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# Prevalence and Predictive Factors of Chronic Postsurgical Pain and Global Surgical Recovery 1 Year After Outpatient Knee Arthroscopy

## *A Prospective Cohort Study*

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**Abstract:** Outpatient knee arthroscopy is one of the most commonly performed surgical procedures. Previous research has demonstrated that chronic postsurgical pain (CPSP) after outpatient surgery is prevalent. Our objective was to determine the prevalence and predictive factors of CPSP and Global Surgical Recovery (GSR) 1 year after knee arthroscopy.

A prospective longitudinal cohort study was performed. Patients were included during an 18-month period. Data were collected by using 3 questionnaires: at 1 week preoperatively, 4 days postoperatively, and 1 year postoperatively. A value of  $>3$  on an 11-point numeric rating scale (NRS) was defined as moderate to severe pain. A score of  $\leq 80\%$  on the Global Surgical Recovery Index was defined as poor GSR. Stepwise logistic regression analysis was performed to determine which variables were predictors for CPSP and poor GSR.

The prevalence of moderate to severe preoperative pain in patients undergoing knee arthroscopy ( $n = 104$ ) was 71.2%, of acute postsurgical pain 37.5%, and of CPSP 32.7%. Risk factors for CPSP were the presence of preoperative pain and preoperative analgesic use, with odds ratios of 6.31 (1.25–31.74) and 4.36 (1.58–12.07), respectively. The prevalence of poor GSR 1 year after outpatient knee arthroscopy was 50.0%. Poor GSR 4 days after the surgery was a risk factor with an odds ratio of 8.38 (0.92–76.58) and quality of life 4 days after surgery was a protective factor with an odds ratio of 0.10 (0.02–0.64).

Both CPSP and poor GSR are common 1 year after knee arthroscopy. Patients at risk for CPSP can be identified during the preoperative phase. Prediction of poor GSR 1 year after surgery is mainly related to early postoperative recovery.

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**Abbreviations:** APSP = acute postsurgical pain, ASA = American Society of Anesthesiologists, AUC = area under the curve, CPSP = chronic postsurgical pain, GSR = global surgical recovery, NRS = numeric rating scale, Q1 = Questionnaire 1, Q2 = Questionnaire 2, Q3 = Questionnaire 3.

## INTRODUCTION

Arthroscopic knee surgery is one of the most commonly performed surgical procedures, especially in the outpatient setting. Indications for performing this procedure include functional complaints, as well as acute or persisting pain. Recently, the effectiveness of arthroscopic knee surgery has been questioned for various indications and is now considered controversial.<sup>1</sup> Several randomized studies have been performed to compare optimal conservative treatment or sham surgery with arthroscopic knee surgery for various diagnoses, but were not able to demonstrate a benefit of surgical intervention.<sup>2–5</sup> Nevertheless, due to methodological constraints, correct interpretation of the results is difficult. First of all, no study has yet been performed to determine which variables, besides the presence of osteoarthritis, might predict whether a patient might benefit from surgical intervention or not. In this respect, variables such as those related to socio-demographic, clinical, and psychological predictors are of main interest. Second, most studies determine the effectiveness of arthroscopic knee surgery in terms of functional complaints. In this context, the question of both acute and chronic postsurgical pain (APSP and CPSP) should not be overlooked, since pain is most often the major indication for surgery, and at the same time pain is also considered to be an important complication of the surgical procedure.<sup>6,7</sup> Both APSP and CPSP have been associated with several negative consequences for the patient's general health, the cost-effectiveness of the surgical procedure, and for society in general.<sup>8–10</sup> Another important outcome parameter is global surgical recovery (GSR), measuring the patient's satisfaction and overall success of the procedure.<sup>11</sup> Patients who experience CPSP might consider themselves fully recovered and participate in regular work and social activities. In contrast, some patients without CPSP might experience suboptimal overall recovery. Interestingly, previous studies have demonstrated that predictors of poor GSR might not be identical to predictors of CPSP.<sup>7,12</sup>

The aim of this study is to describe the prevalence and predictive factors of chronic postsurgical pain and poor global surgical recovery 1 year after outpatient knee arthroscopy in order to be able to identify the patients who are at risk.

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## METHODS

### Subjects

This study is a subgroup analysis of a previously published prospective longitudinal cohort study performed to collect information about the prevalence and predictive factors of APSP and CPSP, and GSR in patients undergoing outpatient surgery.<sup>7</sup> Approval to perform this study was given by the Ethics Committee of the Maastricht University Medical Center + (MUMC+), and all patients gave written informed consent to participate. The study included all adult patients undergoing outpatient surgery, regardless of the nature of the procedure. Patients were excluded if they were younger than 18 years, were unable to express themselves, were visually impaired, or if their understanding of the Dutch language was insufficient. In this present article, only patients who underwent arthroscopic knee surgery are described.

### Instruments

Information was collected by using 3 questionnaire packages; a preoperative pain questionnaire package (Q1), an acute postsurgical pain questionnaire package (Q2), and a chronic postsurgical pain questionnaire package (Q3). Q1 contained questions about preoperative pain intensity, analgesic use, health care utilization, quality of life, as well as questions about demographic and psychological candidate predictors. Q2 and Q3 contained questions about pain intensity, analgesic use, health care utilization, quality of life, global recovery, and postoperative side effects.<sup>7,12</sup> All questions regarding pain were measured on an 11-point numeric rating scale (NRS; where 0 = no pain, and 10 = worst pain imaginable). Furthermore, patients were specifically asked if they thought the pain they were experiencing was related to the surgery. Global surgical recovery (GSR) was measured by using the Global Surgical Recovery index, which represents a single question about the extent to which patients considered themselves recovered from the surgery ("if 100% recovery means your health is back to the same level as it was before the surgery, what percentage of recovery are you at now?").<sup>12</sup> In order to measure the patient's psychological status 4 validated questionnaires were used (ie Pain Catastrophizing Scale, Surgical Fear Questionnaire, Life Orientation Test Revised, and the EuroQol).<sup>13–16</sup> A detailed description of the questions asked and the questionnaires used can be found elsewhere.<sup>7</sup>

### Study Design

Between November 2008 and April 2010, patients scheduled for elective outpatient surgery at the MUMC+ were asked to participate if they were planned for outpatient surgery. In the case of consent, patients received an envelope with the first 2 questionnaires and a standardized prescription for postoperative analgesics (ie acetaminophen 1000 mg 4 times a day, with an upgrade to acetaminophen/tramadol 650/75 mg 4 times a day in the case of insufficient analgesia). Patients were asked to complete Q1 1 week before the surgery and Q2 4 days after the surgery. Patients who returned Q1, but not Q2, were reminded to complete Q2 by telephone or mail. Patients received Q3 1 year after the surgery. All clinical information (eg ASA physical status, type of anesthesia, duration of the procedure, duration of hospital stay) was acquired by systematic chart review. The severity of osteoarthritis was graded during the arthroscopic procedure, according to the Outerbridge Classification.<sup>17</sup> This classification consists of a 5-point scale, where 0 is no osteoarthritis, 1 is softening and swelling of articular

cartilage, 2 is fragmentation and fissuring of articular cartilage affecting <0.5 inches, 3 is fragmentation and fissuring of articular cartilage affecting >0.5 inches, and 4 is cartilage erosion to the bone.

### Outcome Measures

The main outcome variables in this study were chronic postsurgical pain and global surgical recovery. In accordance with previous studies, NRS > 3 was used to define moderate to severe pain.<sup>7,18,19</sup> Global surgical recovery was defined as poor when the GSR index was  $\leq 80\%$ .<sup>7,12</sup>

### Statistical Analysis

Only patients who returned all 3 questionnaires were included in the analyses. In order to evaluate patient characteristics and mean pain scores, descriptive statistics were used. For Q1 and Q3 the average pain intensity during the last week was used, and for Q2 the actual pain intensity.

We recently identified variables that were relevant predictors for the development of CPSP or poor GSR.<sup>7</sup> The following variables were included in the analyses: age, gender, preoperative pain, preoperative analgesic use, expected postoperative pain, surgical fear, preoperative quality of life, early postoperative quality of life, acute postoperative pain, acute postoperative global recovery, comorbid osteoarthritis, and additional surgery during the first postoperative year. Missing data were imputed using multiple data imputation according to the Van Buuren method.<sup>20</sup> Only missing predictors variables were imputed, missing outcome variables were not.

Predictor variables were initially tested in a univariate logistic regression analysis. If the *P* value was <0.1, the variable was also included in the multiple logistic regression model. Stepwise forward 4-step multiple logistic regression analysis was performed. The steps were based on the availability of the variables during the perioperative phase. The first step contained variables that were easiest to obtain; before the patient visits the outpatient clinic (ie gender and age). A forced entry method was used for the first step. The second step contained variables that can easily be obtained during the preoperative visit (ie preoperative pain and preoperative analgesic use). The third step contained variables that can be obtained preoperatively, but require more detailed questionnaires (ie expected postoperative pain, surgical fear and preoperative quality of life). The fourth step consisted of variables that can only be obtained during or after the surgery (ie comorbid osteoarthritis according to the Outerbridge Classification, acute postoperative pain, acute postoperative global recovery, additional surgery during the first postoperative year, acute postoperative quality of life). A *P* value of <0.05 was considered to be statistically significant. The area under the curve (AUC) was calculated to determine the models' ability to discriminate. All analyses were performed by SPSS version 20.0 (SPSS Inc, Chicago, IL) and STATA version 11.2 (StataCorp, College Station, TX).

## RESULTS

Of the 908 patients that underwent outpatient surgery and were included into our database, 104 patients fulfilled the inclusion criteria of the current substudy. For the flowchart of the original 908 patients we would like to refer to our previous publication.<sup>7</sup> Patient characteristics of the 104 patients are given in Table 1. Because the patient characteristics were

**TABLE 1.** Baseline Patient Characteristics

	N (%) /		N (%)
Age (years)		Type of surgery	
< 45 years	28 (26.9)	Lavage and debridement	21 (20.2)
≥ 45 years	76 (73.1)	Partial meniscectomy	81 (77.9)
Gender		Microfracture chondral defect	2 (1.9)
Male	54 (51.9)	Indication for surgery	
Female	50 (48.1)	Pain	98 (94.2)
Educational background		Symptoms of locking	15 (14.4)
Elementary school	8 (7.7)	Instability	7 (6.7)
Intermediate	80 (76.9)	Effusion	5 (4.8)
Higher degree, university	16 (15.4)	Outerbridge Classification	
Work situation		0 and 1 (no osteoarthritis)	30 (28.8)
Paid work	53 (51.0)	2 and 3 (mild osteoarthritis)	39 (37.5)
Unpaid work	23 (22.1)	4 (severe osteoarthritis)	16 (15.4)
Not working	28 (26.9)	Type of anesthesia	
ASA physical status		General	50 (48.1)
I	52 (50.0)	Spinal	44 (42.3)
II	46 (44.2)	Combination	10 (9.6)
III	3 (2.9)		

NRS = numeric rating scale.

calculated before multiple imputation, the results do not always add up to a total of 104 patients. The mean age of the patients was 53.1 years (standard deviation 13.6 years) and there were 54 male and 50 female patients. Forty patients (38.5%) used analgesics during the week before the surgery, and 62 patients (59.6%) did not. A total of 8 patients (7.7%) underwent another surgical procedure during the first postoperative year (ie 6 patients underwent total knee arthroplasty, 1 patient underwent a different arthroscopic procedure of the same knee, and 1 patient underwent anterior cruciate ligament reconstruction).

**Prevalences of Acute and Chronic Postsurgical Pain and Poor Global Recovery**

The prevalences of preoperative pain, APSP and CPSP, as well as the GSR of patients undergoing knee arthroscopy are demonstrated in Table 2. Seventy-four patients (71.2%) experienced moderate to severe pain during the week before surgery. In 72 patients (69.2%) pain interfered with usual activities. Thirty-nine patients (37.5%) experienced moderate to severe APSP on the fourth postoperative day. Pain interference had not decreased. Thirty-four patients (32.7%) experienced moderate to severe CPSP 1 year after the procedure, and in 32 patients

**TABLE 2.** Preoperative, Acute Postoperative, and Chronic Postoperative Pain Intensity and Global Surgical Recovery Index

	Preoperative N (%)	4 Days Postoperative N (%)	1 Year Postoperative N (%)
Global Surgical Recovery Index (%)			
Median (IQR)		50 (40–70)	80 (60–99)
Mean pain intensity <sup>1</sup> (NRS 0–10)			
Median (IQR)	5 (3–7)	4 (2–6)	2 (0–5)
NRS 0–3	29 (27.9)	46 (44.2)	70 (67.3)
NRS 4–10	74 (71.2)	58 (55.8)	34 (32.7)
Information missing	1 (1.0)	–	–
Present pain intensity (NRS 0–10)			
Median (IQR)	5 (2–6)	3 (1–4)	1 (0–3)
NRS 0–3	41 (39.4)	65 (62.5)	80 (76.9)
NRS 4–10	62 (59.6)	39 (37.5)	24 (23.1)
Information missing	1 (1.0)	–	–
Pain interference with usual activities (NRS 0–10)			
Median (IQR)	5 (3–7)	5.5 (3–7)	2 (0–4)
NRS 0–3	30 (28.8)	32 (30.8)	72 (69.2)
NRS 4–10	72 (69.2)	72 (69.2)	32 (30.8)
Information missing	2 (1.9)	–	–

IQR = interquartile range, NRS = numeric rating scale.

**TABLE 3.** Number and Percentages of Patients With Acute Postsurgical Pain (APSP) and Chronic Postsurgical Pain (CPSP) for Patients With and Without Moderate to Severe Preoperative Pain

Preoperative NRS	APSP n (%)	CPSP (%) n (%)
NRS 0–3 (n=29)	5 (17.2)	2 (6.9)
NRS 4–10 (n=75)	34 (45.6)	32 (42.7)

APSP = acute postsurgical pain, CPSP = chronic postsurgical pain, NRS = numeric rating scale.

(30.8%) pain interfered with daily activities. One year after the knee arthroscopy, 17 patients (16.4%) reported more pain than preoperatively, 13 patients (12.5%) reported the same amount of pain, and 74 patients (71.1%) reported less pain than preoperatively. Table 3 demonstrates the percentage of patients with APSP and CPSP for patients with and without moderate to severe preoperative pain.

Ninety-two patients (88.5%) scored a GSR  $\leq$  80% 4 days after the surgery, 9 patients (8.7%) scored GSR  $>$  80% and thus showed good recovery, and of 3 patients data were missing. One year after surgery, 52 patients (50.0%) presented a GSR  $\leq$  80%, 48 patients (46.2%) a GSR  $>$  80%, and the data of 4 patients were missing.

### Predictors of CPSP and Poor Global Recovery

Based on a logistic regression analysis for CPSP and poor GSR no colinearity for any of the variables was observed (Table 4). Surgical fear, acute postoperative GSR, the presence of osteoarthritis, and additional surgery in the year after the index procedure were not statistically significant predictors for CPSP in the univariate analysis and were thus not added to the

final model. Variables predictive of CPSP in the multiple regression model were the presence of preoperative pain and the preoperative use of analgesics (AUC of 0.78). The only significant predictors for poor GSR 1 year after surgery were poor GSR 4 days after the surgery and poor quality of life 4 days after the procedure (AUC of 0.70). Surgical fear, the presence of comorbid osteoarthritis, and additional surgery in the year after the index procedure were no predictors for poor GSR.

The severity of osteoarthritis according to the Outerbridge Classification versus the GSR and pain intensity 1 year after knee arthroscopy is shown in Figures 1 and 2.

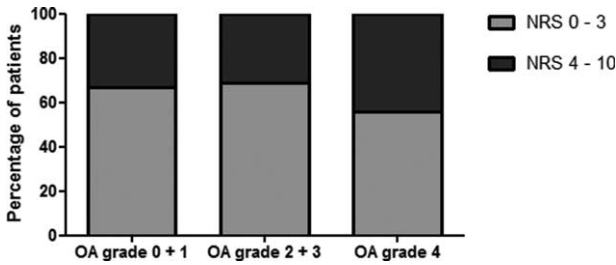
### DISCUSSION

In this study we report a prevalence of preoperative pain in patients that underwent arthroscopic knee surgery of 71.2%, a prevalence of acute postsurgical pain of 37.5%, and a prevalence of chronic postsurgical pain 1 year after surgery of 30.8%. During the last decade, the prevalence of CPSP after several inpatient procedures was reported to vary between 10% and 60%.<sup>21–23</sup> A more recent large cross-sectional study reported a prevalence of 18.3% of moderate to severe CPSP after various surgical procedures.<sup>24</sup> With respect to knee arthroscopy a CPSP prevalence of 30% (NRS  $\geq$  1) was reported 1 year after surgery.<sup>25</sup> The prevalence of CPSP after knee arthroscopy as reported in our study is higher than reported by Rosseland and colleagues, but it should be noted that in their study only patients with moderate acute postoperative pain were included, whereas all patients with preoperative pain or severe acute postoperative pain were excluded. For that reason, the results of Rosseland and colleagues and our results regarding the prevalence of CPSP 1 year after knee arthroscopy are difficult to compare. Closely related, but not identical, data on the prevalence of CPSP in patients after joint arthroscopy have been published.<sup>26–28</sup> It should be taken into account that arthroscopic knee surgery is a relatively minor outpatient procedure, which causes less tissue damage and no or even

**TABLE 4.** Results of the Linear Regression Analysis for Chronic Postsurgical Pain (CPSP) and Global Surgical Recovery (GSR)

Independent Variable	CPSP OR (95% CI)	AUC	Poor GSR 1 year After Surgery OR (95% CI)	AUC
Step 1		0.57		0.52
Age				
>45 years vs <45 years	0.80 (0.32–2.02)		1.00 (0.42–2.43)	
Gender				
Male vs female	0.68 (0.29–1.56)		0.84 (0.38–1.85)	
Step 2		0.78		–
Preoperative pain (NRS > 3)				
Yes vs no	6.31 (1.25–31.74)			
Preoperative analgesic use				
Yes vs no	4.36 (1.58–12.07)			
Step 3		–		–
Step 4		–		0.70
GSR 4 days after surgery				
>80% vs $\leq$ 80%			8.38 (0.92–76.58)	
QOL 4 days after surgery				
Per point (range –0.59 to 1.00 points)			0.10 (0.02–0.64)	

Step 1 Used a Forced Entry Method, Whereas in Other Steps Only Significant Variables (Univariate  $P < 0.1$ ) are Entered. Area Under the Curve (AUC) are Presented Per Step AUC = area under the curve, CI = confidence interval, CPSP = chronic postsurgical pain, GSR = global surgical recovery, NRS = numeric rating scale, QOL = quality of life.



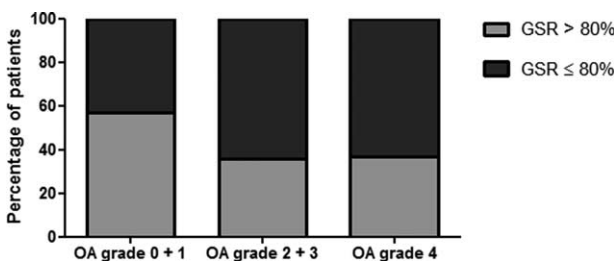
**FIGURE 1.** Presence of chronic postsurgical pain (CPSP) versus the severity of osteoarthritis according to the Outerbridge Classification. CPSP = chronic postsurgical pain, NRS = numeric rating scale, OA = osteoarthritis.

shorter hospital admission compared to joint arthroplasty. Nevertheless, the prevalence of CPSP after joint arthroplasty, varying between 37.5% 6 months after total hip replacement, 50.5% 3 months after total knee replacement, and 37.5% 1 year after total shoulder replacement, does not significantly differ from our data in patients after arthroscopic knee surgery.<sup>26-28</sup> This might indicate that, in the case of orthopedic surgery, the extent of tissue damage and the duration of hospital admission are no reliable predictors for CPSP compared to other variables.

We previously reported a CPSP prevalence of 15.3% after various surgical outpatient procedures.<sup>7</sup> This suggests that CPSP occurs more often after knee arthroscopy (32.7%) compared to other outpatient procedures. This increased prevalence might be explained by a high prevalence of preoperative pain in these patient populations (71.2% for arthroscopic knee surgery versus 37.7% for various outpatient procedures). Preoperative pain has proven to be one of the most important risk factors for the development of CPSP.<sup>7,12,21,23,28,29</sup>

Another aim of this study was to analyze risk factors of CPSP after outpatient knee arthroscopy. Age and gender were included into the first step of the logistic regression model. Neither age nor gender proved to be a significant predictor of CPSP in our model. Large recent studies on CPSP in a general population, as well as smaller studies performed in a specific orthopedic population, could not identify gender as a predictable risk factor for CPSP.<sup>7,12,24,26,28</sup> In contrast, conflicting results have been reported for age. Some studies have not been able to find an effect, whereas other large studies observed an increasing chance of developing CPSP with decreasing age.<sup>7,12,24,26,28</sup> This finding is not supported by the results of the present study in patients undergoing knee arthroscopy.

Significant predictors in the second step of our model were the presence of preoperative pain and preoperative analgesic use. The addition of these variables into the regression model



**FIGURE 2.** Presence of poor global surgical recovery (GSR) versus the severity of osteoarthritis according to the Outerbridge Classification. GSR = global surgical recovery, OA = osteoarthritis.

resulted in an AUC of 0.78. As mentioned before, preoperative pain has been proven to be an important predictor of CPSP.<sup>7,12,21,23,28,29</sup> This is most probably related to the fact that preoperative pain causes both peripheral and central sensitization, which in turn can cause CPSP to develop more easily. Preoperative analgesic use was also an important predictor of CPSP. We previously demonstrated that patients with preoperative analgesic use and preoperative pain were more likely to develop CPSP than patients with adequately treated preoperative pain.<sup>7</sup> We therefore hypothesize that it is not analgesic use in itself that is the risk factor for CPSP, but rather the inefficacy of the analgesic use.

Psychological variables were added to the regression model in the third step. As these variables were not statistically significant in predicting CPSP, they were discarded from the model. Psychological traits have been extensively studied and previous research has demonstrated that these variables (eg surgical fear, pain catastrophizing, depression, pessimism) are important risk factors for the development of CPSP.<sup>7,12,27,29,30</sup> We hypothesize that these variables were not significant in this study because knee arthroscopy is a relatively minor procedure without a large emotional aspect, as opposed to other surgical procedures (eg oncologic surgery).

All further perioperative and postoperative variables were added to the regression model in the fourth step, but none of these variables were statistically significant. Acute postoperative pain has been proven to be an important predictor for the development of CPSP after varying procedures.<sup>7,12,21,29</sup> One small-scale study did not report a predictive effect of acute postoperative pain on CPSP in patients that underwent total hip arthroplasty.<sup>26</sup> The conclusion of this study is at least debatable as the absence of a significant effect might be related to the small amount of patients included. In our previous large-scale study, acute postoperative pain was shown to be a significant predictor of CPSP, although it only slightly improved the prediction model.<sup>7</sup> We speculated that long-lasting preoperative pain is a more relevant predictor, because long-lasting preoperative pain might cause more extensive neuroplastic changes compared to brief acute postoperative pain. Additional related surgery in the first postoperative year was also added to the regression model in the fourth step, but was not a predictor. One could argue that this was not statistically significant because of the small number of patients that actually underwent a second procedure (n = 8). However, the prevalence of CPSP in these patients was 37.5% as opposed to 32.3% in the patients that did not undergo another related surgical procedure.

Another important variable that was added to the regression model was the severity of osteoarthritis according to the Outerbridge Classification. The degree of osteoarthritis was not a significant predictor, although we did observe a trend toward an increasing prevalence of CPSP in patients with concomitant grade 4 osteoarthritis. In this respect 2 relevant studies have been published.<sup>3,4</sup> The first study described patients with a meniscal tear and concomitant osteoarthritis and could not demonstrate any benefit of arthroscopy versus optimized physical therapy.<sup>4</sup> The second study studied patients with a meniscal tear without osteoarthritis and could also not find any benefit of arthroscopy versus sham surgery.<sup>3</sup> The authors hypothesize that a meniscal tear could be an early sign of knee osteoarthritis rather than a separate clinical problem. It should, however, be noted that in this study patients with a traumatic meniscal rupture were excluded, while specifically this subpopulation might benefit from arthroscopy surgery. Unfortunately, in both studies no subgroup analysis was done

in order to determine which patients might benefit from surgery and which patients might not. Here we did not observe a predictive effect of osteoarthritis on CPSP, but the present study was not powered for this secondary outcome. On the other hand, we observed a trend of an increased risk for the development of CPSP in patients with grade 4 osteoarthritis (Figure 1A). In order to better answer the question whether the degree of osteoarthritis is a predictor of CPSP after knee arthroscopy, an adequate trial comparing knee arthroscopy with nonsurgical intervention in patients with a meniscal tear, with and without osteoarthritis, and patients with and without a traumatic case should be performed. Then subgroup analyses would have to be performed to determine which patients might benefit from surgical intervention.

The second outcome parameter of this study was global surgical recovery (GSR). This parameter was chosen because it measures overall recovery and previous studies have demonstrated that the risk factors for developing CPSP might not be identical to those for poor GSR.<sup>7,12</sup> A substantial amount of patients in this study (ie 50.0%) experienced poor GSR 1 year after knee arthroscopy. This percentage of 50.0% is relatively high as compared to those reported in other studies. The study of Peters and colleagues reported a prevalence of 34.4% 6 months after various inpatient procedures.<sup>12</sup> Recently, we reported a prevalence of 22.3% 1 year after various outpatient procedures, and 39.2% in the subset of patients undergoing ambulatory orthopedic surgery.<sup>7</sup> Clearly, the prevalence of poor GSR after outpatient knee arthroscopy is amongst the highest of all procedures, including other orthopedic procedures. It would be interesting to know in which domain knee arthroscopy patients experience suboptimal recovery (eg functional, emotional, daily activities, and social activities). We were able to define 2 significant risk factors for poor GSR 1 year after knee arthroscopy: first, poor GSR 4 days after surgery and second poor quality of life 4 days after surgery. Unfortunately, this implies that patients at risk for a long-term poor GSR after knee arthroscopy can only be identified after surgery. Hence the model cannot be used to predict preoperatively which patients might benefit from the surgery. Nevertheless, it would be of major interest to study whether modifications in postoperative therapy in patients with poor GSR 4 days after surgery can change the 1-year outcome.

The present study has a number of limitations. The most important limitation is that we were not able to determine if the CPSP was a newly developed postoperative problem, or rather a continuation of pre-existing preoperative pain. This might result in an overestimation of the incidence of CPSP after arthroscopic knee surgery. Table 3 shows that the prevalence of CPSP in patients without preoperative pain was 6.9%. In these patients, it is fairly certain that the newly acquired pain is CPSP and thus a complication of the procedure. Furthermore, we have demonstrated that 16.4% of the patients reports worse pain after 1 year than before the procedure. In patients with moderate to severe preoperative pain, the prevalence of CPSP was 42.7%. One could argue that most of these patients have benefitted of the arthroscopic procedure, because fewer patients are in moderate to severe pain after 1 year. However, since the natural cause of the pain without arthroscopic knee surgery is unknown, our study is not able to either support or reject that theory either. Future studies should therefore focus on trying to establish whether CPSP is indeed newly developed pain. The second limitation of the present study is the fact that the performed arthroscopies were quite heterogeneous (ie lavage and debridement, partial meniscectomy, microfracture chondral defect).

Variable procedures might result in small but significant changes in predicting CPSP and poor GSR, and this can lead to instabilities in the logistic regression model. However, we accepted this variability, because it reflects clinical reality much better than focusing on a specific group of arthroscopic treatments (eg meniscal tear). A third limitation of the present study was the fact that certain parameters were acquired by retrospective systematic chart review (ie performed arthroscopic procedure, indication for the surgery). This was necessary because the present study is based on a subgroup analysis of a previously performed study.<sup>7</sup> For this reason, we are not able to clarify the discrepancy between the prevalence of pain as the indication for the procedure (94.2%) and preoperative pain as measured by our questionnaire (71.2%). A possible explanation might be that orthopedic surgeons are more likely to look at a composite endpoint (eg consisting of pain, annoyance, bad feeling, functional complaints, etc) instead of standardized pain questionnaires. A second possible explanation for the discrepancy could be the natural course of the pain. Patients may experience serious pain when visiting the orthopedic outpatient clinic, but the pain could have diminished by the time the surgery is performed, usually several weeks later. This would require a re-evaluation of the pain complaints immediately before performing the surgery.

In conclusion, our study demonstrates that a substantial amount of patients experienced CPSP after outpatient knee arthroscopy. Patients with preoperative pain and patients with preoperative analgesic use were at risk for experiencing CPSP. The prevalence of poor GSR 1 year after outpatient knee arthroscopy was 50%. A poor GSR 4 days after surgery and poor quality of life 4 days after surgery were strong predictors for poor GSR 1 year after surgery. Even though increasing severity of osteoarthritis according to the Outer bridge Classification was not a significant predictor for either CPSP or poor GSR 1 year after surgery, we did demonstrate a trend toward a bad outcome.

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