



FUNCTIONAL OUTCOME OF COMPOUND FRACTURES OF TIBIA TREATED BY EXTERNAL FIXATION

Dr. Dheeraj L	Junior resident , Government medical college ,Thrissur, Kerala
Dr. Shibu Andrews*	Additional Professor , Department of Orthopaedics, Government medical college ,Thrissur, Kerala*Corresponding Author
Dr. Jojo Inassi	Additional Professor , Department of Orthopaedics, Government medical college ,Thrissur, Kerala
Dr. Ajai Ram V	Resident , Government medical college ,Thrissur, Kerala

ABSTRACT Tibial fractures are among commonly occurring long bone fractures which frequently present as open fractures due to subcutaneous nature of tibia and increasing high velocity trauma in road traffic accident. The precarious blood supply and lack of soft tissue cover of the shaft of tibia and increased incidence of open fracture make it difficult for treatment and high rate of non-union and infection. So aggressive treatment with adequate wound debridement and IV antibiotics and fracture stabilization is necessary. Various methods for fracture stabilization include plating , intra-medullary nailing or external fixator application. This prospective study was done among 39 patients who sustained compound tibial fractures(Gustilo grade II , IIIa and IIIb) and were admitted in Department of Orthopaedics, Government Medical College, Thrissur. Functional and clinical outcome is assessed at 1st and 2nd week followed by 1st , 3rd & 6th months using modified johner and wruh's criteria. The post operative outcomes- intermediate and final, were assessed and analysed for statistical significance using Microsoft Word, Microsoft Excel and statistical software IBM-SPSS (International Business Machines- Statistical Product and Service Solutions) ver18, using appropriate statistical tests. The patients were in the age group of 23 to 63 years and with a mean age of 41.59 years. Males were predominant. Most common mode of injury is road traffic accident which accounts for 71.8% of cases. Majority of injury were type 2 (61.5%) Gustilo-Anderson classification. There were 12.8% Excellent results, 38.5% Good results, 10.3% Fair results and 38.5% Poor results according to Modified Johner and wruh's criteria. External fixation is a simple and effective means of treating of open tibial shaft fractures especially in type 2 , type 3A & type 3B fractures, the external fixator as a treatment in open tibia fracture is a valuable tool as it gives advantage to less operative time and intra-operative blood loss. There is easy access to the soft tissue and easy wound management with a stable fixation can be obtained.

KEYWORDS : Tibial fractures ; Compound tibial fracture ; External fixator ; prospective study ; Modified johner and wruh's criteria.

INTRODUCTION

In 1843, Jean Francois Malgaigne devised a claw-like clamp which he applied percutaneously to reduce and stabilize fractures of the patella. In 1897, Clayton Parkhill devised a system utilizing percutaneous pins connected to a rigid external plate. Coincidentally, Albin Lambott of Belgium developed a system quite similar in design to Parkhill's.

An open fracture is defined as an injury where the fracture and the fracture hematoma communicate with the external environment through a traumatic defect in the surrounding soft tissue and overlying skin. It should be emphasized that the skin defect may not entirely lie over the fracture site and may lie at a distant site. It may communicate with the fracture under degloved skin. Hence any fracture associated with a wound in the same region must be considered to be an open injury until proven otherwise. The tibia is the most commonly fractured long bone in the body. The subcutaneous location of the anteromedial surface of the tibia means that severe bone and soft tissue injury is not infrequent, and there is a high incidence of open fractures compared with other long bones. The use of the AO tubular external fixation for open tibial shaft fracture is not a new subject. It is simple, safe and a satisfactory method of fixation for that particular fracture (probably the commonest). It improves the functional result of severely injured limb. The external fixation method enables early postoperative rehabilitation and functioning of extremities which reduces the time of treatment and provides good results.

In this study, along with the primary objective of evaluating treatment outcome , the association of the disease with age, gender, occupation, socioeconomic status, coexisting comorbidities and the complication rates, following surgery were also analysis.

MATERIALS AND METHODS

This is a prospective observational study among 39 patients of either sex, aged 23 to 63 years for a period of 9 months who is admitted in department of Orthopaedics at Government medical college hospital, Thrissur, Kerala. The study population included only those patients, with compound diaphyseal tibia fractures(Gustilo grade II , IIIa and IIIb) of age more than 16 years. The patient data are obtained

according to the proforma, which includes age, sex, socioeconomic status, Occupation, nature and side of the fracture, type of fracture and associated injuries and comorbidities. After proper history taking, clinical examination, radiological work up, pre operative work up and pre-anaesthetic check-up was done in all patients. In all patients, preoperatively wound inspection and wound wash done from casualty. Hemostasis attained and fracture stabilization done with splinting. tetanus toxoid , parenteral antibiotics and NSAIDS were given. The details and complications of surgery were explained to the patient and bystander for obtaining written informed consent. The surgery was done by the guide and assisted by the principal investigator.

The procedure done under spinal anaesthesia or general anaesthesia. patient in supine position. The skin over the affected limb was scrubbed with betadine after thorough wound wash with copious amount of sterile water, parts scrubbed and through wound debridement done. Skin incision made directly at site of pin insertion. Bone drilled with 3.2 mm drill bit. A 4.5 mm bone tap is used. 4.5mm schanz pin is inserted with a T-handle. AO clamp and rod is inserted and distal pin site marked and pin inserted as in same manner. Frame construction is made once proximal and distal pins are inserted and after achieving reduction.

RESULTS

The following observations were made from the data collected from the study of functional outcome of compound tibial fractures treated with external fixator in the Department of Orthopaedics, Government Medical College, Thrissur.

Distribution of Mode of Injury

Table no. 1 Distribution of Mode of Injury

Mode of Injury	Frequency	Percent
RTA	28	71.8%
Fall from Height	6	15.4%
Cutter Injury	3	7.7%
Others	2	5.1%

Distribution of Grade**Table no.2 Distribution of Grade**

Grade	Frequency	Percent
Type II	24	61.5%
Type III A	10	25.6%
Type III B	5	12.8%

Distribution of Time for Fracture Healing**Table no.3 Distribution of Time for Fracture Healing**

Time (Months)	Frequency	Percent
< 4	9	23.1%
4 - 6	13	33.3%
6 - 9	3	7.7%
> 9	14	35.9%

Distribution of Non-union**Table no.4 Distribution of Non-union**

Non-union	Frequency	Percent
Yes	16	41.0%
No	23	59.0%

Distribution of X-ray Finding**Table no.5 Distribution of X-ray Finding**

X-ray Finding	Frequency	Percent
Consolidated	4	10.3%
Consolidating	16	41.0%
Union	3	7.7%
Not United	16	41.0%

Distribution of Outcome**Table no.6 Distribution of Outcome**

Outcome	Frequency	Percent
Excellent	5	12.8%
Good	15	38.5%
Fair	4	10.3%
Poor	15	38.5%

The average functional score was 11.31 with standard deviation 6.578. The minimum and maximum functional score was 1 and 23 respectively.

DISCUSSION

Management of compound fracture of tibia has undergone tremendous evolution over a past few decades. However its treatment continues to be a challenging problem for any Orthopaedic surgeon because of plethora of factors influencing the final treatment outcome. External fixation is one of the mode of treatment in compound fracture tibia, especially when there is soft tissue and bone loss with contamination of wound.

This study comprised of 39 patients of age above 16 years with compound fracture of tibia treated with external fixator, admitted in department of orthopaedics in Government medical college thrissur.

Patients involved in this study ranges from 23 to 63 years with an average age of 41.59 years with standard deviation of 10.06 years. Chandan gupta¹ et al conducted a study in which average age of patients were 37.84 years. Muhammed imran khan²² et al conducted a study in which average age of patients found to be 37.7 years. p-value is 0.438, hence the association between outcome and age is not significant.

In the study right sided fractures accounted for 61.5% and left side accounted for 38.5%. The study reveals that the poor outcome is significantly higher in right side (50%) compared to left side (20%). right side may be more common due to right hand driving in india, and most common cause of tibial compound fracture is road traffic accidents.

The male to female ratio in our study was 37 : 2, that is 94.9% affected population are male. In india, majority of bread winners in a family are males and chance of road traffic accident and fall from height are common among males. Chandan gupta¹ et al conducted study in which 80 % affected are males and 20 % females. Muhammad Imran Khan²² et al conducted a study In which 72% of the patients were male and 28% were the females. XIAO Bai-ping⁶ et al treated 120 cases with external fixator of which 86(71.67%) are males and 28.33% were females.

Study shows mode of injury as road traffic accidents in 71.8% cases. 15.5% cases were caused due to fall from height. Compound fracture of tibia may be due to high velocity injury as in road traffic accident. Cutter injury accounts for 7.7 % of compound fracture of tibia. Study by Chandan gupta¹ et al shows the mode of injury as road traffic accidents in 76% cases. 8% cases were caused due to fall from height. Baral R et al⁷ in 2010 had observed that more than 70 percent of their subjects had road side accident as the cause of injury.

By Gustilo-Anderson grading this study shows type 2 injury in 61.5% cases and 25.6% in type 3A injury and 12.8% cases of type 3B injury. P vale is less than the significance level, there for the association between outcome and grade is significant. Poor/fair outcome is higher in type 3A and type 3B injury as compared to type 2.

In our study out of 39 wounds, 22 wounds heal (56.4%) without any intervention, out of it 13 heal by primary intention (33.3) and 9 heal by secondary intention (23%). 17 cases undergone secondary procedures (43.6%) of which 12 split skin grafting (30.7%) and 5 fascio-cutaneous flap (12.8%) were done. 3 cases had persisted infection. Study by Chandan gupta¹ et al showed 28% showed healing by primary intention, 32% by secondary intention, 28% by split skin grafting and 12% by fascio-cutaneous flap.

Study shows fracture union in 64.1% cases within 9 months, in which 23% fracture unite within 4 months and 33% cases fracture unite within 6 months and 7.7% cases fracture united within 9 months. Study by Chandan gupta¹ et al (19(76%)) Out of the 25 cases united with an average time of 29.15 weeks or 6.8 months. Golubović I et al⁸ in their study achieved Union in 76.2% patients and our result coincided with their study. Al-Sayyad and Mohammed J⁹ in their study say average time of union to be 6 months. Bone loss may lead to fracture non union or shortening of limb if united. presence of infection and loss of soft tissue may be a cause of delay in union due to local avascularity at the fracture site. The association between outcome and time for fracture healing is significant. The table reveals that the poor outcome is significantly higher in cases with time for fracture healing >9 weeks (93%) compared to the cases with time for fracture healing < 4 weeks (0%), 4-6 weeks (8%) and 6-9 weeks (33%).

CONCLUSION

The patients were in the age group of 23 to 63 years and with a mean age of 41.59 years. Males were predominant. Most common mode of injury is road traffic accident which accounts for 71.8% of cases. Majority of injury were type 2 (61.5%) Gustilo-Anderson classification. There were 12.8% Excellent results, 38.5% Good results, 10.3% Fair results and 38.5% Poor results according to Modified Johner and wruh's criteria.

External fixation is a simple and effective means of treating of open tibial shaft fractures especially in type 2, type 3A & type 3B fractures, the external fixator as a treatment in open tibia fracture is a valuable tool as it gives advantage to less operative time and intra-operative blood loss. There is easy access to the soft tissue and easy wound management with a stable fixation can be obtained.

REFERENCES

- Chandan gupta¹ et al. 2016. Role of External Fixator in The Management of Compound Fractures Fractures of Leg. Int J Recent Sci Res. 7(12), pp. 14625-14630.
- J Kenwright I, J B Richardson, J L Cunningham, S H White, A E Goodship, M A Adams, P A Magnussen, J H Newman 1991 Jul;73(4):654-9. doi: 10.1302/0301-620X.73B4.2071654
- Chandra-Prakash Pal 1, Harish Kumar, Deepak Kumar, K S Dinkar, Vivek Mittal, Naveen Kumar Singh 2015;18(6):347-51. doi: 10.1016/j.cjtee.2015.08.006.
- Hitesh J Mangukya 1, Neetin P Mahajan 1, Eknath D Pawar 1, Aakash Mane 1, Jitsen Manna 1 2018 Jan 31;15(1):275-281. doi: 10.1016/j.jor.2018.01.041. eCollection 2018 Mar
- Jeya Venkatesh, P (2014) Functional analysis of Distal tibial fractures treated by Hybrid external fixator., Kilpauk Medical College, Chennai 2014
- Bai-ping X, Ming L, Wei-min M, Rong-ming X, Long Z, Jing-wei Z. Therapeutic strategies of grade-III open fractures of tibia and fibula. China Journal of Orthopaedics and Traumatology. 2008; 21(4): 289-290
- Baral R, Khan JA, Singh GP. Pattern of tibial shaft fractures in universal college of medical sciences, Bhaairahawa: A review of sixty cases. J Universal College of Med Sciences. 2013;1(03):11-4
- Golubović I, Vukašinović Z, Stojiljković P, Golubović Z, Stamenić S, Najman S Open segmental fractures of the tibia treated by external fixation. Srp Arh Celok Lek. 2012 Nov; 140(11-12):732-7.
- Al-Sayyad, Mohammed J. Taylor spatial frame in the treatment of open tibial shaft fractures. Indian J Orthop. 2008 Oct; 42(4):431-8.
- Court-Brown CM, Heckman JD, McQueen MM, Ricci WM, Tornetta III P. Rockwood and Green's fractures in adults. 2015;353
- M. H. A. Malik et al., Factors affecting rates of infection and nonunion in intramedullary nailing, JBJS 2004; 86-B, 556-60.
- Giannoudis PV, Papakostidis C, Roberts C. A review of the management of open

- fractures of the tibia and femur. VOL. 88-B, No. 3, March 2006;281-93
13. Gopal S, Giannoudis P V. The functional outcome of severe, open tibial fractures managed with early fixation and flap coverage. Vol. B, No.6, August 2004, 861-867
 14. Poletti et al, current concepts and principles in open tibial fractures - part I historical background and classification system, volume 8 issue 2 – 2017, april 24, 2017, moj orthopedics & rheumatology
 15. Broughton ii et al. carl von reyher and the origins of debridement, brief history of wound care. *Plast reconstr surg* 117, wounds uk | vol 15 | no 3 (2006)
 16. Michele bisaccia et al ,the history of external fixation, a revolution idea for the treatment of limb's traumatized and deformities: from hippocrates to today, canadian open orthopaedics and traumatology journal vol. 3, no. 4, september 2016, pp. 1-9. Open fractures of long bones: retrospective and prospective analyses prevention of infection in the treatment of onethousand and twenty-five, rb gustilo and jt anderson j bone joint surg am. 1976;58:453-458.
 17. Stefanos tsourvakas et al. Selected topics in plastic reconstructive surgery,chapter, local antibiotic therapy in the treatment of bone and soft tissue infections,published: january 20th 2012doi: 10.5772/1292isbn: 978-953-307-836-6 copyright year: 2012 ,alexander fleming
 18. klemm k. et al, gentamicin-pmma-beads in treating bone and soft tissue infections, *zentralbl chir.* 1979;104(14):934-42.
 19. Thomas p. Rüedi et al, ao principles of fracture management, volume 2, ao publishing, 2007 - fractures - 947 pages.
 20. Pedro antich-adrover et al,external fixation and secondary intramedullary nailing of open tibial fractures, *j bone joint surg [br]* 1997;79-b:433-7
 21. Keating jf et al, reamed nailing of gustilo grade-iiib tibial fractures, *j bone joint surg br.* 2000 nov;82(8):1113-6.
 22. Khan MI, Saqib M, Alam W. Open tibial shaft fractures; treatment with external fixator. *Professional Med J* 2014;21(4): 654-658.