ROLE OF COMPRESSION-DESTRUCTIVE OSTEOSYNTHESIS WITH INTRODUCTION OF CUCUMAZIM AND MARROW IN NONUNION FRACTURES AND PSEUDOARThROSIS OF HUMERAL BONE

Nonunions and pseudoarthrosis of diaphysis of the humeral bone are one of the main problems of modern traumatology and orthopedics. The issue is not studied well; lack of information on use of modern diagnostic techniques (CT, X-ray, densitometry) of research nonunions and pseudoarthrosis diaphyseal humeral bone. We analyzed treatment of 51 patients with nonunions and pseudoarthrosis of the humeral bone treated in the department of adult trauma in scientific research institute of traumatology and orthopedics of Uzbekistan for 2009 to 2012. The results showed that the method of treating the condition using a proteolytic enzyme cucumazim combined with transosseous osteosynthesis, can improve patient results of treatment.

Keywords: Nonunions, pseudoarthrosis, humeral bone, proteolytic enzyme, cucumazim, marrow


Introduction

Treatment the patients with pseudoarthrosis of long bones of extremity is one of the actual and at the same time unsolved problem of present day of traumatology and orthopedy.

Pseudoarthrosis and nonunion of humeral bone are the most severe and not rare complication of fractures of this field. Pseudoarthrosis of humeral bone in practice of restorative surgery, by the data of different authors, make 51-71% against to all pseudoarthrosis of the long cortical bones.

In the fractures of humeral bone is often observed the injury of nerve trunks that aggravates normal course of regenerative process. Fractures of humeral bone are often splinter nature, which requires applying the massive hardware with wide impressments and exposure of fracture fragments. It leads to the disorder of blood supply of bone. In recent years applying the little traumatic procedures of osteosynthesis has not solved this problem, as in applying of these procedures has high percent of complication (Merrell, Wolf, Kasena, Gao, Kaseno, 2003).

It has been developed and widely applying different techniques of free-bony autoplasty, microsurgical transplantation of tissues, methods of compressive-destructive osteosynthesis by Ilizarov (Karlov, Xlusov, Chaykina, Drujinina, 2007; Ozkan, Ozgentas, Safak, Dogan, 2006; Rath, 2006). Though, unsatisfactory treatment results of the pseudoarthrosis occur from 5 to 40% (Ozkan et al., 2006; Potenza, 2003; Rajan, Premkumar, Partheebarajan, Ebenezer, 2006).

At present one resort to autoplasty with free grafts rarely. Microsurgical method gave good results, but it is labour-intensive, difficult and it is implemented at some clinics of our Republic and countries of commonwealth of independent countries (CIS) Merrel et al., 2003; Rajan et al., 2006). At present transosseous method is a method of choice in the treatment of pseudoarthrosis of humeral bone (Peter and Waters, 2007; Rath, 2006). But opportunities limitation of removal of bone deformations and exclusion of fibrous tissues,
densely soldered with relative bone requires further development of surgical treatment methods of pseudoarthrosis.

In 1999 the method developed by professor V.I. Zorya, which was directed to the acceleration of reparative bony regeneration with the help of transplantation in pathological foci of autologous bone marrow in combination with protein-degrading enzyme chemotrypsin.

In the recent years one began to apply domestic preparation of cucumazim in the field of gynecology, contaminated surgery, endocrinology, and also in phthisio-surgery which is extract of papaya widely. But we did not find the data about applying of cucumazim in the treatment of nonunion fractures and pseudoarthrosis in domestic and foreign literature. Improvement the treatment issues of nonunion fractures and pseudoarthrosis, development of effective means, well-directly affecting to the regeneration of bone tissue and preventing postoperative complications, and decreasing the invalidity is actual problem of up to date traumatology.

To improve the treatment results of nonunion fractures and pseudoarthrosis of humeral bone by applying the transosseous compressive-destructive osteosynthesis in combination cucumazin and bone marrow.

Materials and methods

Our report is based on study the treatment results of 51 patients with nonunion fractures and pseudoarthrosis of humeral bone, who have been treated during 2009 - 2012 in the department of Adults traumatology of Research Institute of Traumatology and Orthopedy of the Health Ministry of the Republic of Uzbekistan (SRITO HM RUz). Of them men - 23, women -28. Absolute majority patients age were from 18 to 60. 40 patients were with pseudoarthrosis of humeral bone, the others (11) have been treated with nonunion fractures of humerus.

![Figure 1: Distribution patients groups by malunions and pseudoarthrosises](image)

In 10 patients the pseudoarthrosis was localized in upper third of humeral bone, 16 patients in middle third, and in other (25) patients the pseudoarthrosis were localized in inferior third of humerus.

In 30 patients the hypertrophic pseudoarthrosis was observed, 21 patients had atrophic pseudoarthrosis. All observed patients were incapable.

All patients were conducted medical imaging in two standard projects. Additionally patients were carried out ultrasound Doppler-graphic investigation intended for determining the condition of blood supply of extremity, 41 patients were performed X-ray.
densitometry for detecting of developing stage of osteoporosis. Ultrasound imaging was performed in 25 patients, in 12.5% patients the multispiral computer tomography (MSCT) with the aim of analysis of interfragmental space condition. Operations were performed in planned process in all patients.

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<th>TABLE 1. DISTRIBUTION OF PATIENTS BY AGE GROUP</th>
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<td>Sex</td>
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<td>Total:</td>
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We proposed the new method of treatment the nonunion fractures and pseudoarthrosis of humeral bone. The base of this method is introduction of cucumazin and bone marrow in the region of false joint combination with osteosynthesis by apparatus Ilizarov.

Cucumazin is a natural proteolytic enzymes of papain, chemotrypsin and proteinase III, discharging from milky sap of papaya. Preparation has a high proteolytic activity. The effect of preparation was conditioned by proteolytic enzymes to be included in its content and which consists of sulfhydryc groups in its active centers.

**Method of the treatment**

In offering method under general anesthesia for the accelerating bone fragments union, and for the realization of correct orientation of bone fragments with repairing of axis and removing of segment shortcut as well, in the conditions of stable osteosynthesis, one introduces preparation into area of false joint or nonunion which accelerates bone regeneration. A day before operation the cucumazin in 50 PU dose is introduced into area of pseudoarthrosis or nonunion. Next day after introducing of cucumazim, in sterile conditions, under general anaesthetization, when patient lies on back the apparatus of Ilizarov is put on injured segment. Then from thickness of cog of iliac bone the bone marrow mixture is taken in 2 ml volume. Taken bone marrow is introduced into area of false joint in aseptic conditions. Introducing of red bone marrow into area of pseudoarthrosis or nonunion leads to the formation of hematoma, rich with calcium, which accelerates regeneration of bone tissue in injury focus. After it the aseptic bandage is put around needles of Ilizarov apparatus and in places of needle impale. Introducing of cucumazim promotes fibrinolysis, and introducing of bone marrow mixture, taken from cog of iliac bone, promotes optimization of regeneration process of bone tissue. Using of Ilizarov apparatus provides stability of bone fragments fixation. The next day one begins the distraction of Ilizarov apparatus, which promotes the enlargement of hematoma. After achievement of necessary distraction the x-ray examination in two projects is made, and then one performs compression with the help of Ilizarov apparatus till junction of fragments ends.

**Results and their discussion**

For studying operative treatment results of nonunion fractures and pseudoarthrosis of humeral bone the data of clinical and x-ray examination methods of investigation have been used. For observation of dynamics of bone tissue regeneration process the control x-ray examinations of patients have been made in a month after operation, then each 2 months till a year.
For estimation of efficacy of applying method of osteogenesis stimulation, we studied remote treatment results of patients with nonunion fractures and pseudoarthrosis of humeral bone.

The remote treatment results of considering pathology have been marked as good, satisfactory and unsatisfactory. The anatomical and functional outcomes of treatment have been studied.

Good anatomic results included the presence of full union on control radiographs. Good functional results were: absence of pain in adjacent joints during movements, with their restriction not more than to 5°, complete recovery of capacity for work of upper extremities.

If during x-ray examination there was incomplete union between fragments (to half of shaft of bone width) in correct axis of extremity segment, the anatomical results were marked as satisfactory. The satisfactory functional results were: periodical morbidness during movements in adjacent joints generally associated with physical exercise and weather changing, restriction of movements in adjacent joints not more than to 10°, partial recovery of capacity for work of upper extremities.

In absence of consolidation signs between fragments on control radiographs the anatomical results were thought as unsatisfactory. Unsatisfactory results were: a presence of pain syndrome and pathological mobility in area of false joint, restriction of movements in adjacent joints more than to 15°, disorder of capacity for work of upper extremities.

Remote results were studied in 44 patients in the period of 1 till 3 years. Good outcome has been noted in 75% cases, satisfactory in 18, 1%, unsatisfactory in 6, 9% of patients (the signs of regeneration have not been noted in three patients, who have been operated again with applying of auto bony plastics).

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<th>Table 2. Descriptions of long term anatomic and functional results in treatment of nonunions and pseudoarthrosises of humerus</th>
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<tr>
<td>Treatment evaluation</td>
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<td>Good</td>
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<td>satisfactory</td>
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<td>unsatisfactory</td>
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As good anatomical functional results we give the following clinical example:
Patient N.B. 27 years old, history case №3386, was admitted to clinic in 31.05.2012 with diagnosis: Atrophic pseudoarthrosis of middle third of right humeral bone with the presence of wires. He was operated 13 months ago. During examination the atrophy of muscles of right shoulder is noted, the volume of movement in elbow joint: flexure to 65°, extension to 165°.

A day before operation for softening and lysis of connective tissue the cucumazim in 50PU has been introduced into false joint area. In 02.06.2012 the osteosynthesis of Ilizarov apparatus, which consist of 3,5 rings, was made. There was stable fixation, after that the bone marrow taken from cog of iliac bone in 2 ml volume was introduced into false joint area. On fourth day, after decreasing of pain, one begins distraction in Ilizarov apparatus until appearance of diastasis to 1,0 sm between fragments in false joint area. After x-ray examination the stage of compression was performed until junction of bone fragments endings. Dismantling of Ilizarov apparatus was made after 145 days. After taking down of Ilizarov apparatus physiotherapeutic procedures and physiotherapy exercises were prescribed. The complete consolidation of bone fragments was noted in radiographs.
Conclusion

During analysis of reasons of unsatisfactory outcomes and complications we came to the conclusion that the reason of unsatisfactory results development is premature taking down of apparatuses of external fixation because of inflammation of soft tissue around needles. It is necessary to conduct individual conversation with patients about the care of apparatus and a period of fixation in apparatus. Therefore, our long-term observations showed high efficacy of applying of cucumazim and bone marrow in the treatment of pseudoarthrosis of humeral bone, which in most cases leads to good and satisfactory outcomes of treatment.

References


