Greater Trochanteric Pain Syndrome: A Review of Anatomy, Diagnosis and Treatment

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Greater trochanteric pain syndrome (GTPS) is a term used to describe chronic pain overlying the lateral aspect of the hip. This regional pain syndrome, once described as trochanteric bursitis, often mimics pain generated from other sources, including, but not limited to myofascial pain, degenerative joint disease, and spinal pathology. The incidence of greater trochanteric pain is reported to be approximately 1.8 patients per 1000 per year with the prevalence being higher in women, and patients with coexisting low back pain, osteoarthritis, iliotibial band tenderness, and obesity.

Symptoms of GTPS consist of persistent pain in the lateral hip radiating along the lateral aspect of the thigh to the knee and occasionally below the knee and/or buttock. Physical examination reveals point tenderness in the posterolateral area of the greater trochanter. Most cases of GTPS are self-limited with conservative measures, such as physical therapy, weight loss, nonsteroidal antiinflammatory drugs and behavior modification, providing resolution of symptoms. Other treatment modalities include bursa or lateral hip injections performed with corticosteroid and local anesthetic. More invasive surgical interventions have anecdotally been reported to provide pain relief when conservative treatment modalities fail.

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Greater trochanteric pain syndrome (GTPS) is estimated to affect between 10% and 25% of the population in industrialized societies.[1–3] Considering the prevalence, frequent misconceptions that surround the condition and elemental limitations in diagnosis and treatment, the relative paucity of studies and reviews published on this topic is somewhat surprising. To address this knowledge gap, we have undertaken a comprehensive, evidence-based review of the literature with the purpose of critically evaluating the epidemiology, etiology, diagnosis, and treatment of GTPS. Articles reviewed were obtained via MEDLINE and OVID search engines, book chapters, and bibliographic references dating to the early 1900s.

Trochanteric bursitis (TB) is a term used to describe chronic, intermittent pain accompanied by tenderness to palpation overlying the lateral aspect of the hip.[4,5] First described by Stegemann in 1923, TB has been referred to as the "Great Mimicker" because it is frequently mistaken for other conditions.[6,7] Yet, the term "trochanteric bursitis" may in fact be a misnomer given that three of the cardinal symptoms of inflammation, erythema, edema and rubor, are uncommon.[5,8] More than 50 years ago, Leonard[9] proposed using the phrase "trochanteric syndrome" to refer to symptoms in the vicinity of the trochanter major. The term "greater trochanteric pain syndrome" may better characterize the condition because pain and reproducible tenderness in the region of the greater trochanter (GT), buttock or lateral thigh, may be associated with myriad other causes such as tendinitis, muscle tears, trigger points, iliotibial band disorders (ITB), and general or localized pathology in surrounding tissues.[10] GTPS, which to some extent has already replaced TB as the most frequent designator for chronic lateral hip pain in light of the inherent difficulties in elucidating the true etiology of symptoms, can most accurately be described as a regional pain syndrome that often mimics pain generated from other sources, including, but not limited to, myofascial pain, degenerative joint disease, and spinal pathology.

ANATOMY

Bursae are fluid-filled sacs that provide cushioning between bony prominences and the surrounding soft tissues. Overlying the lateral aspect of the greater femoral trochanter, the trochanteric bursae are commonly implicated as a cause of lateral hip pain.[11] Four bursae have been consistently described outside the GT, with three being present in most individuals. These bursae serve to provide cushioning for the gluteus tendons, ITB, and tensor fascia latae.[5] Figure 1 illustrates the relationship of the various bursae to the bony landmarks.

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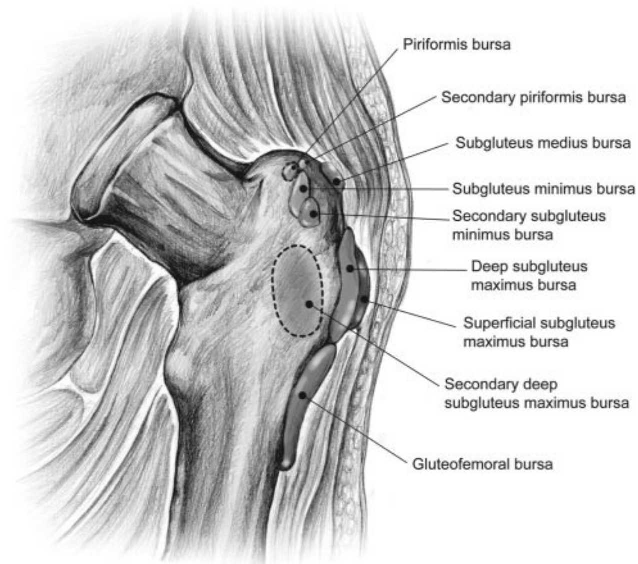

Figure 1. Bursae of the Left Greater Trochanter (anterior view). The dotted lines indicate posterior location. Drawing by Olive Chung.

The gluteus minimus bursa is a minor bursa located cephalad and ventral to the GT. The two major bursae are the subgluteus maximus and subgluteus medius bursae. The subgluteus maximus bursa is located lateral to the GT, juxtaposed between the gluteus medius tendon and the gluteus maximus muscle. This largest of the greater trochanteric bursae is most frequently incriminated in GTPS. In an anatomical study by Dunn et al.,[12] the authors found at least one subgluteus maximus bursa present in 13 of 16 dissected cadaver hips. In each of the 13 specimens containing a subgluteus maximus bursa, the largest bursa was found to lie just superficial to the common attachment of the gluteus medius, minimus and vastus lateralis muscles onto the lateral surface of the GT. This was referred to as the "deep" subgluteus maximus bursa or "deep dominant" bursa if there were more than two in the same tissue plane. In five specimens, at least one secondary subgluteus maximus bursa was present. This smaller, "superficial" subgluteus maximus bursa tended to be present deep within the surface of the gluteus maximus muscle, near to where the fibers inserted into the fascia lata. In 2 of the 16 hip specimens, deep and 2 superficial subgluteus maximus bursae were identified.

Woodley et al.[13] investigated the bursae deep to the tendons of each of the gluteal muscles (gluteus maximus, gluteus medius, and gluteus minimus) in 18 embalmed human hips (Table 1). Four different bursae were located deep to the gluteus maximus (deep, secondary deep, superficial subgluteus maximus, and gluteofemoral bursae). The deep subgluteus maximus bursa, often referred to as the "trochanteric bursa," was positioned deep to the fascia lata and the gluteus maximus muscle; it was present in 16 of the 18 specimens. The secondary deep subgluteus maximus bursa was present in the same plane as the dominant deep subgluteus maximus bursa, posterior to the dominant deep bursa, in 6 of 18 specimens. In 8 of the 16 specimens the superficial subgluteus maximus bursa was positioned superficial to the deep bursa and was attached to overlying tissues during dissection. The gluteofemoral bursa was present in 17 of 18 hips but was associated with the GT in only 10 of 18 specimens.

In these cases, the gluteofemoral bursa was positioned caudal to the GT and deep and superficial subgluteus bursae, and adhered to the ITB in the area where the tendinous fibers of the gluteus maximus inserted. Deep to the gluteus medius tendon, on the anterior surface of the GT, three bursae were located. The two major bursae were the anterior subgluteus medius bursa, found in 16 of 18 specimens, and the piriformis bursa, identified in 15 of 18 hips. A secondary piriformis bursa was found in 4 of 18 hips. The anterior subgluteus medius bursa was generally located deep to the gluteus medius tendon, and anterior to the piriformis bursa and apex of the GT. The piriformis bursa (a.k.a. posterior subgluteus medius bursa) tended to be found at the insertion of the piriformis muscle at the apex of the GT. Two bursae were identified deep to the gluteus minimus tendon: the primary and secondary subgluteus minimus bursae. The primary subgluteus minimus bursa was present in 15 of 18 hips, located deep to the anterior border of the gluteus minimus tendon as it inserted onto the anterior aspect of the GT, near its apex. The secondary subgluteus minimus bursa, found in 7 of 18 specimens, was usually found deep to the tendinous insertion of the gluteus minimus onto the anterolateral aspect of the GT. In summary, whereas three bursae are consistently described in the region of the GT, many secondary bursae may be present. The large and inconsistent number of bursae, combined with their variable location and unpredictable referral patterns from other potential pain generators in the area, such as the buttock, groin, and low back, may contribute to the frequent misdiagnosis of GTPS and the variable response to injection therapy.

EPIDEMIOLOGY

In the United States, 10%–20% of the adults aged 60 yr or older reported hip pain on a majority of days over the previous 6 wk,[14] and 2.5% of all sports-related injuries involve the hip.[15] In primary care settings, the incidence of greater trochanteric pain is reported to be around 1.8 patients per 1000 per year.[2] Hip pain occurs in all age groups, but is more prevalent between the fourth and sixth decades of life.[5] Although most studies suggest a female predominance (3–4:1),[1,10,16–18] others have not found a gender predilection.[19] The presence of low back pain (LBP) seems to predispose patients to hip pain. The prevalence of GTPS in adults with musculoskeletal LBP has been reported to range between 20% and 35%.[1,10,20] In a large, multicenter, cross-sectional study involving 3026 middle-age to elderly adults, Segal et al.[1] found the prevalence of GTPS to be 17.6%, being higher in women

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Table 1. Location and Size of Bursae of the Greater Trochanter[13]

Bursae	Dimensions cephalocaudad height (cm)	Dimensions ventrodorsal width (cm)	Area (cm^2)	Center position relative to greater trochanter
Subgluteus maximus bursae				Centered over the greater trochanter
Deep subgluteus maximus	3.8 ± 1.3	3.3 ± 0.8	9.7 ± 4.2	
Superficial subgluteus maximus	2.5 ± 0.6	1.9 ± 0.4	3.7 ± 1.5	
Secondary deep subgluteus maximus	2.7 ± 1.1	2.0 ± 0.7	4.1 ± 2.1	
Gluteofemoral	5.6 ± 1.2	2.9 ± 0.9	9.9 ± 4.2	Inferolateral
Subgluteus medius bursae				Anterosuperior
Anterior subgluteus medius	1.2 ± 0.5	1.0 ± 0.4	1.0 ± 0.7	
Piriformis (posterior subgluteus medius)	1.2 ± 0.4	1.0 ± 0.3	0.9 ± 0.4	Posterosuperior
Secondary piriformis	1.1 ± 0.5	0.8 ± 0.3	0.8 ± 0.6	
Subgluteus minimus bursae				Anterolateral
Subgluteus minimus	2.1 ± 0.9	1.6 ± 0.4	2.7 ± 1.7	
Secondary subgluteus minimus	1.5 ± 0.4	0.9 ± 0.3	1.1 ± 0.6	

Adapted from Woodley SJ, Mercer SR, Nicholson HD. Morphology of the bursae associated with the greater trochanter of the femur. J Bone Joint Surg Am 2008;90:284–94.

Table 2. Conditions Associated with Greater Trochanteric Pain Syndrome[5,20]

Ipsilateral and/or contralateral hip arthritis
Lumbar spine degenerative osteoarthritis
Lumber spine degenerative disk disease
Chronic mechanical low-back pain
Rheumatoid arthritis
Leg length discrepancy
Post surgical lumbar disk disease
Radiculopathy or other neurologic sequelae
Obesity
Fibromyalgia
Iliotibial band (snapping hip) syndrome
Total hip arthroplasty
Lower limb amputation
Pes Planus

Adapted from Shbeeb MI, Matteson EL. Trochanteric bursitis (greater trochanteric pain syndrome). Mayo Clin Proc 1996;71:565–9. Collee G, Dijkmans BA, Vandenbroucke JP, Rozing PM, Cats A. A clinical epidemiological study in low back pain. Description of two clinical syndromes. Br J Rheumatol 1990;29:354–7.

and patients with coexisting LBP, osteoarthritis (OA), ITB tenderness, and obesity. Further confounding prevalence estimates is the observation that many conditions that predispose patients to GTPS can also simulate the condition (Table 2). In a retrospective analysis of 247 patients referred to an orthopedic spine center for LBP, Tortolani et al.[10] found that 62.7% of patients with GTPS had previously been evaluated by a spine surgeon for suspected radicular symptoms. In a prospective, observational study involving 100 consecutive patients with rheumatoid arthritis, Raman and Haslock[21] found that 15% of patients had concomitant GTPS. The higher reported incidence in women, and patients with leg length discrepancies, LBP and knee pain, suggest that altered lower-limb biomechanics and abnormal force vectors across the hip may predispose patients to GTPS.[1]

MECHANISM OF INJURY

Many risk factors have been associated with GTPS, including age, female gender, ipsilateral ITB pain, knee OA, obesity, and LBP.[1,22] In an observational study, Schapira et al.[23] found that 91.6% of patients diagnosed with TB had other associated pathological conditions, such as peripheral OA, rheumatoid arthritis, and lumbosacral OA. The increased prevalence in women may be attributed to altered biomechanics associated with differences in the size, shape, and orientation of the pelvis (gynecoid vs android), and its relationship with the ITB. Obesity may be a contributing risk factor by the combined effect of increased stress on the hip joint, hip and knee OA and LBP.[1]

Because TB can result from friction between the bursae and GT, it frequently occurs with overuse or trauma, especially falls.[5,24] However, misdiagnosis is common. In a retrospective review of magnetic resonance imaging (MRI) obtained in 24 patients with lateral hip pain and tenderness, whereas nearly all patients had gluteus medius abnormalities, radiological evidence of bursitis was relatively uncommon, occurring in only 8% of cases.[25] True bursal inflammation (bursitis) may result from either chronic microtrauma, regional muscle dysfunction, overuse or acute injury.[5,24,26] The gluteus medius and minimus muscles are the major abductors of the hip and have been implicated in GTPS. The main tendon of the gluteus medius muscle attaches to the postero-superior aspect of the GT, with the lateral tendon inserting into the lateral aspect. The gluteus minimus muscle attaches to the anterior facet of the GT.[27] Consequently, inflammation and tears of either the gluteus medius or minimus muscles, or their tendinous insertions, from tension imposed by the ITB and/or frictional trauma from overuse, may result in GTPS. Conditions other than actual bursal inflammation and gluteal tendinopathy that may result in lateral hip pain include gluteus medius muscle dysfunction, ITB syndrome, meralgia paresthetica, OA, and lumbar spine disorders.[1,22] Specific etiologies of GTPS include repetitive activity, acute trauma, crystal deposition and infection, especially tuberculosis.[1,28,29] When an inciting event can be identified, the initial pathology usually occurs at tendinous attachments to the GT, with secondary involvement of adjacent bursae.[19] In cases of acute trauma or the presence of other risk factors, extra caution should be exercised so that a more serious condition, such as femoral neck stress fracture or avascular necrosis is not

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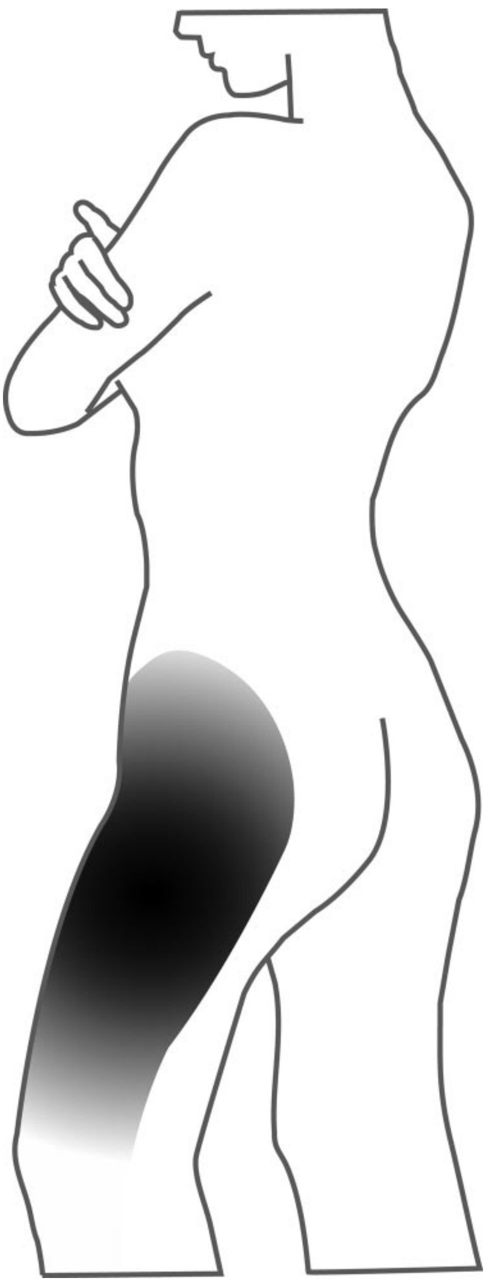

Figure 2. The typical pain referral pattern in greater trochanteric pain syndrome. The most common referral pattern extends from the darkest to the lightest regions. Drawing by Olive Chung.

misdiagnosed as TB.[24,30] Whereas bursal inflammation is often considered by lay practitioners to be the sole pathology in cases of GTPS, one small case-control study conducted in five patients who underwent total hip arthroplasty found no pathological differences in bursal specimens between three control patients without clinical TB, and two who met criteria for the disorder.[18]

EVALUATION

Symptoms

GTPS typically presents as chronic, persistent pain in the lateral hip and/or buttock that is exacerbated by lying on the affected side, with prolonged standing or transitioning to a standing position, sitting with the affected leg crossed and with climbing stairs, running or other high impact activities. Approximately, 50% of patients experience pain radiating along the lateral aspect of the thigh to the knee, and occasionally below the knee.[19] Invariably, there is tenderness along the lateral or posterior aspect of the GT.[5,18] Pain extending to the groin or down the lateral thigh that mimics lumbar disk herniation (i.e., pseudoradiculopathy) may be reported by some individuals.[10,22] Pain radiation patterns may complicate the diagnosis of GTPS because of anatomical overlap with the iliotibial tract and mid-lumbar dermatomes (L2–4)[10] (Fig. 2). Not only nerve roots, but radiation patterns from other structures in the lumbar spine, including the zygapophysial joints, sacroiliac joint, and intervertebral discs and ligaments, can replicate TB.[31–33] In addition, damage to the nerve supply of surrounding structures may elicit neuropathic symptoms that can simulate GTPS. These nerve structures include the inferior gluteal nerve, which innervates the gluteus maximus muscles and is formed from the ventral rami of spinal nerves L5–S2, and the superior gluteal nerve, which derives from the L4–S1 nerve roots and innervates the superior aspect of the femoral neck, tensor fascia lata, and the gluteus medius and minimus muscles.[12] Regional pain syndromes, such as tendinosis and tears of the gluteus medius or minimus muscles, must also be considered in the differential diagnosis.

Table 3. Criteria for Diagnosis of Trochanteric Bursitis[35]

Lateral hip pain
Distinct tenderness about the greater trochanter
Pain at the extreme of rotation, abduction, or adduction, especially positive Patrick-FABERE test
Pain on hip abduction against resistance
Pseudoradiculopathy–pain radiating down the lateral aspect of the thigh
Patrick-FABERE (Flexion, abduction, external rotation, extension)

Adapted from Ege Rasmussen KJ, Fano N. Trochanteric bursitis. Treatment by corticosteroid injection. Scand J Rheumatol 1985;14:417–20.

Need first 2 criteria plus one of the remaining criteria to make diagnosis.

Physical Examination

The physical examination of a patient with GTPS characteristically reveals point tenderness ("jump sign") in the posterolateral area of the GT.[10] Typically, this will be at either the site of the gluteus medius tendon insertion[5,16,19] or in a more cephalad position overlying the insertion of the gluteus minimus tendon on a ridge lateral to the anterior triangular area of the GT.[19,34] Table 3 describes the initial criteria established by Ege Rasmussen and Fano[35] for a diagnosis of TB. The initial criteria for TB did not account for the many bursae at the GT nor the tendonitis that may represent the pain generator at the lateral hip. Pain reproduction can be accomplished by active resistance to abduction and external rotation, and sometimes by internal rotation. Rarely is pain reproduced by hip extension. In contrast,

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Table 4. History and Physical Examination Finding in Hip Pain[11,46–48]

	Condition	History and symptoms	Physical examination findings
Anterior hip	Osteoarthritis	Gradual onset of thigh/groin pain worsened with weight bearing	Limited range of motion secondary to pain
		Referred pain to anterior hip and the inguinal-groin or lateral hip area	Positive patrick's test
		Hip joint stiffness most significant after brief periods of rest and inactivity	Significant hip joint pain frequently noted at end range of motion, particularly in the internal and external rotation planes
		Hip pain often relieved significantly with prolonged rest	Antalgic gait
	Avascular necrosis of femoral head	Dull ache in groin, thigh and buttock	Hip range of motion and gait should be normal unless the necrotic process is advanced
		Groin or hip pain that is nonspecific	Anteroposterior and lateral radiographs of both hips are essential
		Systemic corticosteroid use and heavy alcohol use are the most common underlying factors	
	Iliopsoas bursitis	Anterior hip pain, associated snapping sensation	Tenderness with deep palpation over femoral triangle
			Positive snapping maneuver
Lateral hip	Greater trochanteric pain syndrome	Female:male 4:1	Point tenderness over greater trochanter
		Fourth to sixth decade Spontaneous, gradual onset of lateral hip pain	
	Gluteus medius muscle dysfunction	Gradual onset of lateral hip pain	Pain with resisted hip abduction
			Tender over gluteus medius muscle
			Positive trendelenburg test
	Iliotibial Band syndrome/ external snapping Hip	Lateral hip pain with or without snapping during walking, jogging or cycling	A positive Ober's test with a tight iliotibial band
		Sharp or burning lateral knee pain that is aggravated during repetitive activity	
	Meralgia paresthetica	Numbness, tingling, and burning pain over anteroloateral hip and thigh	Pressure over nerve may reproduce dysesthesias in the distribution of lateral femoral cutaneous nerve
		Aggravated by extension of hip and with walking	
Posterior hip	Lumbar radiculopathy	History of low back pain	Pain reproduced with isolated lumbar flexion or extension
		Radicular symptoms or history consistent with spinal stenosis	Major muscle weakness is in relation to the nerve root involved (L3–hip flexors, L4–knee extensors and hip adductors, L5–hip abductors, knee flexors, ankle dorsiflexors, and foot everters and inverters; and S1–ankle plantar flexors
		Location of the pain depends on the nerve root involved (L4–anterior thigh, anterior or medial knee, and medial leg pain, L5–buttocks and anterolateral leg pain, S1–posterior thigh and calf pain)	
	Sacroiliac joint dysfunction	Pain or tenderness over the posterior buttock pain radiating into the buttock, groin, posterior proximal thigh, and occasionally, lower leg	Pelvic asymmetry found on exam
			Positive Gaenslen's test
			Positive Gillet's test
			Positive Patrick's test
			Positive Yeoman's test
			Positive shear test
	Hip extensor or rotator muscle strain	History of overuse or acute injury	Pain with resisted muscle testing
		Tenderness over gluteal muscles	

Adapted from Margo K, Drezner J, Motzkin D. Evaluation and management of hip pain: an algorithmic approach. J Fam Pract 2003;52:607–17. Frontera WR, Silver JK, and MD. Consult LLC. Essentials of Physical Medicine and Rehabilitation, 2002. DeLee J, Drez D, Miller MD. DeLe and Drez's Orthopedic Sports Medicine, 2003. Benzon HT, Raja SN, Molloy RE, Liu SS, Fishman SM, eds. Essentials of Pain Medicine and Regional Anesthesia. 2nd ed. Elsevier Churchill-Livingstone, 2005;358–9.

intraarticular disease is frequently characterized by pain elicited with flexion and extension of the hip.[36] Causes of lateral hip pain, such as ITB syndrome and meralgia paresthetica, are common regional pain syndromes that can be differentiated from GTPS by physical examination signs, such as a positive Ober's test and sensory deficits, respectively (Table 4 and Appendix). Aside from point tenderness at the lateral hip, there are a paucity of signs with high specificity for GTPS.[25] Bird et al.[25] conducted a prospective study in 24 patients with a clinical diagnosis of GTPS assessing the correlation between MRI and physical examination findings. Physical examination signs evaluated for their association with MRI results included Trendelenburg's sign and pain provoked by resisted hip abduction and internal rotation. Overall, 15 patients were found to have gluteus

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Table 5. Assessing Accuracy of History, Physical Examination and Radiological Imagining in the Diagnosis of Lateral Hip Pain

Author, year	Study type	Number and type of patients	Diagnostic standard	Results	Comments
Lequesne et al., 2008[49]	Prospective observational study assess the value of single-leg stance held for 30 s on the affected leg and resisted external derotation in the diagnosis of GTPS	17 patients with refractory GTPS	MR imaging in transverse, coronal and sagittal planes of hip/pelvis confirming tendonitis of gluteal medius tendon, disruption of tendon or bursitis of subgluteal subgluteus medius and minimus bursa	Single-leg stance found to have 100% sensitivity and 97.3% specificity; resisted external derotation had 88.0% sensitivity and 97.3% specificity	Single-leg stance producing similarly reported pain and external derotation show high diagnostic accuracy for GTPS
Bird et al., 2001[25]	Prospective observational study assessing the prevalence of gluteus medius pathology by utilizing magnetic resonance imaging (MRI), and to evaluate the presence of Trendelenburg's sign, pain on resisted hip abduction, and pain on resisted hip internal rotation as predictors of a gluteus medius tear	24 patients with symptoms of GTPS	MR imaging in axial and coronal planes of the affected hip assessing the gluteus medius and minimus tendons (tendonitis & tears); subgluteus maximus and subgluteus medius bursae (bursitis)	A positive Trendelenburg's sign provided the highest sensitivity (72.7%) and specificity (76.9%) in predicting a gluteus medius tear (partial or complete)	Pain on resisted hip abduction sensitivity 72.7%, specificity 46.2%; pain on resisted hip internal rotation sensitivity 54.5%, specificity 69.2% in predicting a gluteus medius tear (partial or complete)
Anderson P, 1958[16]	Prospective observational (review)	45 patients with primarily lateral hip pain or pain radiating to the lateral hip	Intermittent, aching pain at lateral aspect of the hip	Tenderness about the greater trochanter in 91% of subjects	In all cases pain either about the lateral hip or radiated to the lateral hip
Karpinski, MRK, Piggott H, 1985[50]	Prospective observational, evaluating objective evidence of bursitis	15 patients with tenderness at the tip of the greater trochanter	Radiographs of the hip	Twelve patients with normal radiographs and 3 patients with minimal soft tissue calcification	Bursitis (inflammation of the lateral hip bursa) is absent in many patients with trochanteric bursitis
Schapira D, 1986[23]	Prospective observational	72 patients with mechanical lateral upper thigh pain	Strict criteria based clinical diagnosis (described by Little, 1979)	Trochanteric bursitis was associated with other pathologic conditions in 91.6% of patients	Local corticosteroid infiltration proved to be treatment of choice as well as a diagnostic test
Tortolani PJ, 2002[10]	Retrospective prevalence study in patients with low back pain	247 patients with low back pain	50% reduction of pain with anesthetic steroid and five clinical examination criteria	Twenty percent of patients referred for low back pain to tertiary care surgical spine specialists were diagnosed with GTPS	Symptoms of GTPS may be vague and mimic LBP. Radiation of pain along the iliotibial tract can mimic nerve root irritation

GTPS = greater trochanteric pain syndrome; LBP = low back pain; MR = magnetic resonance; MRI = magnetic resonance imaging.

medius tendonitis, 11 patients had a gluteus medius tear, two patients had trochanteric bursal distension, and one had avascular necrosis of the femoral head. Trendelenburg's test was noted to be the most accurate test in detecting a tendon tear, with a sensitivity of 73% and a specificity of 77%. It was also found to have the highest reliability of the three physical signs.[25] Yet, despite its long-standing history and high prevalence rate, few studies have evaluated the association between physical examination findings and trochanteric bursa pathology (Table 5).

TREATMENT

Most cases of GTPS are self-limiting and tend to resolve with conservative measures, such as nonsteroidal antiinflammatory drugs, ice, weight loss, physical therapy, and behavior modification that aim to improve flexibility, muscle strengthening and joint mechanics while decreasing pain. These modifications and alternative activities that decrease precipitating motions but allow patients to remain active may speed recovery.[29] When these interventions fail, bursa or lateral hip injections performed with corticosteroid and local anesthetics have been shown to provide pain relief, with response rates ranging from 60% to 100%.[17,19,35–38] Although there are no placebo-controlled trials evaluating the efficacy of corticosteroid injection therapy, several prospective studies have been published[36] (Table 6). In an open observational study, Shbeeb et al.[36] found landmark-guided corticosteroid injections to be effective in 77% of patients 1 wk after injection, and 61% of patients 6-mo

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Table 6. Clinical Studies Evaluating Corticosteroid Injections for Lateral Hip Pain

Author, year	Study type	Number and type of patients	Treatment	Primary outcome	Comments
Shbeeb MI, et al., 1996[36]	Prospective observational, evaluating a single local corticosteroid injection	75 patients with clinical diagnosis of trochanteric bursitis	Single local corticosteroid (6, 12, or 24 mg betamethasone) and local anesthetic (1% lidocaine) injection	77%, 68%, and 61% or responding patients reported improvement on a visual analog scale for pain at weeks 1, 6, 26	Local glucocorticosteroid injection for trochanteric bursitis provides effective, prolonged benefit
Ege Rasmussen KJ, Fano N, 1985[35]	Prospective, observational evaluating the effectiveness of local corticosteroid injections	33 patients with a clinical diagnosis of trochanteric bursitis	One to three local corticosteroid (40–80 mg methylprednisolone or 20–40 mg triamcinolone) injections	Nine of 33 patients relapsed at an average of 23.2 mo	Local glucocorticosteroid injection for trochanteric bursitis provides effective, prolonged benefit
Cohen et al., 2005[37]	Prospective observational, evaluating the accuracy of blind trochanteric bursa injections	40 patients with diagnosis of trochanteric bursitis	Single local corticosteroid (80 mg depomedrol) and local anesthetic (15 mg bupivacaine) injection	The greater trochanter was contacted in 78% of cases and a bursagram obtained in 45% of patients on the first needle placement. Treatment outcomes not noted	Fluoroscopy was necessary to ensure the spread of injectant into the targeted bursa
Cohen et al., 2009 (BMJ, accepted for publication)	Randomized controlled study comparing fluoroscopically-guided to "blind" trochanteric bursa injections	65 patients with a clinical diagnosis of trochanteric bursitis	Patients randomized to receive either a "blind" or fluoroscopically-guided injection with corticosteroid and local anesthetic	47% of subjects who received "blind" injections and 41% who received fluoroscopically-guided injections experienced >50% pain relief lasting at least 3 mo. No difference in outcomes between intra- and extra-bursal injections	The use of fluoroscopy does not improve outcomes for trochanteric bursa injections

postprocedure. Symptom persistence after corticosteroid and local anesthetic injection may indicate other etiologies, including other bursae involvement, tendonitis, misdiagnosis, inaccurate needle placement, or recurrence of symptoms.[37,39] In patients who obtain short-term relief from local anesthetic infiltration, but fail to experience long-term benefit from the corticosteroid, the possibility of a noninflammatory contributor, such as peripheral or central sensitization, should be entertained. When recurrence of lateral hip pain develops after a previous strong response, injections may be repeated with similar effect.[40] In patients who fail conservative treatment, surgical intervention has been advocated. This recalcitrant TB can sometimes be addressed with arthroscopic bursectomy and/or ITB release.[6] In a prospective study, Baker et al.[41] investigated the effectiveness of arthroscopic trochanteric bursectomy for recalcitrant TB in 30 patients. The mean pain score improved from a visual analog scale score of 7.2 preoperatively to 3.1 at final follow-up (mean, 26.1 mo). In another prospective study, Craig et al.[42] evaluated ITB lengthening for refractory TB in 15 patients (17 hips) with a mean follow-up of 47 mo. Complete resolution of symptoms was reported in 8 of 17 patients, partial relief occurred in 8 patients, and 1 patient experienced no benefit.

Similar to other interventional procedures,[43–45] fluoroscopy has been advocated for trochanteric bursa injections to confirm appropriate needle placement.[37] Cohen et al.[37] sought to determine the accuracy of landmark-guided trochanteric bursa injections by using fluoroscopy to discern injectate spread. Among the

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40 patients enrolled in the study, a bursagram was obtained during the initial injection in only 45% of cases. Not surprisingly, a trend was noted whereby accuracy was found to be positively correlated with experience level. In a follow-up multicenter randomized study, Cohen et al. (BMJ, accepted for publication) allocated 65 patients with clinical TB to receive either landmark (i.e., blinded) or fluoroscopically guided corticosteroid and local anesthetic bursa injections. No significant differences were noted in 3-mo outcomes between the blinded and fluoroscopically guided groups, nor were differences appreciated between intra- and extra-bursal injections. Conceivably, targeting the bursa with fluoroscopy may actually be counterproductive in those patients without true bursal inflammation. Extra-bursal injections may be more likely to occur in patients with diffuse tenderness, distorted anatomy, and high Body Mass Indexes.[37]

CONCLUSIONS

The myriad etiologies that can result in posterolateral hip pain and the inherent difficulties involved in diagnosing the pain generator have led to the term GTPS supplanting "TB." Between 10% and 20% of adults report persistent hip pain, with the prevalence of GTPS increasing to between 20% and 35% in people with LBP. Inflammation of the bursal structures at the lateral hip was once proposed to be the sole etiology in the condition, but imaging and histological evaluations have demonstrated that this accounts for only a minority of cases. It is now recognized that other conditions, such as gluteal tendinopathy and small muscle tears, account for a large percentage of GTPS.

GTPS typically presents as chronic pain in the lateral hip pain and/or buttock that is exacerbated by various positions and maneuvers. Many patients experience pain radiating along the lateral aspect of the thigh to the knee, which is often confused with lumbar spinal pathology. The diagnosis of GTPS is based on history and physical examination findings, which include point tenderness at the lateral hip and a positive response to provocative testing.

Examination tools such as Ober's test, Thomas test, and straight leg raising may assist in determining the etiology of the posterolateral hip pain.

The treatment of GTPS initially involves conservative therapy, such as physical therapy, weight loss, nonsteroidal antiinflammatory drugs, and behavior modification. When pain persists, TB injections done with local

APPENDIX.

Common Tests Utilized in Evaluation of Lateral Hip Pain

Point tenderness at greater trochanter	The patient is in standing or supine position. Point tenderness is elicited at the ipsilateral greater trochanter. If lateral hip pain is elicited—Greater trochanteric pain syndrome may be present.
Resisted active abduction	The patient is in the supine position with the affected hip at 45° abduction. A positive test results if the patient indicates replication of symptoms over the greater trochanter on resisted active abduction. If lateral hip pain is elicited—Greater trochanteric pain syndrome may be present.
Resisted internal rotation test	The patient is in the supine position and the affected hip at 45° flexion and maximal external rotation. The test result is as positive if the patient indicates replication of symptoms over the greater trochanter on resisted active internal rotation. If lateral hip pain is elicited—Greater trochanteric pain syndrome may be present.
Ober's testing	The patient is in the lateral position with the unaffected side down. The affected leg is passively extended and lowered to the table. If lateral hip pain is elicited or iliotibial band tightness—Iliotibial band syndrome may be present.
Patrick (Fabere) testing	The patient is in the supine position with the affected leg flexed, abducted, and externally rotated with the ankle resting on the thigh of the unaffected leg. One hand is placed on the anterior superior iliac spine of the unaffected side, while the other hand applies downward pressure on the affected leg. The test result is positive if the patient indicates pain about the affected hip. Pain may also be elicited at or about the sacroiliac joint indicating sacroiliac joint dysfunction.
Sacroiliac (Posterior) shear test	The patient is in the prone position and palm of the examiner's hand is placed over the posterior iliac wing, and an inferiorly directed thrust produces a shearing force across the sacroiliac joint (SIJ). If SIJ pain is elicited—SIJ dysfunction may be present.
Yeoman's test	The patient is in the prone position and palm of the examiner's hand is placed at the anterior aspect of the knee and the other hand rotates the ilium by downward pressure at the crest of the ilium. If SIJ pain is elicited—SIJ dysfunction may be present.
Gillet's test	The patient stands with the feet apart and the clinician places one thumb on the posterior superior iliac spine (PSIS) of the side to be tested and the other thumb on the sacral base. The patient flexes the hip and knee to 90° on the side being tested. The test result is positive if the PSIS moves superiorly—Sacroiliac joint dysfunction may be present.
Thomas test	The patient lies supine and flexes the unaffected hip, holding the knee to the chest. The test result is positive if the patient's other leg will rise off the table—Sacroiliac joint dysfunction may be present.
Trendelenburg's testing	The patient stands on the affected leg and raises the unaffected leg to 30–90°. A pelvic tilt below the level of the stance side indicates a positive test—Gluteus medius muscle dysfunction may be present.
Straight leg raise	The patient lies supine and the affected extremity raised straight up. The test result is positive if the patient complains of pain in the extremity (not the back) typically in a specific nerve root distribution—Lumbar radiculopathy may be present.

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anesthetic and corticosteroid can provide intermediate-term relief. Severe cases of refractory GTPS can also be treated with surgical intervention.

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