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Open Reduction and Internal Fixation of Bi - Malleolar Fractures of Ankle

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Abstract: ***Introduction****: The ideal management of a fracture accomplishes a solidly united fracture in the perfect alignment, restored length and freely mobile joint by normal musculature all with in a shortest possible time.Several aspects in the management of malleolar fractures pose technical problems to the surgeon. The present clinical study of internal fixation of bi-malleolar fractures using malleolar screws, K-wires, one – third tubular plates is done to assess results.*

Materials and methods *: The study was carried-out inthe department of the orthopaedics, SVRR Government General Hospital, Tirupati, from December 2007 to October 2009. The study consisted of 25 patients , 10 cases representing the cross- sectional population reported in detail. Clinical examination and x rays were done and fractures classified based on Lauge – Hansen's classification. Internal fixation of both malleoli in 25 patients. Medial malleolus fixed with malleolar screws in 18 cases and k-wires in 7 cases. Lateral malleolus was held with plate in 12 cases and intramedullary device like K- wire or Rush nail in 11 cases, in two cases it was fixed with interfragmentary screws.*

Results *: The present study consists of 25 cases of bimalleolar fractures treated by open reduction and internal fixation. Among these 5 (20%) were females and 20 (80%) were males. Right ankle involved in 9 cases (36%) and left ankle in16 cases (64%). Based on Lauge – Hansen's classification 15 cases(60%) grouped under supination and external rotation injuries,6(24%)cases under pronation external rotation injury and 4(16%) cases under pronation abduction injury. 3 cases were compound(2 are type 3 b and 1 is type 2 compound)in nature. Medial malleolus stabilized with malleolar screws in 18 cases, and k-wire in 7 cases. Lateral malleolus with plate in 12 cases and interfragmentary screws in 2 cases and intramedullary device (k-wires, rush nail, ulna nail) in 11 cases. All cases were followed for 12 months, 6 months on an average. Cast was removed after 6 weeks and active mobilisation started. Full weight bearing allowed after 3 months. Last case was done in the month of May 2009 and followed upto October 2009. Subjective evaluation was asymptomatic in 48%cases, minimal in 40%cases and moderate in 12%cases. Objective evaluation normal in 24%, minimal in 32%, and moderate in 32% cases, severe in 8%. The results were poor when number of deranged structures were increased.*

Conclusion *: we conclude that all unstable bimalleolar fractures needs to be fixed by open reduction and internal fixation, for faster rehabilitation and better functional outcome.*

Key words *:Bimalleolar fractures, Lauge – Hansen's classification.*

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I. Introduction

The frequency of occurrence of fracture is increasing enormously day today. These are of great importance not only to the thousands who suffer them each year, but also the medical and social services because of the enormous demands made on them by those injured. The great increase in the incidence of fractures, is forcing the profession to resort to a quick and effective treatment.

Several aspects in the management of malleolar fractures pose technical problems to the surgeon. Union is not assured, in all cases by conservative form of treatment. As it is one of the important weight-bearing joints of the lower extremity, ugly and early osteoarthritis are the outcomes. With the intention of rehabilitating patient at an earliest possible time and unsatisfactory outcome of the conservative management, prompted us to make an attempt to treat these fractures by open reduction and internal fixation using various methods like K-wires, malleolar screws, TBW, one-third tubular plates and screws based on characteristics of the fracture.

Studies on simulated ankle fractures in cadavers supported that even small talar and fibular displacement lead to abnormal contact loading and forces across tibiotalar joint, potentially leading to post traumatic osteoarthritis. Ramsey and Hamilton JBJS [1976] demonstrated that 1mm of lateral talar shift increases contact loading of tibiotalar joint by 42%. Yablon et al demonstrated that talus followed the displacement of the fibula. The combination of these two studies provided evidence that any displacement of the fibula should be anatomically reduced to prevent abnormal loading of the tibiofibular joint.

Materials and methods

It is a prospective randomized study conducted from Nov 2007 – Nov 2009 on 25 patients with bimalleolar fractures in the department of Orthopaedics, SVRR Government General Hospital, Tirupati.

Fractures are classified based on **Lauge – Hansen classification**.

Supination external forces accounted for 15 (6o%) cases. Pronation-external rotation forces accounted for Six cases (24%), Remaining cases belonged to pronation- abduction injury. Four of these fractures were associated with a fractureof the fibula above the joint line, indicating rupture of the inferior tibio- fibular syndesmosis.

The fractures further classified as to degree of **lateral talarshift** noted on the original roentgenograms. it is as follows

Minimum :< 0.5cm - in 15 patients.

Moderate : 0.5 to 1.0cm - in 8 patients.

Severe :> 1.0cm - in 2 patients.

Indications Of Open Reduction:

These were as follows

- Failure of closed reduction.
- Rupture of syndesmosis.
- Fracture of medial malleolus at tibial plafond.

Internalfixationofbothmalleoli in 25patients. Medial malleolusfixedwith malleolar screws in 18 cases and k-wires in 7 cases. Lateral malleolus was held with plate in 12 cases and intramedullary device like K- wire or Rush nail in 11 cases, in two cases it was fixed with interfragmentary screws.

The following information also was recorded:

- ► The presence and sites of abrasions and lacerations about ankle.
- ► The presence of fracture blisters pre-operatively.
- ► Whether the patient was first seen at this hospital or at another hospital.
- ► The reason was given for any delay before operation.
- ► Whether tourniquet was used and for how long,
- ► Other concurrent injuties or medical problems, and also the Age and sex of the patient.

Method Of Open Reduction And Internal Fixation Of The Bi-Malleolar Fractures:

In this study 25 selected cases of bi-malleolar fractures of the ankle to various classification groups were treated by plates and malleolar screws, intra-medullary device and tension band wiring principle. In all the cases thorough history was takento assess the nature of traumaand good quality radiographs were taken to know the type of thefracture. After the thorough pre-operative assessment, the cases were taken up for surgery.The duration between occurrence of the injury and internal fixation in fresh cases varied from 5 to 7 days and in late cases from 2wks to3wks.

ANAESTHESIA: spinal.

POSITION :Supine with a sand bag under the buttock of the affected limb , to bring the lateral malleolus forward and making it easier to reach. Esmarch Tourniquet applied after exsanguinating the limb by elevating it for 3 to 5min.In all cases tourniquet time was one hour.

APPROACH

Medial malleolus :Anterior approach.

Lateral malleolus : Postero - lateral approach.

Procedure:

Reconstruction of the fibula was given priority. Surgery began with the reduction andprovisional fixationof thefibula.If there is anydifficulty in achieving anatomic reduction of the fibula, medial malleolus is exposed beforefixation of the fibula and to inspect anysoft tissue interposition onmedial side.

Fixation Of The Lateral Malleolus:

Incision is centered directly over the fracture site along the Posterior marginof the fibula.It is extended proximally or distally depending on the type of the fracture and length of the plateused.

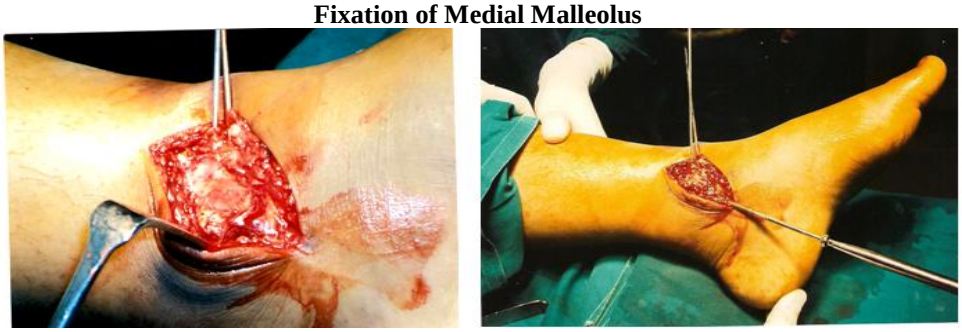
After incising the skin and deepfascia, cleavage developedbetweenPeroneal muscles and flexormuscles.

Fracture site is exposed and fragments isolated. Periosteum is stripped adequately to expose the fracture edges. Anatomic reduction is carried out using a pointed reduction forceps. Accuracy of the reduction is checked along the posterioredge offibula. Appropriate sized one-third tubular plate or recon plate is centered over the fracture site and held securely with bone clamps toretainanatomicallyreduced fracture with properly positioned plate. Now by using proper size 2.7 drill bit and 3.5mm tap , plate is fixed by inserting screws of appropriate length and diameter to both fracture fragments.
In case of short spiral fractures ,fracture is stabilized with two or three lag screws , inserted perpendicular to the fracture. It was done in two cases.

Stabilization Of The Syndesmosis:
This was done by inserting a cortical screw (3.5mm) 2- 3cm above the ankle joint , through the fibula into the both cortices of the tibia.
The screw was inserted obliquely from back to front at an angle of 25 - 30 degree , starting postero-laterally and aiming antero-medially. Drill holes were tapped prior to the insertion.

Medial Malleolar Fixation:
Anterior approach was followed.
A longitudinal curved incision was made with its mid point Just anterior to the tip of the medial malleolus. The dissection is carried directly down to the periosteum.
The fracture site is exposed and trapped periosteum is carefully reflected to expose fracture edges. Haematoma is cleared.
Arthrotomy was done to have a good view of intraarticular portion of the fracture.
Small bone splinters from the anterior edge were removed. Large pieces are reduced and provisionally fixed with two smooth K-wires drilled across fracture site as temporary fixation devices.
Fracture was checked with antero-posterior and lateral roentgenograms. Once the reduction was satisfactory one of the Kirschner wires was removed the path drilled with 2.5mm drill bit.4mm lag screw was inserted into the path. In the similar way another K-wire was replaced with lag screw.
Interior of the joint was inspected at supero-medial corner, to make sure the screw has not crossed the articular surface. Position of the screw and quality of the reduction was checked in C-arm.
If the medial malleolar fragment is very small or comminuted several Kirschner wires or tension band wire loop was used.

Fixation of Medial Malleolus



Fixation of lateral malleolus

Post-Operative Management

The ankle was immobilized in a posterior plaster splint With ankle in neutral position and elevated. Sutures removed between **10th and 15th post-operative day**.

Range -of-motion exercises were begun after suture removal. Weight- bearing was restricted for **6 weeks**. After 6 weeks, cast was discontinued and active range of motion was started.

Full weight bearing was allowed after **12 weeks.**

7. Follow-Up

	6 WEEKS	**12WEEKS**	**24WEEKS**
Pain (with movements of the joint and standing)			
Tenderness			
Movements Dorsiflexion Plantar Flexion			

II. Results

In our study 25 patient with bimalleolar fractures are treated by open reduction and internal fixation. The study conducted between Dec 2007 to Oct 2009. The results based on my observation during study period were as follows.

Table 1: Age Incidence:

Age in year	**No cases**	**Percentage**
20-30	9	36%
31-40	6	24%
41-50	5	20%
51-60	2	8%
61-70	3	12%

Majority were in the 3rd& 4th decade.

Table 2: Sex Incidence:

Age in years	**No. of Cases**	**Male**	**Female**
20-30	9	7	1+1(2)
31-40	6	6	-
41-50	5	4	1
51-60	2	1	1
61-70	3	2	1

Males accounted for : 80%

Females for : 20%

Table 3: The results based on Lauge – Hansen's classification

Type	**No. of Patients**	**Percentage**
Supi + Ext.Rot	15	60%
Pron + Abd	4	16%
Pron + Ext	6	24%

Majority fractures were due to Supination Ext. rotation forces.

Table 4: Side Involved

Right Ankle	**Left Ankle**
9 cases (36%)	16 cases (64%)

Table 5: Mode of Injuries

	No. of Patients	**Percentage**
Road traffic accident	15	60%
Fall from height	3	12%
Slipping and tumbling	6	24%

Table 6: Type of fractures

Type	**No. of patients**	**Percentage**
Closed	22	88%
Compound	3	12%

Compound: Type II – 1 case
Type III B – 2 cases

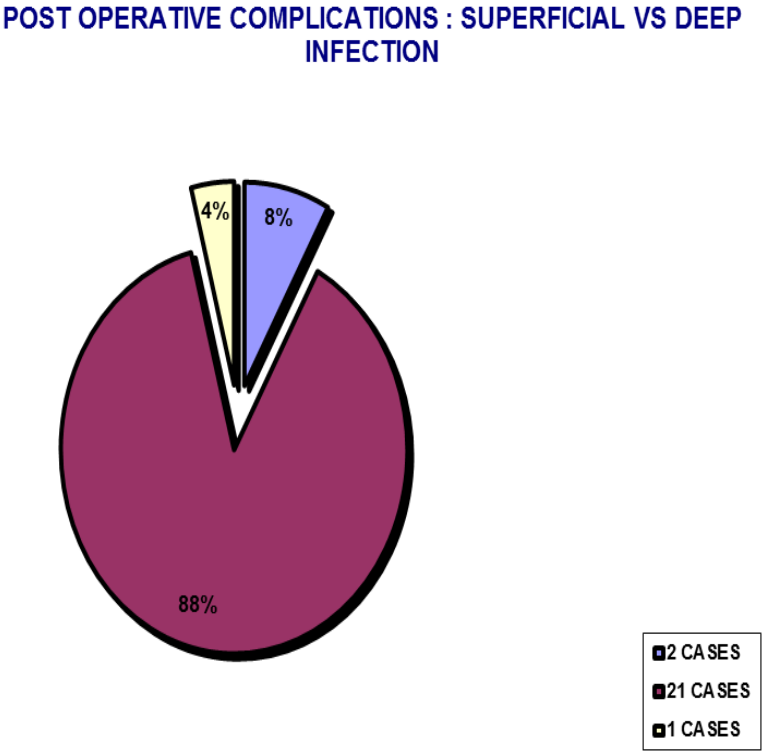
Table 7: Type of Internal fixation

a) Medial Malleolus

Malleolar screws	16 cases	64%
K- Wires	7 cases	28%
Malleolar screw + K- Wire	2 cases	8%

b. Lateral malleolus

Implant	No. of Patients	Percentage
Plates and screw(Recon plate + 1/3 tubular plate)	12 cases	48%
Intra medullary devices (K-Wires, Ulnar nail or Rush nail)	11 cases	44%
Inter fragmentary screws	2 cases	8%



III. Conclusion

1. Bimalleolar fractures were common in males, incidence was more between 21-40 years.
2. Most common cause of fracture was road – traffic accidents.
3. Understanding the mechanism of injury is essential for good reduction and internal fixation.
4. Open reduction and internal fixation eliminates chances of non-union of medial malleolus due to periosteal inter position.
5. Fibular length and rotation and in turn talar tilt are well corrected with open reduction and internal fixation. For this plates and screws are suitable implants. Use of intramedullary devices are not advocated.
6. When supra syndesmotic screw was used, walking not permissible with the screw in situ.
7. Hence we conclude that all unstable bimalleolar fractures needs to be fixed by open reduction and internal fixation, for faster rehabilitation and better functional outcome.

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