Treatment with and without Initial Stabilizing Surgery for Primary Traumatic Patellar Dislocation

A Prospective Randomized Study

By Petri J. Sillanpää, MD, Ville M. Mattila, MD, PhD, Heikki Mäenpää, MD, PhD, Martti Kiuru, MD, PhD, Tuomo Visuri, MD, PhD, and Harri Pihlajamäki, MD, PhD

Investigation performed at Central Military Hospital, Helsinki, Finland

Background: There is no consensus about the management of acute primary traumatic patellar dislocation in young physically active adults. The objective of this study was to compare the clinical outcomes after treatment with and without initial stabilizing surgery for primary traumatic patellar dislocation in young adults.

Methods: Forty young adults, thirty-seven men and three women with a median age of twenty years (range, nineteen to twenty-two years), who had an acute primary traumatic patellar dislocation were randomly allocated to be treated with initial surgical stabilization (eighteen patients, with each receiving one of two types of initial stabilizing procedures) or to be managed with an orthosis (twenty-two patients, including four who had osteochondral fragments removed arthroscopically). After a median of seven years, thirty-eight patients returned for a follow-up examination. Redislocations, subjective symptoms, and functional limitations were evaluated. Radiographs and magnetic resonance images were obtained at the time of randomization, and twenty-nine (76%) patients underwent magnetic resonance imaging at the time of final follow-up.

Results: A hemarthrosis as well as injuries of the medial retinaculum and the medial patellofemoral ligament were found on magnetic resonance imaging in all patients at the time of randomization. During the follow-up period, six of the twenty-one nonoperatively treated patients and none of the seventeen patients treated with surgical stabilization had a redislocation ($p = 0.02$). Four nonoperatively treated patients and two patients treated with surgical stabilization reported painful patellar subluxation. The median Kujala scores were 91 points for the surgically treated patients and 90 points for the nonoperatively treated patients. Thirteen patients in the surgically treated group and fifteen in the nonoperatively treated group regained their former physical activity level. At the time of follow-up, a full-thickness patellofemoral articular cartilage lesion was detected on magnetic resonance imaging in eleven patients; the lesions were considered to be unrelated to the form of treatment.

Conclusions: In a study of young, mostly male adults with primary traumatic patellar dislocation, the rate of redislocation for those treated with surgical stabilization was significantly lower than the rate for those treated without surgical stabilization. However, no clear subjective benefits of initial stabilizing surgery were seen at the time of long-term follow-up.

Level of Evidence: Therapeutic Level I. See Instructions to Authors for a complete description of levels of evidence.

Acute lateral patellar dislocation is a common injury among young adults[1]. More than 100 surgical methods have been described to treat this injury[2]. However, because of a lack of prospective randomized studies, there is no clear evidence regarding which method is superior, or whether any method is superior, to nonoperative care for primary traumatic patellar dislocations. In a recent study of seventy-four patients with a first-time patellar dislocation, the authors

Disclosure: The authors did not receive any outside funding or grants in support of their research for or preparation of this work. Neither they nor a member of their immediate families received payments or other benefits or a commitment or agreement to provide such benefits from a commercial entity. No commercial entity paid or directed, or agreed to pay or direct, any benefits to any research fund, foundation, division, center, clinical practice, or other charitable or nonprofit organization with which the authors, or a member of their immediate families, are affiliated or associated.

characterized the injury as one that typically occurred in active, young individuals[3]. However, to our knowledge, only one prospective randomized study of acute patellar dislocations has been published in the English-language literature[4], and it included a large number of skeletally immature patients and thus may not be applicable to adults.

Primary (first-time) patellar dislocation has been defined as a clinical entity that usually causes a traumatic disruption of the previously uninjured medial peripatellar structures[2,3,5]. Proper treatment is essential in order to minimize sequelae such as recurrent dislocation, painful subluxation, and osteoarthrosis. We are not aware of any previous randomized prospective studies comparing operative and nonoperative treatment of primary traumatic patellar dislocation in adults.

The stabilizing role of the medial patellofemoral ligament has been emphasized recently, with cadaver studies demonstrating that this ligament is responsible for >50% of the lateral restraining force of the patella[6]. The medial patellofemoral ligament extends from the superior-medial border of the patella and attaches firmly to the femur just anterior to the medial epicondyle[7]. Additional medial restraints include the medial retinaculum and the medial patellotibial ligament, both of which play only a minor role[6]. In previous studies, the reported prevalences of injuries of the medial patellofemoral ligament associated with acute patellar dislocation has ranged widely, from 49% to 100%[8-11].

The results of many previous studies[2,4,12] on acute patellar dislocation have been difficult to interpret, either because the study setting included both first-time and recurrent dislocations or because the traumatic dislocation was inadequately defined. Moreover, several studies[2-4] have included patients who ranged widely in age, and the majority of the investigations[2] have had retrospective and nonrandomized designs. Therefore, we designed a prospective randomized study with the primary goal of comparing the outcomes of treatment (the occurrence of redislocation and subjective instability [subluxation]) of primary patellar dislocations treated with and without initial stabilizing surgery in young adults. The second goal was to evaluate the development of articular cartilage lesions within the patellofemoral joint and assess injuries to the medial patellar restraint in association with acute traumatic patellar dislocation in young adults.

Materials and Methods

Patients

Between 1998 and 2000, military recruits who had been admitted to a military hospital because of an acute primary traumatic patellar dislocation were randomized to treatment with surgical stabilization or to nonoperative management. We included patients who had sustained an acute primary traumatic patellar dislocation and then excluded those with a previous traumatic or nontraumatic dislocation of the patella, a previous subluxation of the patella, a preexisting pathological condition of the ipsilateral or contralateral knee, a previous ligamentous injury or fracture of the involved knee, or a large osteochondral lesion of the involved knee that needed open surgery. The study design was approved by the medical ethics committee of the institution. The study was registered in Clinical Trials.gov, with the registry identifier NCT00551668.

Forty-four patients with suspected primary traumatic patellar dislocation were eligible for the study. Four of these patients were subsequently excluded: three were unable or unwilling to participate in the study, and one had missing information regarding previous symptoms of an unclear nature. Written informed consent was obtained from each patient. With use of a sealed-envelope method, forty patients were randomly allocated to two treatment groups: (1) initial patellar stabilization surgery and (2) nonoperative treatment with a knee orthosis (as well as arthroscopic removal of an osteochondral fragment if necessary). The specifics of the technique of surgical reconstruction were not defined or controlled; they were left to the preference of the surgeon. The steps in the patient-selection process are illustrated in Figure 1.

The vast majority of the patients (thirty-seven; 93%) who entered into the trial were male. This was expected since the study population consisted of persons performing military service, which, in Finland, is obligatory for men and voluntary for women (2% of recruits annually are female). The median age at the time of treatment was twenty years (range, nineteen to twenty-two years). All patients included in the study underwent the same initial evaluation with physical examination, knee aspiration, radiographs, and magnetic resonance imaging. There were no significant differences in the patient characteristics between the two treatment groups, as shown in Table I.

The postinjury or postoperative rehabilitation protocols were identical for the two groups. It consisted of guided isometric quadriceps exercises and the use of a knee orthosis with a patellar stabilizer (Patella-Camp; Camp Scandinavia, Helsingborg, Sweden). For the first three weeks, full straight-leg weight-bearing was allowed with a knee range of motion of 0° to 30° permitted. Over the second three weeks, flexion was allowed to progress to 90°. At six weeks, the orthosis was removed, free mobilization was allowed, and a guided muscle-strengthening program was started. The rehabilitation protocol was initiated immediately after randomization in the nonoperatively treated group and at twenty-four to forty-eight hours after the surgical procedure in the group treated with surgical stabilization.

After a median duration of follow-up of seven years (range, six to nine years), thirty-eight of the forty patients returned for a follow-up clinical assessment, which was performed by one orthopaedic surgeon in order to minimize interobserver error. Our main outcome variable was patellar redislocation during the follow-up period, and posttreatment patellar subluxations, contralateral dislocations, and reoperations were recorded as well. We also measured the range of motion of the knee and the girth of the quadriceps femoris muscle (10 cm above the superior pole of the patella), and we calculated the difference between the injured and uninjured sides.

The functional outcome was assessed with use of the scoring system described by Kujala et al.[13], which was designed

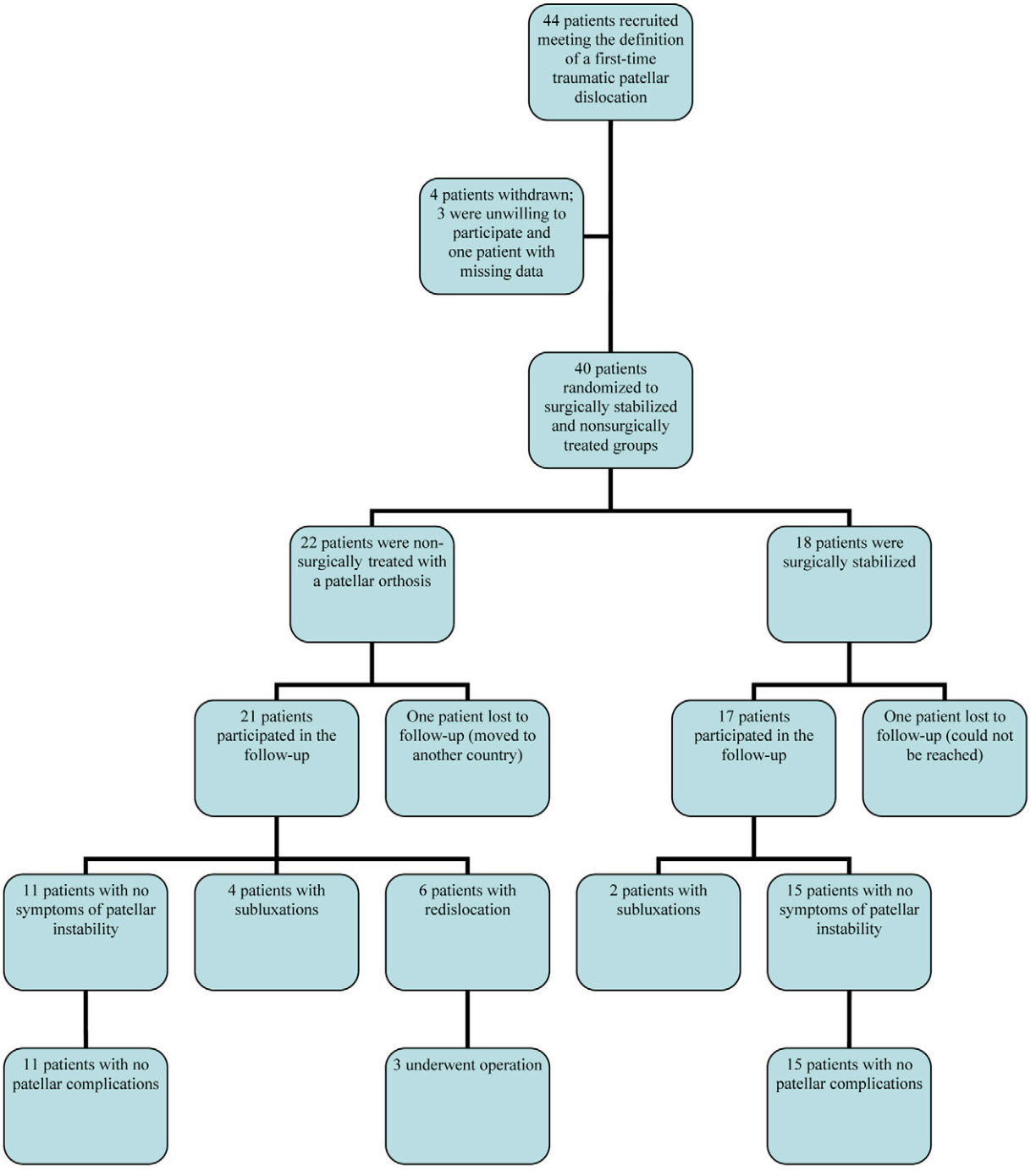

Fig. 1

Flowchart of patient inclusion and outcomes of the surgical stabilization and nonoperative treatment of primary traumatic patellar dislocation.

to evaluate symptoms such as pain, swelling, subluxation, and limitation of functional abilities such as jumping, squatting, or climbing stairs. The physical activity levels were assessed with the scale described by Tegner and Lysholm[14], which ranges from 0 to 10 points, with 0 points denoting severe disability and 10 points indicating an athlete competing at the national or international level. The patients were also asked whether the treatment of the primary patellar dislocation had affected their physical activity level.

At the time of follow-up, radiographic and magnetic resonance imaging examinations were performed, as will be described later. Two patients treated with surgical stabilization

TABLE I Patient Characteristics in the Surgical Stabilization and Nonoperatively Treated Groups

Characteristic	Surgical Stabilization	Nonoperative Treatment
Randomized patients *(no.)*	18	22
Female patients *(no.)*	1 (6%)	2 (9%)
Patients followed *(no.)*	17 (94%)	21 (95%)
Side of injury *(no.)*		
Left	9	8
Right	9	14
Age at time of treatment* *(yr)*	20.0 (19-22)	20.0 (19-21)
Height* *(cm)*	177 (162-194)	183 (168-204)
Weight* *(kg)*	70 (58-95)	74 (60-100)
Age at time of follow-up* *(yr)*	27.0 (26-29)	27.0 (24-30)
Follow-up time* *(yr)*	7.0 (6-8)	7.0 (5-9)
Previous dislocations	0	0
Activity when injury occurred *(no.)*		
Military exercise	10	9
Sports	8	13
Time between injury and magnetic resonance imaging* *(days)*	3 (1-17)	2 (0-11)
Magnetic resonance imaging findings at randomization		
Articular cartilage lesion in patellofemoral joint† *(no.)*		
Patella		
Grade II	8 (44%)	10 (45%)
Grade III or IV	0	0
Femur (any grade)	0	0
Rupture of medial patellofemoral ligament *(no.)*	17 (94%)	22 (100%)
Lateral femoral contusion *(no.)*	18 (100%)	22 (100%)
Patellar contusion *(no.)*	8 (44%)	6 (27%)
Osteochondral fracture *(no.)*	6 (33%)	7 (32%)
Hemarthrosis		
No.	18 (100%)	22 (100%)
mL*	45 (15-110)	72 (20-120)
Grade-I or more severe osteoarthrosis in patellofemoral joint seen on radiographs at randomization‡	0	0

*The values are given as the median with the range in parentheses. †Graded according to the ICRS rating scale[21]. (Superficial Grade-I lesions were excluded because of the possible insensitivity of magnetic resonance imaging for detection of such lesions[22].) ‡Graded according to the Ahlbäck system[20].

and seven treated nonoperatively were unable or unwilling to undergo the follow-up magnetic resonance imaging.

Nonoperative Treatment Group

Twenty-two patients were randomized to receive nonoperative treatment with the knee orthosis. Four of these patients also underwent arthroscopic removal of an osteochondral fragment (as described below). The twenty-two patients were admitted to the hospital at a median of one day (range, zero to seven days) after the injury. The median time between the injury and the initial radiographic and magnetic resonance imaging examinations was two days (range, zero to eleven days). To relieve pain, the knee was first aspirated in all of the patients, and more than one aspiration was performed in those with a massive knee joint effusion. An osteochondral fracture was identified in seven patients; four were considered to have a loose body, which was removed with arthroscopy (with no additional procedures performed) at a median of three days (range, two to four days). In the remaining three patients, the fragment was considered to be extra-articular (located near the patellar attachment site of the medial patellofemoral ligament) and arthroscopic removal was not performed. All twenty-two patients completed the first six weeks of aftercare and then began the physiotherapist-guided muscle-strengthening rehabilitation program.

TABLE II Clinical Results and Findings on Magnetic Resonance Imaging at the Time of Follow-up in the Surgical Stabilization and Nonoperatively Treated Groups

Study Parameter	Surgical Stabilization	Nonoperative Treatment	P Value
Patients followed *(no.)*	17	21	
Redislocations *(no.)*	0 (0%)	6 (29%)	0.02
Painful subluxations *(no.)*	2 (12%)	4 (19%)	0.67
Kujala score* (max. 100 points) (*points*)	91.0 (52-100)	90.0 (59-100)	0.82
Pain score on visual analog scale* (0-100 mm)	20 (0-80)	15 (0-60)	
Knee flexion* *(deg)*			
Affected side	138 (130-140)	140 (130-150)	
Unaffected side	140 (130-140)	140 (130-150)	
Tegner activity level* (1-10 points) (*points*)	5 (2-9)	5 (3-10)	0.65
Quadriceps girth* *(cm)*			
Affected side	41 (36-53)	44 (28-48)	
Unaffected side	42 (36-53)	44 (28-49)	
Patients with follow-up magnetic resonance imaging *(no.)*	15/17 (88%)	14/21 (67%)	
Magnetic resonance imaging findings at time of follow-up *(no.)*			
Patellar chondral lesion†			
Grade II	4/15 (27%)	4/14 (29%)	
Grade III or IV	7/15 (47%)	4/14 (29%)	
Femoral chondral lesion†			
Grade II	1/15 (7%)	0 (0%)	
Grade III or IV	1/15 (7%)	3/14 (21%)	
Subjective results			
Regained same activity level as before dislocation	13/17 (76%)	15/21 (71%)	0.73
Worse activity level than before dislocation	4/17 (24%)	6/21 (29%)	1.00
Reoperation	0 (0%)	3/21 (14%)	0.24
Grade-I or more severe osteoarthrosis in patellofemoral joint seen on follow-up radiographs‡	1/17 (6%)	0 (0%)	0.45

*The values are given as the median with the range in parentheses. †Graded according to the ICRS rating scale[21]. (Superficial Grade-I lesions were excluded because of the possible insensitivity of magnetic resonance imaging for detection of such lesions[22].) ‡Graded according to the Ahlbäck system[20].

Surgical Stabilization Group

Eighteen patients were randomized to the surgical stabilization group. Preoperatively, the knee was aspirated in all of the patients. The median interval from the injury to the hospital admission was two days (range, zero to eleven days), the median interval from the injury to the initial radiographic and magnetic resonance imaging examinations was three days (range, one to seventeen days), and the median interval from the injury to the surgery was seven days (range, four to seventeen days). All operations were performed by two experienced orthopaedic surgeons, and the choice of the surgical procedure depended on the preference of the surgeon. Fourteen patients underwent medial reefing, which was performed with the patient in the supine position and with tourniquet-controlled bloodless-field surgery. A medial incision of 12 to 20 cm was made, the disrupted medial structures were repaired, and both the medial patellofemoral ligament and the superficial retinacular structures were reefed between the medial patellar margin and the femoral insertion of the medial patellofemoral ligament. The sutures were tightened with the knee in 30° of flexion. The closure was performed in layers. Four patients were treated with the Roux-Goldthwait procedure[15], in which the lateral half of the patellar tendon was attached to the medial aspect of the tibia. The Roux-Goldthwait procedure was chosen over the medial repair, despite the absence of dysplastic features of the patellofemoral joint, because of surgeon preference. In six patients with an osteochondral fracture, the fracture fragments were removed through arthroscopy during the procedure. Thus, the treatment of osteochondral fractures was identical in both patient groups. After surgery, the knee was placed in a brace, and the limb was elevated for twenty-four to forty-eight hours. After this period, a

TABLE III Subjective Assessments of Pain and Functional Knee Limitation in the Surgical Stabilization and Nonoperatively Treated Groups

Study Parameter	Surgical Stabilization*	Nonoperative Treatment*
Stairs		
No difficulty	13 (76%)	18 (86%)
Pain going down stairs	2 (12%)	2 (10%)
Always painful	2 (12%)	1 (5%)
Running		
No difficulty	8 (47%)	19 (90%)
0-2 km without pain	7 (41%)	1 (5%)
Pain from the start or severe pain during running	2 (12%)	1 (5%)
Squatting		
Normal	11 (65%)	16 (76%)
Painful when repeated	3 (18%)	5 (24%)
Always painful or unable to squat	3 (18%)	0 (0%)
Pain		
None	4 (24%)	11 (52%)
Slight and occasional	12 (71%)	10 (48%)
Occasionally severe or interferes with sleep	1 (6%)	0 (0%)

*The values are given as the mean number of patients with the percentage in parentheses.

patellar orthosis was applied. The patients then followed the aftercare instructions, as described. All eighteen patients completed the first six weeks of aftercare and then began the physiotherapist-guided muscle strengthening rehabilitation program.

Radiographic Examination

Posteroanterior, lateral, and patellofemoral axial radiographs were made both at the time of randomization and at the end of the follow-up period. Merchant axial[16] radiographic views with the knee in 45° of flexion were used to analyze the medial and lateral facets of the patellofemoral joint. The parameters, measured on the axial views, included the sulcus angle as described by Brattstroem[17], the lateral patellofemoral angle, and lateral patellar displacement as described by Laurin et al.[18]. Patellar height was measured on the lateral radiographs with use of the method described by Blackburne and Peel[19]. The severity of osteoarthrosis within the patellofemoral joint was graded from 0 to V, according to the Ahlbäck classification[20], with Grade 0 representing normal, Grade I representing joint space narrowing, Grade II representing obliteration of the joint space, and Grades III, IV, and V representing more severe joint destruction.

Magnetic Resonance Imaging

Magnetic resonance imaging was performed on all patients when they were admitted for the treatment of a primary traumatic patellar dislocation in order to confirm the diagnosis, assess injuries to the medial structures of the knee, and define the location and severity of any cartilage defects and/or osteochondral fractures within the patellofemoral joint. A follow-up magnetic resonance imaging scan was performed on twenty-nine patients. A 1.0-T scanner (Signa Horizon; GE Healthcare, Milwaukee, Wisconsin) with a knee coil with a field of view of 10 to 16 cm was used. The slice thickness was 3 mm, with a 0.5 or 1.0-mm intersection gap. Sagittal proton-density-weighted spin-echo sequence images with fat suppression (repetition and echo times, 3400 and 17 msec, with two signals averaged, and a 256 × 256 [516] matrix) and sagittal T1-weighted spin-echo sequence images (repetition and echo times, 680 and 11 msec, with two signals averaged, and a 256 × 256 [512] matrix) were obtained. T2-weighted fast-spin-echo sequences with fat suppression were performed to obtain images in the axial plane (repetition and echo times, 2560 and 85 msec, with two signals averaged, and a 256 × 256 [512] matrix) and the coronal plane (repetition and echo times, 4000 to 4600 msec and 72 to 90 msec, with two signals averaged, and a 256 × 256 [512] matrix).

Magnetic resonance images were also evaluated to detect injuries to the medial restraints by assessing possible disruptions of the medial retinaculum and the medial patellofemoral ligament.

Articular cartilage lesions were classified, on the basis of their depth, with the numerical grading system developed by the International Cartilage Repair Society (ICRS) study group[21]. The mildest lesions (Grade I) were excluded because of the insensitivity of magnetic resonance imaging for the detection of such lesions[22]. Thus, only severities of Grade II or higher were recorded. Grade II indicates abnormal cartilage with the lesion extending through <50% of the cartilage depth; Grade III, a cartilage defect extending through >50% of the cartilage depth; and Grade IV, a severe cartilage defect extending to the subchondral bone. Articular cartilage lesions were assessed in four segments within the patellofemoral joint: the medial and lateral patellar facets and the medial and lateral femoral condyles.

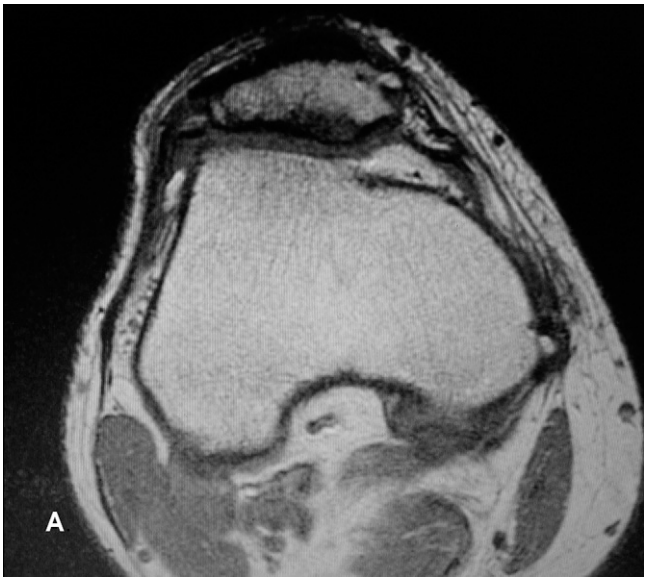

Fig. 2-A

Fig. 2-B

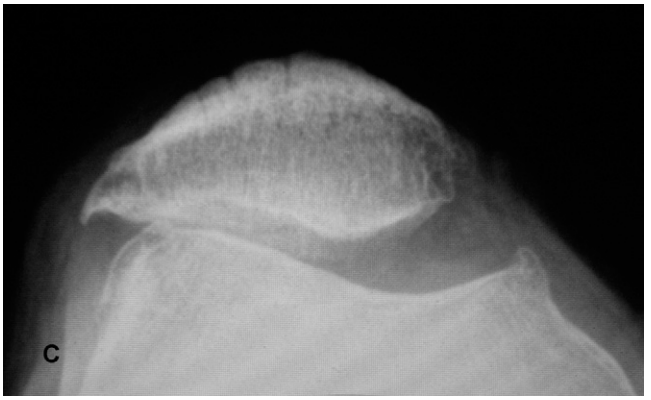

Fig. 2-C

Figs. 2-A, 2-B, and 2-C A twenty-eight-year-old man who sustained a primary traumatic lateral dislocation of the patellofemoral joint. **Fig. 2-A** A transverse gradient-echo image obtained at the level of the patellofemoral joint eight years after the primary dislocation shows osteoarthrotic characteristics at the patellar articular cartilage surface. **Fig. 2-B** A plain Merchant axial radiograph made soon after the dislocation demonstrates an osteochondral fracture, a secondary sign of an injury to the medial patellofemoral ligament, at the patellar attachment. **Fig. 2-C** A plain Merchant axial radiograph made eight years after the injury.

Statistical Methods

The Kruskal-Wallis test was used to evaluate differences in nonparametric ordinal data between the groups, and the independent-samples t test was used to assess differences in the continuous normally distributed data between the groups. Differences in the two-way tables were determined with the Pearson chi-square test or the Fisher exact test when the expected cell count was less than five. Significance was set at $p \leq 0.05$. SPSS 14.1 for Windows software (SPSS, Chicago, Illinois) was used for the statistical analysis.

The sample-size calculation was based on the assumption that the redislocation rate would be 50% in the nonoperatively treated group and 10% in the group treated with surgical stabilization, which would require seventeen patients in each group for a power of 80%, a type-I error (alpha) of 0.05, and an estimated effect size of 1.0. On the basis of the same assumption (50% and 10% rates for the nonoperatively and operatively treated groups, respectively), we concluded that assessing subjective instability (subluxation) and end-point articular cartilage lesions would require seventeen patients in each group to provide the study-power and type-I-error values listed above. We also calculated that the sample-size requirement for assessment of the subjective end-point outcome (the Kujala score) would be sixteen patients per study group to provide those study-power and type-I-error values, with the assumption that the mean Kujala score would be 70 points for the nonoperatively treated group and 85 points for the group treated with surgical stabilization.

Source of Funding

We did not receive any outside funding or grants in support of this investigation.

Results

Clinical and Functional Results

Twenty-one (95%) of the twenty-two patients in the nonoperatively treated group and seventeen (94%) of the eighteen patients treated with surgical stabilization returned for the follow-up evaluation. The median age at the time of follow-up was 27.0 years (range, twenty-four to thirty years) in

TABLE IV Radiographic Findings in the Surgical Stabilization and Nonoperatively Treated Groups

Study Parameter	Surgical Stabilization*	Nonoperative Treatment*	Normal Value
Sulcus angle† *(deg)*	143 (135-148)	141 (135-148)	<150
Lateral patellofemoral angle†	0.0 (−6 to +5)	−0.5 (−6 to 0)	Horizontally or laterally
Lateral patellar displacement† *(mm)*	0.0 (−2 to +8)	+2.0 (−4 to +5)	>0
Blackburne-Peel ratio	0.94 (0.88-1.00)	0.96 (0.85-1.08)	0.54-1.06

*The values are given as the median with the range in parentheses. †Measured on the follow-up radiographs; the initial measurements were highly pathological because of acute knee effusion, etc.

both groups. In the group treated with surgical stabilization, no redislocations were identified within a median follow-up time of 7.0 years (range, six to eight years). Six (29%) of the twenty-one nonoperatively treated patients had had a redislocation within a median follow-up time of 7.0 years (range, five to nine years) ($p = 0.02$). Painful subluxation was noted in two patients in the surgical stabilization group and in four in the nonoperatively treated group ($p = 0.67$), but none of these patients underwent an operation during the follow-up period. Thus, overall, instability (redislocation or subluxation) of the patella was reported in two (12%) of the seventeen patients treated with surgical stabilization and in ten (48%) of the twenty-one patients in the nonoperatively treated group ($p = 0.02$). Three of the six patients with a redislocation in the nonoperatively treated group were operated on during the follow-up period. Clinical findings are shown in Table II. The subjective assessments of pain and functional knee limitations in daily living and sports activities are shown in Table III. The differences between the groups with regard to climbing stairs, running, squatting, and pain were not significant.

The median Kujala score was 91 points (range, 52 to 100 points) in the group treated with surgical stabilization and 90 points (range, 59 to 100 points) in the nonoperatively treated group ($p = 0.82$). The Tegner activity level score was 5 points (range, 2 to 9 points) in the group treated with surgical stabilization and 5 points (range, 3 to 10 points) in the nonoperatively treated group ($p = 0.65$). At the time of the last follow-up, four patients treated with surgical stabilization and six nonoperatively treated patients reported that they had been unable to return to their previous level of physical activity. In a separate analysis of the results in the thirteen patients who underwent acute medial repair (i.e., one of the two types of surgical stabilizing procedures that were performed), we found a median Kujala score of 92 points (range, 68 to 100 points) and a median Tegner activity level of 6 points (range, 3 to 10 points). No redislocations occurred in this subgroup of thirteen patients, and none had painful subluxations.

Results of Radiographic and Magnetic Resonance Imaging Examinations

At the time of the primary traumatic patellar dislocation, none of the patients in either group had patellofemoral osteoarthrosis visible on plain radiographs. Moreover, the two groups were comparable with respect to the measured radiographic parameters (Table IV). The radiographic parameters measured confirmed the presence of only a few factors that have traditionally been considered as predisposing to patellar dislocation[23]—e.g., patella alta or dysplastic features of the femoral groove. One patient in the nonoperatively treated group had a mild patella alta, and lateral patellar displacement was seen in four patients. At the final follow-up examination, the plain radiographs demonstrated patellofemoral osteoarthrosis (Ahlbäck Grade I or more severe osteoarthrosis) in one patient treated with surgical stabilization

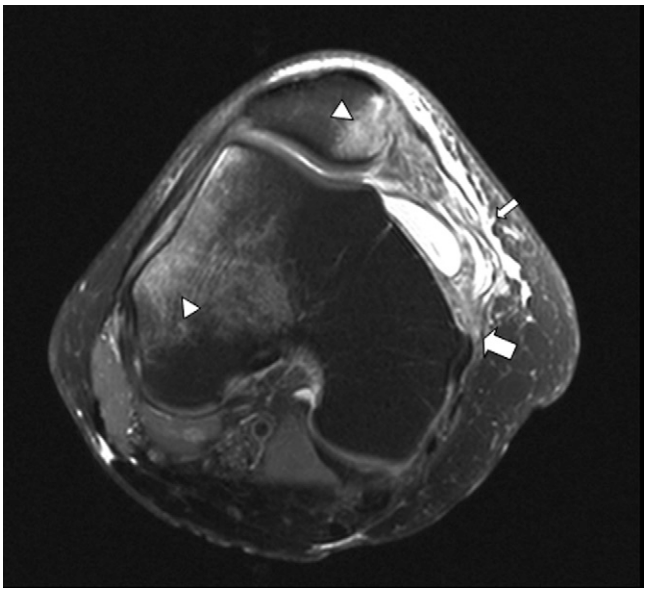

Fig. 3

An axial T2-weighted fast-spin-echo magnetic resonance imaging scan of a twenty-year-old man who sustained a primary traumatic lateral dislocation of the patella while playing soccer. Complete avulsion of the medial patellofemoral ligament from its femoral insertion can be seen (thick arrow). The medial patellofemoral ligament fibers are wavy and show a longitudinal split (thin arrow). Note the bone contusions (arrowheads) of the lateral femoral condyle and the medial patellar facet.

TABLE V Radiographic Findings in Patients with and without Patellar Redislocation at the Time of Final Follow-up

Measure	No Redislocation*	Redislocation*	Normal Value
Sulcus angle† *(deg)*	142 (135-148)	143 (138-148)	<150
Lateral patellofemoral angle†	0.0 (−6 to +5)	−0.0 (−5 to 0)	Horizontally or laterally
Lateral patellar displacement† *(mm)*	0.0 (−4 to +8)	+2.0 (−2 to +5)	>0
Blackburne-Peel ratio	0.94 (0.85-1.06)	0.99 (0.97-1.08)	0.54-1.06

*The values are given as the median with the range in parentheses. †Measured on the follow-up radiographs; the initial measurements were highly pathological because of acute knee effusion, etc.

(Figs. 2-A, 2-B, and 2-C) but in none in the nonoperatively treated group.

On initial magnetic resonance imaging (performed on all patients at the time of admission for treatment of the primary dislocation, and before randomization to the treatment group), the two groups showed a similar pattern of acute traumatic lesions, and, with the numbers studied, no significant differences between the groups were found. The characteristics of the articular cartilage lesions seen within the patellofemoral joint on the initial magnetic resonance images are shown in Table I. An osteochondral fracture in the patellofemoral joint was detected by magnetic resonance imaging in seven (32%) of the twenty-two patients in the nonoperatively treated group and in six (33%) of the eighteen patients in the surgical stabilization group ($p = 0.92$); thus, the overall rate of osteochondral fracture was 33% (thirteen of forty patients). The medial patellofemoral ligament was found to be completely ruptured (Fig. 3) in all patients in the nonoperatively treated group and in seventeen patients in the surgical stabilization group. In one patient in the latter group, the medial patellofemoral ligament was considered to be partially ruptured at its midsubstance.

Twenty-nine (76%) of the thirty-eight patients who returned for long-term follow-up were evaluated with magnetic resonance imaging at that time, and the characteristics of the articular cartilage lesions within the patellofemoral joint in these patients are shown in Table II. Of the fifteen knees treated with surgical stabilization, four had a Grade-II and seven had a Grade-III or IV patellar chondral lesion. Of the fourteen knees in the nonoperatively treated group, four had a Grade-II and four had a Grade-III or IV patellar chondral lesion. One patient treated with surgical stabilization had a Grade-II femoral chondral lesion, and one had a Grade-IV femoral chondral lesion. In the nonoperatively treated group, no patient had a Grade-II femoral chondral lesion and three had a Grade-III or IV femoral chondral lesion. Overall, eleven patients (38%) who were evaluated with magnetic resonance imaging at the time of long-term follow-up had a full-thickness articular cartilage lesion visible on either side of the patellofemoral joint.

We found that severe patellar chondral lesions were more frequent in the patients who had a redislocation than they were in those without a redislocation, but the difference was not significant. Three of the six patients with a redislocation had an initial osteochondral fracture compared with ten (31%) of the thirty-two patients without a redislocation. We found no significant differences in the radiographic parameters measured at the time of follow-up between the patients with and those without redislocation. However, the median Blackburne-Peel ratio was somewhat higher among those with redislocation, suggesting a higher-riding patella. At the time of follow-up, magnetic resonance imaging did not demonstrate an articular cartilage lesion with an ICRS grade of II or more severe within the tibiofemoral joint in either group.

Discussion

To our knowledge, this is the first prospective, randomized, controlled study comparing the outcome of treatment with initial stabilizing surgery with the outcome of nonoperative treatment of primary traumatic patellar dislocation in a young adult population. The principal finding was that initial stabilizing surgery significantly reduced the number of patellar redislocations (from six to none). Within a median follow-up interval of seven years, no significant improvements in clinical scores were found in the group treated with the initial stabilizing surgery. However, the clinical symptoms reported at the end of the follow-up period in the nonoperatively treated group may have been better than expected because stabilizing operations had been performed during the follow-up period.

We found one previous well-designed, randomized, prospective study of acute primary dislocations, by Nikku et al.[4]. This study included mostly women (65%) and also included skeletally immature patients less than eighteen years of age. The authors neither emphasized nor used magnetic resonance imaging to detect a possible traumatic injury to the medial structures. Also, the confounding effect of the number of skeletally immature patients and the large percentage of women on the overall study outcome was discussed as a reason for caution when interpreting the study results because younger age and female preponderance have been associated with higher redislocation rates in some studies[4,12,23]. Whether initial stabilizing surgery for treatment of a primary traumatic patellar dislocation is more preferable for males than for females remains unclear.

The six redislocations that occurred in the nonoperatively treated group might be explained by the inefficient medial restraints because no preponderance of traditional predispos-

ing factors, such as femoral trochlear dysplasia and patella alta, was demonstrated radiographically in the patients who had a redislocation (Table V). Initial stabilizing surgery was associated with a lower redislocation rate but no difference in the Kujala score, which may be partly explained by the three patients in the nonoperatively treated group who underwent subsequent stabilizing surgery. The median Tegner physical activity level was the same in the two groups. Moreover, a considerable proportion of the patients (twenty-nine of thirty-eight) were participating daily in various sporting activities at the time of the seven-year review.

The strength of the present study was the homogeneous patient population consisting of young healthy adults, as this ensured good comparability between the study groups. Our study was limited by the small number of female patients, and, therefore, conclusions concerning treatment of primary traumatic patellar dislocation in females should be drawn with caution. The surgical stabilizing techniques consisted of medial repair and, in a smaller number of patients, the Roux-Goldthwait procedure, so the study results cannot be directly applied to patients treated with other surgical techniques. On the basis of current clinical and research evidence, it seems rational to assume that, if traumatic patellar dislocation has occurred and an injury of the medial patellofemoral ligament is identified, the choice of the procedure would be medial repair or medial patellofemoral ligament reconstruction rather than a distal realignment procedure. Very few dysplastic patellofemoral joint features were found in the patients in this study. When there is a predisposing pathological condition, such as patella alta or an excessive Q-angle, it might be reasonable to use a combination of techniques, such as a distal realignment procedure and a medial repair, in the management of traumatic patellar dislocation.

Four patients in the nonoperatively treated group underwent arthroscopic removal of an osteochondral fragment, but no additional procedures were performed. Since primary traumatic patellar dislocations are frequently associated with osteochondral fractures, we believe that performing arthroscopy initially in some patients may be unavoidable, even in a randomized study. Ten patients (four treated nonoperatively and six treated with surgical stabilization) had removable fragments, and the osteochondral fractures were treated identically (i.e., with arthroscopic removal of the fragments) in the two treatment groups. Candidates for open reduction and initial fixation of a large osteochondral fracture were not included in this study because the procedure itself or the possible failure of the procedure might have affected the final results.

The present study indicated that injuries of the medial patellofemoral ligament and the medial retinaculum as well as hemarthrosis are the definite signs of an acute primary traumatic patellar dislocation. A complete rupture of the medial patellofemoral ligament was detected in all of the patients except one in whom the ligament was partially ruptured. The reported prevalence of injuries to the medial patellofemoral ligament in association with acute patellar dislocation has varied considerably in previous studies[8-11]. Elias et al. reported this prevalence to be 49%, but they did not limit their imaging to primary dislocations[11]. Also, the mean delay between the magnetic resonance imaging and the injury was twenty-one days in their study, compared with two days in our study, and this may have unfavorably affected the efficiency of the imaging for detecting injuries of the medial patellofemoral ligament in their study[11]. Other authors have reported a high prevalence of injuries of the medial patellofemoral ligament (90% to 100%) in association with acute patellar dislocation[8-10].

At the time of follow-up, a full-thickness defect of the patellofemoral articular cartilage was present in eleven patients (38%) in our study, and the prevalence of this finding was unrelated to the form of treatment. This result is in line with the previous finding of Mäenpää and Lehto, who showed, in their series of 100 patients with a primary patellar dislocation, that patellofemoral osteoarthrosis had developed in 35% by thirteen years after the dislocation[24].

In conclusion, following an acute primary traumatic patellar dislocation, good patellar stability can be achieved with initial stabilization surgery and such surgery might be considered for patients with high demands for patellar stability. Since no clear long-term subjective benefits of the initial stabilizing surgery were seen, additional prospective randomized studies are needed to better define the role of initial stabilizing surgery in the management of primary traumatic patellar dislocation. ■

NOTE: The authors thank Mrs. Marja Vajaranta for language editing.

Petri J. Sillanpää, MD
Heikki Mäenpää, MD, PhD
Tampere University Hospital, P.O. Box 2000, 33521 Tampere, Finland.
E-mail address for P.J. Sillanpää: petri.sillanpaa@uta.fi

Ville M. Mattila, MD, PhD
Martti Kiuru, MD, PhD
Tuomo Visuri, MD, PhD
Harri Pihlajamäki, MD, PhD
Centre for Military Medicine, Research Department, P.O. Box 50,
00290 Helsinki, Finland

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