The Research of Medical Science Review
ISSN: 3007-1208 & 3007-1216 Volume 3, Issue 5, 2025

SHORT-TERM FUNCTIONAL OUTCOME AFTER INTERNAL FIXATION OF UNSTABLE ANKLE FRACTURES

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DOI: https://doi.org/10.5281/zenodo.15463164

Keywords
Ankle Fractures, Functional Recovery, Internal Fracture Fixation, Postoperative Period, Short-Term Outcome

Article History
Received on 10 April 2025
Accepted on 10 May 2025
Published on 19 May 2025

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Abstract

OBJECTIVE: *To assess the short-term functional outcome after internal fixation of unstable ankle fractures.*

METHODOLOGY: *This descriptive cross-sectional study was performed at the Department of Orthopaedics, Chandka Medical College (SMBBMU), Larkana, using non-probability consecutive sampling. Patients aged 18 to 65 years, either gender, presenting with unstable ankle fractures were enrolled. Postoperatively, patients were followed up in the outpatient department at one, three, and four months to assess the functional outcomes using the American Orthopedic Foot and Ankle Society (AOFAS) scoring system, which grades outcomes as Excellent (95–100), Good (75–94), Fair (51–74), and Poor (≤50). Data were analyzed using SPSS version 26, with a significance level of $p \leq 0.05$.*

RESULTS: *In the present investigation involving 179 subjects (mean age 39.77 years; 74.9% female, 25.1% male) diagnosed with unstable ankle fractures, the application of internal fixation resulted in exemplary outcomes in 35.8% of cases and satisfactory outcomes in 38.5%, as evaluated by AOFAS scoring metrics. The functional outcomes exhibited a statistically significant association with the Lauge Hansen fracture classification ($p = 0.0001$), with particularly favorable results noted within the supination-external rotation subgroup. Conversely, factors such as age ($p = 0.318$), gender ($p = 0.593$), and additional clinical parameters including smoking ($p = 0.618$), diabetes ($p = 0.257$), and type of fracture ($p = 0.659$) did not demonstrate a significant effect on the recovery process.*

CONCLUSION: *This investigation elucidates that the internal fixation of unstable ankle fractures results in positive short-term functional outcomes, with a significant proportion of patients attaining excellent to good recovery as quantified by the AOFAS score. The outcomes were markedly affected by the fracture patterns categorized according to the Lauge Hansen classification system. These results substantiate internal fixation as a potent intervention for facilitating early postoperative recovery in cases of unstable ankle fractures.*

INTRODUCTION

Ankle fractures are among the most common orthopedic injuries seen by orthopedic traumatologists [1]. Cases of ankle fractures are increasing and this trend is expected to continue with the ageing population [2]. An increase in sports participation could also be responsible for the

increased number of these injuries, with ankle fractures being a common injury from physical sporting activities [3]. Most factures of the ankle require operative treatment, usually by open reduction and internal fixation and the benefits of stabilising these injuries are well appreciated within the medical profession [4].

Internal fixation has become a popular surgical method of treating unstable ankle fractures. The ultimate goal of operative management is to reconstruct and stabilize anatomy of the ankle joint to promote sound healing and return to function [5]. The results of ORIF on different ankle fracture types are mainly dependent on the accuracy of OR and the amount of initial injury [6]. The short-term functional outcome after internal fixation of unstable ankle fractures may vary according to numerous factors: the type and severity of the fracture, the surgical procedure, the patient's general health condition, and the rehabilitation program after operation [7].

Short-term functional results often tend to be reported weeks to months following surgery. Kumar DG et al. found excellent to good 86.6%, fair 6.6%, and poor 6.6% results [8]. In Balaji G et al. according to AOFAS scoring standard, 35%, 40%, 15% and 10% of patients obtained excellent, good, fair and poor functional outcomes respectively. Using the OMAS score, results were recorded as 26% excellent, 41% good, 23% fair, 17% poor [9].

The goal of our study is to have a functional comparison of annular fixation in an individual with unstable ankle fracture. To date, no standardized surgical protocol is available for the treatment of unstable ankle fractures. The literature on both the international and local level regarding the functional results of internal fixation in the patient population is extremely limited. This study aims to be a valuable contribution to the current literature gap due to the fact that it offers empirical evidence on the short-term functional results in patients treated with internal fixation for unstable ankle fractures. Focusing on the immediate postoperative period, this study aims to help clinicians as they strive to increase their understanding of recovery immediately after surgery and to recognize any early adverse events related to surgical treatment. Such an understanding could potentially guide toward a more tailored post-operative care, better patient education and management in general of patients suffering from these complex fracture patterns.

METHODOLOGY

This cross-sectional investigation was executed within the Department of Orthopaedics at Chandka Medical College (SMBBMU), located in Larkana. A total of 179 consecutive patients exhibiting unstable ankle fractures were selected employing a non-probability consecutive sampling methodology.

Unstable ankle fractures were characterized as those manifesting with significant pain (Visual Analog Scale [VAS] score >6) and an inability to bear weight on the compromised limb. The diagnosis was substantiated through a clinical assessment of ankle joint functionality and radiographic imaging. Fractures were categorized in accordance with the Weber Classification system, with Types A, B, and C deemed indicative of instability. The patients were between 18 and 65 years old, without any restriction of gender, who fulfilled the inclusion diagnosis like who were scheduled to have internal fixation surgery under general anesthesia were included in the study. Only patients with ASA physical status I to III were considered eligible. Excluding criteria covered individuals with neurological damage, severe cardiac or autoimmune disorders, previous ankle fractures or surgeries, open fractures, ligament lesions, as well as rejection to provide informed consent.

All study participants gave informed consent after detailed explanation of the purpose and methods of this study. Baseline demographic and clinical details had been prospectively collected on a structured proforma.

All patients received internal fixation therapy according to established orthopedic principles. Patients were then followed up in the surgical outpatient clinic at one, three and four months post-operatively for functional assessment. Functional results were measured using AOFAS (American Orthopedic Foot and Ankle Society) score, which rated outcomes as Excellent (95–100), Good (75–94), Fair (51–74) and Poor (≤50).

The dataset was subjected to analysis utilizing SPSS software, version 26. Continuous variables are represented as mean ± standard deviation, while categorical variables and functional outcomes are delineated as frequencies and percentages. Additional

comparisons were conducted employing the Chi-square test, with a p-value of ≤ 0.05 deemed statistically significant.

RESULTS

A total of 179 individuals participated in the study, with an average age of 39.77 ± 13.26 years. The age distribution revealed that 49.7% of the participants were aged between 18 and 40 years, while 50.3% exceeded the age of 40 years. A predominant proportion of the participants were female (74.9%), with the remaining 25.1% being male. Concerning the classification of fractures, 24.0% of the participants experienced open fractures, whereas 76.0% encountered closed fractures. Fracture dislocation occurred in 5.6% of the cases, while 94.4% presented without dislocation. With regard to smoking status, 33.0% of the participants identified as smokers, while 67.0% classified themselves as non-smokers. The presence of diabetes mellitus was noted in 25.7% of the participants, whereas 74.3% were categorized as non-diabetic. Hypertension was detected in 58.7% of the subjects, while 41.3% were identified as non-hypertensive. Alcohol consumption was acknowledged by 15.1% of the participants, while 84.9% refuted any alcohol use. According to the Lauge Hansen classification, the predominant pattern identified was supination-external rotation (36.3%), followed by pronation-abduction (29.6%), supination-adduction (20.1%), and pronation-external rotation (14.0%). Based on the Weber classification, type B fractures emerged as the most common (58.1%), succeeded by type C (25.1%) and type A (16.8%). Syndesmotic injury was noted in 55.9% of the participants, while 44.1% exhibited no such injury, as illustrated in Table I.

The analysis of functional outcomes in conjunction with demographic and clinical variables across a cohort of 179 patients indicated that factors such as gender, age category, fracture type, fracture dislocation, smoking habits, presence of diabetes mellitus, alcohol consumption, Weber classification, and syndesmotic injury exhibited no statistically significant correlation with functional outcomes ($p > 0.05$). Conversely, hypertension demonstrated a statistically significant correlation with functional outcomes ($p = 0.027$), as evidenced by a greater proportion of fair outcomes recorded among hypertensive patients (84.6%) in comparison to their non-hypertensive counterparts. Furthermore, a highly significant correlation was established between functional outcomes and the Lauge Hansen classification ($p = 0.0001$). Patients exhibiting the supination-external rotation pattern achieved the highest percentage of excellent outcomes (57.8%), whereas individuals with pronation-external rotation and pronation-abduction patterns generally experienced inferior outcomes (Table II).

DISCUSSION

The evaluation of early functional results after the surgical treatment of unstable ankle fractures with internal fixation is a key component in evaluating the effect of surgery on result. The functional outcomes in the present study showed that 35.8% patients had excellent functional outcomes, 38.5% had good outcomes, 14.5% had fair outcome and 11.2% had poor functional outcome. This is in strong agreement with the prospective cohort study by Balaji et al. Compared to this, [9] found 35% of their cohort had excellent results, 40% had good results, 15% deteriorated in functional status and 10% had poor results at final follow-up after surgery. This stability demonstrates a broader pattern of favorable recovery in most surgical-treated unstable ankle fractures, emphasizing internal fixation as a treatment modality with a proven track record.

Further contextualizing these outcomes, the broader literature provides evidence that supports these results, while accounting for other factors that impact the outcomes. Salas-Gómez et al. Hussey et al [10] performed a 12-month longitudinal study and found that bimalleolar fractures treated with open reduction and internal fixation (ORIF) continue to have deficits in balance, ankle mobility, and hip strength for as long as 1 year after surgery. Even though surgical management can provide some early benefit, inactivity-related impairments are likely to affect long-term function. Thus indicating that although initial results may be beneficial; durable functional improvements are contingent on long-term rehabilitation and follow-up.

Similarly, de Ávila et al. In a systematic review, [11] indicated that surgical treatment usually gives satisfactory results; however, the wide range of functional recovery is influenced by a multitude of

patient- and injury-specific factors. These include the age of the fracture, the type of fracture, the presence of comorbidities and adherence to postoperative rehabilitation. The results further highlight the necessity of a personalised strategy for post-surgical care in order to achieve improved results in diverse patient groups.

An interesting comparison arises from the study by Kho et al. [12], which explored the outcomes of intramedullary fibular nailing versus lateral locking plates. Their midterm results in young patients suggested comparable functional outcomes, indicating that the choice of fixation method may not significantly alter the recovery trajectory, provided surgical principles are upheld. Similarly, Dal Porto-Kujanpaa et al. [13] studied the short-term results of intramedullary fixation of lateral malleolus fractures and found favorable functional improvement, supporting the use of less invasive techniques in selected cases.

Tantigate et al. [14] and De Luna et al. In contrast, [15] reviewed a more complicated, specific group of ankle injuries, fracture-dislocations. They observed that surgical management did however yield reasonable outcomes here too, although De Luna et al. found that although they recovered, radiological abnormalities often remained. These studies highlight the consideration of clinical resolution and its correspondence with the radiographic resolution, which may not match perfectly

Furthermore, Albin et al. Allison et al[16] examined adjunct therapies and found a significant improvement in early postoperative function with manual therapy. This supports the idea that physiotherapeutic treatment can support surgical treatment and facilitate return to function.

Lastly, Pham et al [17]. Explain the biological perspective that enabled you to show that increased acute inflammatory cytokines and fracture malreduction were both drugs that were worse in terms of 12 months-down-the-road outcomes of the two outcomes usefully-drugged. This implies that biomechanical and biological aspects of fracture fixation should both be addressed for optimal functional outcomes.

Our findings are consistent with existing literature, reinforcing that internal fixation of unstable ankle fractures generally results in good to excellent short-term outcomes in the majority of patients. However, functional variability due to biological, mechanical, and rehabilitative factors necessitates a comprehensive and individualized treatment approach. Future studies should focus on integrating clinical, radiological, and biological markers to predict and enhance long-term recovery.

This study, while methodologically sound, had several notable limitations. Primarily, it was conducted at a single center—Chandka Medical College—which may limit the generalizability of the findings to broader populations or diverse healthcare settings. Additionally, the cross-sectional design restricts causal inferences and only captures short-term outcomes, failing to assess long-term functional or radiological progress. The study's duration of six months further narrows its scope, as many complications or recovery milestones may arise beyond this timeframe. Another limitation lies in the use of non-probability consecutive sampling, which introduces potential selection bias and limits the randomness of patient inclusion. Finally, potential confounders such as post-operative physiotherapy adherence and socioeconomic factors influencing rehabilitation were not controlled for or analyzed.

There were also limitations in study design and execution. To illustrate this fragile internal validity, we may ponder the absence of a control group (eg, conservatively managed fractures) over which treatment effect can be appraised. In addition, AOFAS score is a commonly used score, but it is partially subjective and does not account for patient-centered outcomes, such as satisfaction or quality of life. A second limitation was that only uncomplicated unstable fractures (no open fractures or ligament injuries) can be extrapolated out of the results. Likewise, even the follow-up of four months was relatively short, thus probably leading to an underestimation of late complications or delayed functional improvement.

Nonetheless, there are several strengths of the study despite these limitations. It is strengthened by a strong sample size of 179 patients. Use of a standardized classification system (Weber) and validated functional outcome measure (AOFAS score) provide consistency for diagnosis and evaluation. In addition, strict inclusion and exclusion criteria reduced heterogeneity, adding strength to the internal

validity of the study findings. Follow-ups were conducted systematically at multiple time-points providing a broad perspective of early recovery trends. Future research should incorporate multicenter designs with randomized sampling to enhance generalizability. Long-term follow-up is recommended to evaluate sustained functional recovery and late complications. Incorporating patient-reported outcome measures and examining rehabilitation adherence would also provide a more holistic view of recovery.

CONCLUSION

This investigation elucidates that the internal fixation of unstable ankle fractures results in positive short-term functional outcomes, with a significant proportion of patients attaining excellent to good recovery as quantified by the AOFAS score. The outcomes were markedly affected by the fracture patterns categorized according to the Lauge Hansen classification system. These results substantiate internal fixation as a potent intervention for facilitating early postoperative recovery in cases of unstable ankle fractures.

Table I: Baseline Demographic and Clinical Characteristics of Patients (n=179)	
Variable	**n** (%)
Age (Mean ± SD) = 39.77 ± 13.26	
18 - 40 years	89 (49.7)
>40 years	90 (50.3)
Gender	
Female	134 (74.9)
Male	45 (25.1)
Type of Fracture	
Open	43 (24.0)
Closed	136 (76.0)
Fracture Dislocation	
Yes	10 (5.6)
No	169 (94.4)
Smoking Status	
Smoker	59 (33.0)
Non-Smoker	120 (67.0)
Diabetes Mellitus	
Diabetic	46 (25.7)
Non-Diabetic	133 (74.3)
Hypertension	
Hypertensive	105 (58.7)
Non-Hypertensive	74 (41.3)
Alcohol Use	
Yes	27 (15.1)
No	152 (84.9)
Lauge Hansen Classification	
Supination-Adduction	36 (20.1)
Supination-External Rotation	65 (36.3)
Pronation-Abduction	53 (29.6)
Pronation-External Rotation	25 (14.0)
Weber Classification	
Type A	30 (16.8)
Type B	104 (58.1)

Type C	45 (25.1)
Syndesmotic Injury	
Yes	100 (55.9)
No	79 (44.1)

Table II: Comparison of Functional Outcomes with Demographic and Clinical Parameters (n=179)

Demographic and Clinical Parameter		Excellent (n=64)	Good (n=69)	Fair (n=26)	Poor (n=20)	P-Value
Gender	Male	51 (79.7)	51 (73.9)	19 (73.1)	13 (65.0)	0.593
	Female	13 (20.3)	18 (26.1)	7 (26.9)	7 (35.0)	
Age Group	18 - 40 years	30 (46.9)	34 (49.3)	17 (65.4)	8 (40.0)	0.318
	>40 years	34 (53.1)	35 (50.7)	9 (34.6)	12 (60.0)	
Type of Fracture	Open	13 (20.3)	20 (29.0)	6 (23.1)	4 (20.0)	0.659
	Closed	51 (79.7)	49 (71.0)	20 (76.9)	16 (80.0)	
Fracture Dislocation	Yes	6 (9.4)	3 (4.3)	0 (0.0)	1 (5.0)	0.322
	No	58 (90.6)	66 (95.7)	26 (100.0)	19 (95.0)	
Smoking Status	Smoker	25 (39.1)	21 (30.4)	7 (26.9)	6 (30.0)	0.618
	Non-Smoker	39 (60.9)	48 (69.6)	19 (73.1)	14 (70.0)	
Diabetes Mellitus	Diabetic	15 (23.4)	23 (33.3)	5 (19.2)	3 (15.0)	0.257
	Non-Diabetic	49 (76.6)	46 (66.7)	21 (80.8)	17 (85.0)	
Hypertension	Hypertensive	36 (56.3)	35 (50.7)	22 (84.6)	12 (60.0)	0.027
	Non-Hypertensive	28 (43.8)	34 (49.3)	4 (15.4)	8 (40.0)	
Alcohol Use	Yes	10 (15.6)	12 (17.4)	3 (11.5)	2 (10.0)	0.811
	No	54 (84.4)	57 (82.6)	23 (88.5)	18 (90.0)	
Lauge Hansen Classification	Sadd	13 (20.3)	13 (18.8)	5 (19.2)	5 (25.0)	0.0001
	Ser	37 (57.8)	18 (26.1)	4 (15.4)	6 (30.0)	
	Pabd	12 (18.8)	28 (40.6)	9 (34.6)	4 (20.0)	
	Per	2 (3.1)	10 (14.5)	8 (30.8)	5 (25.0)	
Weber Classification	Type A	12 (18.8)	12 (17.4)	3 (11.5)	3 (15.0)	0.750
	Type B	32 (50.0)	43 (62.3)	17 (65.4)	12 (60.0)	
	Type C	20 (31.3)	14 (20.3)	6 (23.1)	5 (25.0)	
Syndesmotic Injury	Yes	37 (57.8)	35 (50.7)	16 (61.5)	12 (60.0)	0.725
	No	27 (42.2)	34 (49.3)	10 (38.5)	8 (40.0)	

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