

TREATMENT OF FRACTURE SHAFT FEMUR IN PAEDIATRIC AGE GROUP WITH TITANIUM ELASTIC NAIL

Kishan Gopal Nama¹, Ram Khiladi Meena², Bal Mukund³, Bharat⁴, Dinesh Meena⁵

¹Assistant Professor, Department of Orthopaedics, M.B.S. Hospital and Government Medical College, Kota.

²Assistant Professor, Department of Orthopaedics, M.B.S. Hospital and Government Medical College, Kota.

³3rd Year Resident, Department of Orthopaedics, M.B.S. Hospital and Government Medical College, Kota.

⁴2nd Year Resident, Department of Orthopaedics, M.B.S. Hospital and Government Medical College, Kota.

⁵Associate Professor, Department of Orthopaedics, M.B.S. Hospital and Government Medical College, Kota.

ABSTRACT

BACKGROUND

In this era of speed, management of fracture of shaft femur in paediatric age group have changed from conservative to operative. This reduced the chance of malunion, rotation and angulation along with allow early mobilisation to minimise the morbidity and complications for the child. In this study, we intend to evaluate the functional and radiological outcome of diaphyseal fracture of shaft of femur in children treated with titanium elastic intramedullary nail.

MATERIALS AND METHODS

In this study, 30 patients of 4 - 14 years' age group with femoral fractures were treated with TENS nail.

RESULTS

In this study, outcome was assessed by using Flynn's criteria of titanium flexible nail outcome score. Average operative time was 35 minutes. Partial weight bearing started was at 5 weeks and full weight bearing was started at 8 weeks. Most cases 63.4% were having excellent results, 33.3% were having satisfactory results and 3.3% were having poor results. One case was having superficial infection, which was controlled by antibiotic.

CONCLUSION

TENS nail is having excellent result in fracture shaft femur in paediatric age group with less side effects. So it is surgeon's and patient's friendly implant.

KEYWORDS

Fracture Shaft Femur, Titanium Elastic Nail.

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BACKGROUND

Femoral shaft fractures are common injuries in paediatric age group and represent nearly 1.6% - 2% of all bony injuries in children.^{1,2,3} In the last decade, the management of paediatric femoral fractures has evolved from non-operative to operative approach.^{4,5} Traditional management of paediatric femoral shaft fractures has been by immobilisation in spica cast. Indications for surgical management were few including open fracture with extensive soft tissue trauma, children with associated injuries like head injury, abdominal injury or polytrauma. In non-operative treatment, it has been noticed that problems such as angulation, malrotation and limb length discrepancy cannot be effectively controlled. The goals should be to stabilise the fracture, to control length and alignment, to promote bone healing and to minimise the morbidity and complications for the child.

Among the various operative treatments such as plating, external fixator, rigid intramedullary nailing and elastic

stable intramedullary nailing has become gold standard now. Ender⁶ developed this further with his nails, which were the first to feature adaptations to both ends of the nail in order to improve both control of insertion and quality of fixation. In the early 1980s surgeons in Nancy, France, developed an elastic stable intramedullary nail based on a theoretical concept by Firica.⁷ Previous experience had suggested that elasticity and stability were not easily combined in one construct. However, working from the concept of three-point fixation used with a single Rush nail, these surgeons were able to improve stability significantly by using two pre-tensioned nails inserted from opposite sides of the bone.⁸

In this study, we intend to evaluate the functional and radiological outcome of diaphyseal fracture of shaft of femur treated with elastic intramedullary nail.

MATERIALS AND METHODS

In this prospective study, thirty patients with diaphyseal fracture femur were treated with titanium elastic nail in M.B.S. Hospital and Medical College, Kota from July 2014 to April 2017.

We included children between 4 - 11 years with fracture shaft femur at least 3 cm distal to lesser trochanter and 4 cm proximal to physis.

This study is not limited to children below four years and above 14 years, comminuted, high sub-trochanteric and pathological fractures and bilateral fracture.

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Corresponding Author:

Dr. Kishan Gopal Nama,

#B-17, Civil Line,

Opposite M.B.S. Hospital, Kota.

E-mail: drkgnama1808@gmail.com

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Objective

In this study, we intend to evaluate the functional and radiological outcome of diaphyseal fracture of shaft of femur in children treated with Titanium elastic intramedullary nail.

Operative Technique

Patient was taken on a fracture table and traction was applied under fluoroscopic guidance to reduce the fracture. Proper size elastic nails of 2 to 3.5 mm diameter were taken. Nails were slightly bent in an even curve. This facilitates the nail to bounce off the opposite cortex into the canal and gives three-point fixation. After incising the skin, soft tissue was separated with the help of artery. Using awl insertion points were made, one on lateral and another on medial side of distal femur, 1 - 2 cm proximal to the distal epiphyseal plate. The selected nail is introduced and gently tapped along the medulla with the tip angled away from the cortex. The nails were introduced right up to fracture site, then reduction was achieved at fracture site and one of the nail was passed across the already reduced fracture site followed by second one. The nails were guided in such a way that end of medial nail was introduced into the neck and end of lateral nail just below trochanteric apophysis in a divergent shaped manner. Two divergent elastic nails provide adequate fixations and stability in adolescent femur.^{9,10} We slightly bend the nail before cutting.

Knee bending and quadriceps strengthening exercises were started as soon as the patient could tolerate it, usually within first 24 hrs. itself. Non-weight bearing ambulation was started within first few days, though partial weight bearing was permitted only after radiological evidence of callus formation. Full weight bearing was permitted only on radiological evidence of firm union. Minimum followup of the patient was 1 year.

RESULTS

Between March 2015 and April 2017, 30 children with 30 femoral shaft fractures were treated with Titanium Elastic nails. Ages of children ranged from 4 - 14 years (average 7.7 years). There were 21 boys and 9 girls. The M: F ratio in our study was 7: 3. In our series, 25 patients sustained injury due to fall from height and 5 patients sustained injury due to road traffic accident.

Out of 30 fractures, 19 (63.3%) were of the right side and 11 (36.7%) were of left side. In all 19 fractures were in middle third, 4 in distal third and 7 in proximal third; 18 cases had transverse fracture, 5 were oblique and 7 were spiral in pattern. On Winquist¹¹ grading system 16 were grade I, 8 were grade II, 4 was grade III and 2 was grade IV; 1 segmental fracture was seen. Open fractures and bilateral fractures were not included. Associated injuries were seen in 5 cases.

In this study, the minimum interval between injury and surgery was one day and maximum was seven days. In our study, minimum days of hospital stay were 3 days and maximum were 11 days. The mean hospital stay was 6 days. The average duration of surgery was 35 mins. Except one case, all cases were operated closely. Average blood loss was 40 mL. Knee bending and quadriceps strengthening exercises were begun as soon as patient was able to do. Partial weight bearing was begun around 4 weeks depending on fracture configuration, callus formation and patient tolerance. Full weight bearing was begun in about 6 - 9 weeks' time in most of the cases. The average time to partial weight bearing was

4.3 weeks, full weight bearing was 8 weeks (5 to 12 weeks), full movement was achieved in 11 weeks (8 to 16 weeks); 24 patients out of 30 had limb length discrepancy of 10 mm at 24 weeks followup, while 5 patients had limb length discrepancy of 15 mm, 1 patient had limb length discrepancy of 21 mm; 19 out of 30 patients had angulations of less than 5 degrees, while 10 patients had angulations between 5 to 10 degrees and 1 patient had angulations of more than 10 degrees at 24 weeks followup. In this study, out of 30 cases 21 cases had full range of movement, while 8 had range of movement of 120 degrees and 1 case had range of movement of 110 degrees at 24 weeks followup. In our study, majority of cases 63.33% had excellent and 33.3% had satisfactory and 3.33% had poor result.

Limb Length Discrepancy	Patients Number	Percentage
Less than 10 mm	24	80
10 mm to 20 mm	5	16.7
More than 2 cm	1	3.3

Table 1. Limb Length Discrepancy and Percentage

Angulation	Patients Number	Percentage
5 degrees or less	19	63.3
6 - 10 degrees	10	33.3
More than 10 degrees	1	3.33

Table 2. Angulation and Percentage

Followup

The average followup was 13 months (8 to 24 months). By this time, all the patients had full-unrestricted activity; 24 patients out of 30 had limb length shortening of less than 10 mm at 24 weeks followup, while 5 patients had limb length discrepancy of 12 mm and one had more than 20 mm; 19 patients had angulations of five degrees or less, while 10 patients had angulations between 5 to 10 degrees and 1 patient had angulations of more than 10 degrees at 24 weeks followup. In this study, out of 30 cases 21 cases had full range of movement, while 7 had range of movement of 120 degrees and 2 cases had range of movement of 110 degrees at 24 weeks followup.

Results (Variables at 24 Weeks)	Excellent	Satisfactory	Poor
Limb-length inequality	< 1.0 cm	< 2.0 cm	> 2.0cm
Malalignment	5 degrees	10 degrees	> 10 degrees
Pain	None	None	Present
Other complications	None	Minor and resolved	Major and lasting morbidity

Table 3. Flynn's Criteria. TENS Outcome Score (Flynn et al)¹²

Complications

One case was having superficial infection, which was controlled by antibiotics and one case was having protrusion of nail. In those cases, the nail was removed earlier after formation of callus. In our study, no deep infection occurred.

DISCUSSION

The management of children with femoral shaft fractures in the age group of 4 - 14 years is dilemma to orthopaedic

surgeons. Conservative treatment with spica has disadvantages such as prolonged hospital stay, angular and torsional deformity and shortening. Many orthopaedician reserve surgical management for open fracture, multiple trauma, associated head injuries, burns and neuromuscular wounding. External fixation causes high rate of pin tract infections and chance of refracture after removal of fixator.¹³⁻¹⁵ Rigid intramedullary nailing may damage the blood supply to the femoral head resulting in AVN or causing growth arrest at the greater trochanter.



Figure 1. Preop.



Figure 2. Postop.



Figure 3. Four Weeks Later



Figure 4. Eight Weeks Later



Figure 5. After Union



Figure 6, 7, 8. Full Range of Motion in Various Positions

In our series, average duration of hospital stay was 6 days (range 3 to 11 days), whereas in a study conducted by Houshian et al¹⁵ the mean hospital stay was 6 days and range of hospital stay was 2 to 20 days. In a study done by Dr. Shrawan Kumar Thapa et al,¹⁶ the duration of hospital stays were between 5 to 12 days. In our study, 25 (83.3%) cases were due to fall from height and 5 (16.7%) cases were due to road traffic accident. The major cause of fracture was road traffic accident in 42 (75%) cases followed by fall from tree in 13 (23.2%) cases in a study done by Dr. S K Thapa et al.¹⁶ In our study, 19 (63.3%) cases were having right-sided trauma and 11 (36.7) cases were having left-sided trauma which was comparable to study done by Dr. S K Thapa et al. In our study mean blood loss was 40 (+/- 5 mL); in study done by Saha P et al it was 70 mL with duration of 25 minutes comparable to our study of 45 minutes. The average time to partial weight bearing was 4.3 weeks, full weight bearing was 8 weeks (5 to 12 weeks) and full movement was achieved in 11 weeks (8 to 16 weeks) in our study.

The fracture heals within 8 to 10 weeks in M Bary study.

The average time to full weight bearing was 6.6 weeks (5 to 12 weeks), full movement was achieved in 9 weeks (6 to 15 weeks) in Ibrahim study.

In our study, majority of cases (63.33%) had excellent and 33.3% had satisfactory and 3.33% had poor result which was comparable to series reported by Pulate et al.¹⁷ Results were excellent in 12 patients (60%), successful in 7 (35%) and poor in 1 patient (5%). In Moroz et al¹⁸ study it was excellent in 150 (65%), satisfactory in 57 (25%) and poor in 23 (10%).

CONCLUSION

Titanium elastic intramedullary nail for fracture shaft femoral in children is the gold standard, easy technique of insertion, proper stabilisation and movement of lower limb. It is ideal and cost effective with short hospital stay and minimal complications.

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