

TENS FOR THE SURGICAL MANAGEMENT OF FEMORAL SHAFT FRACTURES IN 5-16 YEARS AGE GROUP CHILDREN

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Abstract

Background: Femoral shaft fractures they represent 1-2% of all fractures in the paediatric population, males are affected more commonly than females. Femoral fractures management in the age group of 5-16 years is grey area and controversial. They occur due to fall from height in early childhood but between 5-16 years of age most are due to sports injuries or road traffic accidents in teenagers. Children above 5 years of age spica not indicated. Compression plating for femur fractures requires large incision and exposure [4]. TENS nailing is a new technique which has advantages like closed insertion, physéal sparing entry, preservation of fracture healing factors with fracture hematoma, early weight bearing and easy implant removal. Short duration of hospital stay and early mobilisation are the main advantages of TENS treatment. **Materials and Methods:** Total of 20 patients were selected for the proposed prospective study between age group of 5-16 years with fracture shaft femur who attended OPD or in emergency ward. All cases were admitted in the orthopaedic department at Mc.gann teaching district hospital SIMS Shivamogga satisfying the inclusion criteria during the study period. Cases selected from Jan23 onwards. The cases were operated with two pre-bent flexible titanium elastic nails inserted in a retrograde fashion both medial and lateral aspect of thigh. **Result:** Average surgical time from incision to closure was 65mins. average age of children's is 11.4years. Average duration of hospital stay was 5.3 days. Average time taken to clinic-radiological union was 9.33 weeks. Clinical Outcome was Excellent in 16 in children and Satisfactory in 4 children. **Conclusion:** Titanium elastic nailing for fracture shaft femur in 5-16-year children's needs shorter time for surgery, less expensive, less demanding skills, simple surgical procedure and shorter duration of hospital stay, with Minimal surgical scars and complications. Due to short duration of study and follow-up, less sample numbers without control group, we recommend long duration results with control group.

INTRODUCTION

They represent 1-2% of all fractures in the paediatric population, males are affected more commonly than females.^[1] They occur due to fall from height in early childhood but between 5-15 years of age most are due to sports injuries or road traffic accidents in teenagers.^[2,3] Children above 5 years of age spica not indicated. Compression plating for femur fractures requires large incision and exposure also re-surgery for removal.^[4] In external fixation pin tract infection

and loosening can occur and can lead to delayed union or malunion.^[5,6]

TENS nailing is a new technique which has advantages like closed fixation, physéal sparing entry, preservation of fracture hematoma, early weight bearing, early and easy implant removal.^[7,8] Shorter hospital stay and early mobilisation are the main advantages of surgical fixation of fracture with Titanium nails.^[9] In paediatric femoral shaft fractures the aim of treatment is to stabilize the fracture, maintain the length, control the rotational alignment, promote healing, and minimize the morbidity and complications for the child.^[10,11]

Dr. Metaizeau and his team from the Children's Hospital of Nancy, France, developed the technique of flexible stable intramedullary nailing with titanium elastic nails, during 1979-1984, for forearm fractures.^[12] Plating of fracture needs wide exposure, large scarring and increases surgical complications and one more surgery for implant removal.^[13] The main advantage of this technique provides early union due to repeated micromotion at fracture site, early mobilization with high patient satisfaction rate.^[14-17] Good results at mid-term follow-up have been reported in children older than six years of age.^[18]

Hence, we decided to carry out a prospective study with TENS in paediatric femur fractures (5-16 years age group).

MATERIALS AND METHODS

Twenty children selected among 18 boys and 2 girls between 5-16 years with fresh femoral shaft fractures 19 closed and one cases were type I open injuries. These cases were fixed with Titanium Elastic Nail, after obtaining ethical committee clearance and with proper consent. mainly fractures were due to road traffic accidents (n=14, 70%) and self-fall amounts to 30%(6cases). Fourteen (70%) cases affected on Right-side femur than left side (n=6, 30%). Five fractures were in the proximal third, thirteen in the middle third and two were in the distal third shaft of femur. Eight fractures were transverse, one case was long oblique, four cases comminuted, one case was spiral and 6 were short oblique. Majority of the patients underwent surgery within four days of their injury.

These fractures were fixed with two pre-bent flexible titanium elastic nails passed through the fracture site in a retrograde manner. Entry portal were made 1 inch proximal to the distal femoral physis, both medial and lateral aspect. The narrowest part of the

medullary canal measured and 80% of the canal size divided equally for both nails. Flynn et al's formula (Diameter of nail = Width of the narrowest point of the medullary canal on antero-posterior and Lateral view x 0.4 mm), which makes 40% of the medullary canalwidth.^[14]

Nails were passed up to calcar part of the neck medially and just below the physis of greater trochanter laterally. Both nails were passed till fracture site and closed reduction done. Both nails passed alternatively to the proximal fragment. Nails were cut at entry portal 1-2cm outside the bone and the cut ends were foiled to reduce irritation to soft tissue and bursitis.

Patients were allowed non weight bearing on walker. Sutures were removed on 12th day.

Patients were followed up on 6th and 12th week for clinical and radiological assessment for union of fractures. Clinical examination of hip, knee and ankle joints done. After confirming union signs both clinically and by x-rays patients were allowed graded weight bearing gradually.

RESULTS

Average duration of surgery from incision to closure was 65mins. Average age of children's is 11.4years. Average duration of hospital stay was 5.3 days. Average time taken to clinic-radiological union was 9.33 weeks.



Fig 1. X-rays of Mr. Harsha 9yrs/M.

Fig 1. First two x-ray films are pre-operative both AP/LAT views, 3rd and 4th are post-operative AP/LAT views, 5th film after 3months and 6th after implant removal.

Table 1: Flynn et al's Scoring Criteria

Criteria	Excellent	Satisfactory	Poor
Limb length discrepancy	< 1 cm	1-2 cm	> 2 cm
Malalignment (degree) >	<5°	5°-10°	10°
Pain	Absent	Absent	Present
Complication	Absent	Mild	Major complication and /or extended period of resolvable morbidity
Number of Patients = (n = 45)	n = 40	n = 5	n = 0
Clinical Outcome	No of Patients		Percentage
Excellent	n=16		80%
Satisfactory	n=4		20%
Poor	0		0

Table 2: According to fracture site, pattern and complications

Gender	Patients' details	No. of patients	Percentage
	Male	18	90%
	Female	2	10%
Total		20	
Fracture site			
	Proximal 1/3rd femur	5	25%
	Middle 1/3rd femur	13	65%
	Distal 1/3rd femur	2	10%
Complication			
	Shortening <1cm	2	10%
	Knee flxn/extn arc<1200	0	

	Pain at entry portal	2	10%
Deformity at healing site (<100)	Varus/valgus/rotational malalignment	3	15%
	Infections/bursitis	2	10%
Fracture pattern	Transverse	7	35%
	Spiral	1	5%
	Comminuted	2	10%
	Oblique=short/long	n=8/n=2	50%

Majority of femoral shaft fractures were middle 1/3rd, 13(65.0%) was proximal 1/3rd, 5(25. %) was Proximal 1/3rd femur and Distal 1/3rd femur 02(10%).

Highest fracture pattern was oblique type 10(50%), Transverse 07(35%), spiral fracture was 01(5%) and 02 (10%) were Comminuted fractures patterns.

All patients had full range of motion at hip and knee of 12 weeks. Average limb length discrepancy was 0.6 cm.

Out of 20 patients 18(90%) were male and 02(10%) were female.

No patient had poor results. All patient's had excellent to satisfactory results.

DISCUSSION

Fixation in children between age 5-16 years of fracture shaft of femur remained as grey area and controversial in the past few decades. But TENS fixation gives excellent results when compared to fixation with other modalities.

TENS Widely accepted treatment in recent years. TENS fixation is more patient friendly having less complications. TENS implants are cheaper and early mobilization is possible.^[28]

Elastic nailing has fast recovery, less time required for rehabilitation, early mobilization and less psychosocial morbidity to the children.^[29]

Dynamic Plate osteosynthesis was done previously until elastic nail fixation become popular. Plate fixation is associated with a long incision and exposure, relatively more time required for mobilization and the risks of delayed union, infections leading to osteomyelitis of femur, second surgery needed for plate removal with wide exposure and non-union which leads to implant failure.^[30]

Intramedullary locking nail has been standard treatment in the past, but AVN of femoral head and due to proximal physeal injury growth failure of greater trochanter leading to excessive deformation of femoral neck especially in skeletally immature child.^[31]

In open fractures external fixation application in children is cumbersome, difficult to maintain, pin track infection with refractures at pin sites are possible including stiffness at knee. Fracture stability and early weight bearing is the main advantage in this procedure; hence TENS is becoming popular.^[19,20] Many studies of femoral shaft fractures fixation with TENS done abroad, but further studies are needed in India to establish TENS fixation is the primary choice and superior mode of fixation comparing to old methods of treatment.

Titanium rods are superior to steel rods as they have unique biological properties like less reactive and inert to the host tissues and mechanical properties like flexibility, strength and durability of implants.^[21] Hence, we did study in paediatric age between 5-16 years of age with flexible titanium fixation to compare the results with similar studies done in literatures.

In K C Saikia et al study surgical time was 70 mins, in our study it was 65mins.^[22] Hence, our study report is comparable. In our result average duration of hospital stay before discharge was 4 days (3-5days), Topak et al,^[23] Showed that mean duration of hospital stay was 2.32 (1-7) days.

We have shown that average time for union was 9.33(6-8 weeks) weeks, which is comparable to Sarkar et al results, (radiological union was achieved by 8 weeks to 10 weeks (mean 8.3 weeks).^[25] Narayanan et al. studied over 5-year period, almost 50% entry portal Complications of Titanium Nail.^[26] Mazda et al. proved that 10 of their 34 patients had pain at entry portal. Ends of titanium rods were left too long which irritates and causes painful bursae and restricted ROM knee.^[27]

In our study 3 cases of shortening (average shortening 5mm) Thus, these complications are also comparable to All.

Range of motion at knee and hip joint gained by 12 weeks (12-16wks). Implant removal done between 12 -16 weeks but 4 patients appeared to OPD for removal between 3-6months.

Final clinical outcome in this study was excellent and satisfactory in all patients.

CONCLUSION

Fracture shaft femur in 5-16-year-old patients is cost-effective, easy fixation technique, short surgical time, minimal incision scars, shorter hospital stay and early mobilization with negligible complications.

We are recommending further studies in this area with more duration of study, follow-up and with control group to minimise errors and accurate results.

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