

PATIENTS' ASSESSMENT OF KNEE JOINT EFFUSION FOLLOWING ARTHROSCOPY

Master's thesis in Medicine

By

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Patients' assessment of knee joint effusion following arthroscopy

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Dansk Resume

Baggrund: Tidligere forskning har vist at der er en association mellem operationstype, multimodal smertelindring og tilbagevenden til arbejde efter knæ artroskopi. De fleste patienter formodes at vende tilbage til normal aktivitet indenfor 4 uger. Der er begrænset viden om varigheden af ansamling efter knæ artroskopi. Formålet med dette studie er at undersøge hvor længe patienterne har symptomer på ansamling i 8 uger efter knæ artroskopi.

Metode: Patienter fra Ortopædkirurgisk afdeling på Aalborg Universitetshospital blev inviteret til at deltage i spørgeskemaundersøgelsen i perioden d. 24. september til d.25. november.

Der blev spurgt ind til følgende fire symptomer; hævelse, stramhed, spændthed, og ustabilitet i knæet. Patienterne blev stratificeret i fem grupper baseret på antallet af symptomer de rapporterede efter knæ artroskopi. Gruppe 0 angav at patienterne ikke havde oplevet nogen symptomer, mens gruppe 4 betød at de havde oplevet alle 4 symptomer.

Rehabilitering blev målt på reduktion i antal af symptomer på ansamling, smerte de seneste 24 timer samt antal dage indtil genoptaget arbejde.

Resultater: Der blev inkluderet 118 patienter. Median alder var 42 (18-74 år) (min. og maks.), 46 var mænd og 41 var kvinder. 2 ud af 73 patienter havde ikke symptomer på ansamling efter 1 uge, 3 ud af 68 efter 2 uger, 9 ud af 43 efter 4. uger, 7 ud af 29 efter 6 uger samt 4 ud af 22 efter 8 uger. Ved 1 uges opfølgning angav 60 ud af 73 patienter at opleve hævelse. Efter 8 uger angav 10 ud af 22 at have hævelse. 48 ud af 73 angav at knæet følte stramt ved 1 uges opfølgning og 6 ud af 22 ved 8 ugers opfølgning. 46 ud af 73 angav at knæet følte spændt ved 1 uge og 10 ud af 22 ved 8 ugers opfølgning. 20 ud af 73 patienter angav at knæet var ustabil ved 1 uge og 6 ud af 22 ved 8 ugers opfølgning.

Antal symptomer angivet var 2 (2-3) (median og 1.-3. kvartil) efter 1 uge, 2 (1.75-3) efter 2 uger, 2 (1-3) efter 4 uger, 2 (1-2) efter 6 uger samt 1 (1-2) efter 8 uger.

Værste smerte var 4 (2-6) efter 1 uge og 3 (1-6) efter 8 uger. 38 ud af 73 patienter rapporterede forbrug af smertestillende medicin ved 1 uges opfølgning og 5 ud af 22 patienter ved 8 ugers opfølgning.

17 ud af de 64 patienter på arbejdsmarkedet vendte tilbage til deres arbejde 1 uge efter artroskopi, 21 ud af 60 efter 2 uger, 16 ud af 37 efter 4 uger, 19 ud af 25 efter 6 uger samt 16 ud af 19 efter 8 uger.

Konklusion: Kun en femtedel af patienterne havde ingen symptomer på ansamling ved både 4 og 8 ugers opfølgning efter knæ artroskopi. Der ses en association mellem den faldende ansamling, reducere i smerte, indtag af smertestillende og antal dage indtil genoptaget arbejde i de 8 ugers opfølgning.

Abstract

Background: Previous research has shown an association between the type of operation, multimodal pain treatment, and time for returning to work following knee arthroscopy. Most patients are expected to return to normal activity within four weeks. However, there is limited research on the extent of joint effusion following knee arthroscopy. This study aims to investigate for how long patients report symptoms of effusion 8 weeks following arthroscopy.

Methods: Patients from the Orthopaedic Department at Aalborg University Hospital were invited to participate in the questionnaire survey during the period of 24th of September until 25th of November.

Participants enrolled were asked to report the following four symptoms in the knee: swelling, tightness, tenderness, and instability. The patients were stratified into five groups based on the number of symptoms they reported after arthroscopy. Group 0 indicated that patients had not experienced any symptoms while group 4 indicated that the patients had experienced all four symptoms.

Rehabilitation was measured on reduction in the number of symptoms of joint effusion, pain in the last 24 hours, and the number of days until returning to work.

Results: 118 patients were included. The median age was 42 (18-74 years) (min. and max.), 46 were men and 41 were women. 2 out of 73 patients reported no symptoms of knee joint effusion 1 week following arthroscopy, 3 out of 68 after 2 weeks, 9 out of 43 after 4 weeks, 7 out of 29 after 6 weeks and 4 out of 22 after 8 weeks.

At 1 week follow-up 60 out of 73 patients reported swelling and 10 out of 22 at 8-weeks follow-up. 48 out of 73 reported tightness in the knee at 1-week follow-up and 6 out of 22 at 8-weeks follow-up. 46 out of 73 reported tenderness in the knee at 1-week follow-up and 10 out of 22 at 8-weeks follow-up. 20 out of 73 patients reported instability in the knee on 1-week follow-up and 6 out of 22 at 8-weeks follow-ups.

The number of symptoms was a median of 2 (2-3) after 1 week, 2 (1.75-3) after 2 weeks, 2 (1-3) after 4 weeks, 2 (1-2) after 6 weeks, and 1 (1-2) after 8 weeks.

The worst pain reported was 4 (2-6) at 1-week follow-up and 3 (1-6) at 8-weeks follow-up.

Furthermore, 38 out of 73 patients reported consumption of painkillers after 1 week and 5 out of 22 after 8 weeks.

17 out of the 64 patients in the labor market returned to their work 1 week after arthroscopy, 21 out of 60 after 2 weeks, 16 out of 37 after 4 weeks, 19 out of 25 after 6 weeks, and 16 out of 19 after 8 weeks.

Conclusion: Only one-fifth of the patients reported no symptoms of joint effusion at 4- and 8-weeks follow-up after knee arthroscopy. There is an association between a decrease in joint effusion, reduction in pain, the use of analgesia, and time of return to work in the 8 weeks follow-ups.

Introduction

Knee arthroscopy is the most popular minimally invasive surgical procedure in Orthopaedic surgery. 300 in 100.000 people undergo arthroscopic partial meniscectomy annually in the Western World. In Denmark, the surgery rate has doubled from 2000 to 2011 with the largest increase in middle-aged and older patients [1]. Even though the procedure is minimally invasive, patients still develop swelling, knee effusion, and 60% experience moderate to severe pain following knee arthroscopy [2].

Moreover, it is known that effusion is a main complaint during convalescence and can delay rehabilitation for up to 2 weeks after surgery [2]. Several studies have demonstrated an association between pain treatment, effusion, and faster recovery following knee arthroscopy. Jawish et al. found that intra-articular pain treatment with Tenoxicam, a nonsteroidal anti-inflammatory drug (NSAID) could reduce knee joint effusion following arthroscopy measured 14 days postoperatively [3]. Felli et. al investigated the use of tranexamic acid (TXA), an antifibrinolytic medication, in patients undergoing anterior cruciate ligament (ACL) reconstruction with knee arthroscopy. He concluded that the study group had better postoperative results in terms of patellar circumference, pain score, and a significant reduction in effusion when compared to the control group at 2 weeks follow-up [4].

These are all interesting findings on effusion following knee arthroscopy, yet there is still limited research on the extent of joint effusion following knee arthroscopy.

This study aims to investigate patients' assessment of knee joint effusion following arthroscopy at 1-, 2-, 4-, 6- and 8- weeks follow-up using a simply designed questionnaire. Furthermore, we will investigate the association between effusion and rehabilitation measured on worst pain, use of painkillers, and time of return to work.

Methods

Design overview

The study is a prospective study, patients who were assigned to undergo arthroscopic surgery were invited to participate. A total of 118 patients were enrolled in the study at baseline. Overall, 31 patients were excluded and another 3 were lost to follow-up. Participants were asked to fill out a questionnaire before their appointment for knee arthroscopy and again 1, 2-, 4-, 6- and 8-weeks following arthroscopy. At each time point, all self-reported outcomes were re-evaluated. Questionnaires were sent out to the participants as a link to their email address and it was answered online.

Recruitment

All participants were recruited during a time period of 2 months between 24th September to 25th November. Potentially eligible participants (eligibility criteria outlined below) referred to the Department of Orthopedic surgery sector for knee arthroscopy at Aalborg University Hospital were identified on the database. Patients were contacted on the telephone before the date of planned surgery, and they were introduced to the project. Participants' information folder was sent by email to those who were interested in the project. The participants were allowed time to think before they decided whether they wanted to participate.

Inclusion and exclusion criteria

The inclusion criteria were all patients above the age of 18 referred to knee arthroscopy. Exclusion criteria were age younger than 18 years, all non-Danish speakers, and lack of ability to cooperate or incapable of following instructions.

Self-report outcomes

At baseline, participants completed a questionnaire that included participant demographics and self-reported outcomes. Before arthroscopy, the self-reported outcomes assessed were pain, stiffness, and function of the knee using the Western Ontario and McMaster Universities Arthritis Index (WOMAC). After arthroscopy participants completed self-reported pain, function,

use of analgesics, return to work, and effusion in the knee joint using our questionnaire. In the absence of specific effusion outcomes, we considered these four symptoms: swelling, tightness, tenderness, and instability relevant to capture the domain of effusion.

Patients were stratified into five groups based on the number of symptoms they reported. Group 0 indicated that patients had not experienced any symptoms while group 4 indicated that the patients had experienced all four symptoms. Pain was reported using the numeric pain rating scale (NRS; 0-10) and was measured based on worst pain for the last 24 hours.

WOMAC score

WOMAC is a standardized self-administered questionnaire used worldwide, it was originally designed for the evaluation of hip and knee osteoarthritis. The questionnaire consists of 24 questions and is divided into 3 subgroups: pain, stiffness, and physical functioning of the joints with 5, 2, and 17 questions respectively. Each question is scored from 0-4, which corresponds to none (0), mild (1), moderate (2), severe (3), and extreme (4). The total index score is the combination of pain, stiffness, and physical function [5].

Statistical analysis

All data obtained were ordinal values and hence non-normally distributed data were collected. The data are presented as median and interquartile ranges (IQR) or minimum and maximum values (min and max). To evaluate knee joint effusion changes over time, repeated measures analysis was used with time as the repeated measure (1-, 2-, 4-, 6- and 8 weeks) and effusion as the dependent variable. We investigated the association between effusion, worst pain for the last 24 hours, and time for return to work.

Ethics

The study was conducted in compliance with the Declaration of Helsinki III and was submitted to the Research Ethics Committee of North Jutland (study ID: 2021-000438). The study was further approved by the Danish Data Protection Agency, which must approve all extractions of data for research purposes.

Enrollment

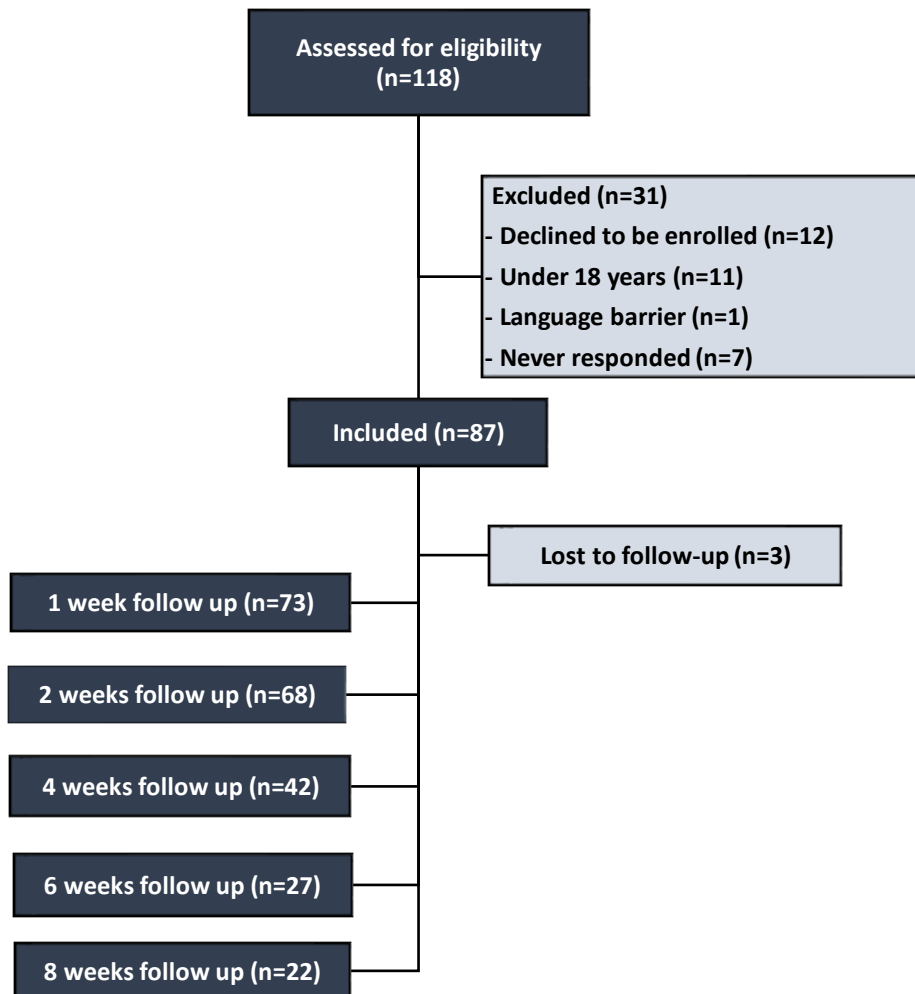


Figure 1, Flowchart of the selection process and outcome for the study population.

Results

This study included 87 patients between the age of 18 and 74 (46 males, 41 females) who underwent knee arthroscopy. Self-reported data were available for 87 patients at baseline, 73 at 1 week and 68 at 2 weeks, 43 at 4 weeks, 29 at 6 weeks, and 22 at 8 weeks follow-up (fig. 1).

3 patients were lost to follow up on 1 week.

Due to the cut-off date for this project, data was not included for all participants at the different

time points. The missing data from follow-ups will be gathered and released in the nearest future.

Baseline data

Table 1 presents the baseline characteristics of the participants. Values are medians, min and max unless stated otherwise.

Characteristics	Knee arthroscopy
<u>Demographics:</u>	n=87
Sex M/F	46/41
Age [years]	42 (18-74)
Weight [kg]	85 (53-120)
Height [cm]	176 (157-204)
Body mass index, BMI	27 (18-39)
No smokers	11
Alcohol above Health care advisement M/F	6/3
No primary school education only	32
No high school education	22
No education at university level	44
Previously treated for knee pain	36 out of 87
<u>Comorbidity:</u>	
0	56
1	18
2	9
3 or more	4
<u>WOMAC scores before arthroscopy:</u>	
Pain symptoms (0-20, best to worst)	7 (0-14)
Stiffness (0-8, best to worst)	2 (0-8)
Function (0-68, best to worst)	18 (0-68)
<u>Type of procedure:</u>	
Partial resection of the meniscus in knee joint	32
Plica resection	9
Anterior cruciate ligament (ACL) reconstruction	9
Meniscus suture	9
Partial synovectomy	10
Other	18

Table 1, Demographics

1: Effusion in terms of swelling, tightness, tenderness, and instability

2 out of 73 patients reported no symptoms of knee joint effusion 1 week following arthroscopy, 3 out of 68 at 2 weeks, 9 out of 43 at 4 weeks, 7 out of 29 at 6 weeks, and 4 out of 22 at 8 weeks follow-up.

At 1 week follow-up 60 out of 73 patients reported swelling compared to 10 out of 22 at 8 weeks follow-up. 48 out of 73 reported tightness in the knee at 1-week follow-up and 6 out of 22 at 8 weeks follow-up. Furthermore, 46 out of 73 reported tenderness in the knee at 1-week follow-up compared to 10 out of 22 at 8 weeks follow-up. Finally, 20 out of 73 patients reported instability in the knee at 1-week follow-up compared to 6 out of 22 at 8 weeks follow-up. (Fig. 2)

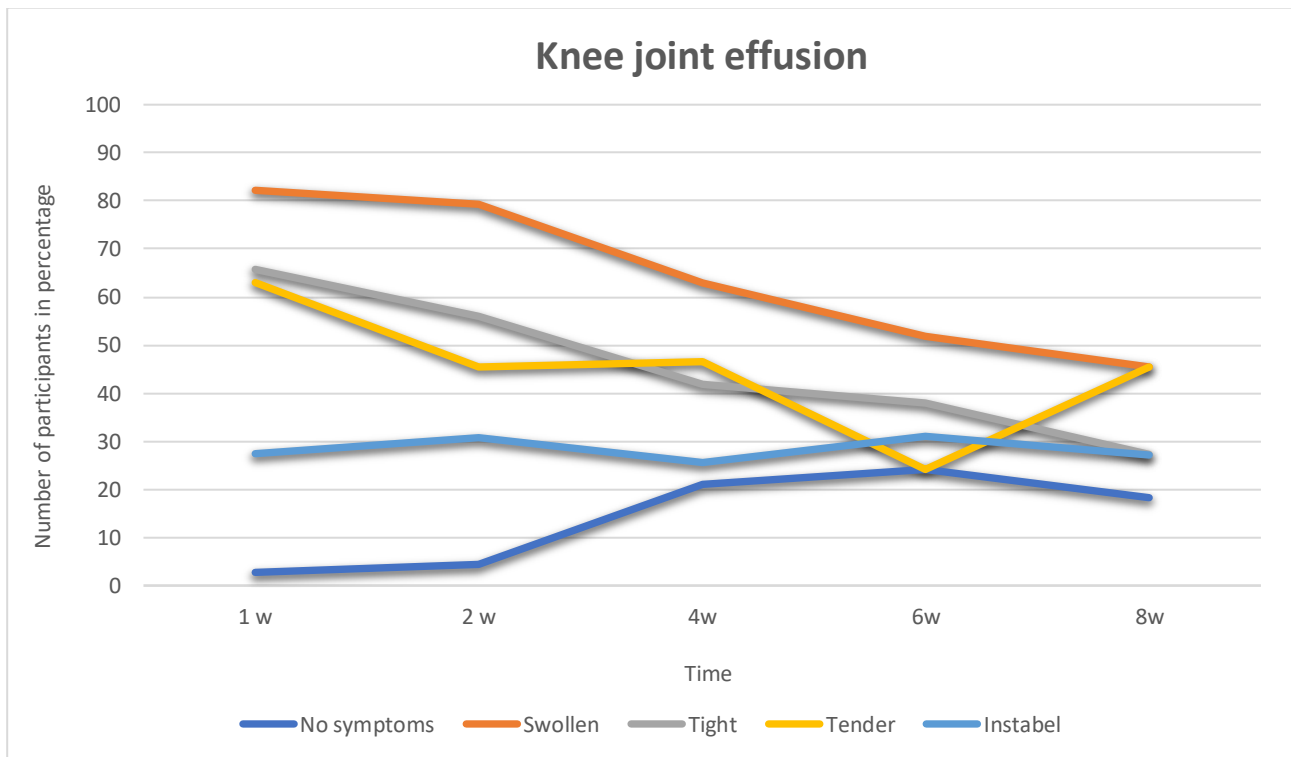


Figure 2, Diagram representing the symptoms of knee joint effusion over 8-weeks following arthroscopy.

2: Number of symptoms

The number of symptoms was a median of 2 (1st- 3rd quartile [Q1-Q3] 2-3) at 1 week, 2 (1.75-3) at 2 weeks, 2 (1-3) at 4 weeks, 2 (1-2) at 6 weeks and 1(1-2) at 8 weeks follow-up.

7 out of 73 patients reported 1 symptom of knee joint effusion on 1 week following arthroscopy, 31 reported 2 symptoms, 27 reported 3 symptoms and the remaining 6 patients reported all 4

symptoms. In comparison to 8 weeks follow-up, 8 out of 22 patients reported 1 symptom, 6 reported 2 symptoms, and 4 reported 3 symptoms with no one reporting 4 symptoms (table 2)

	1 week follow-up (n=73)	2 weeks follow-up (n=68)	4 weeks follow-up (n=43)	6 weeks follow-up (n=29)	8 weeks follow-up (n=22)
0 symptoms	2	3	9	7	4
1 symptom	7	14	5	6	8
2 symptoms	31	26	17	12	6
3 symptoms	27	22	11	4	4
4 symptoms	6	3	1	0	0

Table 2, Changes in symptoms over 8 weeks.

3: Association between effusion, worst pain last 24 hours and painkillers

The worst pain reported was a median of 4 (2-6) at 1 week, 3 (2-6) at 2 weeks, 2 (1-6) at 4 weeks, 3(1-5) at 6 weeks, and lastly 3 (1-5.75) at 8 weeks follow-up for all participants (fig. 3).

The reduced number of effusion symptoms in the knee joint (defined as the change from 1 to 8 weeks follow-up) was moderately associated with reduced worst pain during the last 24 hours. Week 1 ($r=0.37$, $P<0.001$, Spearman's rank correlation coefficient), week 4 ($r=0.46$, $P<0.001$) and week 8 ($r=0.68$, $P<0.001$) [6].

Improvement in effusion and worst pain was also associated with a reduction in the use of pain killers. 38 out of 73 patients (53%) reported the use of analgesics for knee pain at 1 week, 27 out of 68 (40%) at 2 weeks, 9 out of 43 (21%) at 4 weeks, 2 out of 29 (7%) at 6 weeks and finally 5 out of 22 (23%) at 8 weeks follow-up.

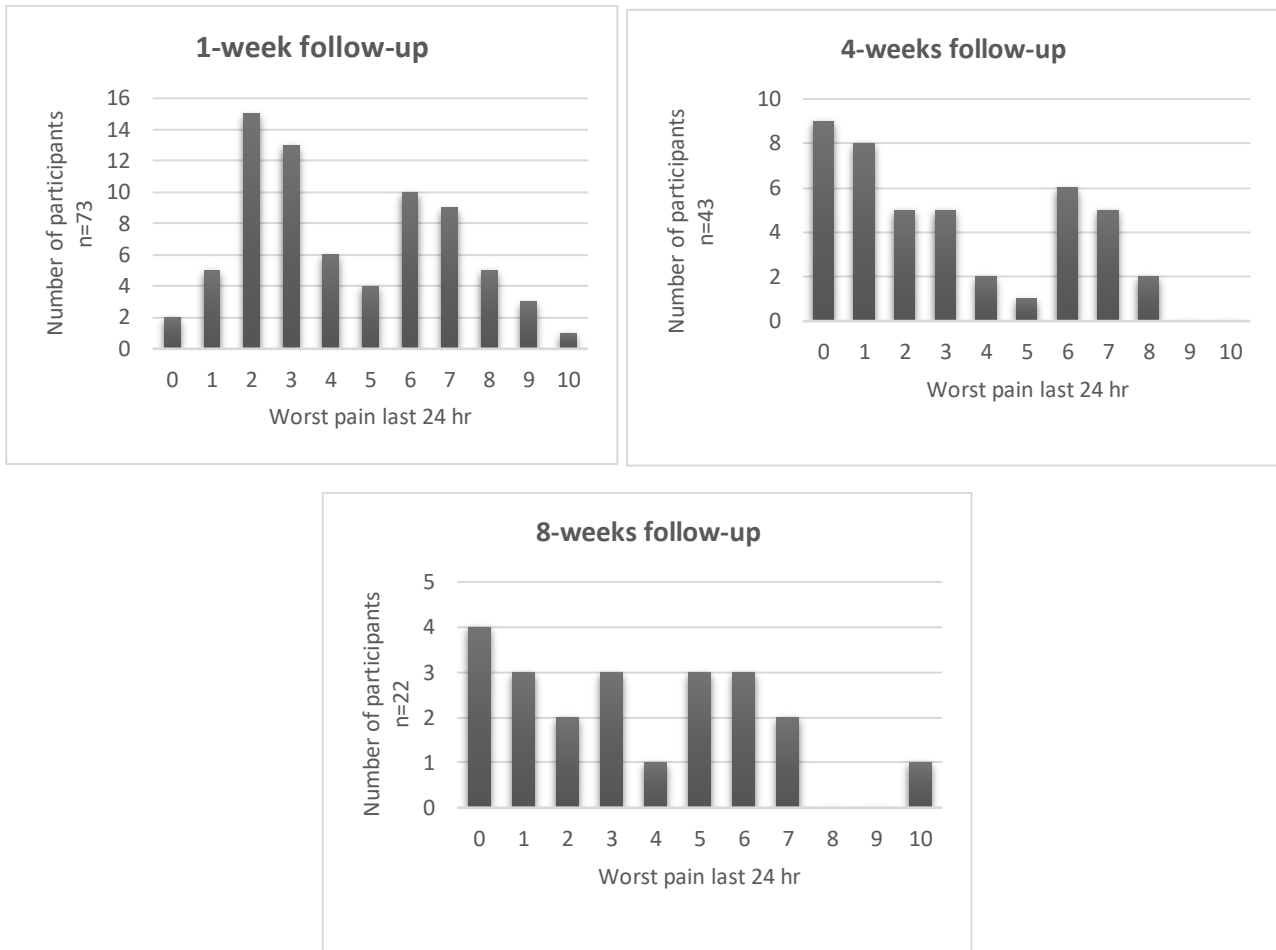


Figure 3, Histogram showing result for worst pain for last 24 hours on 1- 4- and 8- weeks follow-up

5: Return to work

Furthermore, reduced effusion in the knee joint was also associated with recovery measured on time to return to work. 17 out of the 64 (27%) patients in the labor market returned to their work 1 week following arthroscopy, 21 out of 60 (35%) at 2 weeks, 16 out of 37(43%) at 4 weeks, 19 out of 25(76%) at 6 weeks and 16 out of 19 (84%) at 8 weeks follow-up.

Discussion

Despite the increased rate of knee arthroscopy procedures for the last decade, there is still a lack of research covering knee joint effusion and how this affects rehabilitation.

In this study, we wanted to investigate for how long patients experienced knee joint effusion following arthroscopy. We found that 97% had reported at least one symptom of effusion at 1 week compared to 82% at 8 weeks follow-up. When pooling data this way it seems that only a small number of patients have improved in their symptoms of effusion over 8 weeks.

However, when we look at the number of symptoms, we see that 42% reported 2 symptoms at week 1 compared to 27% at week 8. 37% reported 3 symptoms at week 1 compared to 18% at week 8 and finally, 8% reported 4 symptoms at week 1 while there was no report of 4 symptoms at week 8.

These findings are interesting since there is limited research on knee joint effusion following arthroscopy and even less research on how effusion affects rehabilitation.

We compared our results to a randomized double-blinded, placebo-controlled study by Rasmussen et al [2]. The study included a total of 120 patients in which 59 patients were given naproxen sodium orally at a dose of two times 550 mg daily for 10 days. Patients were followed on days 10 and 20 postoperatively. The study group demonstrated a difference in synovial effusion ($p=0.01$) and days until pain-free ($P=0.0001$) following knee arthroscopy compared to placebo. A reduction in time of return to work from 17(11-31) for placebo to 14 (10-31) for naproxen was also seen. We noted no difference in patient's characteristics in terms of age, sex, and knee pathology between Rasmussen's study group and ours which made it a comparable study.

A total of 95.6% of our patients developed effusion at 2 weeks follow-up compared to 35% with oral naproxen sodium and 61% with placebo on day 10. At 4 weeks follow-up 79% of our patients still reported effusion compared to 16% in the naproxen sodium group and 36% in the placebo group on day 20. This indicates a positive effect of NSAIDs on effusion following arthroscopy.

It is worth noticing that even in the placebo group fewer patients reported effusion compared to our study. One possible explanation for this difference is the quantification of effusion, Rasmussen defined effusion as a yes or no question measured by a doctor on clinical examination at different follow-ups.

Another study with promising results for reducing postoperative effusion is the use of intraarticular Tenoxicam, another NSAID [3]. Effusion was measured by the same surgeon on clinical examination 14 days postoperatively. Jawish et al. found that effusion only developed in 15.7% out of 134 patients when Tenoxicam was used. Furthermore, this study also concluded that knee effusion was more likely to develop in specific knee pathologies such as degenerative arthropathy and meniscal lesions. Due to the small sample size in our study, we combined all data for the different knee pathologies in one analysis therefore we do not know if effusion was more common in a specific surgery group.

Additionally, in our study, we did not check for radiographic images of the knee before arthroscopy and hence we do not know if there was any pre-existing degenerative arthropathy. A study by Moseley JB et al. stated that patients with existing osteoarthritis who underwent knee arthroscopy, debridement or lavage, versus a placebo group who was manipulated to believe they had arthroscopy surgery, all reported the same level of pain and function postoperatively [7]. This indicates that any patient with a pre-existing osteoarthritis condition may not benefit from arthroscopy due to the existing degenerative condition in the knee [8-10]. This is further supported by a randomized controlled trial by Kise et al. This study investigated exercise therapy versus arthroscopic partial meniscectomy for degenerative meniscal tear in middle-aged patients, above the age of 35 [1]. It concluded that after 2 years of follow-up there was only a minimal difference in the treatment effect, encouraging middle-aged patients and clinicians to consider exercise therapy as a treatment. Participants in our study were also middle-aged patients with a median age of 42 years and hence degenerative knee pathology is likely to have been present in more than 50% of our patients.

Moreover, we also found that effusion in our patients was moderately associated with worst pain during the last 24 hours over 8 weeks. The median for worst pain was 4 (2-6) at 1 week and 3 (1-5.75) at 8 weeks follow-up. It is easy to postulate a difference in pain scores if we do not measure pain for a specific task. For instance, we do not know if the worst pain score reported, was experienced during or after running several kilometres.

In addition to this, we need to consider the use of pain killers as there might be an increase or

decrease in the use of medication affecting the outcome of worst pain score. We compared our pain results to Rasmussen's study [2]. Patients treated with naproxen sodium had significantly less pain than the placebo group up to 20 days after arthroscopy. He reported a median VAS score of 0 (0-42) (median, min and max) in the group of naproxen sodium compared to 3(0-84) in placebo on day 10 and 0 (0-50) in the Naproxen Sodium group and 1 (0-51) in placebo on day 20. One limitation to this result is that we do not know if this decrease in pain was related to an increase in the use of painkillers since patients were allowed to take analgesics when needed. In our study, we saw an association between a decrease in the use of painkillers and the worst pain reported over 8 weeks. 53% reported the use of analgesics for knee pain at 1 week, 40% at 2 weeks, and 23% at 8 weeks follow-up.

Another aspect of recovery was time for return to work. In our study, 27% of the patients returned to their work 1 week following arthroscopy, 43% at 4 weeks, and 84% at 8 weeks follow-up. It is known that effusion can delay the time of return to work [2] and hence a faster recovery from effusion can help reduce this time. In another study by Rasmussen et al., he investigated the effect of intra-articular glucocorticoid, bupivacaine plus morphine on pain, inflammatory response, and duration of convalescence after arthroscopic meniscectomy in a placebo-controlled study [11]. The study included 60 patients followed for 10 days postoperatively. The study group revealed a reduction in time of return to work 3(0-13) (median and range) days compared to 10(1-30) days for placebo. Furthermore, the study also found a difference in synovial effusion between the study group and placebo ($P=0.007$). Altogether this suggests that the use of intra-articular pain treatment can help reduce the time of return to work as well as synovial effusion. One limitation was the selection of surgery group to include meniscectomy only compared to our study that included a wider range of knee pathologies.

Limitations and further needs for evaluation

We did not include data for all patients on the different time points due to the cut-off date for handing in this project. This led to a continually smaller sample size over time and hence a lower statistical power. However, the unselected group of patients and differences in knee pathologies increases the validity of the study.

Multimodal treatment has shown to be effective in accelerating recovery. NSAIDs, glucocorticoid, Tranexamic acid are all examples of medications that have been suggested for faster recovery following knee arthroscopy. Yet, safety and effectiveness need to be further investigated [12]. Similarly, the use of intra-articular drains after ACL has been suggested but when assessed it was not found to be effective [13]. Early viscosupplementation has also been suggested following ACL and had some positive findings in terms of patellar circumference and range of motion following arthroscopy [14].

Furthermore, a different study by Rasmussen et al. showed that the use of NSAIDs was significantly effective in arthroscopic procedures but it had only a minor effect in diagnostic arthroscopy [15]. This indicates that the effect is related to the severity of the surgical trauma which leads us to another limitation in our study since we did not examine the data for each surgery group separately.

One important factor in this study was the way we quantified effusion compared to the studies mentioned above [2-4]. Our patients could choose among 4 different symptoms and even when only one symptom was reported it still counted as effusion. Pooling data this way may have led to an overrepresentation of effusion. This raises the question of which method is the best way to measure effusion in the future?

One way of measuring effusion could be using magnetic resonance imaging, MRI but the disadvantage, besides the cost, is that patients would have to come in for controls. Another way could be to have clinicians determine effusion on follow-ups but what if the doctor determines there is no effusion and yet the patient reports symptoms of effusion then who is right? One might argue that since it is the patient's knee it would be more relevant to ask the patient rather than have a clinical examination performed.

In conclusion, our study provides new insight into the severity of effusion following arthroscopy. More than 80% of our patients still experienced symptoms of effusion up to two months after surgery. This is a higher proportion than expected, and more research with larger sample sizes needs to be performed to elaborate on this. Furthermore, there is a need for future research to monitor effusion following arthroscopy in different knee pathologies but also to any preexisting condition of osteoarthritis in the knee.

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