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COMPARATIVE STUDY BETWEEN FIBULA PLATING VERSUS INTRAMEDULLARY K-WIRE WITH MEDIAL MALLEOLAR SCREW IN FIXATION IN BIMALLEOLAR FRACTURES OF ANKLE

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ABSTRACT

Background: Pott's fracture is eponym of bimalleolar fracture, which account for one fourth of patients of ankle injury, it is more common in women, people over 60 years of age. There has been an increase in the prevalence of one such fracture over the last two decades both in the young, active patients and in the elderly.

Objectives: The aim of this study was to compare the clinical and functional results of patients with bimalleolar fractures treated with semi tubular / reconstruction plating or intra medullary k-wire in fibula along with medial malleolar screw.

Material And Method: This was a prospective randomized comparative study carried out using fibula plating and intramedullary k wire for fixation of lateral malleolus fracture and malleolar screw fixation for fracture medial malleolus among 60 patients admitted in S.M.S Hospital, Jaipur during the study period of April 2018 to December 2019. Informed consent was taken and functional assessment of patient was done at 1, 3 and 6 months after discharge according to the Modified ankle score of Olerud Molander.

Results: The quantitative data was presented as mean and standard deviation and were compared by student's t-test. Probability was considered to be significant if less than 0.05. There was a significant differences (P=0.008 & P=0.001) in both the groups on the basis of mean duration of partial weight bearing (weeks) and initiation of full weight bearing (weeks). There was a significant difference in both the groups on the basis OMA score at 1, 3 and 6 months.

Conclusion: The final functional outcome was compared by Modified Olerud & Molander Score. 24 (80%) cases in fibula plating group had excellent to good results whereas, 15 (50%) cases in intramedullary k wire group had excellent to good results (P=0.010). In conclusion, cases managed by Fibula Platting had better functional outcome as compared to those treated by Intramedullary K Wire group.

KEYWORDS : Pott's fracture, Fibula plating, Intramedullary K wire, Olerud Molander score.

INTRODUCTION:

Ankle fractures are one of the most common skeletal injuries seen in clinical practice[1]. Sir Robert Jones said "Ankle is most injured joint of the body but the least well treated[2]. Ankle injury gain importance because body weight is transmitted through it and locomotion depends upon stability of joint.

Ankle fractures account for 9% of all fractures, with an incidence of up to 174 cases per 100,000 adults per year and around 2% of ankle fractures are open fractures[3] Pott's fracture is eponym of bimalleolar fracture, which account for one fourth of patients of ankle injury, it is more common in women, people over 60 years of age. There has been an increase in the prevalence of one such fracture over the last two decades both in the young, active patients and in the elderly[3].

They are usually mixed injuries, ligamentous and bony and each injury is an end result of ligamentous and bony failure due to deforming forces. As with all intraarticular fractures, malleolar fractures necessitate accurate reduction and stable fixation. The two most universally accepted classification systems are the Danis-Weber and Lauge-Hansen systems.[4-6] While both systems define the fracture pattern, managing these injuries is primarily based on an assessment of stability, which incorporates the amount of displacement, presence of medial injury and associated talar shift.

Ankle joint with its complex anatomy and variegated fracture patterns has constantly baffled the surgeons working on it. Of the many injuries that occur, ankle fractures are increasingly common, trailing only hip fractures and wrist fractures in frequency among elderly patients. Among younger patients, ankle fractures likely represent an even larger proportion of injuries. Surgical treatment of ankle fractures is frequently required, and appropriate treatment and recognition of potential risk factors are essential for optimizing outcomes. Injuries around the ankle joint cause destruction of not only the bony architecture, but also often the ligamentous and soft-tissue components.[7]

The best results are obtained by anatomical joint restoration; the method used to accomplish this may be either closed manipulation or open reduction and internal fixation. For most fractures, the latter method most often ensures anatomical joint restoration and union. As with all intraarticular fractures, malleolar fracture necessitates accurate reduction and stable internal fixation. This ensures that early joint motion can be initiated and improves the healing of articular cartilage. Furthermore, when malleolar fractures are not reduced accurately, they may lead to post traumatic painful restriction of motion or osteoarthritis or both.[8,9]

The great developments in the field of orthopaedic surgery, newer and safer internal fixation devices and techniques with better prognosis have shifted the balance toward surgical intervention in these cases. Surgery can produce higher rate of union, an earlier return to work or recreational activities, avoids prolonged periods of immobilization and prevent any residual displacement which may lead to the development of post traumatic arthritis of the ankle.[10] The aim of this study was to compare the clinical and functional results of patients with bimalleolar fractures treated with semi tubular / reconstruction plating or intra medullary k-wire in fibula along with medial malleolar screw.

MATERIALS AND METHODS:

A prospective randomized comparative study was carried out using fibula plating and intramedullary k wire for fixation of lateral malleolus fracture and malleolar screw fixation for fracture medial malleolus among 60 patients admitted in S.M.S Hospital, Jaipur during the study period of April 2018 to December 2019.

The patients were divided into two groups;

Patients treated with fibula plating (n=30) as group 1
Patients treated with intramedullary k-wire (n=30) as group 2

Inclusion Criteria:

All patients received in S.M.S Emergency and in O.P.D satisfying the following criteria were included in our study;
Patients with bimalleolar fractures of ankle
Skeletally matured

Patients willing for treatment and who gave informed written consent.
Closed fractures

Exclusion Criteria:
Compound fractures
Associated with other fractures
Cases which are treated by non-operative methods (Type I Dennis Weber).

Functional assessment of patient was done at 1, 3 and 6 months after discharge according to the Modified ankle score of Olerud Molander.

Pre-Operative Preparation:
1. Thorough history taking and detailed physical examination with a special emphasis on the type of injury.
2. Routine laboratory investigation carried out to assess patient's fitness for anaesthesia.
3. Preoperative skin preparation with Betadine.
4. Pre-operative antibiotic injection.
5. Pre-anaesthetic evaluation.

Operative procedure:
Lateral column was fixed first followed by medial malleolus.

Fixation of lateral malleolus:

Open reduction internal fixation with one third tubular plate:
Place the patient supine on the operating table with a sandbag under the buttock of the affected limb. The sandbag causes the limb to rotate medially, bringing the lateral malleolus forward and making it easier to reach. Operating with the patient on his or her side also provides excellent access to the distal fibula. Exsanguinate the limb by elevating it for 3 to 5 minutes, and then inflate a tourniquet.

Make a 10 cm incision along the posterior margin of the fibula centering over the fracture site. Elevate the skin flaps taking care not to damage the short saphenous vein, which lies posterior to the lateral malleolus. The sural nerve, which runs with the short saphenous vein, also should be preserved. The fracture site is exposed subperiostially. Fracture ends were cleared of all clots.

Open reduction and internal fixation was then performed with one third tubular plate. Surgical site washed with normal saline. Closure was then performed in layers and sterile dressing applied. Below knee plaster of Paris slab was then applied. Post-operative check X-ray was taken.

Make a 10- to 15-cm incision along the posterior margin of the fibula all the way to its distal end. From there, curve the incision forward, below the tip of the lateral malleolus.

Incise the periosteum on the subcutaneous surface of the fibula longitudinally.

Expose the distal fibula subperiosteally.

Fixation of lateral malleolus with intramedullary k-wire:
Place the patient supine on the operating table with a sandbag under the buttock of the affected limb. The sandbag causes the limb to rotate medially, bringing the lateral malleolus forward and making it easier to reach. Operating with the patient on his or her side also provides excellent access to the distal fibula. Exsanguinate the limb by elevating it for 3 to 5 minutes, and then inflate a tourniquet.

The distal fibula is palpated, noting the fracture site. A Longitudinal 1 to 2 cm skin incision was made 1 cm distal to the tip of the fibula .Care was taken to avoid deep sharp dissection as the peroneal tendons lie deep to this incision and the tip of distal fibula identified under fluoroscopy. After confirming of the starting point, the k wire of appropriate diameter and length placed from the distal tip into the intramedullary canal proximally with slight medial angle to preserve the lateral cortex of fibula. A small bone holder or towel clamp was used temporarily to hold the attained anatomical reduction.

Fixation of medial malleolus:
Open reduction and Internal fixation with Malleolar Screw:
After suitable anaesthesia patient is placed in supine position. Exsanguinate the limb by elevating it for 3 to 5 minutes, and then inflate a tourniquet. Medial malleolus exposed by antero-medial curved incision (approach described by Colonna and Ralston for medial ankle). Make an incision about 5-7cm. long, beginning 5 cm proximal to the medial malleolus curved anteriorly and inferiorly then posteriorly and inferiorly, and end it approximately 2 cm distal to the tip of malleolus. Skin flap are carefully reflected and fracture is exposed. Periosteum and fibrous tissue, which are interposed in between the fracture surface are removed. Now with the bone holding clamp or towel clip, fractured malleolus is reduced and while holding it there, it was fixed temporarily with k wire perpendicular to the fracture. Then a temporary hole was drilled through the medial malleolus from distal to proximal. Appropriate size malleolar screw was inserted. K-wire removed and Tourniquet released. Perfect haemostasis achieved and closure of wound done in layers. Sterile Dressing was placed and below knee POP slab applied.

Post-operative Care:
Patient advised to keep limb elevated and to perform active toe movements and Post-operative antibiotic injection for 2 days. It's followed by oral antibiotic up to 5th post-operative day. Stitch removal was done on 14th post-operative day. Stitch line was observed for healing by primary intention, marginal necrosis, stitch abscess, superficial or deep infection, and any discharge necrosis.

Below knee POP cast applied for 4 weeks after stitch removal. Partial weight bearing and mobilization of ankle and foot was started after 6 weeks or depending on X-ray and full weight bearing was permitted after 3 months.

Follow up:
Regular follow up was done at 1, 3 and 6 months after discharge till the fracture united. The evaluation was done according to modified Olerud Molander Ankle Score (OMAS).[11] The scoring scale has a maximum of 100 points and is based on 7 different parameters: pain, stiffness, swelling, stair climbing, sports, supports and daily activity and work. If the scoring scale >91 = excellent results, 91-90 = good results, 71-80 = fair results and <70 = poor results.

OBSERVATION & RESULTS:

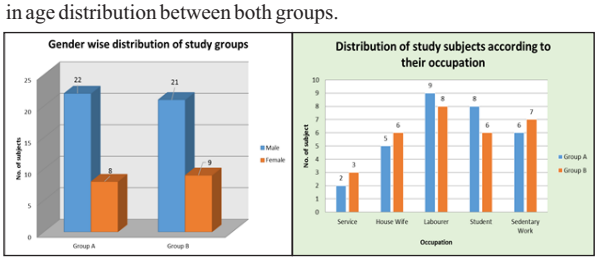
Statistical Analysis
Statistical analysis was performed with the SPSS, version 21 for Windows statistical software package (SPSS inc., Chicago, IL, USA). The Categorical data was presented as numbers (percent) and were compared among groups using Chi square test. The quantitative data was presented as mean and standard deviation and were compared by student's t-test. Probability was considered to be significant if less than 0.05.

Table 1: Age distribution of study groups

Age group (years)	Group A		Group B		Total	
	N	%	N	%	N	%
20-29	10	33.3	9	30	19	31.7
30-39	7	23.3	11	36.7	18	30.0
40-49	9	30	7	23.3	16	26.7
50-59	4	13.3	3	10	7	11.7
Total	30	100	30	100	60	100
Mean ± SD	36.27 ± 11.21		35 ± 9.21			

Chi-square = 1.175 with 3 degrees of freedom; P = 1.000 (NS)

In this study, the mean age in Fibula Plating and Intra medullary k wire is 36.27 and 35 years respectively. There was no significant difference in age distribution between both groups.



There was no significant difference in sex distribution and occupation between both the groups

Table 2: Distribution of study subjects according to mechanism of injury

Mechanism of injury	Group A		Group B		Total	
	N	%	N	%	N	%
Fall from height	5	16.7	4	13.3	9	15.0
Rood traffic accident	19	63.3	20	66.7	39	65.0
Slip and fall	6	20	6	20	12	20.0
Total	30	100	30	100	60	100

Chi-square = 0.137 with 2 degrees of freedom; P = 0.934 (NS)

In this study, most common mode of injury was road traffic accidents (65%). Fall from height was the second most common mode of injury (15%). 20% cases had injury by slipping or stumbling.

Table 3: Comparison of mean duration of non-weight bearing, partial weight bearing and initiation of full weight bearing (weeks)

Comparison of mean in different groups	Group A (n=30) Mean ± Std. deviation Range	Group B (n=30) Mean ± Std. deviation Range
Duration of non-weight bearing	5.8±0.48 5-7	6±0.56 5-7
Duration of partial weight bearing	5.97±1.33 4-9	6.83±1.09 5-9
Initiation of full weight bearing	11.67±1.12 10-14	12.77±1.33 11-15

There was no significant difference on the basis of mean duration of non-weight bearing in both the groups.There was a significant differences (P=0.008 & P=0.001) in both the groups on the basis of mean duration of partial weight bearing (weeks) and initiation of full weight bearing (weeks).

Table 4: Comparison of functional outcome among study groups (OMA score)

Follow up time	Group A	Group B	P value
1 month	22.67 ± 5.04	18.17 ± 8.66	0.017 (S)
3 month	57.17 ± 8.68	49.83 ± 11.48	0.007 (S)
6 month	87.17 ± 6.14	81.17 ± 10.62	0.010 (S)

p value calculated using student t test

There was a significant difference in both the groups on the basis OMA score at 1, 3 and 6 months.

Table 5: Frequency of complications among study groups

Complications	Group A		Group B		P value
	N	%	N	%	
Wound dehiscence	2	6.7	0	0	0.492
Infections	2	6.7	0	0	0.492
Mal-alignment	0	0	3	10	0.237
Stiffness	0	0	3	10	0.237
Delayed union	1	3.3	4	13.3	0.353
Non union	0	0	3	10	0.237
Screw break	1	3.3	0	0	1.000

p value calculated using Fisher's Exact test. There was no significant difference in complications in both the groups.

Case 1: 53-year-old male admitted with fracture pott's ankle of Rt side, was operated with ORIF using medial malleolar cc-screw and fibular plating on 1st day of admission. The fracture reduction was anatomical. On 6 months follow up, the range of motion was comparable to the normal side and no difficulty in walking.

Pre and Postoperative X-ray

6 months follow up

Case 2 : 40-year old male was admitted with fracture pott's ankle of the Rt side. The patient was operated on 1nd day of admission with ORIF with medial malleolar cc-screw and fibular k-wire. The reduction achieved of medial malleolus was anatomical and of fibula was satisfactory. The patient had good post-operative range of motion and the fractures united after 6m follow up.

Pre and postoperative X-ray

DISCUSSION:

Pott's fracture is an archaic term loosely applied to a variety of bi-malleolar ankle fractures. English Physician Percivall Pott noticed this injury in 1765 and described his clinical findings in a paper published in (1769).[12] Past few years have seen remarkable changes in the older concepts of management of ankle trauma. The great developments in the field of orthopaedic surgery, newer and safer internal fixation devices and techniques and better prognosis have shifted the balance towards surgical intervention in these cases (Vasil 1957[13]; Jergesen 1959[14]; Burwell & Charnley, 1965[15]; Denham, 1974[16]; Segal, 1979[17]). Majority of ankle fractures can't be reduced anatomically by close manipulation. Interposition of periosteum and small intermediate fragments of bone and cartilage commonly prevent close reduction. The most disabling sequel of fractures about the ankle is post traumatic arthritis. Anatomical restoration is the most important contribution the surgeon can make.

This series includes randomly selected 60 cases of closed fracture Pott's ankle. All patients were admitted in the Department of Orthopaedics of Sawai Man Singh Medical College and Hospital, Jaipur.

The AP and lateral views of the ankle were taken. In this series of ankle fractures, fixation of lateral malleolus was done with Tension band wiring in 30 cases and in other 30 cases intramedullary K-wire was used as fixation modality. In fracture of medial malleolus, fixation was done with malleolar screw all cases. All fractures were classified by the Lauge Hansen[18] method.

In this series minimum age was 20 year and maximum age was 59 years. Mean age in male was 34.76 years and in female was 37.64 years. Peak incidence of trauma occurred in 20-37 age years group. This age group was more vulnerable to injury due to more involvement in out-door activities, athletic activities and involvement in manual works. David Segal (1979)[17] rightly mentioned that ankle fracture is not "old men's" fracture but occur more commonly in young adults. Nelson F. Schoo et al (2009)[19] in his study of ankle fracture analyzing complication rates following open reduction and internal fixation of ankle fractures, mean age was 51 (range 18-103 years).

In this series male female ratio was 4:1. The men out numbered the women for apparent reasons. Apart from few exceptions most women are house wives and men go for jobs. Hence men were exposed to trauma much moreSex ratio in our series is almost similar to series of Charnley (1965)[15] in which male were predominant. Klossner (1962)[20] Wilson and Skilbred (1966)[21]; Kauko and Solonsen, (1968)

Colton, (1974)[22]; Nelson and Soohu (2009)[19] recorded higher incidence in female compare to male.

In this study most common mode of injury was road traffic accident in 39 cases (65%) followed by fall from height in 9 cases (15%), slipping and fall was responsible in 12 cases (20%). Kenneth A. Egol et al (2006)in his study had 71% due to fall, 17% due to road traffic accident and 12% was due to sports related injuries.

The present series noticed that whenever there was delay in treatment it caused organization of traumatic exudates and fibrosis and made surgery and anatomic reduction difficult. In this series, the mean dorsiflexion in fibula platting group was 16.43 degrees whereas for intamedullary k wire group, the mean dorsiflexion was 14.17 degrees. The p value for this observation was 0.080 and hence this association was not found to be significant.

In this series, the mean plantarflexion in fibula platting group was 32.17 degrees whereas for intramedullary k-wire group, it was 28.33 degrees. The p value for this observation was 0.105 and hence this association was not found to be significant.

Lindsjo et al; (1985)[23] in his study of 162 cases having fracture dislocations ankle, operatively treated according to AO principles, they recorded restriction of ankle dorsiflexion up to 10 degree in 31.00% cases and plantar flexion in 17.00% cases. It came out that in our study restriction of ankle movement was more in intramedullary k wire group than in fibula platting group. The difference in management by two modalities was also highlighted by the complications encountered during follow up. 2 Patients in fibula platting group developed infection whereas; no patient of intramedullary k wire group had this complication. Stiffness of ankle joint was more common in intramedullary k wire group as compared to the fibula platting group.

In our study, the final functional outcome was compared by Modified Olerud Molander Score. 24 (80%) cases in fibula platting group had excellent to good results whereas, 15 (50%) cases in intramedullary k wire group had excellent to good results (P=0.010). This association is also highly significant. Thus, it is evidently clear that patients managed by fibula platting group had better functional outcome as compared to the patients managed by intramedullary k wire group group.

CONCLUSION:

The aim of surgery should be achieve anatomical reduction of the fracture fragments, ankle mortise congruity, restoration of the length of the fibula and restoration of syndesmotic integrity. It was observed that there was no significant association between range of motion at final follow up and group. Two patients in fibula platting group developed infection whereas; no patient of intramedullary k wire group had this complication.

In our study, the final functional outcome was compared by Modified Olerud & Molander Score. 24 (80%) cases in fibula plating group had excellent to good results whereas, 15 (50%) cases in intramedullary k wire group had excellent to good results (P=0.010). This association is also highly significant. In conclusion, cases managed by Fibula Platting had better functional outcome as compared to those treated by Intramedullary K Wire group.

REFERENCES:

1. P. Pott.. Some few general remarks on fractures and dislocations. 2007:1758. Clin Orthop.;458, pp. 40–41.
2. Dr. Bhavik Y. Dalal, Dr. Krunal J. Chaudhri, Dr. Parimal J. Patel, Dr. Ravi R. Bhesaniya A study of Bimalleolar fractures treated with open & closed method by TBW, k-wire, CC screw & semitubular plate Volume : 3 | Issue : 10 | October 2014 ISSN No 2277–8179.
3. Colton CL. The treatment of Dupuytrens fracture dislocation of the ankle. J Bone Joint Surg. 1971; 53B:63-71.
4. Danis R. Les fractures malleolaires. In: Danis R, editor. Theorieetpratique de l'osteosynthese. Paris: Masson; 1949.
5. Weber BG. Die verletzungen des oberen sprunggelenkes. 2. Berne: Verlag Hans Huber; 1972.
6. Lauge-Hansen N. Fractures of the ankle II: combined experimental-surgical and experimental-roentgenologic investigations. Arch Surg. 1950;60:957–985. doi: 10.1001/archsurg.1950.01250010980011.
7. Gumann G. Ankle fractures. In: Foot and ankle trauma. Chapter- 28, Edt. Scurran BL, New York: Churchill Livingstone, 1989;579- 638pp.
8. Geissler WB, Tsao AK, Hughes JL. Fractures and injuries of the ankle. In: Rockwood and Green's fractures in adults.4th ed. Lippincott Raven; 1996: 2201-66.
9. Ponzer S, Nåsell H, Bergman B, Törnkvist H: Functional outcome and quality of life patients with Type B ankle fractures: a twoyear follow up study. J Orthop Trauma. 1999,13:3638.10.1097.
10. Gregory Joy, Michael J Paizakis, Paul J Harvey Jr. Precise evaluation of the reduction of severe ankle fractures, technique and correlation with end results. J Bone Joint Surgery Am 1974;979-93.
11. Olerud C, Molander H: A scoring scale for symptom evaluation after ankle fracture. Arch Orthop Trauma Surg. 1984,103:1904. 10.1007/BF00435553.
12. Pott. P. (1768): Some few General remarks on fractures and dislocations. London, Hawes, Clarks, Collins.
13. Vasll, S. (1957: Operative treatment of ankle fracture Acta. Chir. Scand. Suppl. 226.
14. Jergesn, F. (1959): Open reduction of fractures and dislocations of the ankle. Am. J. Surg.98:136.
15. Burwell HN, Charnley AD. The treatment of displaced fractures at the ankle by rigid internal fixation and early joint movement. J Bone Joint Surg. 1965; 47B:634-660.
16. Denham, R.A. (1964): Internal fixation for unstable ankle fractures. J. Bone Joint Surg. 46B:206-211.
17. David Segal (1979): Ankle fractures. Inst. Course Lectures, Vol. XXVIII, St. Louis, the C.V Mosby Co.72.
18. Lauge-Hansen, N. (1953): fractures of the ankle .Arch. Surg. 67:813.
19. Nelson E Soohoo, et.al (2009): Complication Rates Following Open Reduction and Internal Fixation of Ankle Fractures. J. Bone Joint Surg. Am 91:1042-9
20. Klossner, Olli. Late results of operative and non-operative treatment of severe ankle fractures. A clinical study. Acta Chir Scandinevica, Supplementum 1962;293.
21. Storen,G. (1954): Conservative treatment of ankle fractures. Acta. Chir. Scand. 128:45.
22. Wilson, F.C. & Skilbred, L.A. (1966): Long term results in the treatment of displaced bimalleolar fractures. J. Bone Joint Surg. 48-A: 1065-1078.
23. Lindsjo U: operative treatment of ankle fracture dislocation: Clin. Orthop. Retal. Res; 199:28-38.1.