

# Outcome of Elastic Intramedullary Nailing for the Treatment of Paediatric Femoral Shaft Fractures.

Naseer Ahmed Ch, Muhammad Azeem, Muhammad Shahnawaz Ahmed, Mohsin Bilal

## ABSTRACT

**Objective:** To demonstrate the rate of union after closed elastic intramedullary nail fixation of paediatric femoral shaft fractures.

**Methods:** The design of our study was descriptive and was conducted from 15-04-2016 to 15-10-2016 at Sheikh Zayed Medical College/Hospital, Rahim Yar Khan. All patients fulfilling inclusion criteria who underwent femur elastic intramedullary nail insertion in retrograde fashion for the treatment of Paediatric femur fractures were enrolled in the study. Patients were in regularly followed un-till radiological union.

**Results:** A total of 55 patients including 33 males and 22 females with mean age  $6.5 \pm 1.65$  years and mean weight  $19.11 \pm 4.46$  kg were included. Fracture union was seen in 47 (85.45%) patients. There was almost equal union in both male and females with p value of 0.88. Better union was seen in age group of 5 to 8 years with union in 26 out of 29 patients as compared to age group of 9-12 years ( $p=0.35$ ) Union was better seen in patients with weight less than 20 kg and duration of fracture 5 days or less with p values of 0.06 and 0.45. Thirty (90.91%) out of 33 patients had union in simple fractures as compared to comminuted in 17 out of 22 with p values of 0.16 as displayed.

**Conclusion:** Elastic intramedullary nailing results in early union of femur shaft fractures in children with simple fractures who presented early and with body weight of less than 20 kilogram.

**Key words:** femoral shaft fractures in children, intramedullary elastic nailing, and union rate.

*This article may be cited as:* CH, Naseer Ahmed et al. Outcome of Elastic Intramedullary Nailing for the Treatment of Paediatric Femoral Shaft Fractures.. **Journal of Pakistan Orthopaedic Association**, [S.l.], v. 30, n. 4, p. 175-178, apr. 2019. ISSN 2076-8966. Available at: <http://jpoa.org.pk/index.php/upload/article/view/281>.

## INTRODUCTION

Paediatric femoral fractures account for 1.6% of all fractures in children.<sup>1</sup> the male to female ratio of femoral fracture is 2.6:1 with a bimodal distribution<sup>2</sup>. The first peak occurs in early childhood and the second in mid-adolescence. The bimodal variation is also seasonal with peak in March and in August in a Swedish study<sup>3</sup>. Most fracture in children are the result of accidents which can be easily prevented.<sup>4</sup>

Many treatment options exist to treat Paediatric femoral shaft fractures. Less invasive modalities include application of Spica casting problems in transportation cast in tolerance and hygiene problems were noted Huges<sup>5</sup>. Spica casting after a period of traction associated with delayed union malunion growth disturbance and physiological problem Reeves

*Correspondence: Dr. Naseer Ahmed Ch*

*Email: ali.orthopaedic.ryk@gmail.com*

etal<sup>6</sup>. External Fixator associated with pin infection application of cast after removal of Fixator are reapplication of Fixator Arousan etal<sup>7</sup>. Intramedullary nailing were used were associated over growth and AVN of femoral head Beatty etal<sup>8</sup>. Locking plates were used to fix these fractures. But more extensive surgical dissection is required in plate removal than the insertion Pate etal<sup>9</sup>.

Flexible femoral medullary nailing is the best treatment for these fractures, because it gives immediate stability and mobilization with short hospital stay, small incisions and minimal blood loss and no special expertise are required, after union implant removal easy with minimal scar mark and low risk of a vascular necrosis and implant failure. But are associated with infection wound ulceration leg length discrepancy and mal alignment Mazda etal<sup>10</sup>. There is a great deal of good healing rates as well as the

---

*Department of Orthopedic Surgery  
Sheikh Zayed Medical College/Hospital, Rahim Yar Khan*

remodeling range in younger children. Closed intramedullary elastic nailing has shown promising results in healing and avoiding complications.

## METHODS

This was a descriptive study including children from age group of 5 to 12 years both sex having femur diaphyseal fracture treated with elastic intra-medullary nail during a period of six months from 15-04-2016 to 14-10-2016. Ethical Review Board (ERB) approval was taken and informed written consent was taken from parents. Patient having metabolic bone diseases pathological fractures, compound fracture and with neuromuscular disorders were excluded from the study. Surgical indications were displaced femur shaft fractures with open physics. Study was conducted on 55 patients having diaphyseal femur fracture of transverse, oblique, spiral and minimally comminuted variety. There were 33 male patients and 22 female patients with average age 09 years (range 6-12 years) at the time of injury.

Demographic data like age (in years), gender (male/female), weight (in kilograms) was taken and other data like type of femur fracture i.e. simple or comminuted, fracture were classified according to AO pediatric (Arbeitsgemeinschaft for Osteosynthesefragen) classification for femoral shaft fracture 32-D (4.1, 4.2, 5.1 and 5.2) duration of fracture (in days) and the hospital stay (in days) after the procedure will also be taken. This procedure was done by medical officer with at least two year experience in Orthopaedics. In this procedure two nails made up of titanium of various sizes ranging from 0.5 to 4 mm which will be adjusted according to the bone diameter of the patients and inserted in retrograde fashion just proximal to physics of the femur and advanced proximally to trochanteric area. This all procedure was done in the operation theatre of Sheikh Sayed hospital Rahim Yar Khan under image intensifier control under general anesthesia.

Postoperatively the operated leg kept elevated for 24 hours to reduce swelling and Rehabilitation started including hip and knee motion exercise a day after surgery followed by non-weight bearing mobilization on 5<sup>th</sup> to 7<sup>th</sup> day post operatively when there was no swelling. Partial weight bearing was started after 03 weeks followed by full weight bearing after 6 to 8 weeks once radiological union was observed. Union described when bridging callus was seen within three months of surgery and nonunion after 03 months.

## RESULTS

We treated 55 patients (33 males, 22 females) with mean age  $8.33 \pm 1.65$  years and mean weight  $19.11 \pm 4.46$  kg. Mean duration of fracture was  $4.05 \pm 2.71$  days, while mean hospital stay post operatively was  $3.65 \pm 1.53$  days. Twenty nine (52.73%) patients had age 5-8 years and rest of patients up to 12. A total of 31 out of 55, (56.36%) patients had weight less than 20 kg. About 34 (61.82%) patients had fracture for 5 days or less. There were 30 patients with simple and 17 (40%) patients with comminuted fractures. Forty six (83.64%) patients had hospital stay less than 5 days post operatively.

Fracture union was seen in 47 (85.45%) patients. There was almost equal union in both male and female patients with p value of 0.88. Better union was seen in age group of 5 to 8 years observed of age with union in 26 (89.66%) out of 29 patients as compared to age group of 9-12 years but this difference was not statistically significant with  $p = 0.35$ . In 20 kg weight patients union was observed in 26 patients. Union was better seen in patients with weight less than 20 kg and duration of fracture 5 days or less with p values of 0.06 and 0.45. Thirty (90.91%) out of 30 patients had union in simple fractures as compared to comminuted in 17 out of 22 with p values of 0.16. Union was also higher in patients with duration of hospital stay less than 5 days with  $p = 0.47$ . Angulation was more than 15 degree observed in five patients and there was infected nonunion in two patients and simple nonunion in one poly trauma patient.

## DISCUSSION

Paediatric femoral shaft fractures account for 1.6% of all childhood fractures or 20/100,000 in United States of America.<sup>11</sup>

Different treatment options are available to treat femur shaft fractures in children and these include close reduction and spicca casting, external fixators and intramedullary nails. Spicca casting in older children is associated with shortening and malunion.<sup>12</sup>

In our study, the union in fractured shaft was seen in 47 (85.45%) patients. Similar results were reported in other studies.<sup>13, 14</sup> There was almost equal union in both male and females with slight female predominance. Nineteen (86.36%) out of 22 females as compared to 28 (84.85%) out of 33 males had union with p value of 0.88. This was also observed by the other studies that also found a slight predominance in

female gender healing. The reason of this can be due to males are more active and mobile as compared to females that lead to early and more extensive mobility and lower rate of union.<sup>15-16</sup>

Better union was seen in age group of 5 to 8 years with union in 26 out of 29 patients as compared to age group of 9-12 years in this group union was achieved in 18 patients, but this difference was not statistically significant with  $p= 0.35$ . Other studies also revealed almost the similar results but they used a little different age groups and included the patients up to age of 14 years. The higher failure rate in the older age groups as compared to younger can be extra motile habits and relatively more weight. On the other hand younger kids have more re generation and remodeling capability that ended in good results.<sup>17-18</sup>

Union was better seen in patients with weight less than 20 kg as compared to overweight patients. This difference was found statistically significant with  $p$  value of 0.05. This was similar to previous studies however they did not have the same weight division criteria and some used the BMI type, which was not used in this study. They also did not find the significant association of this with lower weight group. It was not assessed that the patients with higher weight had what sort of height. May be they had more BMI, which leads to extra pressure on the femur and result in failure of the union.<sup>19-20</sup>

The patients with duration of fracture 5 days or less had better union in contrast to those who presented late. However this difference was not statistically significant with  $p$  values of 0.45. Delayed fractures were unable to reduce accurately and difficult to nailed.<sup>21, 22</sup>

Thirty out of 33 patients had union in simple fractures as compared to comminuted in 17 out of 22. There was almost a significant was seen with  $p$  values of 0.16. The data has been revealed in previous studies as well, the simple fracture had good outcome. The reason of this can be as the simple fracture has only one site of fracture and union is relatively easy. While in comminuted fractures, the chances of multiple pieces to unit together and heal is relatively lower and also there are chances of secondary infections as well.<sup>23-24</sup>

Union was also higher in patients with duration of hospital stay less than 5 days ( $p= 0.47$ ) This time frame was not used by the other studies as was used in this study. But the data from previous studies strength our results as well. They described that the patients that

had mean hospital duration longer, they had lesser union rates. The reason can be explained by the complex nature of the fracture, failure of the procedures, malunion or secondary infection that lead to slower rate of the union or nonunion and hence lower results.<sup>25-26</sup>

There were few limitations of this study. We did not collect data regarding the BMI, one component of which, the weight has shown significant association with fracture union.

There were **much strength** too. We used the most common reported fracture types. The gender, weight, age groups, weight were extensively assessed in fracture union.

Further studies can be planned to check for different materials of intramedullary nailing, BMI analysis, infection rate and the malunion i.e. assessed by degree of angulation after the union of fracture.

## CONCLUSION

Elastic intramedullary nailing results in early union of femur shaft fractures in children with simple fractures who presented early and with body weight of less than 20 kilogram. It is a good procedure with excellent results. We recommend that flexible elastic nail should be considered as favorable treatment option for Paediatric femoral diaphysial fracture.

## REFERENCES

1. Loder RT, O'Donnell PW, Feinberg JR. Epidemiology and mechanisms of femur fractures in children. *J Pediatr Orthop.* 2006;26(5):561–566.
2. Hinton RY, Lincoln A, Crockett MM. Fractures of the femoral shaft in children. Incidence, mechanisms, and sociodemographic risk factors. *J Bone Joint Surg Am.* 1999;81(4):500–509
3. Heideken J, Svensson T, Blomqvist P. Incidence and trends in femur shaft fractures in Swedish children between 1987 and 2005. *J Pediatr Orthop.* 2011;31(5):8.
4. McClain, R.F. Clark, C.R. El-Khoury, G.y. C6-7 Dislocation in the neurologically intact neonate: A patient report. *Spine* 1989;14:125-126.
5. Hughes BF, Sponseller PD, Thompson JD. Pediatric femur fractures: Effects of spica cast treatment on family and community. *J Pediatr Orthop.* 1995;15(4):457–460..
6. Reeves RB, Ballard RI, Hughes JL. Internal fixation versus traction and casting of adolescent femoral

- shaft fractures. *J Pediatr Orthop.*1990;10(5):592–595.
7. Aronson J, Tursky EA. External fixation of femur fractures in children. *J Pediatr Orthop.* 1992;12(2):157–163.
  8. Beaty JH, Austin SM, Warner WCI. Interlocking intramedullary nailing of femoral shaft fractures in adolescents: Preliminary results and complications. *J Pediatr Orthop.* 1994;14(2):178–183.
  9. Pate O, Hedequist D, Leong N. Implant removal after sub muscular plating for pediatric femur fractures. *J Pediatr Orthop.* 2009;29:709-712.
  10. Mazda K, Khairouni A, Pennecot GF, et. Closed flexible intramedullary nailing of the femoral shaft fractures in children. *J Pediatr Orthop.* 1997;6(3):198–202.
  11. Hedlund R, Lindgren U. The incidence of femoral shaft fractures in children and adolescents *Pediatr Orthop* 1986;6:47-50.
  12. Kirby RM, Winquist RA, Hansen ST Jr. Femoral shaft fractures in adolescents: A comparison between traction plus cast treatment and closed intramedullary nailing. *J Pediatr Orthop.* 1981;1(2):193–197.
  13. Lohiya R, Bachhal V, Khan U, Kumar D, Vijayvargiya V, Sankhala SS, et al. Flexible intramedullary nailing in paediatric femoral fractures; a report of 73 patients. *J Orthop Surg Res.* 2011;64(6):01-10.
  14. Sela Y, Hershkovich O, Sher-Lurie N, Schindler A, Givon U. Pediatric femoral shaft fractures: treatment strategies according to age - 13 years of experience in one medical center. *J Orthop Surg Res.* 2013;23(8):08-23.
  15. Barry M, Paterson JM. A flexible intramedullary nails for fractures in children. *J Bone Joint Surg Br.* 2004; 86(7): 947-953.
  16. Flynn JM, Hresko T, Reynolds RA. Titanium elastic nails for pediatric femur fractures: A multicenter study of early results with analysis of complications. *J Pediatr Orthop.* 2001; 21: 4–8.
  17. Timmerman LA, Rab GT: Intramedullary nailing of femoral shaft fractures in adolescents. *J Orthop Trauma.* 1993; 7: 331–337.
  18. Kissel EU, Miller ME. Closed Ender nailing of femur fractures in older children. *J Trauma.* 1989; 29: 1585-1588.
  19. Aktekin CN, Ozturk AM, Altay M, Toprak A, Ozkurt B, Tabak AY. Flexible intramedullary nailing of children. *Ulus Travma Acil Cerrahi Derg* 2007; 13(2): 115-121.
  20. Singh R, Sharma SC, Magu NK, Singla A. Titanium elastic nailing in pediatric femoral diaphyseal fractures. *Indian J Orthop.* 2006; 40(1): 29-34.
  21. Houshian S, Gothgen CB, Pedersen NW. Femoral shaft fractures in children: elastic stable intramedullary nailing in 31 patients. *Acta Orthop Scand.* 2004; 75(3): 249-251.
  22. Narayanan UG, Hyman JE, Wainwright AM, Rang M, Alman BA. Complications of elastic stable intramedullary nail fixation of pediatric femoral fractures, and how to avoid them. *J Pediatr Orthop.* 2004; 24(4): 363-369.
  23. Luhmann SJ, Schootman M, Schoenecker PL. Complications of titanium elastic nails for pediatric femoral shaft fractures. *J Pediatr Orthop.* 2003; 23(4): 443-447.
  24. Salem KH, Keppler P. Limb geometry after elastic stable nailing for pediatric femoral fractures. *J Bone Joint Surg Am.* 2010 Jun;92(6):1409-1417.
  25. Ozdemir HM, Yensel U, Senaran H. Immediate percutaneous intramedullary fixation and functional bracing for the treatment of pediatric femoral shaft fracture. *J Pediatr Orthop.* 2003; 23(4): 453-457.
  26. Cramer KE, Tornetta P 3rd, Spero CR. Ender rod fixation of femoral shaft fractures in children. *Clin Orthop Relat Res.* 2000; 376: 119-123.

#### **Authorship and contribution Declaration**

**Dr. Naseer Ahmed Ch**, Conception and design of the study, collected the data

**Dr. Muhammad Azeem**, interpreted the data Final approval of the version for publication

**Dr. Muhammad Shahnawaz Ahmed**, Revised the manuscript critically for important intellectual content

**Dr. Mohsin Bilal**, Drafted the manuscript