Review

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Greater trochanteric pain syndrome: Evaluation and management of a wide spectrum of pathology

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Abstract
Greater trochanteric pain syndrome is a common cause of lateral hip pain, encompassing a spectrum of disorders, including trochanteric bursitis, abductor tendon pathology, and external coxa saltans. Greater trochanteric pain syndrome is primarily a clinical diagnosis, and careful clinical examination is essential for accurate diagnosis and treatment. A thorough history and physical exam may be used to help differentiate greater trochanteric pain syndrome from other common causes of hip pain, including osteoarthritis, femoroacetabular impingement, and lumbar stenosis. Although not required for diagnosis, plain radiographs and magnetic resonance imaging may be useful to exclude alternative pathologies or guide treatment of greater trochanteric pain syndrome. The majority of patients with greater trochanteric pain syndrome respond well to conservative management, including physical therapy, non-steroidal anti-inflammatory drugs, and corticosteroid injections. Operative management is typically indicated in patients with chronic symptoms refractory to conservative therapy. A wide range of surgical options, both open and endoscopic, are available and should be guided by the specific etiology of pain. The purpose of this review is to highlight pertinent clinical and radiographic features used in the diagnosis and management of greater trochanteric pain syndrome. In addition, treatment indications, techniques, and outcomes are described.

Keywords
Greater trochanteric pain syndrome, trochanteric bursitis, tendinopathy, endoscopy, surgery

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Introduction

Greater trochanteric pain syndrome (GTPS) is a general term used to describe disorders of the peritrochanteric space, including trochanteric bursitis, abductor tendon pathology, and external coxa saltans.[1] GTPS is a common cause of lateral hip pain and tenderness, with an annual incidence as high as 1.8 per 1000 adults in the primary care setting.[2] While GTPS is seen in all age groups, it most commonly affects patients during their fourth to sixth decades of life, with a female predominance of 2–3 to 1.[3–6]

While conservative treatment is effective for most patients with GTPS, many demonstrate symptoms refractory to physical therapy, non-steroidal anti-inflammatory drugs (NSAIDs), and corticosteroid injections (CSIs).[2] Given the heterogeneous nature of GTPS, accurate diagnosis of the specific etiology of GTPS and the degree of gluteal tendon injury are critical to guiding appropriate treatment. The purpose of this review is to highlight the clinical and radiographic findings that can differentiate GTPS from other causes of lateral hip pain and guide management. In addition, the indications, techniques, and outcomes for nonoperative and operative management are described.

Methods

Two authors (M.A.P. and J.S.) searched PubMed/MEDLINE with the terms "greater trochanteric pain syndrome," "trochanteric bursitis," and "gluteal tendinopathy." Search was unrestricted by date up to February 17, 2021. Nonduplicate articles were screened by two of the authors (M.A.P and J.S.)

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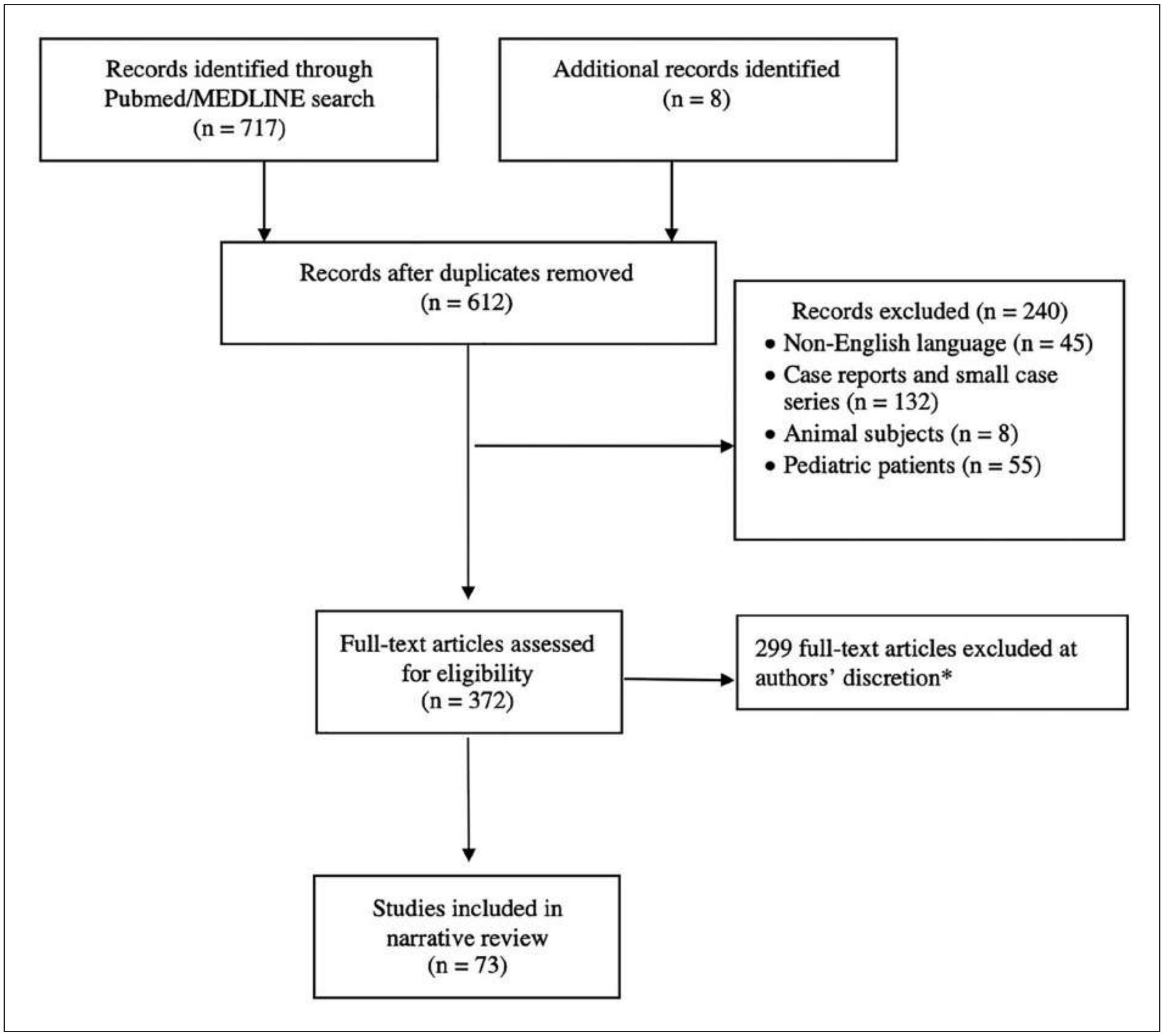

Figure 1. Flow diagram illustrating initial search yield and articles excluded based on prespecified criteria.
*As a narrative review, final eligibility for inclusion was at the authors' discretion based on relevance and importance to the topic.

as shown in Figure 1. Studies addressing the etiology, pathophysiology, clinical or radiographic presentation, and management of GTPS met inclusion criteria for this review. Non-English publications, case reports, small case series ($n < 5$), animal studies, and those including pediatric patients were excluded. As a narrative review, final inclusion of the remaining studies was determined at the discretion of all authors, based on their relevance and importance. Poorly designed studies and those with similar or redundant outcomes to higher quality studies were excluded.

Etiology and risk factors

Historically, most patients presenting with lateral hip pain and tenderness were diagnosed with trochanteric bursitis, which refers to inflammation of the subgluteal bursae located deep to the iliotibial band (ITB) and abductor tendons (Figure 2).[7] However, radiographic and histopathologic studies have demonstrated that the trochanteric bursae are rarely affected in isolation; rather, bursal distention is most commonly associated with abductor tendinopathy.[3,7–9] In a retrospective review of sonograms in 877 patients with GTPS, Long et al.[3] found that 49.9% of patients had gluteal tendinopathy, 20.2% had trochanteric bursitis, and 29.1% had thickening or partial tears of the ITB. In fact, only 8.1% had isolated bursitis without associated gluteal tendinopathy. Similarly, Bird et al.[7] analyzed magnetic resonance imaging (MRI) in 24 patients with GTPS and found that 45.8% had partial or full-thickness tears of the gluteus medius tendon, 62.5% had gluteus medius tendinopathy, and 8.3% had trochanteric bursitis with concomitant tendinopathy. The overlapping spectrum of symptoms and imaging among these disorders has thus led to the use of the diagnostic term GTPS, which describes a source of trochanteric pain derived from

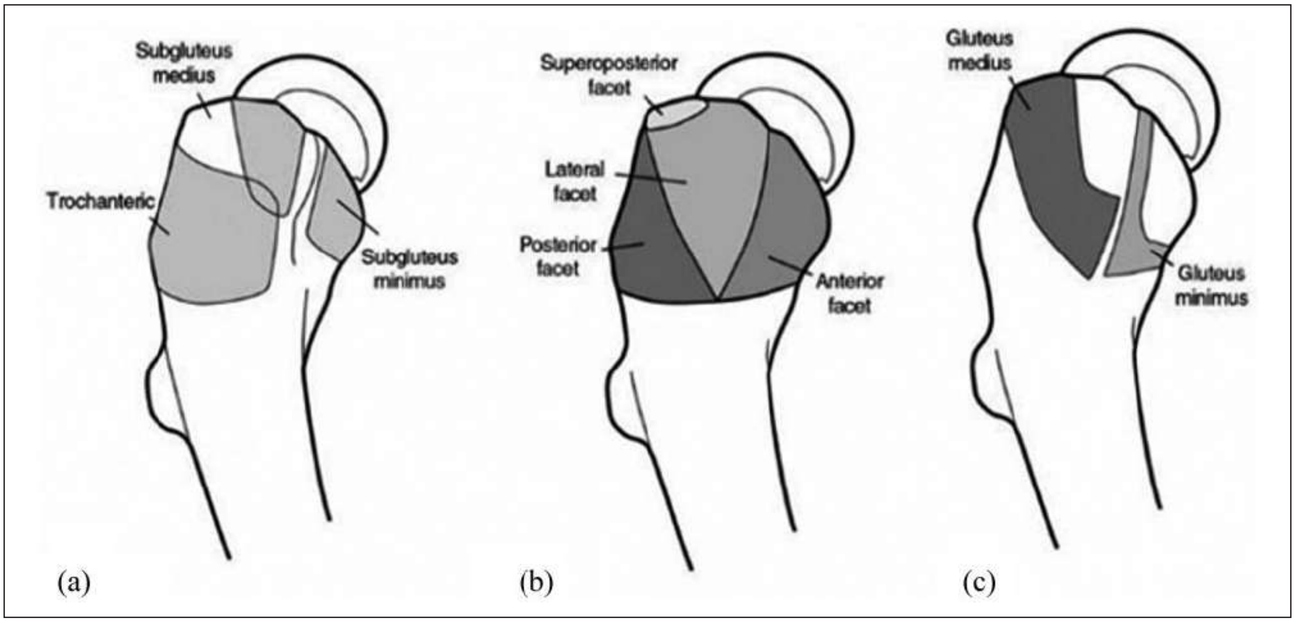

Figure 2. Anatomy of the greater trochanter. (a) Three peritrochanteric bursae, (b) osseous facets of the greater trochanter, and (c) insertion sites for the abductor tendons.[10]

pathology of the trochanteric bursae, gluteus medius and minimus tendons, and the ITB.

GTPS is thought to develop from friction of the ITB over the greater trochanter, leading to regional microtrauma with overuse.[3,11] As previously noted, hip abductor tendinopathy is commonly implicated in GTPS.[3,7,8] The findings of tendon degeneration and associated bursitis in the hip abductor apparatus have invited comparisons with rotator cuff tendinopathy of the shoulder as a possible analogous pathological process, with eventual progression to partial and full-thickness tendon tears.[9,12] External coxa saltans, or external snapping hip, is characterized by palpable snapping of the ITB or gluteus maximus as it moves from posterior to anterior over the greater trochanter with hip flexion and anterior to posterior with extension.[13,14] This is often attributed to thickening of the posterior aspect of the ITB or anterior border of the gluteus maximus, and repeated snapping can lead to trochanteric bursa irritation, gluteal tendinopathy, and consequently, lateral hip pain.[3,13] Less commonly, GTPS can result from blunt trauma to the hip or iatrogenic injury during hip arthroplasty.[15,16]

Several risk factors have been associated with GTPS, including increased age, obesity, osteoarthritis of the knee or hip, lower back pain, and leg length discrepancy.[6,17,18] These findings suggest that altered limb mechanics and abnormal force vectors across the hip likely contribute to the development of GTPS.[6] Similarly, the higher prevalence of GTPS in women is thought to be related to differences in the size and shape of the pelvis, with wider-set trochanters creating greater tension on the ITB.[6,19] GTPS has also been associated with decreased bony constraint of the hip, where instability may contribute to increased strain on the gluteal muscles.[20] Patients who report high levels of pain demonstrate significantly impaired hip stability relative to those who report lower levels of pain.[21]

History and physical exam

GTPS classically presents as chronic lateral hip pain in the region of the greater trochanter that may radiate to the buttock or over the lateral thigh to the knee.[15,22] The pain is often described as deep and aching and is exacerbated by lying on the affected side, squatting, sitting with the ipsilateral leg crossed, and climbing stairs.[15,22] Although rare, patients with GTPS following blunt trauma are likely to describe a history of injury or present with ecchymosis or hematoma of the lateral hip.[9,15] A history of abductor weakness after hip arthroplasty may represent iatrogenic injury to the abductor tendons or the superior gluteal nerve.[16] Psychosocial factors have been shown to impact symptom severity in patients with GTPS and should be evaluated and addressed.[23]

A thorough physical exam of the lumbar spine, hips, and knees is essential to narrow the differential in patients presenting with hip pain. Palpation of the posterolateral region of the greater trochanter classically elicits focal tenderness in patients with GTPS, as this coincides with the anatomic footprint of the gluteus medius on the posterosuperior facet of the greater trochanter.[15,22] The flexion, abduction, and external rotation (FABER) test, Ober test, and resisted abduction (Figure 3) may also elicit trochanteric pain or tenderness.[15,17,24,25] Patients should be assessed for a Trendelenburg sign during ambulation or single leg stance (Figure 4) that may indicate abductor

Figure 3. Evaluation of hip abductor strength. The patient lies in the lateral decubitus position with the affected side facing up. With the hip and knee extended, the examiner asks the patient to abduct the hip against resistance.[24]

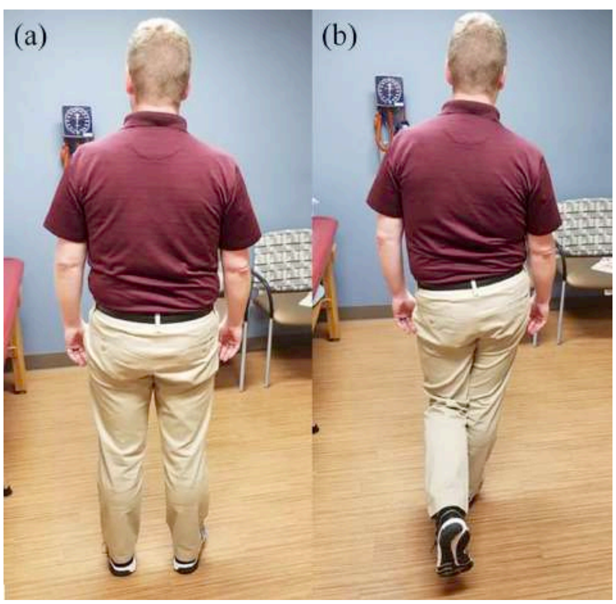

Figure 4. Trendelenburg test. From a (a) standing position, (b) the patient is asked to stand on the affected leg and lift the contralateral foot off the ground. The test is considered positive, if the contralateral pelvis tilts downward, indicating abductor weakness.[27]

weakness. Grimaldi et al.[24] found that tenderness to palpation over the greater trochanter has a high sensitivity, but poor specificity (80% and 47%, respectively) in diagnosing GTPS, whereas tests that involve active abduction have the highest specificity. Pain with abduction against resistance had a sensitivity of 38% and a specificity of 93%, and pain with internal rotation against resistance had a sensitivity of 44% and a specificity of 93%. Single leg stance, which was considered positive with reproduction of pain within 30 s, had a sensitivity of 38% and a specificity of 100% for GTPS. Pain drawings may be considered for identifying subgroups of patients with GTPS and centralized pain, as these patients may require multimodal approaches to management.[26]

Clinical evaluation of GTPS should also focus on determining the specific etiology and severity of GTPS as to inform proper management. Patients with external coxa saltans often have a palpable, and in some cases, observable, snapping of the ITB over the greater trochanter.[13] While patients commonly volunteer to reproduce the snapping, the examiner may reproduce it by placing the patient in the lateral decubitus position and palpating the greater trochanter as the patient actively flexes the hip. The diagnosis is confirmed, if the snapping ceases while applying pressure to the ITB at the level of the greater trochanter.[13]

Abductor tendon tears often present with abnormal gait and weak hip abduction.[7,28] In a review of 24 patients with a clinical diagnosis of GTPS, Bird et al.[7] found that Trendelenburg's sign is the most sensitive (73%) and specific (77%) clinical test in diagnosing partial and full-thickness tears of the gluteus medius tendon. The presence of a Trendelenburg sign has also been associated with an increased need for operative intervention, with an odds ratio up to 15.[28] Lequesne et al.[25] similarly found that the single leg stance has a sensitivity of 100% and a specificity of 97% in diagnosing chronic, treatment-resistant GTPS due to abductor tendon tears.

Differential diagnosis

The differential diagnosis of lateral hip pain is broad. Intra-articular sources include osteoarthritis, avascular necrosis, labral tears, femoroacetabular impingement, femoral neck stress fractures, and loose bodies.[9,22,29] While intra-articular hip pain is often referred to the groin, anterior thigh, and knee, a retrospective analysis of 51 patients with evidence of an intra-articular source of pain found that 27% of patients experienced referred pain over the lateral thigh.[30] Pain associated with osteoarthritis is particularly important to distinguish from GTPS given that these conditions are often comorbid.[6] Fearon et al.[17] compared 41 patients with GTPS and 20 patients with osteoarthritis of the hip. Interestingly, the authors found no difference in Harris hip scores (HHSs) between the two groups, indicating that patients with GTPS and osteoarthritis may experience similar pain and functional impairment. On exam, lateral pain reproduced by the FABER test was able to differentiate GTPS from osteoarthritis with a sensitivity of 81% and a specificity of 82%. Restricted hip passive range of motion and characteristic abnormalities on plain radiographs also differentiate osteoarthritis from GTPS.[22]

In addition to GTPS, extra-articular causes of lateral hip pain include lumbar stenosis and meralgia paresthetica.[9,22]

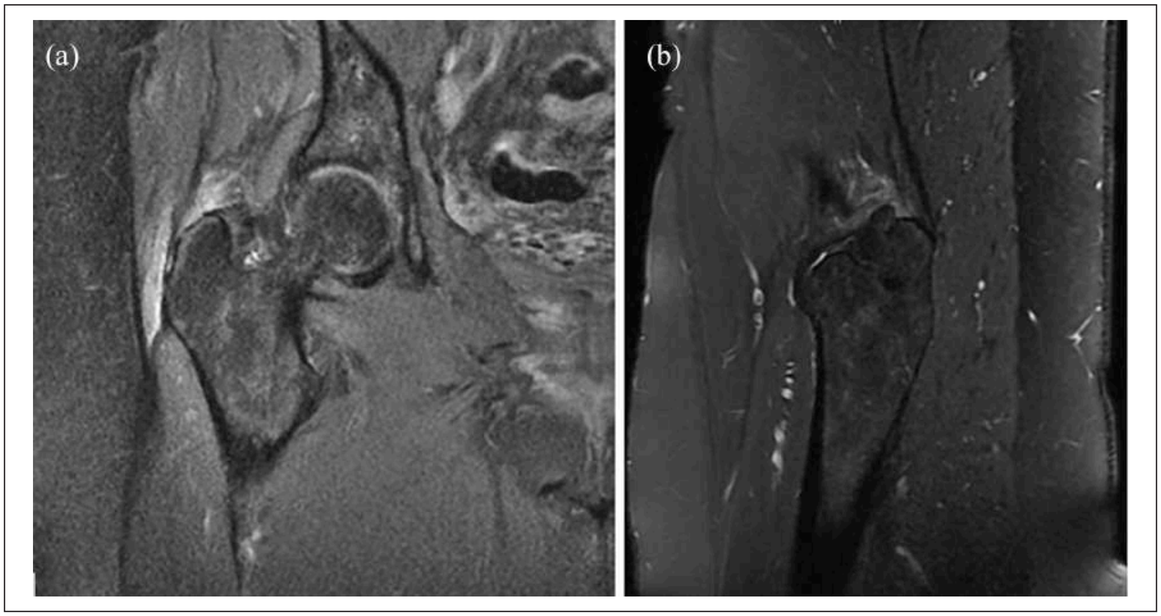

Figure 5. (a) Coronal fat suppressed proton density and (b) sagittal T2-weighted sequences on MRI of the right hip showing a high-grade partial tear of the gluteus medius and minimus tendons with tendinosis and underlying trochanteric bursitis. The patient consented for publication of this imaging.

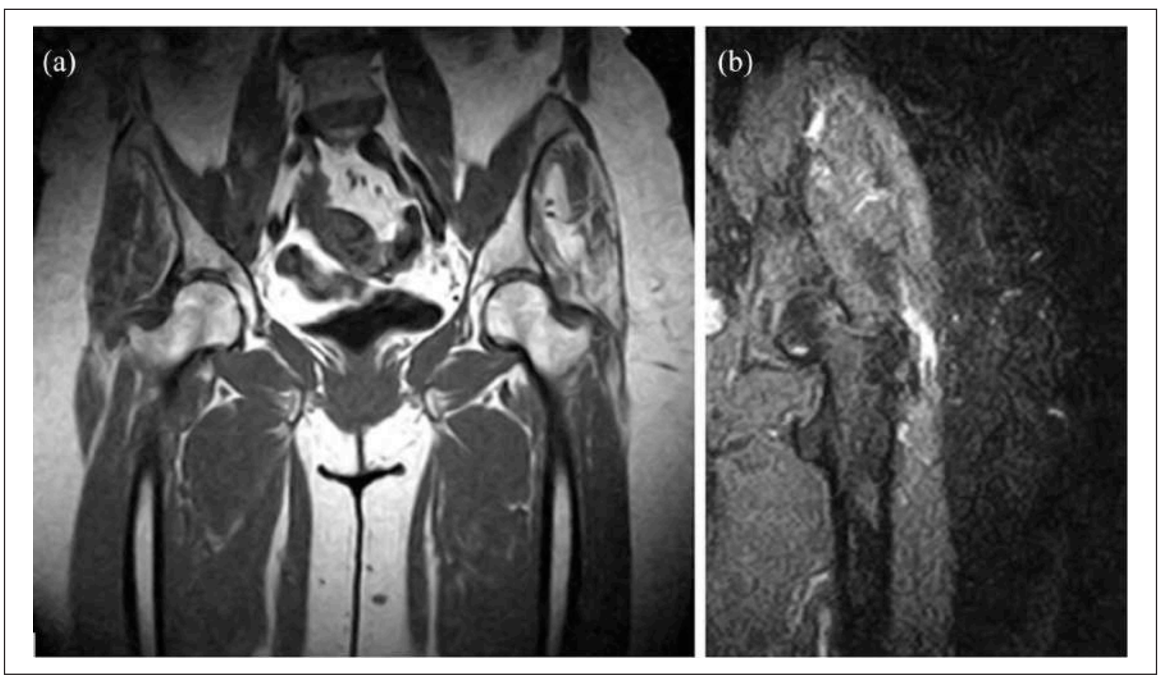

Figure 6. (a) Coronal T1-weighted and (b) short tau inversion recovery (STIR), sequences on MRI with a chronic, full-thickness tear of the left gluteus medius and minimus tendons with significant fatty atrophy of the abductors. The patient consented for publication of this imaging.

Lower extremity radiculopathy resulting from lumbar stenosis can be difficult to distinguish from GTPS; the pattern of referred pain in GTPS can overlap with the distribution of the L2–4 dermatomes; and stenosis can similarly lead to abductor weakness with a Trendelenburg gait.[5,18] The prevalence of GTPS among patients referred to orthopedic spine centers for lower back pain is as high as 51%.[5,18] Lumbar stenosis may be clinically differentiated from GTPS by other characteristic features, including lower back pain, paresthesias, focal weakness, radicular lower extremity pain, and the lack of point tenderness over the greater trochanter.[18] In addition to its therapeutic benefit, peritrochanteric CSI may be used for diagnostic purposes to help differentiate GTPS from other sources of pain.[5,18]

Meralgia paresthetica describes neuropathy of the lateral femoral cutaneous nerve and presents with pain, numbness, and dysesthesia over the anterolateral hip and thigh.[31] Clinical signs that differentiate meralgia paresthetica from GTPS include tenderness to palpation over the lateral inguinal ligament and the presence of Tinel's sign medial and inferior to the anterior superior iliac spine. Administration of a local anesthetic nerve block can help confirm the diagnosis of meralgia paresthetica.[31]

Imaging

Although GTPS is typically a clinical diagnosis, radiographs are routinely obtained to exclude alternative or concomitant pathology, such as osteoarthritis, femoroacetabular impingement, or lumbar spondylosis.[29,32] Greater trochanteric surface irregularities and gluteal tendon calcifications have been described in patients with GTPS.[10,12] One study found that trochanteric enthesophytes protruding greater than 2 mm from the cortical surface on plain radiographs had a positive predictive value of 90% for gluteal tendon abnormalities and peritendinous edema on MRI.[33] However, a recent study found that radiographic surface irregularities are not reliable indicators for clinically diagnosed GTPS, with enthesophytes measuring greater than 2 mm on plain radiographs demonstrating a sensitivity of only 64% and a specificity of 26%.[34] Plain radiographs are primarily useful for the diagnosis of alternative sources of hip pain, including osteoarthritis, avascular necrosis, femoroacetabular impingement, and lumbar spondylosis.

MRI represents the gold standard imaging modality for the diagnosis of GTPS, as studies have shown consistently strong correlations between imaging interpretation and intraoperative findings.[35] In a retrospective evaluation of 74 hips, Cvitanic et al.[36] reported MRI to be 91% accurate in diagnosing abductor tears, with a sensitivity of 93% and a specificity of 92%. Characteristic findings of complete tears of the gluteal tendons include disruption of the tendons with or without retraction, muscle atrophy, and fatty degeneration (Figures 5 and 6).[7,33] Partial tears exhibit attenuation or thinning of the tendons on T1-weighted imaging and associated increased signal intensity on T2-weighted imaging. Tendinopathy in the absence of tears is marked by tendon thickening or increased signal intensity on T2-weighted imaging. Associated bursal involvement is characterized by bursal distention and inflammation.[7] Importantly, MRI evidence of peritrochanteric edema and bursal fluid is commonly present in asymptomatic hips, with detection rates as high as 65%–88%.[4,37] This underscores the importance of a thorough clinical evaluation in the diagnosis of GTPS. Given the variable pathology of GTPS, it is recommended that MRI is obtained and correlated with clinical findings prior to pursuing operative management.[32]

Ultrasonography has also been shown to be effective in the diagnosis of GTPS, with a sensitivity of 79% and 61% for the diagnosis of gluteal tendon tears and bursa pathology, respectively.[38] Characteristic findings of gluteal tendon tears include partial or full-thickness anechoic defects within the tendon.[3,39] Loss of muscle bulk and increased echogenicity due to fatty degeneration may also be present. Tendinosis is marked by heterogeneous echogenicity and tendon thickening with or without calcifications. In addition, bursal fluid collections and thickening may be observed.[3,39] A recent systematic review of 13 studies found significant variance in the definitions and diagnostic criteria used to identify GTPS pathology with ultrasound.[40] The lack of a standardized diagnostic criteria not only contributes to the varying prevalence of bursitis, tendinopathy, and abductor tendon tears reported in the literature, but also make ultrasound a less reliable diagnostic modality when precise diagnosis of the underlying pathology is needed (e.g. prior to surgical intervention).

Dynamic evaluation with sonography may also be useful in the workup of lateral hip pain, including confirming the diagnosis of external coxa saltans.[41] Sonographic evaluation offers several advantages, including low cost and the ability to accurately localize and administer CSIs.[35,38]

Nonoperative management

First-line treatment of GTPS is conservative in nature, and most patients respond to a combination of activity modification, physical therapy, NSAIDs, and CSIs.[42] Furia et al.[43] reported on a group of 33 patients with GTPS treated conservatively for a minimum of 6 months and found significant improvements in mean HHS and visual analogue scale (VAS) pain scores for up to 12 months. In addition, five of the six patients who worked in occupations that require intensive physical activity were able to resume their prior employment. Mellor et al.[44] found that 79% of patients treated with activity modification and exercise therapy reported global improvement in their condition at 1 year compared with 52% of patients managed with observation alone.

In a systematic review evaluating the efficacy of CSI in the treatment of GTPS, the rates of pain improvement and return to baseline activity level ranged from 49% to 100%.[42] Shbeeb et al.[45] found that CSI effectively relieved pain associated with GTPS in 77% of patients at 1 week and 61% of patients at 6 months. In a randomized clinical trial of 120 patients comparing analgesics and physical therapy with analgesics and physical therapy in combination with CSI, Brinks et al.[46] reported that 55% of the CSI group had strongly or fully recovered at 3 months compared with 34% of the solely analgesics and physical therapy group. Patients who received CSI also reported significantly greater improvement in pain compared with the controls. However, at 12-month follow-up, both groups experienced similar rates of pain improvement and recovery. In summary, injections appear to be an effective and safe treatment for GTPS and are associated with a low complication rate, with local pain, skin irritation, and swelling being the most commonly reported complications.[42]

Extracorporeal shock wave therapy (ESWT) has demonstrated promising results in several studies. Ramon et al.[47] conducted a randomized clinical trial of 103 patients with GTPS assigned to receive either three weekly sessions of ESWT plus an exercise protocol or the same protocol with sham ESWT. After 2 months, the mean VAS score improved by 4.3 in the ESWT group compared with 1.6 in the control group ($p < 0.001$). Moreover, clinical and functional outcomes were significantly higher in the EWST group for up to 6 months. Furia et al.[43] similarly found that mean HHS and VAS scores improved significantly for up to 12 months in GTPS patients treated with ESWT compared with traditional conservative management. Regarding longer term relief, ESWT may be more effective than CSI. Rompe et al.[48] conducted a randomized trial comparing ESWT, home exercise therapy, and CSI in patients with GTPS. At 1 month, CSI had a 75% success rate in patient-reported recovery, compared with 13% ($p < 0.001$) and 7% ($p < 0.001$) for the ESWT and exercise therapy groups, respectively. However, this trend was reversed at 15 months, with success rates of 48% in the CSI group compared with 74% ($p = 0.01$) and 80% ($p < 0.001$) for the ESWT and home exercise therapy groups, respectively.

Evidence supporting the use of platelet-rich plasma (PRP) injections in the treatment of GTPS is limited. In a systematic review of five articles and four published abstracts comprising 209 patients treated with PRP injections, Ali et al.[49] concluded that PRP represents a potentially viable treatment, although current evidence is based on small sample, low-quality studies. Three randomized controlled trials were included in the analysis.[50–52] Fitzpatrick et al.[50] found that PRP injections were associated with a significantly greater improvement in the modified HHS than CSI at 3 months (20 versus 13, respectively, $p = 0.048$). However, Ribeiro et al.[51] found that PRP injections provided no benefit compared with CSI in terms of HHS, Western Ontario and McMaster Universities Osteoarthritis Index, and Facial Expression Pain Scale scores at 2 months. Finally, Jacobson et al.[52] compared the efficacy of PRP injections and percutaneous gluteal tendon fenestration. While mean patient-reported pain scores were significantly improved in both groups, there was no significant difference between the treatments up to 3 months.

A recent randomized clinical trial of 24 patients with GTPS compared PRP injections with CSI over a 2-year follow-up period.[53] At 1 month, the CSI group showed significantly greater improvement in pain and function than the PRP group, with HHS improvements of 33 and 25 points, respectively ($p < 0.05$), and VAS score improvements of 4.6 and 2.6 points, respectively ($p < 0.05$), compared with the pre-injection baseline scores. However, at 2-year follow-up, patients who received a CSI returned to their pre-injection HHS and VAS scores, whereas the PRP group experienced sustained improvements of 40 and 5.7 points, respectively ($p < 0.05$ for both). Future, larger scale prospective studies are warranted to adequately evaluate any benefit of PRP in the treatment of GTPS.

Operative management

Operative management of GTPS is typically reserved for patients with persistent symptoms for a minimum of 6–12 months and who remain refractory to conservative therapy.[10] Prior to surgery, an MRI should be obtained to guide appropriate management for the specific source of pain.[10] Several case series have described open and endoscopic bursectomy with or without ITB release for the treatment of trochanteric bursitis and gluteal tendinopathy with good results.[11,32,54–58] A similar operative technique has been described for external coxa saltans.[14,59,60] For partial and full-thickness tears of the abductor tendons, both open and endoscopic bursectomy and tendon repair have been described.[61–64] Tendon augmentation with allografts or muscle transfer are typically reserved for cases of significant tendon retraction or severe muscle atrophy.[62,65]

Trochanteric bursitis and gluteal tendinopathy

In most case series, both open and endoscopic treatment of GTPS with associated trochanteric bursitis and gluteal tendinopathy involves bursectomy with or without ITB release. ITB release can take many forms, including a T-shaped incision, longitudinal release, fenestration, or Z-plasty. Brooker[58] described open bursectomy and ITB release via fenestration or T-shaped incision in a series of five patients. All patients had near-normal function at 1-year follow-up, with a mean improvement in HHS of 42 points. In another study reporting outcomes of open bursectomy and longitudinal release of the ITB in seven hips with a mean follow-up of 20 months, the mean HHS improved by 43 points and all patients were satisfied with their outcome.[57] Craig et al.[32] performed open bursectomy and Z-plasty of the ITB on 17 hips in 15 patients with a mean follow-up of 47 months. Complete resolution of symptoms was reported in eight hips (47%), partial relief was reported in eight hips (47%), and one patient (6%) reported no benefit. Two patients (12%) experienced complications that required reoperation: one patient had poor initial results and an MRI detected a large tear in the gluteus minimus that was subsequently repaired, and another developed a seroma that resolved with incision and drainage. Although less commonly performed, one study reported outcomes of 37 patients treated with open bursectomy alone at a mean follow-up of 25 months.[56] The mean modified Japanese Orthopedic Association hip score improved by 32 points and the VAS score improved by 3.4 points. In patients with GTPS after total hip arthroplasty, however, outcomes following bursectomy are significantly less favorable than in patients with idiopathic GTPS.[66,67] Robertson-Waters et al.[66] found that only 18% of patients experienced sustained pain relief at median 34-month follow-up and 22% experienced no improvement at all. The authors reported a reoperation rate of 11% and a complication rate of 13%, including one patient who developed a postoperative wound infection that progressed to a periprosthetic joint infection.

While no directly comparative studies have been performed to date, endoscopic approaches have also been described with satisfactory results.[11,54,55] In a series of 57 hips in 49 patients who underwent endoscopic bursectomy with longitudinal ITB release with a mean follow-up of 21 months, Oxford hip scores improved by 17 points, VAS scores improved by 5, and the mean International Hip Outcome Tool (iHOT-33) score improved by 46 points.[55] Similarly, Baker et al.[54] reported outcomes in 25 patients treated with endoscopic bursectomy and longitudinal release of the ITB. The mean HHS improved by 26 points and VAS scores improved by 4.1 at 1 year postoperatively. One patient developed a seroma that resolved with incision and drainage, and another experienced continued pain that ultimately resolved with open bursectomy. Govaert et al.[11] performed endoscopic bursectomy and transverse release of the ITB in five patients with a follow-up of 6 weeks. All patients reported significant improvement in pain and function, with one patient requiring operative evacuation of a large hematoma. Endoscopic surgery offers the obvious advantage of a minimally invasive approach, and theoretically should permit faster recovery. However, additional studies with standardized outcome reporting are needed to compare the safety and efficacy of the two methods.

External coxa saltans

Several case series have similarly described successful operative treatment of external coxa saltans with open or endoscopic bursectomy and ITB release.[14,59,60,68] In one study describing open Z-plasty of the ITB in nine hips with a mean follow-up of 23 months, all patients had complete resolution of snapping and seven patients had complete resolution of pain and returned to normal function.[59] One patient experienced persistent groin pain. Zoltan et al.[60] described open bursectomy and ITB release via an elliptical-shaped resection of the ITB in seven patients. All patients reported resolution of snapping and returned to normal function within 6–8 weeks of treatment, although one patient required a second operation to resect an anterior portion of the ITB that was causing continued impingement and pain. Ilizaliturri et al.[14] reported on 11 patients treated with endoscopic bursectomy and a diamond-shaped resection of the ITB at 2-year follow-up. Ten patients (91%) had complete resolution of snapping and pain, and one patient had persistent mild and painless snapping that did not require subsequent revision.

One retrospective review compared outcomes of open versus endoscopic release of gluteus maximus contracture bands in 92 patients at a minimum 2-year follow-up.[68] At 2 years postoperatively, mean HHSs improved by 18 points and maximum hip adduction increased by 13 degrees in both the open and endoscopic groups. There was no difference in the rate of recurrence, with four patients in each group experiencing mild, painless snapping that did not require revision. However, when compared with the open approach, endoscopic release was associated with smaller incisions, lower postoperative VAS pain scores, and a lower complication rate (2% versus 16%, $p = 0.048$). Of note, this study was not randomized and patients were not enrolled prospectively, and therefore, outcomes may be subject to selection bias.

Gluteal tendon tears

Multiple case series have described open or endoscopic repair of partial and full-thickness gluteal tendon tears.[61–64,69] Walsh et al.[61] reported on 72 patients treated with open repair for full-thickness tears at 1-year follow-up. The mean Merle d'Aubigné–Postel hip score improved by 6 points, and 95% of patients reported minimal or no pain. While only 5% of patients had a normal gait preoperatively, 78% had a normal gait at 6 months postoperatively, and 22% demonstrated a slight to moderate limp. The overall complication rate was 19%, including six patients (8%) with deep vein thrombosis and three (4%) with hematomas, one of which required antibiotic treatment for a subsequent infection. Four patients (6%) avulsed the tendon from the suture repair within 6 weeks of the operation, of which two were attributed to acute falls. The remaining two patients (3%) began weight-bearing without crutches prior to the recommended 6 weeks. Davies et al.[62] also described results of open repair of partial and full-thickness tears in 23 hips. The mean HHS and mean Lower Extremity Activity Scale (LEAS) improved by 35 and 2.2 points at 1-year follow-up, respectively. Mean abductor strength on a 5-point scale improved by 1.6. While there was no significant difference in clinical outcomes based on the severity of tear, the three patients who experienced poor outcomes were among those with the largest tears. Two patients experienced retears, both following falls.

Several case studies have also described endoscopic repair of abductor tendon tears with similar outcomes.[63,64,69] McCormick et al.[63] reported on 10 patients who underwent endoscopic repair of full-thickness tears with a mean follow-up of 23 months. The authors did not report preoperative scores, but the mean postoperative modified HHS, hip outcome score-activities of daily living (HOS-ADL) subscale and the hip outcomes score-sports-specific subscale (HOS-SSS) were 84.7, 89.1, and

76.8, respectively, and all patients demonstrated increased abductor strength (mean improvement of 1.3 points). All patients reported normal or near-normal levels of functioning postoperatively, and there were no surgical complications. Hartigan et al.[64] performed endoscopic repair of partial thickness undersurface tears of the gluteus medius in 25 patients with a mean follow-up of 33 months. Significant improvements were noted in the mean modified HHS (21 points), HOS-ADL (31 points), HOS-SSS (37 points), non-arthritic hip score (NAHS, 30 points), and VAS scores (4.4 points). Twelve of 14 patients (86%) with a Trendelenburg gait preoperatively regained a normal gait, and there were no surgical complications. Alpaugh et al.[70] systematically reviewed eight articles, including 135 patients treated with open repair and 39 treated with endoscopic repair of gluteal tendon tears. No significant differences in outcomes were noted between the two techniques. However, complication rates were higher in patients undergoing open repair (13% versus 3%), including a retear rate of 9% after open repair compared with 0% after endoscopic repair.

Gluteal tendon augmentation

Thaunat et al.[69] found significantly greater improvement after endoscopic gluteal tendon repair in hips with less fatty atrophy. Unsurprisingly, this indicates that abductor tendon tears may benefit from early surgical repair prior to the development of fatty degeneration. In patients with chronic, full-thickness tears of the abductor tendons, significant retraction or fatty muscle atrophy may preclude successful tendon repair.[62] For chronic tears without severe muscle atrophy, reconstruction techniques with allograft tendons have been described.[62,65] Fehm et al.[65] reported on abductor reconstruction using an Achilles tendon allograft in seven patients with avulsion of the gluteal tendons after total hip arthroplasty. At a minimum 2-year follow-up, the mean HHS improved by 51 points, and the mean Harris pain subscale score improved by 28 points. While six patients used a walker or cane full-time preoperatively, only two patients required a cane full-time at final follow-up, and an additional two used a cane only for long walks. Other authors have utilized a synthetic graft for gluteal tendon augmentation with similarly effective results.[71]

When significant abductor muscle atrophy is present, transfer of the gluteus maximus and tensor fascia lata to the greater trochanter has been reported with good results.[72–74] Whiteside[72] reported on 11 patients with abductor deficiency associated with total hip arthroplasty who underwent this procedure with a mean follow-up of 33 months. Preoperatively, all patients had a positive Trendelenburg sign and were unable to abduct the symptomatic hip against gravity. At last follow-up, nine patients (82%) demonstrated strong abduction strength and had a negative Trendelenburg sign. Other studies have subsequently replicated this procedure with reliable return of abductor strength and resolution of the associated pain and Trendelenburg gait.[73,74] Although muscle transfer is generally an effective procedure, Ruckenstuhl et al.[74] reported a gluteal maximus flap rupture in 1/16 patients (6%).

Limitations

While gaps in the literature regarding the management of GTPS continue to be addressed, the lack of standardized outcome reporting limits cross-study comparisons. Accordingly, there is no definitive evidence to support a standardized management algorithm or the superiority of any single treatment for GTPS. As a result, many physicians rely on experience and training to guide their management, rather than published evidence. In addition, the literature addressing operative management of GTPS is primarily comprised small case series, with only a minority of studies directly comparing postoperative outcomes with preoperative baseline measures. Therefore, the outcomes described in this review may be biased. Finally, as a narrative review, the present study includes a selection of studies that the authors felt were most relevant to our topic and goals. However, without comprehensively identifying, compiling and comparing all studies on GTPS, as in a systematic review, there remains the possibility of excluding studies with more controversial findings. Large, randomized trials with standardized, validated outcome measures are needed to further determine optimal management of GTPS.

Conclusion

GTPS encompasses a spectrum of pathologies, including trochanteric bursitis, external coxa saltans, and abductor tendinopathy and tears. Given this heterogeneity as well as the high rate of comorbid conditions, diagnosis can be challenging. Proper evaluation relies primarily on careful clinical examination. Traditional nonoperative management with activity modification, physical therapy, NSAIDs, and CSI remains the mainstay of treatment. While limited data on ESWT and PRP appear promising, large, randomized trials are required to better understand their role in managing GTPS. In patients with chronic symptoms refractory to conservative therapy, both open and endoscopic operative techniques have demonstrated excellent outcomes.

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