%) underwent fibular fixation in addition to tibial nailing. Acceptable alignment (less than 5° deformity) was found in 83% ($n = 134$) of fractures. Tibia fractures with an associated fibula fracture at the same level had a higher incidence of malalignment (22%) as compared with fractures at different levels (13%) ($P = 0.257$). Valgus was the most common deformity overall although varus deformity was most common with proximal fibula fractures. Complications included 3 nonunions (1.8%), 14 infections (8.6%), and revision surgery in 10 fractures (6.2%).

Conclusion: Distal metaphyseal tibia fractures can be managed successfully with the SIGN intramedullary nail in low- and middle-income countries with excellent outcomes equal to results in developed nations with far more financial resources, technology, and health-care infrastructure. Open fractures are at a significantly increased risk for complications and infection. Open reduction of closed distal tibia fractures in developing settings is safe and effective. Malalignment, especially valgus, is more common in fractures with same-level fibula fractures. For the surgeon interested in disaster relief or international work in developing countries, the SIGN nail is an effective means of managing distal tibia fractures.

- The FDA has not cleared this drug and/or medical device for the use described in this presentation (i.e., the drug or medical device is being discussed for an "off label" use). For full information, refer to page 600.