PAIN IN THE LATERAL HIP AND ITB

DIAGNOSES AND REHABILITATION

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This article provides a review of the common diagnoses of lateral hip and ITB pain and rehabilitation techniques with reference to the anatomical structures involved.

COMMON DIAGNOSES

Clients presenting with pain around the greater trochanter (GT) on the outer (lateral) aspect of the hip are often seen in the clinic. Typical conditions include iliotibial band syndrome (ITBS), external snapping hip, gluteus medius tendinopathy, and greater trochanteric pain syndrome (GTPS). These diagnoses really refer to the same structures and may occur separately or in association with hip impingement (femoroacetabular impingement or FAI), degenerative changes to the joint, and labral conditions. In these latter conditions the quality of movement at the hip changes and, in turn, muscle function is altered giving primary pain anteriorly and secondary pain laterally. Low back conditions may also refer pain into the lateral thigh so screening tests should rule out the low back as a cause of pain. To understand lateral hip pain and treat it successfully we need to examine the structure and function of the area.

APPLIED ANATOMY

Hip joint

Alignment of the pelvis on the femur (femoral pelvic alignment) during single-leg standing is maintained by a balance of the compression forces created by weight-bearing activities, and those of the lateral hip structures. The hip can be thought of as a pivot – like a seesaw – with the client's body weight acting on one side and muscle force on the other.

This set-up subjects the hip joint to considerable forces when weight-bearing. When standing on one leg, forces between 1.8–3.0 times body weight occur, and in walking these increase to 3.3–5.5 times body weight (1). The femoral head is smaller in females while the pelvis is wider. This configuration changes leverage to significantly reduce the mechanical advantage of the abductor muscles (Fig. 1). With a lower mechanical advantage the muscles must work harder to maintain hip alignment, and this increased muscle work acting over a smaller head size results in greater femoral head pressures in females (2), perhaps explaining why the incidence of GTPS has been cited as four times greater in females than in males (3).

Lateral musculature

The lateral muscles are arranged in three layers (Table 1),

Figure 1: The iliotibial band.

which control the femoral head (ball) within the acetabulum (socket) and stabilise the pelvis on the femur. Joint stability is said to be better produced by those muscles lying close to the axis of rotation of the joint (4), and in the case of the hip it is the deep lateral rotators that have this role. The iliacus muscle is normally thought of as an anterior structure, but it actually consists of two sets of fibres with the lateral portion more active in torque production (twisting) and the medial fibres being linked to stability. This stability role is emphasised by the fact that the medial fibres are predominantly slow twitch in nature. The ilocapsularis (also called iliacus minor) is a small muscle that lies beneath the rectus femoris and attaches directly to the joint capsule. It functions to tighten the joint capsule and has been shown to degrade in cases of hip dysplasia (5,6).

TABLE 1: MUSCLE LAYERS OF THE LATERAL HIP

Layer	Muscles	Function
1. Deep	Gluteus minimus	■ Primary stabiliser functioning to control femoral head within acetabulum ■ Proprioceptive role
2. Intermediate	Gluteus medius, piriformis	■ Significant torque producers ■ Secondary stabiliser ■ Low load control of pelvis on femur
3. Superficial	Tenor fascia lata (TFL), gluteus maximus, vastus lateralis	■ Primary torque producers ■ High load control of pelvis on femur

The gluteus medius has three distinct layers (7) each with a separate nerve supply. Although the gluteus medius is often considered the primary hip stabiliser and targeted by clam shell type actions, physiologically it is unable to stabilise the pelvis on the femur in single-leg standing by itself. It has been calculated (8) that the abduction forces responsible for this are divided between the gluteus medius (70%) and the muscles attaching to the ITB (30%). The upper portion of gluteus maximus and the tensor fascia lata (TFL) both attach into the ITB and the vastus lateralis may also be considered through its fascial attachment (9).

Of the hip lateral rotator group it is actually the quadratus femoris (QF) which is of significant interest in terms of joint stability. It shows a greater reduction in muscle volume, wasting by 18% after 6 weeks bed-rest, compared to only 4% for the gluteus medius (10).

The lateral muscles are separated from each other and underlying structures by four main bursae (Table 2) each with deep, superficial and/or secondary portions.

Iliotibial band

The deep fascia of the lower limb is collectively called the fascia lata. It attaches to the outer lip of the iliac crest along its full length, and throws branches to the sacrotuberous ligament, the ischial tuberosity and the pubis, effectively surrounding the upper thigh. On the lateral aspect of the thigh, this fascia is thickened to form the iliotibial band (ITB). The gluteus maximus and gluteus medius muscles insert into the ITB posteriorly and the TFL muscle inserts anteriorly. As the ITB travels down the lateral side of the thigh its deep fibres attach to the linea aspera of the femur, forming the medial and lateral intermuscular septa. The superficial fibres of the ITB continue downwards to attach to the lateral femoral condyle, lateral patellar retinaculum and anterolateral aspect of the tibial condyle (Gerdy's tubercle). A large amount of the lateral retinaculum of the patella actually arises from the ITB to form the iliopatellar band (11) having a direct effect on patellar tracking.

Contraction of the gluteus medius and TFL is transmitted by the ITB to control and decelerate adduction of the thigh (12). Where the gluteus medius shows poor endurance and control, gait alteration may occur leading to lateral pain. In a study of distance runners (14 male, 10 female) with ITBS, significant weakness of the gluteus medius was found on the symptomatic side. Strengthening the muscle over a 6-week period resulted in 92% of the runners being pain free (13).

Muscle balance tests for the lower limb (4,14) often show a reduction in abduction endurance by the gluteus medius compensation by over activity of the tightening of the TFL-ITB. Although both the gluteus medius and the TFL are able to abduct the femur, the TFL will also medially rotate the hip while the postural posterior portion of the gluteus medius is a lateral rotator (15S). As a consequence, dependence on the TFL alone for abduction power during gait causes excessive medial rotation and adduction of the hip increasing the valgus stress on the limb and therefore increasing passive tension in the ITB.

TABLE 2: BURSAE AROUND THE GREATER TROCHANTER (GT)*

Name of bursa	Position relative to GT	Approximate size (cm²)
■ Gluteus maximus	■ Lateral	■ 10–15
■ Gluteofemoral	■ Caudal	■ 10–15
■ Gluteus medius	■ Anterior to apex	■ 1.0–1.7
■ Gluteus minimus	■ Anterolateral	■ 2.7–4.4

*Data modified from Woodley et al., 2008 (26) and Williams and Cohen, 2009 (2)

REHABILITATION

Assessing lumbo-pelvic alignment

The Trendelenburg test is often used in the clinic to assess control of the pelvis on the femur in single-leg standing, so is perhaps the test most relevant to lateral hip pain. With a positive test, as body weight is taken through one leg, the pelvis dips downwards away from the weight-bearing leg (Figure 2). This is known clinically as an uncompensated positive result. A compensated positive result occurs if the body is tilted (side flexed) towards the weight-bearing leg (Figure 3). A further modification of the test is to ask the client to elevate the non-weight-bearing side of the pelvis (Figure 4) and to hold this position for 30 seconds. This modification assesses the postural endurance of the lateral hip muscles. The test is positive if the client is unable to maximally elevate the pelvis or maintain the elevation for the 30 seconds (16).

The Trendelenburg test is not muscle-specific but it does give information about the client's self-selected movement pattern that will be influenced by factors such as pain, habit and energy expenditure as well as muscle performance. Where subjects habitually hang on the hip (single-leg dominant swayback posture) the hip abductors muscles will lengthen, meaning that the Trendelenburg test cannot be held in optimal alignment. Clinically, then, it is useful to check that your client can firstly perform the test, but secondly hold the test position.

Exercise therapy

Rehabilitation (described in 3 phases) aims to correct the movement dysfunction that may be considered as a major factor in the development of lateral hip pain. Initially, our treatment aim is to lengthen the tight lateral structures and

Figure 2: The Trendelenburg test is often used in the clinic to assess control of the pelvis on the femur in single-leg standing, so is perhaps the most relevant test to lateral hip pain. With a positive test, as body weight is taken through one leg, the pelvis dips downwards away from the weight-bearing leg.

Figure 3: A compensated positive result occurs if the body is tilted (side flexed) towards the weight-bearing leg.

Figure 4: A further modification of the test is to ask the client to elevate the non-weight-bearing side of the pelvis.

begin building the endurance of the hip stabilising muscles (phase I). Next, general hip and lumbo-pelvic alignment is enhanced with an emphasis on controlling the weight shift especially during single-leg standing (phase II). Finally, more sport-specific actions are used to build control of the hip in functional sports actions (phase III). Clinically there is much overlap between each rehab stage and the order of exercise application will be dictated by your client's symptoms.

Rehabilitation can focus on pain relief, lengthening tight tissues that restrict correct movement, re-training muscle which is underperforming (strength / endurance / power), and enhancing whole body and segmental alignment. Where pain is a dominant feature its relief is vital as it will have a significant effect on the quality of movement. In many cases trigger points within a tight muscle may be a dominant feature in the production of pain, and so tightness is targeted in this case. Overload of tissues and / or joints can lead to inflammation and pain making posture the lead feature.

Targeting the ITB

Often with lateral hip pain, the ITB becomes the focus of attention (17). Stretching the ITB is a subject of considerable debate. As the band attaches directly to the femur via the intermuscular septa, lengthening it would seem impossible (18). However, clinically, patients with ITBS do respond to stretching exercises showing increased range of motion, reduced pain and an alteration in tissue tension to palpation. It is suggested, therefore, that the superficial portion has some independence from the deeper portions.

An effective ITB stretch must combine movement in three regions: the pelvis, hip, and knee. In order to stretch the ITB, hip adduction and extension on a fixed pelvis must be combined with knee extension. Justification for this joint positioning is that ITBS occurs when the gluteus medius shows poor endurance, and single-leg standing is supported by action of the TFL. This muscle is overworked and develops painful trigger points. To limit the pelvis tipping laterally, the muscle tone increases and the muscle 'shortens', or more accurately becomes overactive in its outer range. As the TFL is placed anteriorly, a position of hip extension will stretch it. The ITB passes over the knee to attach into the head of the fibula and lateral fascia covering the knee. This tissue is placed on stretch when the knee is extended and tension is taken from it as the knee is flexed. Combining hip adduction-extension with knee extension will, therefore, optimally stretch the ITB. However, stretch will be taken off the fascia if false hip adduction is performed. This can occur in the side lying position (Figure 5) if the pelvis tilts laterally allowing the anterior superior iliac spine (ASIS) to move caudally.

To perform an effective ITB stretch the pelvis must remain fixed. The Ober test position (19) is chosen in the first instance, with the affected leg uppermost. Initially the leg is abducted (45° to the horizontal) and extended (10–15° behind the bodyline). The underside of the trunk is then pressed into the floor and kept in this position throughout the exercise. The upper leg is then lowered back towards the horizontal while maintaining the extended leg position. A useful visual cue is for the subject to look down towards their foot. If they can see their patella, the extension has been lost, if they cannot, the leg is extended and the view of the patella is blocked by the front of the pelvis. A tactile cue that may be used is to place a folded towel between the

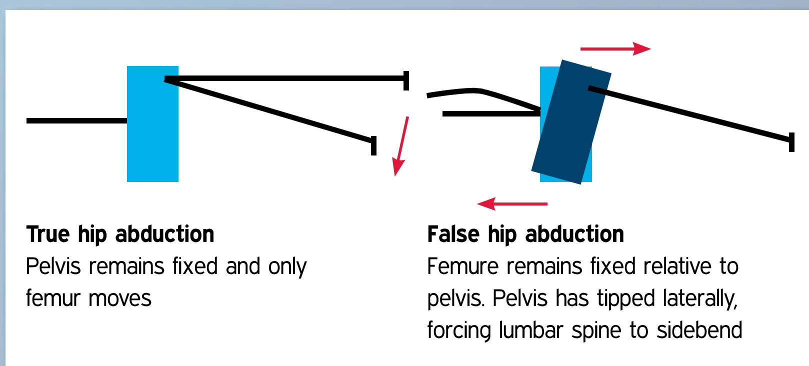
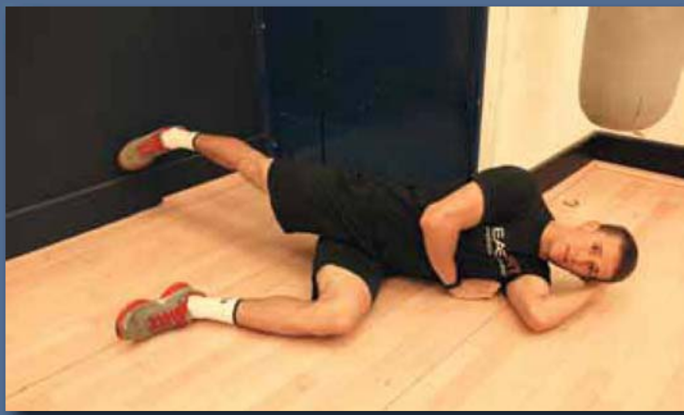


Figure 5: False hip abduction in side lying. [Figure taken from Norris 2004 (17)]

Figure 6: ITB stretch using Ober test position

a: ITB stretch using Ober test position – start



b: ITB stretch using Ober test position – finish

Figure 7: Upper ITB fascial release. (Reproduced with permission from Complete Guide to Clinical Massage, A & C Black, 2013)

Figure 8: Lower ITB fascial release. (Reproduced with permission from Complete Guide to Clinical Massage, A & C Black, 2013)

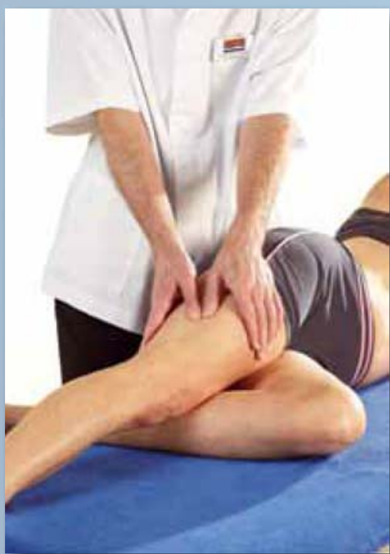


Figure 9: Abductor muscle acupressure. (Reproduced with permission from Complete Guide to Clinical Massage, A & C Black, 2013)

floor and the side of the body, just above the pelvis. The aim is to press down hard on the towel throughout the exercise (Figure 6).

The Ober stretch targets the whole of the ITB. However, where trigger points are present within the TFL-ITB, clinical massage techniques are used to reduce pain and tissue tension prior to stretching.

Clinical massage techniques

The following techniques are taken from Norris, 2013 (20) to which the reader is referred for further details.

Upper ITB fascial release

To release fascia tension in the upper portion of the ITB begin with your client lying on their side with their affected leg on top (Figure 7). Their knee is bent to 90° with the side of their knee resting on the treatment couch. Fix their leg with your left hand (flat) and use the edge of your right forearm as your massage tool. Apply deep massage to the ITB from the greater trochanter downwards. Also address the tensor fascia lata muscle in front of the trochanter and the front portion of the gluteus maximus behind. Search out trigger points in both muscles. For the TFL the trigger point is often found midway between the trochanter and the iliac crest and for the gluteus maximus, in the space between the trochanter and the sacrum. You may find it more comfortable for you to sit (perch) on the couch below your client's knee where light local pressure is applied. Consider also that if your client has a very tight ITB, the side lying starting position may be uncomfortable. If so, begin with their knee supported on a folded towel or block (yoga block). As the ITB tension releases you may find their knee lowers and you no longer need the block.

Lower ITB fascial release

Have your client lie on their back and bend their unaffected left leg. Move their affected right leg across the couch into adduction and hold the crossed left leg over it. Stand to your client's left side (Figure 8). Using the curved fingers on one hand drawn into a straight line supported by your other hand, reach across your client's leg and apply deep transverse frictions (DTF) and specific soft tissue mobilisation (SSTM). For DTF draw your hands towards you (upwards and across the body) to contour the leg. For SSTM hook your fingers beneath the ITB and draw it towards you bending the fascia. Hold the stretched position for 30–60 seconds. If you find this position uncomfortable for SSTM, use the side lying position of Upper ITB release. To access the lower ITB use the little finger side (pisiform grip) of your hand. Remember that the ITB is a thick, tough structure so work into it gradually. It may take 3–4 minutes before your notice any change in tissue tension.

Abductor muscle acupressure

To reduce pain and tension in ITB consider applying acupressure, a technique which applies sustained pressure over the acupuncture points travelling in a painful area [see also Norris, 2003 (21)]. For the lateral hip, the upper leg should rest on a cushion/pillow in a horizontal position. For greater stretch it may be lowered to couch level (Figure 9). Use your thumbs or knuckle as your massage contact.

The acupressure points on the lateral aspect of the thigh lie on the gallbladder (GB) meridian. The most important points for ITB tightness are GB-29 lying at the midpoint of a line joining the anterior superior iliac spine (ASIS) and the greater trochanter, GB-31 seven finger breaths up (proximal) from the outer knee joint line, and GB-34 in front and slightly below the head of the fibula (Figure 10). Press each of the points in turn using a steadily increasing pressure. Maintain the pressure for 30–40 seconds and then release. If you have very flexible thumbs, use your knuckle to apply the technique to avoid stress on your thumb tissues, or select an appropriate massage tool.

Working the lateral stabilising muscles

In parallel with releasing and then stretching the TFL-ITB, the lateral stabilising muscles must be enhanced. Several authors have described lack of inner range holding to be the major dysfunction of this area (15,22). Here, the muscle is unable to hold the femur in a fully abducted (inner range) position over a prolonged period of time, normally up to 10 repetitions holding each for 10 seconds. To enhance this ability the subject begins lying on the side with the affected leg uppermost, hip and knee flexed. Keeping the feet together, the aim is to lift the knee without allowing any trunk rotation. Many subjects with ITBS find this end position of the exercise difficult to achieve. In this case, a training partner is used to lift the leg into position and the subject tries to slowly lower the leg back to the starting position (eccentric control). Once this can be performed in a controlled fashion for 5 repetitions, the subject should begin the movement by holding the leg in the upper position (full inner range) again for 5 seconds (isometric control). Finally, the subject lifts the leg (concentric control), holds it in its upper position (isometric control) and lowers it slowly (eccentric control). Once this movement can be performed for 5–10 repetitions, the subject can progress to phase (II) of the rehabilitation programme. This clam shell position has both advantages and disadvantages. By flexing the knee and hip the lever arm

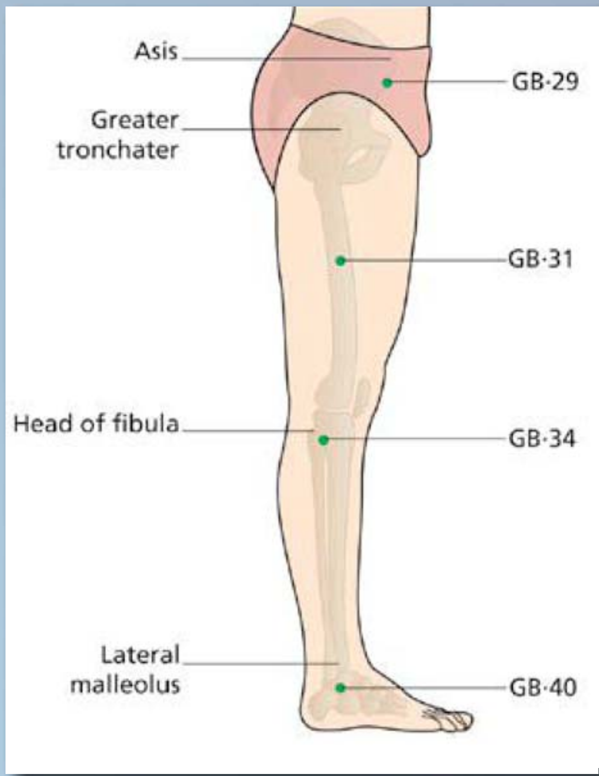


***Figure 10:* Gallbladder acupuncture points on the lateral leg. (Reproduced with permission from Complete Guide to Clinical Massage, A & C Black, 2013)**

of the leg is reduced making the action easier to achieve for the client. However the non-weight-bearing starting position with the hip–knee flexion does not mimic the functional straight leg weight-bearing position. It is important therefore to progress from the clam shell muscle isolation action to weight-bearing whole body movement as soon as the client is able (Figure 11).

Figure 11: Clam shell using tactile cueing.

"THE HIP CAN BE THOUGHT OF AS A PIVOT – LIKE A SEESAW – WITH THE CLIENT'S BODY WEIGHT ACTING ON ONE SIDE AND MUSCLE FORCE ON THE OTHER"

> IN A STUDY OF DISTANCE RUNNERS WITH ITBS, SIGNIFICANT WEAKNESS OF THE GLUTEUS MEDIUS WAS FOUND ON THE SYMPTOMATIC SIDE

Figure 12: Exercises begin with weight-shift actions moving the pelvis to the affected side while keeping it level and avoiding any hip 'dipping'.

12a: Weight shift – normal standing

12b: Weight shift to left leg

12c: Weight shift to left leg, right leg bends

12d: Weight shift to left leg, left hip beginning to dip

12e: Close up of pelvis in normal alignment in standing

12f: Close up of weight shift – normal pelvic alignment

Weight-bearing actions

Later stages of rehabilitation (phase II) sees the introduction of weight-bearing activities maintaining lumbo-pelvic alignment as the weight is taken onto the affected leg. Exercises begin with weight-shift actions (Figure 12) moving the pelvis to the affected side while keeping it level and avoiding any hip 'dipping'. Once the weight can be shifted in a controlled fashion, the knee on the unaffected leg is bent to take the weight off this side and leave the affected leg taking full body weight.

Again control is the focus here. As the weight is shifted over the affected leg the pelvis should remain level, and as the unaffected leg is bent the pelvis must not dip towards this side or 'hitch' upwards. Lower limb alignment must also be emphasised as both excessive pronation and leg length discrepancy have been linked to ITBS in lateral hip pain (23,24). The knee should remain directly over the centre of the foot, avoiding a pronation (foot flattening) and hip adduction. The aim is to maintain precise alignment and to build muscle endurance. Progression is made of holding time, therefore, holding the correct alignment for 20–30 seconds and performing 5–10 repetitions.

The next stage is to perform the same alignment pattern but to allow controlled bending of the knee on the affected side using the mini-dip exercise (Figure 13). The subject stands with the foot of the affected leg on a small (5cm) block. Keeping the pelvis horizontal the weight is shifted towards the affected leg and then lowered into a single-leg squat controlling the action and maintaining lower limb alignment throughout the movement. This mini-dip is performed for 5–8 reps emphasising timing of the eccentric lowering aspect (5-10 seconds) rather than just the concentric lifting (2–3 seconds).

Classic gym-based exercises such as squats, lunges and deadlifts are useful for phase III rehab, and may be modified if required. Squat exercises may be performed free standing (classic barbell squat) or using a frame (Smith frame) to guide the bar. Modifications include squatting with the patient's back resting on a gym ball placed on a wall, squatting onto a chair, and using dumb-bells held in each hand to the side of the hip rather than a barbell held across the shoulders (dumb-bell squat). Performing a squat on a linear frame enables users to better maintain trunk alignment as the bar is unable to move forwards. In addition the action may be changed to a semi-recumbent starting position, where the knee stays over the foot and the users sits back rather than downwards (Hack squat). When performing this type of squat the knee moment has been shown to be greater than the hip moment with more muscle work on the knee extensors (quadriceps) than the hip extensors (gluteals and hamstrings). As the foot is moved forwards into a Hack squat position, the hip moment increases and the knee moment reduces, effectively reversing the muscle emphasis placing significantly

12g: Close up of weight shift – pelvis dips down on the right