

Ocena skuteczności leczenia operacyjnego i procesu rehabilitacji pacjentów po urazowym uszkodzeniu łąkotki stawu kolanowego

Evaluation of the effectiveness of surgical treatment and physical rehabilitation in patients with meniscus tear

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Streszczenie:

Celem pracy była ocena skuteczności leczenia pacjentów po uszkodzeniu urazowym łąkotki stawu kolanowego.

W badaniach wzięło udział 14 pacjentów, spełniających kryteria i doboru, którzy wyrazili zgodę na udział w badaniach. Kwalifikacja pacjentów odbywała się na podstawie rodzaju przeprowadzonej techniki operacyjnej: meniscektomia – podgrupa A i zszycie łąkotki – podgrupa B. Grupy liczyły po 7 osób w przedziale wiekowym 30-66 lat.

Ocenie poddano pooperacyjny zakres ruchu stawu kolanowego, obwody kończyny dolnej oraz stabilność stawu kolanowego. Wykorzystano także kwestionariusz LEFS oraz skalę VAS w celu oceny dolegliwości bólowych.

Stwierdzono, że rodzaj zabiegu operacyjnego różnicuje stan funkcjonalny i nasilenie dolegliwości bólowych. Lepsze wyniki uzyskali pacjenci po meniscektomii stawu kolanowego.

Słowa kluczowe:

meniscektomia, zszycie łąkotki, uraz łąkotki

Abstract

Summary

The aim of this study has been to evaluate the efficacy of treatment and physical rehabilitation in patients after the traumatic meniscus tear.

The total of 14 persons have been examined. The qualifying procedure has been based on the surgery technique applied: meniscectomy – group A, and meniscus repair (by sewing) – group B. Each group consisted of 7 persons, aged 30-66.

The knee range of motion, the leg circumference and the knee stability have been assessed. The LEFS questionnaire and the VAS scale have been used in order to compare the intensity of pain.

It has been found, that the type of the arthroscopy performed has had an impact on both, the functional status and the pain sensation, and that the better results have been achieved in patients, who have had undergone the knee meniscectomy.

Key words:

meniscectomy, meniscus repair, meniscus tear

Introduction

Presently, there are two procedures for treatment of the traumatic meniscus injuries of the knee – conservative approach (non-surgical) and surgical treatment. The former allows the torn meniscus to heal, and delays the surgical treatment, which may result in the additional damage, worsening of the conditions in view of the surgery and lead to various complications [1].

The surgical treatment is most frequently performed using the arthroscopy technique, due to its minimal invasiveness and the quick recovery of the patient to normal functioning. The differences would only concern the arthroscopy techniques being used. The choice of a surgery method depends on a number of factors, such as: the type and the location of the tear, additional injuries, the extent of the damage, the stability of the knee and on the individual factors (age, level of activity, clinical symptoms). Positive results of the treatment are being determined by a number of factors – from preparation of the patient to proper application of the surgical dressing [1, 2, 3, 4].

The aim of this study has been to evaluate the efficacy of the treatment in patients with the traumatic meniscus injury.

Materials and Methods

The total number of 14 persons have been examined, including 5 women (36%) and 9 men (64%), 30-66 years old (48.78 ± 12.46), who have qualified for the knee arthroscopy due to the meniscus tear (Table 1.).

Table 1. Age of the patients divided into two study groups

| Group | x | SD |
|-----------------|-------|-------|
| Meniscectomy | 47.29 | 16.64 |
| Meniscus repair | 32.43 | 8.89 |

The research had been conducted between October 2012 and January 2013, in one of the hospitals in the Lesser Poland region. The study had been conducted in accordance with the Declaration of Helsinki of 1964 (with amendments).

Material Selection Criteria

For the study, recruited were patients with the meniscus injury of the knee. The patients had been divided into groups, depending on the severity and the lesion area (subgroups A and B).

The period between the occurrence of the injury and the surgery was over 3 months (3.2 ± 0.99) – the long-lasting tear. There were no accompanying damages in the treated joint.

The Division Criteria

The study participants were divided into two groups:

Group A – patients with a complete or partial meniscectomy of the lateral meniscus (2 persons) or the medial meniscus (5 persons)

Group B – patients with the repaired lateral meniscus (2 persons) or the medial meniscus (5 persons)

Research Methods

The research method included functional examination and survey.

The analysis of the following indicators was made on the basis of the functional tests: the range of motion of the knee, the lower extremity circumference and the stability of the knee.

The range of motion was measured with a goniometer in the sagittal plane (flexion and extension), according to the scheme proposed by Szczechowicz [5]. Initial measurements in 5 patients had shown the lack of extension, while a significant flexion limitation had occurred in all the participants.

The circumference measurement was taken at the particular spot, with a centimeter tape: thigh circumference – 6 centimeters from the base of the patella. [6]

The evaluation of stability was determined by the number of half squats performed on one and on two feet. [7]

The level of pain was also compared, and was verified with the modified Visual Analog Pain Scale (VAS). This is the subjective, pain self-assessment scale, ranging from 0 (no pain) to 10 (maximum pain) [8].

The LEFS scale (The Lower Extremity Functional Scale) in the original version was used, to assess the functional status. The survey contains 20 questions concerning difficulties in performing particular activities. The evaluation was made for: everyday tasks performed both at home and at work, hobby, sport activity, moving indoors and outdoors – both along short and long distances, squats, lifting objects, standing and sitting position, running in diversified terrain, jumping. The responses were scored from 0 (extremely difficult) to 4 (no difficulty). The sum of points was the final evaluation of the functioning of the leg. The following criteria were used:

- 80-70 pts – very good,
- 69-59 pts – good,
- 58-48 pts – satisfactory,
- 47-0 pts – bad [9].

The measurements were taken prior to the arthroscopy and after one month of rehabilitation. The results were noted in the individual test protocols.

All the patients had undergone the same rehabilitation process. In the program, particular emphasis was placed on the early introduction of exercises. The study participants began rehabilitation, according to a certain exercise scheme, on the second day after the surgery (group A), and the patients who had meniscus repair (group B), after one month – due to the process of regeneration and healing of the sewn section.

The intensity and frequency of exercises had been individually adjusted to the current condition of the patient. After making certain that the introduced exercises are being done properly,

the patients performed them at home. The recommendation was to repeat the exercises several times a day.

In the case of the patients from group A, the first stage covered the period between the first and the seventh day following the arthroscopy procedure (according to the protocol, it was between the 2nd and the 7th day, since the day of the surgery was counted as the first day). During this period, particular emphasis was placed on the isometric exercises of the quadriceps, free active exercises and proprioception exercises – in a closed kinetic chain and self-supported. The patients were encouraged to walk using the elbow crutches, and warned to protect the leg. The number of repetitions, depending on the exercise, was within the range of 5-10, and was gradually increased by the patient, on the individual basis. During the second stage (2nd-3rd week) the exercises were supplemented with the additional training, to increase the muscle strength and endurance.

In the third stage (3rd-4th week), in addition to the exercises done during the previous stages, the patients completed tasks aimed at improving the proprioception as well as the muscle strength and the balance – to make it possible, at the end of this stage, to walk with either just one elbow crutch or without any.

In the case of the patients from group B, the rehabilitation plan was delayed by about one month, due to the time needed to heal the meniscus. At this time, the patients were instructed not to bear loads on the limb and to do isometric exercises of the quadriceps. According to the same protocol, the first stage covered the period between the 1st and the 7th day after exactly one month from the surgery (according to the protocol, it was between the 2nd and the 7th day, since the day of the ultrasonography examination, which confirmed the meniscus adhesion and thus the possibility to bear loads and the intensive exercises for the leg after surgery, was counted as the first day). The second stage covered the period between the 2nd-3rd week after the arthroscopy, while the third stage lasted over the 3rd-4th week.

SPP 17.0 for Windows was used to process the collected data. The statistical analysis of the materials was based on the principles of the descriptive and the mathematical statistics. Methods of the descriptive statistics served to present the results in the form of tables containing arithmetic means, standard deviations, minimum and maximum values.

Due to the small number of the examined patients (7 persons in each group), the statistical analyses were made using the U Mann-Whitney test – to compare 2 unrelated groups, and the Wilcoxon test – to compare 2 related samples. The analysis adopted the significance level of $p < 0,05$.

Results

The range of knee flexion

The analysis has shown an increase in the range of motion at the particular stages of the rehabilitation, but with no statistically significant differences of the results, between the groups. Table 2. presents the average values of the knee flexion range at the particular stages of the rehabilitation, for the two study groups.

Table 2. The knee flexion range at the particular stages of the rehabilitation, for the two study groups

| Variable | Meniscectomy (n=7) | Meniscus repair (n=7) | p |
|------------------------------------|----------------------|-----------------------|------|
| I Measurement: mean; SD; min-max | 87.14; 4.88; 80-90 | 82.86; 16.04; 60-100 | 0.99 |
| II Measurement: mean; SD; min-max | 95.71; 11.34; 85-120 | 89.57; 13.65; 70-120 | 0.90 |
| III Measurement: mean; SD; min-max | 117.1; 3.06; 100-130 | 111.8; 8.59; 100-125 | 0.38 |

p<0,05

I measurement – before rehabilitation

II measurement – after 2 weeks of rehabilitation

III measurement – after 4 weeks of rehabilitation

To determine whether there was any change in the knee flexion range during the following examinations, the Wilcoxon test was used for a given group.

It had shown that the increase in the knee flexion range had occurred in both groups, but within the individual groups there were no statistically significant differences in the measurements ($p>0.05$), which means that the study groups did not differ in terms of the knee flexion range (Table 3.).

Table 3. The Wilcoxon test for the two groups at various stages of rehabilitation

| | Meniscectomy (n=7) | | Meniscus repair (n=7) | |
|-----------------|--------------------|----------------|-----------------------|----------------|
| | I measurement | II measurement | I measurement | II measurement |
| II Measurement | 0.24 | - | 0.016 | - |
| III Measurement | 0.017 | 0.018 | 0.018 | 0.018 |

p<0,05

The Knee Extension Range

Table 4. presents the average values of the knee extension range at the particular stages of rehabilitation for the two study groups. It must be noted that 0 means full extension, and the subsequent results – the degrees of the extension limitation.

The results of the measurements indicate the gradual improvement in the knee range of motion. Upon completion of the rehabilitation process the patients from both groups achieved the full knee extension. The statistical analysis, however, demonstrated no statistically significant differences between the groups ($p>0.05$).

Table 4. The knee extension range at the particular stages of the rehabilitation for the two study groups

| Variable | Meniscectomy (n=7) | Meniscus repair (n=7) | p |
|-----------------------------------|--------------------|-----------------------|------|
| I Measurment: mean; SD; min-max | 1.00; 1.91; 0-5 | 1.00; 1.91; 0-5 | 0.53 |
| II Measurment: mean; SD; min-max | 0.43; 0.79; 0-2 | 0.43; 0.79; 0-2 | 0.71 |
| III Measurment: mean; SD; min-max | 0.00; 0.00.0-0 | 0.00; 0.00.0-0 | - |

p<0,05

To determine whether there was any change in the knee extension range during the following examinations, the Wilcoxon test was used for a given group. It had shown that there had been an improvement in the knee extension range, from one measurement to the next one, but with no statistically significant differences in the particular groups ($p>0.05$). The result indicates that the groups did not differ from each other in terms of the knee extension range, during the subsequent measurements (Table 5.).

Table 5. The Wilcoxon test for the particular groups at various stages of the rehabilitation

| | Meniscectomy (n=7) | | Meniscus repair (n=7) | |
|----------------|--------------------|----------------|-----------------------|----------------|
| | I measurement | II measurement | I measurement | II measurement |
| II Measurment | 0.180 | - | 0.102 | - |
| III Measurment | 0.180 | 0.018 | 0.083 | 0.102 |

p<0,05

Thigh circumference

The analysis had demonstrated, that in both groups there was the increase in the thigh circumference in the second test, in comparison with the first measurement, and that the results for both groups were statistically significant. The result means that in patients who had undergone the meniscectomy there was a bigger increase in thigh circumference, both in the beginning and in the end of the examination, in comparison to the patients after the meniscus repair. Table 6. presents the average values of the thigh circumference measurement, at various stages of the rehabilitation, for the two study groups.

Table 6. Thigh circumference at various stages of the rehabilitation, for the two study groups

| Variable | Meniscectomy (n=7) | Meniscus repair (n=7) | p |
|----------------------------------|--------------------|------------------------|-------|
| I Measurment: mean; SD; min-max | 43.57; 3.41; 37-47 | 37.43; 2.76; 33-41 | 0.007 |
| II Measurment: mean; SD; min-max | 45.00; 2.84; 39-47 | 38.21; 2.41; 34.5-41.5 | 0.004 |

p<0,05

I badanie – przed rehabilitacją/ I measurement – before rehabilitation

II badanie – po rehabilitacji/ II measurement – after rehabilitation

Knee Stability Assessment

The analysis had shown no statistically significant differences between the examined groups, in terms of the double-leg stability assessment, in the subsequent measurements (Table 7. and 8.).

Table 7. Knee stability assessment at the particular stages of the rehabilitation, for the two study groups – two-leg half

| Variable | Meniscectomy (n=7) | Meniscus repair (n=7) | p |
|-----------------------------------|--------------------|-----------------------|-------|
| I Measurment: mean; SD; min-max | 1.14; 0.90; 0-2 | 0.57; 0.79; 0-2 | 0.26 |
| II Measurment: mean; SD; min-max | 0.71; 0.49; 0-1 | 0.29; 0.49; 0-1 | 0.21 |
| III Measurment: mean; SD; min-max | 2.57; 0.53; 2-3 | 1.86; 0.38; 1-2 | 0.053 |

p<0,05

Table 8. Knee stability assessment in the particular stages of the measurement, for the two study groups – single leg half

| Variable | Meniscectomy (n=7) | Meniscus repair (n=7) | p |
|-----------------------------------|--------------------|-----------------------|------|
| I Measurment: mean; SD; min-max | 0.00; 0.00; 0-0 | 0.14; 0.38; 0-1 | 0.71 |
| II Measurment: mean; SD; min-max | 0.14; 0.38; 0-1 | 0.00; 0.00; 0-0 | 0.71 |
| III Measurment: mean; SD; min-max | 1.14; 0.90; 0-3 | 0.71; 0.49; 0-1 | 0.45 |

p<0,05

Pain

In both groups there was an improvement (decrease) in the level of pain after the rehabilitation, in comparison with the initial measurement (Table 9.).

Table 9. Pain assessment in the VAS scale before and after the rehabilitation

| Variable | Meniscectomy (n=7) | Meniscus repair (n=7) | p |
|----------------------------------|--------------------|-----------------------|-------|
| I Measurment: mean; SD; min-max | 4.14; 1.07; 3-6 | 6.29; 1.11; 5-8 | 0.007 |
| II Measurment: mean; SD; min-max | 0.43; 0.53; 0-1 | 2.43; 1.40; 1-5 | 0.004 |

p<0,05

Knee Function Assessment – LEFS Scale

The study had shown that the patients after the meniscectomy achieved the poor result in the first measurement, and the satisfactory result in the second measurement. The average value on the LEFS scale in the first measurement, in the patients after the meniscus repair, had also shown the bad result which, however, did not improve after the rehabilitation (Table 10.).

Table 10. The functional status of the knee before and after the rehabilitation

| Variable | Meniscectomy (n=7) | Meniscus repair (n=7) | p |
|----------------------------------|---------------------|-----------------------|-------|
| I Measurment: mean; SD; min-max | 46.00; 10.94; 28-58 | 47.14; 12.33; 33-70 | 0.902 |
| II Measurment: mean; SD; min-max | 59.00; 300; 55-64 | 40.57; 7.68; 33-56 | 0.001 |

p<0,05

Discussion

Meniscal tears are among the most frequently diagnosed orthopedic disorders. The development of technology has improved the ability to diagnose and to treat the meniscal problems, allowing many people to regain the proper functioning of the knee. The basis for success in this area is to understand the anatomy of the meniscus, and its functions in the knee joint, which include among others: shock absorption, stabilization of the improper knee movements and the retention of the healthy knee cartilage.

In our study, in accordance with the set objective, the attempt has been made to assess the efficacy of the surgical treatment in patients with the traumatic meniscus tear, who had undergone the meniscectomy or the meniscus repair. The set objective has been achieved by evaluating the intensity of pain, the range of motion, the knee stability and its functional level.

Osteras et al. [10], in their studies, had accomplished the decrease in pain intensity in three months after the arthroscopy procedure. The difference between their results of the I and the II measurements was 1.9. In our study, this result was 3.71 for the meniscectomy and 3.86 for the meniscus repair.

Gill et al. [3] had demonstrated the pain reduction, which enabled the patients to return to intensive physical activity and sport. The only difficulties they observed, occurred with the patients kneeling and squatting. Grzesiczak et al. [11], in their studies, noticed a significant correlation between the pain intensity and the knee mobility. They claimed, that the greater is the mobility of the knee, the smaller the pain is. This is also to be found in our study, where after the meniscectomy the range of motion is greater and the pain intensity is smaller.

In our study the pain was measured with the visual analog VAS scale, which is a subjective and commonly used assessment method of the treatment results. The decrease in pain intensity was achieved in both groups. It had also been noted, that the pain intensity in the group of patients after the meniscectomy was smaller, both before and after the rehabilitation process.

It must be noted, that the second measurement of the pain intensity in patients after the meniscus repair was made in the second month of treatment. This difference between the two groups, in the assessment of the pain intensity, may have been caused by the meniscal healing process, which takes approximately one month, and the discomfort associated with this phase of treatment.

An important element of the rehabilitation after the arthroscopy is the restoration of the strength and the muscle mass, which determine its functional efficiency. The increase in the muscle mass may be observed in the linear circumference measurements.

Keller et al. [12] conducted a study on a group of 32 patients, who had undergone the arthroscopy due to the meniscus tear. Each patient had his thigh measured before the surgery and one week after. On the basis of the analysis of the results, the authors presume that the arthroscopy has led to the reduction in the thigh circumference which, in their opinion, is the sign of muscle atrophy and the decreased muscle strength.

In our research the overall increase of the individual circumference values has been achieved, in comparison with the results obtained prior to the surgery.

The differences in the results may be due to a different time of taking the linear measurements. However, the studies by Morrissey et al. [13] indicate that there are no statistically significant differences between the period of restoring the function of the knee joint and the outcome of the particular indicators assessing the functional status of the patient, including the linear measurements.

In the case of the analysis of the thigh circumference, it had been observed that in the group after the meniscus resection, the thigh circumference both at the beginning of the examination and after the therapy, was bigger than in patients after the meniscus repair. The analysis of the knee measurement in patients after the resection had shown the

greater circumference, both at the beginning of the test and after the rehabilitation, in comparison with the patients after the meniscus repair.

Another essential part of the rehabilitation process is to restore the proper range of motion in the knee joint. Czechowska et al. [14] examined 80 persons after the partial meniscectomy, without any accompanying injuries or disorders, which could have had an impact on the course and the results of rehabilitation. They assessed the active range of motion and the linear measurements. The results had shown the significant improvement in the range of flexion and extension, as well as the increase in the linear measurements, which may have been the sign of the growth of the quadriceps muscle mass, which counts as the successful therapeutic effect.

Our research had shown the increase in the range of flexion and extension of the knee in both groups after the therapy, in comparison with the results from the period prior to the surgery.

Mordecai et al. [1] present the long term results of the arthroscopic meniscal repair. They state, that the biomechanics and the stability of the hip joint are satisfactory. Our study had shown the increase in the knee stability in both groups, but no significant differences between the groups after the surgery.

Paxton et al. [15] they established, that the partial meniscectomy brings about better results in treatment and rehabilitation, and the necessity of another, follow-up arthroscopy is statistically less frequent, than in patients after meniscal repair. Stain et al. [16] believe, however, that the arthroscopic meniscal repair produces much better long term treatment results in the case of individual traumatic meniscus damages, if compared to the partial meniscectomy of a knee.

The assessment of the functional status of our patients with the LEFS questionnaire had demonstrated that the better results were achieved by the patients after the meniscectomy.

Yoon and Park [17] conclude, that patients of all ages who have suffered the meniscus damage, should be subjected to the surgical treatment aimed at the restoration of the patient's functional efficiency.

The above research shows that the rehabilitation after the arthroscopic surgery is advisable in order to regain the full fitness, both after the meniscectomy and the meniscus repair. Still we believe, however, that the evaluation of the efficacy of the rehabilitation after the arthroscopy, regardless of the surgery technique, does require further verification based on the randomized control trials on the bigger groups of patients.



Conclusions

1. The choice of the surgical technique has proven to be essential in the assessment of the functional status of the examined patients, as the better results have been achieved by the patients after the meniscectomy.
2. There have been no significant differences between the groups in the knee range of motion.
3. The surgery technique has not affected the assessment of the knee stability in the tested patients.
4. The treatment and the physical rehabilitation have helped to reduce the pain intensity in both groups, but the pain sensation before and after the physical rehabilitation have been lower in

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