Original Article

Tibial Shaft Fractures

Outcome of Fixation of Displaced and Unstable Tibial Shaft Fractures in Paediatric Age Group Patients by Using Titanium Flexible Intramedullary Nails

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ABSTRACT

Objective: To evaluate the outcome of fixation of displaced and unstable tibial shaft fractures in paediatric age group patients by using Titanium flexible intramedullary nails.

Study Design: Prospective case series study

Place and Duration of Study: This study was conducted at the Orthopedic Complex, QAMC/B. V. Hospital, Bahawalpur from March, 2017 to June, 2018.

Materials and Methods: 34 patients (24 males 10 females), age range 06 to 16 years having severely displaced and unstable closed tibial shaft fractures were operated by using Titanium flexible intramedullary nails. Postoperative follow up evaluation was done for 06 months by using Flynn's criteria for TENs.

Results: Of the 34 patients operatedall fractures healed satisfactorily at 10 weeks. Most common complaint was irritation at nail insertion site which was noted in 8 (23.5%) patients followed by nail protrusion in 7 (20.5%) patients while pain was reported by 3 (8.8%) patients. No patient developed superficial or deep infection. Overall functional outcome according to Flynn's criteria was excellent in 28(82.35%) patients, satisfactory in 04(11.76%) and poor in remaining 02(5.88%) patients.

Conclusion: The Titanium flexible nails are a good option for the treatment of displaced and unstable tibial shaft fractures in paediatric age group patients.

Key Words: Titanium elastic nails, Tibial shaft fractures in paediaticpatiatients

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INTRODUCTION

The fractures of the tibia are among the common injuries in children and account for about ten to fifteen percent of the fractures in this age group[1].The diversity of the fracture types range from closed un-displaced to grossly displaced to open comminuted and contaminated injuries. Accordingly the closed un-displaced or minimally displaced reducible and stable tibial shaft fractures can be treated with six to eight weeks cast immobilization while the crushed, open and grossly contaminated fractures need external fixation for wound care and repeat surgical debridement procedures. Sometimes the stable reduction cannot be either obtained or maintained in case of closed fractures due to gross initial displacement or the oblique nature of the fracture fragments and the plaster treatment fails. The available options for treatment in such situations include the percutaneous pinning, the external fixator application, intramedullary interlocking nail or plate and screws[2-7]. The percutaneous pinning gives weak fixation with risk of infection. External fixator also has the risks of pin site infection or re-fracture[8-13].Intramedullary interlocking nails are also unsuitable for the paediatric age group due to open/active growth plates at the nail insertion sites[14] while the plate and screws bear the risk of infection due to excessive soft tissue stripping.

During the last few decades the flexible intramedullary titanium nailing has gained the acceptance due to provision of low risks and more benefits (i.e., insertion without opening the fracture site, conservation of fracture hematoma and physeal plate) associated with this treatment modality[15-17]as compared to most of the above mentioned options for the grossly displaced and irreducible or unstable transverse or short oblique fractures.

We conducted a prospective study and Flynn's criteria for TENs was used for the evaluation of the results of this technique.

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MATERIALS AND METHODS

This was a prospective case series study done at Orthopaedic Complex, Quaid-e-Azam medical college/ Bahawal Victoria Hospital, Bahawalpur from March 2017 to June 2018. 34 patients having closed transverse or short oblique tibial shaft fractures were included in the study. 24 were males and 10 were females. 20 patients were operated on right side and14were operated on left side (Table-1). Age range was 06 years to 16 years. All patients having severely displaced and unstable closed fracture with duration history of trauma of up to one week due to road traffic accidents or fall from height were included in the study. Patients with open fractures, pathological fractures or those having associated osteogenesisimperfecta or neuromuscular disorders were excluded from the study. Informed consent was obtained from the parents. All patients were operated under general anesthesia. The lower limb on the operation side was prepared and draped free. Sterilized tourniquet was applied to the upper thigh and inflated as required. Image intensifier was used to mark the proximal tibial physis, fracture and the proximal entry sites. About 2 cm longituidinal incision was made on lateral aspect of proximal tibial metapyseal region just proximal to the entry site. 2 appropriate size titanium elastic nails with beveled tips were selected. The tips of the nails were bent to 45 degrees to ease the insertion and shafts of the nails were bent three times the diameter of the tibial shaft. Fluoroscopy was used to pass and guide the nail up to the fracture site. The second nail was prepared and entered in the same way from the other side of the proximal tibial metaphyseal region. The fracture was reduced and nails were passed one by one across the fracture site just proximal to the distal tibial physeal plate. Fracture reduction was assessed in both anteropsterior and lateral planes. Proximal nail ends were bent and cut about one centimeter from the cortical surface for easy removal at appropriate time after fracture healing. Wounds were closed in layers and short leg plaster of Paris cast was applied. Stiches were removed at two weeks and further follow up done at six weeks (Fig.1)., twelve weeks and six months for clinical and radiological evaluation. Clinical evaluation included subjective parameters like history of pain or irritation and objective parameters like examination of surgical incision site for wound status regarding superficial or deep infection or wound dehiscence, signs of irritation, swelling, redness, tenderness, nail protrusion, apparent alignment or rotational deformity of extremity across the fracture site, neurovascular status over ankle and foot and range of movements over knee, ankle and joints of foot while radiological evaluation parameters were based upon alignment of fracture fragments across the fracture site in both planes, limb length discrepancy, status of the hardware and fracture healing. Final follow up was done at 6 months and results were evaluated by Flynn's criteria for TENs.

RESULTS

All 34 patients included in the study were followed up for period of six months. Subjective, objective and radiological parameters were assessed at follow up visits at two weeks, six weeks, twelve weeks and six months. Pain was reported by 03(8.8%) patients while the most common complaint was irritation at the nail insertion site which was reported by 08(23.5%) patients. No patient showed the signs of superficial or deep infection or wound dehiscence. Nail protrusion was the second most common complaint which was noted in 07(20.5%) patients. External rotation deformity of less than five degree examined by thigh foot angle comparison with normal side was noted in 02(5.8%) patients. No patient developed sensory or motor deficit.

Figure No.1: Fractures

Table No.1: Demographic Data

Total Number of Patients	**34**
Male	24
Female	10
Right Sided Injury	20
Left Sided Injury	14

Table No.2: Subjective &Objective Parameters

Total Number of Patients	**34**
Pain complaint	03
Irritation at nail insertion site	08
Nail Protrusion	07 (60%)
Rotational deformity (External rotational deformity)	02 (5.8%)
Range of Movements at knee and ankle	Full

All patients had full range of movements over the operated side knee and ankle joints(Table-2). Alignment deformity of less than five degrees was found in 28(82.3%) patients, that of five to ten degrees in 04(11.7%) patients and more than ten degrees in only 02(5.8%) patients. Limb length discrepancy or

hardware breakage was not noted in any patient during or till the end of six months follow up.

Table No.3: Radiological Parameters

Total Number of Patients	**34**
Alignment Deformity Less than five degrees Five to ten degrees More than ten degrees	 28 04 02
Limb length discrepancy	00
Hardware breakage	00
Fracture Healing at 06 months follow up	34

Table No.4: Overall Results (According to Flynn's Criteria)

Total Number of Patients	**34**
Excellent	28 (82.35%)
Satisfactory	04 (11.7%)
Poor	02 (5.8%)

All the patients had signs of radiological fracture healing at ten weeks (Table-3). At final follow up at six months the patients were assessed according to Flynn's criteria for TENs and 28(82.35%) patients had excellent, 04(11.7%) patients showed satisfactory results while poor results were noted in 02(5.8%) patients (Table-4).

DISCUSSION

Most of the closed tibial shaft fractures in paediatric age group can be treated by manipulation and reduction followed by casting but sometimes the reduction cannot be either achieved or maintained due to gross initial displacement. In these situations some type of fixation becomes necessary. Historically the available surgical options include percutaneous pin fixation, external fixation, plate and screw fixation and reamed intramedullary nails. All these techniques have their relevant demerits regarding their usage in paediatric tibial shaft fractures. The percutaneous pin fixation and external fixation are associated with risks of non-union, refracture[18,19,20]or high rate (up to 50%) of pin site infection[21, 22, 23]. Although plate and screw application provide rigid fixation but this technique is also associated with extensive soft tissue stripping risks of non-union and infection[24](Ref.---)ARTICLE [2]. Reamed intramedullary nailing although preferred for long bone shaft fractures in adults, is not suitable for children due to the risk of proximal tibial physeal damage. Titanium elastic intramedullary nails were introduced in Europe and North America during last few decades for the treatment of long bone shaft fractures with reports of good results due to the associated benefits of intramedullary device and prevention of the injury to the growth plates because of entry sites away from the growth plates.

O'brien[25] et al in their study of this technique in sixteen patients reported good results with superficial infection in one patient and sagittal and coronal mal-alignments in seven and six patients respectively while only one child had the shortening of leg length >1.5 centimeters.

Vallamshetla et al[26]presented the results of fifty six fractures in fifty four patients. According to their study two patients had difference of leg length less than two centimeters, development of deep infection in two patients and mal-alignment in other two patients.

Ahmed etal[27]presented results of their study in twenty patients based on Flynn's criteria. They reported excellent results in fifteen cases whilesatisfactory outcome was noted in five cases.

In our study we noted irritation at nail insertion site in 08(23.5%) cases and nail protrusion in 07(20.5%) cases, alignment deformity of less than five degree in 28(82.3%) patients, five to ten degrees in 04(11.7%) patients while significant alignment deformity of more than 10 degrees I 02(5.8%) patients. Overall success rate with excellent results was in 28(82.35%) patients,satisfactory in 04(11.7%) cases while poor in 02(5.8%) cases, which is comparable to most of the studies available in literature. Limitations of our study are that this was carried out in closed transverse and short oblique tibial shaft fractures. However further studies are required for evaluation of the results of this technique in other categories like open fractures, comminuted, long oblique or those present in proximal or distal metaphyseal regions.

CONCLUSION

After evaluation of the results we concluded that this technique is very useful option for the treatment of closed transverse and short oblique tibial shaft fractures in paediatric age group due to its benefits of preservation of fracture hematoma, growth plates and very low risk of post-operative infection.

Author's Contribution:

Concept & Design of Study:	Zulfiqar Ahmed
Drafting:	Muhammad Nasir Ali
Data Analysis:	Zirwa Nasir
Revisiting Critically:	Zulfiqar Ahmed, Muhammad Nasir Ali
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Conflict of Interest: The study has no conflict of interest to declare by any author.

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