Original Article

Modalities of treatment for segmental tibia fracture

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ABSTRACT

Background: Segmental tibia fractures (AO 42-C2) are defined by two or more distinct fracture lines isolating an interposed cortical segment which excludes butterfly fragmentation. Severe soft tissue defects are common due to their association with high energy trauma mechanisms of injury.

Objectives: This study is an attempt to observe the various outcome of operative management of segmental tibia fracture treated by various modalities like intramedullary nailing, plating and external fixator. The results have been studied in depth to determine which modality is better for management of this type of fracture.

Material & Methods: This is a prospective study of 25 cases of segmental tibia fracture treated by intra medullary nailing or plating or external fixator with minimum 6 months of follow up. All cases are evaluated according to time of union, complications, range of motion and modified knee society score. Modified knee society Score on residual effects on clinical ground at final examination. Points are given for pain, function and range of motion in modified knee society score.

Result: Mean knee ROM in intramedullary nailing group is 118, while in plating group is 113.33.Average time of union in intramedullary nailing group is 18.61weeks; while in plating group is 25.33 weeks. Result according to Modified knee society score was found to be excellent to good in 18(72%) patients.11(73%) patients treated by interlocking intramedullary nailing had excellent to good knee score.

Conclusion: Interlocking intramedullary nailing is a excellent method of treatment for the segmental tibia fracture as it provides rotational stability, gives excellent to good result, lower rate of complications and good knee ROM.

Key words: Segmental tibia fracture, Modified knee society score, Intramedullary nailing.

INTRODUCTION

Segmental tibia fractures (AO 42-C2) are defined by two or more distinct fracture lines isolating an interposed cortical segment which excludes butterfly fragmentation [1].

Segmental fractures of the tibia present a challenge to treating orthopaedic surgeons due to their infrequent presentation, wide zone of tissue injury and increased rate of complications [2].Severe soft tissue defects are common due to their association with high energy trauma, so many of the patients initially treated by temporary external fixator and later definitive fixation done after healing of soft tissue [3].

The perfusion of the intermediate segment is provided through endosteal and periosteal blood supply, which sustains increased damage leading to impaired fracture healing with the already precarious blood supply of the intermediary cortical segment [3]. Segmental tibia fracture is associated with complications like delayed union, non-union, infection, adjacent joint stiffness.

The ideal internal fixation device should be such that the patient can be mobilized at the earliest without jeopardizing the reduction, stability and union of the fracture [4].

This thesis is an attempt to study the long term results of operative management of segmental tibia fracture treated by Intra medullary nailing or plating or external fixator in a standardized and objective manner. Factors affecting the quality of fixation and hence patients ambulation have been analysed. A form of pre-operative assessment and final assessment has been used. The results have been studied in depth with a view to outline guidelines for better management of these fractures.

MATERIALS AND METHODS

Study area, duration: A prospective, all inclusive, non-controlled, non-randomized, non-blinded study of 25 cases of segmental tibia fracture treated by various modalities was done from July 2013 to November 2015 at Shri M.P.Shah Government

Medical College & Guru Govindsinh Government Hospital, Jamnagar, Gujarat, India.

Out of 25 patients; 15 patients were treated by interlocking intramedullary nailing, 6 patients by plating, 3 patients by ender's nailing and 1 patient by external fixator.

Inclusion criteria:

- All segmental tibia fractures treated with nailing, plating and external fixator at least before 6 months are included.
- Males and females both are included.
- Patients with age between 18 years to 65 years are included.
- Trauma with different modes of injury is included.
- Patients having other associated injuries are included.
- Open and close, both types of fractures are included.

Exclusion criteria

- Patients younger than 18 years
- Patients older than 65 years
- Fractures with associated neuro vascular injury requiring repair
- Pathological fracture
- Severe systemic illness like active cancer, chemotherapy, insulin dependent diabetes mellitus, renal failure, haemophilia, and other medical contra indications for surgery
- Severe head injury (initial Glasgow Coma Scale <8)

Preoperatively

X ray evaluation provides information about the pattern of fracture, degree of displacement and comminution and quality of bone [5]. In many segmental tibia fractures anterio-posterior and lateral views of knee with leg with ankle provide sufficient information regarding fracture configuration.

Post operative regimen

Parenteral antibiotics, usually third generation cephalosporin were started immediately after the admission and postoperatively. Static quadriceps exercises and ankle mobilization were encouraged from the first day and the knee was mobilized from the third day.

Check x-rays were taken on the same day as soon as patient was stabilized following the surgery. The stitches are removed on 12th post operative day.

Patients were first followed up usually at stitch removal if not already done or at one and a half months after discharge, if stitch removal is already done. Clinical assessment of fracture union, range of movement of knee and ankle and radiological assessment of fracture union is done on subsequent follow up. If union is found satisfactory and radiological union is found to be in progress, partial weight bearing is started as tolerated. Patients are next called after another 1&1/2 months and reassessment, both clinical as well as radiological, is done and if union is found to be progressing satisfactorily full weight bearing is started as tolerated. Patients are next called at every 3 months and reassessment, both clinical as well as radiological is done. Functional outcome assessed using modified knee society Score.

Ethical consent: Ethical clearance was taken from the institutional committee

RESULTS

Table -1: Distribution of cases according to age

Age (in years)	Cases (n=25)
20-29	4 (16%)
30-39	5 (20%)
40-49	9 (36%)
50-59	7 (28%)
Total	25 (100%)

Mean age of patient included in study is 41.88 year. **Table1** shows that maximum patients belong to age group of 40-49 years.

Table -2: Distribution of cases according to implants used for fixation

Implant used	Cases (%,n=25)
Interlocking intramedullary nailing	15 (60%)
Plating	6 (24%)
Ender's nailing	3 (12%)
External fixator	1 (4%)
Total	25 (100%)

Among the various implants available, interlocking intramedullary nailing was most commonly used.

Table -3: Distribution of cases according to mean time of union

Weeks	Cases (%,n=25)
<12	**0 (0%)**
12 – 14	**1 (4%)**
14 – 16	**5 (20%)**
16 – 18	**5 (20%)**
18 -20	**5 (20%)**
20 – 24	**6 (24%)**
>24	**3 (12%)**

Average union time is 19 weeks. Average time of union in intramedullary nailing group is 18.61 weeks. Average time of union is plating group is 25.33 weeks.

Table -4: Distribution of cases according to complications

Complications	Nailing	Plating	Ender's nailing	External fixator
Infection	1 (7%)	2(33%)	1 (33%)	0 (0%)
Delayed union	1 (7%)	3(50%)	2 (66%)	0 (0%)
Non union	3(20%)	0 (0%)	1 (33%)	1(100%)
Fixed flexion deformity of knee >10	0 (0%)	0 (0%)	1 (33%)	0 (0%)

Infection is the common complication following surgery. Higher incidence of infection in plating group about 33%

Table -5: Distribution of cases according to functional results in present study: surgeon's assessment (ACCORDING TO MODIFIED KNEE SOCIETY SCORE)

Knee score	Interlocking intramedullary nailing	Plating	Ender's nailing	External fixator
Excellent	5 (33%)	2(33%)	0 (0%)	0 (0%)
Good	6 (40%)	4(67%)	1 (33%)	0 (0%)
Fair	4 (27%)	0(20%)	1 (33%)	0 (0%)
Poor	0 (0%)	0 (0%)	1 (33%)	1(100%)

72% patients had excellent to good outcome. Though the complication rate was high, it did not affect the final outcome in terms of knee society scoring system. Mean knee score value is 82.32.

Table -6: Distribution of cases according to knee range of motion

Knee ROM	Nailing	Plating	Ender's	Ext. Fixator
Excellent (>120)	**12(80%)**	**2(33%)**	**0 (0%)**	**0 (0%)**
Good(120 - 110)	**3 (20%)**	**4(67%)**	**3(100%)**	**0 (0%)**
Fair (110 – 100)	**0 (0%)**	**0 (0%)**	**0 (0%)**	**1(100%)**
Poor (<100)	**0 (0%)**	**0 (0%)**	**0 (0%)**	**0 (0%)**

All patients in our study underwent supervised physiotherapy regimen. Physiotherapy of knee was started as soon as pain permits, and the stitch lines are dry and sealed.
Mean knee ROM in our study is 115.2. Mean ROM in nailing group is 118. Mean ROM in plating group is 113.3.

DISCUSSION

In my study highest number of patients,9 (36%) patients are in 40-49 years age group and mean age was 41.88 years. A comparative study done by Xianfeng He et al shows mean age of patient was 36.9 years [6].
Most of the patients in our study were treated by interlocking intramedullary nailing 15(60%), while 6 (24%) patients were treated by plating,3 (12%) patients with ender's nailing and 1 (4%)patient with external fixator. In Bonnevialle P et al study, 80 % of the patients were treated by interlocking intramedullary nailing [7].

All the patients are followed up closely and at least for 6 months. In this study,average union time of fracture is 19 weeks. Average time of union in intramedullary nailing group is 18.61 weeks, while in plating group is 25.33 weeks .In Martin Tera et al study, average union time in intramedullary nailing group is 19 weeks, while in plating group is 48 weeks [8].
In this study, 4 (16%) patients had infection. They were treated by appropriate antibiotics according to culture and sensitivity. Most infection responded well to treatment. Infections were more common in plating group (33%) as compared to nailing group. 6(24%) patients develop delayed union and fractures were united in final follow up. 3(20%) patients of intramedullary nailing develop non union. one was treated with exchange nailing + bone grafting + fibulectomy and another was treated with implant removal + Plating + Bone grafting. At final follow up, both fractures were united in both patients. While in Ding chuanzhustudy, in plating group,3(14%) patients develop infection and 2(10%) patients develop delayed union [9].

In this study, we used Knee Society Scoring system for objective quantification of the outcome. This score depends on variables like range of motion, stability and alignment, fixed flexion deformity. Mean of modified knee societyscore value is 82.32.18(72%) patients in our study had excellent to good outcome according to knee society score.11(73%) patients treated by interlocking intramedullary nailing had excellent to good knee score. This shows that interlocking intramedullary nailing in these fracture gives excellent to good outcome in most of the patients. In Ding chuanzhu study [9], 90% of patients having excellent to good outcome in nailing group while 77% of patients having excellent to good outcome in plating group according to Johnerwruhs score.

In this study,14(56%) had excellent knee flexion >120 degree,10 (40%) had good knee flexion >110

and only one patient had knee flexion <100.Mean knee ROM in our study is 115.2.Mean ROM in nailing group is 118.Mean ROM in plating group is 113.33.While mean knee ROM in Oog-jinshon study is 129 degree[10].

CONCLUSION

Modified knee society score is good score to evaluate functional outcome of the patients. In conclusion, interlocking Intra medullary nail, is an optimum implant for the internal fixation of segmental tibia fractures with advantages of stable fixation, early load sharing fixation, early weight bearing and ambulation, lower rate of complications, good knee range of motion, shortened hospital stay and improved rate of union with early resumption of independent life style, excellent functional outcome.

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