



A PROSPECTIVE STUDY ON USEFULNESS OF ANKLE SPANNING UNIAXIAL EXTERNAL FIXATOR IN INTA ARTICULAR FRACTURES OF DISTAL TIBIA

Nagarajan, G., Kanthimathi, B., Santhoshkumar, R and Manikandarajan, A

Orthopaedics, Rajah Muthiah Medical College & Hospital, Annamalai University

ARTICLE INFO

Article History:

Received 18th June, 2016
Received in revised form 1st
July, 2016 Accepted 8th
August, 2016 Published online 28th
September, 2016

Key words:

Intra articular fracture of distal tibia,
Ankle spanning uniaxial external
fixator, Temporary procedure,
Definitive procedure.

Copyright © 2016 Nagarajan, G et al. This is an open access article distributed under the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

ABSTRACT

Intra articular fractures of distal tibia often benefit from uniaxial ankle spanning external fixation, both as a permanent measure and temporary measure prior to definitive fixation. Uniplanar ankle spanning external fixator placement is a safe and reliable technique for achieving fracture reduction and stability while awaiting definitive fixation. It is an versatile tool in achieving fracture union as permanent procedure.

INTRODUCTION

The terms Distal tibial explosion fracture, Tibial plafond fracture, Pilon fracture all have been used to describe intra articular fractures of distal tibia. It is caused by High energy Axial compression force and low energy rotation forces⁽²⁷⁾. Two types of classification of these fractures are mostly used the AO/OTA and Reudi And Allgower classification.⁽⁴⁰⁾

Fractured limb X-rays are of routine use, X-ray of contralateral limb may be of benefit as a template for articular reconstruction.⁽²⁷⁾ C.T scans are extremely useful in determining the size, direction, comminution and displacement of articular fragments.⁽¹⁹⁾ Intra articular fractures of distal tibia are treated by various methods including traction, lag screw fixation, P.O.P, ORIF with plate and screws, MIPPO with plate and screws, External fixation with minimal internal fixation of tibia, external fixation of tibia with ORIF of fibula, only external fixation of tibia alone.⁽³⁹⁾

The present study would look at the outcome of intra articular fractures of distal tibia stabilised with ankle spanning uniaxial external fixator.

MATERIALS AND METHODOLGY

A prospective study was conducted, the data for this study was collected from the patient admitted to Rajah Muthiah Medical College and Hospital, Annamalai University, Chidambaram,

diagnosed to have intra articular fractures of distal tibia, were treated surgically using external fixators, uniaxially during the period JUNE 2015 to JUNE 2016. The clinical and radiological outcome was assessed and recorded. The ethical committee clearance was obtained from the institution.

Inclusion Criteria was 1] Patients with intra articular fracture of distal tibia aged 18 years and above, 2] All unilateral and bilateral cases, 3] compound and closed types of plafond fractures, 4]plafond fractures with diaphyseal extension, 5]any plafond fracture regardless of comminution. 6] patients with gross soft tissue injuries, impending compartment, severe closed soft tissue injuries.

Exclusion Criteria is paediatric closed plafond fracture.

Principle

The uniaxial external fixator that spans the ankle, offers mechanical stability to the fracture there by healing the overlying soft tissues. The fracture is reduced by distraction and ligamentotaxis⁽²⁷⁾.

All parts of the External Fixator are made up of a stainless steel. The system consists of A.O rods, A.O clamps, Shanz screw of size 4.5mm, Tube to tube clamps, 10-11 spanners and T-handle.

Surgical treatment was performed by experts. All patients underwent thorough wound debridement in compound

fractures, attempted closed reduction, or reduction through the compound wound of the fracture using traction and manipulation in a supine position on a table. When fracture is reduced ligamentotaxis and limb length was achieved by ankle spanning uniaxial external fixator. Thus fracture reduction and maintaining the limb length is the main step in the external fixation. If the fracture was found to be unstable, additional A.O rods were used,⁽¹⁸⁾ or lateral pillar is stabilised using fibula fixation with k-wires or 1/3 tubular plate.⁽³⁵⁾ Knee mobilisation started immediately post operatively. The fracture reduction and limb length were obtained intra operatively in both AP & lateral views.

Post-operatively early, non weight bearing mobilization was begun within limits of pain tolerance. Active, assisted and active range of motion exercises of knee joint proved to be valuable adjuvant for achieving a supple knee joint. Pin tract and soft tissue infection was taken care with regular betadine dressing and I.V antibiotics for 7-10 days. All patients were advised partial weight bearing with a walker after a period of twelve to fourteen weeks. Patients were allowed full weight bearing after radiological evidence of fracture union. Radiographs were taken at regular intervals and evaluated for fracture healing, alignment. Clinical union was defined as a painless fracture site during full weight bearing. Radiographic union was defined as bridging trabeculations across the fracture line on two orthogonal views. External fixators were removed after a period of twelve to fourteen weeks and limb was maintained with Ptb cast with full weight bearing for 4 weeks.

Some cases which needed definitive fixation underwent ORIF/MIPPO with plate and screws, after a period of two to three weeks of external fixation, when 1, the soft tissue has healed well, 2, skin wrinkle has appeared, 3, skin pinchability has been achieved, 4, no pin site infection, 5, when fracture is unstable, 6, when fracture pattern is suitable for definitive fixation.

RESULTS

During the period of study a total of 20 cases of intra articular fractures of distal tibia were taken up of which 12 cases were united well with ankle spanning uniaxial external fixator and rest 8 cases went for ORIF with plate and screws, after a period of two to three weeks of external fixation. Case followed up at two weeks, three months, six months and twelve months intervals.

Average age of patients was 53.5 (range 35 to 72) years. There were sixteen male patients, four were females. The youngest patient in our series was thirty five years old and the oldest was seventy two years old. Fourteen fractures involved right side. Six fractures were left sided. The fracture types are given in table 1. Trauma surgery interval was 6hours to 1 day. The average surgical time was 75 minutes (range 60 to 90 min). Average blood loss was 150 ml (range 100 to 300ml). Average hospital stay was 15 days (range 13 to 18 days), in case of uniaxial ankle spanning external fixator. Average time from external fixation and ORIF was fifteen days (range 14-16 days) and when the patient was taken for second surgery the average stay was 25 days (range 20 to 30 days). Average blood loss was 300 ml (range 150-450ml). Full weight bearing was started from third month (range 2 to 4 months) in first surgery. Full weight bearing was achieved after 6months (5 to 7) month. IOWA SCORING was done for all cases. Of twelve

patients, 11 reported excellent, 1 good, in whom plafond fractures treated with ankle spanning uniaxial external fixator alone as definitive procedure. Rest eight patients in whom second surgery was performed, 6 reported excellent, 1 good, 1 fair. In our series most of the complications were minor and resolved with minimal interventions without causing any lasting morbidity. Only one patient had deep infection and skin necrosis which was treated with I.V antibiotics and flap cover.

Table 1 fracture pattern

| Type of fracture | No. of patients |
|------------------|-----------------|
| 43A1 | 6 |
| 43A2 | 0 |
| 43A3 | 4 |
| 43B1 | 0 |
| 43B2 | 0 |
| 43B3 | 2 |
| 43C1 | 1 |
| 43C2 | 6 |
| 43C3 | 1 |

Case 1

Pre Op X-Ray



Immediate Post Op X-Ray



Post Op Clinical Picture



4 Months Follow Up Of Radiology After Ex-Fix Removal And Clinical Picture





Case 2

Pre Op X-Ray & Clinical Picture



C-Arm and Clinical Picture- Immediate



Immediate Post Op X-Ray



4 Months Follow Up X-Ray & Clinical Picture

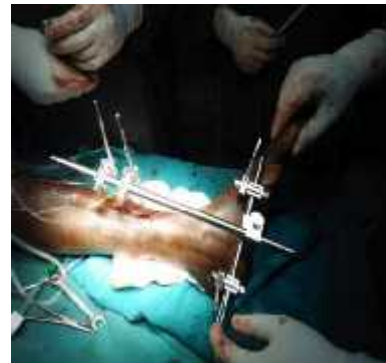


Case 3

Pre Op Clinical Picture & X - Ray



Intra Operative & Immediate Post Op X-Ray



Second Post Operative Clinical Picture



Second Post Operative X-Ray



Table 2 Iowa Scoring System

| Score | No of Patients |
|--------------------------|----------------|
| Excellent (more than 90) | 18 |
| Good (81-90) | 2 |
| Fair (71-80) | 0 |

Table 3 Complications

| Post-operative Infection | 1 |
|--------------------------|---|
| Pin site infection | 1 |
| Skin necrosis | 1 |
| Non union | 0 |

DISCUSSION

Tibial plafond fracture though easy to treat surgically, the most dreadful complications are skin necrosis and arthritis of ankle joint.^(16,34) Uniaxial Ankle Spanning uniaxial external fixator brings solution to the above problems. In our study we maintain the following protocols, regular post operative dressing, plastic surgery opinion for skin condition, physiotherapy to keep neighbouring joint supple, i.v antibiotics for 5 days, regular check for skin wrinkles to appear and skin to become pinchable, radiological assessment of the fracture site. Finally decision is made either to continue external fixator as permanent treatment or to go for second surgery (ORIF), as permanent treatment.^(7,37) In some of our cases certain factors made us necessary to revise ex. fix, they are, soft tissue condition, need for second debridement, pin site infection and loosening, mechanically unstable external fixation, bone loss, neurovascular injury.⁽³⁵⁾ Advantages of ankle spanning uniaxial external fixation in plafond fractures are as follows, 1) less soft tissue damage, 2) no large implants in subcutaneous plane, 3) less rates of infection, 4) maintains limb length, 5) maintains alignment, 6) good soft tissue healing, 7) as a definitive procedure for fracture healing, 8) an ease for second procedure [ORIF], 9) decreased articular impaction prevents ankle joint arthrosis⁽³⁰⁾.

Disadvantages of ankle spanning uniaxial external fixator is, 1) insufficient reduction, 2) loss of alignment, 3) pin tract infection, 4) stiff ankle in few cases.⁽³⁰⁾ Thus ankle spanning uniaxial external fixator in plafond fractures has advantage of percutaneous application and modifiable biomechanical

characteristics.⁽²⁹⁾ It can be used in both emergency⁽³⁴⁾ and elective procedures⁽³⁶⁾ as safe and reliable method.⁽³⁴⁾

CONCLUSION

Ankle spanning uniaxial external fixator in plafond fracture is a SAFE and RELIABLE method in achieving temporary or permanent stability in pilon fractures. It is a versatile tool and has advantage of percutaneous application and modifiable biomechanical characteristics. Used as a device for temporary management in plafond fractures or as a definitive management in patients who can rehabilitate comfortably and stimulate fracture healing through protected weight bearing.

References

- Ruedi T, Matter P, Allgower M (intra articular fractures of distal tibia) *helv chir Acta* 1968; 35 (5) 556-582.
- Tile M. Fractures of Distal Tibial metaphysis involving the ankle joint: the pilon fracture. In: Schatzker J, Tile M eds. *The rationale of operative fracture care*. 2nd ed. New York: springer- verlag, 1996
- Resch H, Philander S, Long term results of conservative and surgical treatment for distal end of tibia 1986; 16:117-123.
- Mast JW, Spiegel PG, Pappas JN. Fractures of the tibial pilon. *clin Orthop Relat Res* 1988(230): 68-82.
- Destot E. *Traumatismes du pied et rayons ex maleoles, astragale, calcaneum, avantpied*. Paris: masson, 1911
- Heim U, Nasser M. Operative treatment of distal tibia fractures. *Technique of osteosynthesis and results in 128 patients (author's transl)*. *arch orthop unfallchir* 1976; 86 (3): 341-346
- Hontzsch D, Karnatz N, Jansen T (one or two step management (with external fixator) of severe pilon-tibial fractures)
- Bone L, stegemann P, McNamara K, *et al*. External fixation of severely comminuted and open tibial pilon fractures: *clin ortho relat res* 1993(292): 101-107
- Tornetta P 3rd, weiner L, bergman M, *et al*. Pilon fractures: treatment with combined internal and external fixation. *J Orthop trauma* 1993;96:489-496
- Wyrsh B, McFerran MA, McAndrew M, *et al*. Operative treatment of the tibial plafond. A randomized prospective study. *J Bone joint surg Am* 1996;75(11): 1646-1657
- Pugh KJ, Wolinsky PR, McAndrew MP, *et al*. Tibial pilon fractures: a comparison of treatment methods. *J Trauma* 1999; 47(5):937-941.
- Sirkin M, Sanders R, DiPasquale T, *et al*. A staged protocol for soft tissue management in the treatment of complex pilon fractures. *J Orthop Trauma* 1999; 13(2): 78-84.
- Collinge CA, Sanders RW. Percutaneous plating in the lower extremity. *J Am Acad Orthop Surg* 2000; 8(4): 211-216
- Herscovici D Jr Sanders RW, Infante A *et al*. Bohler incision: An extensile anterolateral approach to the foot and ankle. *J orthop trauma* 2000;14(6):429-432
- Tibial pilon fractures involves articular surface or adjacent tibial metaphysis or both (thodorsen 2000 thorsen D)
- Holmes SM, Bomback D, Baumgaertner MR. *J. Orthop trauma* (2004) May-June: 18 (5): 316-9

17. Role of temporary internal fixation in the treatment of tibial pilon fractures Ristiniemi J; Hyvonen p; flinkkila T(submitted to Acta Orthopaedica). 2007
18. Stability with unilateral internal fixation in tibia N.Giotakis * B.Narayan: Strat Traum Limb Recon (2007)2:13-20.
19. Rock wood and greens- fractures in adults- seventh edition 1935-1938
20. Moore clinically oriented anatomy 2nd edition Baltimore. William and wilkins 1985.
21. Paley. D Principles of deformity correction. Springer 2002
22. Sivaraman pancovich A.M Anatomical basis in variability in injuries of medial malleolus and deltoid ligament 1979,217-223.
23. Topless CJ, Jackson M, Atkins RM. Anatomy of pilon fractures of the distal tibia. *J Bone joint Surg Br.*2005;87:692-697
24. Watson JT, Moed BR, KargesDE, Cramer KE. Pilon Fractures: treatment protocol based on severity of soft tissue injury.
25. Ruedi T. Fractures of the lower end of tibia into the ankle joint; results 9 years after open reduction and internal fixation. *Injury* 1973; 5(2): 130-134
26. DeCoster TA, Wills MC, Marshb JL, *et al.* Rank order analysis of tibial plafond fractures: does injury or reduction predict outcome? *Foot Ankle Int* 1999;20(1):44-49
27. Text book of campbells operative orthopaedics. S.Terry Canale, 11th ed.
28. A.O. Principles of fracture Management T.P.Reudi:W.M.Murphy.
29. Mechanics of external fixation: national institute of health.
30. External fixation; historic review, advantages, disadvantages, complications and indication clin orthop 180;15,1983.
31. Green S (1982) Complications of external fixation. In unthoff HK. Current concept of external fixation of fractures Berlin Heidelberg Newyork.
32. Burny F (1979) Elastic external fixation of Tibia fracture; a study of 1421 cases. In external fixation. The current state of the art. London, Williams & wilkins 55-73.
33. Tibial plafond fractures: How do these ankle function overtime? By the journal of bone and joint surgery 2003
34. Emergency department external fixation for provisional treatment of pilon and unstable ankle fracture *J. Emerg trauma shock.* 2015 Jan-march 8(1): 61-64.
35. International orthopaedics (SICOT) 2012 36:833-837.
36. Unilateral Enternal fixation Vs open reduction of internal fixation of severe tibial plafond fracture *J Orthop trauma* volume 7 1993 P 169
37. Fracture healing in distal tibial fracture treated by External fixation: Dept of Orthopedic of trauma Surgery University of Oulu.
38. Mast *et al.* 1988 Mast .J W.Spiegel P.Pappas. J.N Fractures of tibial pilon. *Clin orthop* 1988; 230:68-82.
39. Comparison of outcome of tibial plafond fractures managed by hybrid Ext Fixator, two stage Management with final plate fixation.
40. Muller ME, Nazarian S, Koch P, Schatzker J. The comprehensive classification of fractures of long bone Newyork; Springer;1990

