

Morphophysiology of the Synovial Plicae of the Knee

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Abstract Objective. The aim of this study was to determine the features of morphophysiology in synovial plicae of the knee. **Material and methods.** We studied the biopsy, surgical and sectional materials of 54 tissue samples, including 25 medial, 18 suprapatellar, 9 lateropathellar and 2 infrapatellar plicae of the knee. For optical microscopy there was used the tissue samples fixed in 10% formalin solution on phosphate buffer. Paraffin sections were stained with hematoxylin and eosin. In a histological examination of biopsy samples of synovial plicae, we evaluated the structural, proliferative, and inflammatory signs of the stroma. **Results.** It was revealed that the duration of the disease is associated with the severity of proliferation of synoviocytes, the severity of the fibroblastic reaction and the severity of the macrophage reaction. In the presence of obvious clinical course, pathological changes in pronounced manifestations of an inflammatory reaction and proliferative infiltration were determined. In the older age group, these phenomena were less pronounced than in younger patients. In patients with acute knee trauma, insignificant focal lymphoid and plasma cell infiltration was determined. With a prolonged clinical course and the formation of chronic synovitis, a slight severity of changes was noted, while the macrophage reaction was significantly pronounced. In cases of traumatic and inflammatory nature of the synovial plicae syndrome, the monolayer mesotheliocytes emerged above the fibrous surface. **Conclusion.** Pathological synovial plicae of the knee depending on their type, nature of damage and stage of development have various structural transformations, the severity of proliferative and inflammatory reactions. The gradual progression of the pathological process with the prolonged existence of synovial plicae of the knee leads to an increase in inflammatory processes and the formation of severe chronic synovitis, the multiply increasing risk of chondromalation and recurrent synovitis.

Keywords Knee, Physiological and pathological synovial plicae, Morphology

1. Introduction

According to the numerous literature data, 4 types of synovial folds of the knee are found. Pathological changes in synovial folds are due to a number of reasons. Possible causes may be acute direct and indirect injuries or chronic traumatization in the process of sports activities, localized hemorrhages, etc. [1,2,3].

In the process of progression of the process, elasticity is lost, the synovial membranes thicken and become inflamed. The inflammatory process causes plicae fibrosis with subsequent intra-articular disorders [4,5]. A thickened and inelastic synovial plicae prohibit with the normal functioning of the knee joint and can cause gonarthrosis [6].

The aim of this study was to determine the features of morphophysiology in synovial plicae of the knee.

2. Material and Methods

The basis of the study was the biopsy, surgical and

sectional materials of 54 tissue samples, including 25 medial, 18 suprapatellar, 9 lateropathellar and 2 infrapatellar plicae of the knee. Optical micrographs were obtained with an Axioscop 40 - ZEISS microscope connected to a digital camera and a computer. All photomicrographs were processed and data saved on a computer using Microsoft Windows XP-Professional software. For optical microscopy there was used the tissue samples fixed in 10% formalin solution on phosphate buffer. Paraffin sections were stained with hematoxylin and eosin. In a histological examination of biopsy samples of synovial plicae, we evaluated the structural (changes in the synovial membranes), proliferative (fiber hyperplasia, degree of granulation, fibroblastic reactions and angiomatosis), and inflammatory signs (plasma cell, lymphoid and macrophage infiltration) of the stroma.

The results of this study are expected to provide a scientifically proven justification for the correctness of the chosen treatment tactics – surgical arthroscopic intervention in the presence of pathological synovial plicae of the knee.

3. Results

Histological examination of the bioptic material of the normal synovial plicae revealed have the following

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morphological characteristics:

- thin layer of fibrous, fatty and vascular membranes,
- elasticity, which is determined by the high content of fibroblasts.

Optical studies showed that the basis of all four types of synovial plicae is the same and composed of a fibrous loose

conjunctive tissue with a rather large volume of microvessels and layers of fat cells, which are located under the covering layer of synoviocytes (Fig. 1). This conditions are determined by their common genesis - the origin from the synovial membrane of the knee.

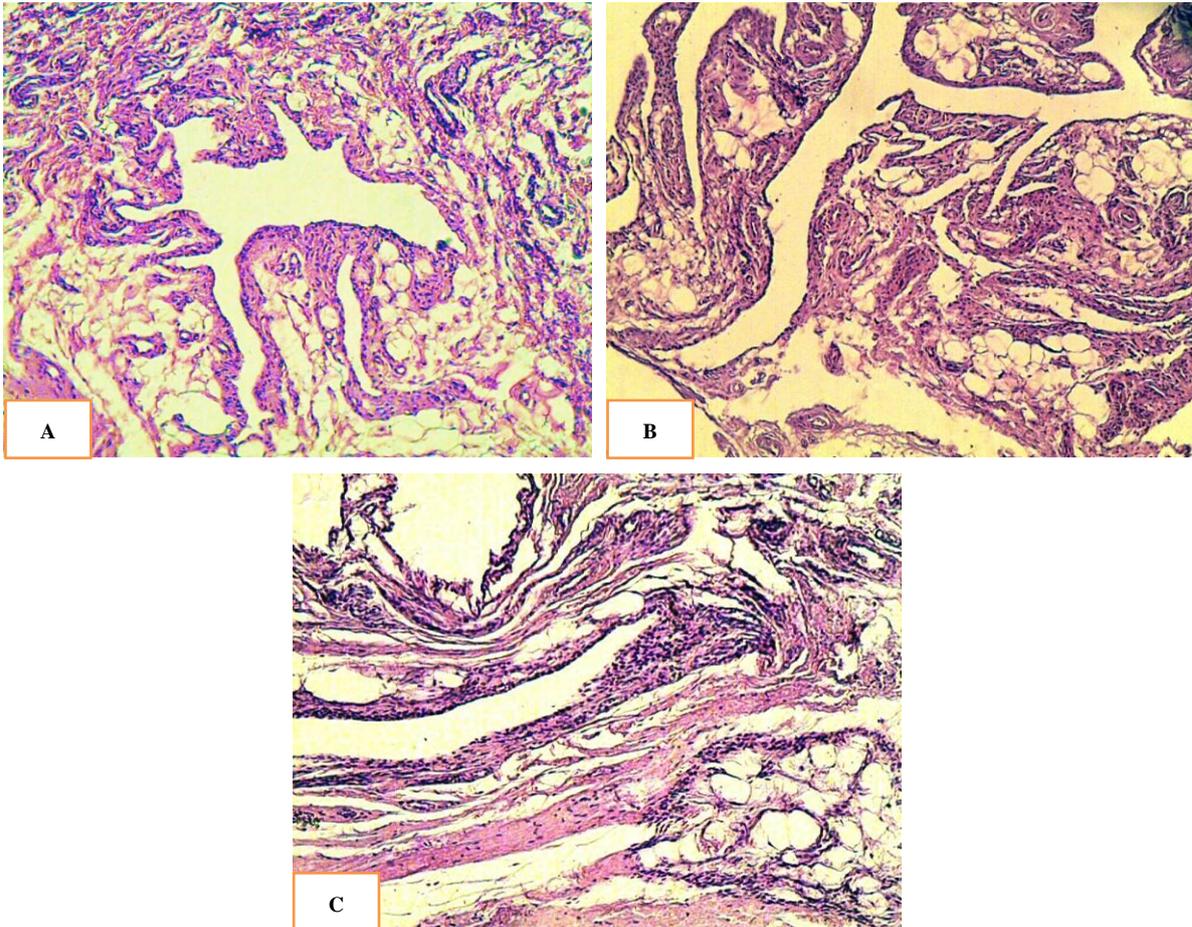


Figure 1. Non-fibrous connective tissue medial plicae (A), suprapatellar (B) and lateropatellar plicae (C), blood vessels with lumens of different caliber, accumulations of fat cells

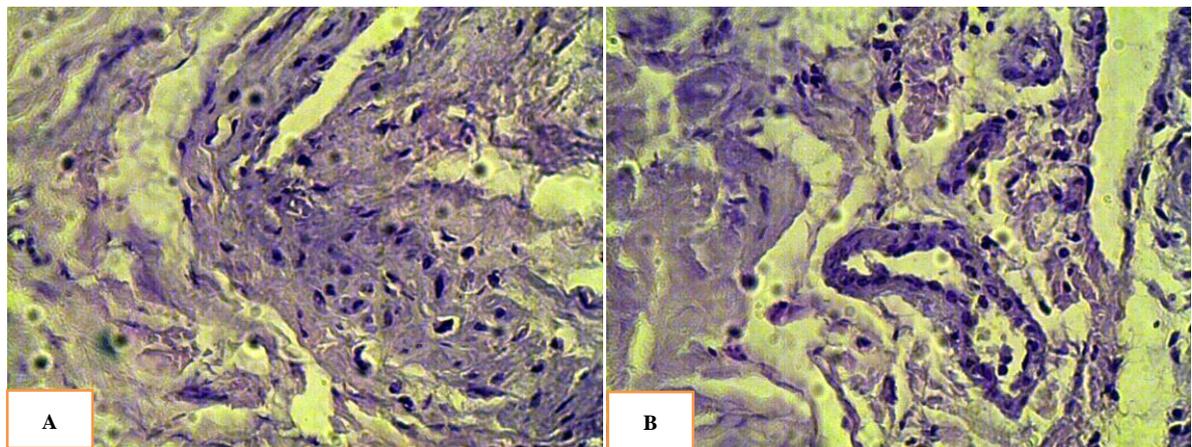


Figure 2. Weakly expressed structural changes. Moderate inflammatory perivascular infiltration: A) medial plicae in case of polyarthritis; B) suprapatellar plicae with shaped elements of blood visible in the lumen of the vessel

In the tissue of the suprapatellar plicae, along with their basis - loose connective tissue, pronounced layers of fat cells are determined. Bundles of collagen fibers, among which inactive fibrocytes are found, represent the stroma. In addition, quite numerous blood vessels represent suprapatellar plicae.

Some of them have significantly widened lumens, which is a distinctive feature of these plicae. The adipose tissue layers, consisting of lipocytes, fibroblasts and histiocytes are more developed than in case of medial plicae. However, the general histoarchitectonics of the medial plicae differs little from that of the suprapatellar plicae. The histological structure of the lateropatellar is also similar to other synovial plicae.

Depending on the knee damage nature, there are weakly expressed structural disorders of the synovial membranes in most cases (Fig. 2). Proliferative signs were mild or moderate in most patients. Villous hyperplasia was found mainly in the form of insignificant and moderate severity.

In the presence of an obvious clinical condition, pathological changes were determined in the form of pronounced manifestations of an inflammatory reaction with an increase in proliferative infiltration, especially in the perivascular zones.

The inflammatory reaction in older age patients are less pronounced than in younger patients since the bulk of synovial plicae is formed by coarse fibrous connective tissue with pronounced fiber hyalinosis and a small number of blood capillaries.

As for the transformations in the areolar synovium, in most cases there is a large number of microvessels in the thickness of the patellar fold of a small caliber with thick walls, usually located in the immediate vicinity of larger caliber vessels. This may indicate the processes of vascular proliferation. The formation of granulation tissue is in most cases undetectable. Only occasionally, in chronic pathological process and the formation of pronounced chronic synovitis, can we find elements that are similar to granulation tissue (Fig. 3).

In patients with acute trauma of the knee, insignificantly expressed focal lymphoid and plasma cell infiltration was determined.

In cases with the long-term existence of medial plicae syndrome and the formation of chronic synovitis, focal lymphoid and plasma cell infiltration was insignificant and moderate, while the macrophage reaction was significantly pronounced.

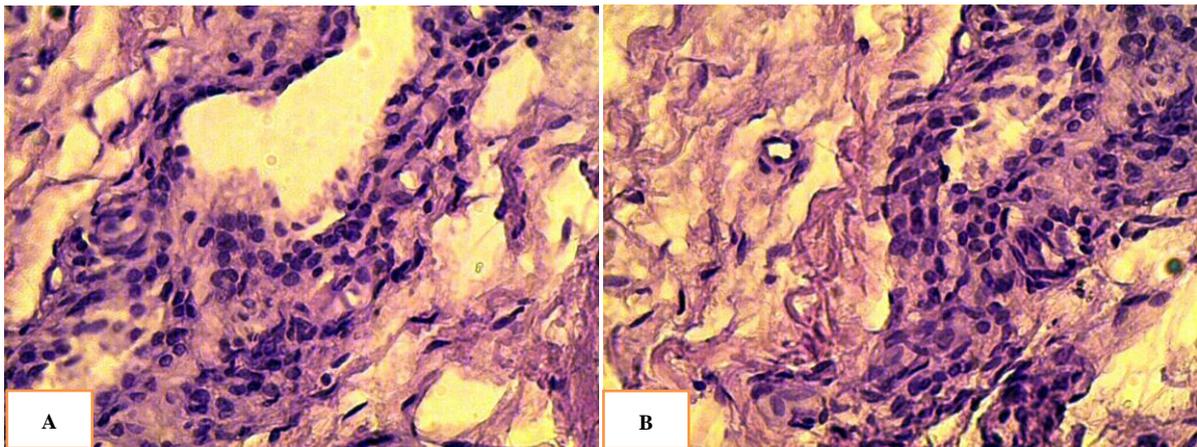


Figure 3. Severe inflammatory perivascular infiltration: A) medial plicae; B) suprapatellar plicae. Pronounced villous hyperplasia with prolonged existence of the knee pathology

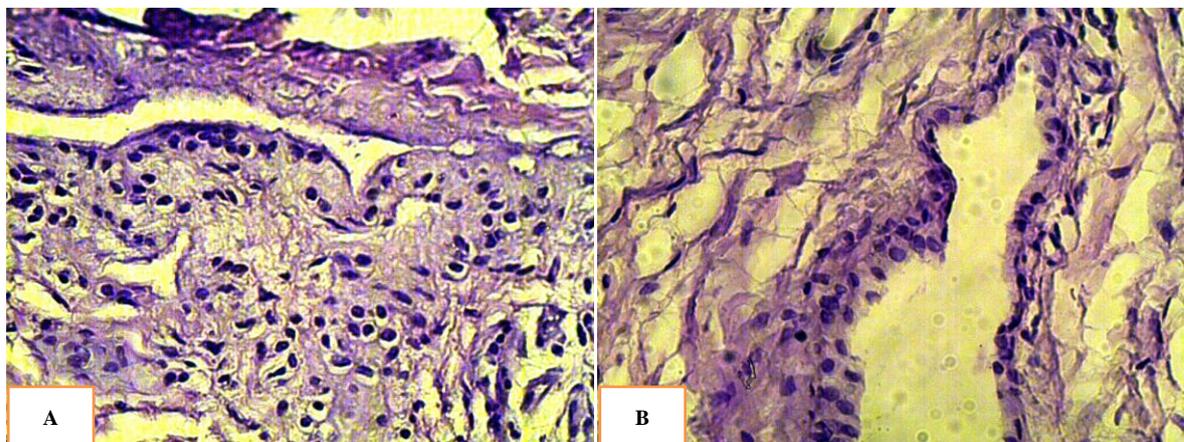


Figure 4. A) Lateral synovial plicae with severe inflammatory perivascular infiltration of; B) Medial plicae with rough fibrous connective tissue, vessels of different caliber and gaps between the fibers

There was a monolayer of mesotheliocyte-type cells above the fibrous surface in cases of traumatic and inflammatory damage of synovial plicae. Accumulations of fat cells are mainly located in the upper layers (Fig. 3).

Another feature of the morphological transformations of the synovial plicae is the presence of the most pronounced inflammatory changes in young patients with acute knee injury and pain syndrome. There were accumulations of inflammatory infiltrate in the perivascular zones. More superficially, in the thickness among the layers of coarse fibrous connective tissue, there is small number of damaged small-caliber vessels (Fig. 4).

The severity of synovial villous hyperplasia in most patients was assessed as insignificant or moderate. The probability of detecting more or less pronounced villous hyperplasia in the corresponding general population does not differ from zero. A similar distribution is observed for the severity of the fibroblastic reaction. There was no granulation tissue in synovial bioptic specimens in 80% cases.

The severity of angiomatosis in biopsy specimens of the synovial membrane was assessed as moderate. The likelihood of lower or higher estimates of the severity of angiomatosis in the corresponding general population does not statistically differ from zero.

In our observations, in middle-aged patients with pathological synovial plicae of the knee, the severity of proliferative reactions was assessed as moderate.

The severity of focal lymphoid infiltration and plasma cell infiltration in the majority of patients was absent or assessed as insignificantly expressed. The probability of detecting pronounced signs of focal lymphoid infiltration and plasma cell infiltration does not differ from zero. The severity of the macrophage reaction in most patients also ranged from mild to moderate. The severity of edema in most cases we assessed as minimally or moderately pronounced. All patients had a slightly pronounced neutrophil reaction.

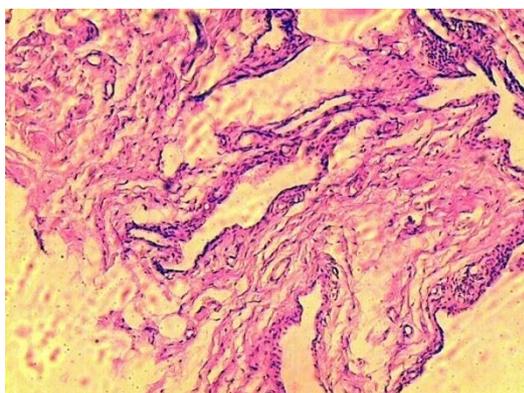


Figure 5. Medial synovial plicae: severe inflammatory perivascular infiltration, false multi-row mesothelium

We assessed the severity of vasculitis as insignificant. There was majority of patients (60%) with moderate

microcirculatory changes. Somewhat less frequently (in 30% of patients), mildly expressed microcirculatory changes were observed. Thus, in 90% of patients, the assessment of the severity of microcirculatory changes in cases of pathological synovial plicae of the knee ranges from insignificant to moderate (Fig. 5).

The severity of sclerosis/hyalinosis in the majority of patients in the study sample we assessed as insignificant or moderate. At the same time, the severity of dystrophy and disorganization of connective tissue ranged from mild to moderate.

4. Conclusions

The pathological synovial plicae of the knee, depending on their type, damage nature and the stage of development, have various structural transformations, the severity of proliferative and inflammatory reactions, signs of focal lymphoid or plasma cell infiltration in most patients.

Pathological suprapatellar and medial plicae undergo pronounced polymorphism of wall layers, dissection and swelling in cases of acute knee traumatization and the addition of an inflammatory process. In most cases, the structural disorders are a consequence of the long existence and progression of the pathological process.

In addition, the gradual progression of the pathological process leads to an increase in inflammatory processes and the formation of pronounced chronic synovitis, increase the risk of degenerative-dystrophic processes, chondromalation and recurrent synovitis.

REFERENCES

- [1] Al-Hadithy N, Gikas P, Mahapatra AM, Dowd G. Review article: Plica syndrome of the knee. *J Orthop Surg (Hong Kong)*. 2011; 19(3): 354-8.
- [2] Schindler OS. The Sneaky Plicarevisited: morphology, pathophysiology and treatment of synovial plicae of the knee. *Knee Surg Sports Traumatol Arthrosc*. 2014; 22(2): 247-62.
- [3] Bellary SS, Lynch G, Housman B, Esmaili E, Gielecki J, Tubbs RS, Loukas M. Medial plica syndrome: a review of the literature. *Clin Anat*. 2012; 25(4): 423-8.
- [4] Oliver S, Schindler. The Sneaky Plicarevisited: morphology, pathophysiology and treatment of synovial plicae of the knee. *Knee Surgery, Sports Traumatology, Arthroscopy*. 2014; 22(20): 247-262.
- [5] Synovial plica from knee joint *J. Morphol. Sci*. 2012;29(2): 69-75.
- [6] Bellary SS, Lynch G, Housman B, Esmaili E, Gielecki J, Tubbs RS, Loukas M. Medial plica syndrome: a review of the literature. *Clin Anat*. 2012 May; 25(4): 423-8.