NATIONAL INSTITUTE FOR HEALTH AND CLINICAL EXCELLENCE

INTERVENTIONAL PROCEDURES PROGRAMME

Interventional procedure overview of open femoro-acetabular surgery for hip impingement syndrome

Hip impingement may restrict movement of the hip joint and can be painful. It may be caused by an unusual shape of the hip socket or of the head of the thigh bone. Hip preservation surgery removes parts of cartilage or bone, with the aim of reshaping the hip joint.

Introduction

This overview has been prepared to assist members of the Interventional Procedures Advisory Committee (IPAC) in making 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 June 2006.

Procedure name

- Hip preservation surgery for impingement syndrome
- Periacetabular osteoplasty

Specialty societies

- British Hip Society

Description

Indications

Hip impingement or femoro-acetabular impingement occurs from a combination of abnormalities of the femoral head and/or acetabulum. It may be the cause of osteoarthritis previously considered to be idiopathic. Impingement can be caused by jamming of an abnormal femoral head into the

acetabulum during forceful motion (especially flexion), or as the result of contact between the acetabular rim and the femoral head–neck junction[1].

Symptoms may include restriction of movement, “clicking” of the hip joint, and pain. Symptoms may occur or be exacerbated during hip flexion activities resulting from sporting activity, or after prolonged sitting.

Current treatment and alternatives

Appropriate treatment may begin with a trial of conservative treatment, including activity modification to reduce excessive motion and burden on the hip. Non-steroidal anti-inflammatory drugs may be useful in patients with acute onset, however they may also mask ongoing pathological processes leading to further degenerative changes and more pain. In patients with advanced osteoarthritic degeneration, a total hip replacement may be required.

What the procedure involves

Preservation surgery for femoro-acetabular impingement focuses on improving the range of movement of the hip joint and alleviation of femoral abutment against the acetabular rim. This is achieved by dislocating the hip to expose the femoral head and acetabulum, using a method to preserve the blood supply to the femoral head. The site of impingement is identified and the labrum and acetabular cartilage are assessed for lesions. Surgical treatment involves removing any non-spherical sections of the femoral head or prominent sections of the anterior femoral neck. If there is an excessive acetabular rim on the acetabular side, this can be treated by resection osteoplasty, or in cases of a retroverted acetabulum, by a peri-acetabular osteotomy. After the femoral and acetabular osteoplasty are completed the hip is allowed to re-locate and the range of motion and any residual impingement are evaluated.

Efficacy

In a series of 213 cases with a follow-up of a minimum of 2 years, most patients had an improved range of movement of the hip and reported reduced pain[2].

In a second series, preservation surgery produced a good or excellent result in 90% (26/29) of hips[3].

In a third case series, 65% (15/23) of cases had functioning hips without subsequent surgery at 5.2 years’ follow-up[4].

One non-randomised controlled trial reported that there was a significant improvement in overall clinical outcome at 2 years following preservation surgery including labral resection (baseline score 12 points, 2 year score 15 points $p<0.0009$), and also an improvement following preservation surgery with refixation of the labrum after rim resection (baseline score 12 points, 2

year score 17 points p<0.0001). The patients treated with refixation had a significantly better overall clinical outcome at 2 years (p<0.01) [5].

A case series of 22 patients found a significant improvement in functional outcomes at 30 months' follow-up. The anterior centre-edge angle was reduced from 36° at baseline to 28° (p = 0.002) and the Merle d'Aubigne score improved from 14 points to 17 points (p < 0.006)[3]

Safety

Few of the studies that were identified reported in any detail on the safety of the procedure.

One non randomised controlled study of 52 patients (60 hips) treated with preservation surgery reported no surgical complications[5]. In a case series of 23 cases with over 5 years of follow-up, no incidents of osteonecrosis were reported[4].

Similarly, in a series of 213 cases there were no reported events of avascular necrosis and postoperative infection. However, heterotopic ossification was seen in 37% (79/213) of hips at 1 year of follow-up
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Literature review

Rapid review of literature

The medical literature was searched to identify studies and reviews relevant to hip preservation surgery. Searches were conducted via the following databases, covering the period from their commencement to 09-06-09: 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.)

The following selection criteria (Table 1) were applied to the abstracts identified by the literature search. Where these 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, laboratory or animal study. Conference abstracts were also excluded because of the difficulty of appraising methodology.
Patient	Patients with hip impingement syndrome.
Intervention/test	Hip preservation surgery (excluding that via an arthroscopic approach).
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 four case series[2-3,6], and one non randomised controlled trial comparing two hip preservation surgery techniques[5].

Other studies that were considered to be relevant to the procedure but were not included in the main extraction table (Table 2) have been listed in Appendix A.

Existing reviews on this procedure

There were no published reviews identified at the time of the literature search.

Related NICE guidance

Below is a list of NICE guidance related to this procedure. Appendix B details the recommendations made in each piece of guidance listed below.

Interventional procedures

- None applicable

Technology appraisals

- None applicable

Clinical guidelines

- None applicable

Public health

- None applicable

Table 2 Summary of key efficacy and safety findings on open femoro-acetabular surgery for impingement syndrome

Abbreviations used: MRI, magnetic resonance imaging			
Study details	**Key efficacy findings**	**Key safety findings**	**Comments**
Ganz R, (2001)[2] **Case series** Switzerland **n = 213 cases (hips)** Study period: From 1992 to 1999 Population: mean age = 33.5 years (range 16–58 years) Indications: anterior impingement resulting from anterior hypertrophy, idiopathic non-spherical femoral head or an insufficiently narrowed head neck junction in 77% of cases (164/213) Technique: Bernese approach used. Treatment consisted mainly of joint debridement and improvement of the anterior. 24 patients underwent simultaneous intertrochanteric osteotomy (inconsistently reported in study text) Standard rehabilitation programme introduced at 8 weeks after surgery **Follow-up =2 years minimum, 30 hips to 3+ years, maximum 7 years** Disclosure of interest: not stated	**Procedure dynamics** Mean operation time from incision to hip dislocation ranged from 25 to 40 minutes. Mean length of stay following surgery was 5 days (range 3–9 days) Mean blood loss 300ml **Functional outcomes** In hips treated without intertrochanteric osteotomy, abductor force usually reached M4 and in most cases was M5 at 4–6 weeks after self-training for abductor muscles. **Clinical outcomes** Most patients had improved motion of the hip, reported reduced pain, and no increased pain or stiffness was related to the intervention.	**Adverse outcomes** There was no clinical or radiological evidence of avascular necrosis , and no postoperative infections. **Operative complications** Partial neurapraxia was found in 1% (2/213) of cases. Both cases resolved within 6 months. Heterotopic ossification was seen in 37% (79/213) of hips at 1 year of follow-up 3% (7/213) of cases demonstrated ‘saddleback deformity’ of the subcutaneous fat due to insufficiency of sutures at the incision site.	No attempt to quantitatively analyse postoperative pain or hip movement, as these may be affected by the underlying disease and therapeutic approach employed. No details of method of case recruitment. Prospective follow-up. No baseline characteristics given. A mixed selection of cases with different underlying disease. No details of outcome evaluation by third parties.

Abbreviations used: MRI, magnetic resonance imaging

Study details	Key efficacy findings	Key safety findings	Comments
Siebenrock K A (2003)[3] **Case series** Switzerland **n = 22 (29 hips)** Study period: April 1997 to August 1999 Population: Age = 29 years, male = 66% (by hip), previous NSAID use = 59%, duration of symptoms = 17 months. Indications: Patients with femoro-acetabular impingement based on clinical symptoms, positive anterior impingement test and MRI findings of acetabular rim lesions Technique: Bernese approach. All hips underwent peri-acetabular osteotomy. Selected cases had arthrotomy to improve low femoral head–neck offset. **Follow-up = 30 months** Disclosure of interest: No commercial funding	**Functional outcomes** Baseline / 30 months / p Anterior centre-edge angle: 36° (26–52°) / 28° (16–46°) / 0.002 Merle d'Aubigne score: 14 points (12–16) / 16.9 points (15–18) / < 0.006 There was an increase in average range of internal motion from baseline of 10° (p = 0.006), an increase in flexion of 7° (p = 0.014) and adduction of 8° (p = 0.017). **Clinical outcomes** The surgery resulted in a good or excellent status in 90% (26/29) of hips.	**Complications** Subsequent surgery was required in 12% (3/26) of hips, one procedure each for postoperative loss of reduction, correction of posteroinferior impingement, and recurrent anterior impingement.	Likely to be the same cases as in Ganz (2004) No details provided of independent outcome assessment. Prospective study. No details provided of method of case accrual.

Abbreviations used: MRI, magnetic resonance imaging

Study details	Key efficacy findings	Key safety findings	Comments
Murphy S (2004)[4] **Case series** USA **n = 23** Study period: not stated Population: Age = 35 years, male = 57%. Indications: Patients with femoro-acetabular impingement based on clinical examination and on radiographic assessment. 10 had cam impingement, 1 isolated pincer impingement, and 12 cases had combined pathomorphology. Technique: Hip exposure by direct lateral exposure in 14 cases, Bernese approach in 6, iliofemoral exposure in 2, and combined iliofemoral and direct approach in 1. Aspherical and osteophytic peripheral portions of the femoral head were debrided. Where necessary acetabular sources of impingement were also debrided. In seven hips concomitant osteotomy was performed. **Follow-up = 5.2 years** Disclosure of interest: not stated	**Functional outcomes** 65% (15/23) of patients continued to function well without further surgery. One patient had arthroscopy for recurrent torn acetabular labrum, and seven cases converted to total hip arthroplasty. **Clinical assessment** The Merle d'Aubigne score was 13.2 (±1.5) points at baseline for the whole series of patients. In the 15 hips with successful outcome the scores improved significantly to 19.9 (±1.35) at the last follow-up ($p < 0.0001$)	There were no cases of osteonecrosis or trochanteric non-union.	Case selection method not defined. A very heterogeneous cohort included. A variety of approaches to access the hip were utilised and the degree of debridement was determined on a case-by-case basis. The only clinical outcome was analysed for successful cases only, rather than intention to treat. Grade of osteoarthritis at baseline is not reported.

Abbreviations used: MRI, magnetic resonance imaging			
Study details	**Key efficacy findings**	**Key safety findings**	**Comments**
Myers S R (1999)[6] **Case reports** Switzerland **n = 4** Study period: not stated Population: Patient with hip impingement following failed periacetabular osteotomy with progressive pain. Age = 33, 26, 18, 30 years, all patients were women Indications: Not stated Technique: Bernese approach **Follow-up = up to 3 months** Disclosure of interest: not stated	**Patient 1** Creation of an improved and deeper femoral head–neck offset by resection osteoplasty of the femoral neck relieved pain 'dramatically' and improved range of movement. **Patient 2** An improved offset was created on the anterior part of the neck, with immediate improvement of flexion. Pain had decreased at follow-up visits (length of follow-up not reported) **Patient 3** An improved offset was created on the anterior part of the neck of the femur with improvement in flexion and a decrease in pain. **Patient 4** The head and neck offset was improved with amelioration of range of movement, pain improved 'dramatically' at 3 months postoperatively	Not reported	Case recruitment not defined. No baseline–outcome comparisons made. No details of outcome assessment by a third party. A specific patient cohort of cases previously treated with osteotomy.

Abbreviations used: MRI, magnetic resonance imaging

Study details	Key efficacy findings	Key safety findings	Comments
Espinosa N (2006)[5] **Non-randomised controlled study** Switzerland **n = 52 (60 hips) (n=32 (35 hips) with labral refixation)** Study period: June 1999 to July 2002 Population: male =63%, mean age = 30 years. Indications: Patients with femoro-acetabular impingement, with persistent pain, mechanical symptoms, and radiographically confirmed structural abnormalities, with pre- and post-operative clinical and radiographic data available. Exclusions, open growth plates, age>40 years, previous hip surgery, professional athletes. All patients had not responded to conservative treatment. Technique: Bernese approach, both groups had standard surgical preservation surgery. Group 1 had labral resection and resection of the overgrown portion of the acetabular rim, group 2 had refixation of the acetabular labrum after rim resection. **Follow-up = 2 years.** Conflict of Interest.	**Clinical outcomes** Clinical outcome assessed using the Merle d'Abigné scale a 0 to 18 point score based on pain range of motion and walking ability (high scores better) Group 1 Outcome: baseline / 1-year / p= / 2-years / p= Overall: 12 (8 to 13) / 14 (14 to 18) / 0.0003 / 15 (10 to 18) / 0.0009 Pain: 1.4 (0 to 2) / 3.4 (0 to 6) / 0.005 / 4.0 (0 to 6) / <0.001 (range) Group 2 Outcome: baseline / 1-year / p= / 2-years / p= Overall: 12 (5 to 16) / 17 (14 to 18) / <0.001 / 17 (13 to 18) / <0.001 Pain: 1.5 (0 to 2) / 5.5 (1 to 6) / <0.001 / 5.6 (4 to 6) / <0.001 Patients treated with refixation of the labrum had significantly better overall clinical outcome than those having resection at 1 and 2 years (p<0.0001 and p=0.01 respectively) **Grade** / **Group 1** / **Group 2** Excellent: 28% (7/25) / 80%(28/35) Good: 48% (12/25) / 14% (5/35) Moderate: 20% (5/25) / 6% (2/35) Poor: 4% (1/25) / 0% Analysis based on hips not patient numbers; 2 years follow up scores shown. **Radiological outcomes** Outcomes measured using the Tönnis grade (high scores worse) mean scores. Group 1 Outcome: baseline / 1-year / p= / 2-years / p= Overall: 0.6 / 1.2 / 0.002 / 1.3 / 0.01 Group 2 Outcome: baseline / 1-year / p= / 2-years / p= Overall: 0.5 / 0.5 / N/S / 0.8 / 0.0027 All patients reportedly demonstrated normal acetabular orientation and depth and restored femoral head-neck offset at 1 and 2 years	**Operative complications** There were no surgical complications in either group.	Two consecutive groups of patients treated as per group 1 then as per group 2. Retrospective analysis. Unlikely to be the same patients as in Ganz (2001) or Siebenrock (2003). Clinical evaluations of outcome undertaken by independent clinicians There was no significant difference between groups in clinical or demographic characteristics at baseline. No comparison between the groups was undertaken for radiological outcomes There was no significant correlation between the clinical and radiographic scores. Standardisation of concomitant treatment is not reported. Group 2 were operated on later than Group 1 and better clinical outcome may represent improved operator experience with the procedure. Authors state that the clinical and radiographic scoring scales used lack sufficient sensitivity to assess subtle changes with early osteoarthritis.

Validity and generalisability of the studies

- Some variation in surgical technique between centres
- Little data to suggest a correlation between radiographic and functional outcomes
- Few patients are followed up past 3 years, with onset of osteoarthritis likely to be a long-term risk.

Specialist advisers' opinions

Specialist advice was sought from consultants who have been nominated or ratified by their Specialist Society or Royal College.

Mr D Pegg, Mr J Witt, Mr R Villar, Dr C Wynn Jones

- The majority of the advisors considered this open procedure (as opposed to the arthroscopic technique) to be a minor variation to an established procedure
- The expected benefits of this procedure are reduction in pain and a delay in the progression of osteoarthritis, thus delaying or avoiding the need for total hip replacement.
- The advisors noted the following adverse events reported in the literature or anecdotally: sciatic nerve neurapraxia, heterotopic ossification, femoral fracture and avascular necrosis of the femoral head
- Additional theoretical complications include deep-vein thrombosis, pulmonary embolisation and deep infection.
- Audit of this procedure should include evaluation of the following outcomes: pain, stiffness, and level of physical activity as subjective outcomes; range of movement and muscle strength as objective measurements; and X-ray and MRI evaluation of the joint over a few years. Important complications to monitor are infection and avascular necrosis.
- One advisor suggested that a similar procedure is established in foot surgery.
- The indications for the procedure, although not well understood, are relatively limited and few patients would be suitable. However, these are patients who have received no invasive treatment.
- The advisors highlighted that there are variations in the procedure, with some interventions including some degree of osteotomy.
- There were no concerns over training: attachment to a unit with an experienced surgeon is probably sufficient.
- The advisors believe that there is some evidence of short-term pain reduction, but there are no long-term efficacy data to prove slowing of degenerative changes.
- The procedure has been attempted through an arthroscopic approach but there are very scarce data on this technique.

Issues for consideration by IPAC

- Efficacy may be influenced by the degree of pre-existing arthritis / degree of degenerative changes that have developed before the time of intervention
- There is a lack of evidence to determine whether the procedure successfully slows the rate of progression to osteoarthritis.
- An arthroscopic approach has been attempted but due to the paucity of the evidence NICE will not be producing guidance on this technique at this time.

References

1. Lavigne M, Parvizi J, Beck M et al. (2004) Anterior femoroacetabular impingement: Part I. Techniques of joint preserving surgery. *Clinical Orthopaedics and Related Research* 418: 61–6.
2. Ganz R, Gill TJ, Gautier E et al. (2001) Surgical dislocation of the adult hip. *Journal of Bone and Joint Surgery. British Volume* 83: 1119–1124.
3. Siebenrock KA, Schoeniger R, Ganz R (2003) Anterior femoro-acetabular impingement due to acetabular retroversion. Treatment with periacetabular osteotomy. *Journal of Bone and Joint Surgery. American Volume* 85: 278–86.
4. Murphy S, Tannast M, Kim Y-J et al. (2004) Debridement of the adult hip for femoroacetabular impingement: Indications and preliminary clinical results. *Clinical Orthopaedics & Related Research* 429: 178–81.
5. Espinosa N, Rothenfluh DA, Beck M et al. (2006) Treatment of femoro-acetabular impingement: preliminary results of labral refixation. *The Journal of Bone and Joint Surgery* 88: 925–35.
6. Myers SR, Eijer H, Ganz R (1999) Anterior femoroacetabular impingement after periacetabular osteotomy. *Clinical Orthopaedics and Related Research* 363: 93–9.

Appendix A: Additional papers on open femoro-acetabular surgery for impingement syndrome not included in summary table 2

The following table outlines the studies that are considered potentially relevant to the overview but were not included in the main data extraction table (table 2). It is by no means an exhaustive list of potentially relevant studies.

Article	Number of patients/ follow-up	Direction of conclusions	Reasons for non-inclusion in table 2
Lavigne M, Parvizi J, Beck M et al. (2004) Anterior Femoroacetabular Impingement: Part I. Techniques of joint preserving surgery. *Clinical Orthopaedics and Related Research* 418: 61–6.	N/A	N/A	Description of procedure
Kloen P, Leunig M, Ganz R (2002) Early lesions of the labrum and acetabular cartilage in osteonecrosis of the femoral head. *Journal of Bone and Joint Surgery. British Volume* 84: 66–9.	N/A	N/A	Assessment of incidence of cartilage lesions rather than treatment case series

Appendix B: Related NICE guidance for open femoro-acetabular surgery for impingement syndrome

Guidance	Recommendation
Interventional procedures	None applicable
Technology appraisals	None applicable
Clinical guidelines	None applicable
Public health	None applicable

Appendix C: Literature search for open femoro-acetabular surgery for impingement syndrome

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

#	Search History	Results	Display
1	imping$.tw. Details	4171	Display
2	(hip or hips$).tw. Details	45118	Display
3	hip/ or hip joint/ Details	17214	Display
4	trap$.tw. Details	34332	Display
5	1 or 4 Details	38439	Display
6	Femur Head/su [Surgery] Details	1100	Display
7	Acetabulum/su [Surgery] Details	1727	Display
8	2 or 3 or 6 or 7 Details	51374	Display
9	debrid$.tw. Details	8347	Display
10	Debridement/ Details	5838	Display
11	9 or 10 Details	11318	Display
12	resect$.tw. Details	120240	Display
13	Correct$.tw. Details	200126	Display
14	11 or 12 or 13 Details	326252	Display
15	surg$.tw. Details	691217	Display
16	14 or 15 Details	913930	Display
17	16 and 5 and 8 Details	106	Display
18	(ganz m or ganz md).au. Details	19	Display
19	17 or 18 Details	125	Display
20	limit 19 to human [Limit not valid in: Ovid MEDLINE(R) In-Process & Other Non-Indexed Citations; records were retained] Details	118	Display
21	from 20 keep 1-118 Details	118	Display