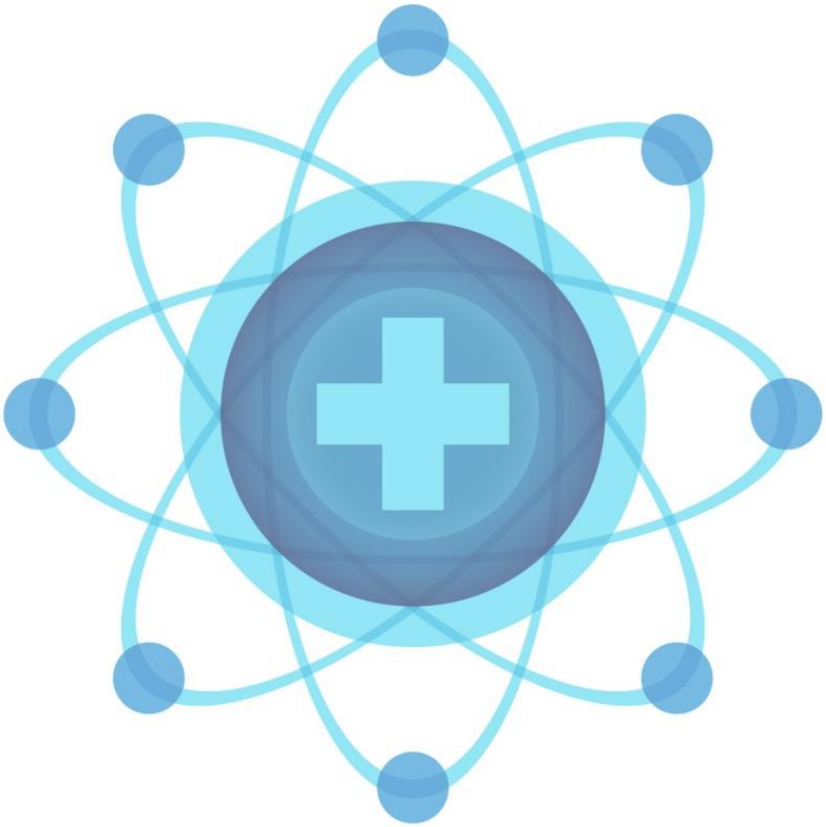

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ANALYSIS OF REPARATIVE AFTER SURGICAL TREATMENT OF DIAPHYSEAL FRACTURES OF THE SHIN BONES

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Abstract. Complications of reparative osteogenesis in long bone fractures remain a major problem in traumatology, despite significant advances in their treatment. As shown by numerous observations, the disability rate of patients with fractures is still high, amounting to 19–37.9%, so it is obvious that it is necessary to study the causes of such conditions. Based on the analysis of radiographs of 122 patients with diaphyseal fractures of the leg bones at the age of 18 to 60 years with dynamic observation for 8 months. up to 3 years, the timing of fusion, types of callus and the frequency of complications of reparative osteogenesis were established. Complications during fracture healing were noted in 46 (37.7%) injured patients.

Key words: bones, shin, diaphyseal fractures, callus, radiography, reparative ostegenesis, complications.

Introduction

Reparative osteogenesis in fractures is a complex, multi-stage process, the course of which is influenced by many factors, including local, peripheral circulation, immune status, and so on [1]. Its essence is the restoration of damaged tissues, anatomical shape, function of the damaged bone and the segment of the limb as a whole [2]. Fracture healing can take different paths. It largely depends on the quality of bone fragments immobilization (complete immobility and good reduction) [3, 4]. Morphologically, the following types of callus are distinguished: endosteal, periosteal, intermediate, and paraossal [5]. Intermediate callus forms between the cortical layers, while the periosteal and endosteal layers are almost absent. With such fusion, the absence of periosteal callus is not a sign of poor regeneration [6]. The presence of a large periosteal callus indicates not so much the favorable processes of

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regeneration as the mobility of bone fragments during the formation of the regenerate [7]. In addition, the size of the callus is influenced by the volume of the hematoma and the nature of soft tissue damage. In healing fractures, they describe mainly the periosteal callus, since the endosteal and intermediate calluses, as a rule, are not visible behind the general shadow [5].

Standard radiography in two projections is the main method for diagnosing fractures at the present time, since, according to many authors, up to 85% of primary diagnoses are made with its help [8]. However, the assessment of the course of the reparative process during the primary healing of fractures (which often occurs during transosseous osteosynthesis) may not always be objective [2].

Complications of reparative osteogenesis in long bone fractures remain a major problem in traumatology, despite significant advances in their treatment [3, 6]. As shown by numerous observations, the disability rate of patients with fractures is still high, amounting to 19–37.9%, so it is obvious that it is necessary to study the causes of such conditions.

Purpose of the study

To study the features of reparative osteogenesis in diaphyseal fractures of the leg bones in young and middle-aged patients.

Materials and methods

The analysis of radiographs of 122 patients with diaphyseal fractures of the leg bones aged 18 to 60 years (men - 54.2%; women - 45.8%) in standard projections with dynamic observation for 8 months. up to 3 years old. All patients were divided into 2 groups in terms of age: group 1 - age from 18 to 35 years (44 patients - 36.1%, average age - 28.4 ± 4.3 years); Group 2 - from 35 to 60 years old (78 patients - 63.9%; average age - 48.7 ± 9.4 years).

According to VI Gongalsky (1987), the timing of the fusion of diaphyseal fractures of the tibial bones is the longest among all fractures of the long bones and is 2.5–3.5 months for fractures of the tibial diaphysis; with fractures of the diaphysis of the fibula - 1.0–1.5 months; with fractures of the diaphysis of both bones of the lower

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leg - 3.0-4.0 months [9]. It was these terms that were taken into account in the analysis; an increase in the duration of fusion up to 2 weeks was not considered a delay in regeneration.

When conducting statistical analysis, the data obtained were expressed in absolute values and percentages, to compare the indicators in the groups, the $\chi 2$ criterion was used; discrepancies in the values of individual signs were considered reliable if the level of significance was less than 0.05 ($p < 0.05$).

Research results

In the study, combined damage to the tibia and fibula was found in 85.2 ± 3.2% of cases. In 61.5 ± 4.4% of cases, patients were treated with external fixation devices; in 22.9 ± 3.8% - by the method of external osteosynthesis, in 15.6 ± 3.3% - with plaster casts.

Complete union of fractures within 4 months was noted only in 28.7 ± 4.1% of cases (35 patients), within 6 months - in 33.6 ± 4.3% (41 patients), up to 8 months - in another 16.4 ± 3.3% (20 patients). In 26 patients (21.3 ± 3.7%), the fusion of diaphyseal fractures of the tibia was formed over 1.5–2 years, among them, in 9 patients (7.3 ± 2.4%), the formation of callus took place over 6 months was completely absent.

The most common ($p < 0.001$) when fractures were healed was periosteal callus - 102 (83.6 ± 3.4%) patients (Fig. 1), less often - intermediate - 14 (11.4 ± 2.9%) (Fig. . 2) and paraossal - 6 (4.9 ± 1.9%). X-ray signs of endosteal callus (sclerosis at the level of the bone marrow cavity) were determined only in combination with periosteal and paraosseal bone formations. Intermediate fusion was observed in isolated oblique fractures of the middle and distal third of the tibial diaphysis at 2.5–3 months. Paraosseous fusion was observed during long-term formation of callus in patients with complications of comminuted fractures of the tibia. The formation of periosteal callus did not depend on the type and location of the fracture.

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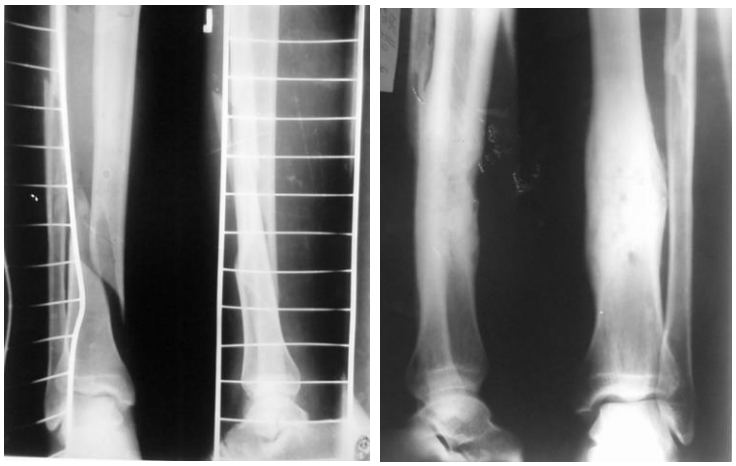

Fig. 1. Patient I., 32 years old: a - on radiographs of the lower leg in frontal and lateral projections with the presence of wire splints, a helical fracture of the distal third of the tibial diaphysis is determined with a transverse displacement by ½ of the diaphysis outward, fragments overlapping up to 1.5 cm and angular displacement, open to the inside; oblique fracture of the middle third of the diaphysis of the fibula; b - on control radiographs of the lower leg after 7 months. from the start of treatment - healed fracture of the tibia due to the formation of circular periosteal and endosteal callus

Fig. 2. Formation of intermediate bone callus in patient K., 24 years old at a control study 2.5 months after surgical treatment

Complications during fracture healing were noted in 46 (37.7 ± 7.2%) injured, among them delayed fracture union - 60.9 ± 7.2% ($p < 0.01$), pseudarthrosis formation - 21.7 ± 6 ,1 %; the development of post-traumatic osteomyelitis - in 26.1 ± 6.5%; fused fractures with preserved deformation of the bone axis - 13.0 ± 5.0%; non-union

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of a fracture with the presence of a bone defect - 6.5 ± 3.6%. Several complications were observed in 18 patients (39.1 ± 7.2%). Slowing down of the fusion of diaphyseal tibial fractures up to 6 months was not included in the group of patients with complications.

In 43.4 ± 7.3% of patients with complications, their radiological signs were determined from 2 to 3 months; in 21.7 ± 6.1% - from 3 to 5 months from the start of treatment, that is, in 65.1 ± 7.0% of patients, the treatment tactics could be changed at an earlier stage of impaired development of the reparative process.

The proportion of complications in the groups was: in the 1st group - 25.0 ± 6.5% (11 patients); in group 2 - 44.9 ± 5.6% (35 patients) ($p < 0.01$).

Discussion of research results

According to [3], during the initial examination of patients of working age with diaphyseal fractures of long bones, their localization at the level of the lower leg was the highest frequency - 54.6%; all the rest (thigh, shoulder, forearm) are only 46.4%. The authors noted that the most frequent complication of diaphyseal fractures of the shin was slow-healing fractures (62.7%), which coincides with the data obtained in the study.

Slowly healing fractures according to the MSEC characteristics were those when, after 4 months. and more after it, the persisting clinical and radiological indicators did not allow predicting the patient's recovery in the next 2–4 months, at the same time, the existing signs did not give grounds to raise the question of changing the treatment tactics. The diagnosis of a pseudarthrosis was made after 6–8 months. from the start of treatment and was considered as a variant of non-union of fragments [3]. At the same time, the term “nonunited fracture” was used to describe a condition when, after 4 months of treatment, there were clear clinical and radiological signs of the absence of regenerative osteogenesis, indicating the need for a radical change in treatment tactics [3]. Such disagreements in the assessment of fracture fusion in terms of callus formation, as well as in terms of diagnosis of complications of reparative osteogenesis, their interpretation and related changes in treatment tactics

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require additional research. Until now, the methods of directed drug management of reparative osteogenesis have been insufficiently studied, although there are publications on the use, for example, of growth factors for its stimulation [10].

According to [6], it is possible to determine the timing of dismantling the external fixation apparatus, as well as to plan the nature and duration of rehabilitation measures for closed diaphyseal fractures of the tibial bones, based on a complex of modern methods of radiation diagnostics (including X-ray, computed and magnetic resonance imaging), with the help of which it is possible to evaluate the features of the formation of contact regenerate and bone remodeling with their quantitative assessment. In our opinion, in all patients 2-4 months after the start of treatment, on the basis of X-ray indicators (type of fracture, formation of callus, degree of its severity), it is possible to predict the duration of maturation of a full-fledged bone regenerate, and the use of magnetic resonance imaging in the presence of metal structures in such patients are not indicated.

The reasons for the high frequency of delayed formation of reparative osteogenesis in diaphyseal fractures of the lower leg bones in young and middle age require further study.

Conclusions

1. In most cases, diaphyseal fractures of the leg bones healed for more than 4 months, with complications in every third patient.

2. It was found that the incidence of complications of reparative osteogenesis in diaphyseal fractures of the shin bones increases with age.

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