Short Research Article

To Evaluate The Safety of Early Weight Bearing Following Fixation of Displaced Bimalleolar Ankle Fractures

Abstract

Fractures of the ankle joint are among the commonest fractures in adults, with an incidence of up to 174 cases per 100 000 persons per year[1]. Open anatomic reduction and internal fixation are routinely advocated for displaced, unstable ankle fractures [2–4] Although operative indications and subsequent stabilization have not changed significantly, postoperative protocols of these remain highly variable. An association have been shown by various authors between clinical outcome & postoperative radiographs. [5–7] This particular study was conducted to clarify postoperative fracture union rates, rates of hardware loosening or failure, and radiographic medial clear space changes when comparing early weight bearing (EWB) to late weight bearing (LWB) following open reduction and internal fixation (ORIF) of displaced bimalleolar ankle fractures. Weight bearing was allowed at three weeks in the early weight bearing group and when signs of radiographic union were noted in the late weight bearing group. Postoperatively, patients were evaluated at regular intervals for fracture union, signs of implant failure or loosening, and evidence of medial clear space widening radiographically. This study suggests that EWB at three weeks postoperatively does not increase markers of radiographic failure compared to six weeks of non-weight bearing (NWB), which has been regarded as the gold standard of treatment to allow for healing. Immediate weight bearing has many advantages such as gaining a good range of motion, decreasing

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risk of soft tissue atrophy and reduced osteoporosis. [8] Earlier weight-bearing will allow patients to return to their activities of daily living quicker and provide improved rehabilitation after ORIF of displaced bimalleolar ankle fractures.

Keywords: Bimalleolar ankle fracture, weight bearing, medial clear space

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Introduction

Ankle fractures are among the most common injuries treated by orthopaedic surgeons in the emergency department. Increase in the prevalence of ankle fractures over the last two decades in the young and old age patients has been observed [9,10]. Ankle fractures are complicated injuries that are difficult to manage & are prone for long-term disability and infections [11]. Recently, emphasis has been shifted to functional outcome and recovery. Faster return of function and return to work are related to rehabilitation strategy. The primary goals of fracture surgery and postoperative regimen are to minimize disability from injury. A secondary goal is to minimize the period of convalescence and thus maximize function as expediently as possible, given the usual considerations to risk and benefit. Following operative treatment of ankle fractures, most surgeons advocate a period of nonweight-bearing followed by partial progressive weight-bearing. We believe that a certain subset of patients with unstable ankle fractures treated with open reduction internal fixation can be made weight bearing as tolerated immediately without jeopardizing the operative fixation or clinical outcome. We assume that earlier weight-bearing will allow patients to return to their activities of daily living quicker, with an overall easier

time during convalescence. Earlier weight-bearing is associated with earlier return to full weight bearing without a reduction in functional outcome scores. [12,13,14] The purpose of this study is to assess the safety of early weight bearing following fixation of displaced bimalleolar ankle fractures.

Material and methods:

This prospective study was carried out among 30 patients with displaced bimalleolar ankle fractures who were admitted to the orthopaedic department at the tertiary care centre. Inclusion criteria for ORIF included patients in the age group of 18-60 years, patients showing closed Bimalleolar Fractures of Ankle, Displaced fractures of lateral & medial malleolus of ankle (more than 2 mm). Patients were followed up for a period of nine months. Patients with open fractures, Undisplaced fractures of lateral & medial malleolus of ankle, Fractures with neurovascular deficit were excluded from the study. The exclusion of open fractures allowed to assess low-energy ankle injuries with a minimal amount of soft tissue attenuation, which could have had a varying effect on healing rates regardless of postoperative weight-bearing protocol. Also excluded were patients with medical comorbidities such as diabetes or peripheral neuropathy that would preclude them from immediate weight bearing. During surgery, participants underwent rigid operative fixation of bony injuries including the lateral malleolus and medial

malleolus. The lateral malleolus was fixed using fibular plate & the medial malleolus fragment was secured by either malleolar screws of appropriate length or tension band wiring or percutaneous k wire. Fluroscopy were evaluated for evidence of residual talar tilt, medial clear space, and syndesmotic clear space. After satisfactory stability was obtained (stress negative mortise), incisions were

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irrigated and closed in layered fashion. All patients were instructed to remain non weight bearing (NWB) until their initial office follow-up at three weeks. All the patients were divided into two groups. Patients who had early weight bearing at 3 weeks post operatively in a below-knee cast (15 patients, 12 male and 3 female) were in group 1 and immobilization in a plaster splint for the first six weeks postoperatively (15 patients, 13 male and 2 female) were in group 2. Beginning at the patient's initial three-week follow-up visit, radiographs of the ankle mortise were evaluated. These were subsequently followed at routine periods postoperatively including six weeks, twelve weeks, six months, and nine months. Close attention was paid to the medial clear space, radiographic evidence of healing, and signs to suggest hardware failure (breakage). Radiographic medial clear space was measured just inferior to the medial shoulder of the talus on the ankle mortise view and was defined as normal if < 5 mm. Radiographic healing was defined as bridging bony callus at three of four cortices or disappearance of fracture lines in fractures treated with absolute stability constructs. Loosening of hardware was also investigated and was defined as lucency about a screw or "backing out" of a screw from its formerly purchased cortex. All radiographs were reviewed by the senior orthopeadic surgeon with nonunion being classified as the absence of the above signs of radiographic healing within the first six months postoperatively. While EWB was allowed strictly at three weeks postoperatively, the LWB group was allowed to weight bear after evidence of radiographic union was noted as detailed above

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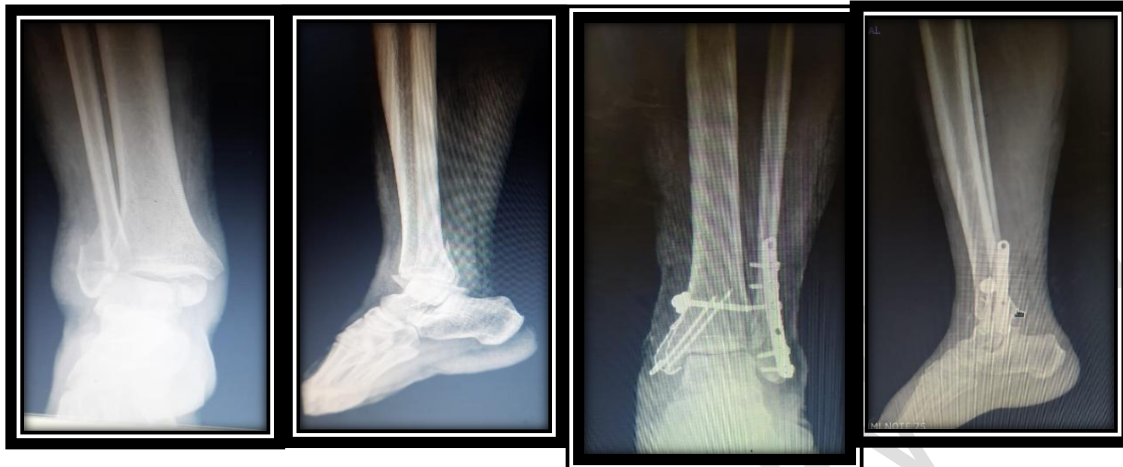
Figure 1. shows pre operative anteroposterior & lateral views of ankle & post operative anteroposterior & lateral views of ankle fixed with fibula plating & medial malleolus fixed with tension band wiring.



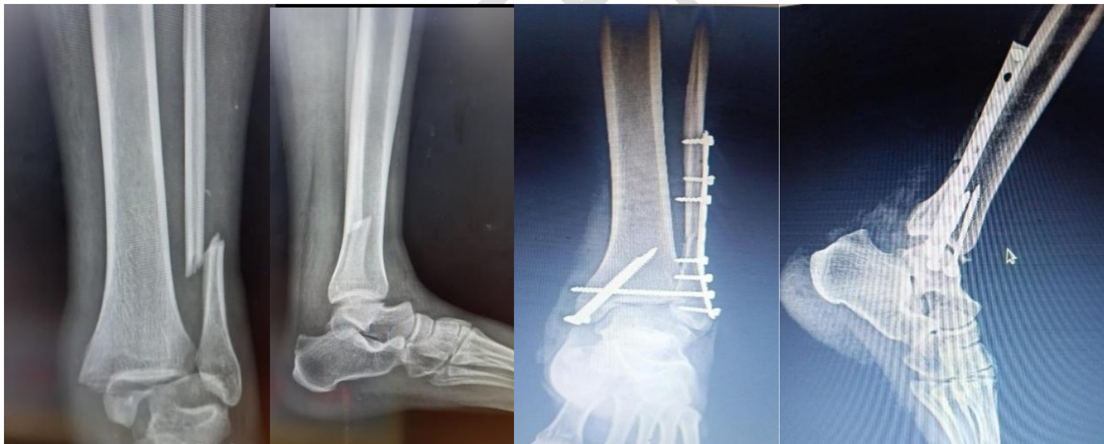


Figure 2. shows pre operative anteroposterior & lateral views of ankle & post operative anteroposterior & lateral views of ankle fracture fixed with fibula plating with syndesmotic screw & medial malleolus fixed with malleolar screw.

Results

A total of 30 patients met the inclusion criteria, and of these patients, 83% were male. The EWB and LWB groups had 15 patients each. Between the two groups, demographic recorded were: age, sex, fracture pattern, or type of fracture according to Lauge & Hansen classification. The majority of these patients (51%) suffered road traffic accidents as the primary mode of trauma. Supination External rotation type (Lauge & Hansen Type) fracture was common than other types of fracture. Mean bony union was achieved in 8.5 weeks. These findings were in consensus with the findings from the study conducted by Egol et al, Ahl et al.[15,16] In our study, no significant differences were found between the EWB and LWB groups with regard to any of the demographic variables listed in Table 1.

Variable	Delayed weight bearing (n=15) (mean)	Early weight bearing (n=15) (mean)
Age (years)	48.5	39.4
Sex (male)	86.66	80
Lauge & Hansen type (Supination External rotation)	46.6	53.3

TABLE 1: Patient Demographics

Variable (mean)	Delayed weight bearing (n=15) (mean)	Early weight bearing (n=15) (mean)
Time to full weight bearing	6.23	3.13

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(weeks)		
Union rate (%)	95.4%	100%
Time to union (weeks)	9.5	7.5
Radiographic clear space after 6 months (mm)	2.38	2.41
Implant loosening	0	0
Implant breakage	0	0

TABLE 2: Postoperative outcomes

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Simanski et al. performed a prospective study comparing functional early weight bearing (3 weeks) to 6 weeks without weight-bearing in a below knee cast [17]. No disadvantage was noted in regard to the early weight-bearing group both clinically and radiographically. Arif et al's study was the only study that we found that allowed immediate weight-bearing without a below knee cast [18].In our study, it was found that mean bony union was achieved in 8.5 weeks, mean union rate was 97.85 % while mean radiographic clear space was 2.40 mm. There was no evidence of implant loosening or breakage. These findings were in consensus with the findings from the study conducted by Simanski et al, Arif et al. In our study, no significant differences were found between the EWB and LWB groups with regard to any of the postoperative outcomes listed in Table 2.

Discussion

The EWB group achieved full weight-bearing status at an average of 3.13 weeks weeks, which was significantly lower than the LWB group at 6.23 weeks. All patients in the EWB group went to union, with time to radiographic union of 7.5 weeks on average. In the LWB group, 1/30 (3.33%) patients were designated as nonunion after six months. The remainder of the LWB group did go on to union at a time of 9.5 weeks.

Postoperatively, there was no significant difference in medial clear space between the EWB and LWB groups at any time interval postoperatively. Radiographic interpretation for implant loosening was also performed at the same time intervals, and no significant differences were noted regarding implant loosening between the two groups. Finally, implant failure was not appreciated in either patient in LWB and EWB group.

The above stated studies all suggest that earlier weight-bearing and motion would allow patients earlier return to function without any compelling disadvantage. Our findings show that earlier weight-bearing is associated with earlier return to full weight bearing without a reduction in functional outcome scores. [12,13,14]

Conclusion

This study found that EWB at three weeks following ORIF of displaced bimalleolar ankle fractures led to no increase in complications or nonunion rates. EWB for bimalleolar ankle fractures does not affect the radiographic medial clear space when compared to LWB. No differences in time to union, union rate, implant loosening, or failure were noted between the groups. Orthopedic surgeons should feel comfortable progressing patients' weight-bearing status prior to six weeks postoperatively in the setting of rigid ankle ORIF without fear of implant failure or loss of reduction. Further

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investigations are necessary to consider the clinical impact of EWB in these fractures.

References

1. Kannus P, Palvanen M, Niemi S, Parkkari J, Jarvinen M. Increasing number and incidence of low-trauma ankle fractures in elderly people: Finnish statistics during 1970–2000 and projections for the future. Bone 2002; 31: 430–3.
2. M. Bauer, B. Bergstrom, A. Hemborg, and J. Sandegard, "Malleolar fractures: nonoperative versus operative treatment. A controlled study," Clinical Orthopaedics and Related Research, vol. 199, pp. 17–27, 1985.
3. M. Bauer, K. Jonsson, and B. Nilsson, "Thirty-year follow-up of ankle fractures," Acta Orthopaedica Scandinavica, vol. 56, no. 2, pp. 103–106, 1985.
4. J. W. Mast and W. A. Teipner, "A reproducible approach to the internal fixation of adult ankle fractures: rationale, technique, and early results," Orthopedic Clinics of North America, vol. 11, no. 3, pp. 661–679, 1980.
5. G. Joy, M. J. Patzakis, and J. P. Harvey Jr., "Precise evaluation of the reduction of severe ankle fractures," The Journal of Bone and Joint Surgery Series A, vol. 56, no. 5, pp. 979–993, 1974.
6. M. A. Mont, E. D. Sedlin, L. S. Weiner, and A. R. Miller, "Postoperative radiographs as predictors of clinical outcome in unstable ankle fractures," Journal of Orthopaedic Trauma, vol. 6, no. 3, pp. 352–357, 1992.

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7. F. A. Pettrone, M. Gail, D. Pee, T. Fitzpatrick, and L. B. Van Herpe, “Quantitative criteria for prediction of the results after displaced fracture of the ankle,” The Journal of Bone and Joint Surgery—American Volume, vol. 65, no. 5, pp. 667–677, 1983.
8. Dogra AS, Rangan A. Early mobilisation versus immobilisation of surgically treated ankle fractures. Prospective randomised control trial. Injury 1999; 30(6): 417-9
9. Bauer M, Johnell O. Supination eversion fractures of ankle joint: Changes in incidence over 30 years. J Foot Ankle 1987;8:26-8.
10. Daly PJ, Fitzgerald RH, Listrup DM. Epidemiology of ankle fractures. Acta Ortho Scand, 1987;58: 539-44.
11. Carragce EJ, Csongradi JJ, Early complications in the operative treatment of ankle fractures. JBone Joint Surg 1991;73B:79-82.
12. C. J. P. Simanski, M. G. Maegele, R. Lefering et al., “Functional treatment and early weightbearing after an ankle fracture: a prospective study,” Journal of Orthopaedic Trauma, vol. 20, no. 2, pp. 108–114, 2006. 6 Advances in Orthopedics
13. G. U. L. Arif, S. Batra, S. Mehmood, and N. Gillham, “Immediate unprotected weight-bearing of operatively treated ankle fractures,” Acta Orthopaedica Belgica, vol. 73, no. 3, pp. 360–365, 2007.
14. P. Honigmann, S. Goldhahn, J. Rosenkranz, L. Audige, D. ´ Geissmann, and R. Babst, “Aftertreatment of malleolar fractures following ORIF—functional compared to protected functional in a vacuum-stabilized orthesis: a randomized controlled trial,” Archives of Orthopaedic and Trauma Surgery, vol. 127, no. 3, pp. 195–203, 2007.

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15. K. A. Egol, R. Dolan, and K. J. Koval, “Functional outcome of surgery for fractures of the ankle. A prospective, randomised comparison of management in a cast or a functional brace,” The Journal of Bone & Joint Surgery—British Volume, vol. 82, no. 2, pp. 246–249, 2000
16. T. Ahl, N. Dalen, S. Holmberg, and G. Selvik, “Early weight bearing of displaced ankle fractures,” Acta Orthopaedica Scandinavica, vol. 58, no. 5, pp. 535–538, 1987.
17. C. J. P. Simanski, M. G. Maegele, R. Lefering et al., “Functional treatment and early weightbearing after an ankle fracture: a prospective study,” Journal of Orthopaedic Trauma, vol. 20, no. 2, pp. 108–114, 2006.
18. G. U. L. Arif, S. Batra, S. Mehmood, and N. Gillham, “Immediate unprotected weight-bearing of operatively treated ankle fractures,” Acta Orthopaedica Belgica, vol. 73, no. 3, pp. 360–365, 2007.

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