STUDY OF EFFICIENCY OF CHONDROITIN SULPHATE IN PATIENTS WITH FRACTURES OF VARIOUS LOCALIZATIONS

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The results of chondroitin sulfate use in 200 patients with fractures of various limb segments are presented. Chondroitin sulfate preparation was administered intramuscularly at a dose of 2 ml (200 mg) every other day. During the observation period of 36 days, all patients were injected with the drug 18 times. As a result of the study, the clinical efficiency of chondroitin sulfate was revealed in the treatment of patients with fractures of various localizations.

Introduction

Treating limb long bone fractures is still one of the urgent problems in modern traumatology and orthopedics due to increasing severity and multiple injuries, duration of treatment and a high percentage of unsatisfactory outcomes [6, 9, 10]. The frequency of disability acquisition as the result of the musculoskeletal system injuries due to non-synostosis and false joint formation is rather high [2, 7].

The main difficulties in the fracture treatment are associated with the fact that processes of consolidation, as well as subsequent restoration of the damaged limb function, are slow and often accompanied by post-traumatic infection and occurrence of bone defects and deformations that require long-term treatment using a complex set of surgical procedures [1, 8].

The bone tissue reparative regeneration processes have a great importance in achieving improvement and final consolidation of limb fractures of different types and localizations. These processes occur in several stages, namely, catabolism of tissue structures, differentiation and proliferation of cellular elements, vessel formation, formation and differentiation of tissue structures, mineralization and reconstruction of the primary regenerated material and bone restitution with defect compensation by identical tissue. In case of incomplete reparative regeneration (substitution), the defect is filled with a dense fibrous connective tissue – cicatricial tissue [3].

Disruption of the bone reparative regeneration is one of the signs of a complex pathological symptom group reflecting a number of physiological and morphological changes in tissues.

Insufficiently strong (unstable) fixation of bone fragments, both in conservative and surgical treatment, is considered to be the most common local reason for the development of delayed consolidation, ununited fractures or false joints. Systemic or general factors that can disrupt the normal course of reparative osteogenesis include the age factor, hormonal imbalance, severe somatic diseases, etc. [4, 5].

Numerous studies have proved that surgical stabilization of fragments provides optimal conditions for the fracture consolidation. Creation of high-tech techniques for transosseous, extramedullary and intraosseous osteosynthesis significantly expanded the possibilities of surgical methods for treating patients with limb long bone fractures. However, despite the success of surgical traumatology and orthopedics, there are unsatisfactory functional results of treatment due to delayed consolidation as a consequence of osteogenesis process disruption. Irreversible functional disorders may occur as a result of prolonged immobilization. In accordance with data of various authors, disruptions of the consolidation processes when treating of the skeletal system injuries occur in 7.8–31.0% of cases [1].

The use of bone grafts for stimulation of osteogenesis and replacement of defects often results in lysis instead of restructuring and formation of a complete regenerated material. In order to decrease failures in treatment of limb fractures, a technique for optimizing the bone consolidation by parenteral administration of chondroitin sulfate has been developed and presented. The use of the drug in conditions of stable fixation of long tubular bones helps improve the bone tissue blood supply in the fracture zone, contributes to adequate formation of the bone callus, and significantly reduces terms of treatment and rehabilitation of the patients.

Objective of the study

Evaluation of the efficiency of chondroitin sulfate preparation, a solution for intramuscular administration, in patients with fractures of limb long bones in conditions of stable external fixation.

Material and methods

The study covered 200 patients with closed bone fractures of various locations, including 92 (46 %) men and 108 (54 %) women.

The study period was 5 weeks (36 days). Patients received the drug according to the instructions for medical use. Each of the patients had 4 appointments with attending physician for the period of drug administration (visit 1– day 0, visit 2 – day 14, visit 3 – day 28, visit 4 – day 36) to conduct the examination and monitoring, and to control callus formation and occurrence allergic reactions, if any.

A radiography was performed on days 0, 14 and 36 of the study.

Criteria for inclusion in the research program:

1. Men and women aged 18 to 75 years inclusive.
2. The patient's ability to adequately follow the doctor's instructions.
3. Established and documented diagnosis: closed bone fracture according to physical and instrumental examination data.
4. Negative pregnancy test for childbearing age women.
5. A consent to follow barrier methods of contraception during the study and 2 months after completion of the study.

Criteria for non-inclusion in the research program:

1. Tumor, infectious-inflammatory or other bone disease requiring special treatment.
2. Any disease accompanied by sensory and motor disorders that can imitate the symptoms of a closed fracture.
3. Oncological diseases.
4. Diseases of the gastrointestinal tract.
5. Diabetes mellitus type 1.
6. Hypersensitivity to the drug components.
7. Any mental illness requiring administration of neuroleptics, and/or antidepressant medications during the course of this study.
8. Pregnancy and lactation.
9. Obstacles or inability to administer the study drug in the form of intramuscular injections.
10. HIV infection.

Research results

In the course of the study, good tolerability of chondroitin sulfate drug was established. No adverse reactions, either general or local, were noted (at the injection sites).

The criteria of the drug effectiveness in treatment of fracture were absence of pain, change of the pain intensity in the fracture area, and radiographic signs of consolidation.

Efficiency criteria included the rate and frequency of bone callus formation, as confirmed by clinical and X-ray findings.

Table 1. **Specific forms pathology of the examined patients**

Fracture type	Closed fracture of distal epimetaphys of a radius bone with no fragment displacement	Closed fracture of lateral malleolus with no bone fragment displacement	Closed fracture of the base of the first metacarpal bone with no fragment displacement	Closed fracture of kneecap with no fragment displacement	Closed fracture of calcaneus with no fragment displacement	Closed fracture of greater tuberosity with no fragment displacement	Closed fracture of olecranon with no bone fragment displacement
Number of patients	86	88	9	8	2	3	4

Table 2. **X-ray pattern on a corresponding day of screening examination**

Day of examination	Data of X-ray examination
V1 – day 0	Setting the diagnosis of fracture after two-dimensional radiography. Registration and dividing patients into groups after history taking, excluding counterindication to examination, excluding the need for surgical treatment of the fracture, excluding counterindication to the drug.
V2 – day 14	Absence of signs of bone callus formation in all age groups. The process of bone tissue proliferation and regeneration. Administration of the drug is continued in the absence of complaints about occurrence of allergic reactions, and upon follow-up radiographs and excluding redislocation of bone fragments.
V3 – day 28	Appearance of the first signs of bone callus in the form of delicate cloud-shape foci after the fracture. In some cases, the boundary of callus becomes more evident
V4 – day36	According to the radiography data, the age group 51 – 75 demonstrates the signs of radius and lateral malleolus fracture consolidation and primary bone callus formation. The X-ray signs of consolidation can be detected by X-ray examination on week 5 instead of 6-7 weeks normally required for the development of primary bone callus signs in the malleolus fracture cases

A decrease of pain during recovery of movements in a previously fixed joint, a reduction of the rehabilitation period, and an increase in the efficiency of physical and exercising therapy were noticed in all age groups.

According to the X-ray findings, all the patients who took part in the study reported appearance of primary bone callus by day 36 or at the end of week 5 (Table 2).

Conclusion

The study revealed clinical efficiency of chondroitin sulfate drug, which has an effect of accelerating the consolidation of fractures of different localizations. Intensity of the effect was noticed to increase throughout the study period reaching a maximum by the end of week 4 after the start of the drug administration.

When analyzing the therapy effectiveness, a high safety indicator of the drug administration and absence of severe side effects were confirmed. The revealed side effects in most cases were due to the drug administration method and were stopped without consequences. These studies allow us to recommend chondroitin sulfate as a reliably effective preparation for treatment of patients with fractures in a day hospital and outpatient conditions in everyday clinical practice.

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