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Dilemmas in the choice of treatment of tibiofibular syndesmosis in malleolar fractures

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Introduction. Ankle joint fractures are one of the most common injuries dealt with by orthopedic surgeons. Objective. To determine to what extent do diagnostics, estimation and choice of treatment of tibiofibular syndesmosis injuries affect the final clinical result. Patients and Methods. The study represents retrospective-prospective analysis of the data obtained from 102 patients treated for ankle injury due to malleolar ankle joint fractures and tibiofibular syndesmosis at the Clinic of Traumatology. The average value of monitoring was 61.62 months. According to the Danis-Weber classification, C1 fracture was present in 77 respondents (75.49%); C2 in 23 (22.5%); and C3 fracture in 2 respondents (1.96%). The Danis-Weber classification was used in this paper and hence we divided 102 patients with type C fractures according to the above mentioned classification. The first group (G1) was consisted of 48 (47%) patients who had undergone the syndesmotic screw fixation during the surgery treatment of fracture stabilization. The second group (G2) was consisted of 54 (53%) patients who did not require the syndesmotic screw fixation during the surgery treatment of fracture stabilization. The syndesmotic screw was placed in cases of: supra-syndesmotic fractures of the fibula associated with rupture of the deltoid ligament and fracture types according to the Topliss A and B. Three, six and twelve months after the surgery, the clinical results were examined using the American Orthopaedic Foot and Ankle Society scoring scale. Discussion. All acute unstable injuries should be treated surgically, which includes the deltoid ligament repair, open reduction and internal fixation of the injured syndesmosis. This is considered to be the best way to avoid unwanted complications. Conclusion. There was no significant difference in the final results of treatment between patients from the group G1, where the syndesmotic screw fixation was performed, and patients from the group G2, where the syndesmotic screw fixation was not performed.

Key words: tibiofibular syndesmosis rupture, syndesmotic screw

INTRODUCTION

Ankle joint fractures are one of the most common injuries dealt with by orthopedic surgeons. The incidence rate of ankle joint fractures is around 10% of all fructures.[1]

The upper ankle joint is a modified hinge joint consisted of: the tibia, fibula and talus. Stability between the tibia and fibula of the ankle joint ensure ligamentum tibiofibulare anterius et posterius.[2] Both of these ligaments are a part of the construction of the upper, concave ankle joint. The ligaments make a tibiofibular syndesmotic base.[2-3] The tibia and fibula are widely interconnected with membrana interossea cruris. The highest outer stability of an ankle joint is provided by ligamentum calcaneofibulare, while the internal stability is provided by ligamentum deltoideum.[3]

Malleolar fractures resulting from the strong externalor forced rotation of the tibia within the fixed foot cause a partial or total rupture of interosal membrane. Syndesmosis injury can be ligamentous only, but it is often accompanied by malleolar fructure.[3]

The Danis-Weber classification of malleolar fractures is commonly used in clinical practice.[4] According to the abovementioned classification, type C fractures area ccompanied by a lesion or rupture of the tibiofibular syndesmosis and are the cause of prolonged pain in the ankle joint.[4]

The Lauge-Hansen classification provides a detailed insight into the biomechanics of the positions and movements of the feet upon the action of the force vector in the formation of malleolar ankle joint fractures.[4]

In cases when the tibiofibular diastasis is overlooked and inadequately treated, there is an increasing predisposition of the talustowards the valgus. In addition, the upper ankle joint is followed bychronic instability, pain and rapid emergence of arthrosis.[5]

OBJECTIVE

To determine to what extent do diagnostics, estimation and choice of treatment of tibiofibular syndesmosis injuries affect the final clinical result.

PATIENTS AND METHODS

The study represents retrospective- prospective analysis of data obtained from 102 patients treated for ankle injury due to malleolar ankle joint fractures and tibiofibular syndesmosisat the Clinic of Traumatology in the period from January 1st, 2003 to December 31st, 2014. The study did not include patients with an isolated lesion of syndesmosis accompanied by an angulation of the talus because there were not enough respondents to conduct a relevant statistical survey.

The study encompassed 58 males (57.87%) and 44 females (43.13%). Injuries among the respondents occurred as follows:in the winter 33 (32%), in the summer 31 (31.06%), in the fall 22 (21.21%), and in the spring 16 (15.90%)respondents.

According to the age, respondents were divided into three groups.

The first group was consisted of the respondents from 60 to 80 years. It included 18 (17.65%) respondents, that is, 6 respondents had the syndesmotic screw placed, and 12 did not.The second group was consisted of 43 (42.16%) respondents, 40 to 60 years old, that is, 22 respondents had the syndesmotic screw placed, and 21 did not. The third group was consisted of 41 (40.20%) respondents, 20 to 40 years old, that is, 20respondents had the syndesmotic screw placed, and 21 did not. Female patients were more represented in the age group of 60-80 years, while male patients were more represented in other age groups.

2 test showed that there was a significant difference between the patients of different gender regarding their association to different age groups (2 = 6.266; p = 0.044).According to the age of the patients, there was no statistically significant difference between the groups ofpatients who had the syndesmotic screw placed, and those who did not. (2 = 1.701; p = 0.427).

In order to classify fractures in 102 patients according to the Lauge Hansen and Danis-Weber classification, medical history, clinical examination and ankle joint radiography: anteroposterior (AP), lateral (LL) and "fork"orientation were used.According to the Lauge Hansen classification, in 83 (81.37%) respondents , the reason for ankle joint injury was extreme pronation and external foot rotation; in 8 (7.84%) respondents, the reason was pronation and abduction of the foot; in 7 (6.9%) was supination-adduction of the footwhile in 4 (3.8%) patients, the reason was supination accompanied by external ankle rotation.

Applying the same parameters for the respondents, according to the Danis-Weber classification: C1 fracture occurred in 77 (75.49%) patients, C2 in 23 (22.5%) and C3 fracture in 2 (1.96%).

The Danis-Weber classification was used in this paper and hence we divided 102 patients with type C fractures according to the abovementioned classification. The first group (G1) was consisted of 48 (47%) patients who had undergone the syndesmotic screw fixation during the surgery treatment of fracture stabilization. 32 males and 16 females were treated this way.

The second group (G2) was consisted of 54 (53%) patients who did not require the syndesmotic screw fixation during the surgery treatment of fracture stabilization. This group was consisted of 26 males and 28 females.

2 test showed there was no statistically significant difference between the groups of patients who had the syndesmotic screw placed (G1), and those who did not (G2). (2 = 3.553; p = 0.059)

After clinical examination and ankle joint radiography, measurement of the medial clear (empty) space (MCS) and tibiofibular clear (empty) space (TFCS) was conducted. The measurement was performed at a distance of 1 cm proximal to the tibial plaster. The average value of the MCS of the respondents belonging to the G1 group was 3.63 millimeter, while of those belonging to the G2, it was 2.94 millimeters. The results of statistical testing (t = 2.214; p =0.029) indicated that there was a significant difference in terms of higher MCS in patients belonging to the G1 group. There was also a significant difference between the genders according to the MCS (t=2.962; p = 0.004), which was higher in male patients.

The average value of TFCS patients in the G1 was 5.42 millimeters, while inthe G2, it was 4.98 millimeters. There was a statistically significant difference in the TFCS between the groups G1 and G2 (t=2.476; p= 0.015). Higher average values of the TFCS occurred in the G1patients. Syndesmotic screw wasplaced in the following cases: supra-syndesmotic fractures of the fibula accompanied by the rupture of the deltoid ligament and fracture according to Topliss A and B. In the G1 and G2 respondents, transient syndemdosiswas performed with 3.5mm cortical screw in three cortical plates. The average distance of the syndesmotic screwfrom the tibia ceiling was 2.5 cm. The screw was placed in the transverse plane at the angle of 25° to 30° in the posteolateral to anteromedial direction. Intraoperative stress test of syndesmosis stability was conducted in 34 (69%) surgically treated respondents.

In order to achieve an adequate reduction of syndesmosis on postoperative AP radiograph, the following conditions were implied - tibiofibular clear space narrower than 5mm and the tibiofibular overlap wider than 5 mm.

The adequate reduction of syndesmosis was performed on the examined sample in 44 (91.77%) patients. According to the radiological parameters in the postoperative radiograph, the acceptable reduction of syndesmosis was not achieved in 4 patients (8.33%).

In 95% of cases, routine removal of the screwwas performed in the operating room: in 51% of respondents after three months, in 37% after four months and in 12% of respondents after 6 months. In 3 patients who had had a syndesmotic screw removed after 6 weeks, a syndesmotic re–diastasis occurred. In 1 patient, transient syndesmosis occurred once again by placing the screw, and in 2 patients, placement of the screw was not done.

In these 3repondents, one year later, a mean value of the American Orthopaedic Foot and Ankle Society score (AOFAS score)[5-8] was 78 points. The sample was insufficient for a statistical verification, but it suggested that it was early to remove the syndesmotic screw after six weeks.

The average time of hospitalization of the respondents was 11.58 days for G1 patients and 13.37 days for G2 patients.

Clinical results of treated ankle joints were obtained with the usage of the American Orthopedic Foot and Ankle Society Score/AOFAS score /.[5-8]

The mobility in the sagittal plane was evaluated upon the medical examination, 12 weeks after the surgery. In this case, the rating "contracture" implieda medium or significant contracture. According to the AOFAS score, it occurred in 63 patients, that is, 43 (89.58%) were the G1 respondents, and 20 (38.46%) respondents were from the G2 group.

The rating "minimum contracture" according to the AOFAS score occurred in 5 (10.41%) G1 patients and in 22 (42.31%)G2 patients. 12 (23.8%)G1 patients had a full mobility.G1 respondents had significantly better mobility on the check-up, which was conducted twelve weeks after the surgery. 2 test confirmed the abovementioned. (2 = 30.584, p = 0.000)

The mobility and reliance on the injured leg was evaluated at the medical examination six months after the surgery.

"Full support and full mobility" according tothe AOFAS score occurred in 46 (45.09%) respondents. The aforementioned clinical findings inthe G1respondents were 28 (17.65) and in the G2 respondents 28 (53.85%). "Painful full support, minimal contracture" occurred in 3 (2.94%) patients, 2G1 patients and 1G2 patient. According to the AOFAS score, "full support, minimal contracture" occurred in 8 (7.84%)G1 respondents. "Minimum painful full support, full mobility" occurred in 11 (10.78%) respondents, that is, 2 from theG1 and 9 from the G2. "Occasionally painful full support, minimal contracture" occurred in 2 patients, one from each group. "Minimum painful full support and minimum contracture" by the AOFAS score occurred in 25 (24.51%) patients, that is, 17 (35.42%) patients from the G1 and 8 (15.38%) patients from the G2. "Minimally painful full support, contracture "occurred in1patient from the G2."Occasionally painful full support, full mobility" occurred in 1 patient from the G2.

Groups G1 and G2 were significantly different according to the results of the examination six months after the treatment. Fisher's exact test (Fisher = 25.364, p = 0.000) indicated better clinical results in the G2 group.

Using the AOFAS score, at least twelve months after the surgery, each patient underwent the final testing of the clinical, i.e. the functional status. The average pain value in G1 and G2 patients was calculated within individual pain values. The average pain value in the G1 patients was 35.42 points, and G2 patient group 34.63 points. There was no statistically significant difference between the groups (t=0.788; p=0.432). In women, pain value was 36.21 points, while in men, it was 33.41 points. According to gender, there was a significant difference in pain (t=2.884; p=0.005), in terms of higher average pain in women.

According to the AOFAS score, the average value of the clinical features of the G1 respondents was 7.88 points, and the G2 patients 7.28 points. There was a significant difference between the groups (t=2.574; p= 0.012) in terms of better clinical result of the G1 respondents.

According to the AOFAS score, the average value of the maximum distance of the G1 patients' walk was 4.54 points, and the G2 patients'4.28 points. There was no significant differences in average values of the maximum distance of the walk between the groups (t =1.946; p = 0.055). There was a significant difference between these variables among age groups (F=13.175, p =0.000). Maximum distance of the walk of the patients in the age group of 60-80 years was less.

The average value of the walking surface of the G1 patients was 3.71 points, while the one for the G2 patients was 3.41 points. There was no significant differences between the average values of the abovementioned variable between the groups (t =1.690, p = 0.094). According to the previously mentioned variable, there was a significant difference between the age groups (F=3.197; p = 0.045).

The average value of walking abnormalities in the G1 patients was 7.92 points, while in the G2 patients was 7.93 points. There was no significant difference in average values of walking abnormalities between the groups (t = -0.083; p = 0.934).

According to the AOFAS score, the average value of motions in the sagittal plane in the G1 patients was 7.50 points, and in the G2 patients was 7.70 points. There was no significant difference in the average values of motion in the sagittal plane between the groups (t = -0.858; p = 0.393).

The average value of motions in the lower ankle joints in the G1 patients was 6.00 points, and in the G2 patients was 5.89 points. There was no significant difference in the average values of motions in the lower ankle joint between the groups (t = 1.428; p = 0.159).

The average value of the ankle joint stability in the G1patients was 8.00 points, and in the G2 patients was 7.85 points. According to the AOFAS score, there was no significant difference in the average values of the stability of the ankle joint between the groups (t = 0.942; p = 0.348).

The average values of relations in the ankle joint of the G1 patients were 10.00 points and 9.93 points for the G2 patients. There was no significant difference in the aver-

age values of relations in the ankle joint between the groups (t = 1.428; p = 0.159).

The average value of the AOFAS score in the G1 patients was 91.15 points, and 89.15 points in the G2 patients. There was no significant differences in the average values of the AOFAS score between the groups (t = 1.688, p = 0.095).

The average values of the AOFAS scores between age groups were significantly different (F= 4.573; p = 0.013). The respondents aged 60-80 years had lower average values of the AOFAS score in relation to the other age groups. The respondents aged 40-60 years had higher average values in relation to the other two age groups. The respondents aged 40-60 years had higher average values of the AOFAS score in relation to the age group of 60-80 years, and lower average values of the AOFAS score in relation to the age group of 40-60 years.

One year after the surgery, only 14 (13%) patients could have carried out all the activities thatthey had been able to perform before the operation, without difficulty and pain. 26 monthsafter the surgery, 40 (41%) patients were able to perform all the activities that they had carried out before the injury and surgery.

The average length of treatment of the G1 group patients was 8.73 months, and the G2 patients 8.35 months. There was no significant difference in the average length of treatment of the patients from G1 and G2 groups (t = 1.315, p = 0.259). Also, there was no significant difference in the average length of treatment between the age groups (F = 2.733; p = 0.070), nor between genders (F = 10.440, p = 0.156). The average length of hospitalization of the G1 patients was 11.58 days, and the G2 patients 13.37 days. There was no significant difference in the average length of hospital stay between the G1 and G2 patients (t = -1.315, p = 0.192;).

The average values of monitoringof the respondents were 61.62 months and the average AOFAS score of the G1 and G2 patients was 90.16 points.

DISCUSSION

In their study on maleolar fractures by type, Bava, et al. showed that the representation of supination-external rotation was 64%, supination-adduction 12%, and the remaining 24% were pronation injuries.[8] In the study conducted in Minnesota by Yasui, et al., the representation of supination injuries was more than 60%, and of pronation injuries up to 40% .[9] In the pronation injuries, there was more frequent occurrence of supra-syndesmotic fractures with syndesmosis lesion.[9] According to the Lauge- Hansen classification of ankle joints, there were 83 (81.37%) respondents with the extreme pronation and external rotation of the foot; 8 (7.84%) respondents with the pronation and abduction of the foot;7 (6.9%) respondents with the supination - adduction of the foot, and 4 (3.8%)respondents with the supination followed by external rotation of the ankle joint.

Many authors claim that, after the injury of the lateral malleolus and syndesmosis , the instability of the ankle joint causes a lateral talus declination.[5] Kennedy,et al. presented their experience gained during the treatment of 45 injuries of lateral malleolus and syndesmosis.[6]The respondents with the same or similar characteristics were allocated into two groups: G1 and G2. The G1 group was consisted of 36patients who had had the syndesmotic screw placed, while the G2 group was consisted of 9 respondents who had not had the syndesmotic screw placed.[6]

According to the Dennis Weber classification, Weening, et al.treated 51ankle joint type C fractures by applying the syndesmotic screw.[5] In our study, 48 G1 respondents with the type C fractures (according to the Dennis Weber classification) had the syndesmotic screw placed. The average age of the respondents in our study was 47.43 years, while in the study conducted by Weening, et al., the average age was 40.6 years. The males in our studyrepresented 56.9% of the respondents, and 67% in the study conducted by Weening, et al.[5]

All asute unstable syndesmosis injuries should be treated surgically, which includes the deltoid ligament repair, open reduction and internal fixation of the injured syndesmosis. This is the best way to avoid unwanted complications.[5-8]

The clinical result showed that there was no difference between the respondents who had the syndesmotic screw placed 2 cm proximal to the ankle joint and those who had the syndesmotic screw placed 3 to 5 cm proximal to the ankle joint. Nevertheless,a general recommendation is to place a syndesmotic screw 3 to 5 cm above the ankle join .[7]

Certainly, there are opinions that stabilization of syndesmosis with the usage of screws causes limited mobility in the ankle joint, but most experts agree that it is only temporary.[8-10] The basic form of treatment is establishing and maintaining proper tibiofibular relationat the location of complete syndesmosis lesion.[10]

The average value of the AOFAS score of comparable patients in the study conducted by Yang Y, et al. witha follow-up period of 31.2 months was 86.67. [11] In our study, the value was 90.16 points. In their paper, Hamid, et al.provided final results of treatment of the syndesmosis lesions in 52 respondents who had had thesyndesmotic screw placed. One group was consisted of patients who removed the screw or the same burst prematurely. The average results of the AOFAS score in the group of patients with the broken screw was 92.40, and the ones with the screw removed was 85.80.[12]

CONCLUSION

There was no significant difference in the final results of treatment between theG1 patients, consisting of patients who had the syndesmotic screw placed,and the G2 patients, consisting of patients whodid not have the syndesmotic screw placed.

There was no significant difference in the duration of treatment and hospitalization among the G1 and G2 groups.

Significantly better average values of mobility, presented in the G2 patients at the examination three and six months after the surgery, were transient.

SUMMARY

DILEME U IZBORU LIJEČENJA TIBIOFIBULARNE SINDESMOSE KOD MALEOLARNIH PRELOMA

Uvod. Prelomi skonog zgloba su jedna od najčešćih povreda kojima se bave ortopedski hirurzi. **Cilj rada.** Utvrditi koliko dijagnostika, procijena i izbor liječenja povrede tibiofibularne sindezmoze utiče na definitivan klinički rezultat. **Ispitanici i metode.** Rad predstavlja retrospektivno-prospektivnu analizu podataka 102 ispitanika liječena zbog povrede skočnog zgloba na klinici za traumatologiju zbog maleolarnih preloma skočnog zgloba i tibiofibularne sindesmose. Prosjena vrijednosti praćenja ispitanika bila je 61,62 mjeseca. Prema Danis-Weber klasifikaciji ispitanici su imali: C1 prelom 77 (75,49%) ispitanika, C2 kod 23 (22,5%) i C3 prelom kod 2 (1,96%). U radu se koristi Danis-Weber-ova klasifikacija tako da smo 102 ispitanika sa prelomom C prema Danis-Weber-ovoj klasifikaciji podjelili u dvije grupe. Prva grupa (G1) imala je 48 (47%) ispitanika kod kojih se tokom operativnog zahvata stabilizacije preloma postavljao i sindezmodetski šraf. U drugoj grupi (G2) bila su 54(53%) ispitanika kojima se tokom operativnog zahvata stabilizacije preloma nije postavljao sindezmodetski šraf. Sindezmotski šraf postavljan je kod: suprasindezmoznih preloma fibule udruženih sa rupturom deltoidnog ligamenta i preloma po Topliss A i B. Kliničke rezultati ispitivani su poslije tri, šest i dvanaest mjeseci koristeći American Orthopedic Foot and Ankle Society-skor poslije operacije. **Diskusija.** Sve akutne nestabilnosti sindezmoze se trebaju tretirati hirurški što uključuje reparaciju deltoidnog ligamenta, otvorenu redukciju i internu fiksaciju povrijeđene sindezmoze. To je najbolji način da se izbjegnu neželjene komplikacije. **Zaključak**: Nema značajne razlike u konačnim rezultatima liječenja između pacijenata grupe G1, koju čine pacijenti kojima se aplicira sindezmodetski šraf i pacijenata grupe G2, koju čine pacijenti kojima se ne aplicira sindezmodetski šraf.

Ključne riječi: Ruptura tibiofibularne sindesmoze, sindesmotski šraf

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