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Pathomorphological Changes in Spondilosis

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Abstract The article discusses pathomorphological changes that develop in osteophytes of the spinal cord, annulus fibrosus and spinal cord in spondylosis. The results showed that the osteophytes arising at the anterior edge of the spine have a morphologically concentric structure, fibrous structures and disordered ground substance, consisting of tissue rich in foci of calcification and pigmentation. As a result of the penetration of osteophytes into the fibrous-annular tissue of the disc, splitting occurs, the destruction of its fibrous structures, the formation of a coarse substance, the development of calcification and chondromatous metaplasia. At first, in the vibrating nucleus, the chondroid material becomes rough, colored, the fibrous structures and the intermediate material are dispersed and thickened. was found, that the number of chondrocytes increased and they underwent processes such as dystrophy and destruction to varying degrees. In chronic spondylosis, complete destruction and necrobiosis of chondrocytes in the nucleus accumbens, their transformation into structureless substances, and the formation of foci of calcification were confirmed.

Keywords Spine, Spinal disc, Spondylosis, Osteophyte, Fibrosis ring, Rebirth nucleus

1. Introduction

Spondylosis is a chronic disease of the spine, the progression of which leads to thinning of the intervertebral disc, resulting in hernias and osteophytes. If not treated in time, the vertebrae become tangled and lose their mobility [1,2]. Its causes are the natural aging of the spine, overload and injury. Injuries play an important role for these reasons. In case of injury, the surface of the vertebrae is damaged and first defects appear, then a calyx forms in their place and osteophytes grow. Excessive stress on the spine leads to stretching and flattening of the disc. These changes ultimately lead to improper regeneration, often with growth and proliferation of connective tissue, leading to pathological changes in the tissue structures of the disc [3,4]. If an inflammatory process joins the foci, then the disease naturally passes into an inflammatory form and pathological infiltrates appear, combining both exudative and proliferative processes characteristic of inflammation in all tissue structures. Changes of this type are observed in metabolic disorders, i.e. in diseases such as diabetes mellitus, obesity, actomegaly [5,6]. With the development of spondylosis, metabolism is often disturbed and the intervertebral disc causes a lack of substances in the disc tissue. Changes of this type are observed in metabolic disorders, i.e. in diseases such as diabetes mellitus, obesity, actomegaly [5,6]. With the development of spondylosis, metabolism is often disturbed and the intervertebral disc causes a lack of substances in the disc tissue. Changes of this type are observed in metabolic disorders, i.e. in diseases such as diabetes mellitus.

The pathogenesis of the development of spondylosis is associated with degenerative changes in the intervertebral disc and osteochondrosis. The risk of its development increases with scoliosis, kyphosis and lordosis [4,5,6,7]. So, spondylosis is the final stage of osteochondrosis. Under the influence of various pathological factors, biochemical changes occur in the intervertebral disc, as a result of which the amount of fluid and proteoglycans decreases in it. As a result, the collagen fibers in the disc break down and break down, reducing cushioning properties. In parallel with these changes, the tone of the spinal cord decreases, it becomes brittle. At this point, bundles of spinal nerves begin to contract.

The purpose of this study was a microscopic study of osteophytes, in which the edges of the vertebrae damaged by spinal cord spondylosis, the fibrous ring wraps around the disc and the elastic core.

2. Materials and Methods

The material of the study is surgical interventions performed in the neurosurgical department of the ASMI clinic in 2019-2022, i.e. with discectomy, laminectomy, fibrous membrane of the intervertebral disc, elastic membrane covering the spine, osteophytes on the anterior edge of the common bone, fibrous ring of the disc. These tissue fragments were solidified for 72 hours in formalin dissolved in 10% phosphate buffer. The bone fragments

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were decalcified in 10% nitric acid. Then all the pieces were washed with running water for 3-4 hours, dehydrated in alcohols of increasing concentration, poured with paraffin wax and prepared bricks. Histological sections 5-7 µm thick were made from paraffin bricks and stained with hematoxylin-eosin and Van Gieson stains. The preparations were studied under a light microscope.

3. Results and Discussion

The results of the morphological study showed that the anterior edge of the vertebrae was thickened, osteophytes of various sizes in the form of tubercles were histologically concentrically arranged randomly, consisting of fibrous structures with numerous cracks and holes of various sizes. Fibrous structures are relatively sparse and scanty in color along the periphery of osteophytes, with dark calcification foci on the outer surface with hematoxylin (Fig. 1). The fibers located in the central part of the osteophytes have a relatively dense structure and are stained dark with eosin. In the center of the osteophyte is a cavity of light soft tissue with granular eosin.

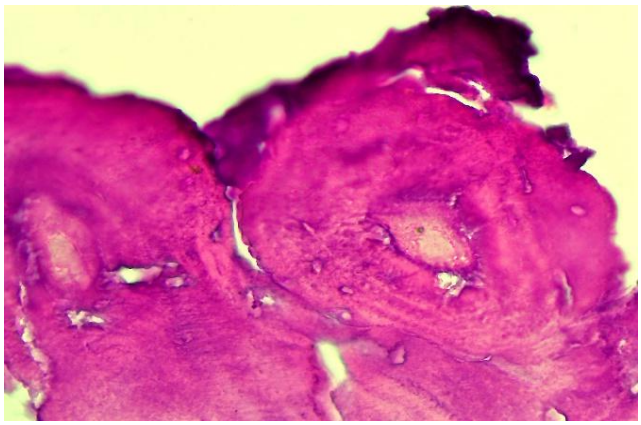

Figure 1. Histological structure of an osteophyte formed along the edge of the spine. Stain: H.E. Size:10x40

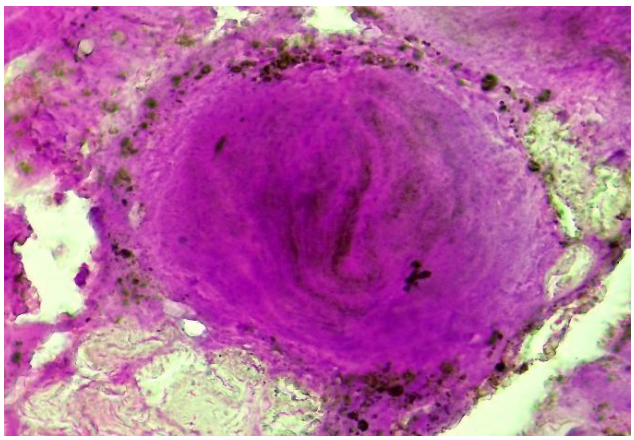

Figure 2. Osteophyte with a relatively dense structure. Stain: H.E. Size:10x40

It has been established that osteophytes arising on the anterior edge of the spine have a histologically different structure. In a number of cases, osteophytes were found, consisting of dense and relatively strong calcified tissue throughout the tumor, i.e. from the center to the peripheral sections. At the same time, it is observed that the fibrous structures of osteophytes are relatively dense and chaotic, strongly calcified in the center, the fibers are sparse and fragmented along the edges, and the degree of ossification is low. Along the perimeter and periphery of such osteophytes, the environment of soft tissue bundles and the presence of a strong degree of pigmentation in the structure of soft tissues are revealed (Fig. 2). Pigmented spots are light brown to dark brown in color, and their appearance occurs after blood transfusions into the soft tissues surrounding the osteophyte.

As a result of the appearance of osteophytes on the anterior edge of the spine, the intervertebral disc is found to fall into the fibrous ring on the outer side of the disc, which has sunk into the bone and calcifies the excess of pathological tissue. It is observed that excess bone tissue in the form of ostriches breaks, squeezes, deforms and draws fibrous structures into the fibrous ring. At the same time, along with the fibrous structures of the fibrous population, destruction and damage to varying degrees of the gel-like intermediate is observed. Histological examination of the tissue of the fibrous ring reveals the development of the following pathological changes. First of all, the tissue of the fibrous ring is disordered, different areas are observed at different levels and stained unevenly. In some places fibrous structures are found dense and coarse, in which calcification furnaces are formed (Fig. 3). In other areas, the fibrous structures are sparsely and weakly colored, the fibers are homogenized and form vacuolated foci. In some areas of the fibrous ring, especially in places where the fibers are dense, the appearance of specific and chondrocyte-like cell structures of different sizes is observed. Thus, fibrosis indicates the development of the process of metaplasia in the form of chondromatosis, in addition to such changes as disintegration and destruction due to the penetration of osteophytes from the bone into the ring. the formation of vacuolated furnaces was found. In some areas of the fibrous ring, especially in places where the fibers are dense, the appearance of specific and chondrocyte-like cell structures of different sizes is observed. Thus, fibrosis indicates the development of the process of metaplasia in the form of chondromatosis, in addition to such changes as disintegration and destruction due to the penetration of osteophytes from the bone into the ring. the formation of vacuolated furnaces was found. In some areas of the fibrous ring, especially in places where the fibers are dense, the appearance of specific and chondrocyte-like cell structures of different sizes is observed. Thus, fibrosis indicates the development of the process of metaplasia in the form of chondromatosis, in addition to such changes as disintegration and destruction due to the penetration of osteophytes from the bone into the ring. especially in places where the fibers are densely located, the appearance of specific and chondrocyte-like cell structures of different sizes is observed. Thus, fibrosis indicates the development of

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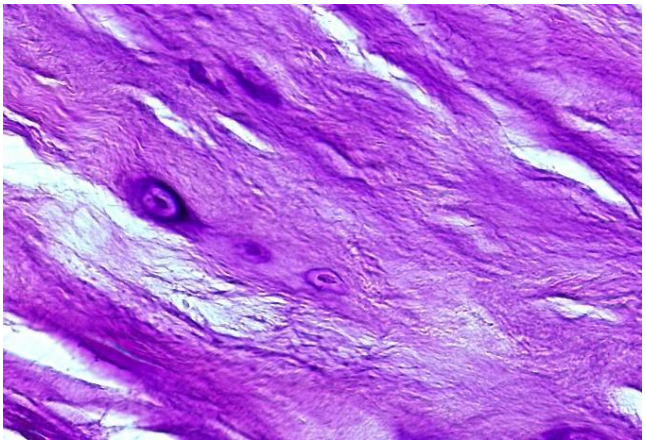

Figure 3. Histological structure of the outer annulus of the disc in the area of osteophytes. Stain: H.E. Size: 10x40

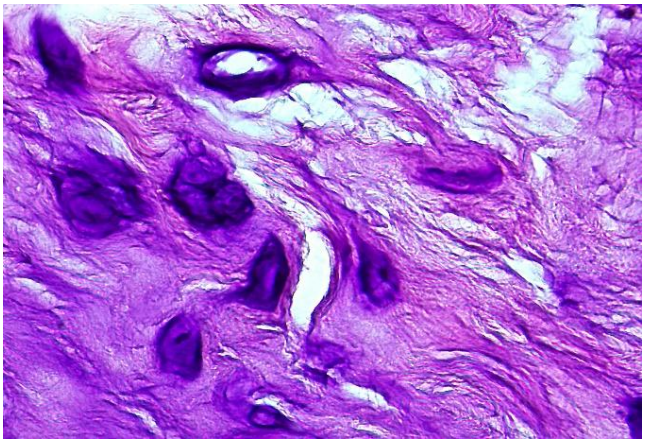

Figure 4. Pathological changes in the fibrous ring of the disc. Stain: H.E. Size: 10x40

The following is defined as the continuation of pathomorphological changes that have developed in the annulus fibrosus of the disc as a result of the appearance of osteophytes at the anterior edge of the spine. In addition to the disintegration and destruction of all tissue structures in the fibrous ring, including fibrous structures, the formation of a large number of calcification foci of various sizes in the fiber and intermediate material is detected. At the same time, it is found that the fibrous structures are almost completely destroyed, they have foci of calcification stained with hematoxylin, and under their influence, further destruction of the fibrous structures occurs (Fig. 4). It is observed that the calcification process proceeds in the form of various bundles, similar to fibrous-annular tissue, in some of which the ossification process is developed. In the tissue of the fibrous ring around the foci of calcification, homogenization of fibrous structures is observed and their transformation into a coarse substance, chondromatous in composition and color. Thus, the development of pronounced dystrophic, destructive changes in the fibrous ring due to the appearance of osteophytes in the vertebrae, the development of irreversible pathological changes in the form of irreversible chondromatous metaplasia, calcification and ossification were confirmed.

In spondylosis of the spine, the following changes were revealed during microscopic examination of the spinal cord, the fibrous ring of the disc simultaneously with the morphological study of the fibrous ring of the disc. It is known that the nucleus accumbens is actually composed of a chondroid substance with a high degree of mild resistance. With the development of spondylosis, specific pathomorphological changes also develop in the structure of the nucleus accumbens due to the development of metabolic disorders, hypoxia, and inflammatory processes. In our material, in the course of the first changes in the nucleus accumbens, it was established that the chondroid substance is coarse, the coloration is distorted, light and dark coloration to varying degrees (Fig. 5), the fibrous and intermediate material in it is dispersed and thickened.

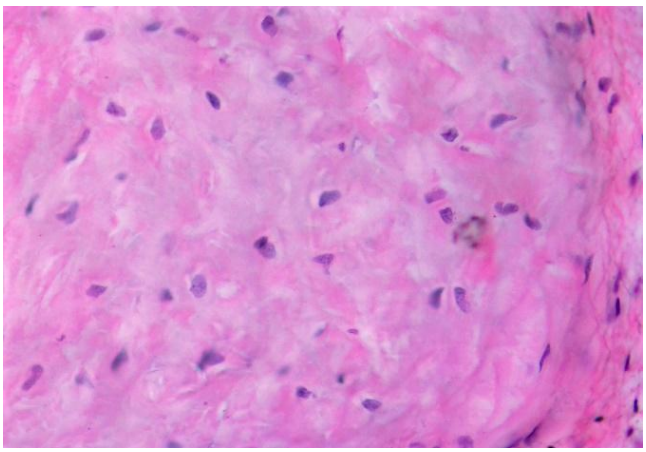

Figure 5. The structure of the nucleus accumbens in spondylosis. Stain: H.E. Size: 10x40

In addition to the initial pathomorphological changes described above, the following processes were identified in the elastic core of the intervertebral disc during a protracted course of spondylosis and the development of a severe form. It was observed that the fibrous structures in the nucleus accumbens were rough, torn, disorganized and stained darker than usual with eochin. At the same time, it was found that the fibrous structures disintegrated, forming separate clusters, turning into a coarsely dispersed substance, part of which calcified. It has been established that chondrocytes in the nucleus accumbens are completely destroyed in this severe form of the disease, necrobiosis, and turn into structureless substances (Fig. 6). The intermediate material was diffusely swollen and disorganized, vacuolated, and in some places formed a homogeneous substance of dark eosinophilic

origin.

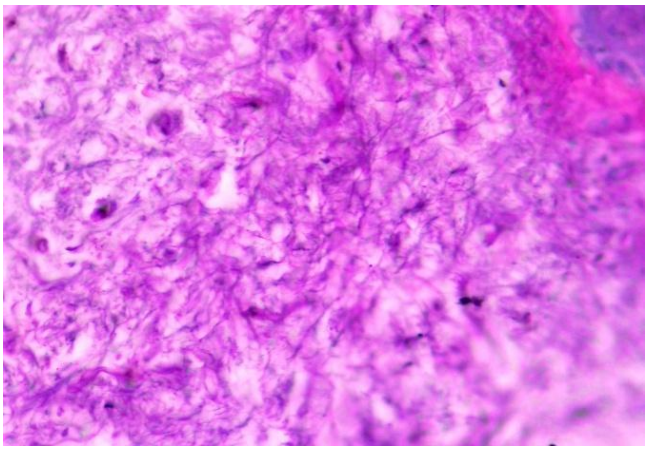

Figure 6. Pathological changes in the nucleus accumbens in severe forms of spondylosis. Stain: H.E. Size:10x40

4. Conclusions

It has been shown that osteophytes that appear on the anterior edge of the spine in spondylosis have a morphologically concentric structure, fibrous structures and a disordered structure rich in foci of calcification and pigmentation.

As a result of the penetration of osteophytes into the fibrous-annular tissue of the disc, splitting occurs, the destruction of its fibrous structures, the formation of a coarse substance, the development of calcification and chondromatous metaplasia.

In the living nucleus, it was initially found that the chondroid material is rough, colored, fibrous structures and intermediates are scattered and thickened, the number of chondrocytes is increased, they are subject to processes such as dystrophy and destruction to varying degrees.

In chronic spondylosis, it was confirmed that chondrocytes in the nucleus accumbens are completely destroyed and necrobiose, turn into structureless substances, and foci of calcification appear.

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