STUDY OF TREATMENT OF FRACTURE SHAFT OF LONG BONE OF LOWER LIMB IN CHILDREN BY TITANIUM ELASTIC NAIL (TENS)

Basanta Kumar Behera¹, Mohammad Sadaab²

¹Associate Professor, Department of Orthopaedics, Kalinga Institute of Medical Sciences, Bhubaneswar.
²Senior Resident, Department of Orthopaedics, Kalinga Institute of Medical Sciences, Bhubaneswar.

ABSTRACT

BACKGROUND
Management of displaced fracture shaft of femur and tibia in children between 3-13 yrs. is still a grey area. Although, conservative treatment provides excellent remodeling ability of immature bone in children, parents are often not happy with immediate post reduction x-ray result. Hence, present study was undertaken to evaluate clinically and radiologically displaced fracture shaft of femur and tibia after reduction by elastic nail in children.

MATERIALS AND METHODS
38 patients of paediatric age group between 3 to 13 yrs. with fracture shaft femur and tibia were treated with titanium elastic nail (TENS, Ender’s nail) from January 2012 to December 2016 at our KIMS Medical College Hospital, Department of Orthopaedics.

RESULTS
All the fractures were united by 12 weeks on an average with good callus formation.

CONCLUSION
Treatment of long bone shaft fracture of lower limb, i.e. femur and tibia in children by TENS is an excellent operative procedure. It is safe, less invasive and associated with minimal complication.

KEYWORDS
Intramedullary Nailing, TENS, Fracture Femur, Fracture Tibia, Three Point Fixation.


BACKGROUND
The fracture of shaft of femur involves around 1.6% of all bone injuries in children.¹ Males are affected more than female children. Tibia and fibula are third most common paediatric long bone injuries (15%) after femoral and forearm bone fractures.

Treatment of fracture femur shaft remains controversial. Treatment includes traction followed by hip spica, closed reduction under GA and hip spica, ORIF with plating, intramedullary titanium elastic nail (TENS) and rigid IM nailing.²

In children, fracture shaft of femur is treated by various methods like traction for 3 weeks till soft callus formation and then followed by hip spica for 3 months. Another method is traction and close manipulation in fracture table under GA and followed by hip spica for 3 months. The major drawbacks with these treatments are prolonged bed rest, prolonged hospital stay and delayed mobilisation leading to plaster sore, bedsore, soiling of skin, breakage of plaster, joint stiffness and difficulty in taking care of child by parents and restrict the child from daily routine activities.

CONCLUSION
Management of displaced fracture shaft of femur and tibia in children between 3-13 yrs. is still a grey area. Although, conservative treatment provides excellent remodeling ability of immature bone in children, parents are often not happy with immediate post reduction x-ray result. Hence, present study was undertaken to evaluate clinically and radiologically displaced fracture shaft of femur and tibia after reduction by elastic nail in children.

MATERIALS AND METHODS
38 patients of paediatric age group between 3 to 13 yrs. with fracture shaft femur and tibia were treated with titanium elastic nail (TENS, Ender’s nail) from January 2012 to December 2016 at our KIMS Medical College Hospital, Department of Orthopaedics.

RESULTS
All the fractures were united by 12 weeks on an average with good callus formation.

CONCLUSION
Treatment of long bone shaft fracture of lower limb, i.e. femur and tibia in children by TENS is an excellent operative procedure. It is safe, less invasive and associated with minimal complication.

KEYWORDS
Intramedullary Nailing, TENS, Fracture Femur, Fracture Tibia, Three Point Fixation.


BACKGROUND
The fracture of shaft of femur involves around 1.6% of all bone injuries in children.¹ Males are affected more than female children. Tibia and fibula are third most common paediatric long bone injuries (15%) after femoral and forearm bone fractures.

Treatment of fracture femur shaft remains controversial. Treatment includes traction followed by hip spica, closed reduction under GA and hip spica, ORIF with plating, intramedullary titanium elastic nail (TENS) and rigid IM nailing.²

In children, fracture shaft of femur is treated by various methods like traction for 3 weeks till soft callus formation and then followed by hip spica for 3 months. Another method is traction and close manipulation in fracture table under GA and followed by hip spica for 3 months. The major drawbacks with these treatments are prolonged bed rest, prolonged hospital stay and delayed mobilisation leading to plaster sore, bedsore, soiling of skin, breakage of plaster, joint stiffness and difficulty in taking care of child by parents and restrict the child from daily routine activities.

Time and experience by many orthopaedic surgeons have shown that children with shaft of femur fracture develop angulation, malrotation, overriding and shortening at fracture site which may not get corrected effectively.

So, treatment of paediatric femur fracture has changed gradually towards operative approach in the past decade.

Shorter hospital stay, early mobilisation, early return to activities help the child and parent for better management. There is less disruption of family life with operative procedure.³ ORIF with plating in children provides rigid fixation, but it requires long incision, more soft tissue injury, bleeding, periosteal stripping, chance of infection and scarring at surgery side. Since, it is not a load bearing implant, chance of refracture of shaft is their after removal. Closed reduction and percutaneous TENS of shaft of femur in children provides 3-point intramedullary fixation and allows micro motion at fracture side that helps in good callus formation without disturbing fracture haematoma.

It is a minimally-invasive, simple and very effective. It provides stable fixation, rapid healing, decreased hospital stay up to one to two days and early ambulation, early return to child’s normal activity. There is less problem and disturbances to family members for taking care the child. Overall, functional results are excellent and complications

³ ORIF with plating in children provides rigid fixation, but it requires long incision, more soft tissue injury, bleeding, periosteal stripping, chance of infection and scarring at surgery side. Since, it is not a load bearing implant, chance of refracture of shaft is their after removal. Closed reduction and percutaneous TENS of shaft of femur in children provides 3-point intramedullary fixation and allows micro motion at fracture side that helps in good callus formation without disturbing fracture haematoma.

It is a minimally-invasive, simple and very effective. It provides stable fixation, rapid healing, decreased hospital stay up to one to two days and early ambulation, early return to child’s normal activity. There is less problem and disturbances to family members for taking care the child. Overall, functional results are excellent and complications
are minor. Antegrade nailing is not done as it damages epiphysis and causes AVN of head of femur.4 & 5

In case of displaced tibia and fibula shaft fractures in children, closed reduction and above knee plaster is practiced. But, many a times, it is difficult to prevent rotation, angulation, overriding and shortening of fracture fragment with closed reduction and plaster above knee. So, TENS is excellent surgical procedure for fracture tibia shaft in children. It gives the same advantage as TENS in fracture shaft of femur.

MATERIALS AND METHODS
A prospective clinical study was carried out in 38 children aged 3-13 yrs. with fracture shaft of femur and tibia and were treated with closed reduction and percutaneous retrograde (TENS) flexible intramedullary nailing in a period from January 2012 to December 2016 in KIMS Medical College and Hospital in Department of Orthopaedics. There were 25 boys and 13 girls in the study. The mean time for surgery was 9 yrs. with range from 5 to 13 yrs. There were 22 femoral fractures and 16 tibial fractures. The injuries were due to RTA (road traffic accident), fall and sports activities. There were 30 closed fractures and 8 open fractures (grade I and II). The decision for surgery was taken on fracture instability and displacement of shaft. Before surgery, all patients were given preliminary emergency medical treatment, POP slap and all investigations were done. Before surgery, pre-anaesthesia checkup was done and made fit for surgery. Patients were operated as early as possible once general condition was stable and patient was fit for surgery by 1-2 days of fracture.

All the patients were operated either under general anaesthesia or spinal anaesthesia based on their age. Whenever possible, we have used fracture table for traction and closed reduction for fracture femur. Then, 2 TENS nails were used retrogradely without damaging the distal growth plate under C-arm control. Closed reduction was tried in all. Open reduction was done when closed reduction failed in some patients.

In tibia fracture, 2 TENS nail were used antegradey without damaging proximal growth plate under C-arm after closed reduction.

Postop Management
POP slab or brace was given for immobilisation for a period of 1 month in unstable fractures. Then, patients were allowed active range of movements as pain subsided. Sutures were removed in 12th postop day. Partial weightbearing was started at 6 weeks. All patients were followed for 24 weeks and at regular interval and were examined clinically for any evidence of pin entry point infection, deformity, range of movement of nearby joints, limb length discrepancy, malalignment, x-ray was taken for evidence of Callus formation and union at second month, third month and sixth month.

RESULTS
All the patients were followed until fracture union occurred and upto 6 months to 1 years till removal of TENS. Results are analysed both radiologically and clinically.

The majority of fracture was due to road traffic accident 50%, fall 30% and sports injury 20%. 70% patients were operated by 1-2 days of injury and 30% patients were operated by 3-5 days. Average time for surgery was 45 minutes to 1 hour.

Majority complication was none. Most of the complication that occurred were minor, i.e. 10 patients had pain at pin entry site. Mild infection at pin entry site in 4 cases, which healed with repeated dressing and antibiotic with culture sensitive test. Limb length discrepancy, which were minor occurred in 4 patients. Two patients had malalignment, which remodelled later.

All fractures were united by 12 weeks with good callous formation with average of 10-14 weeks, 26 patients had excellent outcome and rest 12 had satisfactory outcome. None of patient had poor outcomes.
DISCUSSION

The present study was conducted to assess the result of TENS fixation of femoral shaft fracture in children of 3-13 years. TENS intramedullary nailing is safe, minimally-invasive procedure, has few complications, does not interfere with growth and provides short hospital stay and rapid return to daily activities.1,7,8

Ideal fracture for this technique is transverse short oblique fracture or comminution in long bone. The essential prerequisite is accurate prebending of an elastic nail so that apex of bend will lie at the fracture site. A second nail of equal diameter is put intramedullary to provide a diametrically opposed curve at the fracture site.

Flynn et al9 reported that majority paediatric long bone fracture of lower limb should be treated with closed reduction and plaster.

In our study, union was achieved in 30 cases by less than 3 months and rest 8 cases united by 4 months. Average time for union was 12 weeks. Ohem et al reported average time for union was 10.5 weeks.10 In a study conducted by Winquist RS et al average time of union was 12 weeks.11 Study conducted by Hasan et al mean time of union was 7-4 weeks.

In the present study, 7 (18.4%) had developed pain at nail entry site. J.M. Flynn et al reported 38 cases (16.2%) pain at nail insertion site out of 234 patients. J.M. Flynn et al reported 4 (1.2%) case of superficial infection at nail entry point.

All patient had full range of motion of hip and knee by 12 weeks except 2 with knee stiffness. J.M. Flynn also reported 2 cases of knee stiffness out of 234 cases (18). Shortening femur shaft occurred in 2 cases and 2 had lengthening, but nobody had no major limb length discrepancy (i.e. > ±2 cm). J.M Flynn observed limb length discrepancy in 5 cases (2.2%).

Cramer K. E. et al noted average limb length discrepancy of 7 mm (1-14 mm) in their study. Clinically, significant limb length discrepancy more than 2 cm did not occur in any patient in their study.4

In present study final outcome was excellent in 26 cases (68.42%) and satisfactory in 12 (32.6%) cases. Flynn et al treated 234 cases and the outcome was excellent in 65% cases, satisfactory in 25% cases and poor in 10% cases. In K.C. Saikia et al in their study of 22 children with femoral shaft fracture had 13 (54%) excellent in 6 (27.2%) satisfactory and 3 (13.6%) poor results.

So, most common complication in TENS is entry point pain and irritation and superficial infection, other complication include limb length discrepancy and angulation of fracture.

CONCLUSION

From this study, it is concluded that TENS can be used effectively to treat fracture of shaft of femur and tibia in children of age group 3-13 years with minimal complication. It promotes rapid union at fracture site and provides good stability for early mobilisation. The blood loss is less and operation time is minimal. It is simple, provides shorter
hospital stay and early return to activities. So, TENS is considered to be a physiological method of treatment. Our study confers all the advantages, which the previous studies have shown at various institutions and fairly simple, reliable technique with a shorter learning curve.

REFERENCES