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# Arthroscopic surgery results for plica syndrome of the knee

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## ABSTRACT

**Aim. This study aimed to carry out a comparative analysis of the treatment results in patients with plica syndrome of the knee. Methods. A total of 425 patients are contributed in the study done during 2018-2019 (main group) and 2014-2017 (comparison group). The main group was consisted of 205 patients who underwent early arthroscopic surgery as the main treatment. The comparison group was consisted of 220 patients who were prescribed conservative therapy for 3 months as the first stage of treatment; in case of ineffectiveness, arthroscopic diagnostics were performed, followed by surgical correction of the pathology of the synovial plica of the knee. Evaluation of the results was carried out after 1 and 3 months (early and immediate postoperative period), 6 and 12 months (long-term postoperative period), and was based on the data of clinical (complaints and physical examination), instrumental (ultrasound and MRI) examination and test results on the scale Lysholm and a special questionnaire IKDC-2000 by comparing these indicators with the data before and after the surgical treatment of patients. Results. The share of excellent and good long-term results was increased from 80.4% to 92.7%, the frequency of specific complications was reduced from 17.3% to 5.4%. Arthroscopic surgery provided successful therapy in 94.6% of cases in patients with pathological synovial folds of the knee. Long-term rehabilitation of more than 6 months was required in 5.4% (11 out of 205) cases, in particular with recurrent synovitis (7 out of 11; 63.6%), chronic pain in the patellofemoral joint (2 out of 11; 18.2%) and the presence of movement restrictions in the knee joint (2 out of 11; 18.2%). Conclusion. The early use of arthroscopic surgery of pathologically altered synovial folds of the knee joint is accompanied by a positive dynamics of points on the Lysholm scale and the IKDC-2000 questionnaire during treatment and is characterized by the possibility of regression of the intra-articular pathological process with a significant increase in the proportion of excellent and good results in the immediate and late postoperative periods.**

**Original Article**

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**Knee,
Pathological Synovial Plica,
Syndrome,
Arthroscopic Surgery**

## INTRODUCTION

Today, injuries are largely associated with poor quality of life and are a serious global public health problem [1, 2]. Moreover, according to the World Health Organization, up to 25% of all injuries of the musculoskeletal system and up to 50% of injuries of all joints occur in the knee [3, 4]. This fact is explained by many factors, among which one of the main ones is the increasing frequency of sports. Another explanation is the complexity of the knee design and the effect of multidirectional forces acting on the knee during sports activities. Patients with injuries and injuries of the knee, as a rule, in addition to long-term complex rehabilitation, often require surgical interventions [5, 6].

An independent problem in chronic trauma and damage to the knee is the occurrence of pathological changes in the synovial plica of the knee, which is considered the most common cause of knee pain in middle-aged people and is always mentioned in the differential diagnosis, along with osteoarthritis, meniscus and/or ligamentous apparatus injuries. knee, inflammatory arthropathy and rheumatoid arthritis [3, 7]. From 18% to 33% of all visits to traumatologists-orthopedists and sports doctors about the pathology of the knee are associated with this syndrome [2, 8]. It should also be noted that with long-term existence, the syndrome of the

pathological synovial fold directly or indirectly becomes the cause of other pathologies of the capsular-ligamentous apparatus of the knee [3, 5].

In the conditions of healthcare in Uzbekistan, arthroscopy, as a method of diagnosis and surgical treatment of various intra-articular pathologies, is at the stage of active development. In this connection, one of the main tasks, disclosed in this article and, in particular, was to evaluate the results of arthroscopic surgical treatment of pathological synovial plica of the knee in patients.

## MATERIALS AND METHODS

The main study group was consisted of 205 (48.2%) patients who underwent early arthroscopic surgery as the main treatment (in a study period of 2018-2019). The comparison group consisted of 220 (51.8%) patients who were prescribed conservative therapy for 3 months as the first stage of treatment; in case of ineffectiveness, arthroscopic diagnostics were performed, followed by surgical correction of the pathology of the synovial plica of the knee (in a study period of 2014-2017). Evaluation of the results was carried out after 1 and 3 months (early and immediate postoperative period), 6 and 12 months (long-term postoperative period), and was based on the data of clinical (complaints and physical examination), instrumental (ultrasound and MRI) examination and test results on the Lysholm Knee Scoring Scale (LKSS) and a special questionnaire IKDC-2000 by comparing these indicators with the data before and after the surgical treatment of patients.

An excellent result was defined as a complete cure of the underlying disease while observing the standards for the length of hospital stay. A good functional result was determined upon recovery from the underlying disease with the presence of postoperative pain associated with increased physical activity, with a slight excess of the standard standards for the patient's stay in the clinic. In instrumental studies, the absence of gross changes on the part of the knee. LKSS 84-94 and IKDC 80-89.

A satisfactory functional result was determined when the underlying disease was cured with the presence of postoperative pain associated with small physical exercises, when the standard standards for the patient's stay in the clinic were exceeded. On the LKSS – 65-83 points, on the IKDC scale 70-79.

An unsatisfactory (poor) result was noted in the presence of postoperative complications, which entailed subsequent repeated visits of the patient and a long rehabilitation period. In instrumental studies, the presence of gross reversible changes – less than 65 points for LKSS and less than 70 for IKDC. Postoperative complications included recurrent synovitis, limitation of movement in the joint, pain in the patellofemoral joint, muscle hypotrophy of the limb, the appearance of crunching in the knee during movement, deforming arthrosis.

According to the results of survey of patients according to IKDC-2000, all cases (100%), both in the comparison group and in the main group of patients, corresponded to an unsatisfactory subjective assessment of the function of the knee (less than 70 points). The lowest scores were obtained when the patients evaluated the maximum level of physical activity that was achievable without significant pain in the knee and the maximum level of regular exercise. In turn, the results of testing on the LKSS showed that the vast majority (76.8%) of patients assess the function of the knee as unsatisfactory; 23.2% of patients assess the function of the knee as satisfactory (22.5% in the comparison group and 24.0% in the main group). At the same time, almost all patients noted lameness, instability, the presence of wedges in the joint, the use of additional support when walking, pain and swelling during exercise. The study of the correlation relations between the initial indices of the integral assessment of the function of the knee according to the LKSS and IKDC questionnaires revealed a high direct correlation (Figure 1). Pearson's correlation coefficient is 0.97 in the comparison group and 0.96 in the main group.

Table 1 shows the types and volume of surgical interventions performed in the study groups. Thus, in most cases, isolated arthroscopic resection of the pathological synovial fold of the knee was performed in 41.8% (92 of 220) in the comparison group and in 42.0% (86 and 205 patients) in the main group. Depending on the presence of one or another concomitant or competing intra-articular pathology, the following additional interventions were performed: synovectomy, partial/complete meniscectomy, removal of Goff's body, removal of chondromic bodies, plastic surgery of the kneecap soft tissues.

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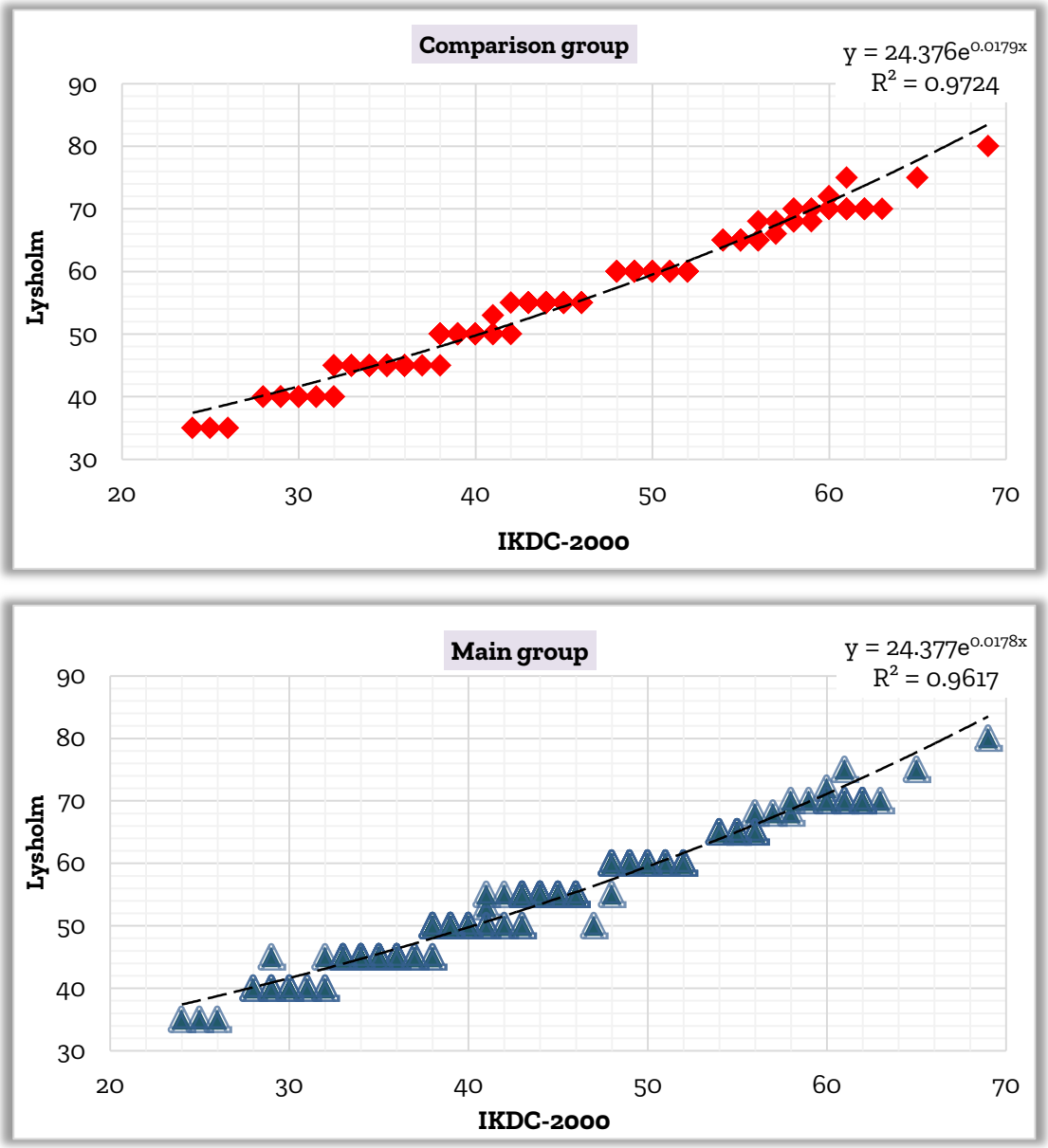


**Figure 1.** Diagram of the linear correlation of the integral assessment of the function of the knee according to the LKSS and IKDC-2000 questionnaires before the start of treatment

**Table 1.** Summary of the distribution of patients by type of definitive surgery in the study groups

| Types of surgical interventions | Comparison group (n=220) | | Main group (n=205) | |
|---|---|---|---|---|
| | n | % | n | % |
| Arthroscopy, resection of pathological plica | 92 | 41,8% | 86 | 42,0% |
| Arthroscopy, abnormal fold resection + synovectomy + meniscectomy | 65 | 29,5% | 62 | 30,2% |
| Arthroscopy, resection of pathological plica with partial meniscectomy | 40 | 18,3% | 32 | 15,6% |
| Arthroscopy, resection of pathological plica + removal of Hoff's body | 9 | 4,1% | 11 | 5,4% |
| Arthroscopy, abnormal fold resection + soft tissue plasty of the patella | 6 | 2,7% | 5 | 2,4% |
| Other | 8 | 3,6% | 9 | 4,4% |
| Total | 220 | 100,0% | 205 | 100,0% |

## RESULTS

It is known that the IKDC-2000 questionnaire and the LKSS are intended for adult patients, perfectly reflect the state of the knee and the general condition of the patient, pre- and postoperative period. These integral scales are described in detail earlier, in the second chapter "Clinical characteristics of material and research methods" of this dissertation work.

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When analyzing the dynamics of the severity of the functional state of the knee according to the indicators, the LKSS, it was revealed that in the comparison group 1 month after the operation, 84-94 points with good function of the knee were scored in 9.5% (21 out of 220) cases and after 3 months in 22.7% (50 out of 220) cases. A similar positive dynamics with an increase in the proportion of patients with 84-94 points according to the LKSS score was noted among patients of the main group in 16.6% (34 of 205) after 1 month and 35.1% (72 of 205) after 3 months. Intergroup statistical indicators were as follows - p<0.001.

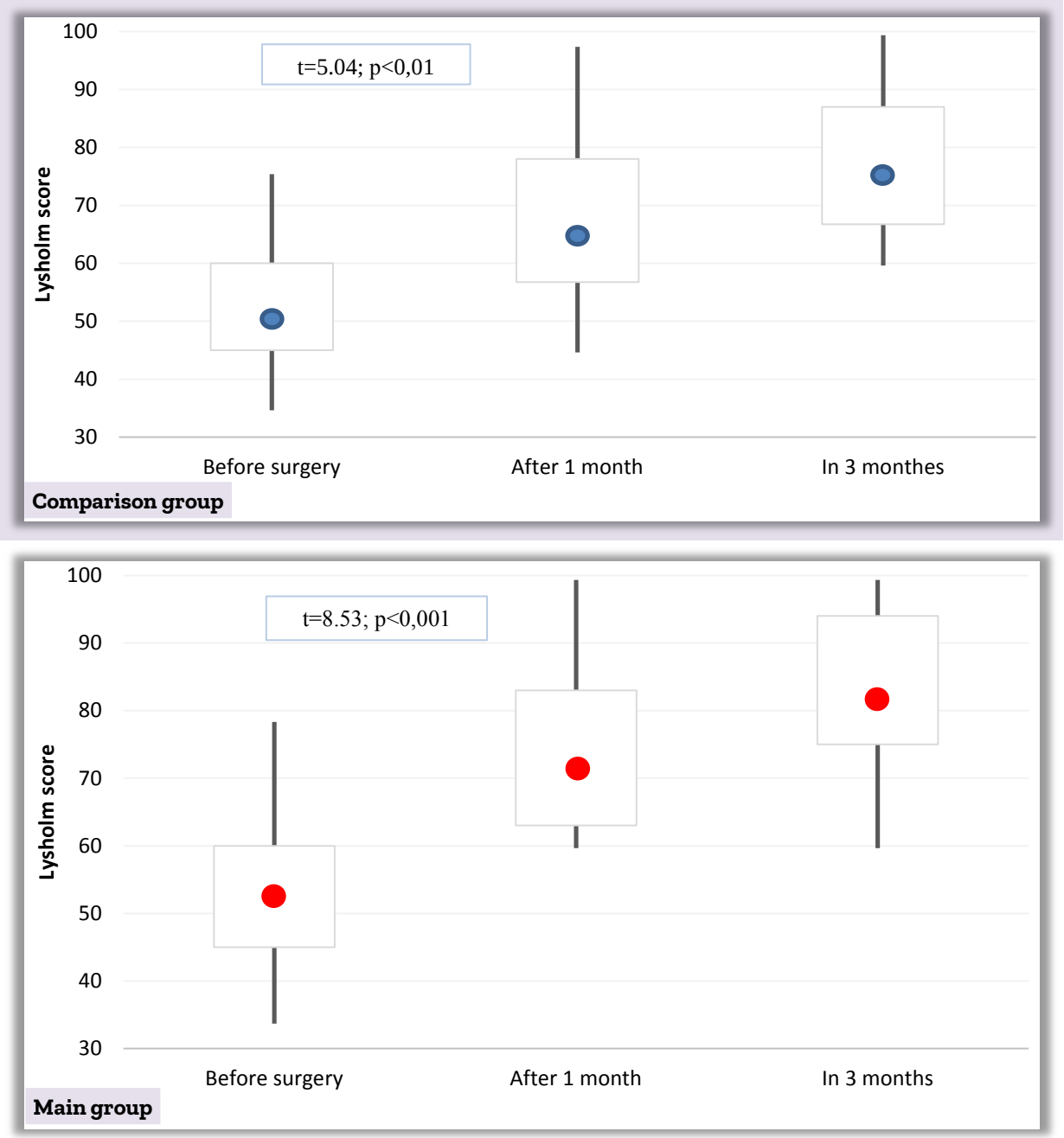


**Figure 2.** Indicators of the subjective integral assessment of the knee according to the LKSS in the study groups 1 and 3 months after surgery

In the comparison group, 1 month after the operation, LKSS of 95-100 were noted in 3.2% (7 out of 220) cases and in 3 months - in 9.6% (21 out of 220) cases, i.e. with a higher frequency in dynamics. The same positive dynamics was noted among the patients of the main group - 7.3% (15 of 205) after 1 month and 22.9% (47 of 205) after 3 months (Df=3; p<0.001 in relation to the comparison group). In general, the higher frequency of excellent and good results according to the LKSS in the immediate postoperative period revealed in the course of the study means the resolution of intra-articular pathological changes in the course of treatment (Figure 2). Figure 2 shows that the median of baseline indicators on the LKSS for the comparison group was 55.0 points, and for the main group it was Me=56.0 points. No significant differences were found between the study groups. In

contrast to the baseline data, the postoperative results (after 1 and 3 months) on the LKSS between the groups were statistically significant (P=0.001). The main problems in patients with low Lysholm scores in both groups were pain and swelling during exercise, as well as discomfort while squatting and kneeling.

Table 2 shows comparative data on the incidence of postoperative complications in the early and immediate period after arthroscopic surgery of pathological synovial plica of the knee. Thus, the overall incidence of specific complications in the period up to 3 months after surgery was 36.7% (156 out of 425). At the same time, the frequency of observations was less in the main group than in the comparison group (26.4% versus 46.4%; $\chi2=17.46$; Df=3; $p<0.001$). The most frequent complications were limitation of movements in the knee (14.1%; 29 of 205) and recurrent synovitis (5.9%; 12 of 205).

During the study, we found that the most significant factors affecting the nature, frequency, and development of complications in the immediate postoperative period are: non-compliance with recommendations and the rehabilitation schedule, the patient's age over 50 and the initial concomitant intra-articular pathologies. If the recommendations for postoperative rehabilitation were followed, the time needed for patients to return to their previous level of activity ranged from 4 to 8 weeks.

**Table 2.** Summary data on the course of the immediate postoperative period in the study groups

| Items | Comparison group | | Main group | | Total | |
|---|---|---|---|---|---|---|
| | n | % | n | % | n | % |
| No complications | 118 | 53,6% | 151 | 73,6% | 269 | 63,3% |
| Recurrent synovitis | 21 | 9,5% | 12 | 5,9% | 33 | 7,8% |
| Limitations of movement in the knee | 45 | 20,5% | 29 | 14,1% | 74 | 17,4% |
| Pain in the patellofemoral joint | 18 | 8,2% | 7 | 3,4% | 25 | 5,9% |
| Limb muscle hypotrophy | 6 | 2,7% | 2 | 1,0% | 8 | 1,9% |
| The appearance of a crunch in the knee when moving | 7 | 3,2% | 2 | 1,0% | 9 | 2,1% |
| Deforming arthrosis | 5 | 2,3% | 2 | 1,0% | 7 | 1,6% |
| Total complications | 102 | 46,4% | 54 | 26,4% | 156 | 36,7% |
| | $\chi^2$=17,46; Df=3; p<0,001 | | | | - | - |

Thus, the dynamics of points according to the LKSS and the IKDC-2000 questionnaire during treatment is characterized by the possibility of regression of the intra-articular pathological process with a significant increase in the proportion of excellent and good results in the immediate postoperative period from 32.3% (71 out of 220) to 58.0% (119 out of 205) on the LKSS and from 30.0% (66 out of 220) to 59.5% (122 out of 205) according to IKDC-2000.

Also, the analysis of the immediate results (up to 3 months) showed that the developed and proposed method for arthroscopic resection of the pathological synovial fold of the knee provides successful therapy in 73.6% (151 of 205) cases. Long-term rehabilitation for more than 4 months due to the development of specific complications was required in 7.8% (16 out of 205) cases, in particular with recurrent synovitis (75.0%; 12 out of 16), muscle wasting of the affected limb (12.5%; 2 of 16) and deforming arthrosis (12.5%; 2 of 16). In turn, the need for repeated examinations did not arise in patients with early treatment, with isolated pathology of the synovial fold and the use of an early one-stage arthroscopic surgical treatment.

In the long-term period (12 months) after arthroscopic surgery of the pathological synovial plica of the knee, a comprehensive assessment of the functional state of the knee according to the Lysholm scale (Figure 3) showed a significant difference in the severity of the pathological process between the study groups (criterion $\chi2=10.731$; Df=3; p=0.002). At the same time, 84-94 and 95-100 points according to LKSS were scored in 39.1% (86 out of 220) and 43.6% (96 out of 220 patients) of cases in the comparison group, while in the main group these criteria were defined in 34.6% (71 of 205) and 60.0% (123 of 205 patients) cases. Satisfactory (66-83 LKSS) results were observed in 11.8% (26 of 220) cases in the comparison group and in 3.0% (6 of 205) cases among patients of the main group. In 5.5% (12 out of 220 patients) and 2.4% (5 out of 205) cases, in the comparison group and the main group, respectively, poor results (<65 LKSS) with complications were revealed. Questioning of patients in the long-term postoperative period using the IKDC-2000 questionnaire (Figure 3) showed a significant difference in the severity of the pathological process between the study groups ($\chi2=12.37$; Df=3; $p<0.001$).

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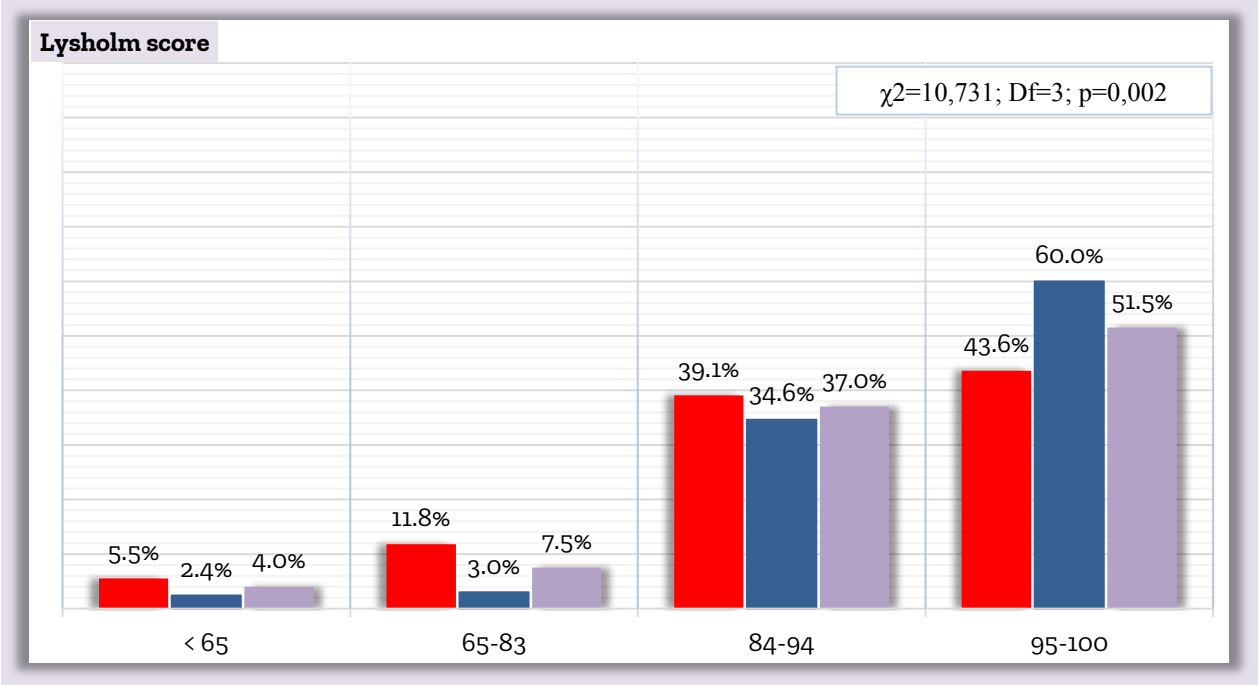


**Figure 3.** Distribution of patients in accordance with the scored points on the Lysholm scale in the long-term postoperative period.

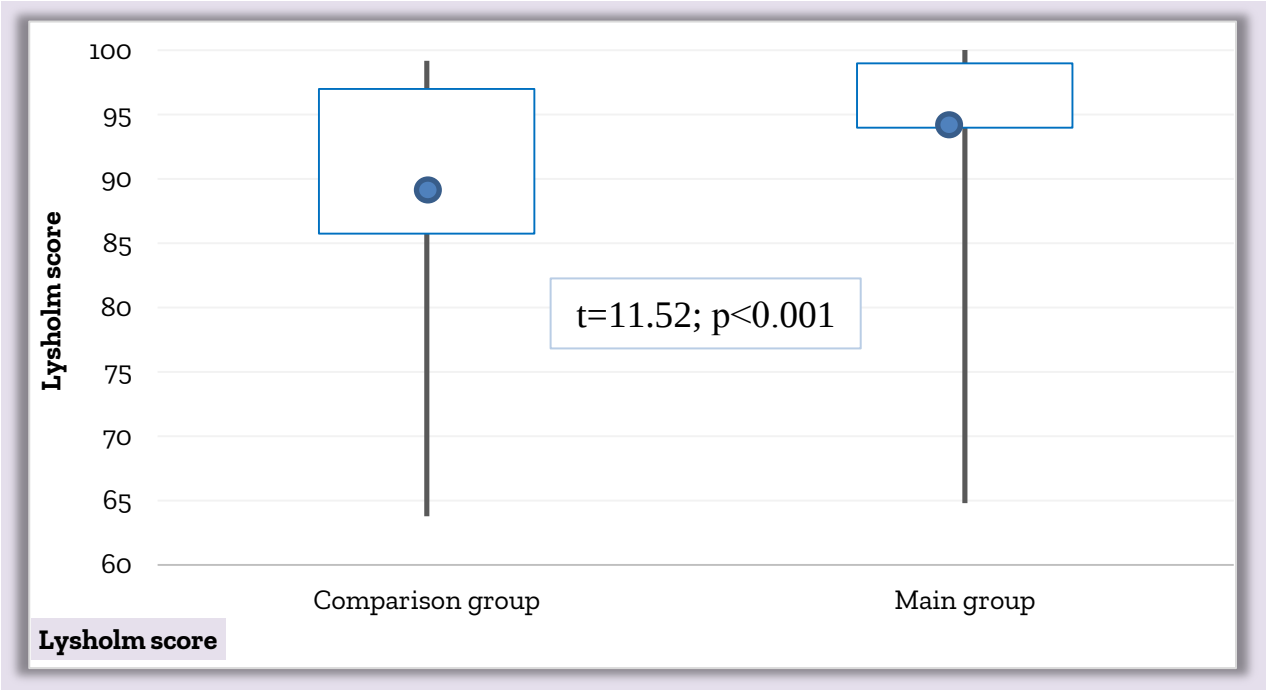


**Figure 4.** Indicators Lysholm score in the study groups in the long term after surgery.

At the same time, in 39.5% (87 out of 220 patients) and 41.4% (91 out of 220) cases in the comparison group, a 90-100 and 80-89 IKDC points were noted, while in the main group these criteria were defined in 57,1 % (117 of 205 patients) and 33.6% (69 of 205) cases. A 71-79 IKDC results were observed in 12.7% (28 out of 220) cases in the comparison group and in 5.4% (11 out of 205) cases among patients in the main group. Poor results (<70 IKDC) and a complicated postoperative course were detected in 6.4% (14 out of 220 patients) and 3.9% (8 out of 205) cases, in the comparison group and the main group, respectively (Figure 3).

Figure 4 shows that the median of the Lysholm score for the comparison group was Me=92 points, and for the main group it was Me=97.0 points. Significant differences were found both within and between the studied groups (t=11.52; p<0.001). The data obtained indicate that the average LKSS in patients with pathological synovial plica of the knee in the long term after arthroscopic treatment had an integral functional assessment of the knee of more than 84 points and belonged to the group with a good and excellent condition of the knee, according to the criteria according to the LKSS. The integral assessment of the knee function according to the

IKDC-2000 questionnaire in the long term after arthroscopic surgical treatment of the pathological synovial fold of the knee showed an overall good result (Me=87) in the comparison group and an excellent (Me=95) result in the main group with a significant statistical difference (t=9.53; p<0.001) (Figure 4).

The data obtained in the course of the study indicate that the average IKDC-2000 in patients with pathological synovial plica of the knee in the long term after arthroscopic treatment had subjective integral functional assessment values of more than 80 points and belonged to the group with a good and excellent condition of the knee, according to the criteria according to the questionnaire IKDC-2000. The main problems in patients with low LKSS in both groups were minor pain during exercise, as well as discomfort while squatting and kneeling. In cases with satisfactory and poor treatment results, patients' scores for such sections of the IKDC-2000 questionnaire as the level of regular exertion, pain in the knee joint and its intensity, as well as the ability to squat, sit with bent knees and especially stand on an injured leg were noted. In general, the higher frequency of excellent and good results on the LKSS and the IKDC-2000 questionnaire in the long-term postoperative period revealed in the course of the study means the resolution of intra-articular pathological changes in the course of treatment. Comparative analysis of the data of the IKDC and LKSS one year after the operation made it possible to conclude that the scores in the main group of patients were significantly higher than in the comparison group (p<0.001). A significant part of the previously observed patients with poor results during the rehabilitation process scored high points on the integral rating scales with significant intragroup differences (p<0.05). Repeated arthroscopy was not required in any case.

Collection of complaints, questionnaires, physical examination using special tests, ultrasound and MRI allowed us to verify the nature of specific complications in the long-term postoperative period (Table 3). The range of long-term complications included recurrent synovitis, limitation of movement in the joint, pain in the patellofemoral joint, muscle hypotrophy of the limb, the appearance of crunching in the knee joint during movement, and deforming arthrosis. The frequency of these complications in the main group was significantly lower. Thus, the overall frequency of the complicated course was 11.5% (49 out of 425 patients), with a significant intergroup difference in favor of the main group (5.4% versus 17.3%; $\chi^2$=14.75; Df=3; p<0.001).

**Table 3.** The nature and frequency of long-term complications in the study groups

| Items | Comparison group | | Main group | | Total | |
|---|---|---|---|---|---|---|
| | n | % | n | % | n | % |
| No complications | 182 | 82,7% | 194 | 94,6% | 376 | 88,5% |
| Recurrent synovitis | 11 | 5,0% | 4 | 2,0% | 15 | 3,5% |
| Limitations of movement in the knee | 14 | 6,4% | 5 | 2,4% | 19 | 4,5% |
| Pain in the patellofemoral joint | 7 | 3,2% | 2 | 1,0% | 9 | 2,1% |
| Limb muscle hypotrophy | 2 | 0,9% | 0 | 0,0% | 2 | 0,5% |
| The appearance of a crunch in the knee when moving | 2 | 0,9% | 0 | 0,0% | 2 | 0,5% |
| Deforming arthrosis | 2 | 0,9% | 0 | 0,0% | 2 | 0,5% |
| Total complications | 38 | 17,3% | 11 | 5,4% | 49 | 11,5% |
| | $\chi^2$=14,75; Df=3; p<0,001 | | | | - | - |

These differences in the frequency of specific complications can be due, on the one hand, to the severity of the course of the pathological process, when, if the patient does not comply with the prescribed conservative therapy, carried out as the first stage of treatment, a significant scatter of indicators on integral scales is possible and, accordingly, a more severe condition in the comparison group, but on the other hand , this may also be the result of the choice of early arthroscopic surgical treatment of pathological synovial plica long before the transition of the disease to the next morphological stage and the addition of other intra-articular pathologies, which significantly affects the severity of the postoperative course both in the immediate and distant period.

In Figure 5 shows the summary long-term results after all arthroscopic operations for pathological synovial plica of the knee in the comparison groups. Thus, it can be seen that the main group of patients was characterized by significantly better results, where 60.0% (123 of 205) cases were excellent, and 32.7% (67 of 205) were good, while in the comparison group these indicators were 43.6% (96 out of 220) and 36.8% (81 out of 220 patients), respectively ($\chi^2$=13.47; df=3; p<0.001). The share of satisfactory results was 9.8% (28 out of 220) in the comparison group and 4.4% (9 out of 205) in the main group.

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The summary frequency of complications observed in the near and long term after arthroscopic surgery of the pathological synovial plica of the knee is shown in Figure 6. So, in the main group, the immediate period became complicated in 26.4% of cases, in the comparison group - in 46.4% (p <0.001). In the long-term period of the main group of patients, complications were observed in 5.4% of cases, in the comparison group - in 17.3% ($\chi^2$=14.75; Df=3; p<0.001). Thus, in accordance with the results obtained, it was revealed that in the long term after arthroscopic surgery for pathological synovial plica of the knee joint, the values of the integral criterion of the LKSS and the indices of the IKDC-2000 subjective questionnaire significantly improved for both groups compared to the values in the early and immediate periods and almost returned to the level of activity of healthy people; the rate of excellent and good outcomes increased from 80.4% to 92.7%, and the complication rate decreased from 17.3% to 4.4%.

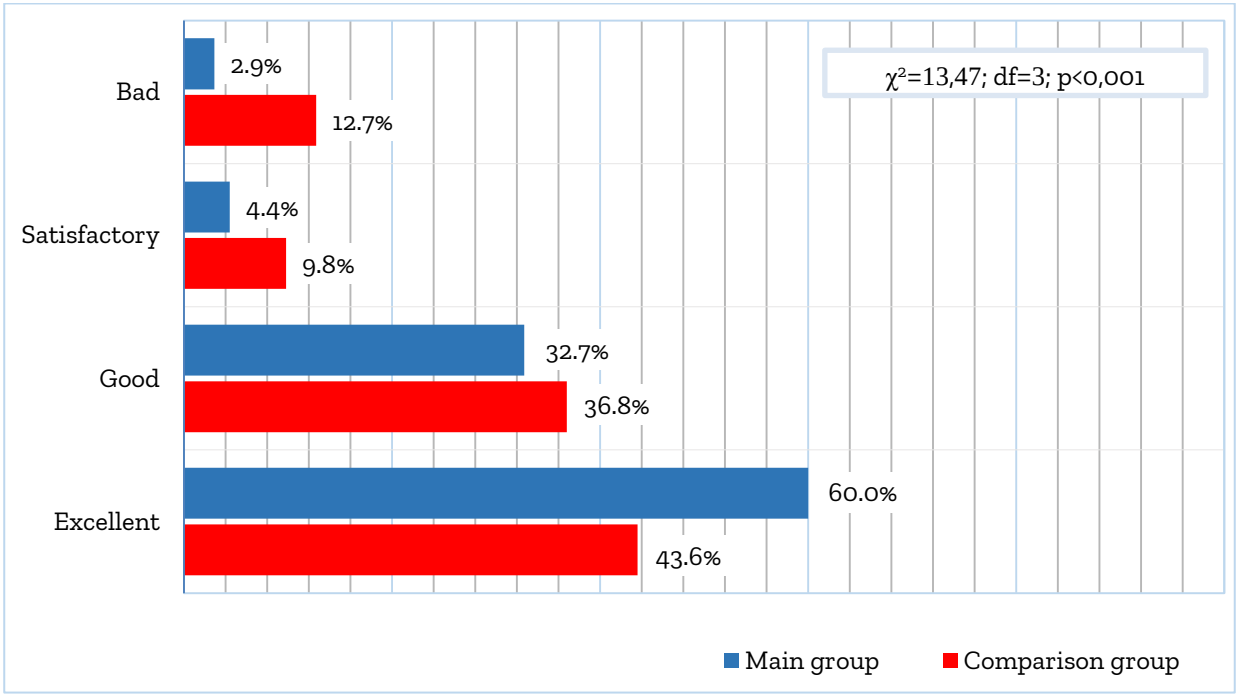


**Figure 5.** Summary long-term results after arthroscopic surgery of pathological synovial plica of the knee joint in the study groups.

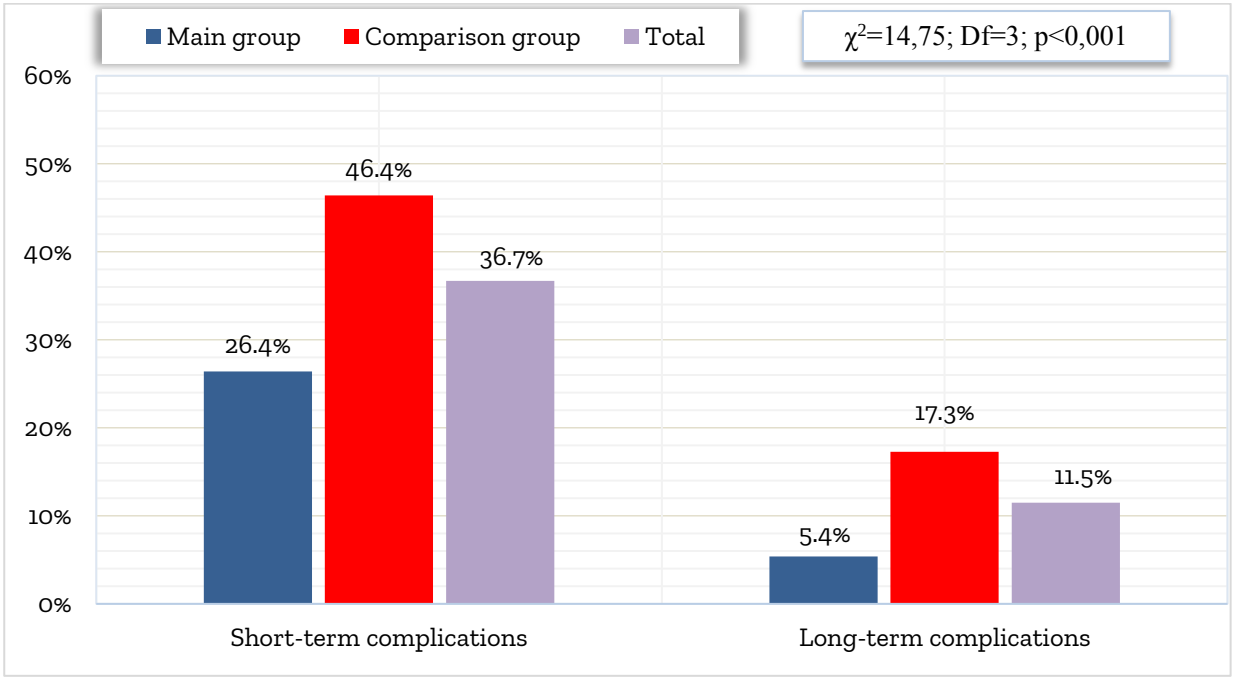


**Figure 6.** The summary frequency of complications in the immediate and late periods after arthroscopic surgery of pathological synovial plica of the knee.

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## DISCUSSION

Clinical patterns and outcomes of the plica syndrome of the knee are in many ways determined by the inflammatory conditions in the synovium, which induce intra-articular lesion. The manifestation of angiogenesis, lymphoid infiltration is unfavourable of histology prognostic factors early development of joint erosions, and early disability [3, 4]. Therefore, one of the main objectives of plica syndrome of the knee treatment is to prevent or slow down this destructive process. The current aspects of conservative therapy offer a wide range of medications. However, the inflammatory reactions on the background of plica syndrome of the knee may take forms that are non-responsive even to the most advanced and aggressive methods of therapy. In such cases, the surgical removal of the synovial plica is the method of choice [3, 6, 8]. The available literature plica syndrome of the knee mostly addresses from the perspective of the improvement of the knee function based on the LKSS and AKDS scores [13]. Pain reduction, lighter walking and stair climbing, improve range of motion, and suspension or reduction in the signs of synovitis – and all these confirm the effectiveness of arthroscopy. According to review of McCunniff et al. [6], conservative treatment has yielded poor results, with success rates between 0%-16% reported in the literature. It was noted that those patients who did well with conservative measures were younger (21.5 years) than the other patients (28.5 years) [6, 7]. Following arthroscopic plicectomy and partial synovectomy, relief of preoperative symptoms are typically noted 2 to 4 weeks postoperatively. However, Schindler et al. [3] also tells that the success of plicae resection in patients with plica syndrome of the knee is also directly influenced by any other additional intra-articular pathology and this may have a direct influence on the good results.

## CONCLUSIONS

Arthroscopic surgical treatment of pathological synovial plica of the knee allows restoring the function of the affected joint in the optimal time, returning patients to their usual activities and improving the quality of life of this group of patients. The advantages of early arthroscopic surgical treatment of pathological synovial plica of the knee before delayed surgery after preliminary conservative therapy are: significantly better restoration of the knee function with a significant increase in the LKSS and the IKDC-2000 questionnaire, fewer complications, and a decrease in the duration of treatment and rehabilitation.

## DECLARATIONS

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**Authors' contributions**

All authors contributed equally to this work.

**Competing interests**

The authors declare that they have no competing interests.

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