Systematic Review

Medial Patellar Instability: A Systematic Review of the Literature of Outcomes After Surgical Treatment

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Purpose: To perform a systematic review of literature reporting on outcomes after surgical treatment of medial patellar instability. **Methods:** A systematic review was performed according to PRISMA guidelines. Inclusion criteria were as follows: the outcomes and complications of medial patellar instability repair with a follow-up greater than 12 months, English language, and human studies. We excluded cadaveric studies, animal studies, basic science articles, editorial articles, review articles, and surveys. **Results:** Searches identified 1,116 individual titles. After inclusion and exclusion criteria were applied, a total of 8 studies were identified. Three studies exclusively included patients with previous lateral release; 1 included patients with chronic instability; 1 included patients with both previous lateral release and other surgical causes; 1 study had patients with previous lateral release, spontaneous instability, and instability due to injury; 1 study included patients after tibial tubercle transfer surgery; and 1 study did not report the etiology of instability. **Conclusions:** Good to excellent outcomes were reported postoperatively in 85% of the patients after surgical treatment of medial patellar instability. However, clinical outcomes data for medial patellar ligament reconstruction is sparse and highly heterogeneous. There is inconsistency in the literature in regard to the indication, timing, and procedure. **Level of Evidence:** Level IV, systematic review of Level IV studies.

Medial patellar instability is a disabling condition that is often misdiagnosed. In 1988, Hughston and Deese described medial patellar instability as a complication of a lateral retinacular release procedure[1] and reported that patients had increased pain and instability after a lateral retinacular release. Several studies have since reported on patients with medial patellar instability after lateral retinacular release, but traumatic and spontaneous cases have also been reported.[2,3]

Lateral retinacular release was historically a popular procedure for treatment of lateral patellar instability, anterior knee pain, and patellar chondromalacia.[4,5] Several studies reported low complication rates with this procedure,[6] which may explain its widespread use. In case of an aggressive lateral retinacular release, some of the important patellar stabilizers on the lateral side of the knee, such as lateral patellotibial ligament and the lateral epicondylopatellar ligament, can be damaged.[7] This is believed to be an important pathomechanism of iatrogenic medial patellar instability.

Several techniques have been described including direct lateral ligament repair,[8] arthroscopic medial retinacular release,[9] lateral retinacular reconstruction with soft tissue augmentation, lateral patellofemoral ligament reconstruction[10,11] and lateral patellotibial ligament reconstruction.[12,13] Given the paucity of literature on the outcomes and complications after treatment of medial patellar instability, the purpose of this study was to perform a systematic review of literature reporting on outcomes and complications after surgical treatment of medial patellar instability. It was hypothesized that good to excellent outcomes would be observed in most patients after surgery for medial patella instability. Moreover, it was hypothesized that medial patellar surgery would result in good to excellent outcomes in patients who underwent a prior lateral release.

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The authors report the following potential conflicts of interest or sources of funding: R.F.L. reports support to institution from Arthrex, Ossur, Siemens, and Smith & Nephew; consultancy fees from Arthrex, Smith & Nephew, and Ossur; grants to institution from Health East, Norway, and National Institutes of Health R-13 grant for biologics; patents for Ossur and Smith & Nephew; and royalties from Arthrex, Ossur, and Smith & Nephew.

Received November 11, 2016; accepted March 9, 2017.

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0749-8063/161098/$36.00

http://dx.doi.org/10.1016/j.arthro.2017.03.012

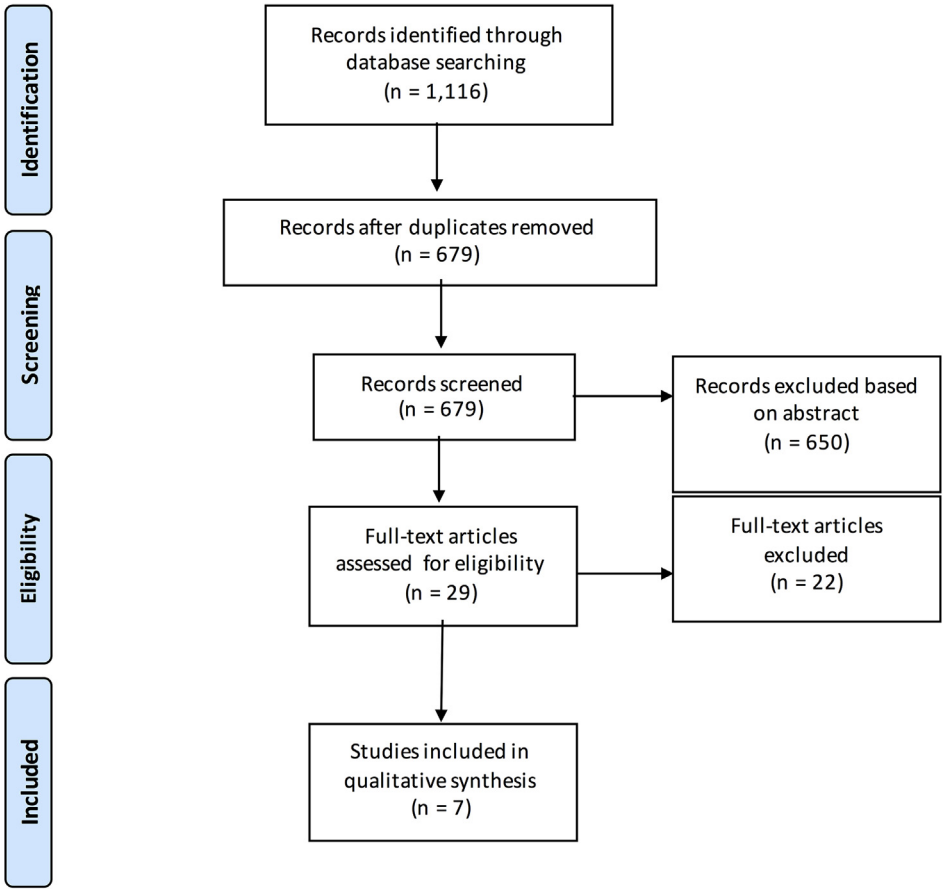

Fig 1. Selection criteria of the studies found with our search. The systematic search performed using the previously mentioned keywords identified 1,116 studies.

Methods

Article Identification and Selection

This study was conducted in accordance with the 2009 Preferred Reporting Items for Systematic Review and Meta-Analysis (PRISMA) statement.[14] A systematic review of the literature regarding the existing evidence for the outcomes and complications of medial patella instability repair was performed using the Cochrane Database of Systematic Reviews, the Cochrane Central Register of Controlled Trials, PubMed (1980-2015), Embase (1947-2015), and MEDLINE (1980-2015). The queries were performed in September 2016. We searched "medial" AND "patellar" AND "instability" AND "reconstruction" in all text fields to perform our search.

The literature search strategy inclusion criteria were as follows: the outcomes and complications of medial patellar instability repair with a mean follow-up greater than 12 months, English language, and human studies. We excluded cadaveric studies, animal studies, basic science articles, editorial articles, review articles, and surveys.

Three investigators (G.M., J.C., M.E.C.)—2 board-certified orthopaedic surgeons and 1 fourth-year medical student—independently reviewed the abstracts from all identified articles. Full-text articles were obtained for review if necessary to allow further assessment of inclusion and exclusion criteria. Additionally, all references from the included studies were reviewed and reconciled to verify that no relevant articles were missing from the systematic review. All studies that met the inclusion criteria were reviewed by the 2 board-certified orthopedic surgeons.

Data Collection

The level of evidence of the studies was assigned according to the classification as specified by Wright et al.[15] The information was collected from the included studies. Patient demographics, follow-up, and clinical outcomes were extracted and recorded. For continuous variables (e.g., age, timing, follow-up, outcome scores), the mean and range were collected if reported. Data were recorded into a custom spreadsheet using a modified information extraction table.[16]

Bias

Studies classified as level of evidence III or IV can potentially be affected by selection and performance bias because of the lack of randomization and

Table 1. Demographic Data for the Included Studies

Author	Number of Patients (Knees)	Mean Age, yr (Range)	Sex Distribution	Mean Follow-up, mo (Range)	Etiology	Surgical Technique
Nonweiler and DeLee, 1994[20]	5 (5)	NR (19-28)	4 F, 1 M	36 (12-84)	Chronic instability	Lateral retinaculum reconstruction
Hughston et al., 1996[12]	63 (65)	29.2 (14-49)	50 F, 15 M	53.7 (24-99)	Previous lateral release: 58 Other surgical causes: 7	Direct repair (60%) Lateral patellotibial ligament reconstruction (40%)
Abhaykumar and Craig, 1999[22]	3 (4)	32.7 (27-39)	3 F	66 (48-84)	Tibial tubercle transfer surgery for correction of recurrent lateral dislocation	Fascia lata sling reconstruction
Teitge and Torga Spak, 2004[10]	60 (60)	NR	NR	NR	NR	Lateral patellofemoral Ligament reconstruction
Shannon and Keene, 2007[9]	7 (9)	25 (15-38)	7 F, 2 M	28 (6-48)	Previous lateral release: 5 Spontaneous: 2 Injury: 2	Arthroscopic medial retinacular release
Heyworth et al., 2012[19]	22 (22)	27.8 (17-58)	17 F, 5 M	3.4 (11-68)	All patients had prior lateral release	Arthroscopic lateral retinacular release
Sanchis-Alfonso et al., 2015[21]	17 (17)	34 (20-42)	13 F, 4 M	56 (48-96)	All patients had prior lateral release	Lateral retinaculum reconstruction
Beckert et al., 2016[18]	17 (19)	29.5 (15.4-54.4)	18 F, 1 M	NR	All patients had prior lateral release	Lateral patellofemoral ligament reconstruction

F, female; M, male; NR, not reported.

prospective comparative control groups (Level IV), especially in populations characterized by heterogeneity of injuries. Selected studies were reviewed to ensure that authors minimized bias while recognizing the constraints present with such studies.

Results

Searches identified 1,116 individual titles and abstracts (Fig 1). After removal of 437 duplicates and 650 studies eliminated based on inclusion and exclusion criteria, 29 articles were available for full-text review. After thorough review of these articles and their references, a total of 8 studies were identified (Fig 1).

Patient Demographics

The 8 studies included a total of 201 knees. The mean age was 28.8 years (range, 14-58 years), and gender distribution was 109 females and 28 males, reported in 5 studies.[9,12,17-19] Six studies reported follow-up intervals, resulting in a mean follow-up duration of 46 months (range, 6-99 months).[9,12,17,19,20] The indications for surgery varied among the 7 studies: 3 exclusively included patients with previous lateral release[17,18]; 1 included patients with chronic instability[20]; 1 included patients with both previous lateral release and other surgical causes[12]; 1 study had patients with previous lateral release, spontaneous instability, and instability due to injury[9]; and 1 study did not report the etiology of instability.[10] Detailed demographic data are displayed in Table 1.

Patient-Reported Outcome Scores

Preoperative and postoperative Lysholm scores were reported in 3 studies; preoperative scores ranged from 33[20] to 36.4,[21] whereas postoperative scores ranged from 86[19] to 90.[20] Four studies[9,12,17,20] reported postoperative Merchant and Mercer scores, with 58 excellent results, 19 good results, 7 fair results, and 6 poor results. Six studies reported an improvement in subjective stability,[9,10,12,18-20] whereas 3 studies reported less frequent instability episodes after surgery.[9,18,20] Five studies reported postoperative improvement in pain,[9,12,17,18,20] with 1 study reporting an improved visual analog scale score from 7.6 to 1.9 postoperatively.[17] Four studies reported limited preoperative function and a significant improvement and full return to activity at final follow-up.[9,12,17,19] Three studies reported patients were satisfied with surgery.[17,19,20] Detailed subjective outcome data for all studies is reported in Table 2.

Surgical Techniques

The surgical techniques performed included reconstruction of the lateral retinaculum,[19-21] direct repair of the lateral retinaculum,[12] lateral patellofemoral ligament reconstruction,[10,18] lateral patellotibial ligament reconstruction,[12] arthroscopic medial retinacular

Table 2. Subjective Outcome Data for the Included Studies

Author, Year	Level of Evidence	Lysholm Score	KOOS Score	Merchant and Mercer Score	Subjective Instability	Episodes of Instability	Pain	Functional Level	Satisfaction	Revisions	Complications
Nonweiler and DeLee, 1994[20]	IV	Pre: 48 (33-65) Post: 75 (45-90)	Pre: NR Post: NR	Excellent: 3 Good: 2	Decreased in all patients	4 without episodes of instability 1 episode of instability 2 NR	Pre: All patients had pain with activity Post: All patients reported significantly reduced pain	Pre: NR Post: All patients reported decreased symptoms with stair climbing	All patients believed surgery to be beneficial	NR	NR
Hughston et al., 1996[12]	IV	Pre: NR Post: NR	Pre: NR Post: NR	Excellent: 41 Good: 11 Fair: 1 Poor: 6	51/65 reported increased stability	NR	Pre: 45 (69%) with disabling pain Post: 50 (77%) moderate, mild or no pain	Pre: 51 knees had significant functional impairment Post: 44/65 reported improvement	NR	6/65 required revision surgery	16/65 knees, including ankylosis (4 knees), fat pad fibrosis (1 knee), painful plica (2 knees), synovitis (1 knee), bursitis (1 knee), synovial fistula (1 knee), suture granuloma (2 knees), stitch abscess (1 knee), postoperative stiffness (1 knee), chronic soft tissue infection (1 knee), and a loose staple (1 knee). A reinjury at 3 weeks required a repeat procedure in 1 knee.
Abhaykumar and Craig, 1999[22]	IV	NR	NR	NR	NR	NR	NR	NR	NR	NR	Anterior knee pain with kneeling and squatting (1 knee)
Teitge and Torga Spak, 2004[10]	IV	Pre: NR Post: NR	Pre: NR Post: NR	NR	Excellent in all patients	NR	Pre: NR Post: NR	Pre: NR Post: NR	NR	NR	2 patients required ORIF of patella fracture after post-op falls
Shannon and Keene, 2007[9]	IV	Pre: NR Post: NR	Pre: NR Post: NR	Excellent: 6 Good: 3	Decreased in all patients	No episodes reported	Pre: All patients had pain with activity Post: 1 patient with pain during squatting	Pre: All patients had decreased activity level Post: Full return to activity in all patients	NR	None	None
Heyworth et al., 2012[19]	IV	Pre: 46.5 (25-90) Post: 86 (48-100)	Pre: NR Post: NR	NR	19/22 (86%) rated good to excellent	NR	NR	All patients reported improved functional status at postoperative status	No patient reported their outcome as poor	None	None

(continued)

Table 2. Continued

Author, Year	Level of Evidence	Lysholm Score	KOOS Score	Merchant and Mercer Score	Subjective Instability	Episodes of Instability	Pain	Functional Level	Satisfaction	Revisions	Complications
Sanchis-Alfonso et al., 2015[21]	IV	Pre: 36.4 Post: 86.1	Pre: NR Post: NR	Excellent: 8 Good: 3 Fair: 6	NR	NR	Pre: VAS = 7.6 Post: VAS = 1.9	Pre: 17/17 had kinesiophobia Post: 9/17 had persistent kinesiophobia	17/17 satisfied with procedure	None	None
Beckert et al., 2016[18]	IV	Pre: NR Post: NR	Pre: 34.4 Post: 69.5	NR	Eliminated in all patients	No episodes reported	Pre: All patients had medial apprehension and pain Post: Improved in all patients	Pre: NR Post: Full range of motion, no patellar maltracking	NR	None	None

KOOS, Knee injury and Osteoarthritis Outcome Score; NR, not reported; ORIF, open reduction and internal fixation; Post, postoperative; Pre, preoperative; VAS, visual analog scale.

release,[9] and fascia lata sling reconstruction.[22] Improved outcomes were reported in all techniques, but a direct comparison of techniques was not possible because of the low numbers.

Complications

Four studies reported no complications and 1 study did not report on complications. One study reported that 9% of the patients required a revision procedure,[12] and 1 study reported postoperative falls in 2 patients (3%) that required open reduction and internal fixation for patella fractures in both patients.[10] Hughston and Deese reported complications in 16 patients (25%) after the initial procedure; 15 of these 16 patients underwent a subsequent surgical procedure.[1] The complications reported by Hughston and Deese included ankylosis (4 knees), painful plica (2 knees), fat pad fibrosis, synovitis, bursitis, synovial fistula, joint stiffness, chronic soft tissue infection, and some minor cases such as loose staple and suture granuloma. Abhaykumar and Craig reported that 1 patient had persistent anterior knee pain with kneeling.[22] Detailed complication and revision surgery data are reported in Table 2.

Discussion

The main finding of this systematic review was that good to excellent outcomes can be achieved after surgical treatment of medial patellar instability; however, some complications and a learning curve of these procedures were reported. Patient satisfaction was reported to be high, with significant improvements in the pain scores and functional stability. Furthermore, high heterogeneity existed among studies regarding the indications for surgery, timing of the procedure, technique, and rehabilitation.

Static and dynamic factors play an important role in patellar stability. Static factors comprise the medial and lateral retinacula, the medial patellofemoral and patellotibial ligaments, the ipsilateral lower limb axis, the depth of the trochlea and the articular shape of the patella. In contrast, contraction of the quadriceps muscle acts as a dynamic stabilizer by placing the patella within the trochlear groove. Disrupting the static and dynamic mechanisms on the lateral side of the knee can cause medial patella drifting into a subluxed position.[18] As the knee passively flexes, the patella re-enters the groove, which can be visualized clinically.[18] In this regard, it has been reported that patients with medial subluxation are severely limited in their activities, unable to work, and experience subluxation and unremitting pain.[12] In our review, most of the patients affected by this pathology were young (mean age, 29 years old) and 4 times more likely to be female.

Several causes of patellar instability ranging from iatrogenic to post-traumatic were described. Notably, 119 patients in the studies reviewed underwent a prior

lateral release to address chronic patellar instability. Lateral retinacular release has historically been employed to treat recurrent patellar subluxation; however, as seen in the present review, it can produce medial patellar instability and worsen the symptomology of instability. It is important to be aware of this complication when treating patients who present with patella instability. In a recent population-based study of 6190 patients, the most common procedure associated with patellar instability insurance claims was prior lateral retinacular release (43.7%).[23] Furthermore, a recent systematic review reported a significantly higher rate of iatrogenic medial patellar instability in patients who underwent lateral release compared with those who did not.[24] These studies, in addition to the findings reported in the present review, highlight the risks associated with and caution required during lateral release.

Besides the fact that all the authors reported significant improvement postoperatively, this systematic review highlighted the inconsistencies in the outcome measures utilized. Lysholm scores were reported in 2 studies,[17,20] Merchant and Mercer scores in 4 studies,[9,12,17,20] subjective stability on 6 studies,[9,10,12,18-20] pain improvement in 5 studies,[9,12,17,18,20] and patient satisfaction in 3 studies.[17,19,20] Concerning complications, revision, and failure rates, 2 studies identified a subset of patients with less than optimal results. Hughston et al.[12] reported that 9% of the patients required a revision procedure related to the index surgery before the sixth week. Teitge and Torga Spak reported postoperative patellar fracture in 3 patients (5%) that required an open reduction and internal fixation for patella fractures in 2 of the patients.[10]

Limitations

We acknowledge limitations to this systematic review. The heterogeneity of techniques described, the low number of studies reporting on this subject, the relatively small sample size of each study (largest series was 60 patients) and the lack of standardization of a postoperative protocol constraints direct comparisons among studies when evaluating subjective/objective outcomes and failure rates. The definition of complications differed among the studies included, making it difficult to evaluate complication rates. It is possible that other relevant articles were not identified by this search strategy. Furthermore, there is potential bias in patient selection and reporting because of the retrospective nature of the studies included.

Conclusions

Good to excellent outcomes were reported postoperatively in 85% of the patients after surgical treatment of medial patellar instability. However, clinical outcomes data for reconstructions to treat medial patellar instability is sparse and highly heterogeneous. There is inconsistency in the literature in regard to the indication, timing, and procedure.

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