NATIONAL INSTITUTE FOR HEALTH AND CARE EXCELLENCE

INTERVENTIONAL PROCEDURES PROGRAMME

Interventional procedure overview of arthroscopic trochleoplasty for patellar instability

Stabilising the kneecap using arthroscopic trochleoplasty

The kneecap (patella) lies in a groove (known as the trochlea) on the lower end of the thigh bone (the femur). If this groove is shallow or uneven the kneecap can slide off during movement of the knee: this is called patellar instability. In arthroscopic trochleoplasty, special instruments are inserted through small cuts in the knee and the trochlear groove is made deeper, to prevent the kneecap sliding off.

Introduction

The National Institute for Health and Care Excellence (NICE) has prepared this overview to help members of the Interventional Procedures Advisory Committee (IPAC) make recommendations about the safety and efficacy of an interventional procedure. It is based on a rapid review of the medical literature and specialist opinion. It should not be regarded as a definitive assessment of the procedure.

Date prepared

This overview was prepared in May 2013 and updated in October 2013.

Procedure name

- Arthroscopic trochleoplasty for patellar instability.

Specialist societies

- British Orthopaedic Association
- British Association for Surgery of the Knee.

Description

Indications and current treatment

Patellar instability occurs when the patella fails to engage securely in the trochlea at the start of flexion; it slips laterally and either dislocates completely or slips back medially to its correct position as flexion continues. In some patients this happens because the trochlear groove is too shallow or uneven (trochlear dysplasia).

Conservative treatment includes physiotherapy and exercises to strengthen the quadriceps. Surgical approaches include direct reconstruction of the dysplastic trochlea or correction of associated factors by procedures such as medial patellofemoral ligament reconstruction. Trochleoplasty aims to reshape the bony anatomy of the trochlea: it may involve deepening the groove or elevating the lateral wall of the trochlea (which should be higher than the medial). Trochleoplasty is usually done as an open procedure, which is associated with risks such as arthrofibrosis and rarely infection.

What the procedure involves

Arthroscopic trochleoplasty aims to deepen the trochlea in the same way as open trochleoplasty but with less soft tissue trauma, which should reduce postoperative pain and allow more rapid recovery.

Arthroscopic trochleoplasty is done with the patient under general or regional anaesthesia. Using an arthroscopic approach, the articular cartilage of the trochlea is raised as a flap. A round burr shaver is then used to deepen the trochlear groove. The articular cartilage is then returned to the deepened groove and fixed in place. The procedure is often done in combination with medial patellofemoral ligament reconstruction.

Outcome measures and clinical assessment

Kujala scale

The Kujala scale was specifically designed for patients with patellofemoral pain. It is a self-administered questionnaire that is used to evaluate pain during stair climbing, squatting, running, jumping, and prolonged sitting with the knees flexed; the presence of a limp, swelling, and subluxation; the amount of quadriceps muscle atrophy and knee flexion range-of-motion deficit; and the need for support when walking. The final score ranges from 0 to 100 with higher scores indicating less severe symptoms.

Tegner activity scale

The Tegner activity scale was designed as a score of activity level to complement other functional scores for patients with ligamentous injuries. It is the most widely used activity scoring system for patients with knee problems.

Scores range from 0 (indicating the highest degree of disability relating to the knee joint) to 10 (indicating ability to participate in competitive sports).

Knee injury and osteoarthritis outcome score

The knee injury and osteoarthritis outcome score questionnaire evaluates the functional status and quality of life of patients with any type of knee injury who are at increased risk of developing osteoarthritis. It consists of 5 subscales: pain, other symptoms, activities of daily living, sport and recreation function, and knee-related quality of life. Standardised answer options are given and each question is assigned a score from 0 to 4. A normalised score (100 indicating no symptoms and 0 indicating extreme symptoms) is calculated for each subscale.

Patellar apprehension test to assess stability of the patella

Pressure is applied to the medial side of the patella while the patient is lying on their back with the knee extended, and the knee is passively flexed to 30°. Any lateral patellar movement or 'apprehension' from the patient is used to assess patellofemoral instability.

Literature review

Rapid review of literature

The medical literature was searched to identify studies and reviews relevant to arthroscopic trochleoplasty for patellar instability. Searches were conducted of the following databases, covering the period from their commencement to 1 May 2013: MEDLINE, PREMEDLINE, EMBASE, Cochrane Library and other databases. Trial registries and the Internet were also searched. No language restriction was applied to the searches (see appendix C for details of search strategy). Relevant published studies identified during consultation or resolution that are published after this date may also be considered for inclusion.

The following selection criteria (table 1) were applied to the abstracts identified by the literature search. Where selection criteria could not be determined from the abstracts the full paper was retrieved.

Table 1 Inclusion criteria for identification of relevant studies

Characteristic	Criteria
Publication type	Clinical studies were included. Emphasis was placed on identifying good quality studies. Abstracts were excluded where no clinical outcomes were reported, or where the paper was a review, editorial, or a laboratory or animal study. Conference abstracts were also excluded because of the difficulty of appraising study methodology, unless they reported specific adverse events that were not available in the published literature.
Patient	Patients with patellar instability.
Intervention/test	Arthroscopic trochleoplasty.
Outcome	Articles were retrieved if the abstract contained information relevant to the safety and/or efficacy.
Language	Non-English-language articles were excluded unless they were thought to add substantively to the English-language evidence base.

List of studies included in the overview

This overview is based on 31 patients from 2 case series[1, 2].

Table 2 Summary of key efficacy and safety findings on arthroscopic trochleoplasty for patellar instability

<table>
<tr><th>Study details</th><th>Key efficacy findings</th><th>Key safety findings</th><th>Comments</th></tr>
<tr>
<td>Blønd L (2013)[1]

Case series
Denmark
Recruitment period: 2008–11

Study population: patients with recurrent patellar dislocation and trochlear dysplasia type B to D

n=31 (37 knees)

Age: median 19 years (range 12–39)
Sex: 21 female, 10 male

Patient selection criteria: 2 or more patellar dislocations with a positive patella apprehension sign above 20° of flexion and trochlear dysplasia grade B or more (according to classification of Tecklenburg et al.)

Technique: All procedures were done using spinal anaesthesia. Each of the procedures was combined with medial patellofemoral ligament reconstruction. Postoperative full weight bearing was allowed immediately after surgery and a knee brace with limited extension of 30° but free flexion was prescribed for 2 weeks. All patients had knee stabilising training for 12 weeks after the procedure, guided by physiotherapists.

Follow-up: median 29 months (range 12–57)

Conflict of interest/source of funding: none.</td>
<td>Number of patients analysed: 29 knees

At follow-up, all knees had regained the preoperative range of movements, and the patella apprehension sign was not found.

There were no redislocations.

Median Kujala score at follow-up (higher scores indicate less severe symptoms):
• Preoperative=64 (range 12–90)
• Postoperative=95 (range 47–100)

Median Tegner score at follow-up (scores range from 0 to 10 with higher scores indicating higher activity levels):
• Preoperative=4 (range 1–6)
• Postoperative=6 (range 4–9)

Median knee injury and osteoarthritis outcome scores at follow-up (range)
<table>
<tr><td></td><td>Pre-operative</td><td>Post-operative</td><td>p value</td></tr>
<tr><td>Pain</td><td>86 (42–97)</td><td>94 (53–100)</td><td><0.001</td></tr>
<tr><td>Symptoms</td><td>82 (32–100)</td><td>86 (57–100)</td><td><0.001</td></tr>
<tr><td>Activities of daily living</td><td>91 (31–99)</td><td>99 (69–100)</td><td><0.001</td></tr>
<tr><td>Sports</td><td>40 (0–95)</td><td>85 (20–100)</td><td><0.001</td></tr>
<tr><td>Quality of life</td><td>25 (0–69)</td><td>75 (25–100)</td><td><0.001</td></tr>
</table>
Patient satisfaction
Patients were satisfied with the outcome of the operation for 93% (27/29) of knees.
Further surgery=17% (5/29)
2 patients developed symptomatic subluxations 28 months after the procedure (both were treated by medialisation of the tibial tubercle). 3 patients had pronounced postoperative anterior knee pain at flexion and had tightness of the lateral retinaculum, indicating lateral hyper-pressure syndromes; all were subsequently treated by lateral releases.</td>
<td>‘No infections, cartilage flake breakage or necrosis were recorded.’</td>
<td>Includes the same patients reported in a previous paper by the same author (ref. 2)

Study design issues:
• Prospective study with consecutive patients.
• Results were obtained for 78% (29/37) of knees. Losses to follow-up were not described.
• All patients treated by 1 surgeon.
• No validated score for patellofemoral instability was used.
• Two observers (not independent), both specialists in orthopaedic surgery with a special interest in the patellofemoral joint, evaluated all patients before and after the procedure.

Study population issues:
• 16 knees had previously undergone stabilising procedures without success.

Other issues
• The authors suggest that medial patellofemoral ligament reconstruction may be used alone to treat patella instability but addition of trochleoplasty may reduce cartilage wear and subsequent pain.</td>
</tr>
</table>

Study details	Key efficacy findings	Key safety findings	Comments
Blønd L (2010)[2] **Case series** Denmark Recruitment period: 2008 onwards Study population: patients with 2 or more patellar dislocations and trochlear dysplasia **n=8 (9 knees)** Age: mean 20 years (range 13–34) Sex: 6 female, 2 male Patient selection criteria: 2 or more patellar dislocations with a persistent apprehension sign from 0° to 30° of flexion and trochlear dysplasia grade B or more as defined by Dejour et al. and regraded by Tecklenburg et al. Exclusion criterion was a cartilage defect in the trochlea International Cartilage Repair Society (ICRS) grade 3 or 4 with a diameter of 5 mm or more. Technique: all patients had patellar-stabilising training for at least 3 months before and after the procedure. All procedures were done using spinal anaesthesia. Each of the procedures was combined with either reinsertion of the native ligament using suture anchors or reconstruction. Postoperative full weight bearing was allowed immediately after surgery and a knee immobiliser was used for 2 weeks. **Follow-up: 3 months** Conflict of interest/source of funding: none.	Number of patients analysed: **8** All patients left the hospital the morning after surgery. Postoperative pain was described as mild and could be controlled by regular analgesics. All patients achieved full weight bearing from the first postoperative day and reached the preoperative range of motion when the knee immobiliser was removed. At 3-month follow-up, the apprehension sign was negative in all patients. 2 patients had a re-arthroscopy: 1 was done as a second look arthroplasty simultaneous with an arthroscopic trochleoplasty of the other knee, and the other patient had resection of a ruptured patellotibial ligament. In both knees, macroscopic normal cartilage was found. An MRI scan of a knee at 3-month follow-up demonstrated a new trochlea with good congruence of the patella and the trochlea bump had disappeared.	Complications: • Suspected infection from the superolateral portal, n=1 (treated with oral antibiotics)	**The same patients are included in the more recent paper by the same author (ref. 1)** **Study design issues**: • Consecutive patients. • The main text of the paper describes 8 knees in 7 patients but the table presents data for 9 knees in 8 patients. **Study population issues**: • 3 patients previously had an imbrication of the medial soft tissue structures and a lateral release, and 1 patient was operated twice with an Elmslie-Trillat procedure first, followed by a medial patellofemoral reconstruction due to instability. **Other issues**: • The authors note that this is a technically difficult procedure with potential dangers and a long learning curve.

Efficacy

Knee scores

A case series of 31 patients reported outcomes for 29 knees with a median follow-up of 29 months. The median Kujala score (scores range from 0 to 100 with higher scores indicating less severe symptoms) improved from 64 before the procedure to 95 at follow-up. The median Tegner score (scores range from 0 to 10 with higher scores indicating higher activity levels) improved from 4 before the procedure to 6 at follow-up. The median knee injury and osteoarthritis outcome scores for pain, symptoms, activities of daily living, sports, and quality of life improved from 86, 82, 91, 40 and 25 before the procedure to 94, 86, 99, 85 and 75 respectively at follow-up (all p values <0.001)[1].

Patient satisfaction

The case series of 31 patients reported that patients were satisfied with the outcome of the operation for 93% (27/29) of knees[1].

Reoperation rate

The case series of 31 patients reported that 17% (5/29) of knees needed further surgery. Two patients developed symptomatic subluxations 28 months after the procedure and were both treated by medialisation of the tibial tubercle.
Three patients had pronounced postoperative anterior knee pain at flexion and had tightness of the lateral retinaculum, indicating lateral hyper-pressure syndromes; all were subsequently treated by lateral releases[1].

Dislocations

The case series of 31 patients reported that there were no redislocations over a median follow-up of 29 months[1].

Safety

No infections, cartilage flake breakage or necrosis were reported in the case series of 31 patients[1].

Suspected infection from the superolateral portal was reported, within 3 months of arthroscopic trochleoplasty, in 1 patient in a case series of 8 patients. This was resolved with oral antibiotic treatment[2].

Validity and generalisability of the studies

- There was only 1 small case series identified with a mean follow-up of 29 months[1]. A proportion of the patients included in this case series were also included in an earlier publication[2].

- The case series included patients treated with a combination of arthroscopic deepening trochleoplasty and reconstruction of the medial patellofemoral ligament[1].

Existing assessments of this procedure

There were no published assessments from other organisations identified at the time of the literature search.

Related NICE guidance

There is currently no NICE guidance related to this procedure.

Specialist advisers' opinions

Specialist advice was sought from consultants who have been nominated or ratified by their specialist society or royal college. The advice received is their individual opinion and does not represent the view of the society.

Sanjeev Anand, Caroline Hing (British Orthopaedic Association).

- Neither of the specialist advisers have performed the procedure.
- One specialist adviser considers the procedure to be definitely novel and of uncertain safety and efficacy.
- Key efficacy outcomes include improved pain and function scores (such as Kujala scores and International Knee Documentation Committee scores), recurrence instability rates, and radiological outcomes such as patellar tilt and sulcus angle.
- Theoretical adverse events include pain, stiffness, infection, persistent instability, chondrolysis, avascular necrosis, non-union, the inability to correctly visualise the amount of correction needed, and the inability to securely fix down the flaps to the deepened groove.
- One specialist adviser noted that prior experience of dealing with the theoretical adverse events mentioned above and good arthroscopic skills are necessary.
- One specialist adviser considered the procedure to have a potential minor impact on the NHS, in terms of patients and use of resources; one specialist adviser considered the potential impact to be moderate.

Patient Commentators' opinions

NICE's Patient and Public Involvement Programme was unable to gather patient commentary for this procedure.

Issues for consideration by IPAC

None other than those described above.

References

1. Blønd L, Haugegaard M. (2013) Combined arthroscopic deepening trochleoplasty and reconstruction of the medial patellofemoral ligament for patients with recurrent patella dislocation and trochlear dysplasia. Knee surgery, sports traumatology, arthroscopy Feb 1 [epub ahead of print]

2. Blønd L, Schöttle PB. (2010) The arthroscopic deepening trochleoplasty. Knee surgery, sports traumatology, arthroscopy 18: 480–5

Appendix A: Additional papers on arthroscopic trochleoplasty for patellar instability

There were no additional papers identified.

Appendix B: Related NICE guidance for arthroscopic trochleoplasty for patellar instability

There is currently no NICE guidance related to this procedure.

Appendix C: Literature search for arthroscopic trochleoplasty for patellar instability

Databases	Date searched	Version/files	No. retrieved
Cochrane Database of Systematic Reviews – CDSR (Cochrane Library)	22/10/2013	Issue 10 of 12, October 2013	10
Database of Abstracts of Reviews of Effects – DARE (Cochrane Library)	22/10/2013	Issue 10 of 12, October 2013	13
HTA database (Cochrane Library)	22/10/2013	Issue 10 of 12, October 2013	2
Cochrane Central Database of Controlled Trials – CENTRAL (Cochrane Library)	22/10/2013	Issue 10 of 12, October 2013	90
MEDLINE (Ovid)	22/10/2013	1946 to October Week 1 2013	16
MEDLINE In-Process (Ovid)	22/10/2013	October 22, 2013	8
EMBASE (Ovid)	22/10/2013	1974 to week 42	37
CINAHL (NLH Search 2.0)	22/10/2013	1981-present	30
PubMed	23/10/2013	-	22
JournalTOCS	23/10/2013	-	0

Trial sources searched on 30/04/2013

- Current Controlled Trials *meta*Register of Controlled Trials – *m*RCT
- Clinicaltrials.gov
- National Institute for Health Research Clinical Research Network Coordinating Centre (NIHR CRN CC) Portfolio Database

Websites searched 30/04/2013

- National Institute for Health and Care Excellence (NICE)
- Food and Drug Administration (FDA) - MAUDE database
- French Health Authority (FHA)
- Australian Safety and Efficacy Register of New Interventional Procedures – Surgical (ASERNIP – S)
- Australia and New Zealand Horizon Scanning Network (ANZHSN)
- Conference search
- Evidence Updates (NICE Evidence Services)
- General internet search

The following search strategy was used to identify papers in MEDLINE. A similar strategy was used to identify papers in other databases.

1	*Arthroscopy/
2	(Arthroscop* adj3 surg*).tw.
3	Trochleoplast*.tw.
4	Surgical Procedures, Minimally Invasive/
5	(minimal* adj3 invasive* adj3 surg*).tw.
6	(key* adj3 hole* adj3 surg*).tw.
7	or/1-6
8	Patella/
9	Patellofemoral Joint/
10	or/8-9
11	(Dislocat* or instabilit* or unstable*).tw.
12	10 and 11
13	Patellar Dislocation/
14	Knee Dislocation/
15	((patell* or knee* or trochlea*) adj3 (dislocat* or dysplasi* or instabilit* or unstable*)).tw.
16	Patellofemoral*.tw.
17	or/12-16
18	7 and 17
19	Arthrex PushLock.tw.
20	Vicryl tape.tw.
21	or/18-20
22	Animals/ not Humans/
23	21 not 22