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Comparative study of titanium elastic nailing v/s dynamic compression plating for the management of fracture shaft of femur in adolescent age group

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ABSTRACT

Background: Femoral fractures are one of the common long bones fractured in paediatric age group. Over the past 20 years, there has been a dramatic and sustained trend toward the operative stabilization of femoral shaft fractures in school-aged children. Femoral fracture demands stable fixation in adolescent.
Methods: A retrospective cohort study was conducted in a tertiary care hospital. All children's between the age 11 to 18 years with femur fracture managed with either TENS or dynamic compression plating between march 2014 to march 2017 were included into the study.
Results: most common mode of injury was RTA. Middle third being the most common site for fracture. There was100% union in our study. The mean time of union in TENS group was 12 weeks and that of Plating group Was 13.1 weeks. Irritation at entry site was seen in 11 (22.9%) out of 48 patients. Malunion was seen in 9 out of 48 children's in group a, whereas malunion in group b seen in 1 child. All the malunion was less than 5 degree and Varus being most common type of malunion. Limb length discrepancy in group A was observed in 5 patents (10.5%) out which 3 were shortening and 2 were lengthening. In group b 1pateint had shortening at end of follow up. In group B superficial infection was seen in 4 (15%) out of 33 children's and in group A it was observed in 2 children's (5%).
Conclusions: we concluded that compression plating in adolescent age group especially older and obese children for the management fracture shaft of femur comparatively better than TENS.

Keywords: TENS, DCP, RTA

INTRODUCTION

Femoral fractures are one of the common long bones fractures in paediatric age group. They are known to create substantial short-term disability.[1] The incidence of femoral fractures is 20 per 100000. In relation to age it has bimodal presentation, with peaks at 2nd and 17th years.[2] The mechanism for injury varies with age. Child abuse accounts for 80% when the age is before the walking age. And in older /adolescent children, high energy trauma (RTA) is the most common mechanism of injury.[1]

Traditionally femur facture in children's were managed with immediate hip spica or traction followed by spica application. And operative management was reserved for children's with head injury or multiple traumas. Over the past 20 years, there has been a dramatic and sustained trend toward the operative stabilization of femoral shaft fractures in school-aged children. The main factors to be considered are age, fracture pattern, associated injuries

and social and economic situation of the child and family.[1]

Staheli defined the ideal treatment of femoral shaft fractures in children as one that controls alignment and length, is comfortable for the child and convenient for the family, and causes the least negative psychological impact possible.[2]

Generally femoral fractures in younger children are thought to heal satisfactorily irrespective of the form of treatment, but the management of femoral fractures in adolescents presents specific challenges. Femoral fracture demand stable fixation in adolescent as their body weight and immature skeleton approaches to that of an adult.[3]

Flexible intramedullary nails, plating, external fixation, locked intramedullary nails are the current operative option available. Flexible intramedullary nailing being a closed easy procedure became popular in management in pediatric shaft fracture.

Although good results have been reported with elastic intramedullary nails, plate fixation continues to be a viable alternative in surgical treatment of femoral shaft fractures. And compression plating is considered as a safe and effective treatment option in management of isolated femoral fracture and those associated with multiple injuries.[4,5]

But ideal method for adolescent age grouped is still unclear. Hence this retrospective study is conducted to compare the ESIN and compression plating in management of fracture shaft of femur.

METHODS

After taking clearance from ethical board, a retrospective cohort study was conducted in a tertiary care hospital. All children's between 11 to 18 years with femur fracture managed with either TENS or compression platting between March 2014 to March 2017 were included into the study. Statistical software used to analyse the data is SPSS-16.

All hospital records along with radiological films were retrospectively reviewed of the patient included in the study and the findings were recorded and analysed.

Inclusion criteria

Inclusion criteria were children with simple femur shaft fractures; children aged between 11 years old and younger than 18 years; with open physis; available for at least 12 months of follow up.

Exclusion criteria

Exclusion criteria were children younger than 11 years and older than 18years; children with epiphysis fused; children not available for follow up for at least 12months; compound femur fractures.

Based on radiological findings (AP and lateral view of femur) fracture pattern (transverse, oblique, spiral or comminuted) and fracture site (proximal 3rd, mid 3rd or distal 3rd) were noted done.

Based up on the fracture location, fracture characteristics, patient age, and patient weight surgeons were given the option to select the either TENS or DCP.

In the TENS group, Titanium elastic nail of appropriate diameter were used and inserted either antegrade according to standard AO guide lines based on the fracture site.

And in platting group, usual lateral approach to femur was employed. After achieving temporary reduction with help of K- wire, 4.5 mm or 3.5 mm DCP were placed and secured with at least 4 cortical screws on either side of the fracture.

Postoperatively- regular dressing done on 2nd, 5th and 10th followed by suture removal.

Patients were encouraged and initiated isometric quadriceps exercises, joint mobilization (hip and knee) immediate postoperative period.

Patient followed at regular intervals, once in a month for first 6 month, followed by once in 3 months for next 1 year and then once in every 6 months for next 1 $^{1/2}$ years.

All the patients were evaluated with help of Flynn et al scoring system (Table 1) following fracture union. And patients were graded as excellent, successful or poor based on the observation.[6]

Table 1: The scoring criteria for TENS.

Limb length	Excellent	Successful	Poor
Discrepancy	<1 cm	<2 cm	>2 cm
Sequence disorder	5°	10°	>10°
Pain	Absent	Absent	Present
Complication	Absent	Mild	Major

RESULTS

Totally 81 childrens were included in the study out of which 54 where were male and 27 were girls. 48 Fracture managed with TENS were considered as group A and 33 fracture managed with DCP plating were grouped into Group B (Table 2).

The mean age in our study was 14.8 years. In group A 40 children were between 11-14 years and 7 children's were of age 15- 18 years. And in group B, 7 children's were of

11-14 years and 26 children were between 15-18 years (Table 3).

Table 2: Distribution of cases based on treatment.

	No. of children's
Group A	48
Group B	33

Table 3: Age wise distribution of cases.

Age	Group A	Group B
11- 14 years	40	7
15-18years	8	26

Table 4: Distribution of cases based on mode of injury.

Mode of injury	No. of children
RTA	67
SRI	13
Others	1

Among the mode of injury RTA accounted for 82.7% (67 out of 81) and sports related injury accounted for 16% (13 out of 81) and 1.2% (1 out of 81) was by other causes (Table 4).

Of the fractures, 67.9% fracture was seen in middle 1/3rd, 19.7% in proximal 1/3rd and 12.3% were seen in distal 1/3rd of shaft of femur. But the distribution was different in both group were, 83.3% was middle 1/3rd, 12.5% was proximal, 4.1% was distal 1/3rd shaft fracture seen in TENS group and in platting group 45.5% was middle 1/3rd, 30.3% was proximal 1/3rd, 24.4% was distal 1/3rd shaft fracture were observed (Table 5).

Table 5: Distribution of cases based on site of fracture.

Site (shaft)	Group A	Group B
Mid 3rd	40	15
Proximal 3rd	6	10
Distal 3rd shaft	2	8

Table 6: Distribution of cases based on type of fracture.

Type	Group A (%)	Group B (%)
Transverse	27 (56.25)	9 (27.3)
Oblique	11 (22.9)	5 (15.15)
Spiral	6 (12.5)	5 (15.15)
Comminuted	3 (6.25)	15 (45.4)

Group A, 56.25% of transverse fracture, 22.9% were oblique fracture, 12.5% spiral fracture and 6.25% comminuted fracture pattern. In group B 27.3% were transverse fracture, 15.15% oblique fracture, 15.15% of spiral fracture and 45.4% was comminuted facture pattern were noticed (Table 6).

There was 100% union in our study. The mean time of union in TENS group was 12 weeks and that of platting group was 13.1 weeks. And mean time of toe touch in group A was 5 weeks and 7.85 weeks in group B (Table 7).

Table 7: Distribution of cases based on time taken to heal.

	Group A (weeks)	Group B (weeks)
Mean time of union	12	13.1
Mean time of toe touch	5	7.85

During the follow up patient were evaluated for loss of reduction, malunion, limb length discrepancy (lengthening, shortening), irritation at entry site, superficial infection and implant failure.

In group A (TENS) irritation at entry site was seen in 11 out of 48 (22.2%) patient, none of group B patient noticed any irritation at entry site. The entire patient with irritation at entry point of group A underwent early implant removal and had complete relief. Malunion was seen in 9 out of 48 children's in group a, whereas malunion in group b seen in 1 child. All the malunion was less than 5 degree and varus being most common type of malunion.

Table 9: Distribution of cases based on complications.

Complication	Group A (%) TENS	Group B (%) DCP
Loss of reduction	5 (10.4)	0
Malunion	9 (18.7)	1 (3)
Limb length discrepancy	5 (10.4)	2 (6)
• **Lengthening**	1 (2.1)	0
• **Shortening**	4 (8.3)	1 (3)
Irritation at entry site	11 (22.9)	0
Superficial infection	2 (4.1)	4 (12.1)
Implant removal	24 (50)	19 (57.6)
Implant failure	3 (6.25)	1 (3)

Loss of reduction was seen in 5 out of 48 children (1 of oblique, 2 of spiral, 2 of comminuted fracture pattern) in group A and required reoperation, were as there was no loss of reduction in group B.

Limb length discrepancy in group A was observed in 5 patents (10.5%) out which 3 were shortening and 2 were lengthening. In group b 1pateint had shortening at end of follow up,

In group B superficial infection was seen in 4 (15%) out of 33 children's and in group A it was observed in 2 children's (5%). This childes were managed with IV

antibiotics according to culture and sensitive report of the entry/incision site.

In our retrospective study, although we included, age group between 11 to 18 years, most the patient in TENS group were between in 11 to 14 year were as in Plating group it was between 14 to 18 years group which indicates that surgeon preferred DCP in older children's (Figure 1).

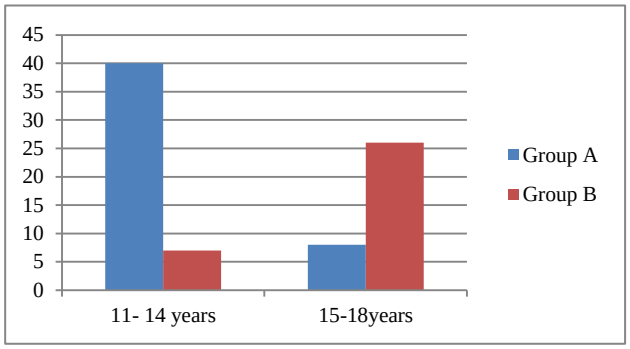

Figure 1: Age wise distribution of cases.

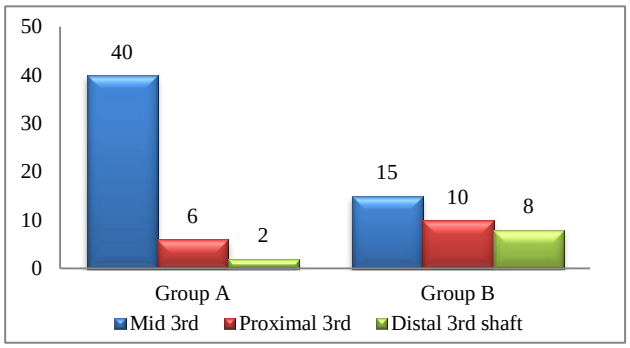

Figure 2: Distribution cases based on site of fracture.

DISCUSSION

The aim of the present retrospective study was to compare the outcome of fracture shaft of femur in adolescent age group by TENS and compression plating. There are limited studies conducted over management of fracture femur in adolescent age group. From above study, we could infer that the most common mode of injury in adolescent is RTA followed by sports related injuries. Males are more commonly involved than female when it comes to femur fracture in adolescent age group.[7]

In group A the maximum type of fracture pattern was Transverse (56.25%) followed by oblique which was 22.9% and spiral 6 which was 12.5% and least being comminuted pattern 6.25%. But In group B most common pattern preferred were comminuted (45.4%), transverse (27.3%), oblique (15.5%) and oblique (15.5%). This indicates that the surgeon's preferred Stable facture pattern in TENS group when compared to compression plating Group. A retrospective study conducted by Sean et al, comparing 3 modalities management of fracture shaft of femur found out that, a significant association was found between treatment type and fracture pattern A higher proportion of spiral fractures and fewer transverse fractures were found in the plate group.[8]

The mean time of fracture union radiologically was statistically insignificant, were mean time of union in group A it was 12 weeks were as in Group B it was 13.1 weeks. Study conducted by Kumar et al observed the mean union in TENS group in femur fracture was 13.00±1.37 and another studies observed that union rate in children's managed with DCP to fracture shaft of femur was between 8-11 weeks.[9]

But mean time toe touch in group A was 5 weeks which was earlier than Group B which was 7.8 weeks. A comparative study conducted by Kumar et al observed that mean toe touch walking in TENS group was 3.97±1.68 weeks and 7.85±2.23 weeks in DCP group. This could be attributed to primary excessive dissections which occur in DCP plating when compared to closed procedure of plating.[9]

The complication in group A was more when compared to Group B. In group A loss of reduction during and post-surgery was 10.4% when compared to Group B were there was no loss of reduction. The most common complication in TENS group was irritation at entry site due to bursitis seen in 22.9% of cases which was not noticed in Plating group. Kumar et al also observed that entry point irritation/bursitis was seen in 10% of TENS group and none in DCP group.

The most common complication in plating group was superficial infection (15%) which was seen only in 5% of cases of TENS group, which was similar to findings of Kumar et al were superficial infection in TENS group was 5% when compared to DCP group were it was 15%.

According to literature malunion is common complication in childrens managed with TENS for fracture femur. Malunion was noticed in 11% and 9.09% in Lingier et al and Saikia et al respectively. In our study We observed that malunion more common in TENS (18.7%) group then DCP group (3%), which correlate with literature.[4,10]

In our study we noticed that limb length discrepancy was more commonly seen in TENs group, shortening was seen in 6.2% of cases and lengthening in 4.1% of cases. But in group B shortening only saw in 3% and no lengthening which is also noticed in other literature, where the limb length discrepancy as seen 12%, 13.6% in Ligier et al and Saikaia et al study were as in childrens managed with DCP was on ly 4.3.[4,10]

CONCLUSION

Femur fracture in adolescent age group can be managed effectively with both TENS and DCP. The radiological

union was almost equal in both groups. But mobilization was delayed in DCP group. During follow-up, complication like, loss of reduction, malunion (especially), limb length discrepancy, entry site irritation are more common in femur fracture managed with TENs when compared to DCP group. But superficial infection was more common in DCP group. Dynamic compression plating in adolescent age group for the management fracture shaft of femur is better in older children, obese adolescents.

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