RESEARCH ARTICLE

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Evaluation of Clinical, Radiological and Functional Outcomes of Surgically Treated Ankle Fractures

ABSTRACT

Objective: The ankle is an important joint in the walking function of the body. Surgical treatment is required in cases where displaced and unstable fractures and joint compatibility cannot be achieved by conservative methods. The main goal of surgical treatment is to restore the anatomical position of the talus within the ankle for a normal tibiotalar joint relationship.

Methods: 73 patients who were admitted to our outpatient clinics between January 2006 and October 2015, who were diagnosed with ankle fracture and underwent surgical treatment, were retrospectively evaluated and compared with the intact ankle.

Results: Of the patients who had surgery; Bimalleol fracture in 34 (46.58%), trimalleol fracture in 8 (10.96%), lateral malleolar fracture in 14 (19.18%), medial malleolar fracture in 13 (17.81%), with posterior malleolar fracture in 1 ankle dislocation (1.37%) and 1 had posterior malleolar fracture with medial malleolus fracture (1.37%). According to the Lauge Hansen classification, the most common type of SER (Supination External Rotation) fracture (14 cases) (19.18%), followed by the second most common PER (Pronation External Rotation) fracture type (14 cases) (19.18%). According to the Danis - Weber classification, Type C (21 cases) (52.50%) was the most common and Type B (14 cases) (35.00%) was the second most common. When the union time was analyzed according to the fracture type, no statistically significant difference was observed (p=0.064).

Conclusions: If surgical treatment is applied in ankle fractures the length of the fibula should be ensured, rigid internal fixation should be made with the aim of anatomical reduction of the joint surface, and ankle movements should be started early.

Keywords: Adult, Ankle Fracture, Surgical Treatment.

Cerrahi Tedavi Uygulanmış Ayak Bileği Kırıklarının Klinik, Radyolojik ve Fonksiyonel Sonuçlarının Değerlendirilmesi

ÖZET

Amaç: Ayak bileği vücudun yürüme fonksiyonunda önemli bir eklemdir. Deplase ve stabil olmayan kırıkların ve eklem uyumunun konservatif yöntemlerle sağlanamadığı durumlarda cerrahi tedavi gerekir. Cerrahi tedavinin temel amacı, normal bir tibiotalar eklem ilişki için talusun ayak bileği içindeki anatomik pozisyonunu sağlamaktır.

Gereç ve Yöntem: Ocak 2006-Ekim 2015 tarihleri arasında polikliniğimize başvuran, ayak bileği kırığı tanısı alan ve cerrahi tedavi uygulanan 73 hasta retrospektif olarak sağlam ayak bileği ile karşılaştırıldı.

Bulgular: Ameliyat olan hastalardan; 34'ünde bimalleol kırığı (%46.58), 8'inde (%10.96) trimalleol kırığı, 14'ünde lateral malleol kırığı (%19.18), 13'ünde medial malleol kırığı (%17.81), 1'inde posterior malleol kırığı ile birlikte ayak bileği çıkığı (%1.37) ve 1'inde de medial malleol kırığı ile birlikte arka malleol kırığı vardı (%1.37). Lauge Hansen sınıflamasına göre en sık SER (Supinasyon Eksternal Rotasyon) kırık tipi (14 olgu) (%19.18), ardından ikinci en sık PER (Pronasyon Eksternal Rotasyon) kırık tipi (14 olgu) (%19.18) görüldü. Danis - Weber sınıflamasına göre en sık Tip C (21 vaka) (% 52.50) ve ikinci en sık Tip B (14 vaka) (% 35,00) görüldü. Kaynama süresi kırık tipine göre incelendiğinde istatistiksel olarak anlamlı farklılık gözlenmedi (p=0,064).

Sonuç: Ayak bileği kırıklarında cerrahi tedavi uygulanacaksa fibula uzunluğu sağlanmalı, eklem yüzeyinin anatomik olarak redükte edilmesi amacıyla rijit iç tespit yapılmalı ve ayak bileği hareketlerine erken başlanmalıdır.

Anahtar Kelimeler: Yetişkin, Ayak Bileği Kırığı, Cerrahi Tedavi.

INTRODUCTION

It is aimed to achieve anatomical reduction in ankle fractures even with surgical methods to protect the reduction until the fracture heals, and to restore normal function in the pre-injury period with a painless movable ankle (1-4). The main purpose of surgical treatment is to provide the anatomical position of the talus within the ankle for a normal tibiotalar relationship. The most important factors affecting the results of the treatment in ankle fractures are the fracture type, the number of fractured malleolus, the adequacy of the reduction and the age of the patient (5,6). Studies have shown that the fibula plays a key role in the reduction of ankle fractures and the lower tibiofibular ligaments are extremely important in ankle physiology. Failure to fully reduce the lateral malleolus and talar tilt are the main factors that lead to bad results (7). One of the factors causing complications in ankle fractures is diastasis of syndesmosis and enlargement of the mortis. Considering the fracture of the lateral malleolus and the type and level of the lower tibiofibular syndesmosis lesion, different surgical methods and implants are recommended (8). The purpose of this study was to evaluate the results of surgical treatment of ankle fractures and to compare the clinical, radiological and functional outcomes.

MATERIAL AND METHODS

Seventy-three patients who were hospitalized with the diagnosis of ankle fracture and underwent surgical treatment were included. Preoperative evaluation of the patients was made by standard AP (Anteroposterior) radiographs (Figure 1), lateral ankle radiographs (Figure 2), mortis radiographs and Computed Tomography (CT). The fracture types (isolated medial/lateral/posterior malleol or their combination) were evaluated by these methods. The patients were evaluated retrospectively in terms of functional and radiological aspects.

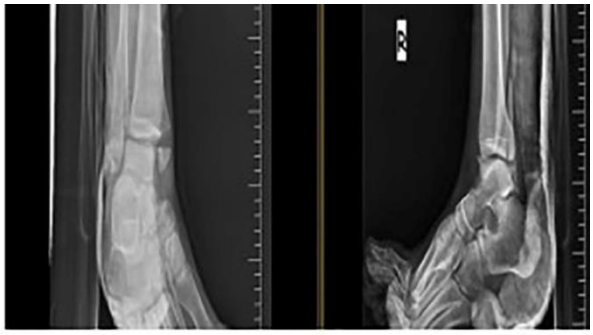

Figure 1. Preop Ap-Lateral ankle radiography

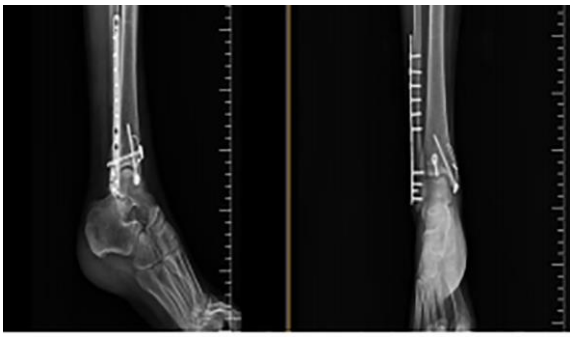

Figure 2. Postop Ap-Lateral ankle radiography

All of the patients included in the study were 18 years of age or older, and all had only one-sided ankle fracture. Ap-Lateral ankle radiographs were used for the postoperative evaluation of the patients (Figure 3).

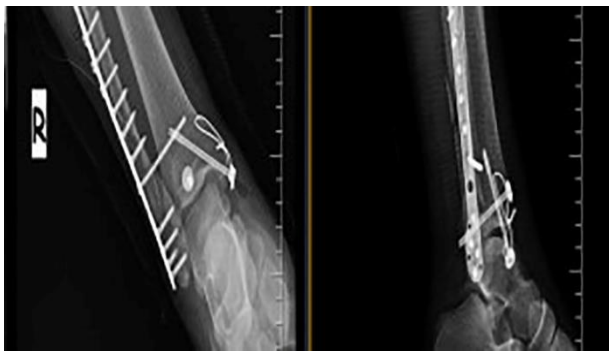

Figure 3. Malleol screw or cortical screw was used as fixation material radiography

Other accompanying extremity fractures, fracture etiology, fracture complications, range of motion after fracture union on physical examination, time to union, technique applied, fracture type, duration of treatment, hospitalization and start time, and functional results of the fractured side according to the healthy ankle were evaluated (Figure 4-5).

Figüre 4. Ankle dorsiflexion

Figüre 5. Ankle plantar flexion

In the surgical treatment, it was aimed to have the talus in anatomical position under the tibial joint surface. Even slight displacement of the talus was not accepted as it would lead to degenerative changes. Our treatment approach was surgical treatment in displaced bimalleolar fractures, displaced lateral malleolus fractures more than 2 mm and 1-2 mm enlargement in the mortis.

In cases with bimalleolar and trimalleolar fractures, the lateral malleolus was first fixed. . In cases with lateral malleolus fracture, the internal malleolus fracture was fixed after fixation of the lateral malleolus fracture. If the posterior malleolus fragment was more than 25% of the joint surface or was displaced more than 2 mm, it was surgically fixed. In patients who underwent surgical treatment for the posterior malleolus fracture, after the lateral malleolus fracture was fixed, the posterior malleolus was reached by advancing subperiostally towards the back. Following the reduction of the posterior malleolus, a small incision was made from the front (fixed with 1 screw from front to back). Fixation was applied to all cases with syndesmosis injury. Malleol screw or cortical screw was used as fixation material. The screw was sent either over the plate applied to the outer malleolus or directly over the fibula, parallel to the plafond, from posterolateral to anteromedial. Care was taken for the transfixation screw to hold the medial cortex of the tibia and pass it 2-3 cm above the plateau. The syndesmosis screw was tightened with the ankle in full dorsiflexion.

Short leg splint was applied to the patients after the operation. Sutures of the patients were removed on the postoperative 15th day. Parenteral antibiotics were given to the patients until discharge after surgery and oral antibiotherapy was started after discharge. The dressing was applied every other day until the sutures were removed. Active ankle exercises were started in the 4-6th week in cases with union, and partial weight was given after the removal of splints. Full load was allowed after complete union was seen on radiographs taken at the 10-12th week.

Functional Assessment: Orthopedic examinations of all patients who came for control were done and AP, lateral and mortis radiographs of the ankles were taken. The evaluation of the cases was done separately according to the Weber, AOFAS and Freiburg protocols.

RESULTS

The preoperative waiting period was found to be shorter in patients with a high Weber and AOFAS scores. Although it is not statistically significant according to all 3 scoring systems, the rate of bad results increases with the prolongation of the preoperative waiting period.

When we look at the distribution of postoperative late complications by fracture types, 20 of 34 patients with bimalleolar fractures had late complications. We encountered late complications after surgery in 2 patients with lateral malleolar fractures, 1 patient with medial malleolar fracture, 2 patients with posterior + medial malleolar fractures, and 1 patient with posterior malleolar fractures + ankle dislocations, and 1 patient with trimalleolar fractures (Table 1).

Table 1. Distribution of late postoperative complications by fracture type

	Late complication		Arthritis		Sudeck Atrophy		Tibiofibular Synostosis		Fibular Shortness		Wound Problem		Syndesmosis Screw Breakage		Total	
BF	17	73.91%	8	80%	6	75%	4	100%	1	50%	2	0%	1	50%	34	46.58%
LMF	2	8.70%	0	0%	0	0%	0	0%	0	0%	2	12.5%	1	50%	14	19.18%
MMF	1	4.35%	0	0%	0	0%	0	0%	1	12.5%	0	0%	0	0%	13	17.81%
TF	1	4.35%	1	10%	0	0%	0	0%	0	0%	0	0%	0	0%	8	10.96%
P+MF	1	4.35%	1	10%	1	12.5%	0	0%	0	0%	0	0%	0	0%	3	4.11%
PMF + AD	1	4.35%	0	0%	1	12.5%	0	0%	0	0%	0	0%	0	0%	1	1.37%
Total	23	100%	10	100%	8	100%	4	100%	2	25%	4	12.5%	2	100%	73	100%

BF: Bimalleolar fracture; LMF: Lateral malleolar fracture; MF: Medial malleolar fracture; TF: Trimaleolar fracture; P+MF:Posterior+ malleolar fracture; PMF + AD: Posterior malleolar fracture + ankle dislocation

When the patients with postoperative late complications were examined according to Weber classification, 2 patients with Weber A type, 2 patients with Weber B type and 7 patients with Weber C type were found. According to the Lauge-Hansen classification, 2 patients with SAD type, 2 patients with SER type, 5 patients with PER type, and 2 patients with PAP type were determined. When evaluated according to the Weber scoring protocol, 42 patients had poor results, 22 patients had good results, and 9 patients had excellent results. Excellent improvement was found to be statistically significantly higher in the 18-42 age group ($p = 0.029$) (Table 2).

Table 2. Distribution of Weber protocol results by age groups

WEBER	18-42 age		43-60 age		>60 age <		Total		
Great	5	14.29%	1	2.86%	3	8.57%	9	25.71%	**0.029**
Good	11	31.43%	9	25.71%	2	5.71%	22	62.86%	0.937
Bad	19	54.29%	20	57.14%	3	8.57%	42	120.00%	0.288
Total	35	47.95%	30	41.10%	8	10.96%	73	100.00%	

Patients scoring AOFAS a Rated by me protocol; Poor results were obtained in 5 patients and good results were obtained in 68 patients.

When the patients were evaluated according to the Freiburg scoring protocol, good results were obtained in 57 patients, moderate results in 14 patients and poor results in 2 patients (Table 3).

Table 3. Distribution of the FREIBURG protocol by age groups

FREİBURG	18-42 Yaş		43-60 Yaş		>60 Yaş		Toplam		p
Good	27	77.14%	23	76.67%	7	87.50%	57	78.08%	0.791
Medium	8	22.86%	5	16.67%	1	12.50%	14	19.18%	0.720
Bad	0	0.00%	2	6.67%	0	0.00%	2	2.74%	0.229
Total	35	47.95%	30	41.10%	8	10.96%	73	100.00%	

The mean union time for the fractures was found to be 10.22±2,31(6-14) weeks.there was not any statistically significant relationship between union time and fracture type (p<0.064).

When the patients are evaluated according to Weber protocol; Excellent results were obtained in 9 patients, good results in 21 patients, and poor results in 43 patients. Poor result was found significantly higher in bimalleolar fracture according to Weber. According to the Weber scoring protocol, excellent results were found to be significantly higher in lateral malleolus fractures (Table 4).

Table 4. Distribution of results by fracture type (Weber)

	Weber						
Fracture Type	**Great**		**Good**		**Bad**		**p**
Bimalleolar fracture	2	22.22%	5	23.81%	26	60.47%	**0.007**
Trimaleolar fracture	2	22.22%	2	9.52%	5	11.63%	0.611
Medial malleolar fracture	0	0.00%	7	33.33%	5	11.63%	0.844
Lateral malleolar fracture	4	44.44%	6	28.57%	5	11.63%	**0.048**
Medial+posterior malleolar fracture	1	11.11%	1	4.76%	1	2.33%	0.475
Posterior malleolar fracture + ankle dislocation	0	0.00%	0	0.00%	1	2.33%	0.702

Good results were found to be high in the simple fall group according to the Weber protocol (40.9%). Poor outcome was higher in the simple fall group according to the AOFAS protocol. Good results were higher in the simple fall group according to the Freiburg protocol (39.6%).

The mean AOFAS score of patients who had bimalleolar fractures and transfixed with a syndesmosis screw was 84.45, and the mean AOFAS score of those who could not be transfixed with a syndesmosis screw was 80.41. The AOFAS score of patients who had lateral malleolus fractures and transfixation with a syndesmosis screw was 92.33, and the AOFAS score of patients who were not transfixed with a syndesmosis screw was 91. The AOFAS score of patients with a trimalleolar fracture, whose posterior malleolus was fixated, was 92.11.

DISCUSSION

Ankle injuries can range from a simple soft tissue trauma or ligament injury to a complex fracture-dislocation or even traumatic amputation. In many studies, it has been emphasized that anatomical reduction is important for a good result after ankle fractures, and the type of fracture and treatment method will affect this reduction (9).

In order to get a good result in the treatment of ankle fractures, the fracture must be stabilized anatomically in the early period and early joint movement must be initiated. Some authors argue that if anatomical reduction is achieved with conservative methods, surgical treatment will not be required (10,11). In our clinic, surgical treatment is applied in cases where full anatomical reduction cannot be achieved with conservative methods in ankle fractures with intra-articular extension.

Our average time until the operation is 5.38 days. Although this period is a little longer; it is compatible with the 4.2-8.4-day periods given in the literature (12-14). Carrage et al. recommended early surgical treatment in high-energy ankle fractures, because more soft tissue problems were

seen in cases delayed for more than 24 hours (15). Fogel et al. showed that in patients with ankle fracture, the reduction would be wrong in most of the cases where surgical treatment is delayed for more than 1 week (16). Breederveld et al and Koontrath et al. evaluated the effect of delaying surgical treatment and found that there was no significant difference in results in the delayed group (1,17,18). In our study, it was observed that the average waiting period of patients with poor results in FREIBURG, AOFAS and WEBER ankle scoring systems was longer.

In cases where the medial clear space is more than 4 mm, syndesmosis or damage to the deltoid ligament is considered. Again, if the tibiofibular overlap is less than 10 mm in anteroposterior radiographs, this is an indication that syndesmosis is impaired (19,20). After the lateral malleol fixation is completed in surgery, stress test should be performed under fluoroscopy control with lateral rotation and forced eversion, and those with syndesmosis instability should be treated. In our study the syndesmosis damage was fixed by one 3.5 mm screw from the plate in 37 cases, 2 screws from the plate in 1 case, 1 free screw in 3 cases and 2 free screws in 1 case.

Early mobilization and early weight-bearing affect the results positively by preventing the adhesions (21). The recommended time for weight-bearing in cases with transfixation screws is seen to vary between 6-8-12 weeks in the literature (11-22). The patients in our study, weight bearing started in an average of 8 weeks and there was no loss of reduction. Synovial adhesion, arthritis and sudeck atrophy were observed in 10 cases where movement and weight bearing started late.

Mandracchia et al. think that maintaining fibula length and alignment has a major role in stabilizing the talar component of the ankle (11). Lateral plating is a common surgical treatment method for lateral malleolar fractures; however, complications such as wound infection and necrosis of the wound lips have been reported with a rate of 11% related to this technique (23). In elderly and osteoporotic patients, lateral plate increases wound healing problems and causes poor fixation (24). There are publications reporting that the quality of fixation can be increased in osteoporotic fractures with supportive methods and combined application of locked lateral plates (25). It has been shown that posterior plating is not mechanically different from lateral plating in osteoporotic elderly patients. Minihane et al. found that the posterior plates provided better biomechanical stability over the lateral plating (26). Işık et al. showed that surgical techniques with lateral plates and tension bands used in Danis-Weber Type A and B fractures yield excellent results and the tension band technique can be an inexpensive and acceptable treatment option in such fractures (27). For the patients in our study lateral plate-screw osteosynthesis was performed (except for 1 patient) and union was detected in all of them. Posterior plating was not preferred due to the risk of peroneal tendon irritation.

One of the common complications after ankle fracture surgery is skin problems around the incision (28). Wound and skin problems occurred in 4 patients in our study after surgery. Recovery was achieved with local debridement and dressings. Another complication that can be seen is reflex sympathetic dystrophy (29). Prolonged inactivity after surgery sets the stage for this. In our study; Reflex sympathetic dystrophy occurred in 8 (10.96%) patients.

It has been reported that the prognosis is poor in PER type injuries of the ankle (3-30). Roberts applied surgical treatment to 25 patients with malleolar fractures and reported the average follow-up results of 1.5 years, found poor results in PER type injuries in his study (31). He stated that the reason for this was that syndesmosis was not fully healed by complete ligamentous tear in PER type injuries. Yılmaz et al. stated that 31 cases at the end of an average of 26 months of follow-up had poor results in PER type injuries and the best results were in SER type injuries (32). In our study, while poor results were higher in PER injury according to Weber, good results were found to be more according to Aofas and Freiburg classifications.

Isolated posterior malleolus fractures constitute 1% of all ankle fractures and are associated with axial compression or plantar flexion injury that ankle fracture classification systems do not include (33-35). In ankle fractures accompanying posterior malleolar fractures, less satisfactory functional results are seen in relation to the size of the fractured fragment (36,37). Fixation of the posterior malleolus has been recommended in cases with trimalleolar fractures in which the posterior malleolus contains more than 25% joint surface and the talus is subluxated posteriorly more than 2 mm, and it has been reported that the size of this undetected fragment may cause poor functional results (14,30,38-40). In 9 cases with trimalleolar fractures in our study, since the posterior fragment contains more than 25% of the joint surface, it was fixed with 1 malleolar screw and the functional results of these patients were good.

CONCLUSION

As a result; we found that the rate of good results was high in patients with ankle fracture after a simple fall in etiology. We think that in patients with bimalleolar and trimalleolar ankle fractures, the fibular fixation should be done firstly and this may affect the ankle results more positively. Functional scores and results of trimalleolar fractures were found to be good. The reason for this is; it was thought that the good outcome rate in the ankle was significantly higher with posterior malleolar fracture stabilization. We also found that

the ankle functions were better in patients who started early motion. Patients who underwent surgical treatment as soon as possible had better functional results and that the longer the preoperative waiting period, the higher the poor results.

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