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Short Term Functional Outcome of Displaced Midshaft Clavicle Fractures Treated with TENS nailing.

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ABSTRACT

Clavicle fractures are one of the commonest fractures of upper limb. Traditionally clavicle fractures have been treated conservatively in the past. Conservative treatment of clavicle fractures have yielded good results in the past, but leads to malunion, shortening and stiffness of the shoulder joint leading to unsatisfactory results. Modern day techniques of treatment include open reduction and internal fixation with plate osteosynthesis. But it has complications of invasive surgery, wound healing problems, higher rate of non-union and additional procedure for implant exit. In recent times, clavicle fractures have been treated with closed/open Titanium Elastic Nailing. It has the advantages of minimally invasive surgery, biological union and cosmetics and avoids the need for extensive surgery for implant exit.

Keywords: Mid shaft clavicle fractures, Transcutaneous Elastic Nailing System (TENS), closed reduction and internal fixation

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MATERIALS AND METHODS

It is a prospective study carried out between 2010 and 2012 after approval from institutional ethics committee. We present a series of 32 enrolled cases of midshaft clavicular fractures who were subjected to intra medullary fixation with titanium elastic nail system with average diameter 2.5 to 3 mm by closed / open reduction method under image intensifier control. The mean age of our patients is 35.8 (21-58 yrs) with male : female ratio of 96 : 4. Right to left sided fracture ratio was 1.13 : 1. RTA was the commonest cause in 93.75% and direct fall in 6.25% patients.

All patients, after pre operative investigations, were informed of surgical risks and complications. Consent has been obtained, that their photo and detail can be published in this report. They were taken up for surgery. ORIF with reconstruction plate were done in 3 patients, ORIF with precontoured clavicle plate in 17 patients and ORIF with TENS in 3, and CRIF with TENS in 11 of them.

Technique [1-23]

Under GA, pt in beach chair position, C-arm from the head end is introduced such that both AP and axial views are obtained prior to draping. Entry point made through stab incision in the medial 1/4th of the clavicle by bone awl or drill bit under fluoroscopy. 2mm, 2.5mm or 3mm TENS nail is selected based on clavicle inner diameter and inserted from the medial end through a T handle. Reduction of fracture done by manipulation and nail passed across fracture by gentle tapping. The distal bend in the nail is used to maneuver it across the fracture. Position is checked under C arm in both AP and lateral views. The nail is pushed as far laterally as possible and cut close to the bone in the medial end. Skin is closed over the nail by staplers or simple sutures.

Post operatively, arm is rested in sling. Patient was given iv antibiotics for 3 days. The patient is allowed to mobilize the shoulder as early as 4 to 5 days if the pain permits. However the patient should be warned against developing a "false sense of security". The success of closed reduction and internal fixation depends on early restoration of joint mobility. Suture removal is done on 12th day. Shoulder mobilization exercises started after suture removal. Patient is asked to restrict heavy activities for 6 weeks.

The patients were regularly reviewed at interval of 6 weeks up to 12 weeks and then every 12 weeks. The follow up period ranged from 2 months to 24 months. Mean follow up of 13 months. Three patients were lost in follow up period. The patients were examined and functional assessment was done with the help of Constant and Murely scoring system.

RESULTS

All the patients were reviewed at regular intervals and were examined clinically and radiologically and were assessed using the scoring system. The average period of union of plating was 12 wks and of TENS nails was 13 wks.

Functional outcome in % (TENS NAIL):

Excellent (81-100 points) 9pts	64.29%
Good (61-80 points) 4pts	28.57%
Fair (31-60 points) 2pts	14.29%
Poor (<30 points) 0	0%
Lost follow up 0pts	0%

Functional outcome in % (ORIF PLATE):

Excellent (81-100 points) 5pts	35.71%
Good (61-80 points) 8pts	57.14%
Fair (31-60 points) 1pts	7.14%
Poor (<30 points) 0	0%

Lost follow up 3pts **21.42%**

Complications in our study:

1. Post operative wound disorders 6.25%
2. Delayed union 15.63%
3. Non Union 3.1%
4. Hardware irritation 71.36% (TENS nail)
15.62% (plating)
5. Hypertrophic scar 3.1%
6. Implant failure 6.25%

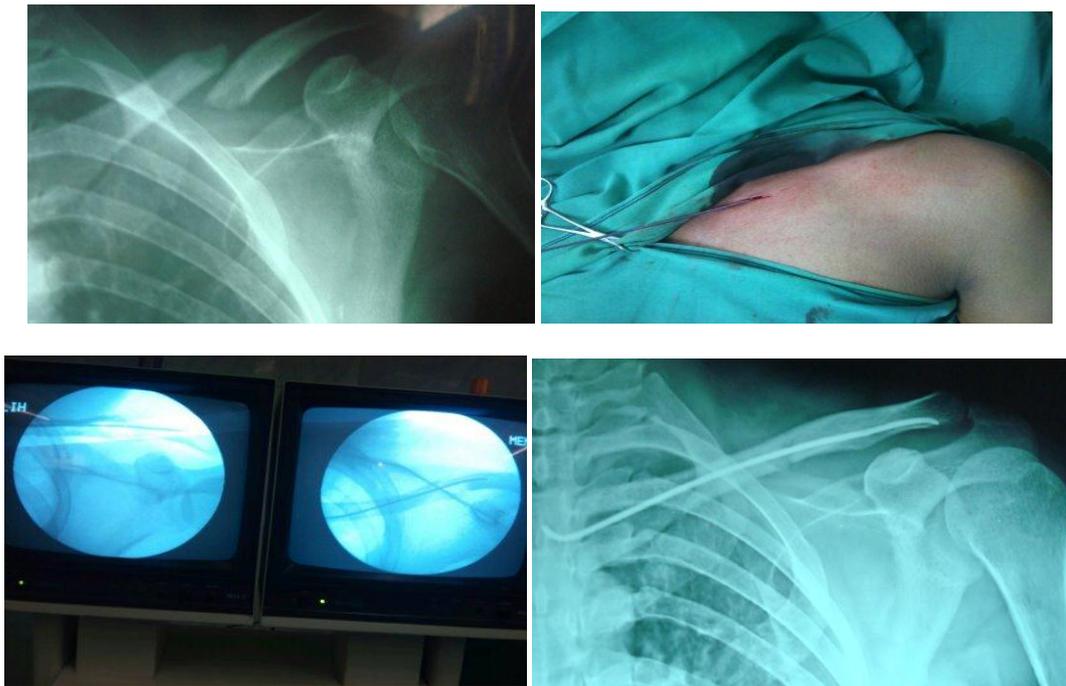


Fig 1-4 : Case 5 with displaced midshaft clavicle fracture treated with TENS nail

The average Constant- Murley score after assessment of shoulder function was 96.8. Statistical detail of Constant- Murley score is Max-100, Min-92, SD=2.3. Sample variance=5.67, Standard error=0.27, Skewness=0.58 and the study was considered significant ($p < 0.05$).

S. No	Study	Constant Murley Score
1.	F. Hartmann et al	95.3 (range 91.2-99.1)
2.	Yun-feng Chen et al	95.2 (range 86.5-97.0)
3.	Zhang W et al	97.0 (range 92.8-99.8)
4.	Our study	96.8 (Max-100; Min-92)

Table 1: showing comparisons of result of shoulder function score after TENS nailing

DISCUSSION

This study shows comparative excellent results of operative treatment displaced mid shaft clavicle fractures in both plating as well as TENS nailing. The patients showed a high comparative constant score, early pain reduction, early return to activity and high patient satisfaction rating.

Displaced midshaft clavicle fractures are considered benign with minimal complications with satisfactory outcome if treated conservatively. However several reports challenge this view and there has been an interest in operative treatment for fractures of clavicle that display significant shortening.

Possible complications resulting from conservatively treated clavicle fractures are

1. Cosmetic deformity,
2. delayed union,
3. persisting non union,
4. chronic shoulder pain,
5. and impaired shoulder function

Studies show conservative management of displaced and shaft clavicle fractures show up to 15% non union. Literature review shows midshaft fractures with a shortening of more than 2 cm predispose to non union. The risk of non union was increased by lack of cortical apposition, female gender, the presence of comminution and advancing age. **Open reduction with internal fixation** was considered one of the reason for non union.

In our study we had 90% union. In reviewing the literature, both CRIF with TENS nailing and ORIF with plate osteosynthesis shows union from 90-100%.

In our study we had one case of non union in the TENS nail group due to spontaneous implant exit and 5 cases of delayed union(15.63%)

Many different methods of operative fixation of mid shaft clavicle fractures have been described: intramedullary pinning, Steinmann pins, Knowles pins or elastic nails, Kirchner wires and the use of screws and different plates.

In our study, the majority of complications were post operative disorders. No post operative infections were noted in our study. Literature review shows infection rate up to 10% for plate fixation of displaced and shaft fractures. We had 3 implant loosening and one spontaneous implant exit in the TENS nail group and one screw breakage in the plating group. We had implant failure in one case of delayed union.

The other complication of our study was hardware prominence at the medial end in 80% of patients mostly treated with TENS nail. These patients underwent implant removal. All cases were followed up regularly. We have no refracture till date.

Taking these percentages into account, we believe that operative treatment of acute middle third clavicle fractures should be preserved for persons who wishes to return early to activity and who accept the risk for potential complications.

CRIF with TENS nailing has certain definite **advantages** over ORIF with plating like

- Lesser operating time
- No scar
- Minimal bleeding
- Biological fixation
- Less post op pain/discomfort
- Lesser rates of infection/wound problems
- Better union rates
- Easy implant exit

However it also has certain **disadvantages** like

- Demanding technique

- Radiation exposure
- Lesser stability in severe comminution
- Hardware prominence.

CONCLUSION

The acute treatment of displaced mid shaft fractures remains a subject of controversy. Our study demonstrates early pain relief with good shoulder function, quick return to activities and a high patient satisfaction rate. ORIF with plating also has similar union rates and functional scoring, but has a relatively higher rates of non union, malunion and resurgery. It has the disadvantage of cosmetically disfiguring scar, and a major surgery for implant exit in the future.

Therefore, we believe that closed reduction and internal fixation with TENS nail is a valuable option in the acute treatment of displaced mid shaft fractures in active adults despite certain risks for complications which is typically well accepted by the patients with high functional demands. It has the added advantage of scarless surgery, biological fixation and early return of functions.

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