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Analysis of the current state of treating intra-articular fractures of the calcaneus

Abstract. *The paper considers the problem of treating fractures of the calcaneal bones, features of application of surgical treatment methodology that provides anatomical reposition, osteoplasty and stable functional osteosynthesis. The analysis of the methods for conservative and surgical treatment of intra-articular fractures of the calcaneal bones was performed, the advantages and disadvantages of techniques used today were identified.*

Keywords: *calcaneus; fractures; osteosynthesis*

Introduction

Fractures of the calcaneus belong to high-energy traumas that lead to serious injuries of the locomotor system. Patients with intra-articular fractures of the calcaneus lose their ability to work for a long period of time, and in many cases they become disabled due to a number of complications (pain, swelling, deformities). Fractures of the calcaneus account for 1–2 % of all fractures of skeleton and up to 60 % of fractures of tarsus in the structure of locomotor system injuries [1, 2]. Fractures of the calcaneus occur 3–11 times more often in men than in women. Fractures of both calcanei are observed in 11.7–20.7 % of cases, and their combination with other injuries of the locomotor system occur in 35.4 %. These fractures result from high-energy traumas, direct action of destructive forces on the heel, falling from a height (catatrauma) or traffic accidents. The complex anatomy and diversity of types of fractures of the calcaneus cause difficulty in treating patients with these injuries. Treatment of damaged articular surface of the calcaneus of talocalcaneal joint is an especially difficult task in treating patients with fractures of the calcaneus. The share of such injuries accounts for 75–80 % of fractures of the calcaneus [3–5]. Due to significant difference in the literature data regarding rational approach to the treatment of fractures of the calcaneus and their consequences, the comparative analysis of the results of treatment of these injuries with conservative and surgical methods was conducted.

Goal of the thesis: to analyze the effects of conservative and surgical treatment of intra-articular fractures of the calcaneus.

Materials and methods

The results of clinical observation of 142 patients with intra-articular fractures of the calcaneus formed the basis of the present thesis. Patients have been hospitalized in the 1st and 2nd trauma departments of the Communal City Clinical Emergency Hospital of Lviv in the period from 2006 to 2015.

The patients examined were aged from 19 to 84. The average age of the victims was 42.9. There were 111 men (78.2 %), and 31 women (21.8 %). 67 (47.1 %) victims were hospitalized in a state of alcoholic intoxication. 130 patients had unilateral lesion, and 12 patients had bilateral lesion. Isolated injuries were in 47 patients. In 95 patients calcaneal fractures were a part of a multiple trauma. Direct mechanism of injury of the calcaneus was mainly associated with catatrauma, observed in 103 (72.5 %) patients.

Primary causes of catatrauma were negligence at work performed at home (falling from trees, roofs, stairs, balconies, into a hole, etc.), there were 77 (74.8 %) such observations; accidents related to safety rules violations (falling at a construction site, from a floor, or into sewers or inspection hatches, etc.) made up 9 (8.7 %); 17 (16.5 %) cases of falling from a height caused by mental disorders (alcoholic delirium, schizophrenia, depression, etc.); compression between

a car and other mechanisms was observed in 39 (27.5 %) patients.

Victims were taken to the clinic by ambulance team from the scene of injury or by the team of the Emergency Medicine Center after the victims received medical care in district hospitals. The terms and scope of the medical activities depended on the presence of associated injuries. All patients hospitalized underwent comprehensive clinical and radiological orthopedic examination according to the routine treatment schedule. They focused on X-ray examination in three projections: lateral, allowing assessment of Böhler and Gissane angles; axial (tangential Harris projection) of posterior foot, allowing assessment of the degree of expansion of heel and identification of varus or valgus; oblique projection (Broden projection), allowing visualization of posterior articular facette of subtalar joint and the degree of displacement of fragments. If necessary, anterior-posterior X-ray of the foot was performed allowing for visualization of calcaneocuboid joint and the degree of displacement of fragments. During the analysis of X-ray pictures, the following parameters were taken into account: decrease in height of the calcaneus, defiguration of the surface of posterior articular region, change in values or tear of Gissane and Böhler angles shoulders, deviation of the body of calcaneus in axial radiograph. For preoperative planning computed tomography of calcanei was used. When choosing a treatment strategy, we primarily evaluated the state of skin of the damaged segment, the overall condition of the patient, presence of concomitant pathology or combined injuries, potential complications (hypostatic, vascular, infectious, etc.). The severity of fractures of the calcaneus in patients was assessed according to P. Essex-Lopresti and R. Sanders classifications. Clinical examination of patients was based on manifestation of a number of clinical symptoms, the severity of which was in direct proportion to the degree of fracture of the calcaneus.

Results and discussion

Results of treatment were studied in 142 patients with intra-articular fractures of the calcaneus in a period from 6 and 12 months after the injury. Anatomical and functional implications depended on the type of intra-articular fractures of the calcaneus and treatment methods applied. Depending on the degree of displacement of fragments, intra-articular fractures of the calcaneus were divided into three degrees of severity: mild — fractures without displacement (8.22 %), average — fractures with displacement of the 1st degree (27.36 %), and severe — fractures with displacement of the 2nd — 3rd degrees (64.42 %). Positive clinical results with lingual fractures were better (71.01 %) than the ones with the central impression (66.37 %), however the latter were better than the fragmented fractures (48.04 %). The severity of damage was the basis to determine therapeutic approach. Patients with intra-articular fractures of 88 (62 %) calcanei were treated with plaster cast, including 58 (65.9 %) patients without reposition of fragments, 9 (10.2 %) patients with manual reposition and 21 (23.8 %) patients with skeletal traction. This technique was performed at intra-articular fractures of the calcaneus with dis-

placement of the 1st and 2nd degrees without lesion of the capsule-ligamentous apparatus of talocalcanean joint. After conservative treatment, the results were positive in 20.7 % of patients (excellent in 3 patients, good in 19, satisfactory in 41, and bad in 25 patients). The average duration of disability made up 5.9 months (2,5–13 months). After 6 months, 4 (4.5 %) patients achieved satisfactory results, 71 (80.6 %) patients had good results; in 12 months 77 (87.5 %) patients maintained good results, and excellent results were obtained in 5 (5.7 %) patients. Among the conservative methods of treatment of patients, the greatest number of unsatisfactory results (28.4 %) was due to the use of plaster cast without the reposition of fragments of the calcaneus. Analysis of conservative methods of treating intra-articular fractures of the calcaneus showed lack of effectiveness. Fixing with plaster cast after manual repositioning led in some cases to secondary displacement of fragments of the calcaneus. Possibilities of conservative treatment, including skeletal traction, are very limited, especially in fragmented fractures of the calcaneus, when capsule and ligamentous apparatus of the posterior subtalar joint is damaged. Repositioning of these fractures is possible with surgical method (open or closed). Displacement of posterior articular surface of the calcaneus for more than 2 mm, decrease in Beller angle for less than 20°, valgus of the calcaneus exceeding 10°, varus greater than 5°, extension or shortening of the calcaneus for more than 20 % were the indications for surgery. Surgical treatment was conducted in 54 patients with intra-articular fractures of the calcanei. Perosseous osteosynthesis was applied in 15 (10.6 %) patients. Metal osteosynthesis of fractures of the calcaneus was performed in 39 (27.4 %) cases with the traditional external plates and plates with angular stability.

Metal osteosynthesis was performed under tourniquet with lateral L-shaped access. Full thickness skin graft was retracted cranially and supported with three Kirschner wires incised into the ankle bone. Under direct visual control we performed open reposition of fragments of the calcaneus with pre-fixation by wires. In most cases, after repositioning and restoring shapes of the calcaneus, there occurred spongy bone tissue defect. The greater was the displacement of articular fragment, and, correspondingly, compression of the spongy substance, the more severe was the defect. For plastic repair we used cortical-spongy autograft of the wing of ilium, the most part of which was firmly inserted after appropriate preparation into the defect so that it would perform both plastic and supporting function for the repositioned articular fragment. The remaining part of the graft was fragmented, and we tightly filled the gaps left. We applied a plate on the external surface of the calcaneus and then fixed it with screws. During the procedure intraoperational radiological control was performed. Vacuum drainage was carried out for 2–3 days. Procedures showed that reposition and osteosynthesis of comminuted fracture of the calcaneus are very difficult because of the small bone fragments. With surgical treatment, positive results were obtained in 79.3 % of patients (12 patients had excellent results, 17 patients had good results, 9 patient had satisfactory, and 1 patients had unsatisfactory result). The average duration of disability was 4.5 months. After 6 months, 26 (66.6 %) patients

achieved satisfactory results, and 13 (33.4 %) patients had good results; 12 months later good results were maintained in 22 (56.4 %) patients, excellent results were obtained in 17 (43.6 %) cases.

All complications of metal osteosynthesis with external plates were divided into intraoperative and early postoperative that occurred within 4 weeks. Among the early postoperative complications postoperative hematomas were observed in 6 (15.3 %) cases, including 5 cases where wound healed by primary intention after draining. Superficial marginal necrosis of the skin of peripheral regions of surgical wound was observed in 3 (7.7 %) patients, which did not lead to further complications. Superficial maturation of the region of postoperative wound was found in 2 (5.1 %) patients, which required only conservative treatment.

Conclusions

The study demonstrated that a differentiated approach to the treatment of intra-articular fractures of the calcaneus with consideration of the type of injury allows improving functional results and reducing the number of complications and duration of disability period. Conservative treatment does not ensure recovery of the shape of the calcaneus and the anatomical and functional characteristics of the foot, it takes more time for treatment. Application of the methodology of surgery that involves anatomical reposition, bone plasty and stable-functional osteosynthesis, provides 79.3 % of the foot function already in 6 months after surgery with

further improvement within 1 year. The results of the study suggest the benefits of surgical treatment of intra-articular fractures of the calcaneus.

Conflicts of interests. Authors declare the absence of any conflicts of interests that might be construed to influence the results or interpretation of their manuscript.

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Аналіз сучасного стану лікування внутрішньосуглобових переломів п'яткових кісток

Резюме. У статті розглянуто проблему лікування внутрішньосуглобових переломів п'яткових кісток, особливості застосування методології оперативного лікування, що передбачає анатомічну репозицію, кісткову пластику та стабільно-функціональний остеосинтез. Проведений аналіз

методик консервативного та оперативного лікування внутрішньосуглобових переломів п'яткових кісток, визначені переваги та недоліки методик, що застосовуються на сучасному етапі.

Ключові слова: п'яткова кістка; переломи; остеосинтез

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Анализ современного состояния лечения внутрисуставных переломов пяточных костей

Резюме. В статье рассмотрены проблема лечения внутрисуставных переломов пяточных костей, особенности применения методологии оперативного лечения, предусматривающей анатомическую репозицию, костную пластику и стабильно-функциональный остеосинтез. Проведен анализ

методик консервативного и оперативного лечения внутрисуставных переломов пяточных костей, определены преимущества и недостатки методик, применяемых на современном этапе.

Ключевые слова: пяточная кость; переломи; остеосинтез