Case 14

Stephen Bramson

Ultrasound Guided Aspiration & Injection of the Gleno-Humeral Joint (GHJ)

Presentation

83-year-old female with recurrent pain and gross swelling of the left shoulder with significant reduction in range of movement.

Relevant Medical History

Hypertension
Arthritis
Eczema
Hypercalcemia
Hypercholesterolaemia
Osteoporosis
Multiple previous fractures (recent T10, old T6 & T8, left wrist and ankle)

Current Medication

Amlodipine
Bendroflumethiazide
Prednisolone
Adcal D3
Not tolerating oral bisphosphonates.

The patient has a weekly cleaner but remains active running her own business, drives, lives alone, independent of ADLs, mobile with walking stick and furniture walks at home. Mobility is limited by pain in the neck and left shoulder for which she takes analgesia. The patient was on long term prednisolone for her eczema (currently 5mg) with no other obvious secondary osteoporosis risk factors. High risk for major osteoporotic fractures with a FRAX Score of 64%. Lowering the risk of further significant fracture with associated morbidity by increasing mobility, reducing pain, and risk of falls are the goals of intervention.

Investigations

Initial x-rays (images A and B) demonstrated moderate OA changes to the GHJ with osteophytic lipping of the glenoid and humeral head with mild narrowing of the subacromial space in keeping with possible rotator cuff injury type pattern.

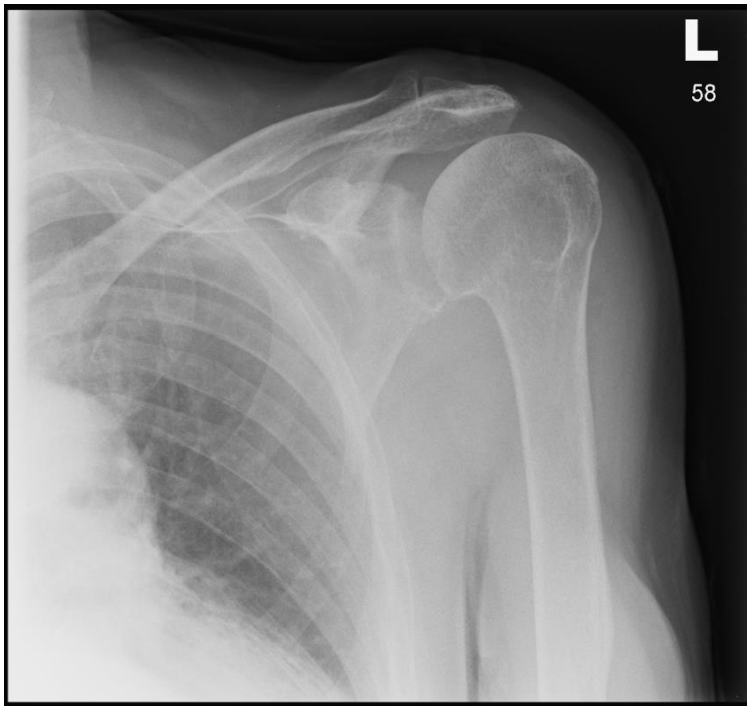
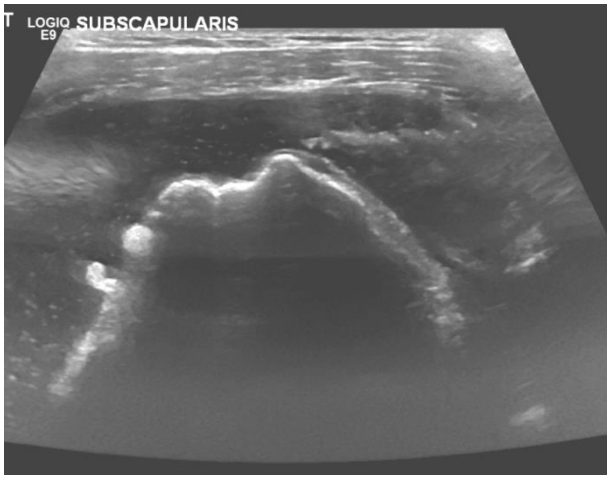


Image A: X-ray; AP view

Image B: X-Ray; Y view

Subsequent diagnostic ultrasound scan of the left shoulder (images C and D) in Summer 2018 demonstrated a large effusion in the anterior, lateral, and posterior aspects of the glenohumeral joint with internal synovial hypertrophy and hyperaemia on the outer joint capsule. Very few fibres of the Long Head of Biceps (LHB) tendon were demonstrated in keeping with a rupture. There was a complete tear of the subscapularis and supraspinatus. The AC joint was degenerative. Very irregular bone contour was evident in the head or humerus.



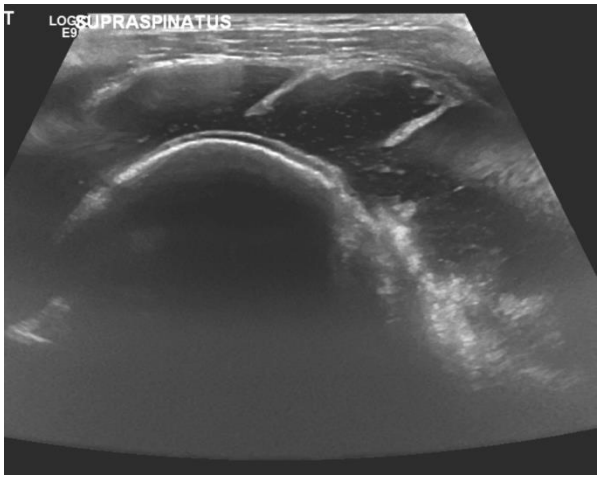


Image C:

Diagnostic ultrasound; subscapularis

Image D:

Diagnostic ultrasound; supraspinatus

Previous Management

80 ml of inflammatory viscous joint fluid was previously aspirated under ultrasound guidance (September 2018) by a consultant rheumatologist. As potential differential diagnosis included septic arthritis, gout or pseudogout, aspirated synovial fluid was sent for analysis; microscopy, culture and sensitivity (MC&S), cell count, gram stain, crystallography, and TB culturing (all negative). Subsequently, a repeat aspiration of 100 ml of inflammatory joint fluid was performed under ultrasound guidance (November 2018) by the consultant rheumatologist, followed by injection of 80mg methylprednisolone with 2ml 2% lidocaine.

Referral (June 2019)

Referred by the consultant rheumatologist for further repeat ultrasound guided aspiration and cortico-steroid injection to the left GHJ.

Ultrasound Guided Aspiration and Corticosteroid Injection (CSI) to the left GHJ (July 2019)

Patient information leaflet on injection therapy, including associated risks had been sent to the patient in the post prior to appointment, allowing the patient time to process the information to facilitate appropriate informed consent. Pre-procedural scan (image E) confirmed a current large effusion distending the glenohumeral joint / sub acromial bursa of the left shoulder consistent with previous imaging.

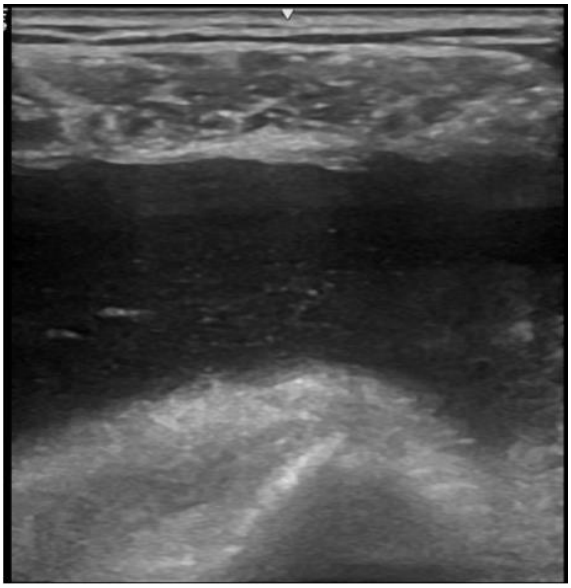


Image E: Pre-procedure ultrasound image

Following appropriate informed verbal consent including risk of infection, skin depigmentation, fat atrophy, post injection flare and recurrence, and no recent infections, 5ml of 1% lidocaine was infiltrated to the GHJ under ultrasound guidance with 121ml of blood stained fluid aspirated (image F). As infection was not suspected from the clinical presentation and previous negative synovial fluid analysis, 40mg in 1ml of the corticosteroid methylprednisolone was injected to the GHJ with the procedure being well tolerated with no immediate adverse effects.

Image F *Critical reflection: improved preparation with adequate stock of larger syringes (20/50ml) would have led to improved technical efficiency of aspiration procedure.*

Discussion

As a non-prescriber within the NHS, the above procedure was performed under the direction of a Patient Group Directive (PGD) which prohibits the mixing of two licensed medicines together, creating a new unlicensed product, before administration (CSP 2016). Therefore, the above procedure was performed using an aseptic technique with the same needle in situ (green 21G 40mm), with change of syringe performed following initial infiltration of local anaesthetic, to multiple syringe changes for aspiration and finally, injection of corticosteroid. Compared to previous procedures, a lower dose of 40mg methylprednisolone was used in alignment with maximum dose permitted under the PGD.

Following a massive growth in the literature over the last decade, a position statement (Finnoff 2015) by the American Medical Society for Sports Medicine (AMSSM) highlights there is now strong evidence that Ultrasound Guided Injections (USGI) are more accurate than Land Mark Guided Injections (LMGI), moderate evidence that they are more efficacious and preliminary evidence that they are more cost-effective.

An interesting original study on 12 cadaver specimens by Gofeld (2019), confirmed continuity of the GHJ capsule and the biceps tendon sheath through injection of blue

dye into the biceps groove, validating this anterior approach as a simple alternative to accessing the glenohumeral joint. A study of 100 patients by Rutten (2009) concluded that compared to fluoroscopically guided techniques, US-guided injections to the shoulder and especially the anterior approach are significantly less time consuming, more successful on the first attempt, cause less patient discomfort and eradicate the need for radiation and iodine contrast. However, Chen (2015) stated the posterior GHJ approach is preferred in glenohumeral joint injection as less extravasation will occur as compared with the anterior rotator interval approach and avoids the axillary neurovascular structures. As outlined by Smith (2009) advanced planning of the procedure is important for successful intervention including review of regional anatomy (with power doppler), selecting shortest possible route skin to target tissue while minimising the neovascular risk and optimising needle visualisation.

The procedure was performed with portable GE Logiq E with patient comfortable in supported long sitting on with left shoulder slightly adducted and in internal rotation. With screen, patient and line of needle all in view and with the high frequency 12MHz linear transducer probe positioned in a longitudinal position, the needle was advanced, from posterior- lateral position, in plane and parallel to the probe for optimum visualisation, into the distended posterior joint capsule. This procedure was performed from a posterior lateral approach due to personal clinical preference and experience that this tends to be a non-sensitive technique with the additional benefit that the patient is not directly visualising the needle. Ultrasound guidance also provided real time monitoring, allowing optimisation of the volume of fluid aspirated.

Long-acting, usually insoluble steroid formulations are frequently used as intra-articular or intramuscular injections in rheumatic diseases, due to their effect on reducing pain and inflammation. For large joints (e.g. shoulder) both triamcinolone and methylprednisolone have been recommended and for smaller joints (e.g. finger), hydrocortisone or methylprednisolone. Both triamcinolone and methylprednisolone have approximately 5 times the potency of hydrocortisone. Triamcinolone has duration of action of 2-3 weeks compared to Methylprednisolone of 3-4 weeks (Stephens 2008). For musculoskeletal injections, lidocaine hydrochloride is the most frequently used local anaesthetic, with a rapid onset and duration of action ranging from 80 to 120 minutes, making it ideal for both subcutaneous and intra-articular

anaesthesia. Only 1% lidocaine concentration should be used, as doses greater than 1% concentration have been associated with chondrocyte toxicity (Murakami 2015). Complications of intra-articular injection include post injection flare of pain (2-10%), skin atrophy (1 %), fat atrophy (1 %), and facial flushing (<1-12%). Less commonly reported side effects include iatrogenic infection (risk of 1 in 1,000) (Stephens 2008).

The recent COVID-19 pandemic is caused by a newly identified coronavirus infection (SARS-CoV-2) in humans which in severe cases can lead to the formation of a 'inflammatory cytokine storm' which can cause respiratory distress, multi-system organ failure and death (Amani 2020). Several governing bodies from leading health professions in the UK subsequently produced joint guidance (BSR et al 2020) around the concern that due to their immunosuppressive effects', steroids can increase the risk from SARS-CoV-2. This guidance was initially widely interpreted on a national basis as steroid injections being contraindicated during COVID-19 (Little 2020) and their subsequent temporary cessation of their use for MSK pathology. Little (2020) discusses how some observational studies have found corticosteroid use conferred a dose-related increased risk of infection in rheumatic patients, who are already at double the population baseline risk of developing infections, however it's important to recognise the comparatively very small doses used in most musculoskeletal corticosteroid injections (CSI).

There is a genuine risk that suspending the legitimate use of a CSI that could alleviate pain, improve quality of life and delay, if not remove, the need for surgery may expose individuals to higher risks than the so far unproven risk from a relatively low dose of steroid, is in itself unethical (Amani 2020, Little 2020). The original guidance summarises that an individual risk analysis should take place on a case-by-case basis and a steroid injection should only be considered at the minimum appropriate dose if a patient has significant disease activity and/or intrusive and persisting symptoms, has failed first-line measures including simple analgesia, activity modification, splinting and exercise and there are no appropriate alternatives.

In line with Montgomery (2015), the judgement to proceed must follow an informed shared decision-making process including risks and implications of CSI versus alternative management strategies with the patient having the mental capacity

(Mental Capacity Act 2005) and appropriate time to reflect their decision with the process recorded in their medical notes. The aspiration and injection discussed in this case study was performed prior to the COVID 19 pandemic. The additional increased risk associated with the medical history of hypertension and the patients age (83) balanced against the acknowledgement of the high risk of osteoporotic fractures and the reliance on shoulder function to maintain the patient's mobility and independence would form the focus of any future individual risks analysis for this patient.

Alternative management

Dean (2013) discusses how as the body of evidence in the literature has gradually questioned the validity of common clinical diagnostic tests of the shoulder, there has been a shift towards increased utilisation of radiological imaging modalities such as ultrasound and MRI. Glenohumeral joint osteoarthritis can mimic frozen shoulder which is why all stiff shoulders should be X-rayed to assist diagnosis (Sinha 2017). However, careful interpretation of investigation findings is required prior to any intervention including guided injections as the cause of shoulder pain can be multifactorial even in the presence of confirmed pathology as demonstrated by Templehof (1999) who showed from a prospective study of 411 volunteers that asymptomatic rotator cuff tears increase with age, with up to 51% in those greater than 80 years of age.

Levy (2008) acknowledges that the management of massive rotator cuff tears in medically unfit, elderly patients can be difficult and concludes that anterior deltoid rehabilitation programmes are suitable for this population to improve pain and function. The patient has not previously benefited from physiotherapy to the shoulder. The surgical option with a clinical presentation of a massive rotator cuff tear with GHJ arthritis would include a reverse shoulder replacement (Petrillo 2017), however the patient is not considered a surgical candidate due to her comorbidities. Ultrasound guided intervention remains an appropriate option. One alternative to using corticosteroid includes performing the aspiration in isolation to improve pain and function, thus removing the concern over the additional use of corticosteroids during the COVID pandemic.

Over the past decade there has been a rapid rise in the clinical use of platelet-rich plasma (PRP) injections in the management of orthopaedic conditions including mild-moderate OA. The platelets contain growth factors which are believed to stimulate chondrocyte proliferation, leading to cartilage repair. A randomised controlled trial of 30 participants by Smith (2016) concluded intra-articular autologous conditioned plasma injections provide safe quantifiable benefits for pain relief and functional improvement in knee OA. Schnieder (2018) discusses how recent literature has shown equivocal to minor benefit of PRP use for shoulder pain, function, and healing. Overall, the body of literature is currently inconclusive regarding the clinical benefit and cost-effectiveness of PRP in the treatment of shoulder pathology. However few complications have been reported from PRP, therefore it may be a viable treatment method in specific populations, such as patients for whom corticosteroid use is a concern. Despite the expanding plethora of PRP-related citations, there remains a paucity of high-level evidence that is comparable, cohort specific, dose controlled, injection protocol controlled, and double-blinded demonstrating efficacy. Consequently, PRP procedures should only be performed with special arrangements for clinical governance, consent, and audit or research (Smith 2016 & NICE 2019).

Viscosupplementation with hyaluronic acid is a well-tolerated treatment for joint OA and has been proven to be effective treatment for mild-moderate knee OA (Henrotin 2015). Messina (2016) reviews the literature and discusses how hyaluronic acid injections are indicated for cuff arthropathy and degenerative arthritis without articular effusion of the shoulder to aid conservative management due to evidence of improved pain and mobility scores. However, in 2014 the National Institute for Health and Care Excellence (NICE) advised against offering hyaluronic acid injections within the NHS due to inconsistent evidence demonstrating statistically significant effects with the benefits not considered clinically important. Mesenchymal Stem Cells (MSC) offer another promising and emerging alternative intervention. A systematic review of 61 articles and 2390 patients by Jevotoysky (2018) concluded stem cell therapy appears to alleviate the symptoms of osteo-arthritis and potentially halt cartilage damage. However, to date there remains limited high-quality evidence and long term follow up, and like PRP, is associated with lack

of consistency and diversity of MSC preparations, with subsequent dearth of reproducibility.

Summary

The patient was reviewed by the consultant rheumatologist 2 months post procedure with the shoulder no longer a source of complaint. No further shoulder intervention has been requested or performed in the 14 months following the aspiration and injection focussed on during this case report, performed in July 2019.

The repeat ultrasound guided aspiration and corticosteroid injection described in this case study proved to have been a safe, appropriate, timely and effective intervention. Recurrence of symptoms during the current COVID-19 pandemic would lead to a review of the risk-benefit analysis of using corticosteroid in this individual with appropriate consideration given to alternative options.

Reference list

Amani, L., Warraich, R., Lee, J. and Tahir, H. (2020). Steroid Injections & COVID-19: Are Specialists Justified in Defying the Guidelines? *Int. J. Clin. Rheumatol*, *15*(4), pp.129-130.

British Society for Rheumatology (BSR), British Orthopaedic Association, British Association of Spine Surgeons, Faculty of Pain Medicine of the Royal College of Anaesthetists, Royal College of General Practitioners, The British Pain Society, Charted Society of Physiotherapy (16th June 2020) Management of patients with musculoskeletal and rheumatic conditions who: Are on corticosteroids, Require initiation of oral / IV corticosteroids, Require a corticosteroid injection

Chartered Society of Physiotherapy (CSP). (2016). The use of medicines with injection-therapy in physiotherapy services. 5th Edition, PD003.

Chen, C.P., Lew, H.L. and Hsu, C.C. (2015). Ultrasound-guided glenohumeral joint injection using the posterior approach. *American journal of physical medicine & rehabilitation*, *94*(12), p.e117.

Dean, B.J.F., Gwilym, S.E. and Carr, A.J., (2013). Why does my shoulder hurt? A review of the neuroanatomical and biochemical basis of shoulder pain. *British journal of sports medicine*, *47*(17), pp.1095-1104.

Finnoff, J.T., Hall, M.M., Adams, E., Berkoff, D., Concoff, A.L., Dexter, W. and Smith, J. (2015). American Medical Society for Sports Medicine (AMSSM) position statement: interventional musculoskeletal ultrasound in sports medicine. *PM&R*, *7*(2), pp.151-168.

Gofeld, M., Hurdle, M.F. and Agur, A. (2019). Biceps tendon sheath injection: an anatomical conundrum. *Pain Medicine*, *20*(1), pp.138-142.

Henrotin, Y., Raman, R., Richette, P., Bard, H., Jerosch, J., Conrozier, T., Chevalier, X. and Migliore, A., (2015). Consensus statement on viscosupplementation with hyaluronic acid for the management of osteoarthritis. In *Seminars in arthritis and rheumatism* (Vol. 45, No. 2, pp. 140-149).

Jevotovsky, D.S., Alfonso, A.R., Einhorn, T.A. and Chiu, E.S., (2018). Osteoarthritis and stem cell therapy in humans: a systematic review. *Osteoarthritis and cartilage*, *26*(6), pp.711-729.

Levy, O., Mullett, H., Roberts, S. and Copeland, S., (2008). The role of anterior deltoid reeducation in patients with massive irreparable degenerative rotator cuff tears. *Journal of shoulder and elbow surgery*, *17*(6), pp.863-870.

Little, C.P., Birks, M.E., Horwitz, M.D., Ng, C.Y. and Warwick, D. (2020). COVID-19: A rethink of corticosteroid injection? *Bone & Joint Open*, *1*(6), pp.253-256.

Messina, C., Banfi, G., Orlandi, D., Lacelli, F., Serafini, G., Mauri, G., Secchi, F., Silvestri, E. and Sconfienza, L.M., (2016). Ultrasound-guided interventional procedures around the shoulder. *The British journal of radiology*, *89*(1057), p.20150372.

Murakami, A. (2015) Ultrasound Guided Injections A Technical Review. *ASPETAR Sports Medicine Journal.* Vol 4.

Petrillo, S., Longo, U.G., Papalia, R. and Denaro, V. (2017). Reverse shoulder arthroplasty for massive irreparable rotator cuff tears and cuff tear arthropathy: a systematic review. *Musculoskeletal surgery*, *101*(2), pp.105-112.

Rutten, M.J., Collins, J.M., Maresch, B.J., Smeets, J.H., Janssen, C.M., Kiemeney, L.A. and Jager, G.J. (2009). Glenohumeral joint injection: a comparative study of ultrasound and fluoroscopically guided techniques before MR arthrography. *European radiology*, *19*(3), pp.722-730.
Schneider, A., Burr, R., Garbis, N. and Salazar, D., (2018). Platelet-rich plasma and the shoulder: clinical indications and outcomes. *Current reviews in musculoskeletal medicine*, *11*(4), pp.593-597.
Silverstein, E., Leger, R. and Shea, K.P., (2007). The use of intra-articular hylan GF 20 in the treatment of symptomatic osteoarthritis of the shoulder: a preliminary study. *The American journal of sports medicine*, *35*(6), pp.979-985.
Sinha, R., Patel, P., Rose, N., Tuckett, J., Banerjee, A.N., Williams, J., Aldridge, S. and Stuart, P., (2017). Analysis of hydrodilatation as part of a combined service for stiff shoulder. *Shoulder & elbow*, *9*(3), pp.169-177.
Smith, J. and Finnoff, J.T. (2009). Diagnostic and interventional musculoskeletal ultrasound: part 2. Clinical applications. *PM&R*, *1*(2), pp.162-177.
Smith, P.A. (2016). Intra-articular autologous conditioned plasma injections provide safe and efficacious treatment for knee osteoarthritis: an FDA-sanctioned, randomized, double-blind, placebo-controlled clinical trial. *The American journal of sports medicine*, *44*(4), pp.884-891.
Stephens, M.B., Beutler, A. and O'Connor, F.G., (2008). Musculoskeletal injections: a review of the evidence. *American family physician*, *78*(8), pp.971-976.
Tempelhof, S., Rupp, S. and Seil, R., (1999). Age-related prevalence of rotator cuff tears in asymptomatic shoulders. *Journal of shoulder and elbow surgery*, *8*(4), pp.296-299.

Web references

FRAX Assessment Tool
https://www.sheffield.ac.uk/FRAX/ Centre for Metabolic Bone Diseases, University of Sheffield, UK

Mental Capacity Act (2005)
https://www.legislation.gov.uk/ukpga/2005/9/contents

Montgomery v Lanarkshire Health Board [2015] SC 11 [2015] 1 AC 1430
https://www.bailii.org/uk/cases/UKSC/2015/11.html

Osteoarthritis: care and management (2014) NICE
https://www.nice.org.uk/guidance/cg177

Platelet-rich plasma injections for knee osteoarthritis (2019) NICE
https://www.nice.org.uk/guidance/ipg637