ORIGINAL RESEARCH PAPER

Orthopaedic

Volume - 7 | Issue - 2 | February - 2017 | ISSN - 2249-555X | IF : 3.919 | IC Value : 79.96

A PROSPECTIVE STUDY OF FUNCTIONAL OUTCOME OF TITANIUM ELASTIC NAILS FIXATION IN LOWER LIMB DIAPHYSEAL FRACTURES IN CHILDREN

KEYWORDS: Titanium elastic nailing system , Flynn,s criteria

Dr Santoshbabu Miryabbelli.
post graduate in Sanjay Gandhi Institute of Trauma and Orthopaedics,Bangalore-560011

Dr.T.H.Prakashap
D.ortho , M S ortho. Professor & unit chief, Department of orthopaedics, Sanjay Gandhi Institute Of Trauma & Orthopaedics, Bangalore-560011

Dr H S Chandrashekar. D.ortho
post graduate in Sanjay Gandhi Institute of Trauma and Orthopaedics,Bangalore-560011

ABSTRACT

A prospective study of 50 Children and adolescents between the age group of 5-16 years with femur and tibia shaft fractures who were admitted in department of orthopaedics in Sanjay Gandhi Institute of Trauma and Orthopaedics, Bangalore, meeting the inclusion criteria were selected. during 24months period from November 2014 to October 2016. In our study, 60% were males & 40% females,70% femur shaft fractures and 30% tibia shaft fractures. All patients underwent titanium elastic nailing fixation for the femur and tibia fractures. Patients were followed up for a period of 6 months at 4,8,12 and 24 weeks. Functional evaluation using Flynn,s criteria showed excellent in 34 (68%) cases, satisfactory in 16 (32%) cases and there were no cases of poor outcome. In conclusion Titanium elastic nailing system leads to rapid fracture union by preservation of fracture hematoma and limited soft tissue exposure. It also helps in preventing damage to the physis. Our study confers all the advantages which the previous studies have shown at various institutes and is fairly a simple, reliable technique with a shorter learning curve imparting lot of advantages over other intramedullary techniques or other methods followed for management of pediatric diaphyseal lower limb fractures.

Introduction

Treatment of long bones fractures in children continues to improve as newer techniques evolve. Previously most of the fractures were effectively managed conservatively & only unstable and displaced fractures were taken up for fixation. Although a number of other intramedullary devices like rush nail or enders nail are available for treatment of paediatric long bone fractures, yet these have poor elasticity, rotational stability and require multiple nails to achieve fracture stability.[6]

There is little controversy over the treatment of adult lower limb long bone shaft fractures with intramedullary nail fixation. Similarly, there is little controversy over the treatment of infants and toddlers with femur and tibia shaft fractures by using spica casting, but the treatment of paediatric and adolescent (age 5 to 15 years) femur fractures remains controversial.

Hence there was an evolution in treatment options for this age group for optimum treatment of fractures. Treatment of paediatric fractures dramatically changed in 1982 when Metaizeau and the team from Nancy, France, developed the technique of elastic stable intramedullary nailing.

In last two decades there was an increased interest in the operative treatment of paediatric fractures, although debate persisted over its indication. There is little disagreement concerning the management of long bone fractures in children less than 6 years i.e. pop casting, and adolescents over 16 years with intramedullary nailing.[6,2]

Differences of opinion about treatment are greatest for patients who are too old for early spica casting and yet too young for adult type of treatment with a reamed IM nailing.

Current treatment options include early spica casting, traction, external fixation, ORIF with plating, flexible intramedullary nails and reamed intramedullary nails. The two major drawbacks with various types of traction and plaster cast immobilization are prolonged bed rest leading to separation of the child from routine activities and the expenditure incurred on the treatment during the stay in the hospital and parental non acceptance.

Over a period of time, with experience, clinicians have shown that children with diaphyseal femur fracture do not always recover with conservative treatment. Angulation, malrotation and shortening are not corrected effectively. Whatever the method of treatment, the goals should be to stabilize the fracture, to control the length and alignment, to promote bone healing and to minimize the morbidity and complications for the child and family.[6]

Orthopaedic surgeons will continue to be challenged to treat this age group with less morbidity at a lower cost, as no clear guide lines have been available till now despite efforts done initially by French surgeons, later on by European surgeons and recently by the PaediatricOrthopaedic Society of North America (POSNA).[7]

The management of paediatric lower limb long bone fractures has gradually shifted towards operative approach in the past decade. Plating offers rigid fixation but it requires a larger exposure with the potential for increased blood loss and scarring. It is a load bearing device and re-fracture is a risk and it can cause growth disturbance also. Also, Antegrade nailing techniques have shown a risk of proximal femur and tibia deformities and avascular necrosis of the femoral head.

The now favoured Elastic internal fixation in the form of flexible intra medullary nailing provides a healthy environment for fracture healing with some motion leading to increased callus formation. This method avoids physeal damage, minimally invasive with relatively reduced hospital stay and high acceptance by parents after a short learning curve.

MATERIALS & METHODS:

Materials and methods

A prospective study of 50 children between 5-16 years of age with diaphyseal fractures of femur and / or tibia admitted at SGITO (Sanjay Gandhi institute of trauma and Orthopaedics), Bangalore - meeting the inclusion and the exclusion criteria (as given below) during the study period november2014-October 2016 will be the subjects of the study. The clearance from institutional ethical committee was obtained before starting the study.

Volume - 7 | Issue - 2 | February - 2017 | ISSN - 2249-555X | IF : 3.919 | IC Value : 79.96

Inclusion criteria: 5-16 years of age, Diaphyseal fractures ,Simple fractures (closed fractures), Ipsilatertal fractures , Fracture without head injury

Exclusion criteria: Metaphyseal fractures, Compound fractures, Pathological fractures Admitted patients are evaluated by paediatrician for fitness, routine pre anaesthetic check-up will be done and informed written consent will be taken before surgery.

Intra operatively -Position of the Patient, bony land mark and surgical incision for the nail Insertion ,reduction modalities under image intensifier, time needed for surgery, blood loss and any other difficulties faced during the procedure is carefully noted, including sizing and suitability of titanium elastic nails as per A.O. guidance . Post operatively after 24 hours - Wound Inspection, Check X-ray to assess reduction and active static exercises/passive exercises / active neighbouring joint movement at the earliest Between 8 to 10 days - wound inspection and suture/staple removal Patient is called for periodic follow up at 4 weeks, 8 weeks, 12 weeks and at 6 months clinical and radiological assessment will be done Clinical evaluation for - pain, range of movements (hip and knee, ankle), limb length and time of weight bearing (partial/complete) is done.Radiological evaluation for – position of the nail, coronal and sagittal alignment, loss of reduction / deformity and delayed/non-union is done.

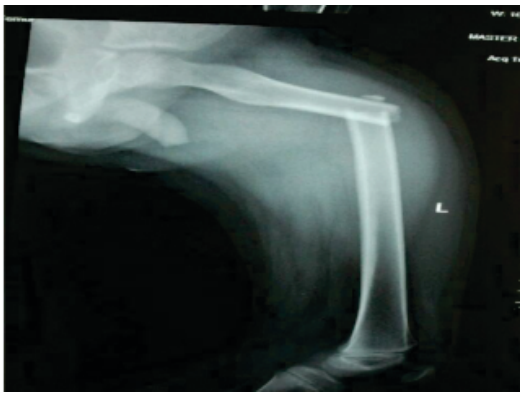
OPERATIVE PHOTOS

Position of patient on traction table for femur fracture fixation with TENS

Entry of titanium nail

Fluoroscopy picture of femur fracture reduction with TENS

RADIOLOGICAL AND CLINICAL PHOTOGRAPHS



PRE OPERATIVE FEMUR SHAFT FRACTRE AP

LATERAL VIEW

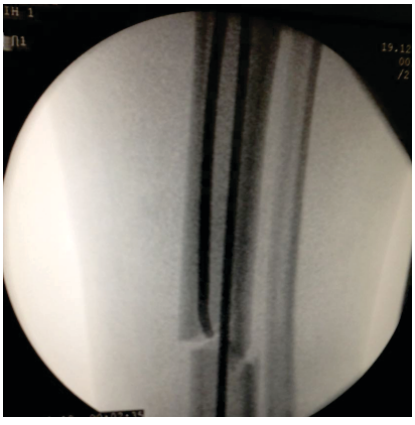
POST OPP AT 4 WEEKS

POST OPP AT 10 WEEKS

Volume - 7 | Issue - 2 | February - 2017 | ISSN - 2249-555X | IF : 3.919 | IC Value : 79.96

FLEXION

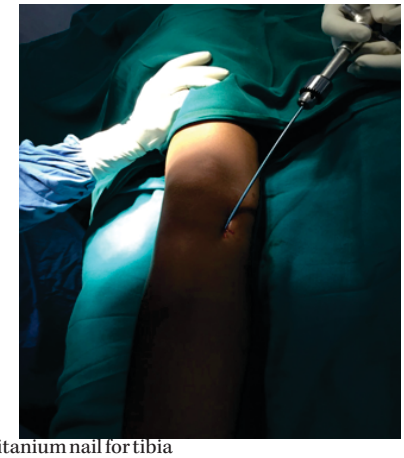
Fluoroscopic picture of tibia entry of titanium nail



Fluoroscopy picture of tibia titanium nail at fracture site

Position of leg after draping for fixation of tibia fracture with TENS

RADIOLOGICAL AND CLINICAL PHOTOGRAPHS



Entry of titanium nail for tibia

IMMIDEATE

Volume - 7 | Issue - 2 | February - 2017 | ISSN - 2249-555X | IF : 3.919 | IC Value : 79.96

POST OPP AT 10 WEEKS

FULL EXTENSION AND LIMBLENGTH

SQUATTING

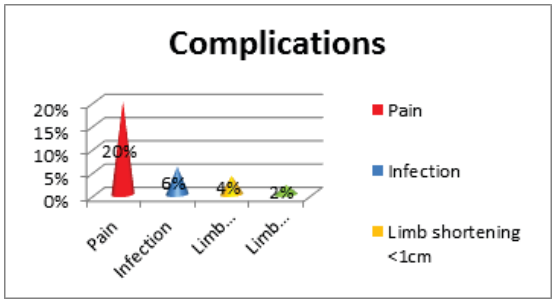
Table- 1: Complications

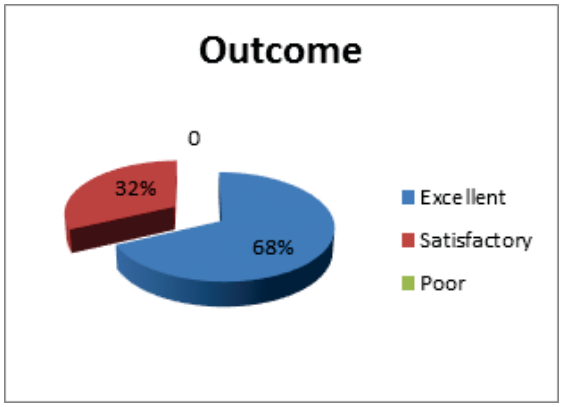
Complications	No. of cases	Percentage
Pain at the site of nail insertion	10	20
Infection	3	6
Limb shortening <1cm	2	4
Limb lengthening <1cm	1	2

Table- 2: Outcome

Complications	No. of cases	Percentage
Pain at the site of nail insertion	10	20
Infection	3	6
Limb shortening <1cm	2	4
Limb lengthening <1cm	1	2

Graph-1: Complications





DISCUSSION

In our study union was achieved in <3 months in all 50 (100%) cases. Average time to union was 10.5 weeks. Oh C.W et al reported average time for union as 10.5 weeks. Aksoy C, et al compared the results of compression plate fixation and flexible intramedullary nail insertion. Average time to union was 7.7 (4 to 10) months in the plating group and 4 (3 to 7) months for flexible intramedullary nailing.

Volume - 7 | Issue - 2 | February - 2017 | ISSN - 2249-555X | IF : 3.919 | IC Value : 79.96

STUDIES	TIME OF UNION (in weeks)
Present study	10.5
Oh C.W , et al	10.5
Aksoy C, et al	16

In our study, closed reduction of the fracture, leading to preservation of fracture hematoma, improved biomechanical stability and minimal soft tissue dissection led to rapid union of the fracture compared to compression plate fixation.

COMPLICATIONS:

Pain at the site of nail insertion:

In the present study, 10(20%) patients had developed pain at site of nail insertion during initial follow up evaluation which resolved completely in all of them by the end of twenty four weeks.

J.M.Flynn et al. reported 38 (16.2%) cases of pain at site of nail insertion out of 234 fractures treated with titanium elastic nails.

Infection:

Superficial infection was seen in 3(6%) case in our study which was controlled by antibiotics & regular dressings on alternate days within a week.

J.M.Flynn et al. reported 4 (1.7%) cases of superficial infection at the site of nail insertion out of 234 fractures treated with titanium elastic nails.

Pin tract infection is a major disadvantage of external fixation

Bar-on E, et al reported 2 cases of deep pin tract infection in their patients treated with external fixation.

Range of motion:

All patients had full range of hip and knee and ankle motion by 10 weeks in the present study.

J.M.Flynn et al. reported 2 (0.9%) cases of knee stiffness out of 234fractures treated with titanium elastic nails.

Limb length discrepancy:

This is the most common sequelae after femoral shaft fractures in children and adolescents. 2(4%) patient had shortening of femur and 1(2%) had lengthening of femur. No patient in our study had major limb length discrepancy (i.e. > ± 2cm).

Beaty et al. reported, two patients had overgrowth of more than 2.5 cm necessitating epiphysiodesis, after conservative treatment.

Ozturkman Y. et al observed mean leg lengthening of 7mm in 4 (5%) patients and mean shortening of 6mm in 2 (2.5%) children.

Cramer KE, et al noted average limb lengthening of 7mm (range l-19mm) in their study. Clinically significant limb discrepancy (> 2cm) did not occur in any patient in their study.

John Ferguson et al noted more than 2cm shortening in 4 children after spica treatment of paediatric femoral shaft fracture. In the present study, limb length discrepancy of less than 10mm was present in 2 (10%) cases.

Comparing to limb length discrepancy in conservative methods, limb length discrepancy in our study was within the acceptable limits.

Assessment of Outcome

In the present study, the final outcome was excellent in 34(68%) cases, satisfactory in 16(32%) cases and there were no poor outcome cases.

J.M.Flynn et al. treated 234 femoral shaft fractures and the outcome was excellent in 150(65%) cases, satisfactory in 57 (25%) cases and poor in 23(10%) of cases.

Hossam M kandil, treated thirty-two children, age 4.9–13.2 years, with femoral shaft fractures, the outcome scoring to evaluate functional results showed excellent results in twenty-six patients (81.25%), satisfactory results in six patients (18.75%), and no poor results.

In K.C. Saikia et al in their study of 22 children with femoral shaft fractures, results were 13 (59%) excellent, in 6 (27.2%) satisfactory and 3(13.6%) poor results.

STUDIES	OUTCOME (%)		
	EXCELLENT	SATISFACTORY	POOR
Present Study	68	32	-
J.M.Flynn et al	65	25	10
Hossam M Kandil	81.25	18.75	-
K.C.Saikia et al	59	27.2	13.6

CONCLUSION

Based on our experience and results, we conclude that Titanium Elastic Nailing System is an ideal method for treatment of paediatric femur and tibia fractures. It gives elastic mobility promoting rapid union at fracture site and stability which is ideal for early mobilization with lower complication rate, good outcome when compared with other methods of treatment.

It is a simple, easy, rapid, reliable and effective method for management of paediatric femoral fractures between the age of 5 to 16 years, with shorter operative time, lesser blood loss, lesser radiation exposure, shorter hospital stay, and reasonable time to bone healing.

Because of early weight bearing, rapid healing and minimal disturbance of bone growth, intramedullary fixation by TENS nails may be considered to be a physiological method of treatment.

Use of TENS for definitive stabilization of femur and tibia shaft fractures in children are considered a reliable, minimally invasive, and more importantly a physeal protective treatment method.

Our study confers all the advantages which the previous studies have shown at various institutes and is fairly a simple, reliable technique with a shorter learning curve imparting lot of advantages over other methods followed for management of paediatricdiaphyseal fractures in lower limb .

References

1. Carey, T. P. MD; Galpin, R. D. MDSection Editor(s): Feibel, Robert J. MD,Flexible Intramedullary Nail Fixation of Pediatric Femoral Fractures, Clinical Orthopaedics& Related Research:November 1996 - Volume 332 - Issue - pp 110-11
2. Narayanan, Unni G. MD*; Hyman, Joshua E. MD; Wainwright, Andrew M. FRCS§; Rang, Mercer FRCSC; Alman, Benjamin A. MD,Complications of Elastic Stable Intramedullary Nail Fixation of Pediatric Femoral Fractures, and How to Avoid Them, Journal of Pediatric Orthopaedics:July/August 2004 - Volume 24 - Issue 4 - pp 363-369 Trauma: Original Article .
3. Saikia K, Bhuyan S, Bhattacharya T, Saikia S., Titanium elastic nailing in femoral diaphyseal fractures of children in 6-16 years of age, Indian Journal Of Orthopedics. 2007 Oct;41(4):381-5.
4. Hosalkar HS, Pandya NK, Cho RH, Glaser DA, Moor MA, Herman MJ., The Journal of the American Academy Of Orthopaedic Surgeons. 2011 Aug;19(8):472-81.
5. Jencikova-Celerin L, Phillips JH, Werk LN, Wiltrout SA, Nathanson I, Flexible interlocked nailing of pediatric femoral fractures: experience with a new flexible interlocking intramedullary nail compared with other fixation procedures, Journal Of Pediatric Orthopedics. 2008 Dec;28(8):864-73.
6. Lee SS, Mahar AT, Newton PO., Ender nail fixation of pediatric femur fractures: a biomechanical analysis, Journal Of Pediatric Orthopedics. 2001 Jul-Aug;21(4):442-5.
7. Im GI, Shin SR, Treatment of femoral shaft fractures with a titanium intramedullary nail, Clinical Orthopedics & Related Research. 2002 Aug;(401):223-9

Volume - 7 | Issue - 2 | February - 2017 | ISSN - 2249-555X | IF : 3.919 | IC Value : 79.96

8. Huber RI, Keller HW, Huber PM, Rehm KE, Flexible intramedullary nailing as fracture treatment in children, Journal Pediatric Orthopedics. 1996 Sep-Oct;16(5):602-5.
9. Khazzam M, Tassone C, Liu XC, Lyon R, Freeto B, Schwab J, Thometz J, Use of flexible intramedullary nail fixation in treating femur fractures in children, American Journal Of Orthopedics (Belle Mead NJ). 2009 Mar;38(3):E49-55.
10. Garner MR, Bhat SB, Khujanazarov I, Flynn JM, Spiegel D., Fixation of length-stable femoral shaft fractures in heavier children: flexible nails vs rigid locked nails, Journal Of Pediatric Orthopedics. 2011 Jan-Feb;31(1):11-6.
11. Carey TP, Galpin RD., Flexible intramedullary nail fixation of pediatric femoral fractures, Clinical Orthopedics & Related Research. 1996 Nov;(332):110-8
12. Morshed S, Humphrey M, Corrales LA, Millett M, Hoffinger SA, Retention of flexible intramedullary nails following treatment of pediatric femur fractures, Archives of Orthopedic & Trauma Surgery 2007 Sep;127(7):509-14. Epub 2007 Jan 20
13. Barlas K, Beg H, Flexible intramedullary nailing versus external fixation of paediatric femoral fractures, ActaOrthopaedicaBelgica. 2006 Apr;72(2): 159-63
14. Karaoğlu S, Baktir A, Tuncel M, Karakaş ES, Sakir TM, Closed Ender nailing of adolescent femoral shaft fractures, Injury. 1994 Oct;25(8):501-6