Case 13

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Ultrasound Guided injection case study- Greater Trochanteric pain syndrome

Introduction:

Mrs A was a 55-year-old housewife referred to the musculoskeletal (MSK) physiotherapy clinic by her general practitioner (GP) with a 2-year history of gradual onset of right hip pain. She reported right lateral hip with some buttock pain with some referred lateral thigh pain spreading to ½ way down leg, nil to knee. She also reported some longstanding mild intermittent lower back pain, but denies any pain radiating down past the knee or paraesthesia. Her hip pain was rated as VAS 7/10 and was aggravated by right side lying, plonged walking, sitting to standing, getting in and out of a car and climbing stairs. She denied any morning stiffness in her hip and there was no locking, giving way or clicking reported. No issues with turning over in bed. She did report disturbed sleep and could be woken at night if she lies on the affected side. Her PMH included hypertension and hypercholesteremia for which she took medications and she was otherwise systemically well.

Following a course of physiotherapy, she was then referred into a MSK specialist review clinic for a second opinion as she had no improvement to date with her treatment. She has had 6 sessions of physiotherapy aimed at lumbar and hip mobility, with some general strengthening exercises prescribed for the lower back and hip regions. Due to her high levels of pain and night pain she was struggling to adhere to the prescribed exercise regime. The clinical question was to establish a diagnosis and indicate whether further physiotherapy or further imaging and intervention was required.

The purpose of the MSK review appointment was that she would be seen by an advanced practice physiotherapist with access to imaging to help guide further management. This second opinion clinic was established on the assumption that effective treatment is dependent upon accurate differential diagnosis, and in Mrs A's case there was no specific diagnosis, she was undergoing general rehabilitation with limited improvement to date.

Examination and Differential Diagnosis:

The differential diagnosis was between lumbar spine referred pain, hip osteoarthritis (OA) and localised greater trochanteric pain syndrome (GTPS). There was a low index of suspicion of specific red flags that can be associated with hip presentations such as a stress fracture, AVN or metastatic disease given her signs and symptoms and routine PMH. GTPS is a very common but often unrecognized or misdiagnosed condition. Accurate diagnosis and differentiation of GTPS from lumbar spine pathologies are essential in avoiding potential unnecessary spinal treatments- in one study over 50% of patients who presented to an orthopaedic spine clinic had GTPS (Lee et al, 2018). Generally, anterior hip and groin pain comes from intra-articular hip disorders while lateral hip pain is more likely from extra-articular disorders (Grumet et al., 2010).

On questioning Mrs A's symptoms were more centred on her lateral hip, with milder back and buttock pain. On physical assessment Lumbar active of range movements reproduced local spinal pain only, nil hip pain. There was no capsular restriction of hip movements usually seen in osteoarthritic presentations (Cibulka et al., 2009.) She had localised tenderness on palpation over the greater trochanter which

reproduced her pain. Her pain was also reproduced after single standing on the affected side for 15 seconds. There was also pain with resisted hip abduction and the resisted external derotation test. Her lateral hip pain was also reproduced with the FABER test which has been suggested as clinically diagnostic in a study by Fearan et al., (2012). The 30-second single-leg stance and resisted external derotation tests had very good sensitivity and specificity for the diagnosis of tendinous lesion and bursitis in patients with MRI-documented refractory GTPS (Lequesne et al., 2008). Grimaldi et al., (2016) from a small sample study found that a patient who reports lateral hip pain within 30 seconds of single-leg-standing is very likely to have GTPS. They also found that patients with lateral hip pain who are not palpably tender over the greater trochanter are unlikely to have MRI-detected GTPS.

Greater Trochanteric Pain syndrome (GTPS)

Greater Trochanteric Pain syndrome (GTPS) is a debilitating condition causing lateral hip pain (Grimaldi and Fearon, 2015). It affects up to 23.5% of women and 8% of men between 50 and 75 years old (Segal et al., 2007). Patients with GTPS report difficulty sleeping and moderate to severe pain and disability (Fearon et al., 2013). Sufferers report comparable quality of life and functional performance, to people with advanced osteoarthritis of the hip (Fearon et al., 2014). On top of this many cases are recalcitrant, with a high proportion of patients still experiencing symptoms twelve months from onset (Rompe et al., 2009). Because of the functional connection between the lumbopelvic and hip region a concurrent or past history of low back pain was found in 20-62% of patients with GTPS (Mulligan et al., 2015).

GTPS is a described as a syndrome with a wide spectrum of aetiologies reflecting the anatomy of the structures outside the hip joint capsule. There are five muscle tendons that insert on to the greater trochanter and three bursae in the region of the greater trochanter. The term GTPS includes tendinopathies, tendinous tears, bursal inflammation and effusion.

Originally considered an inflammatory condition of the trochanteric bursa; recent imaging, surgical and histology studies have suggested it to be, most commonly, a condition associated with tendinopathy of the gluteus medius and gluteus minimus tendons at the site of their insertion onto the greater tuberosity of the femur (Fearon et al., 2010; Long. et al., 2013). One study found MRI evidence in a group of 24 subjects that nearly all had gluteus medius abnormalities but bursitis was only present in 8% of the subjects (Del Buono et al, 2012). However, as an associated array of pathologies are witnessed on imaging (including tendinopathy, partial and full thickness tendon tears, bursitis and iliotibial band abnormalities) and imaging of asymptomatic individuals reveals many false positives (Ganderton et al., 2017; Ramirez et al., 2014), the term greater trochanteric pain syndrome (GTPS) is now used clinically to describe the uncertainty surrounding the definitive pain source from these associated pathologies

Consequently, imaging findings should be used to support or confirm the diagnosis in the context of a thorough clinical examination as opposed to the sole criteria for the identification of GTPS. The high prevalence of this pathology in combination with its effect on quality of life issues speaks to the urgency for effective and efficient intervention strategies.

Imaging:

The diagnosis of GTPS is assisted with imaging studies. MRI showed good accuracy for the diagnosis of tears of the gluteus medius and gluteus minimus tendons. The identification of an area of hyperintensity superior to the greater trochanter on a T2-weighted image had the highest sensitivity and specificity for tears at 73% and 95%, respectively (Cvitanic et al., 2004). However, Blankenbaker et al, (2008) found a high prevalence (50%) of peritrochanteric T2 imaging abnormalities in patients without trochanteric pain. In a small study, ultrasound was shown to have a high positive predictive value for gluteal tendon tears (positive predictive value = 1.0) (Fearon et al, 2013).

Docking et al., (2019) compared US and MRI imaging to identify the presence of a pathological gluteus medius tendon in comparison to surgical and histological findings. Ultrasound identified 17 out of the 19 pathological gluteus medius tendons correctly. However, 5 of the 6 normal tendons were incorrectly identified as exhibiting pathology on ultrasound. MR rated 11 out of 17 pathological tendons as abnormal, with 4 out of 6 normal tendons identified correctly. Both imaging modalities were poor at identifying and differentiating between tendinosis and partial-thickness tears (Docking et al., 2019).

Although not as common as previously thought, the presence of a trochanteric bursa is still proposed to be a contributor in pain in GTPS. Fearon et al., (2014) in a histological study of tendon and bursa tissue biopsies found there was a significantly greater presence of Substance P in the bursa but not in the tendon of subjects with GTPS compared to controls. They extrapolated that an increased presence of Substance P in the trochanteric bursa may be related to the pain associated with GTPS.

With Mrs A. a hip x-ray was ordered which minimal degenerative joint changes which again lessened suspicion that hip osteoarthritis was a significant cause of her symptoms. An office-based US scan was undertaken in clinic to assess the greater trochanter region. Ultrasound appears to be clinically useful modality in the diagnosis of greater trochanteric pain syndrome (Fearon et al, 2014). A GE Logiq E9 machine with a high frequency linear array transducer (6-15MHz) was used to perform the scan. Mrs A. was positioned in left side-lying with the uppermost hip and knee flexed. Images were obtained with the probe placed in the coronal plane so that it lay longitudinally over the greater trochanter initially to visualise the gluteus medius and minimus tendons at their insertion onto the greater trochanter (Resteghini, 2017). The probe was then turned through 90 degrees to lie in the transverse plane over the greater trochanter to visualise the gluteus minimus attachment on the anterior facet and gluteus medius insertion onto the lateral facet (Resteghini, 2017). On viewing the images there was a thickened, hypoechoic gluteus medius tendon with loss of the normal fibrillar pattern. There was mild enthesopathic changes with irregularity over the lateral facet of the greater trochanter present. There was an area of anechoic fluid collection in the location of the greater trochanteric bursa. These US findings of gluteus medius tendinopathy with associated trochanteric bursa further support the diagnosis of GTPS when combined with clinical assessment.

Management:

The diagnosis and management options were discussed with Mrs A. She had completed 6 sessions of physiotherapy, but her high pain levels were still limiting her functionally. Injection therapy was proposed as a treatment option to help alleviate her pain and allow her to further engage in her rehabilitation. Mrs A was provided

with an information leaflet on corticosteroid injections (CSI) outlining the rational for CSI, proposed benefits and possible side effects. This was discussed alongside the theoretical risk of the steroid affecting her immune response in light of the Covid pandemic. The BSR/CSP/BOA/RCGP updated clinical guide during the Covid-19 pandemic for the management of MSK conditions from November 2020 state that a CSI can be considered in lateral hip pain presentations where a patient has failed first line measures, has high levels of pain and disability and a continuation of symptoms will have a significant negative effect on their health and wellbeing. Mrs A met these criteria and was considered low risk as she has no significant past medical history that would put her in a high-risk category. Following this shared decision-making discussion Mrs A was then able to reach an informed decision to proceed with the CSI. A consent form was completed and signed by the patient

Mrs A was again placed in contralateral side lying with the uppermost hip and knee flexed. I was stood behind the patient and the ultrasound machine was placed in front of the patient. This allowed me a direct line of sight to both patient and machine and allowed me to accurately and safely insert the needle. A green 21G 40mm needle was chosen to deliver the medicine after reviewing the depth of the target on ultrasound imaging. The injection site and probe were cleaned using “Chloraprep”, a chlorhexidine and isopropylr alcohol solution. Sterile gel was applied to the target area and sterile gloves were donned. Using a longitudinal in plane with a superior to inferior approach 40mg of “Depo-Medrone”/ Methylprednisolone in 1ml solution and 3ml 1% Lidocaine was injected as a bolus using a no-touch 2-syringe technique into the trochanteric bursa overlying the gluteus medius tendon. The step by step injection procedure to minimise infection was followed as described by Saunders and Longworth (2012). The injection was performed under our trust Patient Group

Directive, which is a supply and administration framework for the provision of medication widely used within the NHS. The CSP (2016) recommends that physiotherapists who are not independent prescribers work within the limits of a PGD to allow them to administer medications. A 2-syringe technique was used as mixing two licensed medicines such as a local anaesthetic and a corticosteroid constitutes, under the terms of the Human Medicines Regulations, the manufacture of a new unlicensed product which therefore cannot be administered under a PGD (CSP, 2016).

Mrs A sat in the waiting room for 15 minutes afterwards to monitor for any post injection adverse effects. She was advised on relative rest for one week and was booked for further physiotherapy input to target the gluteal muscles with a progressive loading programme. A telephone follow-up call was undertaken 6 weeks after the injection. Mrs A reported a 90% improvement in her pain levels, with no pain at night now and VAS 1/10 with certain activities. She had restarted her rehabilitation and was overall very satisfied with the outcome.

Role of Injection therapy:

The NICE guidelines on GTPS (2016) state that over 90% of people with greater trochanteric pain syndrome recover fully with conservative treatment such as rest, pain relief, physiotherapy, and corticosteroid injection. They advise if initial conservative treatment does not provide adequate symptom relief, a peri-trochanteric corticosteroid injection and referral to physiotherapy should be offered. Corticosteroid injection is an established second-line treatment for GTPS that has been shown to be efficacious but not necessarily in the long term (Brinks et al., 2009). They compared corticosteroid injections (40 mg of triamcinolone acetate combined with 1% or 2% lidocaine) versus usual care and showed a clinically

relevant effect for CSI at 3-month follow-up for pain at rest and with activity. At a 12-month follow-up visit, there was no difference in outcomes (Brinks et al, 2009). This short term effect finding has been supported by systematic reviews of GTPS management (Del Buona et al., 2012, Chowdhury et al., 2014). However a recent randomised controlled trial found the most significant improvements in short term pain relief occurred in the education and exercise group, rather than the injection group (Mellor et al., 2018).

In this case in line with the trust PGD, Depo-Medrone (Metylprednisolone), a synthetic gluco-corticoid, was used to reduce inflammation and pain. It depresses formation, release and activity of endogenous mediators of inflammation. Glucocorticoids stabilise phospholipid membrane by inhibiting phospholipase A2, and therefore decrease formation of arachidonic acid and further inflammatory mediators from prostaglandin and leukotriene pathways (Shah et al, 2019).

From my literature search there does not appear to be many studies comparing landmark versus ultrasound guided injections for GTPS. Mitchell et al., (2017) in a study comparing US-guided and anatomic landmark injection of the trochanteric bursa found similar 2-week and 6-month outcomes; and as a result advocated landmark procedures. They advised that US guidance should be reserved for extreme obesity or injection failure. A systematic review of conservative management of GTPs showed fluoroscopy-guided injections failed to show additional benefit to landmark guided (Barratt et al., 2017).

McEvoy et al., (2013) compared ultrasound-guided corticosteroid injections into the greater trochanter bursa versus subgluteus medius bursa for treatment of GTPS. They found from a sample of sixty-five injections that there was a statistically significant difference in pain reduction between greater trochanteric bursa and

subgluteus medius bursa injections with a median pain reduction of 3 as opposed to 0 ($p < 0.01$). They concluded that CSI into the greater trochanteric bursa may be more effective than injections into the subgluteus medius bursa for treatment of GTPS. It is worth noting there was no statistically significant association between pain relief and ultrasound findings.

Park et al., (2016) undertook a retrospective study of factors associated with success of USGI in GTPS. They found there was no statistically significant association between effective treatment and the ultrasound findings of tendinosis, bursitis, partial or full-thickness tear, and enthesopathic changes. This study suggests rather than US findings that knee osteoarthritis and lower back pain might be associated with a poor outcome of ultrasound-guided trochanteric bursa injection for GTPS.

Regarding other injection alternatives to corticosteroid in GTPS there is limited evidence available. There is one trial currently recruiting that may provide an interesting option when published. Platelet-rich plasma (PRP) is an autologous blood product, which has a higher concentration of growth factors postulated to provide enhanced healing and anti-inflammatory properties. The Hip Injections PRP Vs Placebo (HIPPO) trial aims to assess the ability of PRP to improve symptoms and function in patients with GTPS. HIPPO is a single-centre, double-blind randomized placebo-controlled study in patients with a radiologically confirmed diagnosis of gluteus medius or minimus tendinopathy with swelling within the tendon insertion with or without bursitis. Participants will receive one ultrasound (US) guided PRP/placebo injection into the trochanteric bursa and surrounding gluteus medius/minimus tendons (Oderuth et al., 2018). A recent systematic review in 2020 compared PRP and surgery for GTPS. It was based on only 5 low quality studies for each intervention with very small patient numbers but concluded both PRP and

surgical intervention for the treatment of recalcitrant GTPS showed statistically and clinically significant improvements (Walker-Santiago et al., 2020).

Conclusion/Reflection:

Mrs A case was chosen in part as she had a trochanteric bursa as part of her GTPS presentation. The 2 previous US guided injections on GTPS patients I had undertaken prior to Mrs A only had features of Gluteus medius tendinopathy with no bursitis present. I have had some feedback from my mentor that I can apply to much probe pressure and this may compress a small sized bursa and, in this instance, I maintained light pressure when undertaking the US scan. The presence of the bursitis made this an easier injection as there was a specific target to aim for, whereas previously with just tendinopathic features only around G. Med tendon I was somewhat uncertain where exactly the injection target should be aimed at. As a result, I feel I had better needle visualisation during the procedure. Using the 2-syringe technique method makes USGI more complicated as you have to re-site the needle after changing syringes, but again the presence of the anechoic fluid helped with accurate placement. As I was alone with Mrs A and had the US machine on the opposite side of the bed, I was unable to take any images during this procedure. I will have to adapt my set up in the future as understand that there should be a record of the procedure for medicolegal reasons. I have undertaken a lot of landmark GPTS injections in the past and am interested to see does the addition of USGI improve clinical outcomes. There is considerable technical skill to undertake a guided injection and it is an area I will need to invest considerable time and practice in order to become proficient

References:

Barratt, P.A., Brookes, N., Newson, A., (2017). Conservative treatments for greater trochanteric pain syndrome: a systematic review. *British Journal of Sports Medicine* ;51(4),97-104.

Blankenbaker, D., Ulrick, S., Davis, K., De Smet, A., Haaland, B. and Fine, JP. (2008). Correlation of MRI findings with clinical findings of trochanteric pain syndrome. *Skeletal Radiology.* 37(7), 903-09

Brinks, A., van Rijn, R.M., Willemsen, S.P. (2011). Corticosteroid injections for greater trochanteric pain syndrome: a randomized controlled trial in primary care. *Annals of Family Medicine*. 9(3),226–34.

Chowdhury, R., Naaseri, S. and Lee, J. (2014). Imaging and management of greater trochanteric pain syndrome. *Postgraduate Medical Journal.* 90(2), 576–81

Cibulka, M., White, D., Woehrle, J., Harris-Hayes, M., Enseki, K., Fagerson, T., Slover, J. and Godges, J. (2009). Hip Pain and Mobility Deficits – Hip Osteoarthritis: Clinical Practice Guidelines Linked to the International Classification of Functioning, Disability, and Health from the Orthopaedic Section of the American Physical Therapy Association. *Journal of Orthopaedic Sports Physical Therapy.* 39(4), A1-A25.

Cvitanic, O., Henzie, G., Skezas, N., Lyons, J. and Minter J. (2004) MRI diagnosis of tears of the hip abductor tendons (gluteus medius and gluteus minimus). *American Journal of Roentgenology.* 182(1),137-43

CSP 2016. The use of medicines with injection-therapy in physiotherapy services. 5 th Edition. https://www.csp.org.uk/system/files/documents/2019-04/pd003_medicines_injection_therapy_5th_edition_oct_2016_1.pdf

Del Buono, A., Papalia, R., Khanduja, V., (2012) Management of the greater trochanteric pain syndrome: a systematic review. *British Medical Bulletin.*102(10), 115–31.

Docking, S., Cook, J., Chen, S., Scarvell, J., Cormick, W., Smith, P. and Fearon, A. (2019). Identification and differentiation of gluteus medius tendon pathology using ultrasound and magnetic resonance imaging. *Musculoskeletal Science and Practice*. 6 (41),1-5

Fearon, A.M., Twin, J., Dahlstrom, J.E. (2014). Increased substance P expression in the trochanteric bursa of patients with greater trochanteric pain syndrome. *Rheumatology International.* 34(7), 1441–1448

Fearon, A., Scarvell, J., Cook, J. and Smith P. (2010). Does ultrasound correlate with surgical or histologic findings in greater trochanteric pain syndrome? A pilot study. *Clinical Orthopaedic Related Research.* 468(7):1838-44

Ganderton, C., Semciw, A., Cook, J. and Pizzari, T. (2017). Demystifying the Clinical Diagnosis of Greater Trochanteric Pain Syndrome in Women. *Journal of Womens Health*. 26(6), 633-643.

Grimaldi, A. and Fearon, A. (2015). Gluteal Tendinopathy: Integrating Pathomechanics and Clinical Features in Its Management. *Journal of Orthopaedic Sports Physical Therapy*. 45(11), 910-22

Grimaldi, A., Mellor, R., Nicolson, P., Hodges, P., Bennell, K. and Vicenzino, B. (2017). Utility of clinical tests to diagnose MRI-confirmed gluteal tendinopathy in patients presenting with lateral hip pain. *British Journal of Sports Medicine.* 51(6), 519-524.

Grumet, R,. Frank, R., Slabuagh, M., Virkus, W., Bush-Joseph, C., Nho, S. (2010). Lateral hip pain in an athletic population: differential diagnosis and treatment options. *Sports Health*. 2(3):191-6.

Lequesne, M., Mathieu, P., Vuillemin-Bodaghi, V., Bard, H. and Djian, P. (2008) Gluteal tendinopathy in refractory greater trochanter pain syndrome: diagnostic value of two clinical tests. *Arthritis & Rheumatology*. 59(2), 241-6.

Long, S., Surrey, D. and Nazarian, L. (2013). Sonography of greater trochanteric pain syndrome and the rarity of primary bursitis. *American Journal of Roentgenology*. 201(5),1083-6.

Mellor, R., Bennell, K., Grimaldi, A., Nicolson, P., Kasza, J., Hodges, P., Wajswelner, H., and Vicenzino, B. (2018). Education plus exercise versus corticosteroid injection use versus a wait and see approach on global outcome and pain from gluteal tendinopathy: prospective, single blinded, randomised clinical trial. *BMJ*. 2(5), 361-66

Mitchell, W.G., Kettwich, S.C., Sibbitt, W.L. *et al* (2018). Outcomes and cost-effectiveness of ultrasound-guided injection of the trochanteric bursa. *Rheumatology International.* 38 (9), 393–401

McEvoy, J., Lee, K., Blankenbaker, D., del Rio A. and Keene, J. (2013). Ultrasound-guided corticosteroid injections for treatment of greater trochanteric pain syndrome: greater trochanter bursa versus subgluteus medius bursa. *American Journal of Roentgenology.* 201(2), 313-7

Mulligan, E., Middleton, E., and Brunette, M. (2015). Evaluation and management of greater trochanter pain syndrome. *Physical Therapy and Sport.*16(3),205-14.

NICE Guidelines on Greater trochanteric pain syndrome (trochanteric bursitis). (2016). https://cks.nice.org.uk/topics/greater-trochanteric-pain-syndrome-trochanteric-bursitis/

Oderuth, E., Ali, M., Atchia, I. and Malviya, A. (2018). A double-blind randomised control trial investigating the efficacy of platelet rich plasma versus placebo for the treatment of greater trochanteric pain syndrome (the HIPPO trial): a protocol for a randomised clinical trial. *Trials.* 21(1):517

Park, K., Lee, W. and Lee, J., (2016). Factors Associated with the Outcome of Ultrasound-Guided Trochanteric Bursa Injection in Greater Trochanteric Pain Syndrome: A Retrospective Cohort Study. *Pain Physician*. 19(4), 547-57.

Ramírez, J., Pomés, I., Sobrino-Guijarro, B., Pomés, J., Sanmartí, R., Cañete, J. (2014). Ultrasound evaluation of greater trochanter pain syndrome in patients with spondyloarthritis: are there any specific features? *Rheumatology International*.34(7):947-52

Resteghini, P. (2017). *Diagnostic musculoskeletal ultrasound and guided injection: A practical guide.* Thieme.

British society of Rheumatology and other health organisations statement: November 2020 *Management of patients with musculoskeletal and rheumatic conditions who: - are on corticosteroids - require initiation of oral/IV corticosteroids - require a corticosteroid injection.* https://www.rheumatology.org.uk/practice-quality/covid-19-guidance

Rompe, J., Segal, N., Cacchio, A., Furia, J., Morral, A., and Maffulli, N. (2009) Home training, local corticosteroid injection, or radial shock wave therapy for greater trochanter pain syndrome. *American Journal of Sports Medicine*. 37(10),1981-90

Saunders, S & Longworth, S. (2012). *Injection techniques in musculoskeletal medicine: A practical manual for clinicians in primary and secondary care*. 4th ed. Churchill Livingstone

Segal, N., Felson, D., Torner, J., Zhu, Y., Curtis, J., Niu, J. and Nevitt, M. (2007). Multicenter Osteoarthritis Study Group. Greater trochanteric pain syndrome: epidemiology and associated factors. *Archives of Physical Medicine and Rehabilation*.88(8), 988-92.

Shah, A., Mak, D., Davies, A., James, S. and Botchu, R. (2019). Musculoskeletal Corticosteroid Administration: Current Concepts. *Canadian Association of Radiology Journal*. 70(1),29-36.

Stephens, G., O'Neill, S., French, H., Fearon. A., Grimaldi, A., O'Connor, L., Woodley, S. and Littlewood, C. (2018). A survey of physiotherapy practice in the United Kingdom for patients with greater trochanteric pain syndrome. *Musculoskeletal Science and Practice.* 40(9), 0-20.

Tan, L., Benkli, B., Tuchman, A., Li, J, Desai, N., Bottiglieri, T., Pavel, J., Lenke, L., Lehman, R., (2018). High prevalence of greater trochanteric pain syndrome among patients presenting to spine clinic for evaluation of degenerative lumbar pathologies. *Journal of Clinical Neuroscience,* 53(5) 89-91

Walker-Santiago, R., Wojnowski, N., Lall, A., Maldonado, D. Rabe, S. and Domb, B. (2020). Platelet-Rich Plasma Versus Surgery for the Management of Recalcitrant Greater Trochanteric Pain Syndrome: A Systematic Review. *Arthroscopy.* 36(3), 875-888.