



MORPHOLOGICAL STUDY OF THE ELBOW JOINT CAPSULE AT VARIOUS TIMES OF POSTTRAUMATIC CONTRACTURE IN CHILDREN

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ABSTRACT

Closed injuries of the elbow joint with intra-articular fractures are common in the practice of a traumatologist. However, targeted studies depending on the time periods, that is, on the timing of injury and developing structural changes in the joint capsule and synovial membranes among children's patients is still an insufficiently studied problem. Such studies can reveal all sorts of structural deviations, timely diagnosis and treatment of which can prevent serious consequences, including contractures and ankylosis in the elbow joint.

KEY WORDS: Elbow Joint, Radial Head Dislocation, Joint Capsule, Synovial Membrane.

INTRODUCTION

The normal structure of the articular capsule of the elbow joint determines the physiological normal flexion and extension functions of this structural unit [6]. In conditions of pathological damage, which in most cases has a traumatic genesis, various structural disorders develop which entirely depend on multiple factors [5]. This is primarily due to the nature of the damaging factor, the pathomechanism of its action, the age of the patient, the homeostasis of his vascular and nervous systems, and the timeliness of the first medical and then qualified specialized care.

There is a large and extensive literature on the study of traumatic damage to joint capsules and synovial membranes. However, it should be noted that most of them concern closed injuries with intra-articular fractures [1-4]. There are many experimentally modeled research reports on animal materials, which provide stages of regenerative-reparative activity of the synovial membrane of the elbow joint. At the same time, the goals of targeted research on the study of the dynamic morphology of the above-mentioned structural formations in injuries to the elbow joint, at various time intervals in sick people, have not yet been carried out and their morphodynamics remain unclear.

It is a well-known fact that the establishment of the nature and parameters of structural changes in the joint capsule and its synovial membrane in the early and late stages, from the impact of a damaging traumatic factor, with a detailed description of the essence of morphological changes, using modern histological methods, can shed light on the morphodynamics of elbow joint injuries. This can be helpful in developing targeted treatment measures, as well as in preventing undesirable consequences and complications of such injuries.

THE AIM OF THE RESEARCH

To study the morphodynamic aspects of reparative-regenerative processes of the articular capsule of the elbow joint and its synovial membrane, at different time intervals in patients with post-traumatic contractures of the elbow joint.

MATERIAL AND METHODS

The material for the study was the joint bags of the anterior and posterior sections of the elbow joint of 16 children under 16 years old. 10 of these children had traumatic injuries with dislocation of the head of the radial bone, which will be described here as the main group. 9 of them are male, one is female. 6 children had a history of diaphyseal fractures, they will be called the control group, 5 of them are boys, 1 is a girl. The timing of injuries with dislocation of the head of the radial bone (the main group) was following. 4 children were admitted for surgical treatment within 6 months after a traumatic dislocation with reduction in various medical institutions, in 2 children the dislocation was 8-12 months old, in 2 children the surgical intervention was performed within 12-20 months after the dislocation occurred, and in 2 children - after 24 months. In 6 children of the control group, who had a history of diaphyseal fractures, the duration was 10-16 months. The age of sick children in the main group was: 2 patients under 8 years, 5 children under 12 years, and 3 patients under 16 years. In the control group, the age of children ranged from 3 to 12 years.

During the operation, the anterior and posterior sections of the joint capsules were excised from all children. The taken material was poured into a 12% solution of neutral formalin. After a sufficient period of fixation, they were washed in running water, passed through an alcohol battery of increasing strength and poured into paraffin blocks. The prepared thin sections in a sled microtome were stained with hematoxylin-eosin, picro-fuchsin according to the van Gieson method, hexosaminoglycans were detected by the PAS reaction and elastic fibers - according to the Weigert method.

RESULTS OF THE RESEARCH

The results of the morphological study of the joint bags and synovial membranes in the control group of children in all parts of the radial joint showed a variable, but quite characteristic structure of these formations. This entirely concerns the thickness of the synovial membranes, the number of villi, and the structure of synoviocytes. The variability of morphological elements is characterized by the unequal thickness of the synovial bags, the unevenness of their surface and the unequal

appearance of their villi, as well as the polymorphism of the microscopic shapes and height of the villi. Unequal provision of the articular surface with fibrous and fatty bodies was observed. Naturally, such a variation in structures depends on the age of the patients, on the state of individual homeostasis in the metabolic status of the child's body. In general, no pathognomonic deviations in the structure of the synovial membranes and joint bags were found in the materials of the children in the control group (Fig. 1).

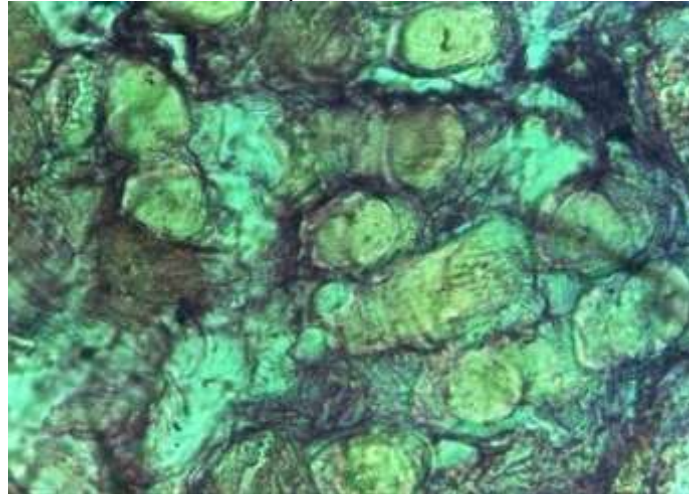


Fig. 1. Micrograph of patient B., 8 years old, osteoid tissue in the joint cavity. Uneven thickness of the synovial bursa and polymorphism of the villi. Hematoxylin and eosin staining. Magnification – 200 x.

During the morphological study of the structural components of the elbow joint in the main group of children with a history of traumatic dislocations, quite contrasting and convincing deviations in the joint capsule and synovial membranes were

found in all age groups. Cicatricial-sclerotic changes of varying degrees with thickening and deformation of the synovial bags, with stenosis of the joint cavity, limiting flexion-extension movements in the elbow joint were noted (Fig. 2).

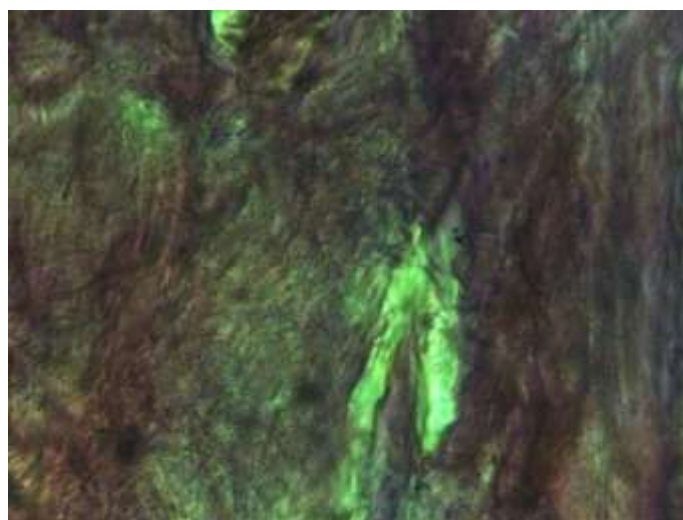


Fig. 2. Micrograph of patient P., 6 years old, lymphoid cell infiltrates. Thickening of the joint capsule and elastic fibers. Hematoxylin and eosin staining. Magnification – 120 x.

In patients with a dislocation period of up to 6 months, weak picrinophilia was determined in the joint capsule of the anterior section when stained according to Van Gieson, thickening and deformation of elastic fibers, determined according to Weigert. In the posterior section, similar disorders were barely

noticeable. Quite multiple lymphoid-cell infiltrates were determined, without signs of their fibroplastic transformation. In these same children, a noticeably expressed PAS reaction was noted, indicating microscopic evidence of the accumulation of glycosaminoglycans (Fig. 3).

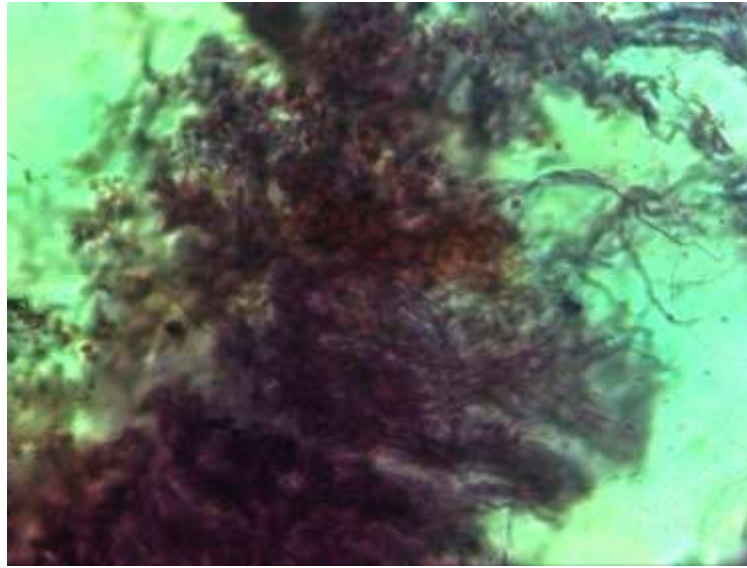


Fig. 3. Micrograph of patient R., 12 years old, significant thickening and sclerosis of the synovial membrane with pronounced picrinophilia. Van Gieson staining. Magnification – 120 x.

Microscopic changes in the articular components in children who had suffered a dislocation 8-12 months earlier were characterized by more pronounced sclerotic changes, also confirmed by increased picrinophilia with van Gieson staining. Staining of elastic fibers according to Weigert did not give any

distinctive features from children with a dislocation up to 6 months. The articular surfaces in these 2 children were characterized by rough deformation without the presence of villi (Fig. 4).

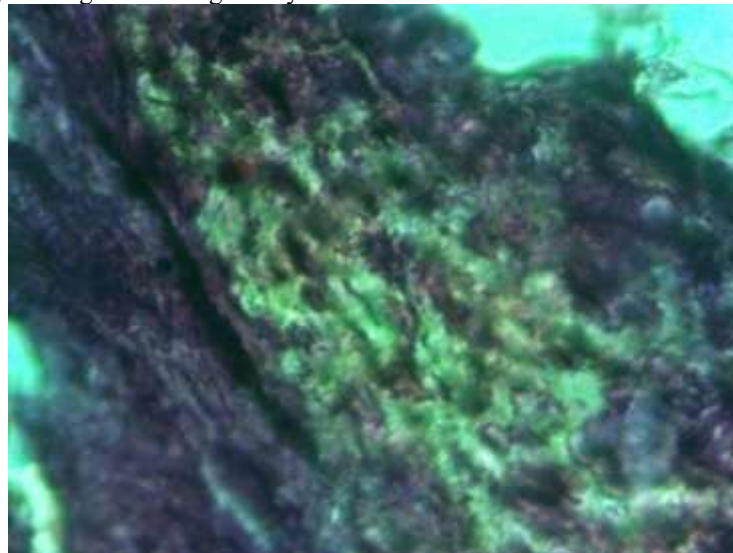


Fig. 4. Micrograph of patient M., 7 years old, uneven thickening of the joint capsule. Hematoxylin and eosin staining. Magnification – 120 x.

The articular components of children operated after 12-20 months were characterized by significantly expressed sclerotic changes in the joint bags and deformation of the synovial membranes. They had more pronounced picrinophilia. The synovial and fibrous layers of the joint bag in these 6 children were almost indistinguishable and were characterized by

monomorphic identity (Fig. 5). At the same time, the PAS positive components were determined by low intensity. Lymphoid cell infiltrates decreased compared to the previous term.

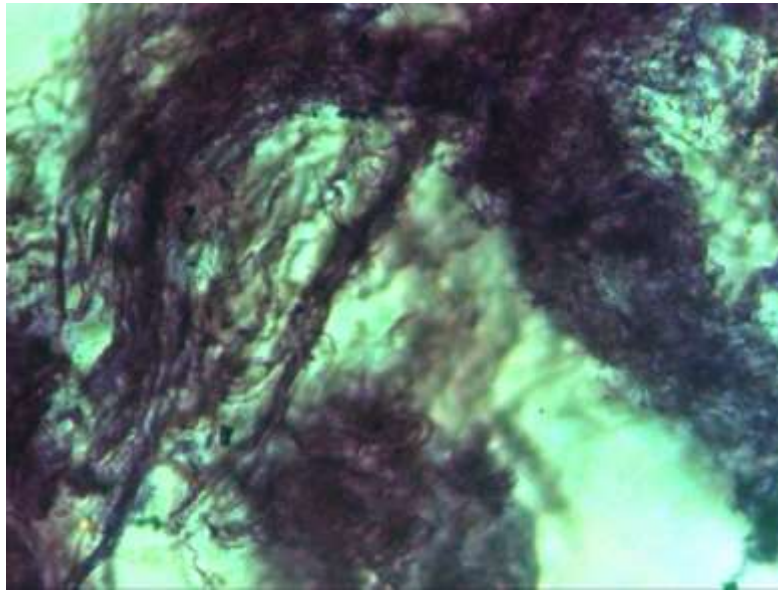


Fig. 5. Micrograph of patient K., 6 years old, sclerotic thickening of the synovial membrane with pronounced picrinophilia. Vannie-Gison staining. Magnification – 120 x.

In two children with a dislocation suffered 24 months ago, a tendency toward demarcation of the layering was noted in the joint capsule and synovial membrane, villous formations and noticeable vascularization appeared. Lymphoid cell infiltrates were not observed. In both patients, shiny monomorphic areas

characteristic of the deposition of hyaline masses were determined in the joint capsule. Picrinophilia with van Gieson staining noticeably weakened, but remained in all areas of the joint capsule (Fig. 7).

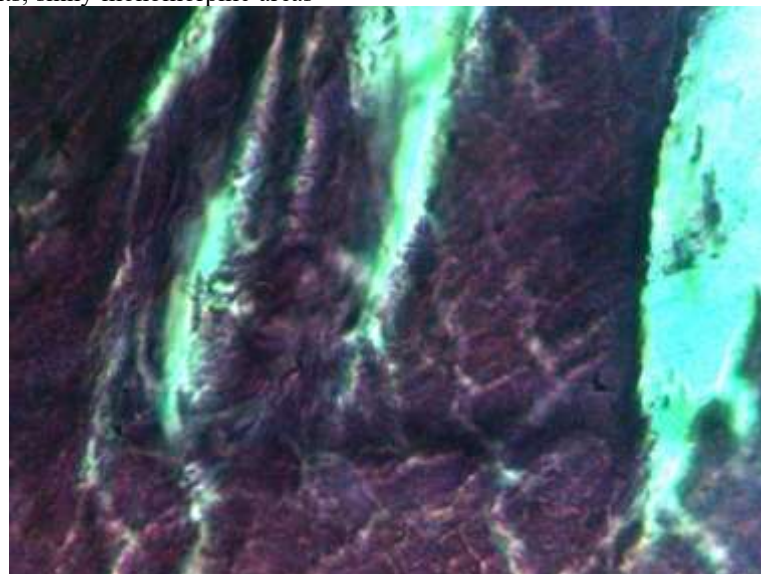


Fig. 6. Micrograph of patient L., 10 years old, sclerotic thickening of the joint capsule, angiomatosis and hyalinosis in the joint. Hematoxylin and eosin staining. Magnification – 120 x.

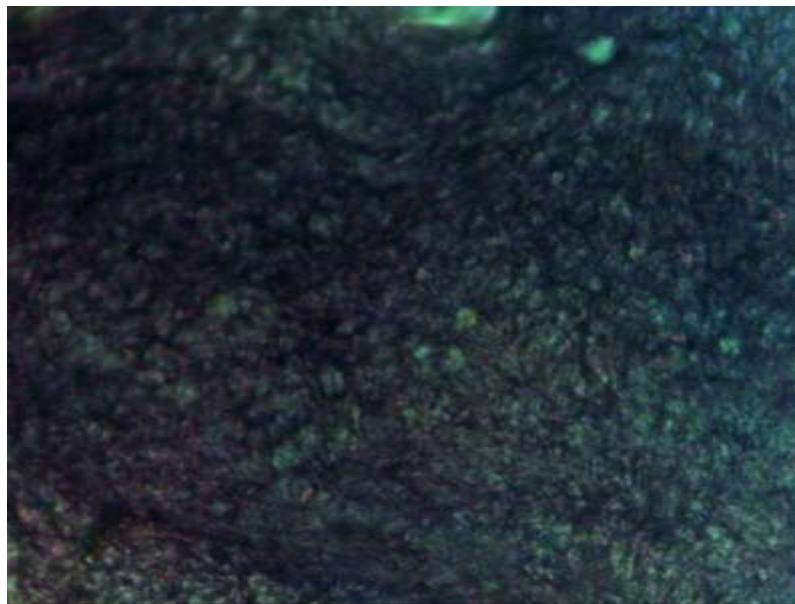


Fig. 7. Micrograph of patient N., 12 years old, total sclerosis, angiomatosis and hyalinosis of the joint capsule. Hematoxylin and eosin staining. Magnification – 120 x.

DISCUSSION OF THE OBTAINED DATA AND CONCLUSION

The results of the study of cellular and tissue elements in children aged 6-16 years with a history of traumatic dislocation of the elbow joint, subjected to surgical treatment with excision of joint bags and synovial membranes at different times after injury, depending on the timing of seeking medical help, showed reliably convincing morpho-histochemical changes that differ in time intervals. In total, the morphodynamics of changes in the elbow joint can be interpreted as restorative-reparative and compensatory-adaptive with the manifestation of a structural pattern characteristic of higher primates with the involvement of their neuroendocrine, regulatory mechanisms. The degree of expression, relief, involvement of joint components in adaptive-restorative processes certainly depend on the etiological factors and pathomechanism of the injury with dislocation of the radial head. However, their dependence on the time of the injury and the age of the children is clearly traced. In younger children, the detected restorative-adaptive structural changes are ahead, that is, they manifest themselves earlier compared to older children. Depending on the time of children's appeal for repeated medical care, a convincing difference is observed in the time intervals of the post-traumatic period, manifested by a dynamic tissue pattern aimed at the possibility of self-preservation and self-recovery, entirely dependent on the state of the children's body and their neuroendocrine regulatory systems.

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