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Surgical management of diaphyseal fractures of tibia treated with intramedullary interlock nailing

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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

The tibia bone is the usually fractured long bone in our body. A shaft of tibia fracture occurs along the length of the bone, below the knee and above the ankle. It requires a major force to cause this type of fracture. Road traffic accidents are a common cause of tibial bone fractures. Along with tibia fractures, the smaller bone in the lower leg fibula is broken as well. Depending upon the force, tibia fractures varies, the pieces of bone may line up correctly (stable fracture) or be out of alignment (displaced fracture). The skin around the fracture may be intact (closed fracture) or the bone may puncture the skin (open fracture). In many tibia fractures, the fibula is broken as well.

Tibia fractures are classified depending on: the location of the fracture (the tibial shaft is divided into thirds: distal, middle, and proximal), the pattern of the fracture (for example, the bone can break in different directions, such as crosswise, lengthwise, or in the middle), whether the skin and muscle over the bone is torn by the injury (open fracture).

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]. Høglund 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].

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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 resending with fracture tibia to Orthopaedic Department, Kanachur Institute of Medical Sciences, Mangalore. 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. All 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 3C (according to Gustilo and Anderson Classification)
4. Immunocomprised patients

Patients were followed up after the operation periodically on an outpatient basis at 4th, 8th, 12th, 16th, 20th 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, swelling, 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 5°, anterior- posterior was more than 10°, internal and external rotations of more than 10° and shortening of more than 10 mm. Radiological assessment

Range of motion

Table 4: Table describing range of motion at knee, ankle and foot

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

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 1: Showing complication in number of patients and percentage

Complications	Number of patients	Percentage
Superficial infection	2	4.44%
Proximal screw breakage	---	---
Distals crew breakage	---	---
Nonunion	---	---
Delayed union	3	6.67%
Anterior knee pain	5	11.11%
Malunion	---	---
Fat embolism	1	2.22%
Shortening	3	6.67%

Deformity assessment

Table 2: Deformity in terms of varus and valgus

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 3: Deformity in terms of flexion deformity and recurvation

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

Functional outcome**Table 5:** Table describing functional outcome

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

Discussion

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 earliest possible ambulation. The present study has been taken to review the results of diaphyseal fractures of tibia treated with intramedullary interlock nailing.

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.

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