Interventional musculoskeletal ultrasonography of the lower limb

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Interventional ultrasonography; Foot; Prosthesis; Tenosynovitis; Haematoma

Abstract
In this case series, out of 823 ultrasound-guided injections carried out over a period of one and a half years, 60% were of the lower limb (LL). In the hip (61% of LL injections), the main indications were pathologies of the gluteal tendons and bursae (80%) and pathologies of periprosthetic soft tissue; in the knee (15% of LL punctures), these procedures were for cysts (51%), tendinopathies and bursopathies (18%), and joint aspirations (7%); in the calf, haematoma drainage; in the foot and the ankle (24% of LL punctures), Morton’s neuroma (47%), tenosynovitis (22%), pathologies of the plantar fascia (13%), cysts (7%), joint aspirations (5%), and bursopathies. For each of these indications, we will detail the specific technique and equipment used, useful tips, and post-procedure care.

Our institution carried out 823 ultrasound-guided injections (UGI) over a 19-month period (Table 1). The lower limb was involved in 60% of these cases (nearly two thirds of which were in the hip) and 40% were for the upper limb (more than half of these being in the shoulder). The lower limb, especially the coxofemoral region, is therefore a predominant target for UGI. The techniques of procedures to treat this area are discussed in the first part of these three articles, and Table 2 summarises the main characteristics of the equipment used.

Pelvic girdle. Hip
Table 3 illustrates the main conditions for which UGI was indicated in the proximal leg and Table 4 shows their respective frequency in our practice.

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Table 1  A prospective series of 823 ultrasound-guided injections (UGI) over 19 months at the Léonard de Vinci medical imaging centre.

<table>
<thead>
<tr>
<th>Equipment</th>
<th>Abbreviations used in the text</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hip</td>
<td>300</td>
</tr>
<tr>
<td>Knee</td>
<td>74</td>
</tr>
<tr>
<td>Foot/ankle</td>
<td>117</td>
</tr>
<tr>
<td>Total LL</td>
<td>491</td>
</tr>
<tr>
<td>Shoulder</td>
<td>198</td>
</tr>
<tr>
<td>Elbow</td>
<td>20</td>
</tr>
<tr>
<td>Wrist</td>
<td>63</td>
</tr>
<tr>
<td>Finger/hand</td>
<td>51</td>
</tr>
<tr>
<td>Total UL</td>
<td>332</td>
</tr>
</tbody>
</table>

Table 2  Equipment used.

<table>
<thead>
<tr>
<th>Equipment</th>
<th>Abbreviations used in the text</th>
</tr>
</thead>
<tbody>
<tr>
<td>Needles</td>
<td></td>
</tr>
<tr>
<td>Green IM (21 G, long [50 mm] or short [40 mm])</td>
<td>Green IM</td>
</tr>
<tr>
<td>Long fawn SC (25 G, 25 mm)</td>
<td>Long SC</td>
</tr>
<tr>
<td>Hypodermic needle (18G, 40 mm)</td>
<td>Hypodermic</td>
</tr>
<tr>
<td>Yellow LP (20G, 90 mm)</td>
<td>Yellow LP</td>
</tr>
<tr>
<td>Black LP (22G, 90 mm)</td>
<td>Black LP</td>
</tr>
<tr>
<td>Local anaesthetic</td>
<td></td>
</tr>
<tr>
<td>Xylocaine (lidocaine) 0.5%</td>
<td>Lidocaine 0.5%</td>
</tr>
<tr>
<td>Cortisone based product</td>
<td>Altim</td>
</tr>
<tr>
<td>Cortivazol (Altim®)</td>
<td>3.75 mg/1.5 ml, suspension for injection</td>
</tr>
<tr>
<td>Prednisolone acetate (Hydrocortancyl®)</td>
<td>25 mg/ml, suspension for injection</td>
</tr>
<tr>
<td>Betamethasone (Diprostène®), suspension for injection in a pre-filled 1 ml (7 mg) syringe</td>
<td>Hydrocortancyl</td>
</tr>
<tr>
<td>Diprostène</td>
<td></td>
</tr>
</tbody>
</table>

Table 3  When ultrasound-guided injections (UGI) are indicated in the pelvic girdle and the hip.

<table>
<thead>
<tr>
<th>Bursopathy</th>
<th>Procedure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trochanteric and gluteal tendinopathy</td>
<td>Useless</td>
</tr>
<tr>
<td>Pelvic and gluteal medius enthesopathy</td>
<td>Useless</td>
</tr>
<tr>
<td>Bursopathy of the iliopsoas muscles</td>
<td>Useless</td>
</tr>
<tr>
<td>Labral cyst</td>
<td>Useless</td>
</tr>
<tr>
<td>Enthesopathy of the hamstring muscles</td>
<td>Useless</td>
</tr>
<tr>
<td>Paraesthesia meralgia</td>
<td>Useless</td>
</tr>
<tr>
<td>Hip aspiration</td>
<td>Useless</td>
</tr>
<tr>
<td>Prosthetic hip</td>
<td>Useless</td>
</tr>
<tr>
<td>Bursopathies of the iliopsoas muscle</td>
<td>Useless</td>
</tr>
<tr>
<td>Iliopsoas-prosthesis impingement</td>
<td>Useless</td>
</tr>
<tr>
<td>Gluteal tendinopathy and bursopathy</td>
<td>Useless</td>
</tr>
<tr>
<td>Periarticular fluid collection</td>
<td>Useless</td>
</tr>
<tr>
<td>Joint aspiration</td>
<td>Useless</td>
</tr>
</tbody>
</table>

Table 4  Total number of injections to the coxofemoral region.

<table>
<thead>
<tr>
<th>Injection</th>
<th>Total: 300 (equates to 61% of UGI of the LL)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gluteal tendons</td>
<td>239</td>
</tr>
<tr>
<td>Other tendons</td>
<td>22</td>
</tr>
<tr>
<td>Calcifications</td>
<td>4</td>
</tr>
<tr>
<td>THR/psaos impingement</td>
<td>26</td>
</tr>
<tr>
<td>Other THR</td>
<td>3</td>
</tr>
<tr>
<td>THR haematoma drainage</td>
<td>2</td>
</tr>
<tr>
<td>Lateral cutaneous nerve of the thigh</td>
<td>2</td>
</tr>
<tr>
<td>Hip joint aspiration</td>
<td>2</td>
</tr>
</tbody>
</table>

Gluteal tendinopathies or bursopathies

These are very common, and the usual treatment is cortisone injections, which are often done by the clinician himself based on clinical landmarks. Ultrasound exploration allows the tendon(s) affected to be specified, usually the lateral lamina of the gluteus medius and possibly also the gluteus minimus [1]. Fig. 1 illustrates the position of these structures in relation to the greater trochanter: the gluteus minimus is anterior, the gluteus medius is lateral and the bursa separating the gluteus maximus from the posterior surface of the greater trochanter (superficial trochanteric bursa) is posterior. In this context, the concept of ultrasound-guided injections seems to be logical in order to be certain of reaching the structure to be treated by using the most suitable approach. UGI of the gluteal tendons, whether as a first line treatment or after injections carried out by the clinician have failed, account for the greatest proportion by far (80%) of our UGI of the coxofemoral region (Table 3).

Technique

Position of the patient: lateral decubitus (Fig. 2) (Table 2). The lower limb rests horizontally on a stable support in order to ensure that the gluteal muscles are sufficiently relaxed, which is crucial for bursopathies to be well visualised.

Probe placed on the lateral surface of the greater trochanter axially (Fig. 3).

Local anaesthetic along the path of the needle (IM green, lidocaine 0.5%).

Yellow or black LP needle.

Cortisone derivative: ½—1 vial of Altim or Diprostène or 2—4 ml of hydrocortancyl and a few millilitres of lidocaine 0.5% at the periphery of the tendon.

Useful tips

Use a yellow LP needle for local anaesthesia, as it is more visible. Ensure the cortisone derivative is well distributed around the tendons and within the bursopathies.
Figure 1. a: insertion of the gluteus medius and gluteus minimus tendons in relation to the greater trochanter; b: corresponding axial MRI view showing the three tendinopathies and bursopathies that are the potential cause. It is logical to use the anterior approach for tendinopathies and bursopathies of the gluteus minimus and the posterior approach for superficial trochanteric bursopathies. Either of the two approaches can be used for lesions of the lateral lamina of the gluteus medius.

Figure 2. Position of the patient for the posterior and anterior approach to the gluteal tendons (a, b).

Figure 3. Tendinopathy and bursopathy of the gluteus minimus (left) and superficial trochanteric bursopathy (right). Path of the needle (in red).
Probe (the widest possible) placed in the groin axially, without pressure in order to avoid causing the femoral vein to collapse.

Local anaesthetic along the path (long green IM needle, lidocaine 0.5%).

Needle: yellow LP.

Cortisone derivative: one vial of Altim or Diprostène.

Useful tips
Look out for the iliac vessels! Normally, this approach avoids them very reliably.

Post-procedure care
Bed rest for 48 hours.

**Labral cysts**
Although these kinds of cysts can be injected directly using the approach described above, we usually prefer to inject the hip joint under fluoroscopic guidance, given that cysts are as a rule secondary to an underlying pathology of the hip joint.

**Enthesopathy of the hamstring muscles**

This site is deep and the principal danger is the immediate proximity of the sciatic nerve. These enthesopathies can be injected under ultrasound guidance or, as some prefer, under CT guidance.

**Meralgia paresthetica**

The lateral femoral cutaneous nerve can often be mapped on sonography at the surface of the tensor fascia latae muscle and, from here, ascending under the inguinal ligament. If there is a neuroma in this area this can be injected under ultrasound guidance using the same technique as described above.

**Hip joint aspiration**

Although this can be carried out using ultrasonography (anterolateral approach along the axis of the femur neck), we generally use fluoroscopy to guide this procedure.

**Prosthetic hip**

The metal mass that is a hip prosthesis, regardless of the type, constitutes a significant block to CT or MRI imaging of the peri-coxofemoral soft tissue. As result, the de facto imaging option is ultrasonography which can be used to demonstrate an intra- or para-articular fluid collection, a gluteal tendinopathy or bursopathy, or another localised tendinopathy: these diagnoses are made using the same signs and symptoms for both prosthetic and natural hips and the puncture technique is also the same [3].

Psoas impingement due to a hip prosthesis is a separate entity in which the iliopsoas tendon rubs against a part of the prosthesis. This may be a prosthetic acetabular cup that protrudes too far (especially acetabular cups without cement),

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**Figure 4.** Bursopathy of the iliopsoas muscles. Approach route. Ultrasound-guided injection.

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Post-procedure care
Bed rest for 48 hours.

**Bursopathy of the iliopsoas muscles**

This can affect a normal or a prosthetic hip. The approach must firstly allow the more medial and more anterior iliac vessels to be avoided, and the needle progression to be followed along its whole path [2]. We place the catheter in the groin axially and use a lateral route in which the needle only crosses the muscular planes (Fig. 4). The hip joint often meets the bursopathy. Injecting the bursa therefore often equates to injecting the hip. Any suggestion of an infection within the contents of the bursa (especially when the patient has a hip prosthesis) must therefore be formally excluded before the injection procedure, if necessary by prior bacteriological assessment of this substance.

**Technique**

Position of the patient: dorsal decubitus, LL rotated slightly internally.
a head that is too large, a fragment of cement, etc. Sometimes there is excessive tension on the tendon because the femoral neck prosthesis is too long, which would explain its excessive pressure on the acetabulum. Injections offer long-term relief to a number of patients. If injections are unsuccessful, the next step is an iliopsoas tenotomy rather than changing the hip prosthesis, which does remain the only alternative.

**Technique**

Position of the patient: dorsal decubitus, LL rotated slightly internally.

Probe (as wide as possible) placed in the groin axially.

Anaesthesia along the needle pathway (long green IM, lidocaine 0.5%).

Needle: yellow LP.

The needle is guided by ultrasonography until it is just inserted between the anterior edge of the protruding part of the prosthesis and the iliopsoas tendon (Fig. 5).

Cortisone derivative: one vial of Altim or Diprostène and a few ml of lidocaine (anaesthetic test. See below).

Variation: Anterior approach with the needle oriented sagittally and ascending towards the protruding part of the prosthesis (Fig. 5a).

**Useful tips**

Take care to avoid very serious sepsis around the prosthetic hip. Only carry out this risky injection when there is full agreement from the clinical team. Take ALL precautions in asepsis. Inform the patient of the risks verbally and in writing, and of course ensure that the prosthesis is not already

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**Figure 5.** Fracture of the right femoral neck. Partial hip prosthesis (only the femoral part has been replaced). Residual anterior pain: a: sagittal ultrasound view: the prosthetic head protrudes clearly leading to rubbing against the iliopsoas tendon (arrow); b: corresponding axial view. The dotted line shows the path of the injection needle; c: needle in place; d: injection. Clinically successful.
infected (full blood tests and bacteriology analysis of the joint fluid before any corticosteroid injection).

Carry out an anaesthetic test at the same time: inject a few ml of lidocaine 2% with the cortisone derivative. If the pain disappears within a quarter of an hour of the procedure this indicates that the cause is indeed a hip prosthesis-psosas impingement.

Post-procedure care
Bed rest for at least 48 hours.

Thigh

Ultrasound-guided punctures are most commonly indicated in the thigh for drainage of a haematoma or, more rarely, of a Morel-Lavallée lesion (be careful of infection ++++).

Knee (with or without prosthesis)

Table 5 summarises the knee pathologies in which UGI® are indicated and their frequency in our series.

Popliteal cyst

Injections to the knee are most commonly indicated for popliteal cysts (PC) (Fig. 6). Usually, these cysts are the result of a knee arthropy (particularly when the femur and patella are involved) and therefore it is logically the cause that should be treated rather than the symptoms. Nonetheless, some significant PC that have thick walls, are compressing a nerve, or are resistant to treatment by intra-articular injection may benefit from a direct injection. All PC must have a channel running between the tendons of the semimembranosus muscle and the medial head of the gastrocnemius muscle providing a link to the medial femoral condyle (Fig. 6), and if this is not present the diagnosis must be questioned and other diagnoses considered, including soft tissue tumour with a mucoid component [4]. The structures to avoid are the nerves (tibial and common fibular) and the popliteal vessels. It is therefore sensible to choose a coronal postomedial approach (Fig. 6).

Technique

Position of the patient: ventral decubitus.

Probe placed axially in the medial popliteal fossa (Fig. 6).

Needle: green IM.

Aspirate the contents of the PC (if it is not too thick) and then inject the cortisone derivative: one vial of Altim or Diprostène.

Post-procedure care
Bed rest for 48 hours.

Meniscal cyst

These types of cyst usually affect the lateral meniscus, and are due to a horizontal meniscal tear. The treatment for the cyst and the meniscus are one and the same. In our practice we prefer to use intra-articular injection. Nonetheless, some voluminous and painful cysts may benefit from an ultrasound-guided in situ injection.

Technique

Position of the patient: lateral decubitus.

Probe placed axially on the cyst. Anteroposterior approach with needle oriented sagittally.

Needle: green IM.

Aspirate the contents of the cyst (if it is not too thick), and then inject the cortisone derivative: half a vial of Altim or Diprostène.

Post-procedure care
Bed rest for 48 hours.

Tendinopathies and bursopathies

The most common of these are pathologies of the semimembranosus (affecting either part of its tendon of insertion) and the pes anserinus. They may require cortisone derivative injections. The pathway of the injection is anterior and posteromedial for the semimembranosus (Fig. 7), and sagittal and medial for the pes anserinus. Some bursopathies behind the patellar tendon can also be injected, as can tendinopathies of the proximal patellar tendon, as long as great care is taken.

Figure 6. Popliteal cyst. Above: axial MRI view. Note the channel that links the cyst to the medial condyle passing between the semimembranosus (SM) tendons and the medial head of the gastrocnemius muscle (black arrow), confirming that this is indeed a popliteal cyst. Below: ultrasound view in the same plane, needle in place.
When ultrasound-guided injections (UGI) are indicated in the knee.

<table>
<thead>
<tr>
<th>Pathology</th>
<th>Total: 74 (equates to 15% of UGI° of the LL)</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cysts (popliteal, meniscal, intercondylar notch, etc.)</td>
<td>51</td>
<td>68.9</td>
</tr>
<tr>
<td>Tendinopathy and bursopathy (pes anserinus, semimembranosus, patellar, etc.)</td>
<td>13</td>
<td>17.6</td>
</tr>
<tr>
<td>Joint</td>
<td>5</td>
<td>6.7</td>
</tr>
<tr>
<td>Haematoma drainage</td>
<td>2</td>
<td>2.7</td>
</tr>
<tr>
<td>Impingement with metallic implant</td>
<td>3</td>
<td>4.0</td>
</tr>
</tbody>
</table>

**Joint injections**

In some difficult cases (synovitis, prosthesis), ultrasound guidance may allow for injection of a knee that has been otherwise impossible to approach: an axial ultrasound image of the suprapatellar bursa allows a needle to be inserted into the joint space to remove or inject fluid.

**Impingement with metallic implants**

Irritation of the soft tissue secondary to an impingement due to a metallic implant (osteosynthesis screw, interference screw, etc.) can be successfully treated with an ultrasound-guided injection. The technique depends on the location of the impingement.

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**Figure 7.** Tendinopathy and bursopathy of the semimembranosus: a: T2-weighted axial MRI view. The SM tendon is surrounded by a fluid collection that meets a small PC; b: ultrasonography. Same view. Path of the needle; c: needle in place (arrows). Injection (asterisk).
Calf

The key application for UGI® in the calf is the drainage of haematoma fluids (haematoma of the triceps, rupture of the aponeurosis of the medial head of the gastrocnemius muscle, etc. [5]). Any fluid collection of a reasonable size must be drained: this drainage encourages and simplifies healing. When should drainage be performed? As soon as the fluid can be aspirated: an anechoic fluid collection, with posterior acoustic enhancement, that can be compressed under pressure from the wave. The time taken for a haematoma to liquefy, to be assessed if necessary by repeated ultrasound scans, ranges from 0 to 15 days.

Technique

Position of the patient: ventral decubitus (Fig. 8).

Mark the position of the haematoma. Probe placed axially.

Green IM needle, or even an 18 G hypodermic needle.

Needle entry in the axial plane. Haematoma drained by gentle aspiration.

Useful tips

• Press the calf above and below to ensure that the maximum amount of blood is aspirated.
• Have a quick look at an ultrasonography image of the veins of the calf: it is not unusual to see tennis-leg associated with venous thrombosis.
• There is usually no need to inject any drug into the cavity of the haematoma.

Post-procedure care

Gentle compression of the calf using a grade 2 compression stocking or a moderately tight bandage. Rest for at least 48 hours, then activity can be gradually resumed. Review the outcome of the aspiration after one week: if there is any recurrence, perform the drainage again.

Ankle and foot

Table 6 summarises foot and ankle pathologies in which ultrasound-guided injections are indicated and how frequently they arose in our case series.

Arthropathies

Injections of the foot and ankle joints are usually carried out under fluoroscopic guidance, but they can also be ultrasound-guided, especially those involving the talocrural joint or the distal ankle and fibula synchondrosis (Fig. 9). Ultrasound-guided injection of post-sprain anterolateral ankle impingement is also possible.

Cysts

Just as in the hand and wrist, various different kinds of cysts are common in the foot and ankle [6]. It may be necessary to drain and inject them due to the pain that they cause or the compression, especially of nerves, that they engender. This is especially so when the tarsal tunnel is affected (Fig. 10).

Technique

Position: this depends on the location of the cyst. A path must be found for the injection that enables the whole course of the needle to be followed and the crucial elements (nerves, vessels) to be visualised on the same image.

Short green IM or SC needle:
• ‘’cleanse’’ the cyst by alternately injecting and aspirating lidocaine, and then inject it with a very small amount of cortisone derivative (0.2—0.3 ml of Altim or Diprostène or 0.5 ml of hydrocortancyl);
• massage and compress the path of the needle thoroughly in order to avoid leakage.

Useful tips

The needle entry site should be away from the cyst in order to avoid secondary percutaneous leakage. Bending the needle often makes it easier to perform the puncture.

Post-procedure care

Rest the treated area for 48 hours.

Tenosynovitis and tendinopathies

Tenosynovitis is common in the foot and the ankle, and it can benefit from a cortisone injection, especially when caused by inflammation [2]. There are some special care guidelines to follow for injections to the ankle tendons:
• the injection must only be carried out in the synovial sheath at the periphery of the tendon and never into it, as there is a risk of rupture;
• when a weight-bearing tendon is injected (especially the posterior tibial tendon) the resulting relief of pain can lead to the patient overusing it, which can in itself worsen anatomic lesions. This is especially true for the posterior tibial tendon, and careful consideration should be made before undertaking injections here;
• pre-Achilles bursopathies often meet fissures of the distal part or the enthesis of the Achilles tendon. An injection to the bursa means that the substance will infiltrate from there into the tendon. Special care +++.

Technique

Position: this depends on the tendon. The injection can be carried out with the needle oriented axially (Fig. 11) or longitudinally.

Long SC needle or short green IM needle.

Aspirate the synovial fluid before injecting a small amount of cortisone derivative (0.2 ml of Altim or Diprostène or 0.5 ml of Hydrocortancyl).

Massage and compress the path of needle thoroughly to avoid leakage.

Useful tips

Using an L-shaped catheter (Fig. 11) and bending the needle makes it easier to perform the injection.
Figure 8. Drainage of a haematoma in a tennis leg of the right medial head of the gastrocnemius muscle 15 days after the trauma: a: the position of the haematoma was marked on the skin, as was the position of the catheter; b: axial view with catheter in place: fluid collection (asterisk); c: needle in place (white arrows); d: aspiration; e: completely drained haematoma; f: drained exudative effusion.

Post-procedure care
Rest the treated area for 48 hours.

Plantar fascia pathologies

Plantar fascia pathologies that are resistant to the usual treatments can sometimes benefit from an injection, especially enthesopathies [7]. This is generally done using the medial approach, and the coronal plane (Figs. 12 and 13). Since the heel is very sensitive, the injection is carried out under local anaesthetic. Using an IM needle, 0.2–0.3 ml of Altim or Diprostène or 0.5 ml of hydrocortancyl is injected at the surface of the enthesis. Rest for 48 hours.

Submetatarsal or intermetatarsal bursitis

Some cases may benefit from an injection, especially inflammatory rheumatoid bursitis.

Technique
Position: The approach depends on the location of the bursopathy. A plantar approach under local anaesthesia with an L-shaped catheter is most commonly used (Fig. 13).
**Figure 9.** Dorsal ascending sagittal approach to the anterior ankle joint recess.

**Figure 10.** Synovial cyst of the tarsal tunnel compressing the posterior tibial nerve: a: sagittal view; b: needle in place. Cyst drained, then injected with 1 ml of Hydrocortancyl (c). Note the proximity of the nerve (yellow arrow) and the artery (red arrow), which have been mapped perfectly accurately on ultrasonography.
Table 6  When ultrasound-guided injections (UGI) are indicated in the foot and ankle.

<table>
<thead>
<tr>
<th>Pathology</th>
<th>Total: 117 (equates to 23.8% of UGI of the LL)</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arthropathies (talocrural, subtalar, distal tibiofibular syndesmosis, etc.)</td>
<td>6</td>
<td>5.1</td>
</tr>
<tr>
<td>Anterolateral ankle impingement</td>
<td>2</td>
<td>1.7</td>
</tr>
<tr>
<td>Cysts (arthrosynovial, paratendinous, etc.)</td>
<td>8</td>
<td>6.8</td>
</tr>
<tr>
<td>Tenosynovitis (posterior tibial, flexor hallucis longus, anterior tibial, fibular, etc.)</td>
<td>26</td>
<td>22</td>
</tr>
<tr>
<td>Plantar fascia pathology</td>
<td>15</td>
<td>12.8</td>
</tr>
<tr>
<td>Morton’s neuroma</td>
<td>55</td>
<td>47</td>
</tr>
<tr>
<td>Submetatarsal bursitis</td>
<td>2</td>
<td>1.7</td>
</tr>
<tr>
<td>Intermetatarsal bursitis</td>
<td>3</td>
<td>2.6</td>
</tr>
</tbody>
</table>

**Figure 11.** Tenosynovitis of the fibula in a patient with rheumatoid arthritis: a: inflammatory tenosynovitis; b: catheter in place under the point of the lateral malleolus. Site and direction of the puncture are marked on the skin (simulation); c: needle in place in the synovial sheath of the peroneus brevis muscle.

Short green IM needle.  
Aspirate the fluid from the bursa before injecting a very small amount of cortisone derivative (0.2 ml of Altim or Diprostène or 0.5 ml of Hydrocortancyl).  
Massage and compress the path of needle thoroughly to avoid leakage.

Useful tips  
Bending the needle makes the injection easier to perform.  
Be careful of bursopathies adjacent to a metatarso-phalangeal joint that that is becoming unstable!  
The intra-articular passage of the cortisone derivative can speed up the rupture of the plantar plate because of overuse following relief of the pain it was causing.

Post-procedure care  
Rest the treated area for 48 hours.
**Morton’s neuroma**

This very common condition usually occurs in women, affects the second or third intermetatarsal space, and the treatment is wearing suitable orthotics [8]. If this is unsuccessful, before an intervention, one or two injections are often carried out [9].

**Technique**

Several approaches can be used: The distal dorsal or plantar approach under ultrasound guidance, dorsal approach after mapping the neuroma on an ultrasound scan. Once the diagnostic stage has been completed, for the injection we use ultrasound mapping to locate the neuroma, or the distal dorsal approach. Probe placed dorsally. The position and depth of the neuroma is specified extremely precisely. We use two techniques:

- ultrasound mapping: the skin is marked at the exact point directly above the neuroma. A vertical puncture is made at the mark to the indicated depth. The injection is made to the surface of the neuroma and in any satellite bursopathy;
- ultrasound guidance using a long SC needle or a short IM needle introduced by the ascending dorsal approach as far as the surface of the neuroma;
- injection of 0.2 ml of Altim or Diprostène or 0.5 ml of Hydrocortancyl and 1–2 ml of lidocaine.

**Post-procedure care**

Rest the treated area for 48 hours.
Figure 13. Intermetatarsal bursitis of the third space: a: gadolinium-enhanced fat-saturated T1-weighted coronal MRI view: bursitis (arrow); b: position of the puncture (simulation); c: plantar sagittal view of the third space: bursopathy; d: needle in place. Injection.

Conclusion

Ultrasound guidance has completely transformed the accuracy and improved the safety of injections to the soft tissue of the LL. By carrying these procedures out under extremely strict guidelines that are followed to the letter, our team has yet to report any serious complication out of more than 1500 UGI’. This type of intervention can only be considered when there is very close cooperation with and the full agreement of the clinical team, both for the treatment itself and for the follow-up.

Disclosure of interest

The authors declare that they have no conflicts of interest concerning this article.

References


