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Ultrasonographic Diagnostics and Evaluation of Calcaneal Fracture: Case Report

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SUMMARY

Introduction Radiography is the standard tool in the diagnostics of bone fractures. This paper presents a case of calcaneal fracture diagnosed by ultrasonography that was also used in the follow-up of recovery progress.

Case Outline A 68-year-old male patient was diagnosed avulsion fracture of the calcaneus by ultrasonography (US) examination using a multi-frequency linear probe (7-15 MHz) and confirmed by X-ray findings; US also provided insight into the dynamics of the reparatory processes. Control examinations were performed on day 14, 21, 30, 60 and 300 (10 months) after the occurrence of the fracture. During this time rehabilitation process was carried out. The diameters of the wedge defect of the calcaneus were measured by US for the follow-up of the healing process of the injured bone. Postero-anterior (PA) or longitudinal diameter and latero-medial or medio-lateral or transverse diameter were measured.

Conclusion Study results indicate a possible use of US in the diagnostics of fractures and monitoring of calcaneal healing.

Keywords: diagnostic ultrasound; injury; calcaneal fracture

INTRODUCTION

The largest tarsal bone is the calcaneus. It is designed to support the body and endure a great degree of force. The most common tarsal bone to be fractured is the calcaneus. Fractures of the calcaneus present 2% of all fractured bones in humans [1]. The fractures of the calcaneus could be divided in the intra- and extra-articular ones. Extra-articular fractures are 25-40% of all calcaneal fractures. All fractures that do not involve the posterior facet are included in this category [1].

There are two types of extra-articular fractures of the tuberositas: first type is avulsion fractures in osteoporosis and in the elderly and second type is fracture of the medial process of the calcaneus. In avulsion fractures in elderly it is common that they appear spontaneously or after a minimal trauma [2]. In the patient presented in this paper the type of fracture of the calcanei correspond to the second described type of avulsion fractures.

CASE REPORT

A 68-year-old man complaining of the presence of severe pain in the left heel was examined for the first time on August 20th, 2008. The patient was not able to walk and stand on that foot. This condition appeared after falling of the ladders one meter high. He did not appear to have any previous medical problems and no history of diabetes, hypertension or osteoporosis. After examination conducted by a surgeon, swelling and pain in the left heel near the tuberositas of the calcaneus were found. Vascular and neurological status was normal. Since the patient could not walk with his left foot ultrasonographic (US) examination of the left Achilles tendon was indicated. US examination, which was conducted on the GE Voluson 730 with a linear probe (7-15 MHz), showed normal presentation of the left Achilles tendon, but avulsion fracture of the tuberositas calcaneus was diagnosed. Due to a dislocation of the bone wedge defect of the left calcaneus was marked 10 mm deep and 5 mm wide at the widest part (Figure 1). Afterwards an X-ray confirmed the diagnosis of the avulsion fracture of the tuberositas of the calcaneus (Figure 2).

After conducted diagnostic procedures adequate therapy was introduced. The left foot was immobilized for 6 weeks with no weight bearing on the left foot. Therapeutic ultrasound was applied at the tarsal region of the calcaneus 0.5 W/cm² (NOMIUS 500Puls, 590 NRAF) together with the diclofenac sodium gel once a day during 10 days. During 20 days, trans-dermal neural electro-acupuncture lasting for 15 minutes (Electronic Design TENS2) as well as pulsing magnetic field 620 Hz of strength with magnetic tape lasting for 25 minutes (IVENT

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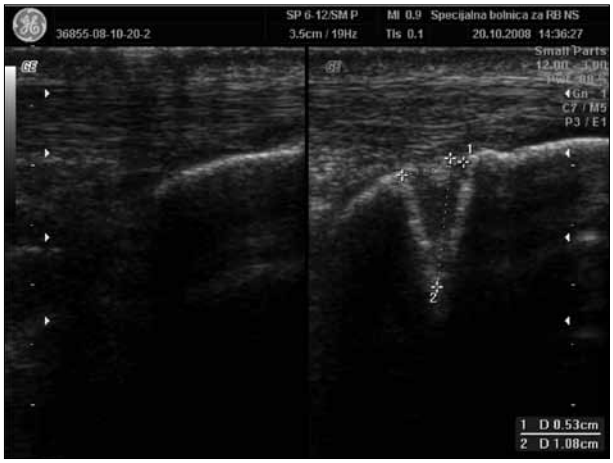

Figure 1. US finding of the right and left calcaneus

Figure 2. RTG of the calcaneus

Table 1. Ultrasonographically measured wedge defect diameters of the calcaneus in the time course

Time of US control	Time from injury (days)	Longitudinal diameter (cm)	Transversal diameter (cm)
20.10.2008.	-	1.08	0.53
03.11.2008.	14	0.58	0.50
10.11.2008.	21	0.41	0.43
20.11.2008.	30	0.25	0.41
18.12.2008.	60	0.29	0.51
13.08.2009.	300 (10 months)	0.18	0.36

manufactured EMPULS Generator Roglić Electromedica) were applied.

Medication therapy included tablets 3×1 of calcium and vitamin D supplementation for two months.

During the next two months control US examinations were performed on day 14, 21, 30 and 60 (Table 1 and Figures 3-6) and the diameters of the wedge defect were measured. The measured diameters were longitudinal and transversal bony defect expressed in cm. During this period the decrease of the diameters of the wedge defect was registered but not fully due to callus organization in the defect of the bone.

Fifty days after the injury occurrence the patient began active weight bearing of the left foot but was complaining of perimalleolar swelling. Physical examination showed the signs of rigid movement of plantar and dorsal flexion. Time of bearing on the left foot was shorter than that on the healthy right foot. US examination 10 months after the injury presented the presence of wedge defect but with significantly smaller dimensions (Figure 7). At that time the patient did not complain of pain, and physical examination was satisfactory.

Figure 3. US finding after 14 days

Figure 4. US finding after 21 days

Figure 5. US finding after 30 days

DISCUSSION

Ultrasonography is not the method of choice for the diagnosis of bone fractures. RTG with low doses of ionizing radiation has high sensitivity of 93.2% and specificity of 99.8% [3]. The advantage of US as a method is that it has a high mobility of equipment and lower price than RTG. This is sensible, because 75% of the world population has no access to any diagnostic services [4].

Figure 6. US finding after 60 days

Figure 7. US finding after 300 days (10 months)

The results of the patient's US examination indicate that this type of fractures could be monitored in such way and that the process of healing is well defined by measuring the diameters of wedge defect. The results of measuring the dimensions of the wedge defect of calcaneal fracture (Table 1) indicate primary decrease in the wedge defect especially in the first two months. After two months a slight increase in the dimension of the wedge defect was observed, but this was most probably linked to the regained full bearing on the injured foot 10 days prior to the US examination. The speed of healing was decreased in time, which was quantified through a lower decrease of the wedge defect with the propagation of time. Management of extra-articular fractures is usually conservative and this type of fracture has better prognosis [1]. Other researchers have also advocated, according to their results, that non-operative treatment of displaced fractures of the tuberosity results in poor outcome and that optimal therapy is fixation of fracture. These authors have not found any complication in the group of patients with the same type of fractures as presented in our study [2]. Reflective acoustic properties of cortical bone allow the identification of fractures with ultrasound as small as 1 mm [5]. Moritz et al. [3] suggest that US has its position as the first imaging method in children with trauma and nonspecific clinical signs or indistinct location of pain, followed by X-ray exams of the predefined region. Other authors' findings indicate a high sensitivity of US exam for diaphyses of the long bones while epiphyses showed somewhat poorer results [6].

This case report is an innovation in the present scientific literature since it presents an extra-articular fracture of the calcaneus diagnosed and monitored using US. After a thorough search of the literature, only one paper reported US diagnosed but did not monitor extra-articular fracture of the calcaneus with the characteristics of insufficiency fractures [7].

US diagnostics and monitoring of reparatory processes is an applicable tool for the assessment of common lesions of Achilles tendon and calcaneus bone.

REFERENCES

1. Daftary A, Haims AH, Baumgaertner MR. Fractures of the calcaneus: a review with emphasis on CT. Radiographics. 2005; 25(5):1215-26.
2. Squires B, Allen PE, Livingstone J, Atkins RM. Fractures of the tuberosity of the calcaneus. J Bone Joint Surg Br. 2001; 83(1):55-61.
3. Moritz JD, Berthold LD, Soenksen SF, Alzen GF. Ultrasound in diagnosis of fractures in children: unnecessary harassment of useful addition to X-ray? Ultraschall Med. 2008; 28:267-74.
4. World Health Organization. Essential Health Technologies Strategy 2004-2007: Taking Basic Health Solutions to Countries: a Needs-driven Programme Increasingly Based on Country-prepared Proposals. Geneva: World Health Organization; 2004.
5. Chen L, Kim Y, Moore CL. Diagnosis and guided reduction of forearm fractures in children using bedside ultrasound. Pediatr Emerg Care. 2007; 23(8):528-31.
6. Weinberg ER, Tunik MG, Tsung JW. Accuracy of clinician-performed point-of-care ultrasound for the diagnosis of fractures in children and young adults. Injury. 2010; 41(8):862-8.
7. Arni D, Lambert V, Delmi M, Bianchi S. Insufficiency fracture of the calcaneus: sonographic findings. J Clin Ultrasound. 2009; 37(7):424-7.

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Ултразвучна дијагностика и процена прелома кости пете – приказ болесника

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КРАТАК САДРЖАЈ

Увод Стандардна дијагностичка метода за визуелизацију прелома костију је рендгенографија. Приказан је болесник са преломом кости пете (калканеуса) који је установљен ултразвучним прегледом и код којег је процес опоравка такође праћен применом ултразвука.

Приказ болесника Код мушкарца старог 68 година дијагностикован је прелом калканеуса ултразвучним прегледом мултифреквентном линеарном сондом (7–15 *MHz*) и потврђен рендгенографијом. Примењена је физикална терапија. Ултразвучне контроле су вршене на 14 дана, 21 дан, месец дана, два месеца и десет месеци, током којих су мерене вредности дефеката у лонгитудиналном и трансверзалном скену у центиметрима.

Закључак Резултати истраживања указују на могућност употребе ултразвука у дијагностиковању и праћењу санације прелома калканеуса.

Кључне речи: дијагностичка ултрасонографија; повреде; фрактура калканеуса

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