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Original Research Article

Prevalence of anterior knee pain among patients following total knee arthroplasty with nonreplaced patella: A retrospective study of 1778 knees

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ABSTRACT

Background and objective: Anterior knee pain (AKP) may compromise the results of total knee arthroplasty in more than quarter of cases. The aim of the current work was to determine the prevalence of AKP and the severity of patellofemoral symptoms among patients who received a total knee arthroplasty with non-replaced patella in East-Tallinn Central Hospital from January 1, 2000 to December 31, 2009.

Materials and methods: We carried out a retrospective study involving 1778 consecutive total knee arthroplasties with non-replaced patella. Mean follow-up time was 68 months. We collected data by two patient-reported measures: the knee pain questionnaire and the Kujala score.

Results: We diagnosed AKP among 20.2% of patients, 33.6% had pain in the knee from a source other than patellofemoral joint and 46.2% were pain free. In 87.3% of AKP cases the pain emerged within the first five years of knee replacement. AKP was more prevalent among patients with osteoarthritis compared to rheumatoid arthritis and among patients below 60 years. There was no difference in the prevalence of AKP in terms of gender or mobile and fixed bearing implants. The severity of patellofemoral symptoms in case of AKP was moderate. **Conclusions:** AKP is a frequent complication of total knee arthroplasty with non-replaced patella and patients undergoing this procedure should be apprised of the high probability of experiencing pain in the anterior part of the replaced knee.

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1. Introduction

Despite constant research in the field, improved implant design and surgical excellence, the anterior knee pain (AKP) following total knee replacement continues to excite the orthopedic community affecting up to 26.2% of the recipients of a prosthetic knee joint [1,2]. Fortunately, a significant proportion of AKP is of nondisabling nature, thus maintaining a reasonable knee function. Patellofemoral symptoms are at the bottom of revision surgery in 1.9%–7.8% of cases of primary knee replacement [1,3,4]. The multiplicity of variables favoring the evolvement of AKP has hindered the development of uniform guidelines for the prevention of this widespread complication. Even meta-analyses of AKP leave the reader often uncertain about the best way to handle the patella during knee replacement [5].

Our aim was to determine the prevalence of AKP and the severity of patellofemoral symptoms among patients who received a total knee arthroplasty with nonreplaced patella.

2. Materials and methods

We carried out a retrospective analysis of 1778 consecutive primary total knee arthroplasties without patellar replacement performed from January 1, 2000, to December 31, 2009, on 1431 patients in East-Tallinn Central Hospital.

The primary outcome included the prevalence of AKP. Subgroup analysis specified data concerning the prevalence of AKP by age, by diagnosis and by implants. The secondary outcome included the severity of patellofemoral symptoms assessed by the Kujala Score.

The knee was the unit of analysis. Implants were inserted using a medial parapatellar approach, fixed to the bone with cement and the patella was not replaced. By the time of the beginning of the study, 213 patients (250 knees) were deceased, 16 knees were revised and contact information of 7 patients (7 knees) was missing. 274 (18.2%) primary unrevised total knee arthroplasties performed on men and 1231 (81.8%) on women were available for the study. 1505 sets of two self-report measures (the Anterior Knee Pain Questionnaire and the Kujala score) were sent to 1200 patients by ordinary mail. Patients with both knees replaced received two sets of measures: one for each knee. The Anterior Knee Pain Questionnaire (Table 1) developed for the current study is based on a reflective model measuring AKP as an indirect construct by observable items [6].

The Anterior Knee Pain Questionnaire looked into the activities exerting the greatest strain on the patellofemoral joint. On the basis of the responses to the Anterior knee pain questionnaire, the knees were grouped into three pain related categories: (1) pain free, (2) anterior knee pain and (3) knee pain of some other origin than patellofemoral joint. Knees marked with “0” to question 1 were considered as pain free. The remaining group with responses “1”, “2”, or “3” to question 1 consisted of painful knees and was further subdivided into two. Anterior knee pain was diagnosed if in addition to response “1”, “2”, or “3” to question 1 either “1” or “2” was chosen to all of the remaining questions (2–6) of the Anterior

Table 1 – Anterior Knee Pain Questionnaire.

1. When did the knee pain arise following arthroplasty?
 - a. The knee does not hurt (0)
 - b. The knee remained painful right after arthroplasty (1)
 - c. Within 1–5 years following arthroplasty (2)
 - d. More than 5 years following arthroplasty (3)
2. Does the knee hurt when rising from the chair or coach?
 - a. Never (0)
 - b. Sometimes (1)
 - c. Always (2)
3. Does the knee hurt when ascending or descending the stairs?
 - a. Never (0)
 - b. Sometimes (1)
 - c. Always (2)
4. Is touching of the knee cap painful?
 - a. Never (0)
 - b. Sometimes (1)
 - c. Always (2)
5. Does the knee hurt when squatting?
 - a. Never (0)
 - b. Sometimes (1)
 - c. Always (2)
6. Do you feel pain mostly in the anterior part of the knee?
 - a. Never (0)
 - b. Sometimes (1)
 - c. Always (2)

Knee Pain Questionnaire. The rest of the knees with the responses “1”, “2”, or “3” to question 1 denoted knee pain of some origin other than patellofemoral joint.

The Kujala score evaluates subjective symptoms and functional limitations in patellofemoral disorders [7]. With Urho M. Kujala's consent, the questionnaire was adapted to the local language. To ensure that the original and the translated questionnaire were identical, forward and back translation method was used [8]. The sum of the Kujala score ranges from 0 to 100, where the greater value indicates a better patellofemoral function. Mean of the Kujala score was calculated for each of the abovementioned three knee categories.

Patients returned 944 sets of completed measures (171 male and 773 female knees) to investigators, thus resulting in a 62.7% response rate. The response rate was fairly similar among men and women, 62.4% and 62.8% respectively. 50 sets of the returned and filled-in measures (6 male and 44 female knees) were defective and therefore excluded from the study. 894 sets (165 male and 729 female) of properly completed questionnaires were left for the final analysis, constituting 59.4% of all questionnaires sent out initially. Fig. 1 describes how the study sample was developed.

Descriptive statistics, including mean and standard deviation (SD) were used for continuous variables. For categorical variables, percentages (%) and absolute (n) frequencies were presented. 95% confidence intervals (95% CI) were calculated to provide an estimate of population parameters. The chi-squared test, t test and ANOVA were used to test the statistical significance. Two-tailed P values less than 0.05 were considered statistically significant.

Approval from Tallinn Medical Research Ethics Committee was obtained to study the prevalence of anterior knee pain.

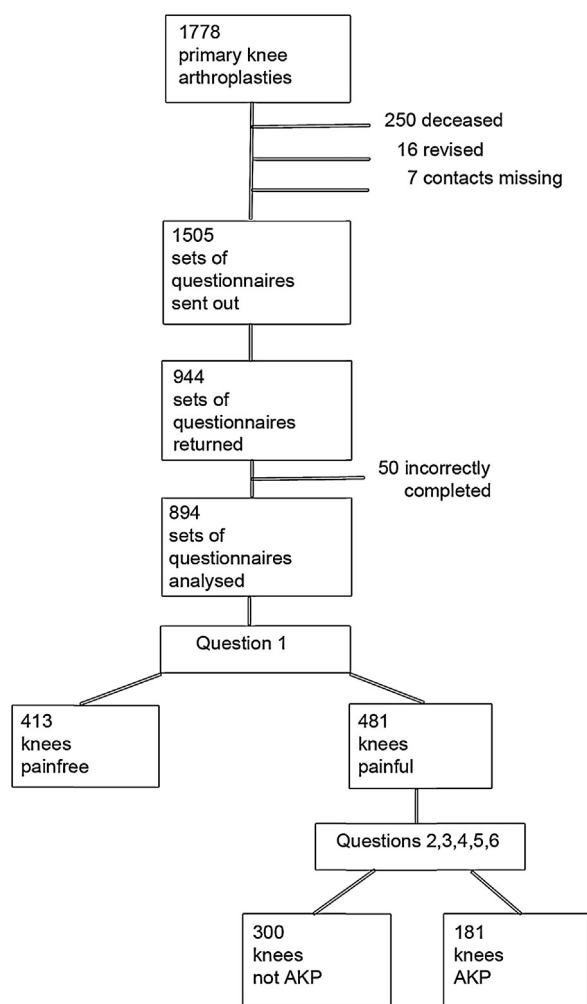


Fig. 1 – Algorithm of the study.

3. Results

Mean follow-up time from knee arthroplasty until completing the questionnaires was 69 (SD, 33; range, 19–137) months. The mean age was 72 years for male respondents (SD, 9; range, 43–88) and 73 years for female (SD, 8; range, 42–92).

Less than half of the knees were pain free and one third had pain originating from a source other than patellofemoral joint. Relying on the diagnostic criteria established in the present study, the prevalence of AKP did not differ significantly between genders ($P = 0.578$) (Table 2).

The highest prevalence of AKP was noted among men below 60 years of age. Also women younger than 60 years experienced more AKP compared to the other age groups of the same gender. Women aged 81 and over were least affected by AKP (Table 3).

There was a statistically significant ($P = 0.010$) difference between the mean age of patients with AKP ($n = 181$) and the rest of the study group ($n = 713$), 71.4 and 73.2 years respectively.

The majority (90.7%) of the knees involved in the study suffered from osteoarthritis, 8.2% from rheumatoid arthritis, and the remaining 1.1% were impaired either by ankylosing spondylitis, psoriatic arthritis or knee dysplasia. The osteoarthritis group showed higher prevalence of AKP compared to rheumatoid knees, 20.5% (95% CI, 17.7–23.4) and 15.1% (95% CI, 7.8–25.4) respectively. The difference was not statistically significant ($P = 0.269$). The prevalence of AKP was 40.0% (95% CI, 12.2–73.8) in the third group of patients. Due to the small number of knees involved and the heterogeneity of diagnoses, the results of the smallest group should be interpreted with caution.

The two most frequently used implants were PFC Σ -CS fixed bearing (J&J) prosthesis in 70.6% of the cases and PFC Σ -CS mobile bearing (J&J) prosthesis in 23.0% of arthroplasties. The prevalence of AKP in the fixed bearing group was 20.1% (95% CI, 17.1–23.5) and in the mobile bearing group 21.4% (95% CI 16.0–27.6). We were unable to show any significant ($P = 0.703$) difference in the prevalence of AKP between mobile and fixed bearing implants.

AKP occurred early following the arthroplasty. In 49.2% (95% CI, 41.7–56.7) of the cases of AKP the knee remained painful right after the surgery, 38.1% (95% CI, 31.0–45.6) became symptomatic within 1–5 years following the knee replacement and in only 12.7% (95% CI, 8.2–18.5) of patients' knees AKP emerged more than 5 years since the operation.

The mean of the Kujala score differed significantly ($P < 0.001$) among pain related knee categories. As expected, symptomless knees had the highest mean of the Kujala score 74.6 (95% CI, 72.5–76.7). The Kujala score of the knees with pain of some other origin than the patellofemoral joint was 55.8 (95% CI, 53.6–58.0) and AKP lessened the outcome to 45.5 (95% CI, 43.0–48.1).

4. Discussion

20.2% prevalence of AKP in our study is in accordance with the data published in medical literature [1,2]. Although modern studies report lower patellofemoral complication rates than studies of the previous decades [4], a definitive solution to the

Table 2 – Pain related categories.

	Male knees		Female knees		Total	
	n	% (95% CI)	n	% (95% CI)	n	% (95% CI)
Pain free	72	43.6 (35.9–51.6)	341	46.8 (43.1–50.5)	413	46.2 (43.0–49.5)
AKP	36	21.8 (15.8–28.9)	145	19.9 (17.1–23.0)	181	20.2 (17.7–23.0)
Painful, not AKP	57	34.6 (27.3–42.3)	243	33.3 (29.9–36.9)	300	33.6 (30.5–36.6)
Total	165		729		894	

Table 3 – Prevalence of AKP by age.

Age, years	Male knees			Female knees		
	n	AKP	% (95% CI)	n	AKP	% (95% CI)
<60	18	7	38.9 (17.3–64.3)	57	17	29.8 (18.4–43.4)
61–70	53	9	17.0 (8.1–29.8)	200	42	21.0 (15.6–27.3)
71–80	71	15	21.1 (12.3–32.4)	348	67	19.3 (15.2–23.8)
>81	23	5	21.7 (7.4–43.7)	124	19	15.3 (9.5–22.9)

problem is still unavailable because of unclear etiology. The largest randomized controlled trial of patellar resurfacing reported to date does not show any advantage of patellar resurfacing over not replacing the patellar articular surface [3].

The focus in the research of possible causes of AKP has shifted away from handling patellar articular surface toward enlightening its multifactorial nature: incision discomfort, neuromas, loss of sensation, bursitis, tendinitis, patellar instability, patellar fracture, subclinical synovitis, Hoffa's fat-pad impingement, design of the femoral component (trochlea surface), positioning of implants and insufficient femoral rollback [5,9–13]. Preoperative AKP has been shown not to correlate with knee pain following the arthroplasty [4]. AKP is probably the result of random combination of several abovementioned factors, unique for each case.

Most studies show the onset of patellofemoral pain as an early complication of total knee arthroplasty developing within 18 months after the procedure [9,14]. Our study also pointed out AKP evolving early: in half of AKP cases the knee remained painful right after the surgery and 87.3% of all painful patellas became evident within five years after surgery.

We did not find any significant differences in the overall prevalence of AKP between male and female knees. However subgroup analysis by gender and age revealed the highest prevalence of AKP among men under 60 years of age. Also among women below 60 there was higher than the average proportion of patients with AKP. The higher prevalence of AKP in the younger age group is probably explained by greater strain on patellofemoral joint due to a physically more active way of life. Sedentary lifestyle, on the other hand, prevents overloading the knee and therefore results in fewer cases of AKP.

The results of the current study do not support recently published data which suggests that AKP is more common among women compared to men following total knee arthroplasty [15].

Prosthetic design has been claimed not to affect the clinical outcome of total knee arthroplasty [16]. We compared the prevalence of AKP between mobile bearing and fixed bearing implants. Mobile bearing platforms have a theoretical advantage of self-alignment of tibia under femur, thus compensating the malpositioning of components and hypothetically diminishing patellofemoral symptoms [17]. We did not find any evidence about prosthetic design affecting the results of total knee arthroplasty concerning patellofemoral symptoms as the prevalence of AKP was similar in mobile and fixed bearing groups.

The results of total knee arthroplasty regarding anterior knee function are no worse among rheumatoid patients compared to patients suffering from osteoarthritis [18–20]. In the current study, there was a statistically insignificant tendency toward AKP being less prevalent in a rheumatoid

group (15.1%) compared to osteoarthritis patients (20.5%). Disease modifying antirheumatic drug treatment in combination with a sedentary lifestyle may be the reason for fewer patients complaining about AKP among a rheumatoid population.

The mean of the Kujala score was 74.6 in the pain-free group, which we established as a standard value among a symptomless population with a replaced knee joint. It scored far less than the maximum of 100 points, but one cannot expect a replaced knee to function equally to a native undamaged joint. Knees with pain from sources other than patellofemoral joint had mean Kujala score 74.8% of the standard value. The mean of the Kujala score was the lowest in AKP category and reached 61.0% of the standard value, confirming the moderate intensity of patellofemoral symptoms [9].

The perfect match of the results of the Kujala score with pain related knee categories served as a validation tool of diagnostic criteria of pain established in the current study.

Data collection by patient-administered questionnaires can be considered as strength of the study. Reports on how the patients feel received from patients themselves is an objective way of diagnosing subjective symptoms such as pain [6]. The outcome is not distorted by the interpretation of the results by a physician, and clinical tests unable to reproduce patellofemoral loading patterns occurring in everyday life are avoided. Following the internationally accepted guidelines [8] while translating the Kujala score into the local language ensured the maintenance of the content validity of the original version.

Also some limitations should be pointed out when interpreting our study results. First, the Anterior Knee Pain Questionnaire was constructed without testing the psychometric properties. This is because we did not aim at developing a new measure but rather asked questions about certain relevant items reflecting AKP as an indirect construct. We used our own questionnaire as the literature search did not reveal any validated patient reported outcome measure for differentiating patients with AKP following total knee replacement from asymptomatic ones. Despite shortcomings in the methodology of the elaboration process, we feel that the questionnaire reached its objective because the set of items was composed of activities provoking AKP which have been well-established in the literature. Secondly, 60% response rate may contribute to selection bias. AKP was diagnosed only on the basis of patient-derived outcomes. Additional objective measurements, such as evaluation of the stability of the ligaments of the knee, analysis of the X-rays for demonstrating possible periprosthetic osteolysis, assessment of patella baja and alta or blood tests for detecting infection might have referred to sources of pain other than the surfaces of the patellofemoral joint.

5. Conclusions

AKP exacerbates the results of total knee arthroplasty with nonreplaced patella in 20.2% of cases. Using mobile bearing implants does not reduce the prevalence of AKP compared to fixed tibial trays. Rheumatoid knees perform better than osteoarthritic joints in regard to AKP. The impairment of patellofemoral function in case of AKP is moderate. Patients undergoing total knee arthroplasty with non-replaced patella should be apprised of the high probability of experiencing AKP.

Further work should examine which diagnostic tools of AKP are appropriate in clinical practice and whether patient-reported outcomes, clinician-specific signs or the combination of clinical tests and questionnaires are accurate enough.

Conflict of interest

The authors state no conflict of interest.

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