

## Comparable Outcomes Between Length Stable and Unstable Pediatric Femur Fractures Treated with Flexible Intramedullary Nailing

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**Purpose:** Pediatric femur fractures are common injuries in school-age children. Various fixation options exist for definitive management with flexible intramedullary nailing (IMN) a popular choice. However, controversy exists regarding the use of flexible IMN in length unstable fracture patterns with reports of increased complications including early femoral shortening and leg-length discrepancy (LLD). The purpose of our study was to further explore length stability in pediatric femur fractures in an expanded data set, hypothesizing no differences in outcomes between stable and unstable fractures.

**Methods:** All pediatric femoral fractures treated with flexible IMN from January 1, 2006 to December 31, 2012 at a tertiary-care institution were identified. Pathologic fractures were excluded. Fracture characteristics were based on review of injury films and categorized as either length stable or unstable using previously described criteria. Length stable fractures had transverse or short oblique patterns. Length unstable fractures had either comminution or long oblique patterns where the obliquity length was greater than twice the shaft diameter at the level of the fracture. Outcome measures included postoperative complication rates, elective hardware removal rates, early femoral shortening, and LLD. Complications included nonunion and/or malunion necessitating reoperation, clinically significant LLD requiring surgical intervention, infection, and/or repeat surgery prior to complete fracture healing (<3 months from initial surgery). Early length stability was assessed by measuring the change in femoral shaft length between initial postoperative radiographs. Additionally, we identified a subset of patients with full-length, standing radiographs and compared leg-length inequalities between stable and unstable populations.

**Results:** We identified 106 patients for analysis (63 stable and 43 unstable fractures). Complications necessitating further surgery were seen in 8 of 63 stable fractures (12.7%) including malunion (n = 3), nonunion (n = 1), LLD (n = 2), and early reoperation prior to fracture healing (n = 2). Of the 43 unstable femur fractures, 5 patients (11.6%) experienced complications including refracture (n = 1) and early reoperation prior to fracture healing (n = 4). There was no difference in complication rates between groups ( $P > 0.1$ ). Hardware removal rates were similar between stable and unstable populations (77.8% vs 65.1%, respectively;  $P > 0.1$ ). There was no difference ( $P > 0.1$ ) in femoral shaft length between initial postoperative visits with stable (average 0.13 mm, n = 56) and unstable (average 0.18 mm, n = 38) patients. Leg-length discrepancies were similar ( $P > 0.1$ ) between stable (n = 30) and unstable (n = 18) groups (average 7.1 vs 5.33 mm, respectively) at an equivalent time from index surgery to standing examination (544 vs 578 days, respectively).

**Conclusion:** Based on data here, unstable femur fractures are not at increased risk for more complications, higher elective implant removal rates, early femoral shortening, or LLD. Flexible IMN likely remains a viable treatment option for length unstable pediatric femur fractures.