Does concomitant meniscectomy affect medium-term outcome of anterior cruciate ligament reconstruction? A preliminary report

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Abstract

Introduction: Anterior cruciate ligament (ACL) injury is often accompanied by injuries of the menisci. In order to restore knee stability, anterior cruciate ligament reconstruction (ACLR) is performed, with meniscus surgery when needed. The purpose of this study was to assess the medium-term outcome of ACLR in subjects with and without concomitant meniscus tear and partial meniscectomy.

Material and methods: We prospectively studied 73 patients after arthroscopically assisted bone-patellar tendon-bone ACLR. Subjects were divided into two subgroups: those who had only ACLR (group A, 54 subjects with mean age 28, (SD 9)) and those who underwent both ACLR and concomitant partial meniscectomy (group B, 19 subjects, mean age 32 [11]). Subjects completed a disease-specific questionnaire, the Knee injury and Osteoarthritis Outcome Score (KOOS), preoperatively and at a minimum follow-up of 1 year.

Results: No differences in mean scores between group A and B were observed either preoperatively or at follow-up. We found a significant change in mean score in the KOOS subscale QoL in group A following ACLR (Δ = 9 points, p = 0.039). Most subjects improved in the KOOS subscales Sports and Recreation and QoL in both group A (59 and 52% respectively) and B (63 and 47% respectively). Eight subjects (15%) from group A and 1 (5%) from group B fulfilled criteria of functional recovery. Criteria of treatment failure were fulfilled in 17 subjects (32%) from A and 4 (21%) from group B.

Conclusions: Patients undergoing ACLR with partial meniscectomy had a similar medium-term outcome compared to individuals with ACL tear alone.

Key words: anterior cruciate ligament, outcome, meniscectomy, functional recovery, treatment failure.

Introduction

The incidence of anterior cruciate ligament (ACL) injuries in the general population has not yet been fully determined but it is estimated at 37–81/100,000 inhabitants per year [1, 2]. Anterior cruciate ligament injury is often associated with concomitant damage of other joint structures, of which injury of the menisci is the most common [2, 3]. Due to the altered

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biomechanics and ongoing knee instability, the number of meniscus tears in ACL-deficient knees increases over time [4, 5].

Since reconstruction of the ruptured ACL might restore knee stability and reduce the risk of further meniscal and/or cartilage damage, it has widely been accepted as a standard surgical procedure, especially in active young subjects [6]. However, clinical analyses show that one third of subjects undergoing ACL reconstruction (ACLR) have residual instability at follow-up and never reach the pre-injury activity level [7]. Data on whether accompanying knee injuries substantially affect patients' outcome are not consistent. Some authors have found concomitant ligamentous and meniscus injuries not to be significant predictors of patient-oriented outcome [5, 8, 9], whereas others reported worse functional outcome in subjects undergoing ACLR together with meniscus surgery as observed in both medium- [10] and long-term follow-up [11, 12]. It has also been proved that additional meniscus surgery can decrease the desired activity level and shorten the career in competitive athletes [13].

We therefore decided to conduct a longitudinal study in patients undergoing ACLR with the focus on identifying factors associated with variability in outcome scores. In this preliminary report we assess the medium-term outcome of ACLR in subjects with and without concomitant meniscus tear and meniscectomy.

Material and methods

Study sample

All patients who had undergone ACLR at our department between January 2007 and November 2011 were identified according to surgical records. The major exclusion criteria were good effect of rehabilitation, collateral or posterior cruciate ligament rupture, chondral lesions assigned to chondroplasty, meniscus rupture assigned to suturing and previous knee surgery (Figure 1). We identified 101 patients who completed a self-administered questionnaire evaluating their knee-specific symptoms and knee function. Of them, 73 subjects with a minimum follow-up of 1 year formed the study group. The whole sample consisted of those who had only ACLR (group A) and those who underwent both ACLR and concomitant partial meniscectomy (group B) (Figure 1).

Surgery and rehabilitation

The postoperative protocol for both groups A and B was identical. All patients underwent standardized arthroscopic single incision bone-patellar tendon-bone autograft ACLR. An additional partial meniscectomy (where no more than half

of the meniscus was resected) was performed in subjects with meniscus tears. Patients with meniscus tears that were suitable for suturing were excluded from the study (Figure 1).

All patients had undergone a standardized, moderately accelerated, 6 months' rehabilitation program [14]. Immediate active full extension and flexion up to 90° of the operated knee was introduced. Free range of motion was permitted 2 weeks after the surgery. The patients were allowed to ambulate 1 day after the surgery and bear weight as tolerated. Crutches were used when needed up to 4 weeks. No knee brace was used. Closed-chain exercises were started gradually postoperatively. Running was permitted three months and contact sports 6 to 9 months postoperatively, provided that the patient had regained
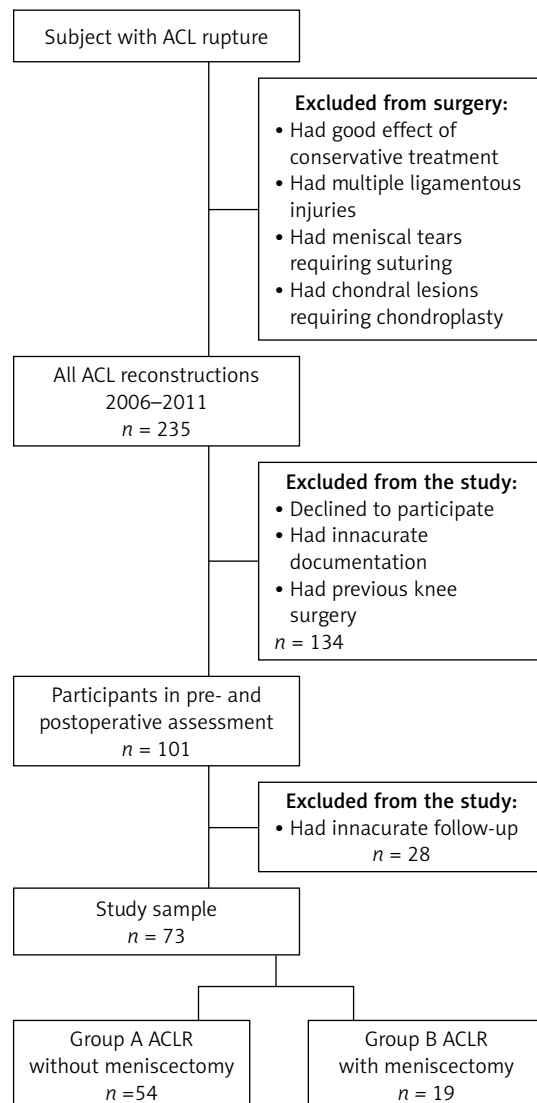

Figure 1. Flow chart presenting inclusion and exclusion criteria for patients. ACL denotes anterior cruciate ligament

functional stability, muscle strength and coordination.

All the subjects were followed up after they had returned to their normal activities.

Clinical assessment

The assessment was performed first preoperatively, then during the routine follow-up at a minimum of 1 year after ACLR. All subjects underwent clinical evaluation encompassing the range of motion activity in the operated knee (assessed with a goniometer), wound healing complications, infections, number of aspirations for hemarthrosis and incidence of limb swelling.

Disease-specific questionnaire

The Knee injury and Osteoarthritis Outcome Score (KOOS) was used. KOOS is a 42-item self-administered knee-specific questionnaire that was developed to be used for short- and long-term follow-up studies of knee injuries and knee OA and is commonly used to evaluate the effect of orthopedic surgery including ACLR [15–17]. The score contains five subscales: Pain, other Symptoms, Activities of Daily Living (ADL), Sports and Recreation and Quality of Life (QoL). A separate score ranging from 0 to 100 where 100 represents the best result is calculated for each subscale. The score had already been validated for ACLR, and culturally adapted for Polish ACL-reconstructed patients [18]. Participants were asked to complete the KOOS questionnaire preoperatively and during the routine follow-up.

Outcome measures

Since the KOOS subscale ADL was reported not to be sensitive enough to detect changes in patients with ACL injury [16], we defined the primary outcome as a change from baseline to follow-up assessment in the average score for four other KOOS subscales, covering Pain, Symptoms, Sports and Recreation, and QoL ($KOOS_4$), with scores ranging from 0 (worst) to 100 (best) [15, 16, 19]. Secondary outcomes included results on all five KOOS subscales and analysis of functional recovery and treatment failure.

Functional recovery and treatment failure

Based on the published Swedish reference population, functional recovery (FR) level was defined as the lower threshold for the 95% CI of 18–34-year-old males from a reference population [20], as a KOOS score above: 90 for Pain, 84 for Symptoms, 91 for ADL, 80 for Sports and Recreation, and 81 for QoL. Treatment failure (TF) was defined as the KOOS subscale QoL score < 44 [5].

Clinically significant difference

The minimal perceptible clinical improvement (MPCI) represents the difference on the measurement scale associated with the smallest change in the health status that could be detected by the patient. A level of 10 points or more on a 0–100 scale was established as a cut-off representing a clinically significant difference [21, 22].

Ethics

The study was approved by the local ethics committee (approval no. RNN/190/07/KB). Informed written consent was obtained from all subjects participating in the study.

Statistical analysis

Continuous outcomes are given as mean (standard deviation, SD) values. No prior sample size determination was made due to the observational character of the present study. However, a post hoc power calculation for unequal variances was performed. Statistical power was calculated to be 52% to detect a 10% difference of the primary outcome between groups with statistical significance at α = 0.05. Between-group comparisons of the primary outcome factor were made using general linear model analysis. A confidence interval excluding differences greater than 10 units between groups was interpreted as indicating the absence of a clinically significant difference [17]. We used the Wilcoxon signed ranks test for assessment of comparisons between groups. Binary data in 2 × 2 tables were evaluated by Fisher's exact test. Values of $p < 0.05$ were considered significant. All analyses were performed with SPSS for Windows 15.0 software package (SPSS Inc., Chicago, IL, USA).

Results

General characteristics

The study sample consisted of 54 subjects in group A with a mean age of 28 years (median: 25, range: 15–54 years) and 19 subjects in group B with a mean age of 32 years (median: 27, range 18–62 years). No significant differences in age between groups were observed.

No significant differences between age of men and women were observed (mean 27 (SD 7) vs. mean 31 (SD 11) years in group A and mean 31 (SD 9) vs. mean 37 [17] in group B, p = 0.15 and 0.36 respectively). The mean follow-up time was 1.6 years (range: 1.0–3.0) in group A and 1.8 years (range: 1.1–3.4) in group B. Subject characteristics are given in Table I.

Clinical assessment

All patients from both groups achieved 90° of knee flexion on the first postoperative day and full

extension 2 weeks postoperatively. The full range of motion was gained within 6 weeks postoperatively. No postoperative complications were reported in the study groups.

Patient-relevant outcome

Score changes on a group level. Analysis of the primary outcome factor

The mean $KOOS_4$ score did not change sufficiently in either group to show improvement at follow-up. No differences in mean $KOOS_4$ scores between group A and B were observed either preoperatively or at follow-up (Table II).

Score changes on a group level. Analysis of the subscale score

Mean scores changed at follow-up in group A for the KOOS subscale QoL (Δ = 9 points, p = 0.039). We observed that mean scores in the subscale Sports and Recreation in subjects from group A and in subscales Sports and Recreation and QoL in group B following ACLR were higher than scores before surgery. However, the increase of these scores did not reach the level of significance (Δ = 10 points, p = 0.063, Δ = 13 points, p = 0.21 and Δ = 11 points, p = 0.25 respectively). Mean scores for other KOOS subscales did not change significantly following ACLR in both study groups (Table II).

No differences in mean scores between group A and B were observed either preoperatively or at follow-up.

Individual subjects' changes

We found substantial intra-individual variability when comparing the individual subjects' scores before ACLR and at follow-up. Improvement in $KOOS_4$ was observed in 46% of subjects from group A and 37% of subjects from group B (Table III).

Table I. Subject characteristics

Characteristics	Group A	Group B
N % females	54 (30)	19 (26)
Age, mean (SD) [years]:		
ACLR	28.1 (8.8)	32.3 (11.7)
Follow-up	29.7 (8.7)	34.1 (11.7)
Time to follow-up	1.6 (0.5)	1.8 (0.6)

N – number of subjects, ACLR – anterior cruciate ligament reconstruction

Most subjects improved in the KOOS subscales Sports and Recreation and QoL in both group A (59 and 52% respectively) and B (63 and 47% respectively). The percentage of individuals who improved and deteriorated in other KOOS subscales was similar in both groups (Table III).

Functional recovery and treatment failure

Eight patients (15%) from group A and one patient from group B (5%) fulfilled the criteria of FR following ACLR. The number of subjects who scored over the threshold for functional recovery in separate KOOS subscales was as follows: 28 (52%) for Pain, 27 (50%) for Symptoms, 34 (63%) for ADL, 19 (35%) for Sports and Recreation and 9 (17%) for QoL in group A and 8 (42%) for Pain, 6 (32%) for Symptoms, 11 (58%) for ADL, 3 (16%) for Sports and Recreation and 1 (5%) for QoL in group B.

There were 17 patients (32%) in group A and four subjects in group B (21%) who fulfilled the criteria of TF.

Discussion

We found that the medium-term clinical outcome in patients undergoing anterior cruciate

Table II. $KOOS_4$ and KOOS subscale scores in subjects from group A (anterior cruciate reconstruction (ACLR) alone, *N* = 54 subjects) and B (ACLR and meniscectomy, *N* = 19 subjects) before surgery and at follow-up

KOOS subscales	Preoperatively		At follow-up	
	Group A	Group B	Group A	Group B
$KOOS_4$	65.8 (17.8)	62.3 (18.7)	70.8 (19.5)	70.5 (14.6)
Pain	84.5 (14.8)	81.1 (14.8)	85.5 (15.0)	83.1 (14.5)
Symptoms	79.3 (15.6)	70.7 (18.3)	79.3 (17.4)	78.9 (12.7)
ADL	87.8 (14.7)	88.3 (11.2)	89.1 (15.3)	90.7 (9.8)
Sports/Rec	51.7 (28.7)	52.9 (24.6)	61.7 (31.0)	65.5 (24.4)
QoL	47.8 (22.8)	44.6 (23.2)	56.5 (25.0)*	55.7 (16.6)

*$KOOS_4$ is the change from baseline to follow-up assessment in the average score for four of the five KOOS subscales, covering Pain, Symptoms, Sports and Recreation and QoL. KOOS scores range from 0 to 100, worst to best. Values are presented as means (SD); *p < 0.05, versus subscale's outcome before ACLR.*

Table III. Number of subjects who reported $KOOS_4$ and KOOS score change at follow-up compared with before surgery. Cut-off for clinically significant difference was set at 10 points

KOOS subscales	Group A			Group B		
	N (%)			N (%)		
	Improvement	No change	Deterioration	Improvement	No change	Deterioration
$KOOS_4$	25 (46)	14 (26)	15 (28)	7 (37)	7 (37)	5 (26)
Pain	17 (31)	25 (46)	12 (22)	4 (21)	11 (58)	4 (21)
Symptoms	17 (31)	19 (35)	16 (30)	7 (37)	7 (37)	5 (26)
ADL	13 (24)	32 (59)	9 (17)	3 (16)	13 (68)	3 (16)
Sports/Rec	32 (59)	6 (11)	16 (30)	12 (63)	2 (11)	5 (26)
QoL	28 (52)	10 (19)	16 (30)	9 (47)	5 (26)	5 (26)

$KOOS_4$ is the change from baseline to follow-up assessment in the average score for four of the five KOOS subscales, covering Pain, Symptoms, Sports and Recreation and QoL. Values are presented as N = number of subjects and % of whole group. Cut-off for clinically significant change = 10 points.

ligament reconstruction (ACLR) alone was not superior to the outcome in patients who had both ACLR and concomitant partial meniscectomy. No significant differences were observed either in the primary outcome $KOOS_4$ or in any of the separate KOOS subscales.

The present study was not the first to investigate the results of ACLR in patients undergoing or not undergoing meniscectomy [3, 10, 11, 23], but to our best knowledge it was the first to find no difference between these groups in medium-term assessment.

Lack of differences in clinical outcomes in patients who had ACLR and those who underwent ACLR together with concomitant knee surgery has been reported to date in one study. This investigation was, however, carried out 5 to 9 years after the surgery and assessed subjects not only with meniscus tears but also with collateral ligament reconstructions [8].

Our results are not consistent with the hypothesis that since the meniscus tear and meniscal resection themselves worsen knee stability, the clinical outcome after ACLR and partial meniscectomy should be worse than after ACLR alone, which, in fact, was observed in several investigations [10, 24, 25].

The ACL rupture is often accompanied by meniscus injury. Several authors have reported that meniscus tears, both medial and lateral, are seen in more than 30% of knees in their series [26–28]. Many such patients undergo meniscus surgery only and are assigned to rehabilitation due to knee instability. Others are subjected to either early or delayed ACLR. It has been reported that about 14% of patients undergoing ACLR in Denmark [29] and 20% in Sweden [5] had surgery of the meniscus prior to ACLR. Subjects with knee operations performed before ACLR were excluded from our study.

Since it has been established that both the functional status and quality of life can be better described by patients themselves than by physicians making clinical examinations, in most ACLR studies the assessment with patient-related outcomes (PROs) is used. However, it has been proved that different PROs have different abilities to capture symptoms and disabilities not only experienced by but also important for patients undergoing ACLR [30]. The inconsistency between our and others' results may thus be due to the method of assessment. Most of the investigators who reported better outcome results of ACLR alone than ACLR with concomitant partial meniscectomy carried out their assessments using the International Knee Documentation Subjective Knee Form (IKDC) [10, 24, 25]. In our study we used the KOOS, a PRO measure which has recently been culturally adapted and validated in Polish [18]. Assessment with the KOOS scale was performed in patients undergoing ACLR assessed in the Swedish, Danish and Norwegian registries. One recent study based on the Swedish National Knee Ligament Register reported that meniscus injury at the time of reconstruction surgery was not a predictor for clinical outcome, but it was a predictor for TF [5].

The ACLR is proved to be a successful procedure. Clinical outcomes are, however, far from optimal, with one third of patients experiencing residual knee laxity and over 60% with disturbances in knee function [7]. Our study confirmed such observations. Even though we found that the number of individuals who improved was much higher than that of those who deteriorated following ACLR in the $KOOS_4$ and in the subscales Sports and Recreation and QoL, it was only slightly higher in the KOOS subscales Pain, Symptoms and ADL in both groups. As expected, the surgery has a substantially smaller impact in the treatment of pain and symptoms and barely improves daily

living activities. Our results were comparable to those reported by Barenius *et al.* [5] and Frobell *et al.* [19], who also used the KOOS scale in their studies. Notably, we used restrictive criteria with a cut-off of 10 points to detect clinically important change [21, 22], which may reduce the amount of "changers" as compared to other studies.

The analysis we made at the individual level showed that 15% of the subjects who had no concomitant meniscus surgery fulfilled severe criteria of FR. There were twice as many subjects in whom a TF was observed. The number of individuals with partial meniscal resection who fulfilled the criteria for both FR and TF was relatively low, but no conclusion should be drawn from that due to the small amount of subjects in this group.

Since there were no published reference population data in Poland, we based our analysis on the Swedish reference population [20]. The FR was defined as the lower threshold for the 95% CI of 18–34-year-old males [20], representing the most common age group and gender of subjects undergoing ACLR. The concept was first used by Barenius *et al.* [5], who assessed data from the Swedish National Knee Ligament Register. The percentage of subjects with both FR and TF in our series and the Swedish Register is similar [5, 31].

It has previously been reported that subjects undergoing partial meniscectomy at the time of ACLR were significantly more likely to develop radiographic knee osteoarthritis (OA) than those who had ACLR alone [23]. Subjects assessed in our study, who are at a minimum follow-up of one year, are either still in recovery or have recently restored knee function [32], but they have not yet developed clinical or radiological signs of OA. Continued observation is thus needed to assess the longer-term effects of ACLR, including development and progression of OA.

As compared to data from the Scandinavian registries, there were fewer women in our group. This reflects, however, the smaller number of women participating in sport and, consequently, lower incidence of ACL injury in females in Poland.

A potential strength of our study is that all patients were operated on by the same team and underwent an identical rehabilitation regimen. The weakest point of the present study is the relatively small sample size and only 52% power of the statistical analysis. The other limitation is that we did not measure the activity level of the patients and thus were unable to assess how many of them returned to their pre-injury level of performance. In this study, we carried out a medium-term assessment with the time from surgery to evaluation ranging from one to over 3 years. Since the clinical outcome following ACLR varies over time, the difference in assessment time can produce a bias affecting the final results. The study is, however, ongoing, and we hope it will secure better opportunities for further analyses.

In conclusion, our data suggest that patients undergoing ACLR with partial meniscectomy have a similar medium-term outcome compared to individuals with ACL tear alone. These data should be, however, interpreted with caution due to the small sample size. Nevertheless, even if our findings were confirmed in a larger study sample, we do not think that the current treatment strategy would be questioned. Young active subjects with traumatic meniscal tears are assigned to either meniscopexy or, if suturing is not indicated, meniscectomy, regardless of whether they undergo ACLR.

Acknowledgments

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