

HYBRID FIXATOR -FIXATION MODALITY IN COMPOUND COMMUNUTED FRACTURES OF TIBIA

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ABSTRACT

Background: Tibial plateau fractures, Tibial plafond fractures, proximal 1/3 fractures of tibia are serious type of injuries which are found to be difficult to treat. The injury is caused by high velocity RTA which apart from causing fractures, cause extensive damage to soft tissue envelop. **Aim:** To study functional and radiological outcome of compound comminuted fractures of proximal and distal third tibia. **Method:** This is a descriptive longitudinal study carried out in 15 patients operated for hybrid external fixation for compound comminuted fractures of proximal and distal third tibia. Every patient was assessed for common fracture site, healing time and functional outcome. **Results:** Out of 15 patients 13 has good result 1 had varus deformity and average fracture healing time with full weight bearing walking was 20 to 24 weeks. **Conclusion:-** The comminuted fractures of the proximal third or the distal third fractures pose serious problems due the injury/ degloving of the soft tissue envelop. The risk of infection secondary to internal fixation is very high. Also it has been noted to have high incidence of post injury residual deformity, & knee joint stiffness. Hence less invasive method of hybrid fixator was tried which would minimize these problems and allow the biological healing of the fracture. This technique is simple, user friendly, & can allow adjustment even after frame application.

INTRODUCTION

Tibial plateau fractures, Tibial plafond fractures, proximal 1/3 fractures of tibia are serious type of injuries which are found to be difficult to treat. The injury is caused by high velocity RTA which apart from causing fractures, cause extensive damage to soft tissue envelop.

The mechanism of injury is initial axial loading which cause impaction fracture, or/ and Further continuation of angular forces mainly valgus force leading to comminution of fractures not only in tibial plateau but also in proximal 1/3 of tibia.^[1]

Deforming force due to high velocity trauma caused extensive damage to protective soft tissue cover, which results in extensive skin & muscle necrosis.^[2] This is secondarily complicated in a) deep infection, b) stiffness of knee joint. This was more common in Schatzker type IV, V, VI injuries.^[3, 4, 5] All of these complications causes poor outcome.

Initially these fractures were conserved and treated with linear traction. But the incidence of varus or valgus deformities with knee joint stiffness was much high.

Whenever open reduction is used for these fractures and poor choice of incision is taken and it increases soft tissue dissection causes flap necrosis, infection as well as delayed union due to loss of haematoma.

Hence some less invasive technique was tried that would help in the following:

- Use the principle of ligamentotaxis

- To make an attempt to restore the anatomical alignment
- Restore the joint congruity
- Provide the stable fixation.

That is now called as "Hybrid fixator". A semicircular ring is fixed either to the proximal tibial metaphysis or near the ankle mortise, with the help of 2-3 olive wires or bayonette wires.^[6] The tension given to the wires, which provides stable trampoline at the proximal end / distal end of tibia. The fractures are stabilized with 2-3 shanz's pins fixed in diaphysis. Hence a study was planned to evaluate clinical utility of Hybrid fixation

Aims & objectives

1. To find out the common type of comminuted fracture of Tibia.
2. To find out average time for healing of the comminuted fracture of Tibia.
3. To study and grade the functional outcome of comminuted fracture of tibia using Hybrid fixators
4. To assess the time lag from the date of injury to surgical intervention.

MATERIAL & METHODS

Study design: This is a descriptive longitudinal study

Ethical approval: The study was approved by the institutional ethical committee & informed consent was obtained from the patients

Place of research: Department of Orthopaedics, PIMS (DU), rural medical college, Loni,

Inclusion Criteria: All patients with comminuted fractures of proximal 1/3 or distal 1/3 of the tibia were enrolled between 24 yrs. to 68 yrs. age group; Patients who have compound Proximal or Distal Tibia Fractures only, Classification used for compound injury is Gustilo Anderson classification.^[7]

Exclusion Criteria: Any co morbidity that prevents the patient from early mobilization, Patients medically unfit for surgery, Patients who did not come for follow-up

Sample Size: 15 patients were treated with hybrid fixator out of which 12 were simple comminuted fractures of tibial plateau /tibial plafond / proximal third or distal third of tibia, & 3 were compound comminuted fractures.

Study duration: All the 15 patients scrutinized in this study were followed for 1 year from the time of surgery for radiological and functional evaluation.

Parameters used for observation

All the patients who were satisfying above mentioned inclusion / exclusion criteria were studied for following.

1. Type of fracture Proximal 1/3 or distal 1/3.
2. Duration between the time of injury and the surgery.
3. Average time of healing of fractures: Clinical healing, Radiological healing.

Preliminary treatment included cleaning & debridement, longitudinal traction, haematological & radiological evaluation. Surgery was performed after 5-7 days, so that soft tissue swelling / edema subsides & patient is hemodynamically stable.

2 wires are passed in proximal Tibia,

- a) One of the wires transfixing fibular head with tibia.
- b) Semicircular ring fixed after giving adequate tension to the wires.

Distal shaft fractures fixed with 2-3 shanz pins. In tibial plafond fractures, semicircular ring is attached nearer to ankle mortise & shanz pins are passed in tibial diaphysis. Alignment of fracture achieved under C-arm control & the fracture fixed with minimal distraction.

Patient advised active knee mobilization of knee & ankle joint from 5 day onwards. Non weight bearing walking and partial weight bearing was started after showing clinical union of fracture frame removed after radiological union conformed followed by PTB brace followed by full weight bearing. Data of average time for these protocols collected.

RESULTS

Total fifteen patients were treated with hybrid fixator out of this 9 were male and 6 were female. The age range of the patients shown in table 1. The average hospital stay was 12 -15 days, duration between injury & surgery was 10 -15 days. Non weight bearing followed up for 10 -12 weeks. Partial weight bearing started after 12 – 16 weeks. Frame was removed after 16 weeks, after the removal of frame the patient was given long knee brace / PTB brace. In 2 cases we had to continue PTB brace for

almost 9 months. (Elderly female with comminution of lower third fracture of tibia)

Average time of healing of fracture is 20 -24 weeks (fig 1), Out of 3 compound fractures wound healed well in all the cases, ROM of knee joint was bet 0-120 degrees. 1 patient had varus angulation of the lower third of tibia, due to early weight bearing & not using support (PTB brace). No extension lag was seen in any of the cases. The final outcome was 13 good and 2 were fair

Table1: Age wise distribution of participants

Age in years	Male	Female	Total
20-29	3	-	3
30-39	4		5
40-49	2	2	4
50-59		1	1
60-69	-	2	2

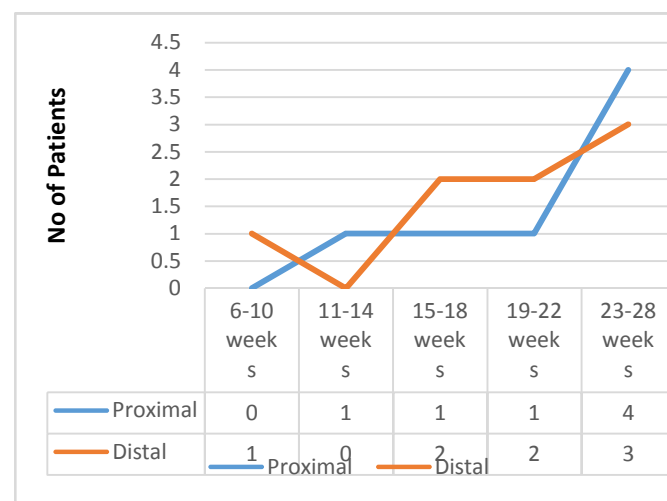


Fig 1: Time for Fracture healing in weeks

Table 2: Details of the Patients

Fracture Site	Duration Of injury& Surg. (In days)	Time for Healing (In Weeks)	Full Weight Bearing (In weeks)	Result
Proximal	11	12	15	Good
Distal	12	26	28	Fair
Proximal	11	23	24	Good
Proximal	13	25	24	Good
Distal	15	25	28	Fair
Proximal	10	16	18	Good
Distal	13	20	24	Good
Distal	13	22	25	Good
Proximal	10	21	24	Good
Distal	12	26	28	Good
Proximal	12	26	28	Good
Distal	14	15	19	Good
Proximal	15	23	27	Good
Distal	14	09	14	Good

Distal	10	17	20	Good
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Fig 2:X-rays of different cases of Distal Tibia Fractures shows near anatomical alignment of fractures with frame



Fig 3: X-rays of different cases of Distal Tibia Fractures shows near anatomical alignment of fractures with frame



Fig 4: X-rays of different cases of Proximal Tibia Fractures shows near anatomical alignment of fractures with frame

DISCUSSION

Our major chunks of the cases were having comminuted fractures in proximal or distal third of tibia, rather than tibial plateau or plafond fractures. Duration between injury & surgery in any of the case was never less than 10 – 15 days. (Patients were admitted quite late after the injury, hence we did not have much scope for ORIF). As mentioned earlier, the goal of treatment were

- i) Anatomical /near anatomical reconstruction of proximal third or distal third of tibia.
- ii) To restore alignment of the limb
- iii) To restore normal anatomical position of tibial plateau or tibial plafond.
- iv) To fix & stabilise the metaphysis- diaphyseal comminution.
- v) Early knee mobilisation
- vi) Early weight bearing
- vii) To allow biological union of the fracture.

All these things were achieved with hybrid fixator.

1 patient who developed varus angulation, she was having OA knee with G. Varus and the residual curve in tibial shaft existed even before surgery. Another reason was that she did not use PTB brace after removal of fixator due to financial constraints. Delayed union was seen 3 cases, all of which were 55yrs or above. Hence as a protocol we advocated use of long knee brace / PTB brace, after removal of the frame. Regular dressing of the pin tracts & removal crusts along pin tracts can easily minimize the incidence of pin tract infection.

There are more than one modalities treatment for these kind fractures which are also in study phase but compare to other studies done for this kind of fractures this study shows similar results and better outcome functionally as well as radiologically after 1 year follow up, less post-operative complications and early mobilization.^[10]

This is a simple & user friendly technique. This frame fixation does not require meticulous pre-operative work like that required in Ilizarov technique.^[11, 12, 13] Since the hematoma is not touched / opened, this technique promotes biological healing of the fracture. Less incidence of soft tissue or bone necrosis, results in less morbidity. Post-surgery changes in alignment were possible in the frame. Incidence of knee stiffness can be significantly reduced by early mobilization of the knee. It is good technique for fixing comminuted prox. third - distal third fractures, tibial plateau, and tibial plafond fractures with reasonably good functional outcome.

However in this study we did not compare our results with the other modalities of fixations. Our limitation for this study was if fracture occurred at tibial plateau or plafond with intra articular extension then fixation becomes more difficult. Also the sample size of our study was also small due to multimodalities of treatment for this kind of fractures and less numbers of cases with types of difficult fractures. In fact we need to continue our follow up on larger sample size wherein we can more elaborately compare our results with other modalities of fixation & over longer duration.

CONCLUSION

The comminuted fractures of the proximal third or the distal third fractures pose serious problems due the injury/ degloving of the soft tissue envelop. The risk of infection secondary to internal fixation is very high. Also it has been noted to have high incidence of post injury residual deformity, & knee joint stiffness. Hence less invasive method of hybrid fixator was tried which would minimize these problems and allow the biological healing

of the fracture. This technique is simple, user friendly, & can allow adjustment even after frame application.

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Conflict of interest: None declared

REFERENCES

1. Kataria H, Sharma N, Kanojia RK. Small wire external fixation for high energy tibial plateau fractures. *Journal of Orthopaedic Surgery* 2007;15(2):137-43
2. Aditya K. Aggarwal, OnkarNagi. Hybrid external fixation in periarticular tibial fractures Good final outcome in 56 patients. *Actaorthop.Belg*, 2006;72:434-40
3. George C. Babis, Dimitrios S. Evangelopoulos High energy tibial plateau fractures treated with Hybrid external fixation. *Journal of Orthopaedic Surgery & Research* 2011;6:35
4. Schatzker J. Fractures of the tibial plateau. In : Chapman MW, Bray TJ, Spiegel PG, Green SA (eds). *Operative Orthopaedics*. JB Lippincott ; Philadelphia, 1988, pp 671-684.
5. Appley AG: Fractures of the tibial plateau. *Orthop Clin North Am* 1979, 10:61-74.
6. fixation, David P Moss Nirmal C Tejwani. Biomechanics of external Bulletin of NYU Hospital for Joint diseases 2007;65(4):294-9
7. Gustilo RB, Anderson JT. Prevention of infection in the treatment of one thousand and twenty five open fractures of long bones : Retrospective and prospective analysis *J Bone Joint Surg* 1976 ;58-A : 453-458
8. Jhanwar, Harish kumar Jain. Management of tibial plateau fractures with compromised soft tissue using minimal internal & hybrid external fixation. *Journal of Pharmaceutical & Biomedical Sciences J Pharm Biomed Sci* 2014;04(05):427-433
9. Venkatesh Gupta, Gottipati Sunil. Management of tibial metaphyseal fractures by Hybrid external fixator. *Open Journal of Orthopaedics*, 2014;4: 84-89.
10. Mayil Vahanan Natarajan, Chethan Nagaraj, R Selvaraj, B Pasupathy, Antony Vimal Raj, P Sankarlingam Management of periarticular fractures of long bones of the lower extremity by hybrid external fixation *IJO* 2004 vol 40 issue 3 page 177-179 .
11. El Barbary H, Abdel Ghani H, Misbah H, Salem K. complex tibial plateau fractures treated with ilizarov external fixator with or without minimal internal fixation. *Int Orthop* 2005 ; 29 : 182-185
12. Kataria H, Sharma N, Kanojia RK. Small wire external fixation for high-energy tibial plateau fractures. *J Orthop Surg* 2007 ; 15 : 137-143
13. Chapman WM. *Chapman Orthopedic surgery. Management of fractures, nonunion and malunion with Ilizarov technique*. Philadelphia, PA:Lippin cott William and Wilkins 2001 3rd Edn third.pp 1082-1089