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Arthroscopy diagnostics of ankle joint injuries of patients with unstable/dislocated supination rotational ankle fractures with or without tibiofibular syndesmosis rupture

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SUMMARY

The development of arthroscopy of the ancle joint has influenced the development of the aforementioned therapetic procedures for a wide range of injuries in the ankle. We observed a group of 20 patients with dislocated supinated extrarotated ankle fractures. (S-ER Lauge Hansen). Each time the ORIF was supported by anteromedial and anterolateral. The lesion of cartilage was assassed Rusing Outerbridge's classification. Disruption of tibiofibular syndesmosis was confimed Turing the burgery Rusing Cotton test. The lesion of C cartilage was fund In 55% patients. Most frequent on the medial side of the talar dome 25%. Disruption of tibiofibular syndesmosis was detected In 5 patients. The additional arthroscopy extends the duration of burgery to 30 minutes. The arthroscopy enables the confirmation of the anatomical reposition of fracture.

Key words: arthroscopy of the ancle, ancke fractures, syndesmosis ruptures

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BACKGROUND

The ankle joint is the most frequently injured joint that carries body weight [1, 2]. The injury predominantly results from the damage caused by an indirect mechanism. Fracture of ankle joint is a result of the dislocation of the talar dome. The direction of translation and rotation of the talus reflects the direction of the affecting force and the anatomy of the subtalar joint. The diagnosis of the ankle fracture is based on the clinical evaluation and post-injury radiogram. This joint is most frequently diagnosed from radiograms in the antero-posterior and lateral view. Typically, radiograms in Cobba projection (20-degree internal rotation) are used in order to obtain more accurate morphology and to detect potential incongruence in the joint. In everyday practice ankle fractures are classified on the basis of the Danis-Weber and Lauge-Hansen system [3]. The Weber classification focuses on the integrity of the syndesmosis, which holds the ankle mortise together and it is based on the level of lateral malleolus fracture. [3, 4]. The Lauge-Hansen system focuses on the trauma mechanism (setting of a foot during injury and the direction of affecting force) [3,5]. Adding the stages of Lauge-Hansen to the Weber system often helps to predict ligamentous injury and instability of the ankle joint. 85% of ankle fractures occur as a result of an exorotation force on the supinated foot (S-ER according to Lauge-Hansen) [6]. Unstable ankle fractures are usually managed with open reduction and internal fixation (ORIF). Because of the widespread application of arthroscopy of a knee, both ARIF (arthroscopy replacement and internal fixation) and ORIF supported by knee arthroscopy have gained popularity. The development of arthroscopy of the ankle joint has influenced the de-

velopment of the afore-mentioned therapeutic procedures for a wide range of injuries in the ankle. A common indications for ARIF and ORIF assisted with arthroscopy of the ankle joint are : cartilage and subcartilage bone injury of the talar dome, low-level fractures of the distal tibia and fibula, rupture of distal tibiofibular syndesmosis and chronic pain after malleolus fractures [7]. Contraindications against arthroscopy of the ankle are: open fractures, additional nerve and vascular injuries and large swelling of the ankle.

Tab. 1. Age and sex of the patients

Age	Male	Female	Total
<20	1	0	1
20-29	2	4	6
30-39	2	2	4
40-49	3	1	4
50-59	1	1	2
50-69	0	2	2
70-79	0	1	1
Total	**9**	**11**	**20**

MATERIAL AND METHODS

In the period between September 2013 and December 2014 we observed a group of 20 patients. The group included 11 females and 9 males with a mean age of 38.8 years (18-79). The qualification criteria were: dislocated supination-exorotation ankle fractures (S-ER, Lauge-Hansen). The criteria were based on radiological evaluation – unstable, dislocated fractures are defined as those which have dis-

Tab. 2. The relationship between the fracture type, injury in the articular cartilage and the accompanying ligaments rupture

	Gender	Age (years)	Fracture type classification Lauge'a-Hansen	Fracture type classification Lauge'a-Hansen	Articular cartilage lesion	Additional ligament rupture
1.	F	35	S-ER 4	III°	Talar dome medial side	Talofibular syndesmosis
2.	M	44	S-ER 4	—	—	—
3.	F	79	S-ER 4	I°	Talar dome lateral side	—
4.	F	57	S-ER 2	—	—	—
5.	M	51	S-ER 4	II°	Talar dome medial side	—
6.	M	43	S-ER 2	—	—	—
7.	F	29	S-ER 2	I°	Talar dome lateral side	—
8.	F	67	S-ER 1	—	—	—
9.	M	32	S-ER 4	III°	Talar dome central part	Talofibular syndesmosis
10.	F	41	S-ER 4	II°	Talar dome medial side	Deltoid ligament
11.	F	29	S-ER 2	—	—	—
12.	M	18	S-ER 2	I°	Talar dome central part	—
13.	M	22	S-ER 4	—	—	—
14.	F	60	S-ER 2	—	—	—
15.	F	29	S-ER 4	II°/I°	Talar dome medial side. Tibia inferior articular surface	Talofibular syndesmosis
16.	M	33	S-ER 2	I°	Talar dome lateral side	—
17.	F	21	S-ER 3	—	—	Talofibular syndesmosis
18.	M	49	S-ER 4	III°/I°	Talar dome medial side. Tibia inferior articular surface	Talofibular syndesmosis
19.	F	37	S-ER 4	II°	Talar dome medial side	Deltoid ligament
20.	M	23	S-ER 1	—	—	—

location of fragments larger than 2mm or have a gap in the medial side that is larger than 2 mm.

For preoperative assessment we used the post-injury radiograms classified according to the Lauge-Hansen's system (the research patients are described in Table 2). There were 10% of S-ER 1 fractures, 35% of S-ER 2 fractures, 5% of S-ER 3 fractures, and 50% of S-ER 4 fractures. The patients were operated under general or spinal anesthesia. We use the tourniquet as a general procedure. Each time ORIF was supported by arthroscopy of the ankle joint in order to confirm the anatomical reposition of the fracture and in order to detect and treat potential injuries in the joints. The arthroscope used was a Stryker 30° oblique view and 4 mm diameter. Arthroscopy was performed through two ports: anteromedial and anterolateral in order to obtain a broader insight into the joint. There was no posterior approach in any case. The operated limb was set on a leg holder on the level of a thigh, so the traction of the ankle joint was only affected by the gravity force. The lesion of articular cartilage was assessed using the Outerbridge's classification [10]. Disruption of tibiofibular syndesmosis was confirmed during the surgery using the Cotton test and with arthroscopy by detecting diastasis larger than 2 mm in the distal tibiofibular joint [11, 12]. The lesion in the joint cartilage detected in arthroscopy was treated by shaving and removing free cartilaginous fragments located within the joint. After the surgery, the operated limb was immobilized in a splint.

RESULTS

The lesion of the cartilage surface was found in 11 out of 20 patients (55%). The most frequent location of the injury was the medial side of the talar dome (25%). Other locations were the lateral side of the talar dome (15%), the central part of the talar dome (15%), and the tibial plafond (10%). Disruption of the tibiofibular syndesmosis (rupture of the lower anterior tibiofibular ligament and/or lower posterior tibiofibular ligament) was detected in 5 patients using arthroscopy. Four of them had a positive Cotton test and in the case of those patients we used a syndesmotic positioning screw. In two cases during arthroscopy we detected a total rupture of the deltoid ligament (10%), which was treated surgically using the medial approach. One patient had an infection of the postoperative wound (approach to the lateral malleolus), which was treated with targeted antibiotics. Another complication was prolonged fluid leak from the wound (anterolater-

Fig. 1. Post-injury radiogram; antero-posterior view. Ankle fracture classified as S-ER 4 by Lauge-Hansen

Fig. 2. Post-injury radiogram; lateral view. Ankle fracture classified as S-ER 4 by Lauge-Hansen

al portal), which lasted for 4 days after the surgery. The fluid leak was controlled with anti-inflammatory and edema drugs coupled with the limb elevation.

Statistical analysis

Statistical analysis was done using STATISTICA 12.5 system. Our aim was evaluation of the association between two variable in which we used Chi-square distribution test. Strengths of the association of random variable we estimated by means of calculation factors: Pearson's Chi-square, Kandell's tau b and c and Spearman's correlation. For all analysis we assume significance level equal 0,05.

DISCUSSION

The aim of this study was to assess the frequency, location, and severity of articular cartilage lesions with co-existence of unstable/dislocated ankle joint fractures as a result of an exorotation mechanism qualified for surgery. It was not our aim to evaluate potential advantages resulting from the application of arthroscopy as supplementary to ORIF. Classic radiograms of ankle joints made immediately after the injury allow the detection of ankle fractures, however they do not allow for the diagnosis of lesions of the articular cartilage. The diagnostic tool which allows evaluation of the articular surface is magnetic resonance (MRI). The great advan-

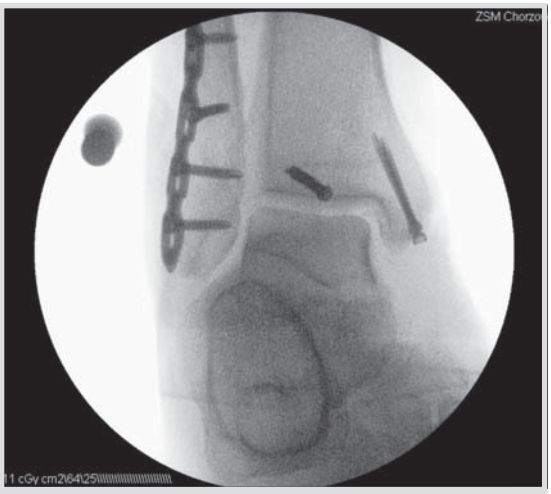


Fig. 3. Control intraoperative radiogram; Cobba projection

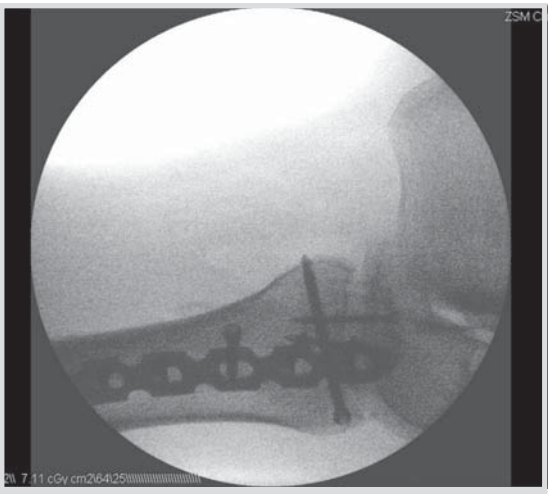
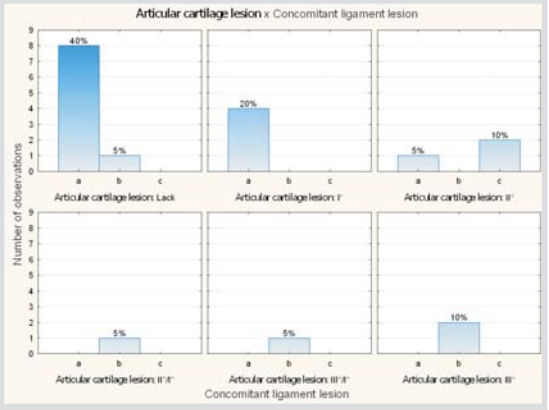
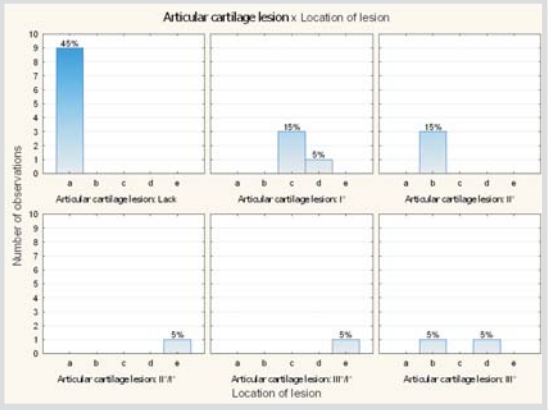


Fig. 4. Control intraoperative radiogram; lateral view



Tab. 3. Additional ligament rupture; a – lack , b – tibiofibular syndesmosis, c – deltoid ligament



Tab. 4. Localisation of lesions; a – lack, b – medial side of the talar dome, c – lateral side of the talar dome, d – cental part of the talar dome, e – medial side of the talar dome; tibial plafond

tage of MRI is the possibility of additional visualization of the ligament structures and importantly, the structure of the subchondral bone [13]. An invaluable asset of arthroscopy over MRI is the possibility of direct inspection of the joint and the treatment of potential articular lesions. While reviewing the literature, we found reports of negative clinical outcomes after the surgical treatment of the ankle fracture despite obtaining the anatomical reposition. The predicted reasons for this are lesions in the articular cartilage, rupture of the ligaments and free elements in the joint [14,15,16,17,18]. In our opinion, the arthroscopy of the ankle joint, as supplementary to ORIF, is an integral part of diagnosing and treating the aforementioned injuries. The frequency of articular cartilage lesions in ankle fractures range from 20% to 79% [14,15]. This disproportion seems to be caused by different authors using different scales for measuring cartilage lesions. Yao and Weis [19] presented a mechanism of the injury of the articular cartilage of the talar dome, according to which the lesions in the lateral side of the talar dome were caused by eversion and dorsiflexion of the ankle joint with the internal-rotated tibia. The lesion in the medial part of talar dome results from the injury in the inversion mechanism and dorsiflexion of the ankle joint. Our results show a similar higher frequency of cartilage lesions in the medial part of the talar dome of an S-ER fracture. (p=0,03). On the basis of statistical analyses we were able to confirm the relationship between the severity of chondral lesions and their localization (p=0,0002). Similar to Loren and Ferkel [8], we found a correlation between the severity of a cartilage lesion in an ankle fracture with accompanying disruption of tibiofibular syndesmosis (p=0,007). We have also confirmed that ankle arthroscopy can aid analysis of different patterns of syndesmosis diastasis (which are hard to detect in traditional radiograms) and also guide anatomic reduction of the syndesmosis [20]. In each of the twenty patients in our study, arthroscopy was helpful in diagnosing the anatomical replacement of a fracture. Arthroscopy was used in removing the articular hematoma and planning the treatment of joint injuries (ligaments rupture and joint cartilage lesions).

We are convinced that the open reduction with internal fixation of the ankle fracture, supplemented with arthroscopy, allows the diagnosis and treatment of joint injuries, which, in our opinion, has a direct impact on improving ultimate treatment effects.

CONCLUSIONS

1. Additional arthroscopy of the ankle joint enables the confirmation of the anatomical reposition of fracture.
2. The arthroscopy of the ankle joint is a valuable diagnostic/therapeutic tool in articular lesions accompanying the ankle fracture.
3. The arthroscopy of the ankle joint facilitates the diagnosis of the disruption of tibiofibular syndesmosis.
4. The articular cartilage lesions of the talar dome accompanying the rupture of tibiofibular syndesmosis are more severe and more common.
5. The most common location of cartilage lesions of ankle fractures resulting from the supination rotational mechanism is the medial part of the talar dome.
6. Additional arthroscopy of the ankle joint extends the duration of surgery to 30 minutes.

REFERENCES

1. James D. Michelson. Ankle Fractures Resulting From Rotational Injuries. J Am Acad Orthop Surg 2003; 11:403-412.
2. Michael J.Coughlin, Charles L.Saltzman, Robert B.Anderson Mann's Surgery of the foot and ankle. ed. 9. Philadelphia:Elsevier; 2014.
3. Aleksandar Lesic, Marko Bumbasirevic. Ankle fractures. Current Orthopaedics 2004; 18: 232–244.
4. Malleolar fractures, in Müller ME, Allgöwer M, Schneider R, Willenegger H (eds): Manual of Internal Fixation: Techniques Recommended by the AO Group, ed 2. Berlin, Germany: Springer-Verlag, 1979; 282-299.
5. Lauge-Hansen N: Fractures of the ankle. Combined experimental-surgical and experimental-roentgenologic investigations. Arch Surg 1950; 60:957-985.
6. Burwell HN, Charnley AD. The treatment of displaced fractures at the ankle by rigid internal ?xation and early joint movement. J Bone Joint Surg Br 1965; 47:634-660.
7. Davide E. Bonasia,Roberto Rossi, Charles L. Saltzman, Annunziato Amendola. The Role of Arthroscopy in the Management of Fractures About the Ankle. J Am Acad Orthop Surg 2011; 19:226-235.
8. Gregory J. Loren and Richard D. Ferkel. Arthroscopic Assessment of Occult Intra-articular Injury in Acute Ankle Fractures. The Journal of Arthroscopic and Related Surgery 2002; 4: 412–421.
9. Phillips WA, Schwartz HS, Keller CS, et al. A prospective, randomized study of the management of severe ankle fractures. J Bone Joint Surg Am 1985; 67:67-68.
10. Outerbridge RE. The etiology of chondromalacia patellae. *J Bone Joint Surg Br* 1961; 43:752-757.
11. Ogilvie-Harris DJ, Reed SC. Disruption of the ankle syndesmosis: diagnosis and treatment by arthroscopic surgery. Arthroscopy 1994; 10:561-8.
12. Andrea Emilio Salvi, Giovanni Pietro Metelli, Rosita Bettinsoli, Steven Adam Hacking. Arthroscopic-assisted fbular synthesis and syndesmotic stabilization of a complex unstable ankle injury. Arch Orthop Trauma Surg 2009; 129:393–396.

13. Masato Takao, Mitsuo Ochi, Yuji Uchio, Kohei Naito, Taisuke Kono, and Kazunori Oae. Osteochondral Lesions of the Talar Dome Associated With Trauma. The Journal of Arthroscopic and Related Surgery 2003; 10:1061-1067.
14. Atsushi Ono, Shinji Nishikawa, Akihiko Nagao, Tomoyuki Irie, Motoshige Sasaki and Teruo Kouno. Arthroscopically Assisted Treatment of Ankle Fractures: Arthroscopic Findings and Surgical Outcomes. The Journal of Arthroscopic and Related Surgery 2004; 20:627-631.
15. B. Hintermann, P. Regazzoni, C. Lampert, G. Stutz, A. Gächter. Arthroscopic ?ndings in acute fractures of the ankle. J Bone Joint Surg [Br] 2000; 82-B:345-51.
16. Van Dijk CN, Verhagen RAW, Tol JL. Arthroscopy for problems after ankle fracture. J Bone Joint Surg Br 1997; 79:280-284.
17. Ferkel RD, Orwin JF. Arthroscopic treatment of acute ankle fractures and postfracture defects. In: Ferkel RD, ed. Arthroscopic surgery. Philadelphia: Lippincott-Raven 1996; 185-200.
18. Nikoletta Leontaritis, Lauren Hinojos and Vinod K. Panchbhavi. Arthroscopically Detected Intra-Articular Lesions Associated with Acute Ankle Fractures. J Bone Joint Surg Am. 2009; 91:333-9.
19. Yao I, Weis E. Osteochondritis dissecans. Orthop Rev 1985; 14:190-194.
20. K. Sri-Ram, A.H.N. Robinson. Arthroscopic assessment of the syndesmosis following ankle fracture. Injury, Int. J. Care Injured 2005; 36: 675—678.