



## ■ INSTRUCTIONAL REVIEW: HIP

# Groin pain after replacement of the hip

## AETIOLOGY, EVALUATION AND TREATMENT

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**Persistent groin pain after seemingly successful total hip replacement (THR) appears to have become more common. Recent studies have indicated a high incidence after metal-on-polyethylene and metal-on-metal conventional THR and it has been documented in up to 18% of patients after metal-on-metal resurfacing. There are many causes, including acetabular loosening, stress fracture, and iliopsoas tendonitis and impingement. The evaluation of this problem requires a careful history and examination, plain radiographs and an algorithmic approach to special diagnostic imaging and tests. Non-operative treatment is not usually successful. Specific operative treatment depending on the cause of the pain usually involves revision of the acetabular component, iliopsoas tenotomy or other procedures, and is usually successful. Here, an appropriate algorithm is described.**

Although persistent thigh pain after total hip replacement (THR) has been associated more frequently with the use of uncemented femoral components,<sup>1</sup> groin pain has been reported as an occasional complication of both cemented and uncemented THR.<sup>2-4</sup> With the re-introduction of resurfacing arthroplasty and the increasing use of various metal-on-metal articulations and large head metal-on-polyethylene THRs, groin pain has once more been reported as a complication.<sup>5-7</sup> This paper reviews the prevalence, aetiology, clinical and radiological evaluation, and treatment options of patients with persistent groin pain after all types of THR.

### Prevalence

The prevalence of groin pain after conventional primary THR varies between 0.4% and 18.3% (Table I).<sup>3-6,8,9</sup> This wide variation is due, in part, to the heterogeneity of published studies in terms of duration of follow-up, varying descriptions of the site, severity and cause of the pain, and its treatment. In most studies, a precise definition of the site of groin pain is not given. It was described by Lavigne et al<sup>6</sup> as pain located in the area extending from the inner thigh to the anterior border of the greater trochanter and from the anterior superior iliac spine to the level of the base of the greater trochanter. As some early residual post-operative pain is expected after any operation involving the hip, this article will focus on groin pain occurring three months or more after surgery.

O'Sullivan et al<sup>9</sup> reported that 0.37% of patients (16 of 3501 hips) had persistent groin pain at a mean of 20 months after uncemented THR (without acetabular screw fixation), but that cohort was narrowly defined to include only patients with painful iliopsoas tendonitis requiring appropriate surgery. This study did not include patients with mild groin pain that resolved spontaneously or after conservative treatment. Ala Eddine et al<sup>3</sup> reported that 4.4% (9 of 206) patients with a painful THR had iliopsoas impingement. Bricteux, Beguin and Fessy<sup>4</sup> also reported that 12 of 280 hips (4.3%) with persistent pain following THR had iliopsoas impingement.

Metal-on-metal articulation in THR has a higher prevalence of groin pain as a complication. Using a non-validated patient generated questionnaire, Bartelt et al<sup>8</sup> reported groin pain in 7% of metal-on-polyethylene or ceramic-on-ceramic THRs, 15% of metal-on-metal THRs and 18% of metal-on-metal resurfacings, in a retrospective review at a mean follow-up of 14 months. However, due to the numbers available, the difference was only statistically significant between conventional THR and hip resurfacing. The increased prevalence of groin pain with metal-on-metal THR seems striking, and there may be new causes<sup>10</sup> such as fracture of the femoral neck and neck impingement with resurfacing, as well as synovitis due to metal ion hypersensitivity or adverse local tissue reaction.<sup>11</sup> In a prospective, non-randomised study of 279 patients by Lavigne et al,<sup>6</sup> significantly

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**Table I.** Reported prevalence of groin pain after total hip replacement (THR) and metal-on-metal (MoM) resurfacing

Authors	Number of hips	Mean follow-up (mths) (range)	Prevalence (interval of follow-up)	Notes
<b>THR</b>				
Ala Eddine et al <sup>3</sup>	206	7.3 (1 to 48)	4.4%	Iliopsoas tendonitis
Bricteux et al <sup>4</sup>	280	NR* (0 to 60)	4.3%	Iliopsoas tendonitis
O'Sullivan et al <sup>9</sup>	3501	20 (2 to 96)	0.4%	Iliopsoas tendonitis requiring surgical release
Bartelt et al <sup>8</sup>	217	14 (12 to 24)	7%	Conventional
Bartelt et al <sup>8</sup>	65	14 (12 to 24)	15%	MoM
Lavigne et al <sup>6</sup>	85	N/A† (3 to 24)	18.3% (3 months) 15.3% (12 months) 12.9% (24 months)	MoM, 28 mm head
Lavigne et al <sup>6</sup>	89	N/A (3 to 24)	30.0% (3 months) 13.5% (12 months) 16.9% (24 months)	MoM, large-head
<b>MoM hip resurfacing</b>				
Bartelt et al <sup>8</sup>	46	14 (12 to 24)	18%	
Bin Nasser et al <sup>5</sup>	116	26 (12 to 61)	18%	
Lavigne et al <sup>6</sup>	105	N/A (3 to 24)	30.5% (3 months) 15.2% (12 months) 14.9% (24 months)	

\* NR, not reported

† N/A, not applicable

increased groin pain was present in those with both large head metal-on-metal THRs (30%) and hip resurfacings (30.5%) compared with those with 28 mm metal-on-metal THRs (18.3%) at three months post-operatively. This prospective study also evaluated the natural history of persistent groin pain in patients with these three types of THRs at three months, one year and two years, and reported that the incidence decreased to 14.9% (hip resurfacing), 16.9% (THR with large diameter head) and 12.9% (THR with 28 mm head) at two years post-operatively.

Other authors have also reported a high prevalence of groin pain after metal-on-metal hip resurfacing. The retrospective studies of Bin Nasser et al<sup>5</sup> and Bartelt et al<sup>8</sup> both reported that 18% of patients with hip resurfacing had persistent groin pain at a minimum of 12 months post-operatively, in series of 116 and 39 patients, respectively.

### Aetiology

There are many causes of groin pain after THR or hip resurfacing. Extrinsic causes include pain due to local neurological or vascular pathology, inguinal hernia, metastatic cancer, and dissecting retroperitoneal pathology as well as distant causes including spinal pathology and radiculopathy. The most frequent intrinsic causes include infection, aseptic loosening of the acetabular component, iliopsoas tendonitis, impingement, synovitis due to metal or polyethylene debris, pelvic osteolysis and occult acetabular or

pelvic fracture. A patient may have several causes, all of which need to be identified and treated for a successful outcome.<sup>12</sup>

Low-grade infection should always be considered when patients present with groin pain after conventional or metal-on-metal THR or metal-on-metal resurfacing. Of 206 patients presenting with a painful THR, Ala Eddine et al<sup>3</sup> reported that 45 patients (22%) had infection. In a series of 37 patients undergoing revision after metal-on-metal THR or hip resurfacing, Browne et al<sup>7</sup> reported that infection was the cause in seven patients (19%).

Aseptic loosening of the acetabular component is a frequent cause of groin pain after THR and metal-on-metal resurfacing, although that of the femoral component is rarely a cause. Loosening of the acetabular component was the cause in eight of 37 revisions (22%) of failed metal-on-metal THR in the study of Browne et al.<sup>7</sup> Aseptic loosening is also a concern in hip resurfacing.<sup>13</sup> Kim et al<sup>14</sup> found that ten of 14 (71%) metal-on-metal resurfacing procedures requiring revision were due to loosening of the acetabular component. Amstutz et al<sup>15</sup> reported that only 1.8% of 400 resurfacing procedures were found to have femoral loosening as a cause of groin pain. An increased likelihood of femoral loosening was correlated with female gender, femoral head cysts, and small component sizes in this study.

There are many reports of occult loosening of an uncemented acetabular component presenting as unexplained

and persistent groin pain. These components have been both two-piece and one-piece porous coated acetabular shells without screw fixation. The modular titanium Sulzer Interop TM component (Sulzer, Austin, Texas) was noted to have an oily residue secondary to a change in manufacturing, and there are two series that reported groin pain due to loosening.<sup>16,17</sup> In one study of 26 acetabular revisions of these components, 16 patients (62%) had persistent groin pain.<sup>16</sup> In another series, 12 of 37 patients (32%) with the Sulzer components reported groin pain and underwent revision surgery.<sup>17</sup> There are two varieties of one-piece cobalt-chrome alloy metal shells that have been associated with groin pain due to failure of bone ingrowth, occult loosening or excessive metal debris. The ASR acetabular component (DePuy, Warsaw, Indiana) has recently been recalled for unacceptably high revision rates. Langton et al<sup>18</sup> reported that, in a series of 660 metal-on-metal hip resurfacings (550 ASR and 110 Birmingham components), 17 ASR components (3.4%) required revision, presumably due to adverse reaction to metal debris. The Durom acetabular component (Zimmer, Warsaw, Indiana) has also been reported to have high failure rates. At a minimum of one year follow-up in a case-matched study, Illgen et al<sup>19</sup> reported 11.1% failure (defined as revision or moderate/severe groin pain) in 63 hips with this component compared with 0% failure in 100 hips with the Trilogy component (Zimmer). Long et al<sup>20</sup> reported revision for acetabular loosening in 30 of 206 hips (15%) with the Durom component within two years of surgery. Finally, in a series of 100 hip resurfacings performed with the Durom acetabular component, Naal et al<sup>21</sup> reported survival of only 88.2% for all patients, and 81.5% for women, at a mean follow-up of five years. Of the 11 revisions, two had persistent unexplained pain, two had impingement, two had loosening of the femoral component, one had loosening of the acetabular component and four had a fracture of the femoral neck.

Iliopsoas impingement or tendonitis is an increasingly frequent cause of groin pain after both conventional and metal-on-metal THR.<sup>22-24</sup> This can result from numerous different causes of irritation or stress on the tendon anywhere through its course, from intrapelvic sites to the anterior edge of the acetabulum to its insertion on the lesser trochanter. Tendonitis or impingement may result from a prominent or malpositioned acetabular component,<sup>2,23</sup> retained cement,<sup>23,25,26</sup> excessively long screws,<sup>4,23</sup> an acetabular cage,<sup>27</sup> a prominent femoral component collar, an oversized acetabular component,<sup>28</sup> or a femoral head which is larger than the native head.<sup>29</sup> There are also circumstances in which intractable iliopsoas tendonitis occurs without a structural problem being identified. Anecdotally, there are more descriptions of iliopsoas impingement with uncemented acetabular components than with cemented components.

Fracture of the acetabulum or pelvis is a much more infrequent cause of groin pain following THR. Four cases

of stress fracture of the medial acetabular wall have been reported with both cemented (three)<sup>30</sup> and cementless (one)<sup>31</sup> acetabular components. These patients are usually elderly, osteoporotic females. Acetabular fracture may occur after revision or primary THR, with an elliptical component or the aggressive press-fitting ( $\geq 4$  mm oversizing) of a hemispherical component. Acetabular fracture has also been reported following a convulsion three years after THR.<sup>32</sup> Although pelvic or peri-acetabular osteolysis is usually an asymptomatic finding, groin pain has been reported with these lesions, with pain presumably due to synovitis or occult fracture in the pubis or medial wall.<sup>33</sup> With hip resurfacing, there is also a risk of femoral neck fracture, with a reported incidence as high as 2.5% (14 of 550 resurfacings).<sup>34</sup>

There are also patients with metal-on-metal THR or resurfacing with persistent groin pain and no evidence of infection, loosening, fracture or iliopsoas tendonitis. Metal hypersensitivity, synovitis due to elevated metal ion levels, or adverse local tissue reactions (formerly aseptic lymphocytic vasculitis-associated lesions (ALVAL))<sup>35</sup> should be considered.<sup>36</sup> Browne et al<sup>7</sup> reported 'metal reaction' as the aetiology for ten of 37 (27%) revisions of failed metal-on-metal THR. There is also a report of metal hypersensitivity reaction causing a large pseudotumour and lower extremity oedema due to extrinsic compression of the femoral vein.<sup>12</sup>

Finally, there are several other rare causes of groin pain following THR or resurfacing reported in the literature. Groin pain is the most frequent cause of conversion of hemiarthroplasty to a THR and, in one study, groin or buttock pain was still present in 20% of patients after conversion.<sup>37</sup> There are many reports of primary tumours, including osteosarcoma<sup>38</sup> and non-Hodgkin's lymphoma<sup>39</sup> occurring after THR and a case of persistent pain attributable to metastatic pyeloureteral carcinoma.<sup>40</sup> Massive wear with metallosis has been reported in the setting of metal-on-ceramic bearing THR.<sup>41</sup> There is also a case report of migration of intrapelvic cement three years after THR to the posterior abdominal wall, causing intractable pelvic pain.<sup>42</sup> Lastly, groin pain started or increased in 60% (28 of 47) of patients with pregnancy after THR.<sup>43</sup> In 18 women, the pain disappeared either before term or immediately after childbirth. Seven women had groin pain after childbirth and five of these underwent revision.

## Evaluation

The evaluation of a patient with groin pain after THR or hip resurfacing should begin with a careful history and physical examination. The date of implantation, surgical approach, type of component, and onset and course of the pain are crucial information. Systemic symptoms are rarely present with infection. Pain that is acute and associated with a fall or trauma may suggest a fracture or loosening. History suggestive of metal synovitis is variable, and may include pain present since the time of THR and progressive in nature, pain aggravated by weight-bearing, mechanical

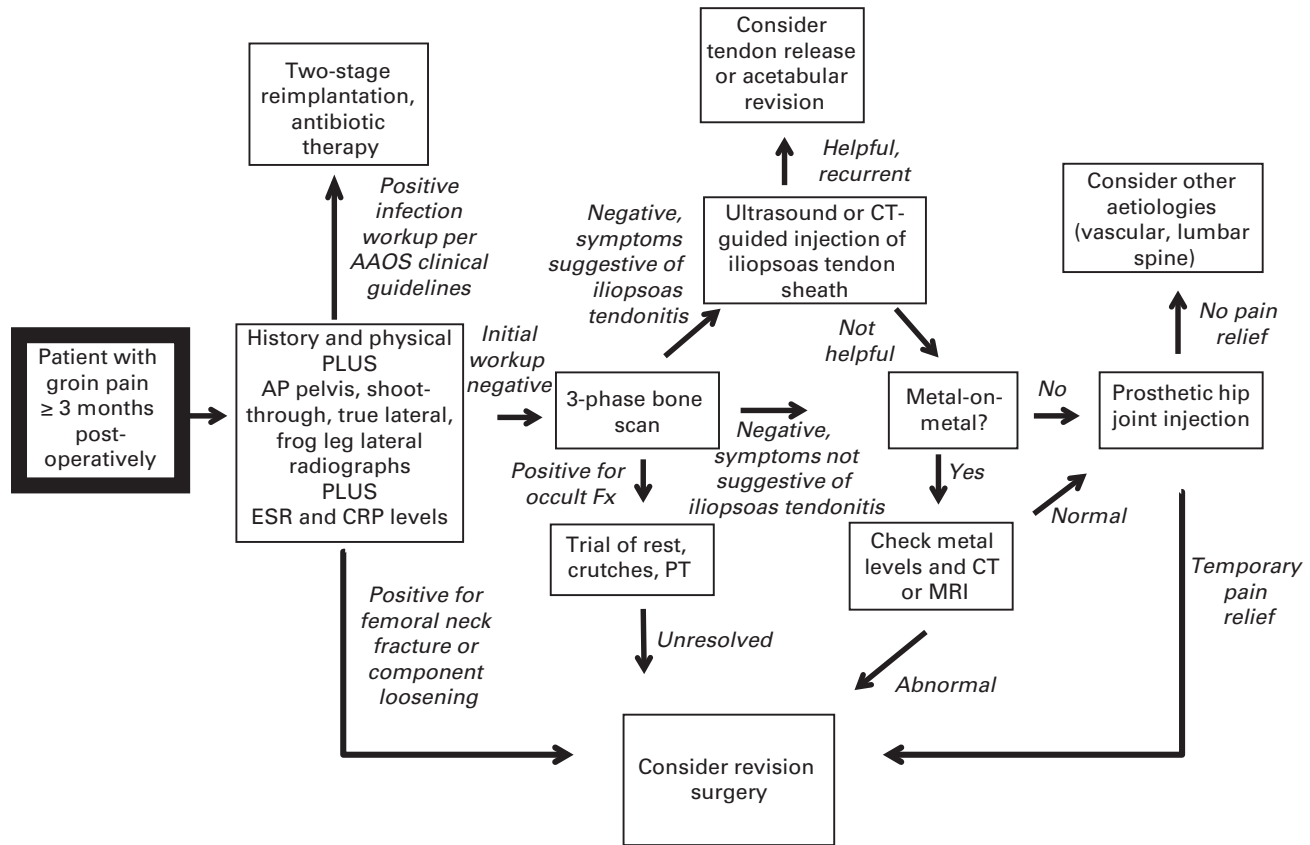


Fig. 1

Algorithm for evaluation and treatment of groin pain after total hip replacement or metal-on-metal resurfacing (AAOS, American Academy of Orthopaedic Surgeons (AAOS)<sup>47</sup>; AP, anteroposterior radiograph; PT, physical therapy; Fx, fracture).

symptoms ('clunking' or catching), and even audible squeaking.<sup>13</sup> The history for a patient with iliopsoas tendonitis is also variable. Usually patients report groin pain exacerbated by stair climbing, getting into or out of bed, rising from seated position, and getting in or out of a car. The onset of such symptoms has been reported between one and 96 months following THR.<sup>22,44</sup> Patients with iliopsoas impingement may occasionally describe a snapping or 'clunking' sensation. As patients may also report groin or buttock pain referred from lumbar, abdominal or vascular pathology, these areas may also require inquiry.

A thorough examination is equally important. Erythema or warmth around the hip or incision may suggest infection. Wound drainage, usually associated with infection, has been reported with metal synovitis one year following metal-on-metal THR.<sup>45</sup> A limp and painful range of movement is non-specific and may be associated with infection, component loosening, iliopsoas tendonitis or fracture. Many patients with iliopsoas tendonitis do not report pain on walking.<sup>44</sup> Resisted seated hip flexion that exacerbates groin pain<sup>22,25,46</sup> occurs with acetabular component loosening, iliopsoas tendonitis and impingement.

Following history and examination, the initial investigations should focus on the most common causes of groin pain: infection, aseptic loosening and occult peri-prosthetic fracture (Fig. 1). Using the American Academy of Orthopaedic Surgeons Clinical Practice Guidelines for prosthetic joint infection,<sup>47</sup> surgeons should first differentiate between patients at 'high' and 'low risk' for infection based on clinical suspicion. Thus, along with plain radiographs, the initial investigations should include ESR and CRP levels. If one or both levels are elevated (for 'high risk' patients), it is recommended to proceed with hip aspiration for white cell count and differential, as well as for culture. A positive cell count and culture would be suggestive of infection, whereas if both are negative infection is unlikely. If aspiration results are borderline, repeat hip aspiration should be undertaken.

The initial imaging studies are plain radiographs, with standard anteroposterior pelvis, cross-table or true ('shoot-through'), and frog-leg lateral views. Comparing old and recent radiographs is important for assessment of fixation of the acetabular component, including emergent radiolucent lines, change in component position, pelvic

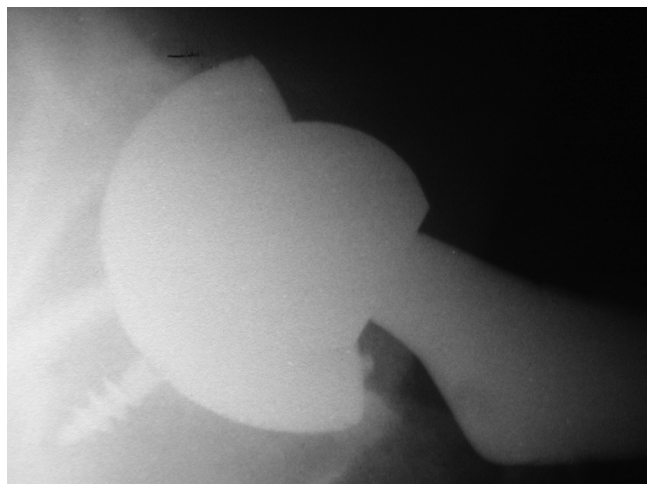


Fig. 2

Pre-operative cross-table lateral radiograph of a 67-year-old man with persistent groin pain four years after an uncemented total hip replacement, showing protrusion of the anterior acetabular shell by 8 mm to 10 mm in front of the anterior acetabular bony rim.

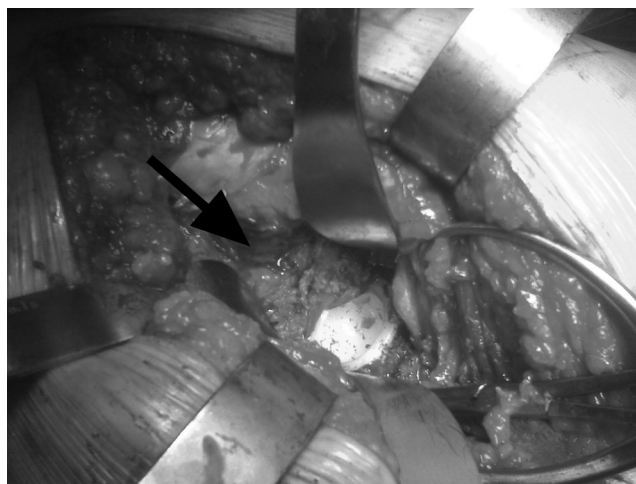


Fig. 3

An intra-operative photograph from the revision surgery of the same patient as in Figure 2 showing an inflammatory mass anterior to the acetabular component (arrow).

osteolysis, prominent intrapelvic screws or retained cement. New or widening radiolucent lines, particularly in zone 3,<sup>48,49</sup> or a change in the position of the component, are suggestive of loosening. The cross-table or true lateral view allows assessment of the anterior aspect of the acetabular component in reference to the anterior bony rim when considering iliopsoas impingement as a diagnosis.<sup>2,22</sup> Body habitus may limit the interpretation of plain radiographs. Computerised tomography should be considered in order to measure the version of the acetabular component and the extent of anterior component overhang.<sup>23,27</sup>

If the initial laboratory and radiological studies do not determine a diagnosis, we recommend a three-phase bone scan as a highly sensitive study to investigate for acetabular loosening or occult fracture.<sup>49,50</sup> If the bone scan is negative, in patients for whom the clinical picture is suggestive of iliopsoas tendonitis, we recommend fluoroscopic, ultrasonographic or CT-guided diagnostic and therapeutic injection of the iliopsoas tendon sheath. In patients without suspicion of iliopsoas tendonitis, additional evaluation with metal suppression MRI, serum metal ion levels, and anaesthetic injection of the hip may be considered. Patients with metal-on-metal articulations should be evaluated for metal synovitis or hypersensitivity, with measurement of serum metal ion levels and CT, MRI, or ultrasound of the affected hip, if not already obtained.<sup>51,52</sup> If these are inconclusive, an intra-articular injection of local anaesthetic into the hip may be helpful in distinguishing between an intrinsic hip problem and pain originating from an extrinsic source.<sup>53,54</sup> When these tests do not reveal a definite cause of the pain, psychiatric evaluation may rarely be necessary.<sup>55</sup>

## Treatment

The treatment of groin pain due to infection involves either a one- or two-stage re-implantation procedure, in conjunction with intravenous antibiotic therapy, managed in conjunction with a bacteriologist. The obvious treatment for aseptic acetabular loosening is revision and the senior author (PFL) usually implants a new component with a so-called enhanced porous-coated surface with adjuvant screw fixation.<sup>56</sup> Dislocation may be a specific problem after isolated acetabular revision and consideration should be given to the routine use of a 'large' head ( $\geq 36$  mm).

The treatment of stress fracture after THR or resurfacing should be determined on a patient-specific basis. There are reports<sup>30,31</sup> of patients recovering with conservative management involving non-weight-bearing for two to three months and progressing as tolerated, with regular radiological review. There is also one report<sup>30</sup> of two revision arthroplasties being needed for stress fracture. Osteolysis associated with the stress fracture may be an indication for revision surgery.

Initial treatment of iliopsoas tendonitis should be conservative, including rest, anti-inflammatory medications and physiotherapy. Many authors have indicated, however, that this is not uniformly successful and may only lead to temporary, partial or even no pain relief.<sup>3,4,23</sup> Nunley et al,<sup>57</sup> in a group of 27 patients with presumed iliopsoas tendonitis, found that 21 (78%) were treated satisfactorily with between one and three fluoroscopically-guided steroid injections. Radiological analysis of those who responded to an injection only *versus* those who went on to require surgery did not reveal any obvious differences between the groups. There is also a case report of successful treatment

of iliopsoas tendonitis with injection of Botulinum toxin type A.<sup>58</sup> A recent review by Lachiewicz and Kauk<sup>22</sup> examining the results of many studies estimated the success of nonsurgical treatment for iliopsoas tendonitis at only 39%. The senior author (PFL) recommends one or two diagnostic-therapeutic injections if the anterior edge of the acetabular component is below the anterior bony rim, but only one injection if it lies anterior to the bony rim.

Should the patient with iliopsoas impingement require surgery successful options include iliopsoas tendon release or resection, removal of protruding cement or screws, and acetabular revision alone or in combination with iliopsoas resection.<sup>2,4,22,25,44</sup>

Tendon release or resection is the simplest procedure, chosen when the lateral radiological or CT imaging does not suggest anterior overhang of the acetabular component. The procedure has been documented using open,<sup>44</sup> percutaneous and arthroscopic<sup>59</sup> techniques. The senior author (PFL) has only used an open approach. In patients with anterior overhang (Figs 2 and 3), acetabular revision is recommended,<sup>2,22,23</sup> typically using the same approach as that of the index THR. Special attention should be paid intra-operatively to positioning the anterior edge of the new component below the bony acetabular rim.<sup>2,4</sup> Our experience is that revision without greater trochanteric osteotomy and without use of a reinforcement ring has a high rate of success and a low rate of complications. When the impingement is due to protruding cement or screws, these should be addressed directly intra-operatively in addition to iliopsoas tenotomy or resection.<sup>4,25</sup> A recent literature review<sup>22</sup> found an overall success rate of 91.5% (65 of 71 hips) for surgical intervention among studies reporting outcomes at a mean of 22.7 months post-operatively.

Synovitis due to local release of metal ions can be a diagnosis that is both difficult to make and often only made following histological analysis at the time of revision arthroplasty.<sup>7</sup> Regardless, when present, it should be treated with revision of the bearing surface. Polyethylene and ceramic head exchanges have both been reported.<sup>7</sup> The decision for revision of a painful metal-on-metal THR or resurfacing arthroplasty is complex and should be individualised, based on a combination of serum metal ion levels, imaging findings and the amount of groin pain felt by the patient.

## Conclusion

THR continues to be a widely successful operation, but persistent groin pain following THR and metal-on-metal hip resurfacing remains a problem for some patients. There are many possible causes including infection, aseptic loosening or malfunctioning components, iliopsoas impingement, metal reaction, and causes extrinsic to the hip joint. A stepwise algorithm for the evaluation and treatment of groin pain after THR or metal-on-metal hip resurfacing is described.

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