TECHNICAL SECTION:
Technical tutorials, notes and tips

Assessment of the ischaemic leg

Jonothan J Earnshaw

Gloucestershire Royal Hospital, Gloucester, UK

In the modern world, where patients arrive in many vascular clinics armed with a complete work-up from the vascular laboratory, this article is arguably superfluous. Most vascular surgeons will agree, however, that accurate clinical examination is the corner-stone of management of an ischaemic leg and also the factor that retains the art to accompany the science of surgery.

Taking a history

Although this is not strictly a part of examination, it remains an important prerequisite. The presence of arterial disease, and also the site of the arterial occlusion, may be predicted from a careful history and this directs a surgeon towards expected signs on examination.

Intermittent claudication

Intermittent claudication pain is confined to muscles, is consistent in its distance of onset, is relieved by rest, never occurs at rest and is worse in cold weather or walking uphill. Pain involving the buttocks and thigh muscles indicates aorto-iliac level disease, whereas pain in the calf muscle suggests femoropopliteal disease.

Ischaemic rest pain

Ischaemic rest pain occurs in the skin of the extremity at its most distal aspect (*i.e*. the toes and feet) **not** the calf muscles. It is classically worse at night and eased by dependency or by getting up and walking about.

Critical ischaemia

This is a specific term used by vascular surgeons to suggest that, without treatment, the leg will require amputation. There are several definitions, but all include a measurement of ankle Doppler pressure, usually less than 50 mmHg.

Inspection and routine examination

Do not be tempted to examine the heavily clad patient in their wheelchair. Patients should be undressed down to their underwear and placed flat on a comfortable examination couch. This manoeuvre also allows observation of general mobility and health. Other observations might include general features of patients with atherosclerosis such as xanthelasma and, of course, nicotine staining of the fingers. Obesity and dyspnoea indicate the presence of significant co-morbidity.

All patients should have a brief physical examination including as a minimum

- Assessment of wrist pulses for equality, rate and rhythm.
- Examination of the abdomen for an aortic aneurysm.
- Auscultation of the carotid arteries for bruits (although not strictly relevant, the presence of carotid bruits is a marker for wide-spread arterial disease).

Inspection of the legs

Positioning of the legs is particularly important: the legs should be splayed as widely as comfortable, as this throws the femoral arteries forwards, making palpation easier. Be careful with patients who have painful critical ischaemia and ensure that pressure areas and necrotic lesions are protected.

Intermittent claudication

There may be very little in the way of physical signs in the feet. Traditional teaching suggests that the legs should be hairless and the toenails affected, but neither of these features is at all reliable. The feet may look and feel entirely normal.

Ischaemic rest pain

There is a significant spectrum ranging from mild rest pain with little to see, to obvious gangrene and ulceration. It is particularly important to check for ulcers between the toes. Another feature of early critical ischaemia is cracking of the hard skin at the heel. The classical 'sunset foot' is associated with capillary leakage and extravasation of blood as tiny punctate haemorrhages in the skin. The red discolouration caused by maximal vasodilatation is sometimes termed ischaemic rubor. These are important and sometimes subtle signs that bring a significant prognosis to the leg. Occasionally, microemboli from proximal disease can result in small areas of ischaemic necrosis in the foot, termed punctate ischaemia.

There are a number of other classic tests that are important to know for examination purposes, but are seldom used clinically.

- **Buerger's sign**: on elevating the ischaemic leg, it becomes very pale with emptying of the veins called venous guttering.
- **Pole test**: listen to the foot pulse with the Doppler whilst elevating the leg against a measure. The measure can be calibrated against ankle pressure.
- **Disappearing pulse**: a palpable foot pulse may disappear if a patient is asked to exercise. This investigation is usually used in the vascular laboratory as part of a treadmill test.
- **Toe pressures**: these are measured like ankle Doppler pressures, only with a smaller cuff. Some definitions of critical ischaemia include toe pressures.
- **Laser Doppler**: this device measures flux, which is proportional to skin blood flow. It has been useful in experimental studies.

Trophic lesions

Once tissue necrosis has become established, the diagnosis is more obvious. Small ulcers or gangrenous patches are often

referred to as trophic lesions. It remains important to document the extent of the necrosis as this too has implications.

Gangrene
Gangrene that extends across the base of a toe is unlikely to be cured by simple digital amputation. Extensive tissue loss and, in particular, gangrene that affects the heel is a sinister sign indicating a significant risk of major amputation.

Diabetic foot
Diabetic patients have specific problems due to small distal vessel arterial disease. They may also have a significant peripheral sensory neuropathy that can be mapped with a needle and cotton wool. More accurate assessment by vibration sensory thresholds is not part of standard clinical examination. Diabetics are also at risk of skin infection and may have areas of chronic sepsis. Detailed discussion about the diabetic foot is beyond the scope of this article, but open lesions should be mapped, together with their relation to joints. Any evidence of deep sepsis such as swelling and erythema will require investigation by X-ray or magnetic resonance imaging. Diabetics with neuropathy are at significant risk of pressure ulcers and the shape of their foot and walking posture are important prognostic signs. Specialist diabetic foot clinics have developed protocols to prevent deterioration in these patients.

Palpating the peripheral pulses
Femoral pulse
Palpation of the femoral pulse in the groin is usually easy, unless the patient is obese, particularly if the patient is positioned correctly with legs apart. Always compare the two groins which should have equal pulsation in a normal patient. Beware the strong femoral pulse on the ischaemic leg; this may be a water-hammer pulse above a proximal common or superficial femoral artery occlusion. If the femoral pulse is absent, check the external iliac artery, the distal 5 cm of which can be palpated in all but the largest patient. In a difficult groin, the site of the pulse may be found with the help of a hand-held Doppler.

Popliteal pulse
The popliteal pulse is the source of much confusion.

- The subject should be lying flat on the couch with the leg resting out straight and relaxed.
- The examiner stands to the right of the subject and places the tips of both fingers in V-formation behind the knee and lifts gently.
- If the subject remains relaxed, the examiner should feel the pulse on flexing the leg further.
- If the pulse cannot be found, move the tips of the fingers proximally to the top of the popliteal fossa pressing harder against the femur, or more distally, pressing harder against the tibial plateau.
- Remember, you should be able to feel a popliteal pulse if you can feel a foot pulse.
- Keep practising.

Pedal pulses
Finally, both foot pulses should be palpated. The posterior tibial pulse is located just below the medial malleolus. Firm pressure may be required in large ankles or oedematous feet. The anterior tibial pulse is best felt at the level of the ankle, at the midpoint between the two malleoli not more distally in the foot, where it lies deeper. If there is any doubt about the presence of a pulse, use the Doppler.

Auscultation for bruits
After the pulses have been examined, listen over the main sites of possible arterial stenosis or occlusion for bruits. An audible bruit, for example over the adductor canal, can pinpoint the site of arterial disease.

Doppler examination
Hand-held Doppler is the most useful investigation device in our practice. Some argue that all vascular patients should have Doppler pressures measured routinely at every visit, and this certainly helps in longitudinal analysis. However, in a busy surgical clinic, there is often too little time for this and Doppler examination might be reserved for when it is useful clinically and, therefore, performed selectively.

Much can be learned simply by listening to the tibial arteries. A triphasic Doppler signal in a patient with palpable pulses pretty much rules out clinically significant arterial disease. Biphasic or monophasic signals indicate proximal disease. The Doppler can also be used to insonate the plantar arch which can be found in the web space between the first and second toes.

When appropriate, pressure measurement is done by attaching a sphygmomanometer cuff around the calf and using the hand-held Doppler to measure the systolic pressure at which the arterial signal is abolished. This is compared with the brachial systolic pressure to produce an ankle brachial pressure index (ABPI). A pressure index below 0.85 indicates peripheral arterial disease. Patients with significant claudication usually have an ABPI of approximately 0.6, and those with critical ischaemia about 0.3.

Recording the results
The final part of a clinical examination is to record your findings. Much of the examination can be recorded by drawing a picture – this does not require the skill of Rembrandt and a crude sketch will suffice.

Further reading
TransAtlantic Inter-Society Consensus (TASC). Management of peripheral arterial disease. *Eur J Vasc Endovasc Surg* 2000; **19** (Suppl A).

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Correspondence to: Mr Jonothan J Earnshaw, Consultant Surgeon, Gloucestershire Royal Hospital, Great Western Road, Gloucester GL1 3NN, UK
Tel: +44 1452 394190; Fax: +44 1452 790100;
E-mail: earnshaw@rudford.demon.co.uk

Obturator 'kick' – how to avoid an own-goal!

C Kouriefs[1], R Ravi[2]

[1]*Department of Urology, St Helier Hospital, Carshalton, Surrey, UK*
[2]*Department of Urology, Darrent Valley Hospital, Dartford, Kent, UK*

The obturator nerve lies close to the inferolateral wall of the bladder.[1] Low frequency currents during transurethral resection (TUR) can thus result in contraction of the thigh adductor muscles and brisk displacement of the bladder towards the resectoscope. Obturator kick occurs in 10–20% of cases.[2,3] Bladder tumour location strongly predicts the risk of obturator kick.[4]

The most reliable way of avoiding obturator 'kick' is general anaesthesia with neuromuscular blockade. Obturator nerve block has been described during spontaneous-respiration general/regional anaesthesia, the commonest being direct nerve block.[4–9] The nerve is approached 2 cm inferolateral to the pubic tubercle. Lignocaine (20 ml of 1%) with adrenaline (1/100,000) is used (Fig. 1). Blind anatomical approach has a success rate of about 85%.[4,5] Gasparich *et al*.[7] described the use of neurostimulator with increased efficacy (89–100%).[6,7,9] Akata *et al*.[10] reported a life-threatening complication of obturator kick despite a successful block. They pointed out the lack of consensus on the type and dosage of local anaesthetic and questioned the neurostimulator output necessary to confirm adequate block reliably. They proposed the presence of accessory obturator nerve (AON)[11,12] as a possible explanation. AON supplies the adductor muscles but has otherwise little in common with the obturator nerve proper and 'accessory femoral' nerve may be a more appropriate term. It gives off a branch to the anterior division of the obturator nerve and can result in obturator kick despite successful obturator nerve block.[5,6]

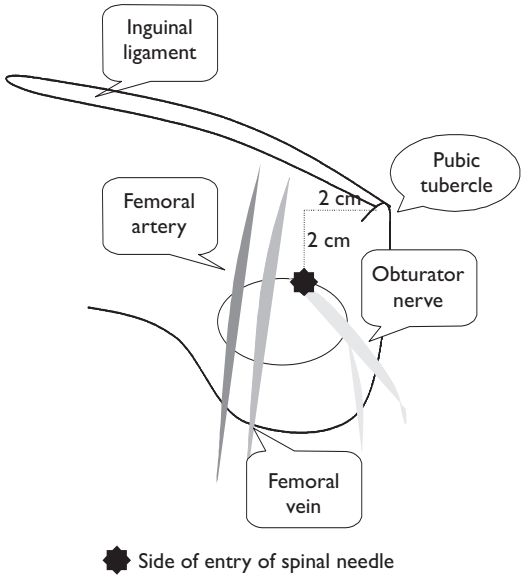

Figure 1 The anatomy of the obturator nerve as it emerges through the obturator canal showing the point of entry of the spinal needle, 2 cm below and lateral to the pubic tubercle.

Winnie *et al*.[13] described infra-inguinal femoral nerve infiltration and retrograde spread of the anaesthetic to the lumbar plexus as facilitated by distal digital pressure (3-in-1 indirect block). This approach is slow and causes unnecessary block of other lumbar plexus branches. Atanassoff *et al*.[14] demonstrated by electromyographic recordings that 3-in-1 block is inferior to direct block. Lang *et al*.[15] reported a 4% success rate, but others have shown higher efficacy.[16] Other techniques include transurethral infiltration of bladder tumours[2] and subvesical/periprostatic infiltration of local anaesthetic.[17,18]

In the majority of cases, simple surgical techniques/measures are all that are needed. Cystometric studies demonstrate that 300 ml of irrigation fluid bring the bladder very close to the obturator.[3,6] Avoiding bladder overdistension is a very important preventative measure. Keep the resectoscope close to the tumour and resect with short bites using the lowest voltage possible.[7] Observations among urological surgeons suggest that coagulation diathermy is less likely to cause obturator kick than cutting diathermy, but evidence to support that is lacking in the literature. Kihl *et al*.[3] demonstrated an 80% success rate by changing the site of the neutral electrode from the patient's buttock to the thigh.

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Correspondence to: Mr C Kouriefs, 41 Marryat Road, Wimbledon, London SW19 5BE, UK
E-mail: c.kouriefs@btinternet.com

Obturator hernioplasty: a new operative approach and technique of repair

Michael Nelson, Biju Aravind, Chris Davies, Brian Sullivan, Keith Tayton, Brian M Stephenson

Departments of Surgery, Radiology, and Orthopaedics, Royal Gwent Hospital, Newport, Gwent, UK

We report a new approach to the repair of an obturator hernia. Presenting with persistent obturator neuralgia, the hernia was diagnosed radiologically with a herniogram and approached surgically via an oblique groin incision rather than the traditional abdominal approach.

Background

The majority of obturator hernias present as emergencies either with a tender lump or, more commonly, with intestinal obstruction. The elective repair of an obturator hernia is challenging and modern textbooks still recommend a high or preperitoneal approach necessitating an abdominal incision.[1,2] We report a new operative approach to the elective obturator hernia and describe a suture-less repair with a preformed polypropylene mesh plug. The technique described illustrates nicely how a surgical approach commonly used in orthopaedic practice has been modified to facilitate a general surgical procedure. The crucial contribution of radiological investigations completes the multidisciplinary team approach.

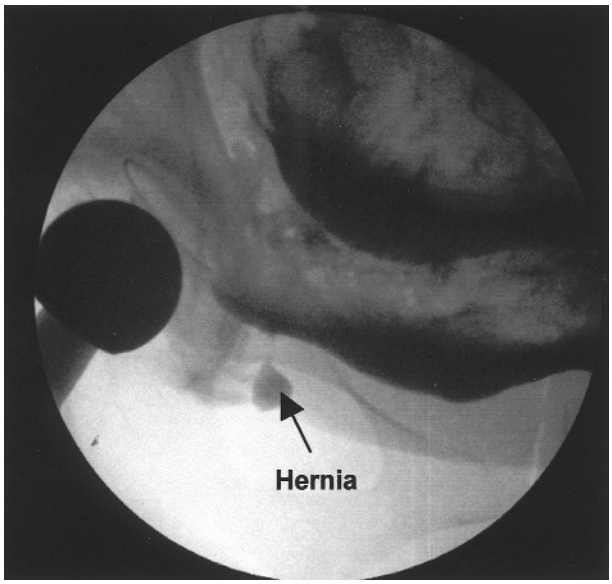

Figure 1 Herniogram demonstrating a small obturator hernia.

Case report

A 50-year-old asthmatic lady underwent a right total hip replacement for osteoarthritis of 10 years' duration. She had persistent pain down the medial side of her thigh after this procedure, but investigations (bone scan, MRI and CT) failed to reveal any abnormality with the implant. Four years later, the hip was re-explored, but no evidence of infection or loosening was found. Removal of scar tissue provided minimal relief of her thigh pain. A subsequent herniogram (Fig. 1) demonstrated a small obturator hernia. Repair was undertaken through an oblique low groin incision, dividing the tendinous origin of the adductor longus muscle to expose the anterior division of the obturator nerve. This was then followed back to the main trunk of the nerve and thence the obturator canal, wherein lay the hernia. The hernial defect was obliterated by inserting a preformed, three-dimensional, mesh plug (PerFix Plug, Bard) into the preperitoneal plane. It was not necessary to suture the plug in place. Within 2 weeks, her symptoms had completely resolved.

Discussion

This case illustrates a multidisciplinary approach to a rare problem and a number of interesting points. Firstly, we would advocate the use of a herniogram to clinch the diagnosis, in this case after exhaustive efforts to ensure the welfare of the hip prosthesis. This radiological technique is perhaps generally under-used, and here proved crucial in isolating the cause for the patient's symptoms. Various other authors have described the use of CT scans[3] and ultrasonography[4] in diagnosing obturator hernias, but these reports are invariably in the acute setting where small bowel obstruction has supervened.

Obturator hernias are difficult to diagnose clinically as palpation of the mass is often impossible, but this lady exhibited

the cardinal sign of obturator neuralgia (Howship-Romberg sign). However, presentation with small bowel incarceration or obstruction is not unusual, and pain in association with hip arthoplasty has been previously described.[5]

The traditional surgical approach to an obturator hernia requires an abdominal incision; this reflects the usual presentation as an emergency and, therefore, laparotomy facilitates bowel resection, if necessary. In the elective setting this seems an unnecessarily invasive procedure and a low approach is more attractive. Most surgeons would agree that the optimal repair is effected by locating a mesh in the preperitoneal plane, and the technique described delivers this by deploying a mesh plug, the use of which in groin hernioplasty is now well established. The close proximity of the obturator neurovascular structures to the hernia makes a suture-less repair using such a system a desirable option. The mesh plug sits astride the defect in the preperitoneal plane; intra-abdominal pressure effectively holds the plug in position whilst it is incorporated.

This territory represents unfamiliar anatomy to most general surgeons, and so the technique described was developed in a combined procedure with orthopaedic surgeons. Dividing the adductor longus origin provides excellent access to the obturator hernia and does not result in any subsequent problems of significance.

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Correspondence to: Mr Brian M Stephenson, Consultant General Surgeon, Royal Gwent Hospital, Newport, Gwent NP20 2UB, UK
Tel: +44 1633 234109; Fax: +44 1633 234252;
E-mail: brian.stephenson@gwent.wales.nhs.uk

Flexion contracture deformities associated with circular frames – an alternative form of splintage

Mark Williams

Barking, Essex, UK

Circular frames are used widely in orthopaedics. Complications include flexion contracture deformity and joint stiffness. With tibial frames, an equinus deformity commonly occurs. Strategies employed to prevent soft tissue contractures include physiotherapy, wire fixation and commercially available orthoses. As an alternative, a removable thermoplastic splint can be attached to the frame by elastic bands when the patient starts to mobilise. The force applied can be varied by changing the number of bands (Fig. 1). The splint is easily removable, and can be worn with a shoe to encourage weight-bearing.

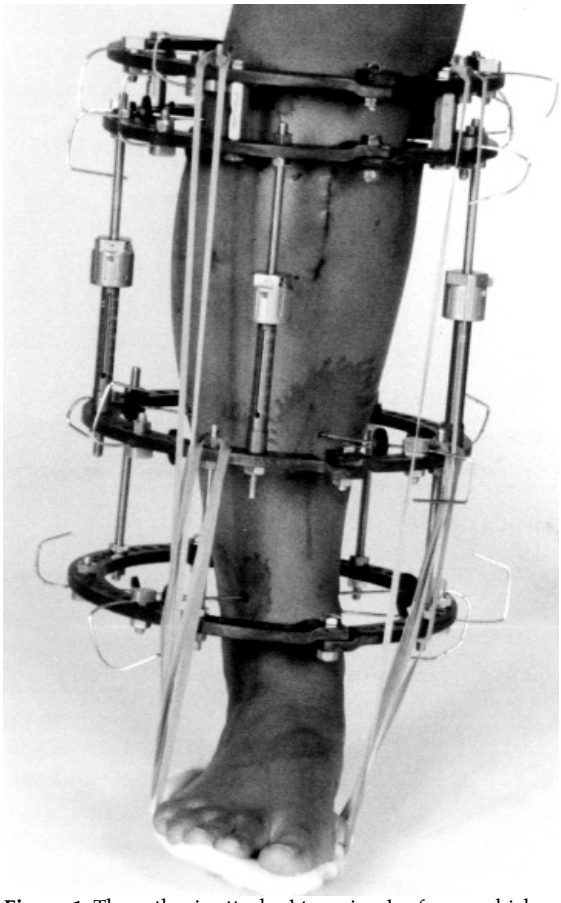

Figure 1 The orthosis attached to a circular frame which can be used with or without footwear.

This modification has been used on a number of patients with favourable results. It provides an inexpensive, effective method to prevent flexion contractures associated with the use of circular frames and can be reproduced in any orthopaedic department.

Correspondence to: Mr Mark Williams, 27 Cuthberga Close, George Street, Barking, Essex IG11 8BS, UK

Orientation and labelling: use of an acetate sheet to label tumour resection specimens

Stuart CA Winter[1], Rogan Corbridge[1], Ketan Shah[2], Peter Millard[2], Graham J Cox[1]

[1]*Department of Otorhinolaryngology, Head and Neck Surgery, The Radcliffe Infirmary, Oxford, UK*
[2]*Department of Cellular Pathology, The John Radcliffe, Oxford, UK*

Surgeons need to supply information to the histopathologist so they can orientate specimens macroscopically, prior to microscopy.[1] After tumour resection and fixation in formalin,

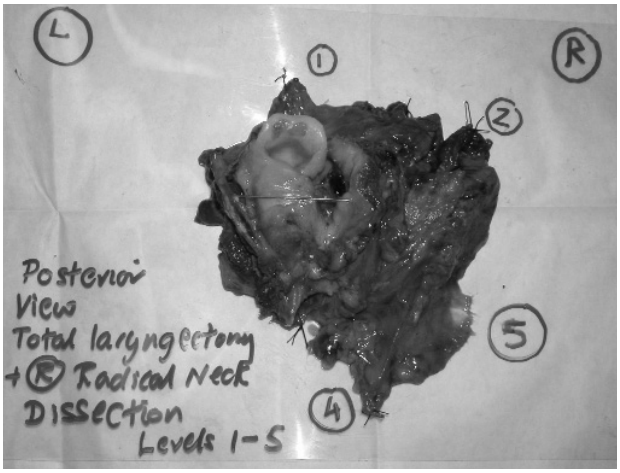

Figure 1 Pathological specimen secured to an acetate sheet, with nodal levels marked.

tissues undergo shrinkage and are difficult to identify. In the past, large surgical specimens have been placed directly into formalin often with a surgical tie, or pinned to a cork board. Our practice has been to secure large resection specimens to an acetate sheet (Fig. 1). Using a permanent marker, labels can be written to supply information, such as orientation, nodal levels, or close surgical margins. This provides a simple method of conveying information to the histopathologist.

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Correspondence to: Mr Graham J Cox, Consultant Surgeon, Department of Otorhinolaryngology, Head and Neck Surgery, The Radcliffe Infirmary, Woodstock Road, Oxford OX2 6HE, UK

Tegaderm technique to protect skin marking

Ji J Bong, Mark Lansdown

St James's University Hospital, The Leeds Teaching Hospitals NHS Trust, Beckett Street, Leeds LS9 7TF, UK

We read with interest the article on the use of durable pre-operative skin marking,[1] and would like to offer our own 'technical tip'. In our practice, we use a waterproof transparent dressing (Tegaderm, 3M Healthcare, Borken, Germany) to cover over any pre-operative skin marking. This method ensures that the marking will withstand any pre-operative washing or sweating by patients, rigorous surgical scrubs, and the solvent effect of alcohol. The dressing can easily be removed prior to skin preparation in theatre, leaving the marking intact. We normally use this technique to protect markings on lumps and bumps, colostomy site, side of operation (e.g. hernia), and for breast surgery. However, the technique is not suitable for extensive varicose vein marking. We would recommend any junior surgeon to consider using this alternative approach.

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Correspondence to: Mr Mark Lansdown, Consultant Surgeon, St James's University Hospital, The Leeds Teaching Hospitals NHS Trust, Beckett Street, Leeds LS9 7TF, UK