# CLINICAL AND ANTHROPOMETRIC CHARACTERISTICS OF PATIENTS AFTER MENISCECTOMY AND THEIR IMPACT ON EARLY POSTOPERATIVE FUNCTIONAL STATUS

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**Annotation.** This article presents the results of a study aimed at determining the relationships between clinical, functional, and morphological parameters in patients after meniscectomy, with the aim of substantiating personalized approaches to medical rehabilitation. The study included 132 patients aged 18 to 60 years who had undergone partial or complete meniscectomy. Pain was assessed using a visual analog scale (VAS), quadriceps strength using a handheld dynamometer, knee range of motion (goniometry), and functional status using the Lysholm scale. Thirty-two patients additionally underwent MRI to analyze the condition of articular cartilage. Statistical processing included correlation analysis (significance level $p < 0.05$). It was found that patients after meniscectomy had significantly higher pain levels (4.8 ± 1.2 versus 0.8 ± 0.6 points; $p < 0.01$), decreased quadriceps strength (−24.5% of normal), decreased range of motion (118.6 ± 8.3° versus 135.4 ± 4.7°; $p < 0.01$) and worsening functional indicators according to the Lysholm scale (78.4 ± 6.5 versus 95.2 ± 3.1; $p < 0.01$). Significant correlations were found between pain level and quadriceps strength ( $r = -0.62$), cartilage condition and muscle activity ( $r = 0.55$), and between pain and cartilage tissue condition ( $r = -0.58$; $p < 0.01$). It was concluded that the condition of patients after meniscectomy is determined by the combined influence of pain syndrome, muscle failure, and morphological changes in articular cartilage. The main determinants of rehabilitation effectiveness are quadriceps strength, pain level, and the structural condition of cartilage tissue. Personalized rehabilitation programs aimed at normalizing

muscle function and correcting pain can improve functional outcomes and reduce the risk of developing postmeniscectomy osteoarthritis.

**Key words:** meniscectomy, knee joint, pain, quadriceps strength, cartilage tissue, medical rehabilitation.

**Relevance.** Meniscus injuries of the knee joint are among the leading musculoskeletal injuries, accounting for up to 10–15% of all intra-articular injuries [1, 2]. Such injuries often lead to limited mobility, chronic pain, and the early development of degenerative changes in the articular surfaces [3]. Despite the introduction of organ-preserving technologies—arthroscopic repair and suturing techniques—meniscectomy remains one of the most common surgical treatments [4, 5].

However, even partial removal of the meniscus leads to changes in the biomechanics of the knee joint, redistribution of loads, and a decrease in the shock-absorbing function, which over time contributes to the development of post-traumatic osteoarthritis [6–8]. The postoperative period is characterized by decreased quadriceps strength, limited range of motion, and impaired functional status, especially in patients with excess body weight and signs of degenerative cartilage changes [9, 10].

In this regard, studying the relationship between anthropometric, anamnestic, and functional parameters in patients after meniscectomy represents an important area of modern sports medicine and medical rehabilitation. This approach allows us to identify key factors determining the rate of recovery and optimize individual physical and physiotherapeutic correction programs [11–13].

**The aim of the study was to** comprehensively assess the anthropometric, clinical, anamnestic, and functional characteristics of patients after meniscectomy to determine factors influencing the course of the early postoperative period and restoration of knee joint function.

**Materials and Methods.** The study included 132 patients (81 men and 51 women) aged 18 to 60 years who had undergone partial (n = 84) or total (n = 48)

meniscectomy of the knee joint. The postoperative period at the time of examination ranged from 6 months to 3 years, allowing for an assessment of both the early and late functional consequences of the procedure. All patients were observed in specialized orthopedic and rehabilitation departments and were treated according to uniform clinical standards.

To comprehensively assess the patients' condition, anamnestic and anthropometric data were taken into account, including age, gender, mechanism of injury, side of injury, body mass index (BMI), and the presence of concomitant ligamentous injuries. These parameters allowed us to identify individual differences and determine potential factors influencing the recovery process.

Clinical assessment included pain intensity assessment using a visual analog scale (VAS), where 0 points represented no pain and 10 represented the most severe pain. Knee range of motion was measured using a standard goniometer, recording maximum active extension and flexion.

Quadriceps strength was determined using a handheld dynamometer using maximal isometric contraction. Each measurement was performed three times and averaged. Joint function was assessed using the Lysholm scale, which includes indicators of stability, pain, swelling, gait, and ability to perform physical activity.

In some patients (n = 32), magnetic resonance imaging (MRI) of the knee joint was additionally performed to assess the condition of the articular cartilage, residual meniscus, and ligaments. MRI data allowed us to correlate clinical manifestations with morphological changes in the joint structures.

Statistical analysis was performed using the SPSS 23.0 software package. Normality of distribution was tested using the Shapiro–Wilk test. To compare mean values between groups, the Student's t-test (for normal distribution) and the Mann–Whitney U-test (for non-normal distribution) were used. Interrelationships between variables were assessed using Pearson's pairwise correlation, and statistical significance was considered at $p < 0.05$.

**Results.** The study found that the majority of patients were **young men (61.3**

**%)** , with a predominance of **sports injuries** (46.2%), primarily involving **the medial meniscus** (59.8%). Individuals over 40 years of age were more likely to have **degenerative injuries and an excess body mass index ,** confirming the influence of age and metabolic factors on the nature of the injury.

**Table 1.**

**General characteristics of the examined patients**

| Indicator | n (%) | Mean ± SD |
|---|---|---|
| Number of patients | 132 (100%) | — |
| Men / Women | 81 (61.3%) / 51 (38.7%) | — |
| Average age, years | — | 34.7 ± 8.9 |
| Mechanism of injury: sports/household/degenerative | 61 (46.2%) / 42 (31.8%) / 29 (22.0%) | — |
| Affected meniscus: medial / lateral | 79 (59.8%) / 53 (40.2%) | — |
| Body mass index, kg/m² | — | 25.1 ± 2.9 |

Table 1 presents the general characteristics of the patients included in the study. A total of **132 patients who** had undergone partial or total meniscectomy were examined. **Men predominated (61.3%) ,** reflecting the higher incidence of sports-related and traumatic knee injuries in males. The average age of the subjects was **34.7 ± 8.9 years** , indicating that the pathological process predominantly involved individuals of working and physically active age.

were the most common mechanism of injury **(46.2%) ,** consistent with literature data on the high risk of injury associated with physical activity that places stress on the knee joints. **Domestic injuries** occurred in 31.8% of cases, and **degenerative changes** in 22.0%, more often observed in patients over 40 years of age.

was most frequently affected **(59.8%) ,** which is explained by the anatomical features of its fixation and its lower mobility compared to the lateral meniscus. The average **body mass index (BMI)** was **25.1 ± 2.9 kg/m² ,** which corresponds to the upper limit of normal and indicates the possible influence of excess body weight as an additional risk factor for degenerative changes.

The data obtained indicate that patients undergoing meniscectomy are predominantly young men with predominantly sports-related injury mechanisms and medial meniscus lesions. Older individuals are more likely to experience degenerative changes associated with a higher body mass index. These characteristics must be considered when developing individualized programs for medical rehabilitation and prevention of recurrent knee injuries.

**Table 2.**

**Clinical and functional parameters after meniscectomy and in the control group**

| Indicator | Patients after meniscectomy (n = 132) | Control group (n = 40) | p |
|---|---|---|---|
| Pain according to VAS, points | 4.8 ± 1.2 | 0.8 ± 0.6 | <0.01 |
| Lysholm scale, points | 78.4 ± 6.5 | 95.2 ± 3.1 | <0.01 |
| Range of motion, ° | 118.6 ± 8.3 | 135.4 ± 4.7 | <0.01 |
| Quadriceps strength, % of normal | 75.5 ± 6.1 | 100 | <0.01 |

Table 2 presents a comparison of clinical and functional parameters in patients after meniscectomy and control subjects without knee pathology. Patients after meniscectomy reported **significantly higher pain scores** —an average of **4.8 ± 1.2 points on the VAS scale** versus **0.8 ± 0.6 points** in the control subjects ( $p < 0.01$). This indicates persistent pain in the postoperative period, even after completion of primary recovery.

**The functional state of the knee joint** , assessed using the **Lysholm scale** , was also significantly lower in the main group ( **78.4 ± 6.5 versus 95.2 ± 3.1; p < 0.01** ), indicating a partial impairment of stability, gait and ability to perform physical activity.

**The range of motion** in the knee joint after surgery remained limited ( **118.6 ± 8.3° versus 135.4 ± 4.7°; p < 0.01** ), which may be associated with postoperative fibrosis, decreased elasticity of the capsular-ligamentous apparatus and pain limitations.

**Quadriceps strength** deserves special attention , averaging **75.5 ± 6.1% of normal** , a quarter lower than the control group ( $p < 0.01$). This

indicates severe hypotrophy and functional weakness of the knee extensor muscles, which are key to joint stabilization.

The study results showed that even after the completion of the surgical and early functional recovery period, patients undergoing meniscectomy continue to experience significant functional impairments, including increased pain, decreased range of motion, quadriceps strength, and the overall functional index (OSI) based on the Lysholm scale. This underscores the need to develop and implement **individualized medical rehabilitation programs** aimed at restoring muscle balance, improving knee biomechanics, and preventing post-traumatic osteoarthritis.

**Table 3.**

**Correlation relationships between clinical and morphofunctional indicators**

| Parameters | Correlation coefficient (r) | Significance level (p) |
|---|---|---|
| YOUR ↔ quadriceps strength | -0.62 | <0.01 |
| Lysholm ↔ range of motion | 0.68 | <0.01 |
| Cartilage condition (MRI) ↔ quadriceps strength | 0.55 | <0.01 |
| YOUR ↔ Cartilage Condition (MRI) | -0.58 | <0.01 |

Table 3 presents the results of the correlation analysis of the relationships between the main clinical and morphofunctional indicators in patients after meniscectomy. It was revealed **A negative correlation was found between pain severity (VAS) and quadriceps strength (** r = -0.62; $p < 0.01$), meaning that the more severe the pain, the greater the muscle weakness. This indicates that pain directly limits motor activity and prevents full muscle function, contributing to the development of hypotrophy.

Between **the functional state according to the Lysholm scale and the range of motion** discovered **A positive correlation was found** ( $r = 0.68$; $p < 0.01$), confirming the interdependence of joint mobility and overall functional status. The greater the range of motion, the higher the patient's functional capabilities and level of physical activity.

A significant **positive correlation between articular cartilage condition as measured by MRI and quadriceps strength** ( $r = 0.55$; $p < 0.01$) suggests that improved cartilage condition is associated with better muscle function. Adequate muscle tone likely reduces stress on articular surfaces and slows degenerative changes.

At the same time, **a negative relationship was found between the level of pain and the condition of the cartilage** ( $r = -0.58$; $p < 0.01$): the more pronounced the degenerative changes in the cartilage tissue, the stronger the pain syndrome.

The results of the correlation analysis revealed close relationships between clinical symptoms, muscle function, and the morphological condition of articular cartilage in patients after meniscectomy. Increased pain is accompanied by decreased quadriceps strength and deterioration of articular cartilage, while maintaining mobility and muscle activity promotes improved functional recovery. These data support the need for **a comprehensive approach to rehabilitation ,** including pain management, quadriceps training, and cartilage monitoring, to prevent postmeniscectomy osteoarthritis.

**Discussion.** The obtained results confirm that the condition of patients after meniscectomy is determined by a complex interaction of clinical, functional, and morphological factors. Increased pain severity, decreased quadriceps strength, and limited range of motion are directly related to the morphological state of articular cartilage, which is consistent with the data of several authors [1–3]. The established negative correlations between pain and muscle activity, as well as between pain and cartilage condition, indicate the mutual influence of degenerative changes and functional insufficiency of the hip muscles.

Anthropometric and age-related characteristics of patients are particularly important. Individuals over 40 years of age and those with excess

body weight demonstrated more pronounced impairments—decreased quadriceps strength, reduced range of motion, and poorer Lysholm scores. This is likely due to both metabolic changes in cartilage tissue and increased mechanical stress on the articular surfaces [4,5].

The severity of pain and muscle weakness in the early and late postoperative periods leads to disruption of knee joint biomechanics, which may contribute to the progression of postmeniscectomy osteoarthritis [6,7]. These data emphasize the need for early implementation of targeted muscle activation programs, weight management, and pain management.

Thus, the key determinants of the effectiveness of rehabilitation after meniscectomy are pain severity, quadriceps strength, and the morphological condition of the cartilage tissue. A comprehensive assessment of these factors allows for individualized rehabilitation programs, increasing their effectiveness and reducing the risk of chronic functional impairment. A personalized approach to rehabilitation should include monitoring the condition of joint structures, dynamic assessment of muscle strength, and the use of biomechanical criteria for load dosing.

**Conclusions:** After meniscectomy, a significant decrease in quadriceps strength, limited mobility, and severe pain were observed. The degree of functional impairment depends on age, body mass index, and the nature of the meniscus injury. The presence of degenerative changes in cartilage according to MRI data is associated with more severe pain and decreased muscle activity. The results support the need for early inclusion of strength exercises in rehabilitation programs aimed at restoring the quadriceps and preventing chondrodegeneration.

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