Case 8 Ultrasound guided hip injection Raymond Leung

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Case History

Mrs X was a 60 year old lady referred to the musculoskeletal (MSK) clinic by her general practitioner (GP) with 2 years history of gradual onset right anterior hip pain radiating to the knee. The pain was 7/10, exacerbated by prolonged walking, sitting to standing, and climbing stairs. She had associated stiffness in her right hip and knee in the evenings. There was no giving way, locking or paraesthesia.

She had about 12 sessions of physiotherapy to work on her hip movements and strength with no improvement. Her GP organised a pelvic X-ray four months ago which showed bilateral hip joint space narrowing and sclerotic changes, particularly on the right.

Mrs X had been struggling to walk to the local supermarket and do her chores. Her past medical history included type 2 diabetes controlled by metformin and gliclazide. She was also on atorvastatin for hypercholesterolaemia and amlodipine for hypertension. She had no known drug allergies.

Examination and differentials

She had reduced active flexion and external rotation (with knee flexed) compared to her left hip. There was localised joint tenderness on passive end range flexion of both the right hip and right knee. Her lumbar spine examination was normal.

Ultrasound scan (US) of her right hip demonstrated no sizeable joint effusion, mild bony irregularity of the anterior acetabulum and no power Doppler signal. The proximal tendon insertions of sartorius and rectus femoris muscles were intact. The iliopsoas tendon appeared intact. There was no evidence of bursitis or significant gluteus medius tendinopathy on the lateral right hip. Her right knee showed mild thickening and heterogenous changes to the proximal medial collateral ligament, some cortical irregularity in the medial tibiofemoral joint line with mild extrusion of the medial meniscus, no synovial hypertrophy and no effusion.

The diagnosis was most likely right hip osteoarthritis (OA) given the clinical assessment, US and previous X-ray findings. A differential was referred pain from right knee OA in view physiotherapy for the hip was ineffective and changes seen on the knee US. She may have both conditions co-existing. Another differential, albeit less likely, was iliopsoas muscle pathology which coincided with some of her symptoms and can be difficult to fully evaluate on US.

Management

Mrs X had already tried physiotherapy exercises with no improvement and she was not keen on oral analgesic medications. Her symptoms were not constant and severe enough to warrant an orthopaedic opinion. She was therefore offered an intra-articular injection of corticosteroid and local anaesthetic into the hip. The injection could provide diagnostic information (i.e. determine if the right hip was the source of the pain) and provide therapeutic symptomatic relief.

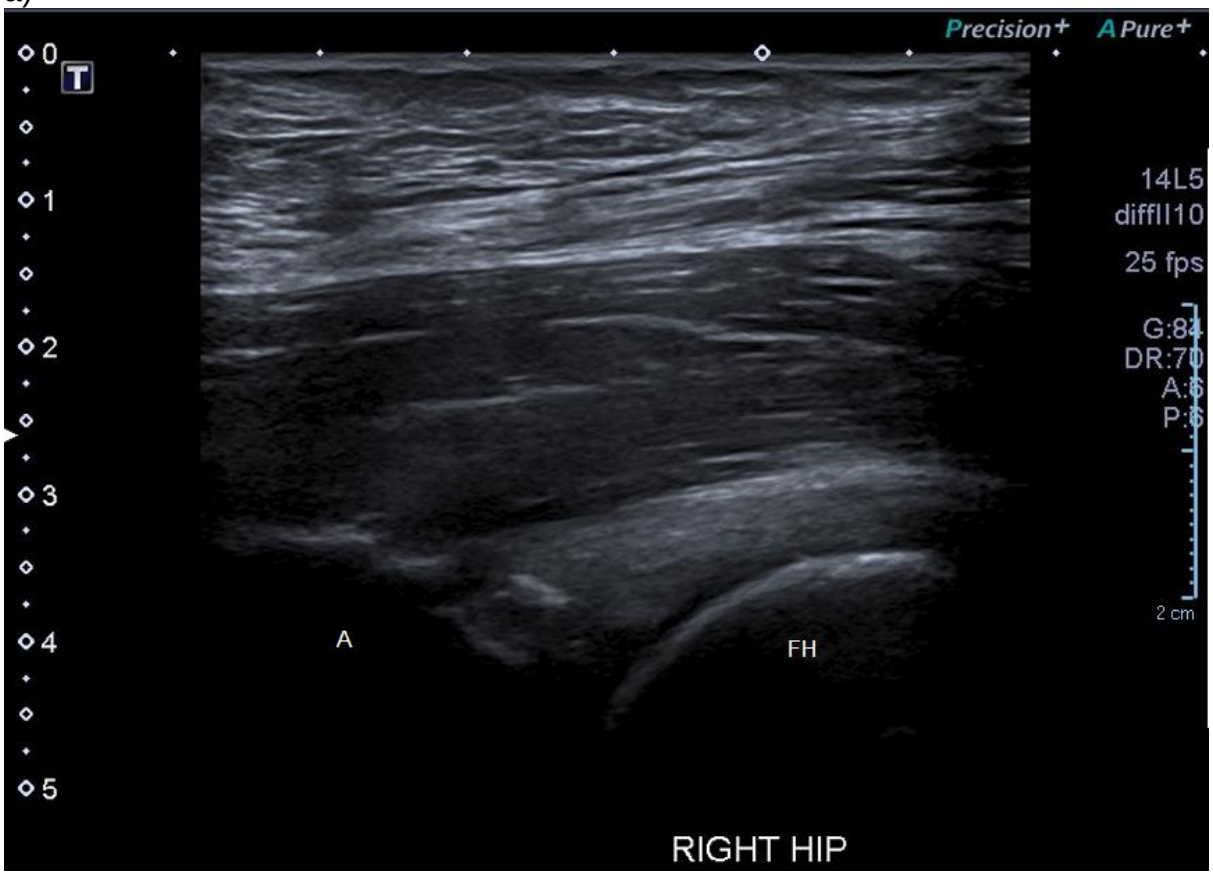
Post-injection she would be advised that the local anaesthetic may start to reduce her pain within a few minutes and last for 1-2 hours. She would be advised the corticosteroid may take longer to have an effect and would hopefully provide her with at least 3 months of pain relief. She would need to avoid strenuous activities for the next 48 hours, monitor her blood sugar levels more regularly (e.g. daily) for one week, and to seek help from her GP or diabetic nurse if the sugars remain elevated. After the procedure, she would be informed to wait in the waiting area for 10-20 minutes to make sure no allergic symptoms develop. She would be advised to seek urgent medical attention if she develops any signs of a joint infection such as the joint becomes more acutely painful, hot, swollen, red and she feels unwell or feverish. A follow-up appointment would be arranged.

Role of ultrasound in hip osteoarthritis

Hip OA can be diagnosed based on clinical presentation alone with symptoms such as progressive hip pain, stiffness, and reduced hip range of motion (Lespasio *et al.*, 2018). US can detect various abnormalities to indicate hip OA such as a joint effusion, synovial thickening or hypertrophy, hyaline cartilage thinning or echogenicity, bony cortex irregularities and peri-articular soft-tissue bursitis (Sudula, 2016). A hip joint effusion in an adult can be defined as an increased distance between the anterior femoral neck surface to the outer margin of the joint capsule of 7mm or more, or 1mm or more when compared to an asymptomatic contralateral hip (Koski, Anttila and Isomäki, 1989). Synovial hypertrophy presents as distension of the hip joint recess which can be hypoechoic, isoechoic or hyperechoic, and lacks compressibility with absent power Doppler flow if no associated synovitis (Jacobson, 2013).

The main findings on Mrs X's right hip US suggestive of OA was the mild bony irregularity of the anterior acetabulum (Figure 1a). There was no power Doppler signal present (Figure 1b) and no sizeable effusion in the anterior recess (Figure 2).

a)



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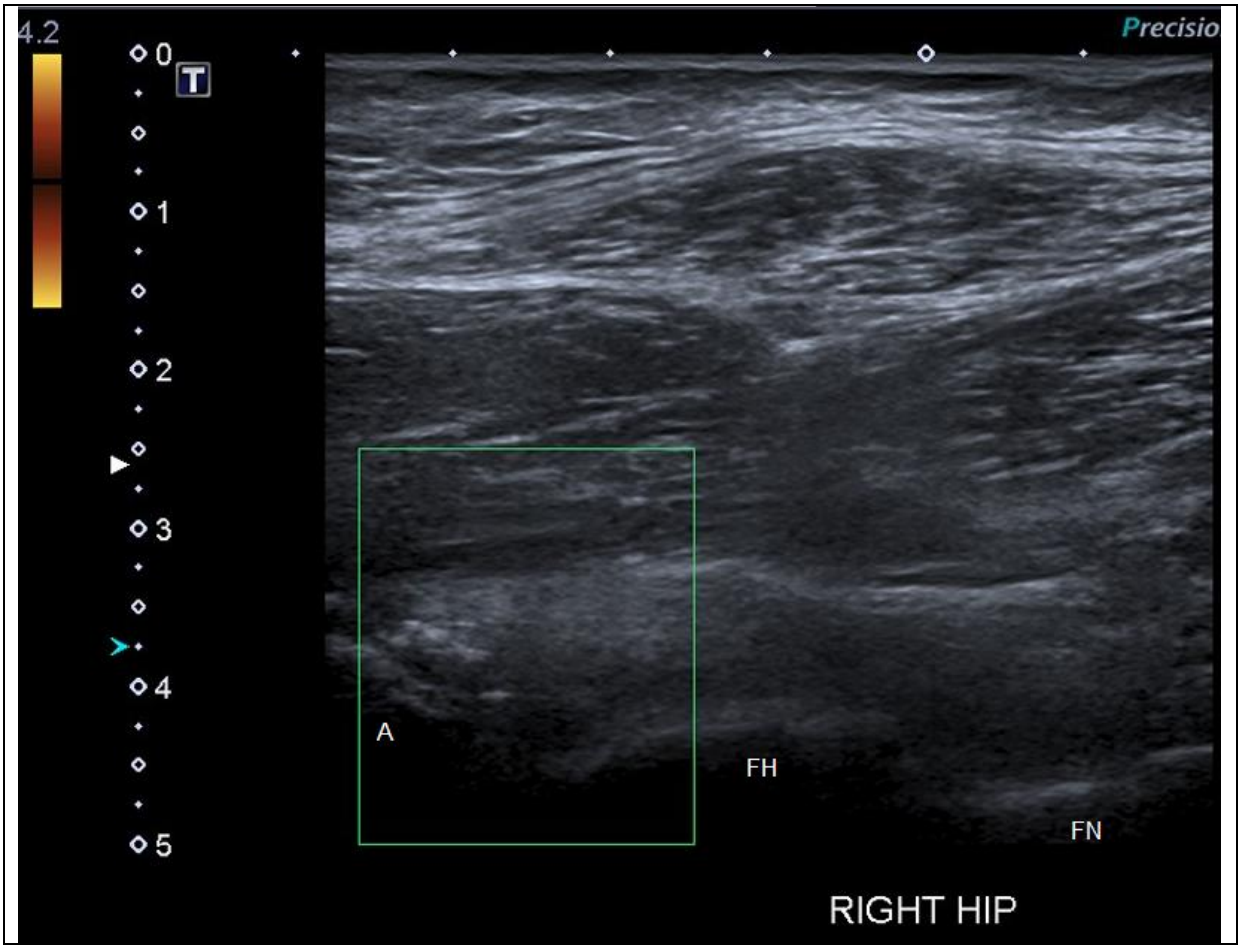


Figure 1. US of the right anterior hip. A = acetabulum with bony irregularity, FH = femoral head, FN = femoral neck. 1a) visualises the acetabular irregularity 1b) demonstrates no power Doppler flow in this area.

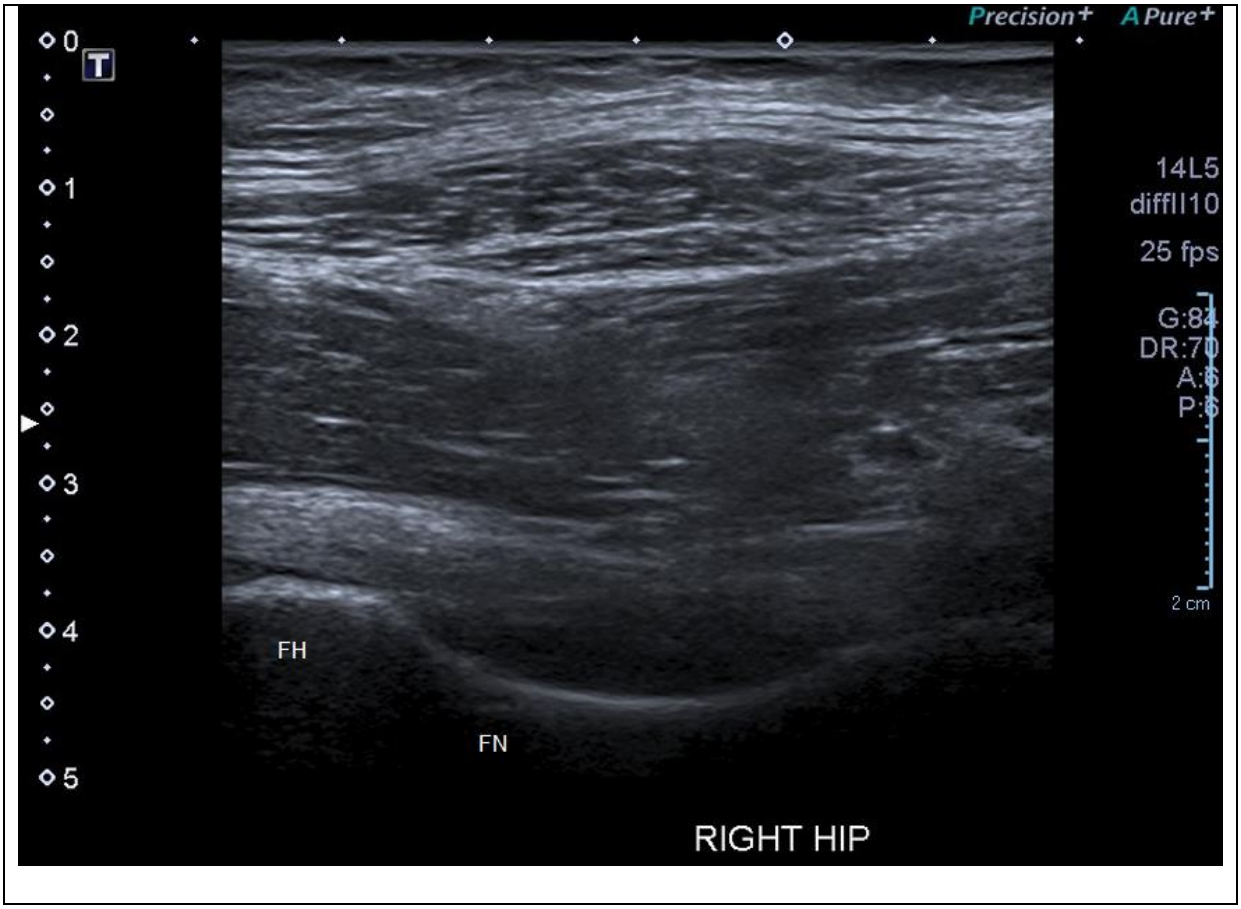


Figure 2. US of the right anterior hip with visualisation of the anterior joint recess and capsule.

A study by Keen et al. (2008) found that osteophytosis in hand OA was detected in approximately 30% fewer small joints in conventional radiography compared to US. Joint space narrowing was also detected more on US in this study. Nevalainen et al. (2018) did a small scale study on the use of US for advanced knee OA in comparison to intra-operative findings, and found US to be 92% sensitive at detecting medial femoral condyle cartilage degeneration, and 97% sensitive at detecting both effusions and synovitis. Despite this evidence, the use of US to evaluate hip OA compared to other imaging modalities has not been well studied.

The GP had already organised an X-ray, which can help establish the diagnosis of OA with features of joint space narrowing, osteophytes, subchondral sclerosis and cyst formation (Kellgren and Lawrence, 1957). However, in the Framingham hip OA study (Kim *et al.*, 2014) of 978 subjects, they found radiological evidence of OA in 19.6% of subjects with only 4.2% symptomatic. Radiological findings therefore do not necessarily correspond to symptoms, so a clinical assessment is paramount.

Magnetic resonance imaging (MRI) is a sensitive, accurate and reliable modality in hip OA to directly visualise the cartilage surface alterations (Sudula, 2016), labral integrity, bone health and surrounding soft tissue structures. MRI is expensive and

not routinely required in hip OA, but maybe useful for surgical planning or to fully evaluate injuries to soft tissue structures, particularly deeper structures. Computed tomography (CT) has high doses of radiation so is usually only reserved for acute hip trauma or for surgical planning. Both of these modalities generally produce static images whereas US can dynamically evaluate abnormal tendons gliding (e.g. snapping hip), some peripheral nerve entrapments, and some abnormal joint space widening (e.g. the acromioclavicular joint). MSK US is also safe with optimal patient acceptance, has low running costs, and has no known contra-indications (Sudula, 2016).

Role of intra-articular injection therapy in hip osteoarthritis

Hyaluronic acid

Hyaluronic acid (HA) is a constituent of healthy synovial fluid and acts as a viscosupplementation for the joint. A meta-analysis of six randomised controlled trials (RCT) of HA in hip OA found an overall improvement in pain and functional scores from baseline (Wu, Li and Liu, 2017). The HA group's pain scores were -0.72 with 95% confidence interval (CI) of -1.06 to -0.39 and $P< 0.05$. These improvements were, nonetheless, not significantly different compared to saline and other treatments such as analgesics.

National Institute for health and Care Excellence (NICE) does not currently recommend the use of intra-articular HA for the management of OA in adults (NICE, 2014).

Platelet rich plasma

Platelet rich plasma (PRP) is extracted from the patient's own blood which contains various growth factors involved with injury healing. PRP is considered a safe treatment which may reduce hip OA pain in the short term (6 months), but no definitive conclusions can be drawn due to methodological concerns with current studies (Bennell, Hunter and Paterson, 2017). PRP is not routinely available in many National Health Service (NHS) trusts in the UK.

Corticosteroids

An early double-blinded RCT of hip OA patients compared intra-articular injection of bupivacaine 0.5% and 20mg triamcinolone against a normal saline placebo group (Flanagan *et al.*, 1988). The study found an improvement in the post-injection steroid group for 75% of patients at 1 month, 33% of patients at 3 months and 7% of patients at 12 months. However, improvements in pain were also found in the placebo groups.

A randomised trial compared intra-articular treatments of hip OA and found a significant treatment effect for pain on walking over 3 months in the corticosteroid (40mg methylprednisolone) group with an effective size of 0.6 (95% CI of 0.1 to 1.1, P = 0.021) compared to the saline group (Qvistgaard *et al.*, 2006). There was also an improvement in hip function outcome measures in 56% of patients at 14 days and 66% of patients at 28 days in the corticosteroid group.

A systematic review of RCTs evaluating the efficacy of intra-articular corticosteroid injections (CSI) in hip OA found a reduction in pain scores 3-4 weeks post-injection, a significant reduction in pain scores with moderate effect size in two trials up to 8 weeks post-injection, and a statistically significant improvement in function scores for three trials at 3 weeks post-injection (McCabe *et al.*, 2016).

NICE (2014) advocates the use of intra-articular CSI as an adjunct to core treatments for the relief of moderate to severe pain in people with OA. Mrs X in this case was rather symptomatic with a pain score of 7/10 so it was reasonable to consider a CSI.

Guided versus unguided injections

A review article has found that ultrasound guided injections (USGI) are more efficacious than landmark-injections in the subacromial space, biceps tendon sheath, shoulder, hand, wrist, knee, ankle and foot joints (Daniels *et al.*, 2018). The authors report no conclusive evidence that USGI of the hip is more efficacious than landmark injections, although hip injections maybe less commonly performed unguided.

A study evaluated an USGI of betamethasone 8mg plus 2ml of 1% lidocaine to 40 patients (45 hips) with hip OA and compared this to 21 patients (21 hips) with hip OA as controls (Micu, Bogdan and Fodor, 2010). The patients were followed up after 1 and 3 months, and the USGI group had significant improvement in pain scores (P <0.001). The study additionally found 75% reduction in US evidence of synovial hypertrophy (defined as a synovitis or an effusion) in those that had an USGI. USGI has the advantage over unguided injections of allowing an initial diagnostic assessment for synovitis which can be target areas for corticosteroid treatment, and directly visualise an effusion for aspiration if required.

A RCT divided 77 hip OA patients into four groups: no injection, USGI hyaluronic acid (60mg), USGI normal saline (3ml) and USGI methylprednisolone acetate (120mg) (Atchia *et al.*, 2011). The study found significant improvement in pain and function scores in the steroid group only, and concluded that ultrasound evidence of synovitis was a predictor of steroid response at 4 weeks and 8 weeks. USGI therefore has the advantage over unguided injections to both assess and monitor synovitis and its response to steroids.

A meta-analysis compared 4 USGI studies (136 hip injections) against 5 landmark-injection studies (295 hip injections), and found that USGI were 100% accurate (95% CI of 98% to 100%) but landmark-injections were only 72% accurate (95% CI of 56% to 85%) (Hoeber *et al.*, 2016). The main limitation of this meta-analysis was that the individual studies did not directly compare hip USGI with landmark-injections, and there was an overall paucity of studies available that do this comparison for the hip.

Safety and medico-legal considerations

Mrs X was informed that the intra-articular CSI for her hip OA is primarily an anti-inflammatory that would be injected into the joint using a needle and syringe with the guidance of ultrasound. She was advised that the steroid will be mixed with local anaesthetic to temporarily numb the area, determine if the hip is the source of the pain, and provide a volume effect on a potentially tight joint capsule. She was informed that the CSI may provide symptom relief for up to 3 months or longer and repeat injections (typically maximum 3 per year) into the same area may be required. Mrs X was also informed that operative hip interventions may need to be postponed for 6 months or more after a CSI to minimise infection risks.

The possible CSI side-effects were discussed including facial flushing, small area of fat loss or pale skin discolouration around the injection site (less likely in a deep injection of the hip), bruising or bleeding around the area, infection, allergic reaction, temporary increase in pain for 24 to 48 hours post-injection (steroid flare) and temporary increase in blood sugar levels (Tidy, 2019). The previous management section outlined Mrs X's post-injection care. She was advised to monitor her blood sugar levels for a week because intra-articular CSI has been shown to elevate blood glucose in this post-injection period (Choudhry, Malik and Charalambous, 2016).

Mrs X had capacity to make a decision on her treatment. She was fully informed about the procedure, the associated benefits and risks of a CSI and alternative management options. She made a voluntary decision to proceed. Both verbal and written consent was obtained from Mrs X.

The choice of corticosteroid was based on local trust policy. Both triamcinolone acetonide (Kenalog®) and methylprednisolone acetate (Depo-Medrone®) have similar relative potencies with the former being slightly more insoluble (Skedros, Hunt and Pitts, 2007). They are therefore both suitable for injection into larger joints for longer duration of action. Kenalog® was used in this case at a dose of 40mg in 1ml within the British National Formulary (NICE, 2019b) recommendations.

Lidocaine 1% is rapid onset with a duration of 1-2 hours and Bupivacaine 0.25% has a slower onset with a duration of 3-6 hours (Murakami, 2015). A small quantity of local anaesthetic can potentially be absorbed systemically during an intra-articular injection, so it should be used cautiously in patients with cardiovascular, liver and renal disease (NICE, 2019a). Both lidocaine and bupivacaine can potentially be

chondrotoxic causing breakdown of articular cartilage (Gulihar *et al.*, 2015), but chondrotoxicity in studies are typically associated with higher concentrations or with the addition of adrenaline. The local trust policy recommends to use Lidocaine 1% or Bupivacaine 0.25% and to avoid vials with higher concentrations. 4mls of 1% lidocaine (40mg) was used in this case within the British National Formulary (NICE, 2019a) recommendations.

USGI technique

The patient was positioned supine with the knee flexed at about 20 degrees (using a cushion) and the right hip in slight abduction. A linear probe 14L5 with a frequency range of 5-14 Mhz was selected with a machine preset for “MSK Hip”. The frequency was set at 10Hz with a depth adjusted between 5cm-6cm to visualise the anterior portion of the femoroacetabular joint, the femoral head-neck junction and anterior femoral recess. Focus was set just above the hip joint. Time gain compensation and overall gain was adjusted so deeper structures were better visualised.

Once the initial US was performed, the sterile field was setup, 1ml of Kenalog® 40mg was drawn up with 4mls of 1% lidocaine (40mg) into a 5ml syringe. A 22 gauge (0.7mm x 90mm) black spinal needle was used. The procedure technique was as follows:

1. Skin around the hip was cleaned with chlorhexidine solution
2. A probe cover was placed over the probe that had gel which was then dipped in the chlorhexidine solution
3. Probe was positioned over the anterior aspect of the hip joint in the transverse oblique plane
4. Due to a few blood vessels seen from the inferolateral side of the probe, entry from the superomedial side was attempted instead
5. The needle was guided in-plane in long-axis to the femoral neck towards the anterior joint recess from a proximal superomedial direction to inferolateral (Figure 3)
6. The corticosteroid and local anaesthetic mixture was injected and flowed freely into the joint (Figure 4a and b)
7. The needle was removed and a plaster was applied to the needle entry site

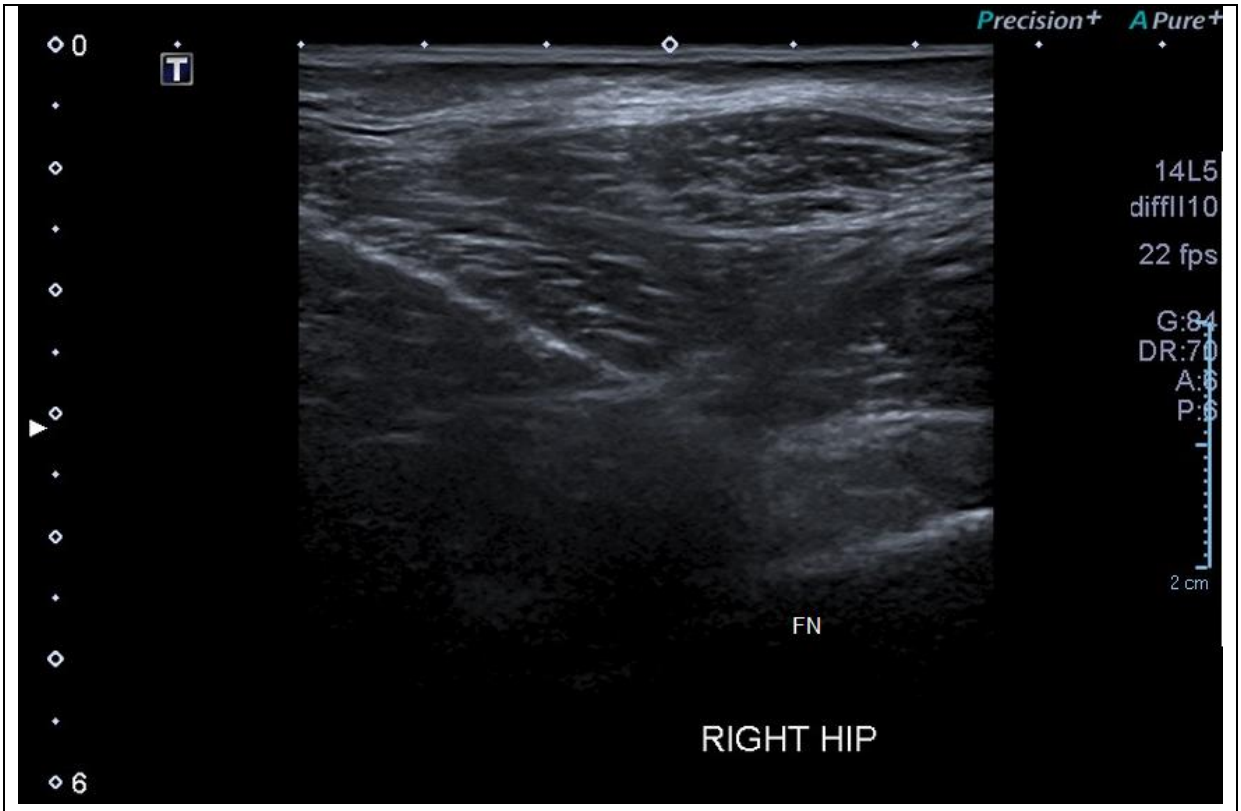
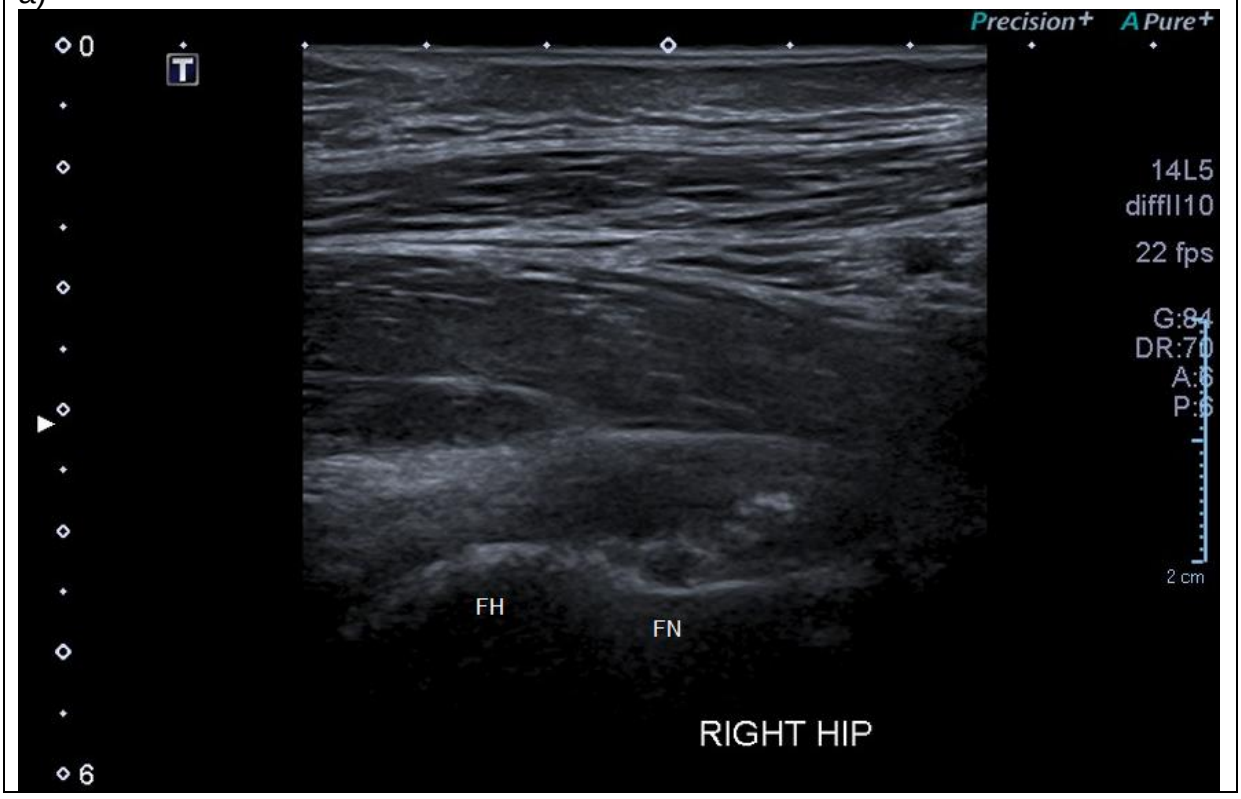


Figure 3. USGI of the right hip – needle visualised directing towards the anterior recess from the proximal side of the screen.

a)



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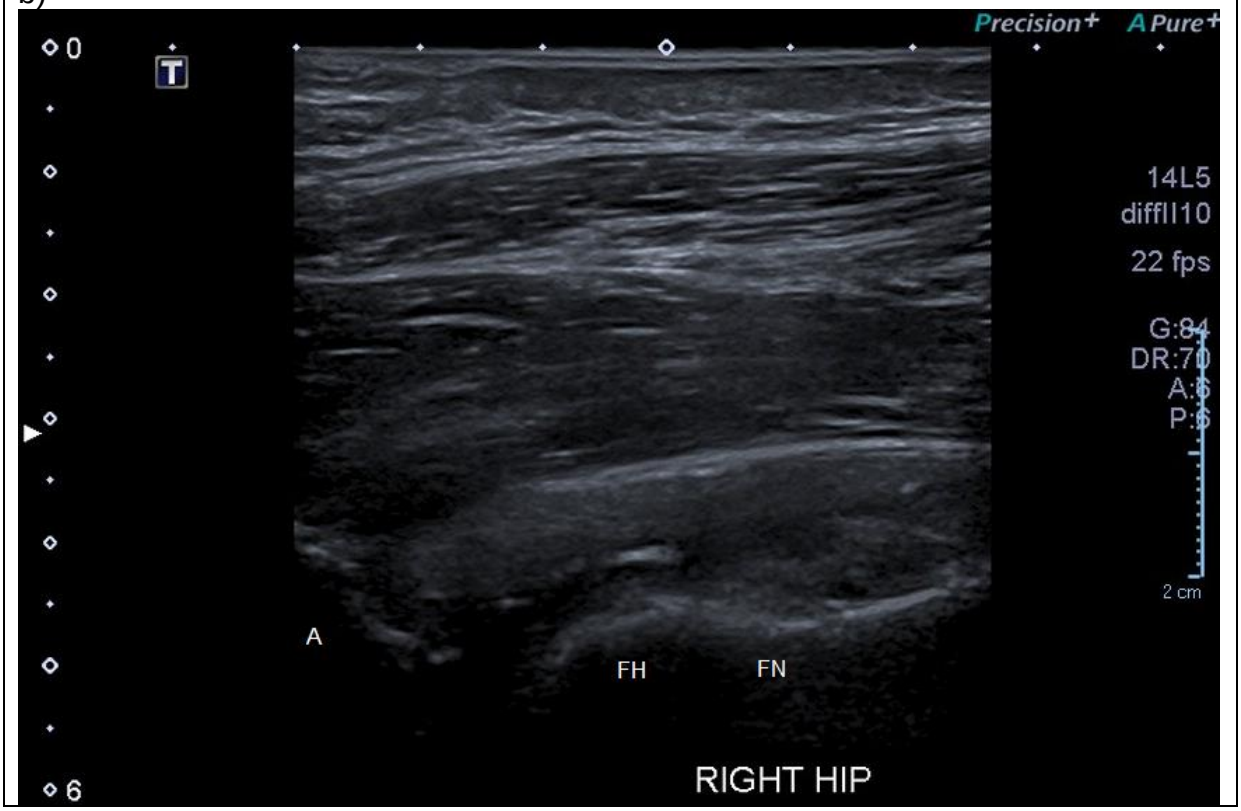

Figure 4. USGI of the right hip. 4a) the corticosteroid and local anaesthetic is seen flowing out from the tip of the needle into the anterior recess 4b) it is then seen flowing across into the femoroacetabular joint.

Mrs X was asked to complete a visual analogue scale of her hip pain and a Lower Extremity Functional Scale (LEFS) questionnaire at baseline and to repeat this at 6 weeks follow-up. On follow-up she reported a drop in her pain score from a maximum of 7/10 to 5/10 with the first 2 weeks post-injection being most beneficial. Her LEFS score at baseline was 61.3% and mildly improved to 65% at 6 weeks.

<u>Key learning points</u>

- Hip OA can be diagnosed clinically but US can be useful to assess the anterior hip joint for cortical irregularities, effusions and synovitis with power Doppler
- It is important to take a detailed past medical history and drug history including allergies to assess risks and suitability for injection therapy
- Short-term (up to 3 months) data suggests CSI maybe beneficial for hip OA and NICE currently advocates it as an adjunct for moderate to severe pain in OA

- USGI for hip OA is found to be more accurate than landmark-injections, but data for effectiveness of USGI versus landmark-injections in the hip is less clear
- Local anaesthetics particularly at high dosages or concentrations can be chondrotoxic so must always consider lower doses or alternative options (e.g. normal saline or not using local anaesthetic entirely)
- During USGI, blood vessels should always be avoided, and small movements can compromise the visualisation of the needle particularly if the needle is thin

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