

COMMENTARY

Use of flexible intramedullary nails in pediatric femur fractures.

Ho C, Skaggs D, Tang C, Kay R.

J Pediatr Orthop. 2006;26(4):497-504.

Various methods can be employed to treat pediatric femoral shaft fractures. The risks and benefits, as well as the fracture type, age and size of the patient, associated medical or traumatic problems, and socioeconomic status must be considered. These factors have been extensively addressed in the literature recently. The authors retrospectively reviewed their outcomes in pediatric patients with femoral shaft fractures treated with retrograde, flexible titanium intramedullary nails. Although they report favorable long-term results, their complication rate was relatively high, especially in older children.

In 2004 Narayana also reported their complications using flexible intramedullary nails through their first 5 years, with the average age of the patients 10.5 years. Most of their complications were related to prominent or bent nail ends early in their experience, causing them to straighten and shorten the ends, leaving them closer to the metaphyseal flare. All fractures united, with median time to union 10 weeks, and functional range of motion achieved at a median of 8 weeks. Malunion was reported in 8 of 78 fractures, attributed to greater than 25% comminution and mismatched nail size. There were 10 reoperations: 3 due to loss of reduction and 2 due to refracture.

The current authors report a complication rate of 17% (16/94 fractures) with 8 unplanned returns to the operating room. Seven complications were related to wound or skin problems; there was one refracture. The eight unplanned surgeries included 3 hardware revisions. Persistent femoral leg length discrepancy averaging 1.5 cm at 2 years was noted in 5 patients. The authors report shorter time to full weight bearing, time to union, time to return to preoperative activity, and complication rate (9% in children younger than 10 years and 34% in children older than 10 years) in patients younger than 10 years of age.

Ligier et al, as well as the current authors, report more skin irritation problems due to the bending and prominence of the flexible nails than are reported in the less flexible Ender rods. Also, the Ender rods have a flat end, leading to less hardware irritation. These more stout nails have less malunion rate as well. Cramer et al reported Ender fixation in 57 fractures for children aged 5 to 14 years and found bridging callus at an average of 3 weeks, union within 12 weeks, and no leg length discrepancies greater than 2 cm. There were no unplanned returns to the operating room. Although use of Ender nails is limited by canal size, Cramer et al recommends their use over titanium nails due to their increased rigidity, flat ends, and locking capability.

Locked intramedullary nails in the adolescent population has been a topic of much controversy. Piriformis entry nails risk damaging the medial femoral circumflex artery, the primary vascular supply to the femoral head. There are multiple case reports in the literature of avascular necrosis following piriformis entry nails. Additional risks not discussed as often include increased femoral neck valgus and thinning of the femoral neck. This has led to moving the portal more lateral and using trochanteric entry nails. Gordon et al reported no avascular necrosis (AVN), thinning, or valgus deformity after lateral transtrochanteric entry with minimum follow-up of 2 years in patients with average age of 10.5 years. Similarly, Momberger et al reported no

incidence of AVN and no significant proximal femur deformity in 50 femoral shaft fractures in children with average age of 13.2 years treated with greater trochanter starting portal locked intramedullary nails with average follow-up of 16 months. Townsend and Hoffinger also report no incidence of AVN in their series of trochanteric entry intramedullary nails in children older than 10 years.

Treatment of femoral shaft fractures in children is dependent on many factors, which makes randomized studies to evaluate different treatment methods difficult to perform. Current philosophies are predominantly age dependent. There exists no consensus on treatment, and the risk and benefits of each treatment must be considered on an individual basis. Favorable results have been reported with most methods, with AVN of the femoral head after piriformis entry antegrade nailing the most feared complication.

References:

Cramer K, Tornetta P, Spero C, Alter S, Miraliakbar H, Teefey J. Ender rod fixation of femoral shaft fractures in children. *Clin Orthop*. 2000;376:119-123.

Gordon J, Swenning T, Burd T, Szymanski D, Schoenecker P. Radiographic changes after lateral transtrochanteric intramedullary nail placement in children. *J Bone Joint Surg Am*. 2003;85:1295-1301.

Ligier J, Metaizeau J, Prevot J, Lascombes P. Elastic stable intramedullary nailing of femoral shaft fractures in children. *J Bone Joint Surg Br*. 1988;70(1):74-77.

Momberger N, Stevens P, Smith J, Santora S, Scott S, Anderson J. Intramedullary nailing of femoral fractures in adolescents. *J Pediatr Orthop-A*. 2000;20(4):482-484.

Narayana U, Hyman J, Wainwright A, Rang M, Alman B. Complications of elastic stable intramedullary nail fixation of pediatric femoral fractures, and how to avoid them. *J Pediatr Orthop-A*. 2004;24(4):363-369.

Townsend D, Hoffinger S. Intramedullary nailing of femoral shaft fractures in children via the trochanteric tip. *Clin Orthop*. 2000;376:113-118.