Case 2 Biceps US guided Genicular nerve blocks James Rodger

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Introduction

The purpose of this essay to present a case study highlighting the use of genicular nerve blocks (GNB) in the management of osteoarthritis (OA) of the knee. To do this a concise patient history and clinical findings will be presented. Differential diagnosis and working hypothesis will be presented and imaging modalities considered. The rationale for injection therapy will be considered and the procedure briefly described. The outcome of the procedure will be discussed and learning points considered.

Patient Presentation

In this work for the purpose of confidentiality the patient will be referred to as Mr A.

- A fifty-five year male, with an eighteen months history of right medial knee pain with no history of trauma.

- There is no reported history of locking or giving way, although there were episodes of intermittent swelling that would occur particularly after a day's work. His symptoms were aggravated by squatting and kneeling and prolonged periods of standing.

- He had undertaken a course of physiotherapy which had included both strengthen and condition exercises around the knee joint which he found to be of limited benefit.

- He had previously taken Paracetamol and Ibuprofen for the symptoms which had not found to beneficial and was not keen to take anything else in case they produced unwanted side effects.

- Prior to undertaking physiotherapy he had received an intra-articular steroid (IAS) injection from his GP, which provided only temporary relief for around forty-eighty hours.

- He has a longstanding history of an idiopathic underactive thyroid which is medicated with levothyroxine. He has no other significant past medical or drug history.

- Mr A is a self-employed builder unable to take time off work due to financial reasons. Recreationally he enjoys coastal walks, which he is unable to do at present

Clinical Assessment

- Mr A had full range of movement both his tibiofemoral joint with only mild discomfort at end of range, patellofemoral joint testing was unremarkable with minimal joint effusion.

- There was no evidence no ligamentous laxity or meniscal pathology and only mild joint line tenderness around the medial aspect of the knee.

- An x-ray of Mr A's right knee showed moderate medial compartment osteoarthritis with normal findings of the lateral and patella femoral component (see Figure 1).

- Oxford knee score (OKS) on initial assessment was 22.

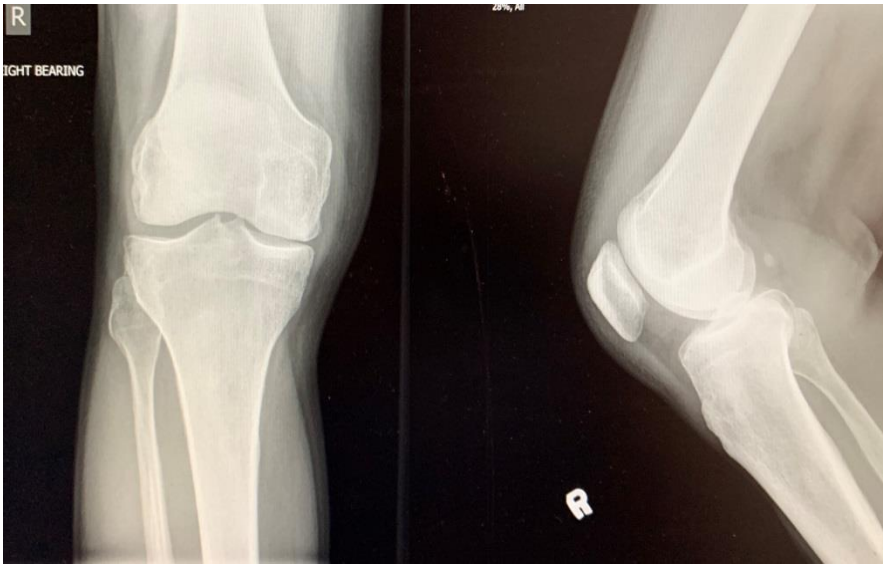

Figure 1 Lateral and Anterior-Posterior Radiograph

Differential Diagnosis

When considering Mr A's clinical diagnosis, the use of appropriate imaging needs to be considered and justified. According to NICE Clinical Guidelines 117 (2014) if a person; is 45 or over and has activity-related joint pain, has either no morning joint-related stiffness or morning stiffness that lasts no longer than 30 minutes the diagnose osteoarthritis of the knee can be made clinically without investigations.

NICE Clinical Guidelines 117 however warns that atypical features, such as a history of trauma, prolonged morning joint-related stiffness, rapid worsening of symptoms or the presence of a hot swollen joint may indicate alternative or additional diagnoses. Important differential diagnoses can include gout, inflammatory arthritis, septic arthritis and malignancy which would require further imaging. (NICE 2014).

Clinical assessment of Mr A was unremarkable and there was no evidence of an underlying concomitant pathology. At this stage however there was justification for a plain film x-ray to evaluate the extent and location of the OA.

At this stage there may have been some merit in the use of magnetic resonance imaging (MRI) to further aid Mr A's diagnosis and prognosis. According to a recent systematic review and meta-analysis however, MRI imaging of asymptomatic knees in a population over the age of forty will show evidence of OA changes in up to forty-three percent of the population. This therefore means that any finding must be

evaluated in relation to clinical context (Culvenor et al 2019). This is further confirmed by Braun et al (2012) confirms that MRI has enhanced benefits for soft tissue imaging around the knee, however with the confirmation of OA on x-ray it has minimal beneficial value in enhancing the diagnosis.

One final consideration is the use of ultrasound sound in the diagnostic management of knee OA. Ultrasound technology has the ability to demonstrate and assess the minimal structural abnormalities, which involve the pathophysiology and progression of OA, such as articular cartilage, synovial tissue, bony cortex, and other soft tissue. Nowadays, ultrasonography is a promising technique for assessing soft tissue abnormalities such as joint effusion, synovial hypertrophy, Baker cyst, and other structural changes including the decrease in cartilage thickness, meniscus bulging, and formation of osteophyte. (Oo et al 2016). A small study by Riecke et al (2014) demonstrated that ultrasound is reliable and valid in detecting knee OA in comparison with standing radiographs of the knees. It however must be accepted that due to the ease of clinical diagnoses and the general accessibility of x-ray that these will be the current frontline choices.

In summary it is accepted that there are a number of imaging modalities that can be used to aid and enhance the diagnosis of knee OA. However, in the case of Mr A a strong clinical history and lateral and anterior-posterior x-ray give a strong diagnosis of knee OA.

Management Plan

When considering the on-going management options for MR A it is important to outline briefly the underlying pathology of OA and potential evidence based management options when developing a management plan.

There is limited understanding of the cause of pain in OA, however substantial evidence indicates that knee OA is caused by the breakdown of joint tissues from age related mechanical loading and inflammation, but the deeper underlying origins of knee OA high prevalence remain unclear (Neogi 2017, Berenbaum 2012). One barrier to understanding the genesis of pain in OA is the structure-symptom discordance, which reflects the observation that some individuals have radiographic changes with minimal symptoms, while others have more significant pain with only

minimal structural pathology (Hunter et al 2013, Bedson and Croft 2008). This dichotomy may be explained to some extent by evidence suggesting that pain experienced as a result of knee OA is not exclusively mediated by just a local inflammatory response. Emerging evidence suggests alterations in pain processing within the central nervous system may be an important factor in accounting for such variations in clinical presentation (Fingleton et al 2015, Arendt-Nielsen 2017).

Conservative Management

The best practice guidelines for conservative management of knee OA: include oral medication, weight management and exercise therapy (NICE 2014, Bruyere et al 2015, McAlindon 2014). In some cases the management of patients can be enhanced with the use of intra-articular steroid injections and knee bracing (Mistry et al 2018, NICE 2014).

Exercise is effective for relieving lower extremity joint pain and recommended as first-line treatment in clinical guidelines for osteoarthritis (OA) treatment. However, research suggests implementation of NICE guidelines for non-pharmacological treatment is suboptimal; this may be due to evidence that patients with knee OA may experience increased pain during physical activity and therefore be hesitant to participate in exercise treatment (Wang et al 2018, Sandal et al 2015).

The use of non-steroidal anti-inflammatories (NSAIDs) and opiate-based medication are regularly used in the management of osteoarthritis. This can lead to tolerance and dependency leading to longer term financial and health costs. NSAIDS can also provide increased health risks, particularly in the older population or those with increased cardiovascular morbidities leading to significant secondary negative effects on gastrointestinal, renal and cardiovascular systems (Fibel et al 2015).

The uses of IAS injections to help with the symptoms of knee osteoarthritis are commonplace. In some cases they can be effective and are only needed on an infrequent basis for their management. However other patients need more regular injections to help manage their symptoms. Unfortunately the use of corticosteroid and local anaesthetic used in these injections potentially cause cartilage change known to exacerbate the osteoarthritic process and increase the risk of infection if

knee surgery is required in the future (Goodwin and Dawes 2004, Campbell et al 2005).

Another potential option is an unloading knee brace. These are considered an economical and effective treatment for unicompartmental knee osteoarthritis. They have been shown to significantly improve a patient's quality of life and potentially delay the need for surgery (Lee et al 2016, Mistry et al 2018).

Surgical Management

When discussing the management options with regard to Mr A it is also important that the surgical options are consider. If conservative interventions do not provide a reduction in pain and/or improvements in functional disability then more radical surgical approach may be considered, including interventions such as knee arthroscopy or knee joint arthroplasty.

In recent times the role of these two common surgical interventions has been called in to question. The use of arthroscopic washout and debridement of osteoarthritic knees provides no more benefit with a greater financial cost and health risk compared to conservative treatment (Siemenieniuk et al 2017 and Sihvonen 2013).

The other surgical alternative, knee joint arthroplasty can provide a more effective solution for patients with severe osteoarthritis, however in younger and/or patients with less severe osteoarthritic change this is questionable. Research has shown that knee replacements undertaken in a younger population under the age of sixty years of age have a higher rate of non-infection related complications and revisions (Julin et al 2010, Bayliss et al 2017).

Genicular Nerve Blocks

In the case Mr A there was another less known intervention that may be of benefit; an ultrasound guided genicular nerve block. Traditionally knee OA is almost

exclusively been managed by General Practitioners, Physiotherapists and Orthopaedic Surgeons. GNB injections however are used by Consultant Anaesthetists in Pain Management clinics to alleviate chronic knee pain traditionally for those; who are either unsuitable for joint arthroplasty or that have under gone previous knee arthroplasty interventions and continue to have pain and functional disability following the procedure.

The GNB is undertaken as a two-stage procedure, which was traditionally done under fluoroscopy. However a recent study by Hoi et al (2019) demonstrated that superior and inferior medial genicular nerve branches can be precisely located using anatomic landmarks and ultrasound guidance. The accuracy of the ultrasound-guided genicular nerve block has also confirmed in cadaveric models (Yasar et al 2015). This therefore means it can be done in an outpatient department with the reduced risk from ionisation and demand on radiology resources.

The procedure is different to the more common IAS injection which delivers corticosteroid directly into the knee joint. The GNB involves injecting local anaesthetic and corticosteriod around three branches of the genicular nerve - lateral superior, medial superior and medial inferior. (Figure 2). This blocks nociceptive information from the distal femur, knee joint, meniscus and patella normally transmitted by these genicular nerves (Yasar et al 2015). This first stage of the GNB procedure is diagnostic and is to determine whether the full intervention will provide significant pain relief.

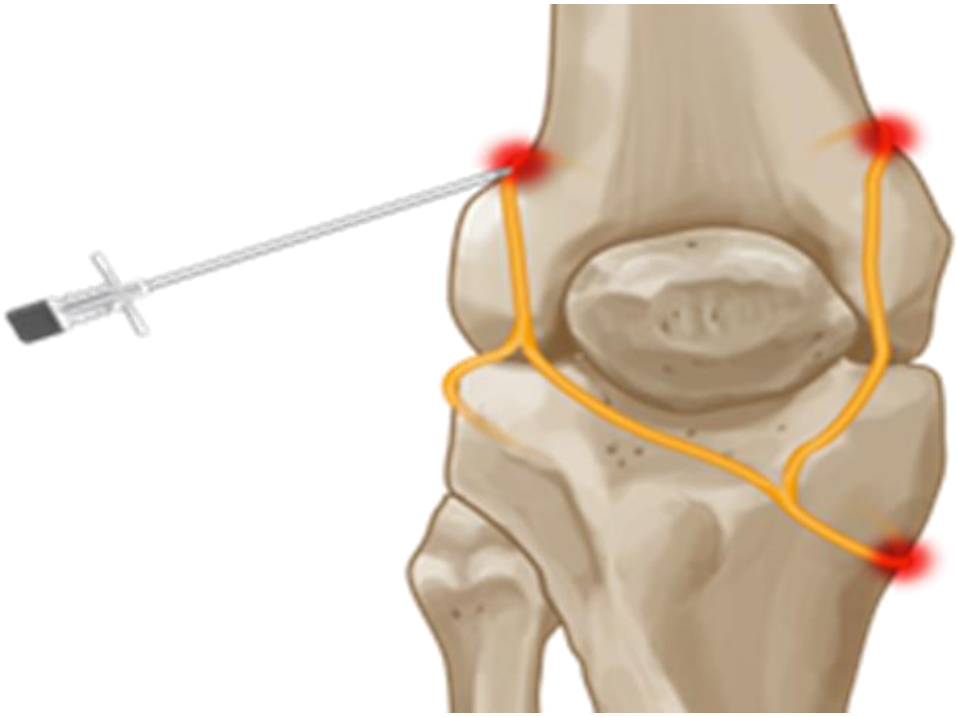

Figure 2 Genicular Nerve Schematic

When the patient achieves 70% or more improvement of their knee pain a definitive second stage procedure is undertaken. This second procedure is almost identical to the first, but utilises a technique to ablate the nerve conduction and provide prolonged pain relief typically lasting 6 months on average.

Review evidence

Limited research trials have been undertaken; Choi et al (2011) carried out a study, which involved 38 patients with severe knee OA pain lasting more than 3 months. Patients were randomly assigned to either fluoroscopic guidance GNB ablation (n = 19) or the same procedure without effective ablation (control group; n = 19). Visual analogue scale (VAS), Oxford knee scores, and global perceived effect on a 7-point scale were measured at baseline and at 1, 4, and 12 weeks post-procedure.

VAS and Oxford Knee scores showed that GNB group had less knee joint pain at 4 ($p < 0.001$) and 12 ($p<0.001$) weeks compared with the control group. No patients reported a post-procedure adverse event during the follow-up period. They concluded that the procedure did allow pain reduction and functional improvement in

a subset of elderly with chronic OA knee pain, and thus may be an effective treatment in such cases. Further trials with larger sample size and longer follow-up are warranted.

More recently Kesikburun et al (2016) undertook a single arm prospective study to evaluate the effect of ultrasound-guided GNB treatment on chronic pain and function in patients with knee osteoarthritis (n=15). Pain and knee function were assessed with VAS and Western Ontario and McMaster Universities (WOMAC) over 3 months. There was a significant reduction in VAS and WOMAC scores, detected over time after the GNB procedure ($P < 0.01$). The study was limited by a small number of participants, the lack of a control group, and short follow-up period. However the treatment was found to be safe and beneficial in osteoarthritis related knee pain. Its conclusion was that further studies with a larger population and randomised controlled study design were warranted to confirm the positive findings.

Further studies are required to assess long-term clinical efficacy, effect on narcotic consumption, and the establishment of therapeutic guidelines for the procedure. Additionally, further studies to monitor radiographic imaging progression of arthritis would help to enhance the safety profile and assess the risks of developing Charcot arthropathy. Although this has not yet been reported in the literature, it is a concern for a neuropathic joint (Kim et al 2019 and Jamison and Cohen 2018).

Shared Decision Making and Informed Consent

With regard to undertaking the GNB for Mr A it was important that a shared decision making process was undertaken. This is a collaborative process in which healthcare professionals and people who use services working together to choose treatments, management or support packages, based on evidence and the person's personal informed preferences and values. This involves making sure the person has a good understanding of the risks, benefits and possible consequences of different options through discussion and information sharing. This joint process empowers people to make a decision about the treatment and care that is right for them at that time (Coulter 2016).

As in keeping with local Trust policy following the informed decision making process, Mr A opted for a local anaesthetic/corticosteroid injection to the genicular nerve of his right knee. This would be the first stage of the process previously described. The risk and benefits were discussed and no exclusions or contraindications to the invention were highlighted.

Injection Technique

Prior to the procedure the patient was formally consented in keeping with Trust policy. At this time a numerical pain rating scale (NPRS) was used to evaluate the patient's current level of pain.

- The patient was positioned in supine position allowing for internal and external rotation of the hip joint so access to the medial and lateral aspects of the thigh can achieved.
- The treatment area is cleaned with Pink Chlorhexidine Gluconate Solution 20% and draped a sterile probe cover is attached and primed with sterile ultrasound gel.
- The procedure is undertaken at three points around the genicular nerve; at the superior lateral, superior medial and inferior medial aspects of the nerve.

- The subcutaneous region above the injection site is first made more comfortable by the use of a local anaesthetic (Lidocaine 4ml (50mg in 5ml) using a 25g gauge (0.5x25mm orange needle) (Figure 3).

Figure 3 Superior lateral probe positioning

- Initially the area of the nerve to be injected is located under ultrasound; visually it sits in close proximity genicular artery which acts as a landmark (Figure 5&6).

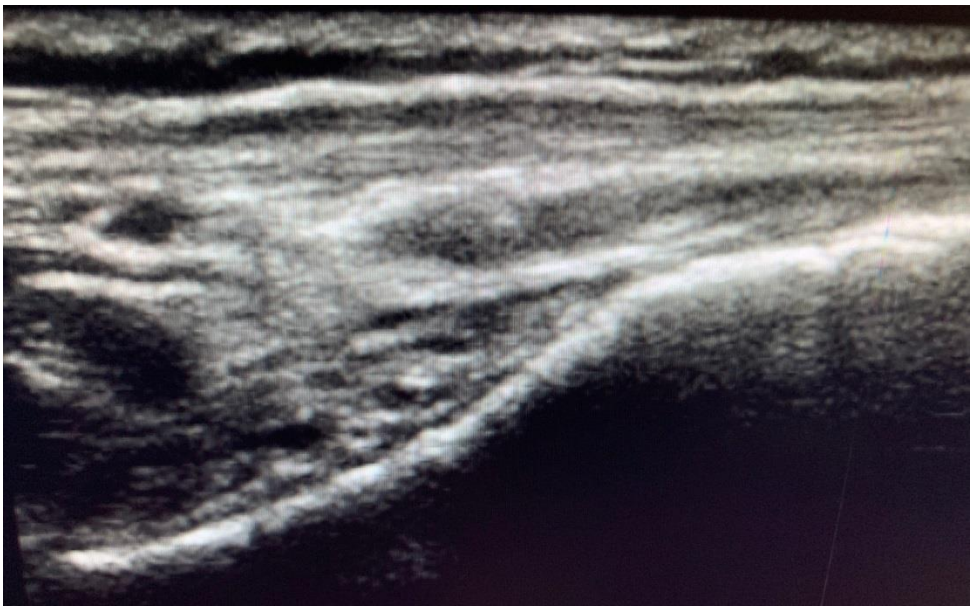

Figure 5 Superior lateral genicular nerve

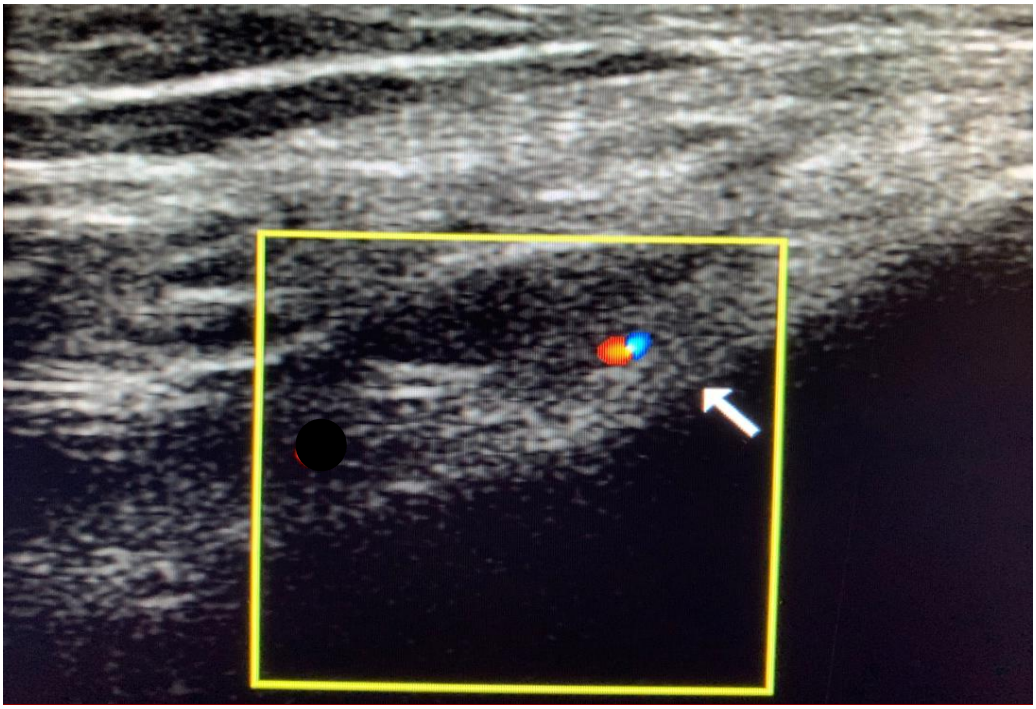

Figure 6 Superior lateral genicular nerve with colour flow

- The USGI injection is undertaken in plane with transverse axis view. Using a Pajunk SonoPlex 22 gauge 80mm needle. A Sonosite SII ultrasound unit was used in conjunction with a 13-6 MHz linear probe (Figure 6).

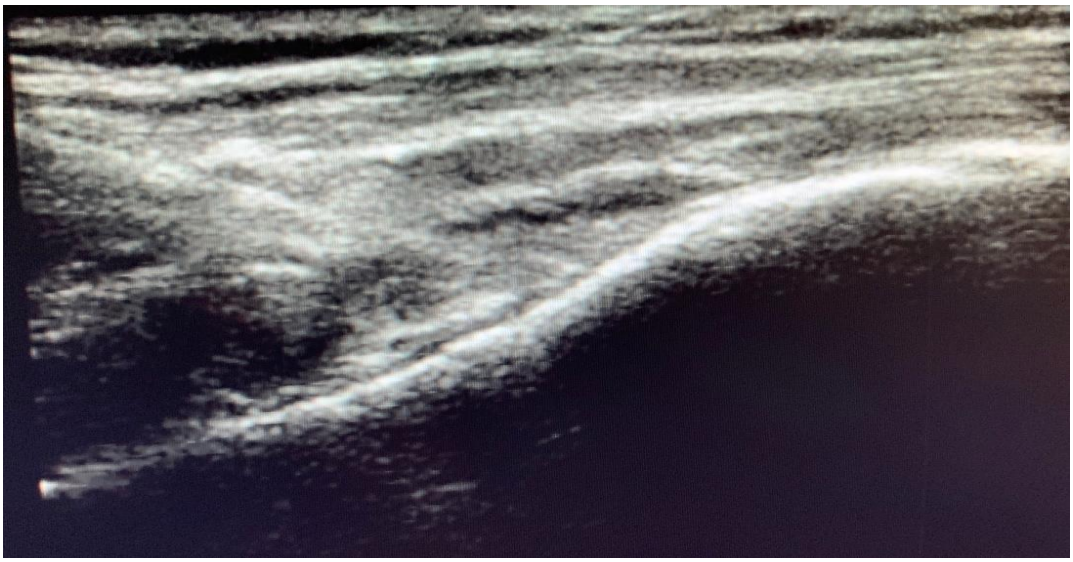

Figure 6 Ultrasound guided injection of the superior lateral genicular nerve

- In total of 1ml (40mg) Methylprednisolone and 4ml (5mg/ml) Levobupivacaine was used around the three nerve sites.

- Post injection the injection sites are covered with sterile plasters and the patient is asked to wit in the recovery area.

- Thirty minutes post procedure the patient is asked to undertake a short walk to assess the change in pain post procedure using the (NPRS).

Outcome Measures

To assess Mr A's eligibility to progress to the second stage of the GNB process NPRs and OKS were taken and are as follows;

- **Pre Intervention**
    - NPRS 7/10
    - OKS 22/48
- **Thirty minutes post intervention**
    - NPRS 0/10
- **Four weeks post intervention**
    - NPRS 2/10
- **Eighty weeks post intervention**
    - NPRS 2/10
    - OKS 32/48

On discussion with Mr A he reported that he had found the GNB at this stage to be a very positive experience. Occupationally he did not feel that he had an significant limitation and he had returned to regular coat path walks.

Learning Points

It is important to be pragmatic when undertaking the GNB procedure and although it is considered a two stage process the need for the second stage radiofrequency ablation may not be needed. As mentioned earlier the use of the nerve block may have caused a reduction in nociceptive information from the knee, allowing Mr A to increase his physical activity therefore providing essential chondral loading of the knee joint.

It is therefore is vital that vigilant monitoring of outcome measures is undertaken when monitoring the clinical efficacy of interventions. The use of the NPRS and OKS showed on going improvement in MR A's function and pain following the first stage of the procedure. Without this the second stage may have been undertaken without it being needed, leading to an increased risk with no increased potential benefit.

A final learning point is that the GNB procedure has been considered a surgery sparing or pain relieving for "failed knee" arthroplasty procedures. Early evidence may suggest that that a increased benefit from this procedure may be gained in patient with less OA knee change (Gerrans et al 2019)

Conclusion

Although GNB are a novel approach to the management of knee OA pain and not yet in the wider domain it is a concept that should be explored further in the future. Similar such procedures are being implemented with the use of suprascaular nerve blocks for the management of chronic shoulder pain (Ozkan 2012). There then may be merit in the future to consider the use of ultrasound guided injection around the neural pain transmitting structures rather than the perceived underlying structural case of the pain.

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