Wrist Ganglia Case Study – Stuart McInnes (2818 words)

Introduction

The following case study will focus on the treatment of wrist ganglia. In particular it will consider the main treatment strategies; the use ultrasound to assist with percutaneous aspiration and the infiltration of chemical substances as an adjunctive therapy during percutaneous aspiration.

Case History

Patient W, a 30 year old man, presented to an out of hours urgent treatment centre with a two year history of a swelling over the volar aspect of his left wrist. This was growing slowly and had reached approximately one centimetre in size. It was not painful but the patient stated that it had begun causing functional impairment and possibly provoking paraesthesia in his middle and ring fingers. These symptoms were beginning to affect his work as a Health Care Assistant at a local hospital. Examination demonstrated a small, cystic swelling consistent with a ganglion and the patient was signposted back to his General Practitioner. They in turn referred him on to a Community Musculoskeletal Service. His assessment by this service was conducted remotely by telephone during the COVID-19 pandemic and he was sent on for ultrasound to confirm the diagnosis.

His past medical history is notable for an ipsilateral distal radial fracture that had been treated with open reduction and internal fixation in 2002. The screw and plate fixation remained in situ. The patient was morbidly obese and suffered with depression for which he took 50mg sertraline once daily.

The ultrasound scan revealed a 10 x 9 x 5 mm anechoic, avascular, cystic structure whose appearance was consistent with a ganglion cyst. The cyst was sited lateral to the flexor carpi radialis tendon and possessed a swan neck connection that appeared to extend towards the trapezoid - capitate articulation (Figure 1). The scan report did contain the caveat that "*the anatomy is difficult to clearly assess due to previous surgery*". Following discussion with the on-site radiology consultant the patient was rebooked for aspiration of the ganglion cyst under ultrasound guidance.

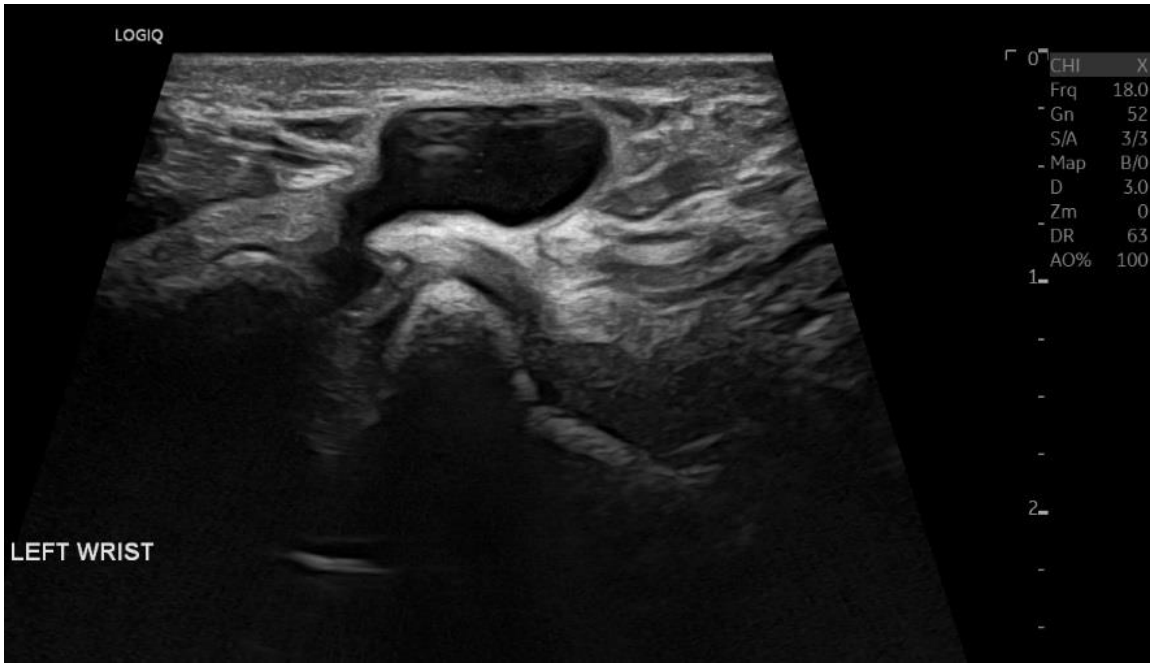

Figure 1: The ganglion cyst with extension towards trapezoid - capitate articulation

This appointment occurred two months later, at which point the cyst was noted to be unchanged in either size or general appearance. The cyst was percutaneously aspirated to near dryness followed by the injection of 10mg of triamcinolone acetonide and 0.25ml of bupivacaine hydrochloride. The infiltration of these two agents was in accordance with local standard operating procedures.

The patient was followed-up six months post procedure, at which point in time, he had not noticed any recurrence of the ganglia, was symptom free and enjoying full function in his left wrist and hand.

Ganglion cysts

Ganglion cysts are the most prevalent soft tissues masses occurring in the wrist and hand (Head *et al*., 2015). Lowden *et al.* (2005) performed magnetic resonance imaging scans on the wrists of 103 asymptomatic volunteers and found that 53 of the 103 (51%) had a wrist ganglia. Despite this frequency, their aetiology is not well understood (Gitto *et al*., 2018). The most established current theory is of recurrent microtrauma to the soft tissue structures of a joint (Head *et al*., 2015) with consequent tenosynovitis and/or joint degeneration (Kurkis *et al*., 2019). Ganglion cysts are lined with a connective tissue capsule and contain a thick material primarily composed of hyaluronic acid (Gude & Morelli, 2008). It is reported that 60-70% of all ganglion cysts occur over the dorsum of the wrist, with somewhere between thirteen and twenty per cent being found on the volar wrist aspect (Gude & Morelli, 2008). In relation to this specific case there was of course a history of local trauma, although no radiocarpal osteoarthritis was noted during ultrasonography. This ganglion arose on the volar aspect of the wrist, the less common presentation. Volar ganglions are

typically located in relatively close proximity to the radial artery (Gitto *et al*., 2018). This has potential implications for the optimal treatment modality, which will be discussed later.

The treatment of ganglion cysts

The documented historical approaches to treating ganglion cysts date back a number of centuries; with 18th century options including binding with a plate of lead, daily rubbing with saliva and incision (Clay & Clement, 1988). Only the latter approach remains in use today and forms one of the three common treatment options, alongside observation and percutaneous aspiration (Kurkis *et al*., 2019).

Dias *et al*. (2007) found, with a mean follow-up duration of 70 months, that 58% of dorsal wrist ganglia will spontaneously resolve. The observation route clearly carries the lowest risk and cost but is not appropriate for all patients. Active treatment is usually considered when a person is experiencing pain, stiffness, weakness or concerns about appearance (Head *et al*., 2015). Percutaneous aspiration can be performed “blind” or with ultrasound guidance, whereas incision can be achieved through an open or an arthroscopic approach (Gitto *et al*., 2018). There remains debate as to which of the active interventions is most effective (Head *et al*., 2015). In particular, there is limited literature pertaining to the use of ultrasound to guide percutaneous aspiration (Kurkis *et al*., 2019). It is these two topics that will form the following sections of this case study.

The systematic review and meta-analysis conducted by Head *et al*. (2015) aimed to compare the efficacy and safety of percutaneous aspiration with open and arthroscopic surgical excision. Amongst the studies included within their analysis, mean recurrence rates of 59% (percutaneous aspiration), 21% (open surgical excision) and 6% (arthroscopic surgical excision) were demonstrated. The complication rates for these three modalities were 3% (percutaneous aspiration), 14% (open surgical excision) and 4% (arthroscopic surgical excision). The authors were however unable to subdivide results according to whether the cyst was found on the dorsal or volar aspect of the wrist; whether the percutaneous aspiration was performed blind or with ultrasound guidance; and whether percutaneous aspiration was followed by corticosteroid injection or not.

Zeidenberg *et al*. (2016) investigated the more specific topic of ultrasound-guided percutaneous aspiration of wrist ganglia. 39 patients, with either a dorsal or volar wrist ganglion treated by a single musculoskeletal radiologist, were followed-up for a minimum of nine months. The observed recurrence rate was just 20%, with no acute complications and high satisfaction rates. This recurrence rate is of course much lower than the 59% found by Head *et al*. (2015) but does originate from a smaller sample size. Kurkis *et al*. (2019), in their own retrospective analysis, found a recurrence rate of 69% after ultrasound guided percutaneous aspiration, compared to 74% following blind percutaneous aspiration. Their study was also small in size, with only 52 patients in total, of whom just thirteen had undergone ultrasound guided

percutaneous aspiration. It did however have a longer follow up period, with a mean of 42 months. They suggest that the recurrence rate might simply correlate positively with the length of follow-up.

It is not possible, from the current evidence base, to claim that the use of ultrasound definitively reduces recurrence rate when compared to a blind percutaneous aspiration technique. However, this is not the sole clinical outcome of interest. It is equally important to consider, for example, safety and cost, when making treatment choices and designing management protocols.

Volar wrist ganglions, as previously mentioned, often lie adjacent to the radial artery and can even sometimes cause it's displacement (Teh, 2012). Ganglion cysts have a characteristic sonographic appearance with a typically hypoechoic structure, occasional thin septa and absent Doppler flow (Guerini *et al*., 2015). This makes them, in ordinary circumstances, easy to distinguish from adjacent structures. Furthermore, ultrasound allows for real-time, continuous, visualisation of needle tip position (Orlandi *et al*., 2014). Radial artery damage was one of the reported complications of open surgical excision found by Head *et al*. (2015) and it is logical to envisage that this injury could also occur with blind percutaneous aspiration.

Gitto *et al*. (2019) explicitly investigated the safety and efficacy of ultrasound-guided percutaneous aspiration of volar radiocarpal ganglion cysts. 88 patients who had undergone this procedure, alongside a combination of anaesthetic lavage, wall fenestration and steroid injection were reviewed retrospectively. In 92% of cases there was immediate and complete ganglion decompression with no instances of post-procedural bleeding, haematoma or infection. 38 of the 88 patients had post-procedural data available with a documented recurrence rate of 66%. This is similar to that found by both Kurkis *et al*. (2019) and Head *et al*. (2015). Interestingly, the presence of internal septa was associated with a higher risk of recurrence. The safety findings of Gitto *et al*. (2019) mirror those of Zeidenberg *et al*. (2015), with no acute complications, whether infection, bleeding or allergic response, during the ultrasound-guided percutaneous aspiration of both dorsal and volar cysts. Ultrasonography therefore appears to be a safe option in the treatment of all wrist ganglion cysts, which is of particular importance for volar cysts that often lie close to the radial artery.

It is also incumbent upon the commissioners of a health service to consider the relative cost-effectiveness of different treatment options. Federer *et al*. (2021) performed a cost minimisation analysis on the treatment of dorsal wrist ganglion cysts. Their simulation model was devised to ascertain the cheapest treatment algorithm and took into account factors such as recurrence rate, complication rate, costs of surgical treatment and even the costs of outpatient visits. This suggested that two percutaneous aspirations should be attempted prior to any form of surgical excision. Their data was however based on the costs found within the USA healthcare system, which may not be transferable to the UK.

The evidence reviewed at this stage suggests that percutaneous aspiration of ganglion cysts is likely to be a safe and cost-effective treatment option, albeit with a relatively high recurrence rate. The use of ultrasound has not yet been shown to

reduce this recurrence rate but it does provide a further degree of safety, which may be of particular benefit in the treatment of volar ganglion cysts. Therefore, the choice of ultrasound-guided percutaneous aspiration seems an appropriate first line treatment option for the patient in this study. However, in addition to ultrasound-guided percutaneous aspiration the patient also received an injection of triamcinolone acetonide mixed with bupivacaine hydrochloride. The evidence for the injection of steroid and/or local anaesthetic as part of the treatment of a ganglion cyst will now be reviewed.

Percutaneous aspiration of ganglion cysts is regularly combined with a chemical injection, whether of corticosteroid, hyaluronidase or even ethanol (Head *et al*., 2015). The use of corticosteroids in the treatment of wrist ganglions has been practiced since Becker in the 1950s, based on the hypothesis that chronic inflammation may be a contributory factor in ganglion aetiology (Gude & Morelli, 2008; Suen *et al*., 2013).

Varley *et al*. (1997) conducted a prospective randomised controlled trial, comparing the efficacy of percutaneous aspiration against percutaneous aspiration alongside corticosteroid injection. Specifically, the steroid used was methylprednisolone, up to a maximum dose of 40mg. They were able to follow up a total of 85 patients for a mean period of 48 weeks. Percutaneous aspiration alone and percutaneous aspiration with concomitant steroid injection both showed the same 67% recurrence rate. Nasab *et al.* (2014) also conducted a prospective trial investigating corticosteroid use together with percutaneous aspiration. Their study was composed of three arms: 24 patients had percutaneous aspiration alone, 20 had percutaneous aspiration alongside methylprednisolone injection and 22 underwent percutaneous aspiration with ethanol injection. They found, at one year, 62.5% recurrence in the aspiration alone group compared with 45% for corticosteroid and 36.5% for ethanol. Therefore, contrary to Varley *et al.* (1997), their study does hint at a reduction in recurrence when a substance is infiltrated alongside the percutaneous aspiration procedure.

The use of corticosteroid is not however without risk. Indeed this was specifically mentioned by Varley *et al*. (1997), who reflected on the potential for two specific local adverse reactions to corticosteroid infiltration: subcutaneous fat atrophy and skin depigmentation. A systematic review by Brinks *et al*. (2010) focused on the adverse effects of extra-articular corticosteroids and found documented rates of subcutaneous fat atrophy ranging from 1.5 - 40% and skin depigmentation rates varying from 1.3 – 4%. The studies included within their review investigated a variety of extra-articular sites, but mainly involve the use of triamcinolone at a dose between 10 and 20mg; thereby making the findings relevant to this specific case. Systemic side effects following corticosteroid injection were considered during the narrative literature review of *Stone et al.* (2021). These include a reduction in immune function, hyperglycaemia and hypothalamic-pituitary-adrenal axis suppression. Although these are all transient effects their importance must be considered, especially during a time of global pandemic.

There is only limited evidence pertaining to the use of corticosteroids as part of ganglion aspiration. It does not clearly show benefit but does highlight the potential for adverse events, both locally and systemically. There is a need for further studies into the benefit of corticosteroid administration as part of the percutaneous aspiration procedure. I do not feel that the current weight of evidence favours the use of corticosteroids as an adjunctive therapy at this time.

The use of local anaesthetics as part of percutaneous aspiration is noted within the literature (Kulinski *et al.*, 2016), but I was unable to locate any specific studies investigating the benefit or risk of using these agents in the treatment of ganglion cysts. Considering their use more broadly during musculoskeletal procedures; the addition of a local anaesthetic agent to corticosteroids is common practice with the numerous aims including the provision of additional, rapid analgesia (Stephens *et al*., 2008). However, given that lidocaine has a mean duration of action of up to two hours (Achar & Kundu, 2002) it cannot provide any direct benefit in this case beyond an initial post-procedural analgesic boost. The most widely documented risk from local anaesthetics pertains to central nervous system and cardiac toxicity following inadvertent intravascular administration (McMahon *et al*., 2009). This hazard is of course ameliorated by the use of ultrasound-guidance.

Hyaluronidase is not available within our local health service. However, its use in the percutaneous aspiration of ganglion cysts, both alone and in combination with corticosteroids has been relatively widely researched (Head *et al*., 2015; Kulinski *et al*., 2016; Suen *et al*., 2013) and is therefore of interest to this review .

The principal constituent of ganglion cysts is, as previously mentioned, hyaluronic acid. The theory underlying the use of hyaluronidase is therefore that it can facilitate cyst aspiration by disrupting the polymeric bonds of hyaluronic acid and reducing the viscosity of the cystic fluid (Kulinski *et al*., 2016). Otu (1992) published the first study investigating the use of hyaluronidase. This involved the intra-lesional injection of hyaluronidase before fine needle aspiration of the ganglion in 340 patients. At six month follow up 95% of patients were felt to be cured on clinical examination. These early, very promising, results were initially supported by a study that compared recurrence rates when percutaneous aspiration with corticosteroid administration was used alone and in combination with prior infiltration of hyaluronidase (Paul & Sochart, 1997). Although each study group only contained 35 patients they were followed up for 2 years, with ganglion recurrence rates of 11% in the hyaluronidase plus corticosteroid group compared to 43% in the corticosteroid group. Unfortunately subsequent studies by both Jagers op Akkerhuis *et al*. (2002) and Hajer *et al*. (2005) were less positive, with recurrence rates of 77% and 85% respectively. Hyaluronidase is not a totally inert substance. Injections are known to be associated with localised pruritus and allergic reactions (Jung, 2020). The documented rate of allergic reactions is low, at less than 0.7%, but these type 1 hypersensitivity reactions often do require treatment with systemic steroids (Jung, 2020).

In summary, for the treatment of ganglion cysts, there is mixed evidence as to the benefit of hyaluronidase, no evidence as to the benefit of lidocaine and limited evidence as to the benefit of corticosteroids. Moreover, each of these agents is

associated with known, if uncommon, side-effects. It is therefore not advisable, based on the evidence presented within this case study, to continue the routine use of corticosteroid and local anaesthetic in the ultrasound-guided percutaneous aspiration of ganglion cysts. More studies are required to investigate recurrence rates of ganglia when treated by aspiration alone compared aspiration in combination with corticosteroid, lidocaine and/or hyaluronidase.

Summary

The spontaneous resolution rate of wrist ganglia is high. However, for individuals troubled by their persistence or by symptoms, percutaneous aspiration offers a safe and cost-effective first line treatment. The principal drawback of percutaneous aspiration is the recurrence rate, with the literature suggesting a level of approximately 60%. The addition of ultrasound does not convincingly improve this rate but does provide added reassurance regarding safety. This is especially important when treating volar wrist ganglia that often lie close to the radial artery. The current evidence base does not compellingly demonstrate any additional benefit from the use of corticosteroids or hyaluronidase as adjunctive therapies during percutaneous aspiration. Given that both agents are associated with small but known risk factors it would seem prudent, until further evidence is published, to avoid their use.

References:

Achar, S. & Kundu, S. (2002) 'Principles of Office Anesthesia: Part I. Infiltrative Anesthesia', *American Family Physician*, 66(1), pp. 91-95. PMID: 12126036.

Brinks, A. et al. (2010) 'Adverse effects of extra-articular corticosteroid injections: a systematic review', *BMC Musculoskeletal Disorders*, 11:206. doi:10.1186/1471-2474-11-206.

Clay, N. & Clement, R. (1988) 'The Treatment of Dorsal Wrist Ganglia by Radical Excision', *Journal of Hand Surgery (British and European volume)*, 13(2), pp. 187-191. DOI: 10.1016/0266-7681(88)90135-0.

Dias, J. et al. (2007) 'The natural history of untreated dorsal wrist ganglia and patient reported outcome 6 years after intervention', *Journal of Hand Surgery (European volume)*, 32(5), pp. 502-508. doi: 10.1016/J.JHSE.2007.05.007.

Federer, A. et al. (2021) Dorsal Wrist Ganglion Cost Minimization Analysis. Available at https://meeting.handsurgery.org/abstracts/2021/OD-Soft%20Tissue2.cgi [accessed 23 November 2021].

Gitto, S. *et al*. (2018) 'Ultrasound guided percutaneous treatment of volar radiocarpal ganglion cyst: safety and efficacy', *Journal of Clinical Ultrasound*, 47(6), pp. 565-578. doi.org/10.1002/jcu.22724.

Gude, W. & Morelli, V. (2008) 'Ganglion cysts of the wrist: pathophysiology, clinical picture, and management', *Current Reviews in Musculoskeletal Medicine*, 1(3-4), pp. 205-211. doi: 10.1007/s12178-008-9033-4.

Guerini, H. et al. (2015) 'Ultrasound of wrist and hand masses', *Diagnostic and Interventional Imaging*, 96(12), pp. 1247-1260. doi.org/10.1016/j.diii.2015.10.007.

Hajer, G. et al. (2005) 'Hyaluronidase aspiration vs surgical excision of ganglion cysts: A randomized controlled trial', *European Journal of Plastic Surgery*, 28, pp. 337–339. doi.org/10.1007/s00238-005-0785-4.

Head, L. et al. (2015) 'Wrist ganglion treatment: systematic review & meta-analysis', *Journal of Hand Surgery (American volume)*, 40(3), pp. 546-53. doi: 10.1016/j.jhsa.2014.12.014.

Jagers op Akkerhuis, M. et al. (2002), 'Hyaluronidase versus surgical excision of ganglia: A prospective, randomized clinical trial', *Journal of Hand Surgery (British volume)*, 2002, 27(3), pp. 256–258. doi: 10.1054/jhsb.2002.0764.

Jung, H. (2020) 'Hyaluronidase: An overview of its properties, applications, and side effects', *Archives of Plastic Surgery*, 47(4), pp. 297-300. doi: 10.5999/aps.2020.00752

Kulinksi, S. et al. (2016) 'Chemical Subsctances Use in The Treatment of Ganglions Located in the Hand and Wrist', *Polimery w Medycynie*, 46(1), pp. 95-100. doi: 10.17219/pim/64803.

Kurkis, G. et al. (2019) 'Ultrasound-Guided Aspiration Does Not Reduce the Recurrence Rate of Ganglion Cysts of the Wrist', *Journal of Wrist Surgery,* 8(2), pp. 100-103. doi: 10.1055/s-0038-1668156.

Lowden, C.M. et al. (2005) 'The prevalence of wrist ganglia in an asymptomatic population: magnetic resonance evaluation', *Journal of Hand Surgery (British volume*, 30(3), pp. 302-3066. doi: 10.1016/j.jhsb.2005.02.012.

McMahon, P. et al. (2009) 'Injectable Corticosteroid and Local Anaesthetic Preparations: A Review for Radiologists', *Radiology*, 252(3), pp. 647-661. doi.org/10.1148/radiol.2523081929.

Nasab, S. et al. (2012) 'Comparative study between three methods of aspiration alone, aspiration plus steroid injection and aspiration plus ethanol injection for treatment of dorsal wrist ganglions', *Pakistan Journal of Medical Sciences*, 28(3), pp. 404-407.

Orlandi, D. et al. (2014) 'Ultrasound-guided procedures around the wrist and hand: how to do', *European Journal of Radiology*, 83(7), pp. 1231-1238. doi: 10.1016/j.ejrad.2014.03.029

Otu, A. (1992) ‘Wrist and hand ganglion treatment with hyaluronidase injection and fine needle aspiration: A tropical African perspective’, *Journal of the Royal College of Surgeons Edinburgh*, 37(6), pp. 405–407. PMID: 1491375

Paul, A. & Sochart, D. (1997) ‘Improving the results of ganglion aspiration by the use of hyaluronidase’, *Journal of Hand Surgery (British volume)*, 22(2), pp. 219–221. doi: 10.1016/s0266-7681(97)80066-6.

Stephens, M. et al. (2008) ‘Musculoskeletal Injections: A Review of the Evidence’, *American Family Physician*, 78(8), pp. 971-976. PMID: 18953975.

Stone, S et al. (2021) ‘Corticosteroids: Review of the History, the Effectiveness, and Adverse Effects in the Treatment of Joint Pain’, *Pain Physician*, 24(S1):S233-S246. PMID: 33492920.

Suen, M. et al. (2013) ‘Treatment of Ganglion Cysts’, *ISRN Orthopaedics,* 940615. doi: 10.1155/2013/940615

Teh, J. (2012) ‘Ultrasound of soft tissue masses of the hand’ *Journal of Ultrasonography*, 12(51), pp. 381-401. doi: 10.15557/JoU.2012.0028.

Varley, G. et al. (1997) ‘Conservative Management of Wrist Ganglia: aspiration versus steroid infiltration’, *Journal of Hand Surgery (British volume)*, 22(5), pp. 636-637. doi: 10.1016/s0266-7681(97)80363-4.

Zeidenberg, J. et al. (2016) ‘Ultrasound-guided aspiration of wrist ganglions: a follow-up survey of patient satisfaction and outcomes’ *Acta Radiologica* 57(4), pp. 481-486. doi: 10.1177/0284185115597719