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Missed talar neck fractures in ankle distortions

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Objectives: Thirty-nine percent of the ankle and midfoot fractures in ankle distortions could be missed during initial evaluation in emergency department because of inadequate clinical and radiological evaluation in a limited time. We aimed to evaluate the follow-up and treatment outcomes of subjects with missed fractures, which were not diagnosed with plain radiographs obtained for ankle distortion, but with advanced imaging studies.

Methods: Eight patients (4 females, 4 males) who were initially treated with a diagnosis of ankle distortion due to trauma between 2004 and 2008 were included in the study. Since there were no fractures in the initial radiographs reported by radiologists, conservative treatment was applied. However, the pain and swelling around the ankle were sustained and advanced imaging studies revealed talus fracture. All patients were evaluated with the scoring system of American Orthopedic Foot and Ankle Society (AOFAS).

Results: Mean age of the patients was 22.37 years (range 20-40 years) at the initial fracture diagnosis. The talar neck fracture was diagnosed with computed tomography (CT) in 1 patient and with magnetic resonance imaging (MRI) in the remaining 7 patients. Mean follow-up time was 6 months (range 3-8 months), and mean AOFAS score at last follow-up was 93.7 (range 80-100).

Conclusion: Talus fractures can lead to serious complications because of its anatomical localization. Areas with edema, tenderness or pain should be defined on physical examination, and deep palpation should be applied on the lateral aspect of the talar neck. If there is pain in this area at late examination and no fracture was reported with conventional radiographs, the possibility of missed talar fracture should be considered and the patient should be evaluated with CT or MRI.

Key words: Ankle; distortion; fracture; talus.

Ankle distortions are quite common and usually associated with ligamentous injury. Thirty-nine percent of the ankle and midfoot fractures could be missed during initial evaluation in emergency department, because of inadequate clinical and radiological evaluation in a limited time.[1,2] Fifty percent of missed fractures due to ankle distortions happen in talar bone. The overlapping of bony structures in conventional radiographs or inadequate experience of the physician can lead to the missed diagnosis of these particular type of fractures. A thorough evaluation should be done with computed tomography (CT) or magnetic resonance imaging (MRI) if there is any suspicion of fracture.[3]

In this study, we aimed to evaluate the treatment and follow-up outcome of unrecognized fractures of talus, which were established with advanced imaging techniques. Advanced imaging was performed

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because of pertinence of complaints of the patients initially diagnosed as normal with conventional radiographs for distortion of the ankle.

Patients and methods

We included eight patients in this study who were initially treated because of ankle distortions and had unrecognized talar fracture between 2004 and 2008. The etiology was ankle distortion during sports activities in two cases, and distortion while walking on the sidewalk in the others. The time period between the dates of admission for ankle distortion and diagnosis of talar fracture was determined. All missed fracture cases were evaluated prospectively. A query for the diagnosis of ankle distortions strain or injury according to the codes of International Classification of Diseases (ICD) was performed from our patient database. We found that 3,100 patients who admitted to emergency service or our out-patient clinic because of ankle injuries were diagnosed initially with the conventional anteroposterior and lateral radiographs of the ankle. We also observed that 2,140 of these cases (71.4%) were re-evaluated one week later, and they declared that symptoms were relieved. Eight patients (0.4%) had edema around the ankle, difficulty to bear weight, and local tenderness above anterior talofibular ligament (ATFL) while ankle was held in plantar flexion and internal rotation. The initial radiology reports for these patients did not mention any fracture, thus, they all were treated initially with conservative methods. There were actually 11 patients, with the same complaints, but since no signs of fracture could be detected despite advanced imaging techniques in three of them, they were excluded from the study with the diagnosis of sot tissue trauma. We also excluded the patients with suspicious fracture lines due to high-energy trauma other than distortion injury.

Four of the patients were male and the other four were female. The mean age was 22.37 years (range 20-40 years) at the time of diagnosis. Seven of the fractures were on the left and one was on the right talus. We searched for tenderness with palpation in anterolateral aspect of talar neck. The talar neck fracture was diagnosed with CT in one patient, and with MRI in other seven patients (Fig. 1, 2). The initial treatment of two patients was made in another hospital with the diagnosis of ankle distortion. One of these patients admitted to our out-patient clinic after 20 days because his complaints were sustained. The fracture of this patient was diagnosed with MRI, and he was treated with open reduction and internal fixation by using screw. The other patient admitted to our out-patient clinic after 15 days with the same complaints, and he was treated with cast applications following diagnosis of the fracture with MRI. All of the patients except one who treated with surgery were treated with conservative means by applying short leg cast for 2 months and they were not allowed to give weight to the extremity until the end of second month. The cast was removed at the end of second month, and weight bearing was allowed gradually.

Results

The mean time interval between the distortion and missed fracture was 10 days (range 3-20 days). There was local tenderness with palpation at the anteroinferior part of ATFL when ankle held in plantar flexion and internal rotation in all the patients. Seven of the talar neck fractures diagnosed with CT and MRI were Hawkins type I, fractures, thus they

Fig. 1. **(a)** Initial lateral radiograph, **(b)** sagittal T1-weighted MR imaging, and **(c)** sagittal T2-weighted MR imaging of missed talar neck fractures in ankle distortions.

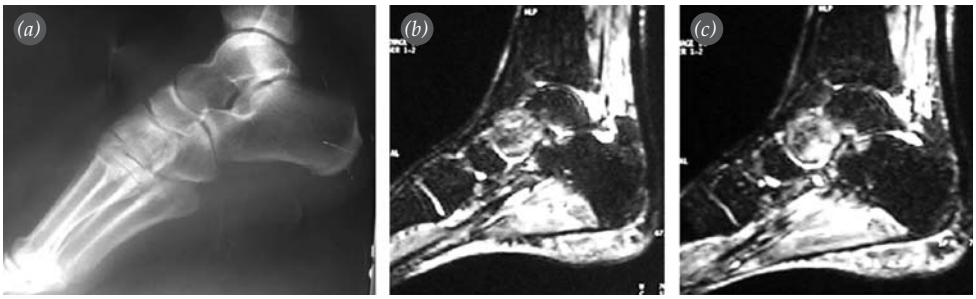

Fig. 2. **(a)** Initial lateral radiograph and **(b, c)** sagittal T2-weighted MR imaging of missed talar neck fractures in ankle distortions.

all have been treated conservatively with short leg cast. One of the fractures was Hawkins type I and it has been treated with open reduction and internal fixation. One of the patients who was treated conservatively developed reflex sympathetic dystrophy and received physical treatment. All of the patients were evaluated with the American Orthopedic Foot and Ankle Society (AOFAS) scoring system.[4] Average follow-up time was 6 months (range 3-8 months) and mean score at last follow-up was 93.7 (range 80-100) (Table 1).

Discussion

One must remember that talar fractures may accompany ankle distortions, especially if there is severe pain at the anteroinferior of ATFL while ankle was held in plantar flexion and internal rotation. Physicians equipped with this knowledge could notice the talar fracture at the initial examination in emergency service or orthopedic out-patient clinic, thus prevent severe complications like displaced talar neck fracture.[5]

Wei et al.[6] studied a considerably large group of patients and reported the foot as the most frequent missed fracture site (7.6%). Same authors reported the missed fracture percentages of knee as 6.3%, elbow 6%, hand 5.4%, wrist 4.1%, hip 3.9%, ankle 2.8%, and shoulder 1.9%. They stated that 70% of these fractures were noticed at second examination after a week when fracture line became visible. They

Table 1
Patients' information

No	Gender	Age	Etiology	Side	Time between trauma and diagnosis (days)	Treatment	Treatment duration (months)	Score	Complication
1	Male	39	Sports	Left	20	ORIF	5	88	-
2	Female	28	Distortion	Left	3	Cast	2	100	-
3	Male	24	Distortion	Left	3	Cast	2	100	-
4	Female	28	Distortion	Left	10	Cast	2	100	-
5	Male	21	Distortion	Left	10	Cast	2	95	-
6	Female	21	Distortion	Left	7	Cast	2	95	-
7	Male	29	Sports	Left	14	Cast	4	80	RSD
8	Female	40	Distortion	Right	14	Cast	4	90	-

ORIF: Open reduction-internal fixation, RSD: Reflex sympathic dystrophy.

advised the education of radiologists and physicians about these fractures.[6,7] The radiology department could not notice the missed fractures in our series at the second examination too. We assumed that this was due to unclear fracture line, which could only be detected with CT or MRI.

It has been advised that Ottawa rules should be applied to the patients admitting to emergency services or out-patient clinics with ankle trauma.[8-10] It has been stressed that the possibility of misdiagnosing a fracture in ankle or foot lessens with the application of these rules. The initial clinical and radiological diagnosis of these fractures is also important. The misdiagnosis of a fracture delays the appropriate treatment and lead to a more complex clinical picture. Talus has borders with tibia and fibula proximally and with calcaneus distally. It also joints with navicular bone anteriorly. Talar bone carries the pressure and forces generated by the body weight and shift it toward the midpoint of ankle joint. However, subtalar joint ensures comfortable walking on uneven surfaces. So inappropriate treatment of talar fractures cause arthrosis of the joint leading to a painful walking in every step taken. One must search for painful, edematous and tender points in physical examination by applying deep pressure near the ligaments. If there is no fracture detected in standard radiographs, but there is pain with pressure at those points especially in late examination, a potential missed fracture should be considered and the patient should be reevaluated with CT or MRI.[11]

Judd and Kim,[2] and Kou and Fortin[11] advised Mortis view radiography in the presence of pain and tenderness at the anterior part of lateral malleolus along the anterior side of talar bone during deep palpation with the suspicion of lateral side fracture of talar dome. They suggested anteroposterior radiography of the ankle in case of pain persistence at the posterior side of medial malleolus along with posterior side of talus with the suspicion of fracture at medial side of talar dome. They again advised ankle mortise view in case of tenderness at pressure point on lateral process suggesting lateral talar process fracture. They advised lateral radiography in case of pain with deep palpation between medial malleolus and Achilles tendon with the suspicion of posterior talar process fracture. At the medial tubercle fractures of posterior talar process, they observed that one can localize pain between medial malleolus and Achilles tendon which is very hard to evaluate with standard radiography, so they suggested oblique view while ankle held 40° of external rotation to get better view of the ankle.[2] In this study, most of the fractures were peripheral fractures of talus, but our series included talar neck fractures.

Talar neck fractures constitute 2% of foot fractures. Talar neck fractures mostly occur with sudden dorsoflexion of the ankle usually at the motorcycle accidents. Another reason for talar neck fracture is excessive force implied to talar neck by medial malleolus with abrupt inversion of the ankle.[12,13]

Hawkins classification is used at talar neck fractures. Treatment type and risk of avascular necrosis also can be evaluated with this classification. While conservative treatment with short leg cast for 8 to 12 weeks is advised for nondisplaced fractures, open reduction-internal fixation is advised for displaced fractures.[12-14] Our cases had normal radiographic appearances, but we diagnosed talar neck fractures with CT or MRI. All but one case with minimally displaced fracture were classified as Hawkins type I fracture and treated with short leg cast application. One patient with minimally displaced fracture was treated by open reduction-internal fixation.

Avascular necrosis, malunion, and arthrosis of subtalar joint are probable complications of talar neck fractures with latter is the most common one. The rate of avascular necrosis is 10% in type I fractures, between 20-50% in type II fractures, and 60-100% in type III fractures. The appearance of subchondral radiolucent line in talus after 6-8 weeks of the fracture is called as Hawkins sign showing low probability to develope avascular necrosis. The loss of talar height and radioopaque appearance of talar body after 4 to 6 months of the fracture is supportive of avascular necrosis. We did not observe any signs of degenerative arthritis or avascular necrosis in our cases, but these complications may occur. We still continue to observe our patients with scheduled follow-ups. Talar fractures frequently cause malunion and nonunion leading to limitation of joint movements.[15] Therefore, the time period between diagnosis of missed fracture and ankle distortion is very important. The transition of nondisplaced fracture to

displaced fracture can be prevented with early diagnosis.

In conclusion, talar neck fracture should be considered in case of increased pain with palpation applied to inferior part of ATFL while ankle is held in plantar flexion. CT or MRI should be obtained in order to detect the fractures that cannot be seen with conventional radiographs.

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