How to Cite:
Rai, K. R., & Harsharaj. K, H. K. (2022). Study of outcome of surgical management of diaphyseal fractures of tibia treated with intramedullary interlock nailing. *International Journal of Health Sciences*, *6*(S7), 1736–1742. https://doi.org/10.53730/ijhs.v6nS7.11657

Study of outcome of surgical management of diaphyseal fractures of tibia treated with intramedullary interlock nailing

Kotedadi Ramprasad Rai
Assistant professor, Department of Orthopedics, Father muller medical college.

Dr Harsharaj. K
Designation: Assistant professor, Department of Orthopedics, Father muller medical college , mangalore.
Corresponding Author

***Abstract*---**The overall incidence of diaphyseal fractures of tibia is 26/1,00,000 population. With the increasing number of vehicles on roads in India, complex trauma cases caused by road traffic accidents have increased progressively. The method of closed nailing with or without reaming followed by early ambulation and weight bearing has positive advantages over all existing methods, significant lower complication rates and has comparable results. The present study has been taken to review the results of diaphyseal fractures of tibia treated with intramedullary interlock nailing.

***Keywords*---**Surgical, Management, Outcome, Diaphyseal, fracture, tibia, intermedullary nailing

Introduction

Bernardino de Sahagun, a 16th century anthropologist who traveled to Mexico with Hernando Cortes, recorded the first account of the use of an intramedullary device.[1] During the mid 1800s through the first decade of the 1900s, most of the work in intramedullary nailing of nonunions appear to revolve around the use of ivory pegs. It had been observed that ivory pegs would reabsorb in the human body compared to metallic implants, which became encapsulated with fibrous material. The majority of this work was reported at the time in the German literature.[2, 3] During the 1890s, Gluck recorded the first description of an interlocked intramedullary device.[4] The device consisted of an ivory intramedullary nail that contained holes at the end, through which ivory interlocking pins could be passed. Around the same time period, Nicolaysen of Norway described the biomechanical principles of intramedullary devices in the treatment of proximal femur fractures. Nicolaysen proposed that the length of

intramedullary implants be maximized to provide for the best biomechanical advantage.[5] Hoglund of the United States reported the use of autogenous bone as an intramedullary implant in 1917.[6] He described a technique in which a span of the cortex was cut out and then passed up the medullary cavity across the fracture site. During World War I, Hey Groves of England reported the use of metallic rods for the treatment of gunshot wounds[7]. These rods were passed into the medullary cavity through an incision made over the fracture site. This technique appeared to have a high infection rate and was not universally accepted. It was not until Smith-Petersen's 1931 report of the successful use of stainless steel nails for the treatment of femoral neck fractures, that the application of metallic intramedullary implants began to expand rapidly.[8] The use of non-operative treatment for tibial diaphyseal fractures that are widely displaced or that are result of high energy forces is associated with a high prevalence of malunion, stiffness of the joint and poor functional outcome.

Being sub-cutaneous in location, the tibia is the commonest bone to be fractured and seen commonly in orthopaedic practice. Open fractures are more common, because one third of its surface is subcutaneous throughout most of its length. Furthermore, the blood supply to the tibia is more precarious than that of bones enclosed by heavy muscles. The presence of hinge joints at the knee and ankle allows no adjustment for rotatory deformity after a fracture. Delayed union, non-union and infection are relatively frequent complications especially after open fractures of the shaft of tibia.

Due to its frequency, topography and mode of injury it has become a major source of temporary disability and morbidity. Hence special care and expertise is necessary when treating such fractures. It requires the widest experience, the greatest wisdom and the nicest of the clinical judgement in order to choose the most appropriate treatment for a particular pattern of injury. Management of the fractures of the shaft of the tibia remained a controversial subject despite advances in both non-operative and operative care. Sir John Charnley stated that, "we have still a long-way to go before the best method of treating a fracture of the shaft of tibia can be stated with finality" in 1961. Several published series regarding treatment of fractures of the shaft of tibia have shown that closed treatment of fractures can have excellent results. But the drawbacks of prolonged healing time, malalignment and non-compliance of the patient has led to the thought of other modalities of treatment, finally resulting in the use of closed interlocking intramedullary nailing which has given excellent results. The method of closed nailing with or without reaming followed by early ambulation and weight bearing has positive advantages over all existing methods, significant lower complication rates and has comparable results. The intramedullary interlock nailing under image intensifier fulfils the objective of stable fixation with minimal tissue damage resulting in better and quicker fracture unions. The important aspects for its use are its ability to prevent axial collapse, rotational and angulation deformities and most important of all being ealiest possible ambulation. The present study has been taken to review the results of diaphyseal fractures of tibia treated with intramedullary interlock nailing.

Aims and Objectives

To study and evaluate the results of intramedullary interlock nailing in diaphyseal fractures of tibia.

Materials and Methods:

Patients of both sexes belonging to adult age group resenting with fracture tibia to Orthopaedic Department, Father Muller Medical College, Mangalore. are admitted from August 2019 to December 2021 and evaluated. Those satisfying our inclusion criteria and are surgically fit are included in the study. This includes a prospective study of 45cases.

Inclusion and Exclusion Criteria

Inclusion criteria:

1. Age >20 years of age
2. A ll Closed diaphyseal fractures of tibia.
3. Open type 1 and Type 2 (according to Gustilo Anderson Classification) diaphyseal fractures of tibia presenting within 24 hours of injury

Exclusion criteria:

1. Age < 20 years
2. Patients with open physis
3. Open fractures of tibia Type 3A, Type 3B and Type C (according to Gustilo and Anderson Classification)
4. Immunocomprised patients

Patients were followed up after the operation periodically on an outpatient basis at 4^{th}, 8^{th}, 12^{th}, 16^{th}, 20^{th} weeks and 6 months and in between if required. The complaints were noted and the clinical and radiological assessment of the patients were done for pain, swellng, tibial malalignment and shortening, range of motion of knee, ankle and foot. Pain was noted as none, sporadic, significant and severe. Swelling noted as none, minor, significant and severe. Tibial malalignment in the form of valgus/ varus in degrees. Shortening was noted in the form of measurement and was noted in cms or was noted as nil if absent.

Anteroposterior alignment was determined by measuring the angle between the lines parallel to the proximal fragment and distal fragment on lateral radiographs. Rotations were assessed clinically. Malunion was considered when varus-valgus angulation was more than 5º, anterior- posterior was more than 10º, internal and external rotations of moret han 10º and shortening of more than 10 mm.

Radiological assessment is done on the basis of whether there is callus, or Union or if fracture is consolidated. Weight bearing was done, initially partial weight bearing at the earliest or as tolerated and depending on type of fracture and rigidity of fixation. Full weight bearing is allowed after bridging callus is seen on radiographs. Late delayed complications like screw breakage, nail bending, mal-union, non-union, limp, anterior knee pain and infection is noted and any secondary procedure done is noted in the proforma. The functional assessment of the results is one on the basis of

a. Resumption of the activities of daily living

b. Resumption of the occupation

c. Pain free movements and walking

d. Squatting and sitting cross legged

Result

Table No :1

Complications	**Numberofpatients**	**Percentage**
Superficialinfection	**2**	**4.44%**
Proximalscrewbreakage	---	---
Distalscrewbreakage	---	---
Nonunion	---	---
Delayed union	**3**	**6.67%**
Anterior knee pain	**5**	**11.11%**
Malunion	---	---
Fat embolism	**1**	**2.22%**
Shortening	**3**	**6.67%**

Deformity Assesment:

Table No : 2

Deformity(in degrees)		**Number of patients**	**Percentage**
Valgus	**None**	**39**	**86.67%**
	2-5	**5**	**11.11%**
Varus	**None**	**39**	**86.67%**
	2-5	**1**	**2.22%**

Table No:3

Deformity(in degrees)		Numberofpatients	Percentage
Flexion deformity	None	44	97.78%
	0-5	1	2.22%
Recurvation	None	45	100%

Range Of Motion

Table No :4

Movements	Flexion	Extension	Number of patients	Percentage
KNEE	> 120°	05°	36	80.00%
	120°	10°	6	13.33%
	90°	15°	3	6.67%
	<90°	>15	0	0
Ankle	Dorsi flexion	Plantar Flexion		
	> 20°	>30°	38	84.44%
	20°	30°	2	4.44%
	10°	20°	5	11.11%
	< 10°	< 20°	0	0
Foot Motion (as compared to normal)				
	5 / 5		39	86.67%
	2 / 3		2	4.44%
	1 /3		4	8.89%
	< 1/3		0	0

Functional Outcome:

Table No :5

Functional outcome	Numberofpatients	Percentage
Excellent	35	77.78%
Good	7	15.56%
Fair	3	6.67%
Poor	0	0
Total	30	100.00

Discussion

Gerhard B.G.Kuntscher (1958) opined that intramedullary nailing represents the ideal treatment of fractures and requires no external fixation or

special postoperative care. The basic principle in this method is stable osteosynthesis through flexible impingement of nail in the bone.[9] J. Zucman et al (1969) treated 36 two-level tibial fractures by intramedullary nailing. The results showed that intramedullary nailing in two-level tibial fractures allows walking with full weight bearing in an average of 3 to 4 months. It decreases the rate of non-union, malunion and it should decrease the rate of infection, in closed fractures compared with other types of internal fixation.[10] Merle d'Aubigne et al (1974) studied the outcome of tibial shaft fractures treated with plates and screws and intramedullary nailing. Between 1960 and 1972, 849 tibial fractures were treated by intramedullary nailing and 58 by other methods. 23 patients were treated with plates and screws. They showed more rate of non-union (69.6%) in the fractures by the plates and screws. The infection rate was 28% including compound and simple fractures.[11] Johner and Wruh (1983) classified tibial fractures based on etiology, morphology and clinical features, documented in a series, 291 fractures treated by AO/ASIF rigid internal fixation. The fractures were placed in 9 main fracture groups, each with three sub-groups according to location in the proximal, middle or distal segment of the shaft. A includes all simple fractures, Group B includes fractures with butterfly fragments and Group C all communited. They also developed criteria for evaluation of final results as excellent, good, fair, or poor by using non-union, pain, deformity, movements of joints, shortening, neurovascular disturbances and gait as parameters for evaluation.[12] Lawrence B.Bone et al (1986) treated 112 cases of tibial fractures by reaming and intramedullary nailing. They opined that it is also indicated in the treatment of non- union and malunion in the absence of sepsis. In segmental fractures, excellent results were noted with average time in union at 19 weeks. Average time to full weight bearing was 4 weeks, 50% of primary nailing and 40% of secondary nailing healed within 3 months. They concluded that interlocking nailing is an excellent management for unstable fractures and for secondary procedures in fractures not associated with infection.[13] Kessler SB Hallefeldt et al (1986) published articles, stating that fractures of tibia can be treated successfully with interlocking nailing.[14] Arne Ekeland et al (1988) treated 45 tibial shaft fractures, in 43 patients with Grosse-Kempf interlocking intramedullary nail between 1979 to 1982. Median age of the nailed patient was 35 years, it included 15 females and 28 males. 23 fractures (51%) were caused by high energy trauma, 5 fractures (11%) were open. Median time of full weight bearing was 30 days. Median time of bone union was 16 weeks with 29 excellent, 13 good and 2 fair results. 1 patient had non-union. They said that interlocking intramedullary nailing is the ideal treatment for communited, segmental and unstable fractures, and in patients with multiple polytrauma.[15] Scott L. Sledge et al (1989) in a study of 51 patients of non-union tibia, treated with intramedullary reaming and nailing between 1980 to 1986 showed that 49 patients had union of the fracture site at an average time of 7 months postoperatively. Thus, they concluded that intramedullary nailing with reaming, can produce union as effectively as other alternatives, while enabling the patient to function more normally without external immobilization or walking aids.[16]

Conclusion

Patients operated with this technique can be ambulated early without external immobilization in majority of cases, patients are allowed to resume work as early as tolerated and this procedure also reduces the hospital stay and boosts up the morale of the patient.

References

1. Arne Ekeland, B. Jorn. O. Thoresen, Antti'Alho, Kunt Stromsoe, Gunnar Folleras and Aren Haukeb.: Interlocking Intramedullary nailing in the treatment of tibial fractures 1988; CORR, 231 : 208-215.
2. Bircher H. Eine neue Methode unmittelbarer Retention beiFracturender Rohrenknochen. Arch Klin Chir. 1886;34:410-22.
3. Farill J. Orthopedics in Mexico. J Bone Joint Surg Am. 1952;24:506-12.
4. Gerhard BG Kuntscher. The Kuntscher method of intramedullary fixation. Journal of Bone & Joint Surgery. 1958; 40A: 17-26.
5. Gluck T. Autoplastic transplantation. Implantation von Frem-dkörpern. Berl Klin Wochenschr. 1890;19.
6. Hey Groves EW. On the application of the principle of extension to comminuted fractures of the long bone, with special reference to gunshot injuries. Br J Surg. 1914;2(7)429-43.
7. Hoglund EJ. New method of applying autogenous intramedul-lary bone transplants and of making autogenous bone-screws. Surg Gynecol Obstet. 1917;24:243-46.
8. Kessler SB Hallefeldt, Perren, Schwiberer. The effects of reaming and intramedullary nailing on fracture healing. Clinical Orthop. 1986: 212.
9. Konig F. Uber die Implantation von Elfenbein zum Ersatz von Knochenund Gelenken. Nach experimentellen und klinischen Beobachtungen. Beitr Klin Chir. 1913;85:91-114.
10. Lawrence B Bone, Kenneth D Johnson. Treatment of tibial fractures by reaming and intramedullary nailing. Journal of Bone & Joint Surgery. 1986: 68A: 877-886.
11. Merle D'Aubigne, P.Maurer J Zucman, Y Mosse. Blind intramedullary nailing for tibial fractures. Clinical Orthop. 1974; 105: 267.
12. Nicolaysen J. Lidt on Diagnosen og Behandlungen av. Fr. colli femoris. Nord Med Ark 1897;8:1.
13. Scott L, Sledge, Kenneth D, Johnson M, Bradfor Henley J, Tracy Watson. Intramedullary nailing with reaming to treat non-union of tibia. Journal of Bone & Joint Surgery. 1989; 71A: 1004-1019.
14. Smith-Petersen MN. Intracapsular fractures of the neck of the femur. Treatment by internal fixation. Arch Surg. 1931;23:715-59.
15. Suryasa, I. W., Rodríguez-Gámez, M., & Koldoris, T. (2021). Health and treatment of diabetes mellitus. *International Journal of Health Sciences*, *5*(1), i-v. https://doi.org/10.53730/ijhs.v5n1.2864
16. Wruhs O, Johner R. Classification of tibial shaft fractures and correlation with results after rigid fixation. Clinical Orthop. 1983; 178.
17. Zucmann J et al. Two level fractures of tibia. Journal of Bone and Joint Surgery, 1969; 51B: 686-693.