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MORPHOLOGICAL CHANGES IN THE MUSCULOSKELETAL SYSTEM IN CHILDREN WITH JUVENILE IDIOPATHIC ARTHRITIS

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Abstract
We studied the morphological features of musculoskeletal lesions associated with juvenile idiopathic arthritis (JIA) in 36 children. We determined the nature of histological changes in the synovial membrane, articular cartilage, and subchondral bone depending on the clinical form of the disease and the duration of the inflammatory process.

Keywords: Juvenile idiopathic arthritis, children, morphology, inflammation

INTRODUCTION

Juvenile idiopathic arthritis (JIA) remains one of the leading causes of chronic disability in children and adolescents worldwide: the inflammatory process in JIA affects not only the synovial membrane of the joint, but also cartilage, subchondral bone, entheses, ligaments and growth zones, which leads to functional impairment, deformities and growth retardation/impairment of the affected limb. Modern therapy (including biological agents) has significantly reduced the incidence of gross arthritic deformities; however, the morphological substructures of the lesion, their variability across JIA subtypes, and the consequences of chronic low-intensity inflammation remain poorly understood [1,2]. Although modern imaging techniques can detect inflammatory changes, it is morphological and molecular studies of synovium, cartilage, and bone tissue that provide the most in-depth understanding of pathogenesis [3,4,5]. Moreover, the child's body has a number of age-specific characteristics—the presence of

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growth zones and immature immune responses—that significantly modify the clinical significance of the detected morphological changes [6,7,8]. Modern reviews highlight significant progress in understanding the pathogenesis and therapy of JIA, including the development of targeted drugs and the integration of morphological studies into clinical practice [9,10]. Despite the development of noninvasive imaging techniques (ultrasound, MRI, targeted radiographs), significant discrepancies remain between visual markers of injury activity and the morphological (histological and immunohistological) picture in the synovium, cartilage-osseous junction, and subchondral bone. In particular, the presence of "subclinical" synovial activity on MRI does not always correlate with typical macro- and microscopic signs of chronic synovitis proliferation, and the nature of cellular infiltration and vascularization of the synovial layer remains heterogeneous across different JIA subtypes. This limits the ability to accurately stratify the risk of structural damage and personalize therapy.

Thus, studying the morphology of joint and periarticular tissues in children with JIA is key to early diagnosis, prognostication of the disease course, and selection of the optimal therapeutic strategy.

MATERIAL AND METHODS

Biopsies and resection specimens from joint tissues of 36 children with various clinical forms of JIA were examined: oligoarthritis (15), polyarthritis (14), and systemic arthritis (7). Standard histological methods were used, including fixation in 10% neutral formalin and staining with hematoxylin and eosin.

DISCUSSION AND RESULTS

Histological examination revealed the following main changes: pronounced proliferation of lining cells in the synovial membrane, cells of the synoviocyte rows arranged in two and three rows, and perivascular lymphomacrophage infiltration, foci of vasculitis and neoangiogenesis, stromal fibrosis, and fibrinosis deposition (Fig. 1 and 2).

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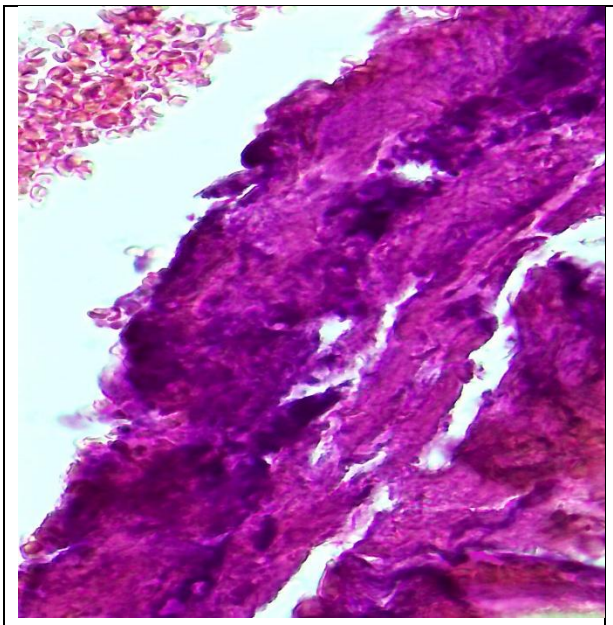

Fig. 1. In the synovial membrane there is a pronounced proliferation of lining cells, cells of the rows of synoviocytes raspoleksno. Staining: G-E. Enlargement: 10x10.

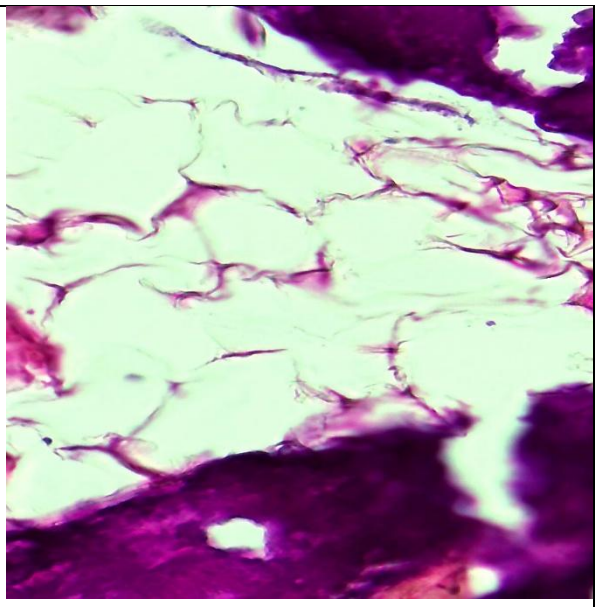

Fig. 2. Vascular dystrophy and fibrosis of the stroma, deposition of fibrinosis in the synovial membrane. Staining: G-E. Enlargement: 10x10.

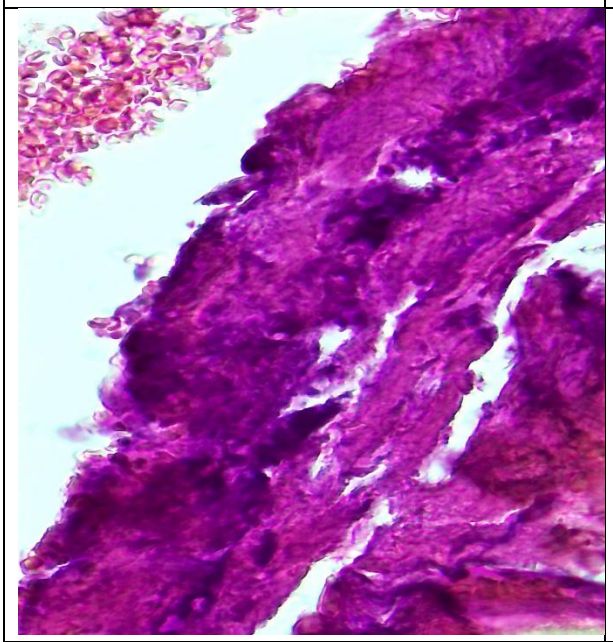

Fig. 3. In the articular cartilage, focal destruction of the superficial zones, chondrocyte hyperplasia and cells, signs of early chondrolytic degeneration - a decrease in matrix basophilia are evident. Staining: G-E. Enlargement: 10x10.

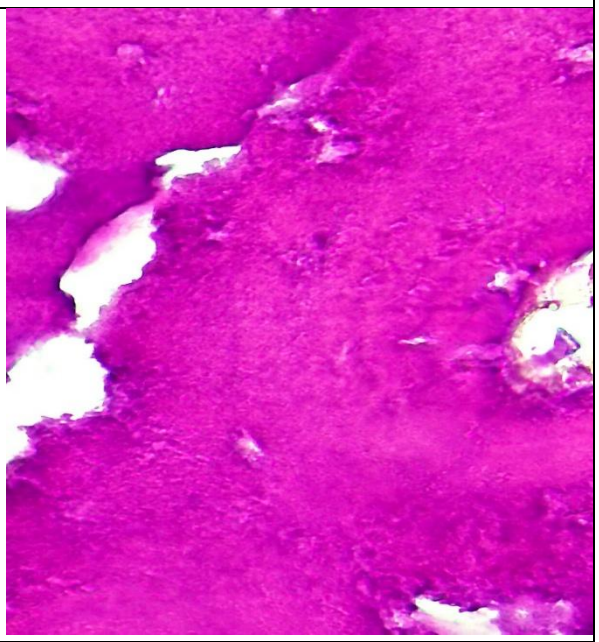

Fig.4. Thickening of bone trabeculae, increased osteoblastic activity, areas of osteoclastic resorption, i.e., fibrosis of entheses, vascularization and foci of calcification in a 14-year-old child. . Staining: G-E. Enlargement: 10x10.

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Articular cartilage reveals focal destruction of superficial zones, chondrocyte hyperplasia and cell clustering, and signs of early chondrolytic degeneration-decreased matrix basophilia, lacunae lysis, areas of subchondral osteosclerosis and microcracks with reactive osteoid proliferation (Figure 3). Thickening of bone trabeculae, increased osteoblastic activity, areas of osteoclastic resorption, i.e., entheseal fibrosis, vascularization, and foci of calcification (Figure 4) are also present. These changes reflect a combination of inflammatory-proliferative and destructive-reparative processes in joint tissues. The predominance of macrophages and $VEGF^+$ angiogenesis indicates chronic inflammatory activity even in clinically remission stages of the disease. Of the biopsy materials studied in 36 sick children, chronic synovitis was detected in 100%, cartilage destruction in 72%, subchondral zone fibrosis in 64%, and enthesopathy in 47% of cases.

CONCLUSION

In children with JIA, the morphological picture of joint lesions is characterized by a combination of chronic productive synovitis and vascular-dystrophic changes in the cartilage and subchondral bone, accompanied by local neoangiogenesis and immune cellular activity. The severity of fibroproliferative changes correlates with the clinical form of the disease and the duration of the inflammatory process.

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