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RESEARCH ARTICLE

Fixation of Paediatric tibial fractures with TENS; A prospective study.

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Abstract

Paediatric tibial fractures account for approximately 15 % of all fractures. Fractures occur most commonly in the distal third of the bone .Various treatment methods are:-**Non Operative:** cast immobilization for treatment of fractures. **Operative:** External fixators, Intramedullary nailing, Plates and screws. The aim of the present study was to analyze the results of fixation of paediatric tibial fractures with intramedullary nail with regard to assessing the union radiologically, complications associated with the procedure and restoration of range of motion and function of the knee and to evaluate the results clinically regarding pain, activities of daily living, range of motion, power, radiologically regarding union, non-union, refracture, nail tip impingement.

INTRODUCTION

Paediatric tibia fractures account for approximately 15 % of all fractures in children after radial/ulnar & femoral fractures and 9% are compound fractures. Average age is 8 years and frequency doesn't change significantly with age. Concomitant ankle & foot are most common injuries associated with tibial fractures. 70 % tibial shaft fractures are isolated whereas 30 % are associated with fibula fractures. Fractures occur most commonly in the distal third of the bone (50-70%) and less often in the middle (19 to 39%) and proximal (least common) thirds.

The aim of our study was to evaluate the results of operative treatment in fracture shaft of tibia by titanium elastic nails (TENS) in children.

Materials & methods

The study was conducted in Post graduate department of orthopaedics of Govt. Medical college, Jammu during period of December 2013 to December 2014. The inclusion criteria includes patients in the 6-16 yr. age group and transverse & short oblique fractures. The patients with long oblique/Spiral fractures and Gustilo-Anderson type III(c) fractures were excluded from the study.

PRE OPERATIVE EVALUATION

Radiographs of the local part including AP view and Lateral view and routine investigations were done

Implant and surgical technique

Antegrade technique is used for tibial fracture. Titanium elastic nails are available in diameters 1.5 to 4mm. The nails are colour coded for easy identification and rounded nail tip ensures smooth and easy insertion. Measure the narrowest diameter of the medullary canal with a ruler, the proper nail diameter is no more than 40 % of width of canal. Select two nails of the same diameter so the opposing bending forces are equal avoiding misalignment. Tibial shaft fractures in children are typically stabilized with two nails inserted in a descending manner.

Surgical Technique-

After induction of general anaesthesia and placement of a well padded tourniquet on the proximal thigh, prepare and drape the affected leg. The tourniquet usually is not inflated. With the use of fluoroscopy, mark on the skin the fracture site, the proximal tibial physis and the starting points for nail entry. The starting point for nail entry hole is

1.5 to 2.0 cm distal to the physis. Make lateral longitudinal 2cm incision over the proximal tibial metaphysic just proximal to the starting points.

Select two appropriate sized nails (2,3 or 4mm) based on the width of the medullary canal, choosing the largest possible diameter nails that will fit the medullary canal; for example, if the canal measured 6mm,use two 3mm nails. The nails come with a bevelled blunt tip. Bend the very tip of the nail to 45 degrees to facilitate passage along the opposite cortex and aid in fracture reduction. Contour the entire length of the nail to a gentle curve such that the apex will rest at or near the fracture site after reduction. The depth of the curve should be approximately three times the diameter of the canal to achieve the optimal balance between ease of insertion and stability.

Use a drill 0.5 cm larger than the nail in a soft tissue sleeve to create the entry hole, confirming the entry hole with fluoroscopy in both anteroposterior and lateral planes. Take care to avoid the tibial tubercle apophysis. Drill the hole in the midpoint of the anteroposterior dimension, starting perpendicular to the physis. Under fluoroscopic guidance, angle the drill caudad until it is 45 degrees from the long axis of the tibia, taking care not to drill out the far cortex or migrate towards the physis. Place the pre-bent nail on an inserter and insert it from the side opposite the distal displacement in an antegrade fashion. Under fluoroscopic guidance, slide the nail along the opposite cortex until the fracture is reached. Reduce the fracture and advance the nail across the fracture. Embed the nail in the distal tibial metaphysis without violating the cortex or the physis.

Place the second nail from the other side in a similar fashion. If necessary, rotate the bent tips of the nails after passing the fracture site to effect an anatomic reduction, taking care not to distract the fracture site. Bend the proximal nail ends and cut them 1cm from the cortical surface so that the nail ends will sit deep to the compartment fascia but be proud for easy retrieval. Close the wounds with an absorbable fascial and subcuticular stitch and apply a short leg cast.

POST OPERATIVE EVALUATION

Post operatively below knee slab gives comfort to the limb. Gentle static exercises are started. Patients were followed up at 10-14 days, the wound was checked and stitches were removed. Weight bearing is dependent on fracture pattern, fracture stability, patient compliance and any other associated injuries. Patients were followed on monthly basis and progression of fracture healing will be assessed till 6 months on average. The results were evaluated using Flynn et al's criteria for TENS.

FOLOW UP

The follow up in the post operative period was done at 3 weeks, 6 weeks, 12 weeks and 6 months. In each visit patient was assessed by clinical examination and radiological examination. Clinical examination included incision site (infection, dehiscence) severity of pain, swelling, tenderness, distal neurovascular status, and deep infection, range of motion, power and fracture healing. Radiological examination included position of fragments, amount of callus, status of implant and any other complication. After six months the patients were assessed by Flynn et al criteria for titanium elastic nailing.

RESULTS

Twenty five cases of paediatric tibial fractures were managed by closed reduction and internal fixation with titanium elastic nailing. Tibial fractures were more common in males (68%). RTA was the most common cause of injury in our series accounting for 80%, other common cause was fall from height which accounts about 20% of the cases. Right side (60%) was more frequently involved than left (40%).

Five patients (20%) had associated injuries like head injuries, blunt trauma abdomen etc, this signifies the importance of high impact trauma associated with tibial fractures. all of the cases were operated within 4 days of injury. the patients in our study were discharged within 1.2 weeks after surgery on average. In this study about 84% fractures united within 8 weeks and in 10 weeks 100% fractures united. Our study showed an overall complication in 2 (8%) of the cases. The most common complication with titanium nailing is a palpable implant & was present in 8% of the patients. Complications like wound infection, knee stiffness were not encountered. All of the cases returned to full power and range of motion at knee within 16 weeks. Our study showed excellent results in 23 (92%) of the patients and good results in 2 (8%) of cases.

DISCUSSION

Historically operative treatment has been recommended rarely for tibial shaft fractures in children. However in the last decade there has been an increased interest in surgical stabilization, particularly for unstable closed tibial fractures as well as open fractures or those with associated soft tissue injuries. Various treatment methods are cast immobilization and Operative procedures like External fixators, Intramedullary nailing and Plates and screws.

Tibial shaft fractures are classified as Transverse, Spiral or Oblique.
b) Comminuted
c) Open or Closed
d) Complete or Incomplete (torus, greenstick)
Cast immobilization has been a standard treatment for vast majority of uncomplicated paediatric tibial shaft fractures by manipulating and cast application. Isolated tibial shaft fractures may develop varus malalignment, valgus angulation and shortening can present a significant problem in children who have fracture of tibia as well as fibula. Displaced fracture should be managed with reduction under appropriate seduction. Using c- arm guidance. Alignment should be checked weekly for 3 weeks after cast has been applied. Muscle atrophy, reduction in tissue oedema may allow fracture to displace into unacceptable malalignment. Cast wedging may be indicated in an attempt to improve alignment and in some cases a second cast application with re-manipulation of fracture under general anaesthesia may be indicated to obtain acceptable alignment. One effective treatment of tibial shaft fractures is use of flexible intramedullary nails such as ender's nail and titanium elastic nails.

Our study included 25 new cases of paediatric tibial fractures which were managed by titanium intramedullary nail. When compared with the study of karamen et al who used titanium nails in 102 cases & got excellent/satisfactory results in all. Complications were present in 18 cases.6 had ineffective reduction,2 had refractures,4 deep infection,1 delayed union,2 limb length discrepancy,3 skin impingement. On comparing this study with griffet j et al who managed 86 children by titanium nail had limb length discrepancy in 2% cases & 4(5%)had infection. On comparing this study with furlan D et al who had 36 tibia fractures managed by titanium nailing had implant irritation in 1 case & no infection.89 % had excellent results & good results in 11%. When compared with vallamshetla vr et al with 56 operated cases, excellent results were found in all cases.

The most common & the only complication in our group was nail end irritation which is a minor complication. In this procedure complete healing with return to pre-injury activity levels occur early. Decreased hospitalization, low cost of implants, less potential damage to growth centres, decreased blood loss and operative time and earlier mobilization suggest that titanium elastic nailing has merit over other procedures and in addition there is less soft tissue disruption and smaller scars. The aim of this biological, minimally invasive fracture treatment is to achieve a level of reduction and stabilisation that is appropriate to the age of the child. Hence we have taken this study of treating fracture tibia in children in the age group 6-14 years with close reduction and internal fixation by titanium elastic nails (TENS).

CONCLUSION

The traditional method of managing paediatric tibial fracture conservatively gives good functional results. Intramedullary fixation is favored in compound fractures & those with failure in cast.
The most predictable method to maintain the reduction of displaced tibial fractures, including length and rotation is intramedullary nail fixation. They ensure angular and rotational stability by 3 point fixation and thus reduces the risk of post operative loss of reduction. The aim of this biological, minimally invasive fracture treatment is to achieve a level of reduction and stabilisation that is appropriate to the age of the child. The biomechanical principal of titanium elastic nail based on the symmetrical bracing action of two elastic nails inserted into the metaphysis, each of which bears against the inner bone at three points. This produces the following four properties: flexural stability, axial stability, translational stability and rotational stability. All four are essential for achieving optimal results. Owing to the subcutaneous anatomy of tibia, implant might cause hardware prominence especially in thin lean children.

The low rate of serious intraoperative complications can be achieved by careful preoperative planning, meticulous surgical dissection, careful handling of fracture ends, careful use of drilling instruments, and appropriate use of antibiotics and programmed rehabilitation. There is a short learning curve with this form of treatment, once one becomes proficient displaced tibial fractures becomes far less intimidating.

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