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Original Article

Supination-external rotation ankle fractures: analysis of clinical results after syndesmotic screw removal☆

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ABSTRACT

Objective: To evaluate the postoperative results of patients with supination-external rotation ankle fractures who underwent syndesmotic screw (SS) removal.
Methods: Retrospective cohort study assessing the late postoperative results of 35 patients operated from January 2013 to June 2015. Patients undergoing treatment of rupture of the distal tibiofibular syndesmosis with SS fixation and who did not have any concomitant surgical injuries in sites other than the ankle were included. Patients who did not complete appropriate follow-up after surgery were excluded from the study.
Results: There was no statistical significant difference in the evaluated outcomes among the patients who had their SS removed and those who remained with the SS.
Conclusion: SS removal did not significantly alter the clinical results of patients surgically treated with SS for supination-external rotation fractures.

Fraturas do tipo supinação-rotação externa: análise dos resultados clínicos da retirada do parafuso transindesmoidal

Palavras-chave:
Fraturas do tornozelo
Fixação interna de fraturas
Traumatismos do tornozelo
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RESUMO

Objetivo: Avaliar o resultado pós-operatório dos pacientes com fratura do tornozelo pelo mecanismo de supinação-rotação externa que foram submetidos a retirada do parafuso transindesmoidal (PT).
Métodos: Estudo de coorte retrospectivo que avaliou os resultados pós-operatórios tardios de 35 pacientes operados entre janeiro de 2013 e junho de 2015. Foram incluídos pacientes submetidos ao tratamento da ruptura da sindesmose tibiofibular distal com fixação com

☆ Study conducted at the Hospital Universitário de Canoas, Serviço de Ortopedia e Traumatologia, Grupo de Pé e Tornozelo, Canoas, RS, Brazil.

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PT e que não apresentavam lesões cirúrgicas concomitantes em outros sítios que não o tornozelo. Pacientes que não foram devidamente acompanhados no pós-operatório foram excluídos.

Resultados: Não houve diferença estatisticamente significativa nos desfechos avaliados entre os pacientes que tiveram o PT removido e os que permaneceram com o PT.

Conclusão: A retirada do PT não alterou significativamente o resultado clínico dos pacientes tratados cirurgicamente com PT por fraturas do tipo supinação-rotação externa.

Introduction

Ankle fractures can range from non-displaced and avulsion fractures to complex fractures, which require reduction and surgical fixation; this can be realized by different methods.[1]

Rotational lesions are the most frequent, and can be classified according to the Lauge-Hansen classification; the most common subgroup is fractures caused by the supination-external rotation mechanism (SER).[2] This type of fracture is subdivided into four stages: stage I, lesion of the anterior syndesmosis (anterior tibiofibular ligament) (SER1); stage II, oblique lateral malleolus fracture with fracture line direction from anteroinferior to posterosuperior (SER2); stage III, lesion of the posterior tibiofibular ligament or posterior malleolus fracture (SER3); and stage IV, medial malleolus fracture or deltoid ligament injury (SER4).[3]

When an ankle fracture occurs with syndesmotic diastasis (SD), several methods can be used for surgical repair, including syndesmosis fixation with syndesmotic screws (SS).[4–6] However, none of the fixation methods have shown to be superior to others. SS, despite being the most commonly used method, also presents failures from both the clinical and biomechanical standpoints. One of the drawbacks of this fixation method is that SS removal is often necessary, which can lead to additional complications.[7,8]

This study is aimed at evaluating the postoperative results of patients with ankle fractures by the SER mechanism that underwent syndesmotic screw removal (SSR).

Material and methods

This is a retrospective cohort study, which assessed the late postoperative results of 35 patients operated between January 2013 and June 2015. This study was approved by the Research Ethics Committee under registration No. 117817/2014/CAAE 40153914.4.0000.5328.

The inclusion criteria consisted of patients who underwent surgical treatment by open reduction and internal fixation of unilateral closed ankle fractures with SER-type trauma mechanism, without other associated fractures, who had undergone preoperative examinations without a cast with bilateral ankle radiography with anteroposterior, mortise and lateral views, and who signed the Informed Consent Form.

Exclusion criteria were as follows: patients submitted to conservative treatment of the fracture for reasons unique to the patient or because there was no surgical indication; associated fractures; lack of adequate skin condition, edema, and phlyctena in the lateral region of the foot, without resolution until the moment of surgery; ankle fractures by mechanisms other than the SER type; lack of clinical conditions due to vascular disorders, cardiopathies, or decompensated diabetes; severe traumatic brain injury; psychosocial issues; heavy smoking; refusal to undergo surgical treatment; bilateral fractures; fixation of the syndesmosis with two screws, removal of the one-third tubular plate or other fixation material or both in association with SSR; spontaneous breaking of the SS; and refusal to sign the Informed Consent Form.

During this period, 92 feet of 75 patients were submitted to the same surgical treatment for ankle fracture with syndesmotic lesion. All patients were called in for reassessment; 35 patients underwent surgical treatment with SS, met the inclusion criteria, and were included in the study.

All patients were assessed by the same surgeon who performed the surgery. The American Orthopedic Foot and Ankle Society (AOFAS), Global Social Functioning Scale (GSFS), visual analog (VAS), and Medical Outcomes Study 36 (SF-36) scales were used.[9]

Clinically, the following aspects were analyzed: range of motion (ROM) of the ankle in flexion and extension, return to normal activities, calf diameter, ankle width, physical therapy during postoperative recovery, and comorbidities. The Lauge-Hansen classification was used to categorize the fractures.[2]

Likewise, all patients underwent late postoperative analysis with bilateral ankle radiographs with monopodal support in lateral and anteroposterior views, and anteroposterior view with 15° of internal rotation.

The sample was divided into two groups, according to the need for SSR. Group I was composed of patients who remained with SS. Group II included patients who underwent SSR. Indication for SSR was based on the patient's complaints regarding irritation at the SS fixation site.

In the surgical procedure for the insertion of a SS, patients underwent spinal anesthesia, and were then positioned in a dorsal recumbent position, with a cushion under the sacroiliac region, ipsilateral to the fracture, and with the knee at approximately 30°–45° of flexion, held by a medical assistant. Preoperatively 2 g of intravenous cephalothin were administered. Thereafter, trichotomy and antisepsis were performed with alcoholic chlorhexidine, and sterile sheets were placed. The limb was subjected to venous drainage with an Esmarch bandage, followed by the application of a tourniquet on the proximal portion of the thigh. Surgery began with the fibula, through a posterolateral approach,[10] from the distal end of the lateral malleolus; it was extended proximally as necessary for

the placement of the chosen plate, preserving the integrity of the fibular tendon sheath and avoiding extensive detachment of the periosteum and ligaments. Subsequently, by a medial approach to the ankle,[10] the medial malleolus was reached for definitive treatment of bone and/or ligament involvement, when present. The selected plate was always that of small fragments (AO one-third tubular plate) applied on the posterolateral aspect of the fibula, of the shortest possible size; the relationship with the fibular tendons in the distal portion of the fibula was observed and interfragmentary compression was performed by using a compression screw.[11]

In order to assess the integrity of the syndesmosis, an intraoperative cotton test was performed by holding the fibula with a Backhaus towel clamp, followed by lateral traction. The stress test was considered positive when a lateral displacement greater than 3 or 4 mm was observed; in these cases, the syndesmosis was fixed[12] through the insertion of a cortical screw. Orthogonally to the plate, the screw is inserted from the fibula to the tibia, with fixation of both fibular cortices and one tibial cortex, parallel to the joint surface, 2–5 cm above it and angled at about 30° anteriorly, whenever possible, as allowed by the fracture line.

When a deltoid ligament rupture was observed, it was repaired with absorbable surgical sutures. The medial malleolus fracture was reduced and then fixed with a cortical screw for small fragments (3.5 mm) associated with a 1.5-mm Kirschner wire by using the tension band technique or by using two parallel 4-mm cancellous screws, according to the size of the fragment. After suture in layers, the limb was immobilized in a cast and kept elevated.

Patients were discharged on the day after surgery, after radiography in anteroposterior and lateral views of the operated ankle, with a cast; patients received recommendations to keep their foot elevated, as well as to use two crutches and a closed dressing. In the first postoperative week, the cast was removed, a dressing was done, and a new cast was made at 90°. In the second postoperative week, the stitches were removed, an orthopedic walking boot was prescribed, and physical therapy was initiated. Sixth weeks postoperatively, a new control radiograph was performed, and weight-bearing was permitted according to tolerance. At three months, in case of irritative symptoms of the SS, SSR was performed. In the sixth postoperative month, patients were discharged from outpatient follow-up.

The quantitative variables were described as mean and standard deviations; categorical variables were described as single (*n*) and relative (%) frequencies. The Shapiro–Wilk test was used to assess the normality of distribution. To assess the mean difference between the types of material, the *t*-test for independent samples or the Mann–Whitney test were used. To verify the existence of an association between the types of material and categorical variables, Fisher's exact test was used. The significance level was set at 5%. The statistical analyses were performed with SPSS version 18.0.

Results

The patients were evaluated clinically and radiographically, and fracture consolidation was observed in all patients around the sixth postoperative week. Regarding gender, 14 were male and 21 female; five male (36%) and six female (29%) patients underwent SSR (Table 1).

Table 1 – Demographic and clinical characteristics of the sample.

Variable	Removal of the screw				p^a
	No		Yes		
Operated side					1.000
Right	10	67%	5	33%	
Left	14	70%	6	30%	
Gender					0.721
Male	9	64%	5	36%	
Female	15	71%	6	29%	
Lauge-Hansen classification					0.174
SER2	2	67%	1	33%	
SER3	12	86%	2	14%	
SER4	10	56%	8	44%	
Return to activities					1.000
No	6	67%	3	33%	
Yes	18	69%	8	31%	
Comorbidities					0.689
No	18	72%	7	28%	
Yes	6	60%	4	40%	
Physical therapy					0.652
No	4	57%	3	43%	
Yes	20	71%	8	29%	

Data presented as *n* and %.

[a] *p*-Value for Fisher's exact test.

Regarding the type of trauma, five patients had traffic accidents, one by automobile and four by motorcycle accident; nine suffered sports injuries, of whom six were caused by soccer playing and three by skating; eight had falls from a height, one by a fall from a horse, one by a fall from a staircase, and six by falls from their own height; and 13 suffered ankle sprains. Among those who underwent SSR, two had suffered a soccer injury, one was involved in a motorcycle accident, three suffered ankle sprain, and three from falls.

Regarding the operated side, 15 underwent right ankle surgery, five of whom (33%) underwent SSR; 20 underwent left ankle surgery, six of whom (30%) underwent SSR (Table 1).

In the present sample, three patients underwent SER2-type trauma, and SSR was performed in one (33%); 14 suffered SER3, and SSR was performed in two (14%); and 18 suffered SER4, and SSR was performed in eight (44%). In the evaluation of the return to the level of activity prior to surgery, 26 patients (74%) returned to normal activities. Ten patients (28%) had comorbidities, of whom four (40%) underwent SSR.

Regarding physical therapy, seven (28%) did not undergo physical therapy; of these, three (43%) underwent SSR and one (9%) presented superficial infection, which was managed with surgical debridement and antibiotic therapy.

The results of the two groups in relation to measurements of physical examination and clinical evaluation scales are presented in Table 2; no statistical difference was observed between the two groups. Therefore, there was no difference

Table 2 – Results of the groups in relation to age, physical examination measurements, and clinical evaluation scales.

	Removal of the screw				p^a
	No ($n=24$)		Yes ($n=11$)		
	Mean	SD	Mean	SD	
Age	50.0	14.12	37.2	17.53	0.051
Difference in calf diameter	1.4	0.96	1.3	1.37	0.573
Difference in ankle width	0.5	0.31	0.6	0.46	0.552
Ankle extension	12.7	4.73	13.8	5.08	0.374
Ankle flexion	25.5	6.26	24.5	7.03	0.701
VAS scale	2.0	1.53	2.3	1.90	0.699
AOFAS scale	90.3	7.92	87.7	9.01	0.340
GSFS scale	1.5	0.88	1.6	1.03	0.532
PF_SF36 Norm-based scale scores	52.9	3.68	54.6	2.44	0.201
RP_SF36 Norm-based scale scores	46.8	6.79	48.5	7.36	0.497
BP_SF36 Norm-based scale scores	54.5	4.25	56.4	2.16	0.090
GH_SF36 Norm-based scale scores	55.4	6.75	57.1	5.72	0.466
VT_SF36 Norm-based scale scores	61.9	5.37	65.0	3.68	0.092
SF_SF36 Norm-based scale scores	47.4	8.00	46.3	8.76	0.743
RE_SF36 Norm-based scale scores	46.1	7.78	48.6	7.08	0.375
MH_SF36 Norm-based scale scores	58.3	5.95	60.2	2.49	0.780
PCS_SF36 Summary scores	50.4	4.87	52.1	4.01	0.387
MCS_SF36 Summary scores	54.0	5.68	55.5	4.90	0.540

Data presented as mean and standard deviation (SD).

[a] p-Value for the Mann–Whitney test.

in clinical outcomes between the group submitted to SSR in comparison to the group that remained with the SS.

Discussion

This study evaluated the postoperative outcome of patients submitted to SSR when compared with the group of patients who remained with SS. Several studies warned against routine implant removal after fracture healing,[5,6,13,14] and SSR is associated with potentially high complication rates. Furthermore, it cannot be predicted whether removal will result in functional improvement.[15,16]

Another argument against routine screw removal is the large amount of resources needed (operating room and time) and economic costs involved (regarding, for example, secondary surgery, surgery time, and treatment of complications).[5,17]

Several authors have reported the phenomenon of recurrent SD after SSR; in 2011, Hsu et al.[4] reported a DS recurrence of 15%.[4,18–20] In the present series, no cases of SD after SSR were observed.

In the present series, the primary complaint of patients for the indication of SSR was local irritation symptoms produced by SS located in the subcutaneous layer. No difference between the complaints was observed after SSR; this finding is in agreement with Schepers et al.[5] and Boyle et al.,[21] who demonstrated that there is no statistical advantage in SSR.

Among patients who underwent SSR, the most positive effects observed were ankle mobility improvement and pain reduction in daily activities. Despite the improvement reported by these patients, no statistically significant difference was observed between the two groups. Thus, it can be deducted that in the group of patients who underwent SSR, there is some bias in favor of the procedure, in cases in which the patient him/herself opted for SSR.[7,21]

The time indicated for the SSR varies in the literature between three and six months.[18,19] At this medical center, SSRs were performed at three months, with no serious outcomes in the present series.

In recent literature, different clinical assessment instruments have been used to evaluate clinical outcomes in patients with ankle fractures. Generally, the AOFAS scale, VAS, SF-36, GSFS, and physical examination of the ankle ROM are used. The Olerud and Molander[22] scores have also been used in current literature.[21,23] However, this score was not included in the present study; in turn, the AOFAS score was preferred, as it allows an associated objective and subjective evaluation. In the present study, the results of the different instruments used were statistically similar between the two groups analyzed.

The main limitation of the present study is its retrospective nature and the small sample, due to the fact that our hospital attends to highly complex patients, many with multiple fractures, which were not included in the analysis. Furthermore, in the present study, the use of prophylactic antibiotics during SSR was not included in the analysis because, at the time of surgery, it was not a routine practice at this hospital to use prophylactic antibiotics in this type of surgery.

Conclusion

SSR does not significantly alter the clinical outcome of patients surgically treated with SS due to SER-type fractures.

Conflicts of interest

The authors declare no conflicts of interest.

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