Case 10

Brendan O'Reilly

Patient Background

Left-handed female presented to the ultrasound department with continued left wrist swelling following a fall 5 months previously, resulting in a tender, swollen, bruised left forearm with reduced movement. X-ray at the time of her emergency visit reported a 'subtle displaced transverse fracture to the distal radius' **(Figure 1).** The patient was placed in a below the elbow cast until a review in the local hospital Virtual Fracture Clinic (VFC). Upon review, the cast was removed, and the patient was given a physiotherapist wrist information exercise sheet to follow. Nevertheless, the patient remained symptomatic and on examination in the Orthopaedic Clinic 2 months after the accident, the patient presented with pain on thumb extension and abduction with a positive Finkelstein test (Goubau et al., 2014) - **(Appendix 1)** and pain on resisted abduction of the thumb, felt along the course of the first dorsal department. An ultrasound request was organised by the Orthopaedic Surgeon who suspected de Quervain's disease. The purpose of the ultrasound examination was to confirm clinical findings with a view to an ultrasound guided corticosteroid injection if clinically appropriate **Figure 1**.

Anterior –posterior X-ray of the left wrist with discrete, non-displaced, transverse fracture (white arrow) of the distal radius.

The patient presented to the ultrasound department with swelling to the radial aspect of the left wrist, the clinical differential diagnosis prior to ultrasound imaging was osteoarthritis of the first carpal-metacarpal (CMC) joint, ganglia, infectious tendosynovitis, Wartenberg's syndrome and intersection syndrome (Shiraj et al., 2013, Rowland et al., 2015)

Ultrasound Examination & Findings

In accordance with the Society of Radiographers (SoR) and British Medical Ultrasound Society (BMUS), Guidelines for Professional Ultrasound Practice, verbal patient consent prior to the ultrasound examination was obtained. The patient sat opposite the operator with

forearm placed upon the couch. Using a high frequency (7-18MHz) GE Logiq hockey stick ultrasound linear probe in an ergonomic setting, the wrist was moved into lateral, pronation and supination positions to visualise extensor and flexor wrist tendons, nerves, bony contours and synovial structures. These structures were assessed in transverse and longitudinal sections. Emphasis was placed upon assessment of the extensor tendons of compartment I, abductor pollicis longus and extensor pollicis brevis tendons.
During assessment of the wrist in the lateral position and thumb facing upwards, ultrasound in transverse section demonstrated thickening of the extensor tendons of compartment I in B-mode with synovial thickening **(Figure 2)** and increased vascularity with power Doppler **(Figure 3)** , sonographically in keeping with de Quervain's tenosynovitis. No other extensor or flexor wrist tendinopathy, synovial thickening, neuropathy or bony erosions evident. In view of the preliminary ultrasound findings, the benefits and risks and side effects of an intra-articular corticosteroid injection therapy under ultrasound guidance were discussed.
Figure 2.

Thickened left extensor compartment 1 tendon (white arrow) with thickened synovium (arrowhead) in Brightness-mode.

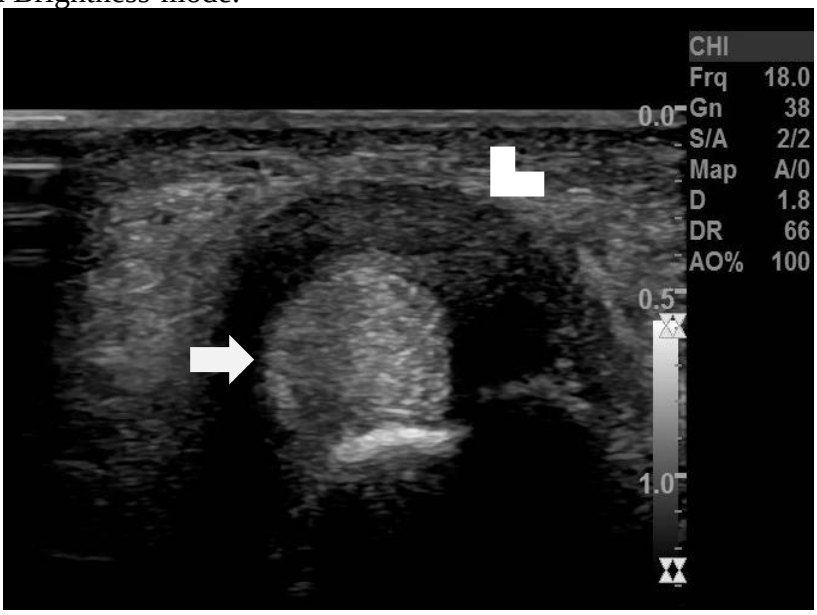
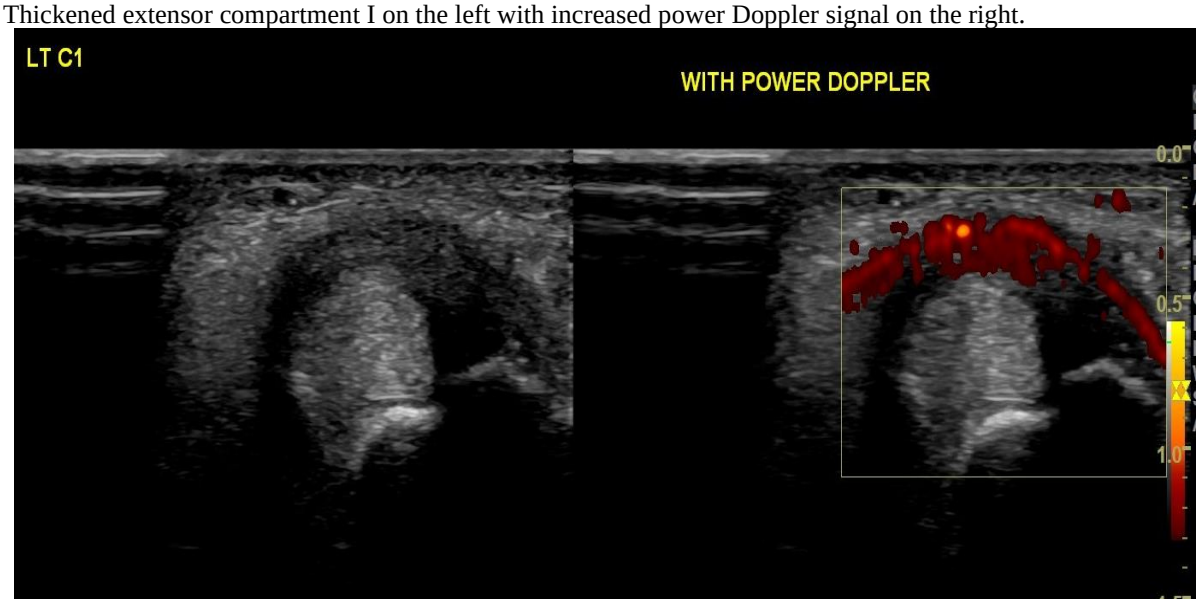


Figure 3.

Thickened extensor compartment I on the left with increased power Doppler signal on the right.



While studies and clinical experience have proven ultrasound guided steroid intra-articular injections with their anti-inflammatory properties are relatively safe, provide pain relief and give greater function (Stephens et al., 2008; MacMahon et al., 2009; NICE Osteoarthritis, 2020) , the side effects of this type of therapy relevant to the patient case were explained and are summarised in **Appendix 2** with references.
Side effects of corticosteroid therapy not relevant to the patient history include diabetic hyperglycaemia, which can persist for 5 to 21days, requiring glycaemic post procedure monitoring (Wang & Hutchinson, 2006; Younes et al., 2007) and bleeding, particularly in patients on anti-coagulation therapy however, studies have shown that stopping anti-coagulation is not required before joint injection provided the INR is within the therapeutic range and less than 4.5 (Conway et al., 2013). Locally the decision to administer corticosteroid for joint injections for those patients on anti-coagulation therapy is clinically dependent. In the setting of the patient case study, who had not been prescribed anti-coagulation therapy, the risk of bleeding remained a side effect for this procedure, of which the patient was informed.

Considering Covid 19, information sharing between clinician and patient is advised by studies from Little et al., 2020 and Morgan & Dattani, 2020. This is regarding the benefits of the intra-articular steroid injection procedure but also the increased immunosuppressive risks to the patient of acquiring Covid 19 following corticosteroid injection therapy. Little et al., 2020 (page 4) goes on to explain 'where a patient has significant disease activity and there are no effective alternatives, corticosteroid injection should be considered following a shared risk assessment with the patient as part of 'Montgomery guided' consent processes'. The patient was made aware that if they contacted the disease following consenting to the procedure then the outcome could be much worse. The patient had already exhausted more conservative treatments for their condition which had been ineffective. While surgery was also an option, involving release of the first dorsal compartment of the wrist and dividing or excising a strip of the tendon sheath with a 97.5 % success rate, this is associated with a high cost, surgical complications (Garcon et al., 2018) and higher waiting times particularly in light of the impact of Covid 19 pandemic on National Health Service. The patient was also given the option not to proceed with treatment or to wait until the Covid 19 pandemic had passed and proceed with the treatment only then. After deliberation, the patient opted to proceed with the injection in view of her persistent symptoms, loss of function and waiting

time which she felt outweighed the risks and side effects of injection. A World Health Organisation Surgical safety checklist for Radiological Interventions (Clinical Radiology, 2019, page 12 - **Appendix 2**) was completed.

Intra-articular Injection Procedure under Ultrasound Guidance

Traditionally, intra-articular injection procedures involving the prescribing and administer of medicines was performed between clinician and patient until the publication of the Department of Health final Crown report review on prescribing, supply and administration of medicines (Crown Report, Department of Health 1999). Following the report, 'legal frameworks were developed that allowed services to be re-designed and for healthcare professionals to work more flexibly for the benefits of patients' (SCoR & BMUS 2019, Guidelines for Professional Ultrasound Practice, page 143). As a result, there are now several legal options for some statutorily registered healthcare professionals for supplying and/or administering medicines including the commonly used Patient Group Directions (PGD)', (SCoR & BMUS, 2019) which is used by practicing extended scope Radiographers at the local hospital. A PGD operates under the authorisation of trained and competent individuals and is a written instruction for the sale, supply and/or administration of medicines to groups of patients who may not be individually identified before presentation for treatment. It is used in situations where patient care is benefitted usually in cases where there is an immediate effect. Limitations to working under a PGD include cannot deliver unlicensed medication and cannot delegate responsibility. PGD can however use 'off label'. The option for staff to train to become independent prescribers (IP) and supplementary prescribers (SP) is also available. The prescribing and administration of corticosteroids for this patient was performed under a patient specific direction (PSD) framework whereby the trainee Advance Practitioner Sonographer was guided by the Consultant MSK Radiologist mentor following patient assessment and delegation of supply and/or administration of medicines.

The patient intra-articular procedure commenced with sterile technique to minimise infection including wearing sterile gloves, cleaning of the effected site with sterile cleaning solution and the use of a Tegaderm film over the hockey stick probe to maintain sterility with sterile ultrasound gel. Using a 25 gauge 1 inch needle and 5mls syringe, local anaesthetic (2mls of lidocaine hydrochloride), was injected at a 45° angle using ultrasound guidance in-plane technique from a distal to proximal direction **(Figure 4)** into the skin and into the extensor compartment I tendon sheath. Following this 20mg of Methylprednisolone Acteate (Depo-Medrone) and 1ml of 0.25% bupivacaine was injected into the extensor compartment I tendon sheath at the level of the distal radius with no immediate complication. Confirmation that the needle was correctly sited in the tendon sheath was demonstrated by using the in-plane technique and rising of the tendon sheath with reduced pressure **(Figure 5)**. Rest of the limb was advised following the examination for 2 weeks with repeat second steroid injection offered if symptoms persisted.

Figure 4.

Figure 5. Visualisation of needle (arrow) and lifting of tendon sheath (arrowhead).

De Quervain's Disease, Treatment Rationale & Discussion

De Quervains is defined as the stenosing tenosynovitis of the synovial sheath of the abductor pollcis longus and extensor pollicis brevis (Lee et al., 2014), causing impaired gliding of these tendons in the narrow and constricted fibro-osseous compartment. It is caused by the overuse and repetitive activities of wrist in ulnar deviation, extension and abduction of the

thumb (Pooswamy & Muralidharaogpalan, 2019). It affects 0.5% of working men and 1.3% of working women (Walker-Bone et al., 2004). Risk factors include manual work, pregnancy, early motherhood and post-menopausal status (Vuillemin et al., 2012). Rheumatoid arthritis is also a causative factor (Weiss et al., 1994). The presence of a dividing septum in extensor compartment 1 (Minamikawa et al., 1991) and multiple slips of the extensor abductor pollicis longus have also been associated with de Quervains (Mansur et al., 2010). Histopathological in de Quervain's examination shows mainly degenerative changes like myoxoid degeneration, fibrocartilaginous metaplasia and deposits of mucpolysaccharide (Clark et al., 1998) however Kuo et al., (2015) demonstrated the presence of inflammatory cells in this condition which increased with disease progression.

Non-surgical treatment of de Quervain disease included immobilisation with splinting and therapeutic exercises however these techniques were unsuccessful. This is supported by Richie& Eriner, 2003 who found the above techniques only 14 % successful in the treatment of de Quervain's. Corticosteroid injection however, under ultrasound guidance has been shown to be effective and a safe method for treatment (Danda et al., 2016 and Pooswamy & Muralidharaogpalan, 2019). The combination of injection and thumb splinting has been demonstrated to show improved functional outcome in comparison to injection alone in one study (Mardami-Kivi et al., 2014). Other non-invasive methods for the treatment of de Quervain's include acupuncture (da Silva et al., 2014), ozone oxygen and hyaluronic acid injections (Moretti,2012), ultrasound-guided percutaneous needle tenotomy, platelet-rich plasma (PRP) injection(Peck & Ely, 2013), prolotherapy (Tseng et al., 2012) and ultrasound guided methotrexate injection (Allam et al., 2017). Failing conservative measures, surgery is an option but as discussed earlier, despite high success rates has drawbacks. Intra-articular corticosteroid injection of joints is the main method used at the local site for the treatment of tendinopathy, including de Quervain disease following exhaustion of all other conservative means.

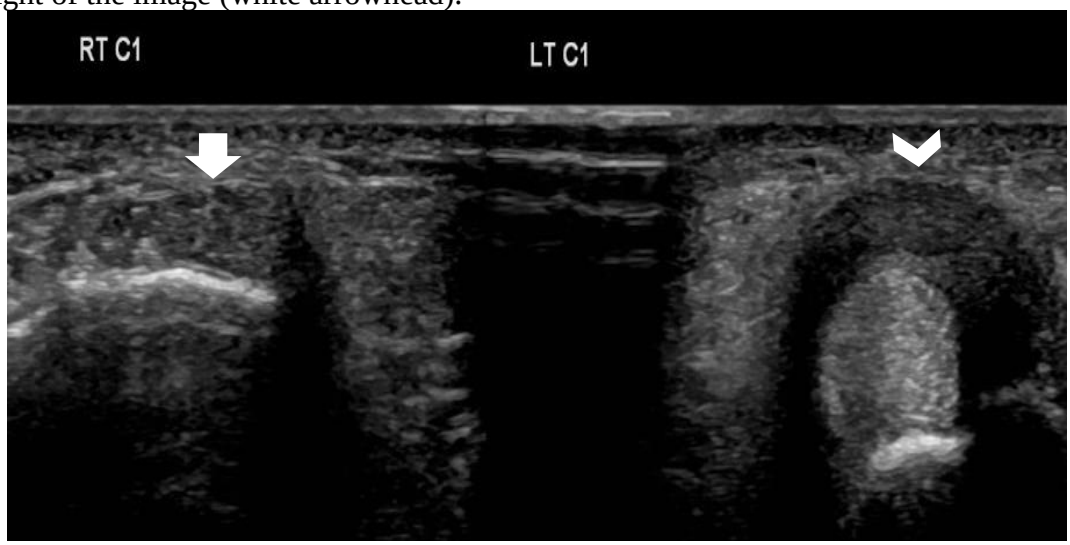
Ultrasound advantages for guided corticosteroid injection include real time assessment and guidance with visualisation of the needle throughout the procedure. The needle bevel tip can be accurately positioned to the area of interest for maximum therapeutic effect, thus avoiding important structures such as vessels and nerves and causing unnecessary side effects to subcutaneous tissues. Additionally, in comparison to blind needle positioning, ultrasound guided needle placement provides high accuracy and low complication rate.

It is particularly advantageous at assessing more superficial structures more quickly in comparison to other imaging modalities such as CT and is also beneficial when injecting into extensor compartment I sub-compartments when there is a dividing septum or multiple slips (McDermott et al., 2012). Rousset et al., 2010 has suggested that the presence of an osseous ridge/double ridge on the radial floor sonographically is associated with the presence of an extensor compartment I septum. Observation of this is important as steroid injection can then be directed into both compartments thereby improving outcome *(*Sawaizumi et al., 2007). Nevertheless, the ability to identify such structures is reliant on the ultrasound skills and experience of the operator. Disadvantage with multiple injections are that there is an increase of procedure side effects. No obvious septum was visualised in the patient case study.

Alongside the advantages above, ultrasound also has good soft tissue resolution, is safe (as it does not use non-ionizing radiation), does not cause patient claustrophobia effects as with MRI, can be used dynamically with fast time duration, cost-effective in comparison to other imaging modalities such as MRI, portable and has the ability to compare an abnormal tissue site to the contralateral normal side and thus support preliminary findings. This is highlight in

(**Figure 6)** of the case study. Ultrasound is also able to identify earlier bony cortical and soft tissue changes such as in Rheumatology patients in comparison to x-ray, thereby providing an earlier diagnosis and therefore earlier treatment with improved patient outcome (Taljanovic et al., 2015). Power Doppler is also used to identify vascular structures and to reflect the degree of inflammation to a joint i.e. synovitis **(Figure 3) -** (Taljanovic et al., 2015).
Ultrasound disadvantages include operator dependency. The ability to identify and provide an accurate diagnosis using all sonographic technical parameters available relies on the training, competency and clinical experience of the ultrasound operator. Ultrasound operators also need to be alert to the many sonographic artefacts that occur, particularly in musculoskeletal ultrasound such anisotropy which can give the impression of an abnormal hypoechoic tendon/tissue, caused by the ultrasound probe not perpendicular to the area of interest.

Figure 6.
Normal extensor compartment I tendons on the left (white arrow) of the image in comparison to thickened hypoechoic tendinopathy with synovial thickening in extensor compartment 1 on the right of the image (white arrowhead).



The purpose of the local anaesthetic used in the case study is immediate pain relief, diagnostically differentiate between local and referred pain (Tallia & Cardone, 2003), add volume to the cortico-steroid enabling spread within the joint space (Stephens et al., 2008) and disruption of any adhesions (Buchbinder & Green, 2004). 2 mls of Lidocaine Hydrochloride and 1 ml of 0.25% bupivacaine were the 2 anaesthetics used for the examination. The former has an onset of 1 to 2 minutes and duration of 1 hour while the latter, an onset of 30 minutes and a duration of 8 hours (Shah et al., 2019). Ropivacaine is also available to use in the department however the choice between ropivacaine and bupivacaine for intra-articular steroid injections is debatable. Burke & Price (2017) have shown that concentrations of less than 0.75% ropivacaine and 0.25% bupivacaine or less have fewer chondrotoxic effects on osteoarthritic cartilage. The article further describes the similar chemical make-up of both drugs but also important differences such as ropivacaine diffuses less readily than bupivacaine into the systemic system and therefore has fewer cardiovascular and central nervous system toxic effects. Bupivacaine is more potent than ropivacaine, which allows it to reach the same therapeutic level as ropivacaine at lower concentrations. A final point is that ropivacaine is more expensive than bupivacaine (Burke & Price (2017).

The choice of corticosteroid is based on clinical experience as well as local and national guidance. Locally the main corticosteroids used are triamcinolone acetonide 20mg/ml (Kenalog) and methylprednisolone acetate 20mg/mL (Depo-Medrone). The clinical effects of these are to reduce blood flow (Caldwell, 1966), lower leukocyte and inflammatory modulator response (Lavelle et al., 2007) and alter local collagen synthesis (Wei et al., 2006) thereby reducing pain and inflammation (Stephens et al,. 2008). Based on recommendations by the National Institute for Health and Care Excellence (2017) methylprednisolone is the preferred choice for smaller joints due to its smaller particle size (0.5-26 μm) in comparison to triamcinolone acetonide which has particle size of 15-60 μm and therefore used on larger joints such as the hip. Methylprednisolone is also used on larger joints but is suggested for superficial soft tissue injections while triamcinolone is used for deeper sites. Doses of methylprednisolone vary to joint site but locally 40mg are used for larger joints (knee, ankle and shoulder) while 20mg are used for superficial structures such as the hand and foot. Some cases have discussed the toxic effect on articular cartilage by steroid injection however, it was also argued that the accelerate joint damage may also be due to overuse (Douglas, 2012). Further studies with humans and primates have shown no harm with multiple injections to the knee (Philipose et al., 2011) while some studies have also supported the notion that steroid has a chondral-protective effect (Douglas, 2012).

Contraindications for intra-articular injection include sepsis, known hypersensitivity to an intra-articular agent, osteochondral and intra-articular fracture, severe joint destruction and unstable coagulopathy (Shabani et al., 2015).

Patient Outcome

On presentation, the patient described the severity of her wrist pain as 9 out of 10. Following diagnosis of de Quervain disease sonographically and intra-articular steroid injection the patient's pain scale had subsided to1 to 2 out of 10. There remained some reduced dorsi-extension and flexion of the wrist but this was non painful. No follow up orthopaedic appointment has been organised.

The patient was advised that the therapeutic effect of the injection may be temporary, prevailing for 6 weeks or possible longer. A repeat injection was offered if symptoms did persist however it was discussed that a repeat steroid injection maybe less effective. On assessment of this Oh et al., 2017 argued that 90% of de Quervain's disease patients did report improvement after a second injection if the initial steroid injection procedure was successful but, this study also suggested that cases of female sex and BMI >30 are associated with increased treatment failure. NICE (2017) current guidelines recommend that the same joint is not injected more than 3 times in one year.

Conclusion:

De Quervain disease is a debilitating condition causing inflammation, pain and reduced function to extensor compartment I. It is more prevalent in women and in pregnancy and is associated with repetitive strain injury and rheumatoid arthritis. Anatomical variations in extensor compartment 1 such as a dividing septum or multiple tendon slips have also been associated with the disease. Intra-articular cortico-steroid injection under ultrasound guidance is a cost-effective, safe and quick method to treat this condition. Efficiency, in comparison to other techniques such as 'blind' injection, is optimised by accurate ultrasound guidance of the needle into the tendon sheath, thus avoiding other important structures. There are however procedure side effects and a current increased risk of contracting Covid 19. These adverse effects/risks need to be shared between operator and patient prior to proceeding. Accuracy and effectiveness of this procedure is reliant upon the ultrasound and

clinical skills and experience of the operator, who must maintain their competency through reflective practice, training, audit and clinical peer review. Procedure failure can be attributed to poor training and poor injection technique.

References:

Allam, AE.Al-Ashkar, DS. Negm, AA, Wu, WT, Chang, KV. (2017). *'Ultrasound-guided methodrexate injection for De Quervain disease of thew wrist: what lies beyond the horizon?'*, JP R, 10, 2299-2302.

Buchbinder, R. Green, S. (2004) *'Effect of arthrography shoulder joint distension with saline and corticosteroid for adhesive capsulitis',* British Journal of Sports Medicine, 38(4), 384-385.

Burke SA, Price LM. (2017). '*Bupivacaine vs. Ropivacaine: Looking at the chondrotoxic effects of intraarticular anaesthetics in osteoarthritic joints'*, MU Scholarly Commons Physician Assistant Capstones. http://commons.lib.jmu.edu/pacapstones/24. Published May 16, 2017.

Caldwell, JR. (1996). '*Guide to selection and indications for use'*, Drugs, 52(4), 507-514.

Conway, R. O'Shea, FD. Cunnane, G. Doran, MF. (2013). *'Safety of joint and soft tissue injections in patients on anticoagulation'*, Clinical Rheumatology,32 (12), 1811-1814.

Clarke, MT, Lyall HA, Grant JW, Matthewson MH. (1998). *'The histopathology of de Quervain's disease'*, J Hand Surg Br; 23:732.

Clinical Radiology, the Royal College of Radiologists. (2019). '*Guidance on implementing Safety checklists for radiological procedures'*, www.rcr.ac.uk (Accessed: November 2020).

Da Silva, JB. Batig, A. Lia, F. (2014). *'Acupuncture in De Quervains ? ™ disease: a treatment proposal'*, Acupunct. Med, 32(1), 70-72.

Department of Health. (1999). 'Review of prescribing, supply and administration of medicines'. Chair: Dr June. Crown London: DH

Douglas, RJ. (2012). '*Cortocosteroid injection into the osteoarthritic knee: drug selection dose, and injection frequency',* International Journal of Clinical Practice, 66 (7), 699-704.

Garcon, J. Charruau, B. Marteau, E. Laulan, J. Bacle, G. (2018). *'Results of surgical treatment of De Quervain's tenosynovitis: 80 cases with a mean follow-up of 9.5 years',* Orthopaedics & Tarmatology: Surgery & Research, 104, 893-896.

Gaujpoux-Viala, C. Dougados, M. Gossec, L (2009). *'Efficacy and safety of steroid injections for shoulder and elbow tendonitis: a meta-analysis of randomised controlled trials'*, Ann Rheum Dis*,* 68 (12), 1843-9.

Goubau JF, Goubau L, Van Tongel A, Van Hoonacker P, Kerckhove D, Berghs B.J (2014). *'The wrist hyperflexion and abduction of the thumb (WHAT) test: a more specific and sensitive test to diagnose de Quervain tenosynovitis than the Eichhoff's Test'.*

Hand Surg Eur (3):286-92.

Gray, G. Tenenbaum, J. Gottleib, NL. (1981). *'Local corticosteroid injection treatment in rheumatic disorders',* Semin Arthritis Rheum*,* 10, 231-254.

Gurses IA, Coskun O, Gayretli O, et al., (2015). *'The anatomy of the fibrous and osseous components of the first extensor compartment of the wrist: a cadaveric study'*, Surg Radiol Anat*,* 37, 773–7.

Kuo, YL. Hsu, CC. Kuo, LC, Wu, PT. Sho, CJ. Wu, KC. (2015) *'Inflammation is present in de Quervain's disease-Correlation study between biochemical and hisptipathological evalulation',* Ann Plast Surg, 74 (Suppl 2), S146-51.

Lavelle, W. Lavelle, ED. Lavelle, L. (2207). *'Intra-articular injection'*, Med Clin North Am, 91(2), 241-50.

Lee, HJ.Kim, PT. Aminata, IW. Hong, HP. Yoon, JP. Jeon, IH. *'Surgical release of the first extensor compartment for refractort de Quervain's tenosynovitis: surgical findings and functional evaluation using DASH score'*, Clin Orthop Surg,6(4),405-9.

Little, CP. Birks, M. Horwitz, MD, Ng, CY. Warwick, D. (2020). *'Covid-19: A rethink of corticosteroid injection?'*, Bone & Joint Open, 1|(6), 1-6.

MacMahon, P. Eustance, S. Kavanagh, E. (2009). *'Injectable cortosteroid and local anesthetic preparations: a review for Radiologists'*. Radiology, 252, 647-661.

Mansur, DI. Krishnamurthy, A. Nayak SR. (2010). 'Multiple tendons of abductor pollicis longus extensors', Int J Anat Var, 3, 25–6.

McDermott, JD. Ilyas, AM. Nazarian, LN. Leinberry, CF. (2012). 'Ultrasound –guided injections for de Quervain's tenosynvitis', Clin Orthop Relat Res', 470(7), 1925-1931.

Mardani-Kivi, M. Karimi Mobarakeh, M. Bahrami, F. Hashemi_Motlagh, K. Saheb-Ekhtiari, K. Akhoondzadeh, N. (2014). ' Corticosteroid injection with and withour thumb spica cast for de cQuervain tenosynovitis', J Hand Surg Am, 39(1), 37-41.

Minamikawa Y, Peimer CA, Cox WL, et al. (1991). *'De Quervain's syndrome: surgical and anatomical studies of the fibroosseous canal'.* Orthopedics14 (5), 45–9.

Moretti, M. (2012). '*Effectiveness of oxygen-ozone and hyaluronic acid injections in De Quervian's syndrome',*Int J Ozone Ther, 11(1), pp. 31-33.

Morgan, C. Dattani, R. (2020). ' *Should I use steroid injections to treat shoulder pain during the Covid 19 pandemic'*, JES International, 1-4.

National Institute for Health and Care Excellence Clinical Knowledge Summaries (2017) Availableat:https://cks.nice.org.uk/topics/osteoarthritis/#!presribinginfosub:2 (Accessed: November 2020).

Nicholas, AW> (2005). *'Complications associated with the use of corticosteroids in the treatment of athlestic injuries'*. Clin J Sports Med, 15 (5), 370—375.

Oh, JK. Messing, S. Hyrien, O. Hammert, WC. (2017). *'Effectiveness of Corticosteroid Injections for Treatment of de Quervain's Tenosynovitis',* Hand (NY), 12 (4), 357-361.

Peck, E. Ely, E.(2013). '*Successful treatment of de Quervains tenosynovitis with ultrasound guided percutaneous needle tenotomy and platelet-rich plasma injection: a case presentation'*, PMR, 5 (5), pp. 438-441. Doi: 10.1016/j.pmrj.2013.02.006.

Philipose, J. Baker, K. O'Rourke, KS. Deodhar, A. (2011). *'Joint Aspiration and Injection: A look at the Basics. Tapping into a valuable diagnostic and treatment resource'*, The Journal of Musculoskeletal Medicine, 28 (6).

Possswamy, SS. Muralidharagpalan, NR. (2019). 'Intra sheath corticosteroid for De Quervain's tenosynovitis'. International Journal of Research in Orthopaedics, 5 (3), 403-407.

Richie, CA. Eriner, WW Jr. (2003). *'Corticosteroid injection for treatment of de Quervain's tenosynovitis: a pooled quantitative literature evaluation'* , J Am Board Fam Pract, 16, 102-6.

Rousett, P. Vuillemin-Bodaghi, V. Laredo, JP. Parlier-Cuau, C. (2010). Anantomic '*Variations in the First Extensor Compartment of the Wrist: Accuarcy of US',*Radiology, 257 (2), 427-433.

Rowland, P. Phelan, N. Gardiner, S. Linton, Kenneth & Galvin, R. (2015). *'The Effectiveness of Corticosteroid Injection for De Quervain's Stenosing Tenosynovitis (DQST): A Systematic Review and Meta-Analysis'*. The Open Orthopaedics Journal, 9, 43-444.

Sawaizumi, T. Nanno M. Ito H. (2007). *'De Quervain's disease: efficacy of intra-sheath triamcinolone injection'*, **Int Orthop**, 31(2), 265–268 .

Shabani, F. Farrier, R. Krishnaiyan, C. Hunt, C. Uzoigew, CE. Venkatesan, M. (2015) '*Common intra-indications and interactions of drugs in orthopaedic practice',* 97 (4)

Shah, A. Mak, SD. Davies, M. James, SL. Botchu, R. (2019). *'Musculoskeletal* Corticosteroid Administration: Current Concepts', Canadian Association of Radiologists Journal', https://doi.org/10.1016/j.carj.2018.11.002

Shiraj, S. Winalski, C.S. Delzell, P. Sundaram, M. (2013). *'Radiologic case study. Intersection syndrome of the wrist'*, Orthopaedic, 36 (3), 165-,225-227.

Society of Radiographers and British Medical ultrasound Society. (Revision 4, 2019) Available at: https://www.bmus.org/static/uploads/resources/Guidelines_for_Professional_Ultrasound_Practice_v3_OHoz76r.pdf (Accessed: November 2020).

Stephens, MB., Beutler, AI, O'Connor, . (2008). *'Musculoskeletal injections: a review of the evidence'*. Am Fam Physician, 78, 971-976.

Taljanovic, MS. Melville, DM. Gimber, LH. (2015). '*High resolution of rheumatologic disease',* Radiographics, 35 (7), 2026-2048.

Tallia, AF. Cardone, DA, (2003). *'Diagnostics and therapeutic injection of the sshoulder region',* AM Fam Physician, 67(6), 1271-1278.

Tseng, V. Ibrahim, V Yokel, NR. (2014). *'Prolotherapy for de Quervain's tenosynovitis/tendonosis: a case report',* PM R, 4 (10), S275.

Vuillemin, V. Guerini, H. Bard, H. Morvan, G. (2012). '*Stenosing tenosynovitis'*. J Ultrasound 15(1), 20–28.

Walker-Bone, K. Palmer, K. Reading, I. Coggon, D. Cooper, C. (2004). '*Prevalence and imapact of musculoskeltal disorders of the upper limb in the general population'*, Arthritis Rheum, 51(4), 642-651.

Wang, A. Hutchinson, D. (2206). '*The effect of cortocsteroid injection at the shoulder joint on blodd gluscose levels in diabetic patients'*. J Hand Surg (am), 31(6), 979-981.

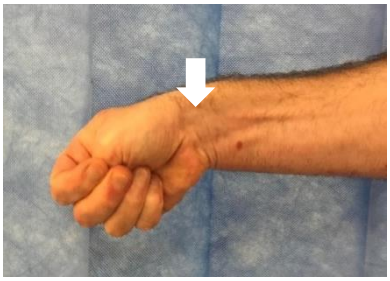
Wei AS., Callaci, JJ. Juknelis, D. (2006). *' The effect of corticosteroid on collagen expressionin injured rotator cuff tendon'*, J Bone Joint Surg AM, 88(6), 1331-1338.

Weiss, AP. Akelman, E. Tabatabai, M. (1994). 'De Quervain's tenosynovitis in pregnant and post-partum women', Obstet Gynaecol. 68, 411-894.

Younes, M. Neffati, F. Touzi, M. (2207). 'Systemic effects of epidural and intra-articular glucocorticoid injections in diabetic and non-diabetic patients', Joint Bone Spine, 74(5), 472-476.

Appendix 1

Finkelstein Test– ulnar deviation of wrist while thumb grasped in palm of hand with pain elicited in extensor compartment 1 during ulnar deviation of wrist (bottom picture, arrow).



Appendix 2

Side Effects	Prevalence	Added note	Reference
Steroid flare	1%-10%	Symptoms subside <48 hours	Gray et al., 1981
Infection	1in 3000 to 1 in 100,000	Best practice septic technique advocated to reduce risk	Stephens et al., 2008 ; Holland et al,. 2012
Facial flushing	<1%	24 to 72 hours	Gray et al., 1981; Brinks et al., 2010)
Skin hypopigmentation	<1% to 4%	More prevalent in dark skinned populations and in superficial injections	Gaujoux-Viala et al., 2009; Nicholas, 2005
Fat atrophy	2.4%	May take 2 years to resolve	Nicholas, 2005
Tendon rupture	<1%	Avoid injecting weight bearing tendons	Stephens et al., 2008

Appendix 3

WHO Surgical Safety Checklist: for Radiological Interventions ONLY

(adapted from the WHO Surgical Safety Checklist)

THE ROYAL COLLEGE OF RADIOLOGISTS

NHS
National Patient Safety Agency
National Reporting and Learning Service

SIGN IN (To be read out loud)

Before giving anaesthetic (local or general)

Have all team members introduced themselves by name and role?
☐ Yes

All team members verbally confirm:
☐ What is the patient's name?
☐ What procedure, site and position are planned?

If general anaesthetic given the two questions above should be moved to the beginning of TIME OUT

Has the patient confirmed his/her identity, site, procedure and consent?
☐ Yes

Has essential imaging been reviewed?
☐ Yes ☐ N/A

Are all IRMER requirements met?
☐ Yes

Is the procedural site marked?
☐ Yes ☐ N/A

Is the anaesthesia machine/monitoring equipment and medication check complete?
☐ Yes ☐ N/A

Does the patient have a:
known allergy?
☐ No ☐ Yes
anticipated risk of >500ml blood loss (7ml/kg in children)?
☐ No ☐ Yes (and adequate IV access/fluids planned)

Have risk factors for bleeding and renal failure been checked?
☐ Yes ☐ N/A

Has Antibiotic prophylaxis been given?
☐ Yes ☐ N/A
Has VTE prophylaxis been undertaken?
☐ Yes ☐ N/A

Is the required equipment available and in date?
☐ Yes

Are there any critical or unexpected steps you want the team to know about?
☐ Yes ☐ N/A

ONLY IF GENERAL ANAESTHETIC IS GIVEN

TIME OUT (To be read out loud)

Before start of radiological intervention
(for example needle to skin)

Anticipated critical events

Anaesthetist (if present):
☐ Is the anaesthetic machine check complete?

Does the patient have a difficult airway/aspiration risk?
☐ Yes ☐ N/A

☐ Are there any patient-specific concerns?
☐ What is the patient's ASA grade?
☐ What monitoring equipment and other specific levels of support are required, for example blood?

Registered practitioner/HCA:
☐ Are there any equipment issues or concerns?

Has the surgical site infection (SSI) bundle been undertaken?
☐ Yes ☐ N/A
- Antibiotic prophylaxis
- Patient warming
- Hair removal
- Glycaemic control

SIGN OUT (To be read out loud)

Before any member of the team leaves the room

Registered Practitioner/HCA verbally confirms with the team:
☐ Has the name and side of the procedure been recorded?
☐ Have all pieces of invasive equipment used been accounted for?
☐ Have any implanted devices been recorded?
☐ Have the specimens been labelled (including with patient's name)?
☐ Have any equipment problems been identified that need to be addressed?

Radiologist, Anaesthetist and Registered Practitioner:
☐ Have the instructions for post procedural care for this patient been agreed?

Remember to scan onto CRIS
or record checklist has been undertaken

PATIENT DETAILS

Last name:
First name:
Date of birth:
NHS Number:*
Date of Procedure:

*If the NHS Number is not immediately available, a temporary number should be used until it is

The checklist is for Radiology Interventions ONLY

This modified checklist must not be used for other surgical procedures.

www.nrls.npsa.nhs.uk

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