

FUNCTIONAL OUTCOME OF OPEN REDUCTION AND INTERNAL FIXATION IN DANIS-WEBER TYPE B ANKLE FRACTURES

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ABSTRACT

Objectives: To determine the functional outcome of open reduction and internal fixation (ORIF) in Danis-Weber type B ankle fractures.

Material and Methods: This study was conducted at Department of Orthopaedics, Khyber Teaching Hospital, Peshawar from April 2015 to October 2015. Study design was descriptive case-series study and the duration of the study was 6 months in which a total of 145 patients were observed by using 60% proportion of no pain after using ORIF surgery with 8% margin of error and 95% confidence interval under WHO software. More over consecutive (Non-Probability) sampling technique was used for sample collection.

Results: In the present study mean age was 40 years with $SD \pm 3.66$. Sixty three percent patients were male and 37% patients were female. The status of pain was analyzed as 65% patients didn't have pain, 20% patients had mild pain, 13% patients had moderate pain while 2% patients had severe pain.

Conclusion: Surgical management of malleolar fractures of ankle is simple, effective and economical which can be carried out in a minimal basic orthopedic set up. It ensures restoration of anatomy and good function of the ankle joint.

Key Words: Open reduction, internal fixation, Danis-Weber type B ankle fractures

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INTRODUCTION

Ankle fractures refer to fractures of the distal tibia, distal fibula, talus, and/or calcaneus. Ankle fractures are one of the most frequently encountered musculoskeletal injuries, occurring with an annual rate of approximately 0.18%(187/100,000) in global population and 15% of all the ankle injuries are observed as ankle fractures. They represent approximately 10% of all kinds of fractures and studies show that their incidence is rising, as observed for the past 20 years. Different classification

systems of ankle fractures are commonly in use for selection of appropriate treatment and to determine the functional outcomes of definitive management. One of the most commonly used classifications is the Danis-Weber classification. Danis-Weber classifies the ankle fracture into three categories, in which the fracture of the fibula at the level of the syndesmosis is called the Type B ankle fracture. Ankle fractures refer to fractures of the distal tibia, distal fibula, talus, and/or calcaneus. Ankle fractures are one of the most frequently encountered musculoskeletal injuries, occurring with an annual rate of approximately 0.18%(187/100,000) in global population and 15% of all the ankle injuries are observed as ankle fractures. They represent approximately 10% of all kinds of fractures and studies show that their incidence is rising, as observed for the past 20 years.¹

Different classification systems of ankle fractures are commonly in use for selection of appropriate treatment and to determine the functional outcomes of definitive management. One of the most commonly used classifications is the Danis-Weber classification.² Danis-Weber classifies the ankle fracture into three

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categories, in which the fracture of the fibula at the level of the syndesmosis is called the Type B ankle fracture.³ Syndesmosis is the fibrous joint in which two adjacent bones are linked by a strong membrane or ligaments. This definition also applies for the distal tibiofibular syndesmosis, which is a syndesmotic joint formed by two bones and four ligaments.⁴ Syndesmotic injury occurs in 50% of Weber type B fractures and 10% patients have a concomitant distal tibiofibular syndesmotic disruption necessitating surgical repair.^{4,5}

Depending upon the mechanism of injury, the Weber type-Bankle fracture may be stable or unstable and choosing between operative or non-operative treatment for it, the stability of ankle fracture is the most important factor to be considered. In cases of suspected unstable ankle fracture having medial malleolus fracture or deltoid ligament injury in addition to a fibular fracture, the best choice of treatment is open reduction and internal fixation (ORIF).⁶ Open reduction refers to open surgery to set bones, and internal fixation refers to fixation of screws and/or plates, intramedullary bone nails to enable or facilitate healing.⁷ Several authors recommend ORIF for Weber type-B fracture because the fracture is either unstable or the talus tends to shift in the mortise.⁸

The decision whether to operate or not the Weber type-B ankle fracture is highly dependent upon the surgeon's individual judgment on displacement. There is consensus that other Weber classified ankle fractures rarely require operative treatment because of their mechanism or nature of injury.^{9,10,11} So the only Weber type-Bankle fractures are left with gray area of operative treatment most often. The primary aim of the current study is to determine the common clinical outcomes in patients with Danis-weber type-B ankle fracture managed with open reduction and internal fixation (ORIF). This study will be useful in a sense that local data regarding this fracture managed with ORIF is quite scarce. The results of this study will be very helpful in generating local statistics about open reduction and internal fixation in Danis-weber type-B ankle fracture and to make guidelines in treating such fractures to mobilize the patients early and to avoid ankle joint stiffness.

MATERIAL AND METHODS

This study was conducted at Department of Orthopaedics, Khyber Teaching Hospital, Peshawar. Study design was descriptive case-series study and the duration of the study was 6 months in which 145 patients were observed by using 60% proportion of no pain after using ORIF surgery¹⁰ with 8% margin of error and 95% confidence interval under WHO software.

Consecutive (Non-Probability) sampling technique was used for sample collection. Patients of both genders and age between 16 to 80 years, All patients with Danis-Weber type-B ankle fracture, Patients with acute and single-sided fracture, Patients with the ability to walk without any assistance before injury were included while nonunion or Pathological fractures, trimalleolar fracture, severe open fractures, severe comminuted fractures, patients with syndesmosis instability were excluded.

The study was conducted after approval from hospital ethical and research committee. All patients presented to emergency department or admitted through O.P.D meeting the inclusion criteria was included in the study. The purpose and benefits of the study was explained to all the patients and a written informed consent was obtained. All the patients were subjected to detailed history and clinical examination. Routine investigation was done from all the patients. All patients had Radiograph done both in AP and Lateral view of the ankle joint to determine Danis-Weber Type B ankle Fracture. Patients confirmed with Weber type-B ankle fracture were operated through open reduction and internal fixation under spinal/general anesthesia. Pre-Operative antibiotic was given before application of Tourniquet. Plain films were taken immediately postoperatively to evaluate reduction. All patients were operated under the supervision of senior orthopedic surgeon, who was the fellow of CPSP and have extensive experience in his field. Patients were followed up postoperatively at sixth week. Wound was checked and stitches were removed, POP cast was removed, fracture was assessed radiologically and patients were assessed for post-operative pain. A pre-defined questionnaire (Appendix-I) was used to measure the functional outcome of ORIF. All the above mentioned information including demographic details was recorded with great patience. Strictly exclusion criteria will be followed to control confounders and bias in the study results. Data was analyzed using (SPSS) version 16 software. Mean $\pm$ SD was calculated for continuous variables like age. Frequencies and percentages were calculated for categorical variables like gender and functional outcome (Pain) of open reduction and internal fixation. Functional outcome (Pain) was stratified among age, gender to see the effect modifications. Post stratification chi square test was applied in which P value < 0.05 was considered as significant value. Results were shown in the form of tables, graphs and charts.

OPERATIONAL DEFINITIONS

Open Reduction and Internal Fixation: It was refer to open surgery of ankle fracture and internally fixing those ankle bones using screws and/or plates, or intramedullary bone nails.

Danis-Weber type-B: If the oblique fracture of fibula at the level of syndesmosis is found on radiology imaging in any of the following, it was considered as Weber type-B ankle fracture.

- At the level of the ankle joint, extending superiorly and laterally up the fibula.
- Tibiofibular syndesmosis intact or only partially torn, but no widening of the distal tibiofibular articulation.
- Medial malleolus may be fractured or deltoid ligament may be torn.
- Variable stability.

Functional Outcome: This would be assessed in terms of post-operative pain on follow up visit at 6th week that has got Weber type-B fracture and undergone ORIF.

Post-Operative Pain: Mild to no pain on Visual Analogue Scale.

RESULTS

In the present study a total of 145 patients were observed in which 55(38%) patients were in age range 20-40 years, 64(44%) patients were in age range 41-60 years and 26(18%) patients were in age range 61-80 years. Mean age was 40 years with SD $\pm$ 3.66. (Table 1). Ninety one (63%) patients were male and 54(37%) patients were female. (Table No 2). Among 145 patients

Table No 1. Age Distribution (n=145)

Age	Frequency Percentage
20-40 years	55 (38%)
41-60 years	64 (44%)
61-80 years	26 (18%)
Total	145 (100%)

(Mean age was 40 years with SD $\pm$ 3.66)

Table No 2. Gender Distribution (n=145)

Gender	Frequency Percentage
Male	91 (63%)
Female	54 (37%)
Total	145 (100%)

Table No 3. Status of Pain (n=145)

Pain	Frequency Percentage
No pain	94 (65%)
Mild pain (1-3)	29 (20%)
Moderate pain (4-6)	19 (13%)
Severe pain (7-10)	3 (2%)
Total	145 (100%)

Table No 4. Stratification of Pain With Age (n=145)

Pain	20-40 years	41-60 years	61-80 years	Total
No pain	45	44	5	94
Mild pain (1-3)	8	11	10	29
Moderate pain (4-6)	2	8	9	19
Severe pain (7-10)		1	2	3
Total	55	64	26	145

Table No 5. Stratification of Pain with Gender

Pain	Male	Female	Total
No pain	61	33	94
Mild pain (1-3)	18	11	29
Moderate pain (4-6)	11	8	19
Severe pain (7-10)	1	2	3
Total	91	54	145

Chi Square test was applied in which P value was 0.003

94(65%) patients didn't had pain, 29(20%) patients had mild pain, 19(13%) patients had moderate pain and 3(2%) patients had severe pain. (Table 3)

DISCUSSION

Ankle fractures refer to fractures of the distal tibia, distal fibula, talus, and/or calcaneus. Ankle fractures are one of the most frequently encountered musculoskeletal injuries, occurring with an annual rate of approximately 0.18%(187/100,000) in global population and 15% of all the ankle injuries are observed as ankle fractures. They represent approximately 10% of all kinds of fractures and studies show that their incidence is rising, as observed for the past 20 years.⁵

Danis emphasized that the internal fixation should be so complete and rigid that the injured joint can be exercised in the early postoperative period. The AO principles for the treatment of ankle fractures were based on Danis recommendations and on biomechanical studies of the importance of the lateral malleolus and the syndesmosis for the stability of the ankle.⁶

Increased knowledge about the normal and post traumatic anatomy, function of the ankle joint has led to demands for exact reduction and rigid internal fixation of ankle fractures. It is difficult to satisfy these demands with closed, non-operative methods of treatment. Open reduction and internal fixation is therefore the standard treatment for displaced and unstable fractures about the ankle. Cedell, Cotton C. L. and many other authors have reported better results after operative treatment as compared with closed methods.⁷

The surgical technique used in this present series contributes a precise method of open reduction and internal fixation by using dynamic compression plate or semi tubular plate and screws, malleolar screws, tension band wiring or a combination of these. Our experience of this method of fixation has given favourable results.

Our study shows that the incidence of ankle fracture was more in age group 41-60 years (44%) followed by 20-40 years (38%). Similarly the occurrence of ankle fracture was found more common in male (63%) as compare to female (37%). More over the status of pain was analyzed as (65%) patients didn't had pain, (20%) patients had mild pain, (13%) patients had moderate pain while (2%) patients had severe pain. Similar results were found in other studies like Makwana et al⁷ found superior outcome in patients of age over 55 years having Weber type-B ankle fracture managed by ORIF. In another study, Lee YS et al.⁸ retrospectively reviewed Knowles pins and lateral plates using ORIF surgery for weber type-B ankle fracture in patients with mean age 38.6 years and found both the procedures with favorable results (92% and 86.4% respectively) in terms of pain, stability of the ankle, ability to walk and run, and motion of the ankle. SrinivasNagendra G¹⁰ and fellows obtained excellent to good ratings as per Weber's protocol in 83.3% patients of malleolar fracture (weber type-B) of ankle by using ORIF surgical procedure, in which 60% of the cases had no pain. Shivarathre DG¹¹ and fellows found 86% functional outcome using ORIF surgical procedure for weber type-B ankle fracture in patients above 80 years of age. However, controversy exists regarding the surgical treatment of unstable ankle fractures in the very elderly age. But the literature regarding the prognosis of surgery in such age is very limited.

Hardware prominence is fairly common in thin individuals following ankle fracture fixation due to the subcutaneous location of the hardware². This most commonly involves lateral fibular plates and screws. Symptomatic relief can usually be obtained with outpatient hardware removal after the fracture is adequately healed. We normally encourage patients to wait 1 year from the time of surgery before removing their hardware. Patients are permitted full weight bearing after hardware removal but are cautioned against activities that could cause significant torsional force for 6 to 12 weeks following hardware removal.

The rating as per the protocol was excellent, good or poor. Of the 30 patients there were 13 patients (43.3%) with excellent results, 12 patients (40%) with good results, 5 patients (16.6%) had poor results.¹¹

The 13 patients fulfilled the criteria as per Weber's protocol and had a score of 0. Taking this into consideration they were rated as excellent.¹¹ In 12 patients, slight pain with excess activity (+), slight diminution of range of movements at ankle and subtalar joint (SD), had normal work with restriction of strenuous activity (NW RSA) and there were no complications. 5 patients had a score of 1 and 7 patients had a score of 2. Taking all these criteria into consideration this group was rated as good.

Of the 5 poor results, one case was a compound fracture. The surgery was delayed in this patient due to the compound injury. At the 6 months, he had pain with normal activity, range of movement at ankle and subtalar joint was limited >1/2 of sound side. The fracture united by 16 weeks. Patient had normal work, but limited in his activity. This patient had infection as a complication and had a score of 10 and rated poor as per Weber's protocol. Compound injury, infection, delay in the treatment were the reasons for poor result.¹¹

One case was a 50 year old male with ankle dislocation. The surgery was delayed in this case. At the end of follow up, this patient had slight pain on excess activity (+), slight diminution of range of movements at the ankle and subtalar joint. Fracture united in 14 weeks and normal work with restriction of strenuous activity was present. The score was 4 and rated poor as per Weber's Protocol. Age of the patient, delay in the treatment and severe soft tissue injury were considered for the poor result.

Another case was a 45 year old female. The patient at the end of 6 months had mild pain on excess activity, slight diminution of ankle and subtalar joint movements. The fracture united in 12 weeks. Patient had normal work with restriction of strenuous activity. The score was 3 and rated poor as per Weber's protocol. Age and being a female patient with tendency for osteoporosis were attributed for the poor result.¹⁰

Another case was a compound fracture. The surgery was delayed in this case. At the end of the follow up, the patient had mild pain on excess activity, fracture united in 14 weeks. Slight diminution of ankle and subtalar joint movements was present, and had normal work with restriction of strenuous activity. The case was given a score of 4 and rated poor as per Weber's protocol. Fracture being compound and delay in the treatment were the reasons for the poor result.

Another case was a compound Tri malleolar fracture. The surgery was delayed in this case too. At the end of 6 months, the patient had mild pain on excess activity. Slight diminution of ankle and subtalar joint movements was there. Fracture united in 16 weeks.

Patient had normal work with restriction of strenuous activity. This case had a score of 4 and was rated as poor as per Weber's protocol. Age of the patient, compound fracture, delay in the treatment and poor cooperation by the patient are attributed for the poor result.

CONCLUSION

Surgical management of malleolar fractures of ankle is simple, effective and economical which can be carried out in a minimal basic orthopedic set up. It ensures restoration of anatomy and good function of the ankle joint.

REFERENCES

1. Ankle Fracture. [Online]. [Cited on Oct 17, 2012]. Available at <http://emedicine.medscape.com/article/824224-overview#a0199>
2. Tabaković D, Manojlović R, Kadija M, Ille M, Turković G, Vukasinović Z. [Possible factors for ankle fractures]. *Vojnosanit Pregl*. 2010; 67(3): 225-28.
3. Danis-Weber classification. [Online]. [Cited on Mar 10, 2013]. Available at http://en.wikipedia.org/wiki/Danis%E2%80%93Weber_classification
4. Hermans JJ, Beumer A, de Jong TA, Kleinrensink GJ. Anatomy of the distal tibiofibular syndesmosis in adults: a pictorial essay with a multimodality approach. *J Anat*. 2010; 217(6): 633-45.
5. Schepers T, Van Zuuren WJ, van den Bekerom MP, Vogels LM, van Lieshout EM. The management of acute distal tibio-fibular syndesmotom injuries: Results of a nationwide survey. *Injury*. 2012; 43(10): 1718-23.
6. Pakarinen H, Laine HJ, Ristiniemi J. When is ankle fracture treatable without surgery *Duodecim*. 2012; 128(17): 1770-76.
7. Internal fixation. [Online]. [Cited on Mar 20, 2013]. Available at http://en.wikipedia.org/wiki/Internal_fixation
8. Lee YS, Chen SW. Lateral fixation of open AO type-B2 ankle fractures: the Knowles pin versus plate. *Int Orthop*. 2009; 33(4): 1135-39.
9. Van Schievan der Weert EM, Van Lieshout EM, De Vries MR, Van der Elst M, Schepers T. Determinants of outcome in operatively and non-operatively treated Weber-B ankle fractures. *Arch Orthop Trauma Surg*. 2012; 132(2): 257-63.
10. Srinivas NG, Prabhakar V, Siddarth M. "A Study of Surgical Management of Malleolar Fractures in Adults". *JEMDS*. 2014; 3(12): 2989-3005.
11. Shivarathre DG, Chandran P, Platt SR. Operative Fixation of Unstable Ankle Fractures in Patients Aged over 80 Years. *Foot Ankle Int*. 2011; 32(6): 599-602.

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AUTHOR'S CONTRIBUTION

Following authors have made substantial contributions to the manuscript as under:

Saqib M:	Idea and concept.
Khan SM:	Operating surgeon
Ullah S:	Bibliography.
Khan MA:	Data collection
Askar Z:	Data collection
Hayat S:	Typing.
Shah SDA:	Typing.

Authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.