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RESEARCH ARTICLE

TENS NAIL IN PAEDIATRIC TIBIAL FRACTURES.

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Manuscript Info**Abstract**

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The occurrence of fracture and its treatment is as old as mankind itself and as far back as records of medical conditions are considered. Shaft of tibia fractures are common paediatric long bone fractures. Average age is 8 years. More than 50 % tibial fractures result from road traffic accidents. Tibia is the second most commonly fractured bone in abused children. Approximately 16-26 % of all those have fractured tibia. 9% are open fractures.

70 % tibial shaft fractures are isolated whereas 30 % are associated with fibula fractures.

Aims and objectives:-

1. To study results of operative treatment in fracture shaft of tibia by titanium elastic nails (TENS) in children.
2. To study the complications of above said method.

The study was conducted in Post graduate department of orthopaedics of Govt. Medical College, Jammu during period of January 2015 to January 2016. 20 patients of fracture shaft tibia both male and female children in the age group 6-16 years were included in this study.

The exclusion criteria were:-

- 1) Long oblique/Spiral fractures and Multi fragmentary fractures.
- 2) Severely compound injuries i.e Gustilo Anderson type IIIC fractures.

Patients were admitted, examined and assessed in emergency wing of Govt. Medical College Jammu. After taking a brief history, necessary first aid in form of intravenous fluids, analgesics and adequate splintage was given. Radiographs of the local part including AP view and Lateral view, Routine investigations like Complete hemogram, Renal function tests, Blood grouping, ECG, Chest x ray PA view of patients were also done preoperatively. Patients were planned accordingly for further management.

Implant and surgical technique:-

Descending 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.

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 metaphysis 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 prebent 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 op evaluation:-

The patients were given injectable antibiotics in form of third generation cephalosporins and aminoglycosides. An above knee slab was used for patient comfort. Weight bearing is dependent on fracture pattern, fracture stability, patient compliance and any other associated injuries. Patients were discharged on 10th post operative day depending on clinical and x ray progress of fracture and nails were removed between 9-12 months of operation. Patients were followed up 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 scoring criteria for TENS.

	EXCELLENT	GOOD	POOR
LIMB LENGTH DISCREPANCY	<1.0 CM	<2.0 CM	>2.0 CM
SEQUENCE DISORDER (ANGULATION RESIDUAL)	<5	5-10	>10
PAIN	ABSENT	ABSENT	PRESENT
COMPLICATIONS	ABSENT	MILD	MAJOR COMPLICATIONS and /OR EXTENDED PERIOD FOR RESOLVABLE MORBIDITY.

Follow 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(70%). 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 (75%) was more frequently involved than left (25%). In our study there were 5 cases(25%) having Associated injuries with fracture shaft of tibia comprising of 1(5%)each of trauma abdomen, head injury,fracture clavicle, Fracture distal end of radius, Fracture of ipsilateral femur.Average duration of hospital stay which was 0.4 weeks (4 days), callus appeared in x ray after an average duration of 3 weeks. The fracture completely united after an average duration of 6.5 weeks and patients were allowed to bear weight thereafter. Our study showed an overall complication in 5(25%) of the cases. The most common complication with titanium nailing was lld & was present in 3 of the patients.1 pt. Had infection and 1 had painful bursa. All of the cases returned to full power and range of motion at knee within 12 weeks. Our study showed excellent results in 17 (85%) of the patients and good results in 3(15%) of cases.

Discussion:-

The ideal treatment in tibial shaft fractures controls length and alignment, is comfortable for the child and convenient for family and causes the least psychological impact possible.In the present study, the children from 6-16 years of age were treated for closed tibial shaft fractures, which were transverse, short oblique or short spiral types. Above knee cast application gives satisfactory results but the children have to tolerate prolonged immobilization for physical, psychological and social reasons.For the last two decades the management of tibial shaft fractures have evolved in favour of operative approach to minimize hospitalization and plaster Titanium elastic nailing is an elastic internal fixation implant to hold fracture fragments in anatomical alignment. The micro motions permitted by titanium nails stimulate formation of large external callus which is not present when rigid fixation is applied. this external callus gives the most rapid restoration of strength and continuity to fracture site.

Fracture union is identified by the presence of bridging callus and minimal tenderness and it is defined as painless preinjury activity of the affected limb. The time till full weight bearing is started was considered the best measure of healing. Callus formation indicates fracture healing.

In this study , the meantime of callus formation was 3weeks after which partial weight bearing was started and average time of union was 6.5 weeks and patients were allowed to bear wt. there after .longer time of union has been noted in patients who have been treated with some other modality.

- Griffet J et al 2011 in their study with elastic nails had fracture union in 6 weeks.
- Fyrlan D et al 2011 in their study with elastic nails had fracture union in 7.5 weeks.
- These studies are consistent with our studies too.
- Yusof NM et al 2009 in their study with plating had union of fracture at 13weeks.

Srivastava et al 2008 in their study with nancy nails had union of fracture in 20.4 weeks. In this study there were very few complications and were insignificant. There were 3 patients who had limb length discrepancies. One case had overgrowth of 5mm and another of 3mm.third patient had shortening of 1.2 cm due to shortening of femoral component because of ipsilateral femoral fracture. The rest 17 patients had no limb length discrepancy. There was no case having rotation or angulation. One patient had skin irritation by nail end at the insertion site at about 3 months and in that patient the nail was removed at 5months. One patient had superficial infection of wound which was treated by regular ASD and antibiotics and was in hospital for 7 days.

Griffet J et al 2011 reported 4 superficial infection. There was no refracture in their study.

Yusof NM et al 2009 reported 1 pt. Each of limb length discrepancy of more than 1.5cm, superficial infection, skin irritation.

Srivastava AK et al 2008 reported 2 patients each having neurovascular complications, infection and malunion. 1 pt. Of limb length discrepancy was also encountered. Qidnai sa et al 2001 reported 1 pt. Each of infected non union and deep infection whereas 4 patients had superficial infection.

Titanium elastic nails appear to be the best implant over other surgical methods in this age group. It is a load sharing implant that does not injure the physis, allows early mobilisation and maintains alignment. Micromotion that occurs at fracture site due to relative stability promotes faster external bridging callus formation. The periosteum is not disturbed and fracture hematoma is preserved as it is a closed procedure minimizing infection. Fracture geometry and location is an important pre requisite as transverse, short oblique and short spiral fractures are suitable for tens.

Conclusion:-

The study and appraisal of treatment for fracture shaft of tibia by titanium elastic nails and their complications and limitations have been studied.

The ideal treatment of tibial shaft fracture in children is defined as one that controls alignment and length, does not compress or elevate the extremity excessively, is comfortable for child and convenient for family and causes the least psychological impact possible. Tens is a safe and satisfactory mode of treatment and is relatively easy to perform. The operative stabilisation of paediatric diaphyseal tibia fractures in children, avoids the risk of pin tract infections and the scars created by open reduction and internal fixation with compression plating. Long term immobilization leading to fracture disease due to continuous traction or spica immobilisation is also avoided.

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