MASTER OF SCIENCE BY RESEARCH

An exploration of the experiences and views of clinicians on the use and role of suprascapular nerve block injections for the non-surgical management of shoulder pain

Smith, Neil

Award date:
2017

Awarding institution:
Coventry University

Master of Science

by

Research in Clinical Practice:

An exploration of the experiences and views of clinicians on the use and role of suprascapular nerve block injections for the non-surgical management of shoulder pain

By

Neil Smith

5th July 2017

Master of Science

by

Research in Clinical Practice:

An exploration of the experiences and views of clinicians on the use and role of suprascapular nerve block injections for the non-surgical management of shoulder pain

By

Neil Smith

5th July 2017

A thesis submitted in partial fulfilment of the University's requirement for the Degree of Master of Science by Research in Clinical Practice.

Abstract

Background

Chronic shoulder pain is a major problem in the UK. The most effective non-surgical management of chronic shoulder pain is unknown. Suprascapular nerve block (SSNB) injections are one treatment option used in the management of chronic shoulder pain however little is known about its use and application in clinical practice.

Objectives

This study aimed to explore the experiences and views of clinicians who use SSNB injections for the non-surgical management of shoulder pain. The main objective was to gain an in-depth understanding regarding the application of SSNB injections in clinical practice. The findings may go on to inform future research in this area.

Design

A pragmatic qualitative approach was adopted and underpinned this study.

Methods

One rheumatologist, one pain consultant and three physiotherapists who currently use SSNB injections in the non-surgical management of shoulder pain participated in a focus group. The focus group was recorded, transcribed and then analysed using thematic analysis.

Findings

Three main themes were identified; Patient Selection, The Intervention and Patient Management. Clinicians in this study currently reserve SSNB injections for patients with long standing shoulder pain that has failed to improve with other treatments including local steroid injections. Variation exists in the approach taken to administer the nerve block as well as the drugs, dosages and volumes used. All clinicians reported that physiotherapy and shoulder exercises played an important part in the overall management of their patients after receiving a SSNB injection.

Limitations

A major limitation of this study was that only one focus group was undertaken. Undertaking a number of focus groups across a wider geographical region that included the views and experiences of orthopaedic consultants, interventional radiologists and general practitioners would strengthen the findings of this study. Using additional methods such as individual interviews and surveys for triangulation would also improve the credibility of the findings.

Conclusion

Clinicians recognise the lack of theory and evidence guiding clinical practice in this area. Based upon the findings of this small group of clinicians, most felt that SSNB injections may have a wider role to play in managing shoulder pain. Future research may be aimed at targeting specific patient groups with shoulder pain earlier for a SSNB injection, rather than waiting to see if other treatments have failed. This study has provided background information that may be used to inform future exploratory research in this area.

Acknowledgements

This thesis forms part of a Master of Science by Research (MRes) in Clinical Practice undertaken at Coventry University. This programme was funded by Health Education England (HEE) and the National Institute for Health Research (NIHR) as part of the Integrated Clinical Academic (ICA) programme.

I would like to thank Professor Jane Coad for giving me the opportunity to undertake this research programme. This MRes programme has increased my understanding and awareness of different research approaches and application. It has also given me the opportunity to further develop my knowledge regarding the evidence surrounding the management of chronic shoulder pain and use of suprascapular nerve block injections. I would also like to thank Ann Green, my Director of Studies, for all her support and for sticking with it and me! I would also like to thank Dr Jo Perry for her support in the delivery of the focus group and for all her valuable and subtle prompts and ongoing guidance throughout. In addition, I would like to thank Dr Jeremy Lewis for his constructive input and valuable feedback at important times throughout the planning and write up of this thesis and Dr Jocelyn Bell (Head of R&D, Sandwell and West Birmingham Hospitals NHS Trust) for her support and advice during the planning and delivery of this study. In addition, I would like to extend my gratitude to the participants who took part in the focus group without whom this study would not have taken place.

Contents

Clinical Portfolio: The clinical portfolio aspect of this Master of Science by Research in Clinical Practice programme was submitted as a separate document. Please see attachment one that accompanies the submission of thesis.

Chapter 1
Background and Introduction

Background to this research project

I am a Physiotherapist with over 17 years of experience in clinical practice in the NHS, of which 15 years have been based within a community musculoskeletal physiotherapy service and a community integrated clinical assessment and treatment service (iCATS) from Sandwell and West Birmingham Hospitals NHS Trust. I have a special interest in treating shoulder pain and have previously undertaken Masters level training in; Injection Therapy, Upper Limb Orthopaedics, Applied Orthopaedic Radiology and Project Management and Research Governance as stand-alone modules at Coventry University, Salford University and Birmingham University. Within my service, the use of local steroid injections in the treatment of chronic shoulder pain is long standing and an accepted practice. I have used local steroid injections in the management of shoulder pain since 2007. As part of a redesign of local musculoskeletal, orthopaedic and pain management pathways in 2014, I was trained and started to administer suprascapular nerve block (SSNB) injections for patients with chronic shoulder pain in community clinics. However, as a service we had no clear criteria regarding which patients should be considered for SSNB injections and no understanding on 'best practice' regarding the long term management of patients following a SSNB injection. Prior to 2014, SSNB injections were only offered within specialist pain clinics in secondary care in my trust.

This research project evolved from my own experiences and questions that arose from using SSNB injections treating patients with chronic shoulder pain in

clinical practice. Whilst undertaking a NIHR Clinical Academic Internship Program (CAIP) I was able to develop further understanding of research methods and application that facilitated the development of my initial ideas for undertaking this research project. I recognised that this project would require a programme of research, involving both qualitative and quantitative approaches, adopting an evolving phased approach. Phase 1 was undertaken within this NIHR funded MRes programme and involved an exploratory study aiming to develop a greater understanding regarding the application of SSNB injections in clinical practice. The findings of this preliminary research may go on to inform and support future research in this area that ultimately may go on to inform clinical practice.

Prevalence and Incidence of shoulder pain in the UK

Shoulder problems are a major cause of pain and disability in the United Kingdom and symptoms may become chronic, recurrent and persistent, affecting the quality of life of many patients (Lowe et al, 2014, Murphy & Carr, 2010). Chronic pain may be defined as pain lasting longer than 3 months (Merskey 1986). Accurate estimates of the number of people living with chronic shoulder pain in the UK is currently unknown due to the paucity of up to date literature. In the year 2000, estimates of the annual prevalence and incidence of people accessing in primary care, in the UK, with shoulder related pain was 2.4% and 1.5% respectively (Linsell et al, 2006). This study also highlighted the issue of chronic shoulder pain with around 20% of people with a shoulder problem, still reporting shoulder pain at 1 year and 13.6% of patients still reporting shoulder pain at 3 years (Linsell et al, 2006).

The literature also indicates that chronic shoulder pain is more prevalent with advancing age (Vecchio et al, 1995, Chard et al, 1991). Linsell et al, (2006) identified that older patients were more likely to have chronic shoulder pain, 17.6% of over 60 year olds with shoulder related symptoms were still reporting pain 2 years on from their initial presentation.

Although the literature indicates that shoulder pain is a common condition, that may become chronic in many patients, a systematic review undertaken by Luime et al, (2004) highlighted problems associated with interpreting the findings from some epidemiological studies measuring estimates of shoulder pain in the general population. Variability in case definition, inconsistent reporting and variability in the ability to diagnose and define shoulder

conditions, by clinicians in general practice were highlighted as issues associated with inconsistent findings within and between epidemiological studies (Luime et al, 2004). This variability in defining and diagnosing shoulder pain may have implications in managing shoulder pain in primary care. Clinicians in general practice may lack confidence in managing shoulder pain when a specific diagnosis is not always clear.

Physiotherapy management is recognised as one of the first treatment options in the management of shoulder problems (Murphy & Carr, 2010). The overall number of patients attending musculoskeletal physiotherapy services in the UK with a shoulder related problem is currently unknown. However, audit data from individual services indicates that shoulder pain is the third most common musculoskeletal problem for someone seeing a physiotherapist (May 2003) or being referred to a Musculoskeletal Clinical Assessment and Treatment Service (CATs) (Roddy et al, 2013). Evidence indicates that many patients with shoulder pain benefit from physiotherapy management (Kuhn et al, 2009, Green et al, 2003), however not all patients improve sufficiently and some patients go on to develop chronic, recurrent and persistent shoulder pain (Chester et al, 2013).

Chronic shoulder pain

Based upon the IASP (1986) definition of chronic pain i.e. pain lasting 3 months or more, clearly many people with shoulder pain could therefore be classified has having chronic pain (Merskey 1986). Although some chronic musculoskeletal conditions continue to have an underlying, ongoing or episodic inflammatory component, such as in rheumatoid arthritis (RA) and osteoarthritis, recent advances in our understanding and knowledge of pain neurophysiology

questions whether all chronic pain conditions are solely maintained and driven by ongoing peripheral tissue pathology (Aronoff 2016, Littlewood et al, 2013, Gifford 1998).

The mismatch between tissue pathology and pain perception is demonstrated by the fact that many people with shoulder pathology, for example a rotator cuff tear identified on imaging, may experience very little pain (Lewis 2016, Littlewood et al, 2013). In addition, improvements in pain following surgical rotator cuff repair have not been shown to be dependent upon successful repair of the tear, implying that structural pathology alone i.e. a rotator cuff tear, is not the only factor in pain perception in some patients with shoulder pain (Yang et al, 2016, Flurin et al, 2007).

Recent literature identifies the potential role of the peripheral and central nervous system, in maintaining and driving ongoing symptoms (central sensitization), in some patients with chronic shoulder pain (Bradnam et al, 2016, Borstad & Woeste 2015, Lewis 2016, Lewis et al, 2015, Sanchis et al, 2015, Dean et al, 2013, Littlewood et al, 2013, Paul et al, 2012, Gwilym et al, 2011). Central sensitization refers to 'an amplification of neural signaling within the central nervous system that elicits pain hypersensitivity' (Woolf, 2011). Central sensitization may play a role in some patients with chronic shoulder pain, although the mechanism by which central sensitization becomes established is not well understood (Sanchis et al, 2015). A lowering of the threshold of activation for pain perception may exist in some individuals. In this situation, essentially a variety of sensory afferent input to the CNS, that in a non-sensitized state or individual would not normally be perceived as painful, may now be sufficient to trigger and maintain pain perception. Clinically and

functionally simple normally non-provocative shoulder movements or palpation around the shoulder may now be perceived as painful (Dean et al, 2013, Basbaum 2009).

Recognition that not all chronic shoulder pain conditions are necessarily driven or maintained by peripheral tissue pathology, damage or inflammation, challenges traditional concepts of diagnosing and managing shoulder pain, and may have important implications in clinical practice when deciding on the most appropriate treatment and management strategies for some patients with chronic shoulder pain. Solely targeting treatments at peripheral pathology may be futile in some patients. Some authors have argued for a 'mechanism-based approach' to diagnosing, managing and targeting pain interventions in chronic pain (Vardeh et al, 2016). Treatment and management strategies targeting the 'mechanisms' that contribute to chronic shoulder pain, may provide more effective care and improve outcomes in the future for some patients. However, recognizing and identifying the mechanisms involved in chronic shoulder pain, in order, to target them with more specific treatments, remains a challenge, due to the lack of validated clinical tools that can identify such mechanisms in clinical practice and the availability of effective therapeutic modalities (Woolf 2011, Smart et al, 2011).

Local steroid injections

The most effective non-surgical management for shoulder pain is unknown (Green et al, 2003). Local steroid injections offer some patients with shoulder pain short term benefit in pain relief and improvements in function (Buchbinder et al, 2003). First discovered by Philip Hench in the 1940's, glucocorticosteroids

are potent anti-inflammatory agents and are commonly used for local steroid injection preparations (Buchbinder et al, 2003, Hench et al, 1949). Although local steroid injections are often used in clinical practice there is uncertainty about their long-term benefits in addition to physiotherapy (Crawshaw et al, 2010). Expert opinion and clinician consensus indicates that local steroid injections are considered an important treatment option within the overall management of shoulder conditions (Bryceland et al, 2015, Griffiths and Yohannes 2014, Kulkarni et al, 2015).

Injection therapy was adopted within the scope of physiotherapy by the Chartered Society of Physiotherapy (CSP) in 1995 and physiotherapists who have undergone specific post graduate training are able to administer and use injection therapy within their practice. Injection therapy combined with shoulder exercises, delivered by physiotherapists, was demonstrated to be a cost-effective model of care that may lead to earlier recovery, including patients returning to work sooner, when compared to treatment with exercises alone, in some patients with shoulder pain (Jowett et al, 2013, Crawshaw et al, 2010).

In a survey of current physiotherapy practice, around 35% of respondents reported that local steroid injections were considered within the overall management strategy for patients with rotator cuff related pain (Littlewood et al, 2012). In a separate survey on the physiotherapy management of frozen shoulder around 80% of respondents reported that administration of local steroid injections would be considered in patients with frozen shoulder, especially when pain rather than stiffness was the main problem (Hanchard et al, 2011). Based on the above survey findings and on the data from service evaluation, local steroid injections appear to be regularly considered and used

by physiotherapists in the treatment and management of shoulder disorders in the UK (Roddy et al, 2013, Littlewood et al, 2012, Hanchard et al, 2011).

Local steroid injections have risks and potential side effects including local tissue atrophy and depigmentation, local tendon rupture, local infection, post injection flare, steroid arthropathy, or more widespread and systemic side effects such has allergic reaction, facial flushing, menstrual irregularity and elevated blood sugar in diabetic patients (Brinks et al, 2010, Saunders and Longworth 2006). The negative effects that glucocorticoid steroids have on tendon homeostasis, that may result in tendon weakening, potentially resulting in worse long-term outcomes for patients, has also received renewed interest in the literature (Ackermann and Hart 2016 page 229 and 239, Dean et al, 2014a, Dean et al, 2014b, Coombes et al, 2010). Local steroid injections may have a negative effect on rotator cuff tendon homeostasis and integrity and arguably this should be a consideration within the overall decision-making process in clinical practice, especially when repeated local steroid injections are being considered. In clinical practice clinicians may often have to make decisions regarding administering repeat local steroid injections with the dilemma and knowledge that although it may provide short term pain relief and facilitate rehabilitation, it may also may have a negative effect on tendon homeostasis and long term outcome.

Although glucocorticosteroids have potent anti-inflammatory properties, the mechanism by which local steroid injections relieve symptoms in patients with chronic shoulder pain has not been widely investigated. It is possible that, apart from their local anti-inflammatory actions, other systemic effects of glucocorticosteroids, may, in some part, be responsible for their overall

beneficial effects in some patients. These effects may include actions on wider systems in the body including the peripheral and central nervous system, as well as a possible placebo effect of receiving an injection. Furthermore, when glucocorticosteroids are administered together with a local anaesthetic agent, it is also possible that the actions of the local anaesthetic agent could also contribute to the overall beneficial effect. It is plausible that local steroid injections, containing local anaesthetic agents, modulate central pain processing, in part, by temporarily blocking afferent pathways, rather than purely through an anti-inflammatory effect of the steroid. Subacromial injections undertaken with only local anaesthetic have been shown to provide pain relief beyond the pharmacological action of the drugs used, and have comparable outcomes to patients receiving injections containing local anaesthetic and glucocorticostreoid (Murphy and Carr 2010, Ekeberg et al, 2009, Alvarez et al, 2005, Akgün et al, 2004, Vecchio et al, 1993).

Although local steroid injections are widely used, and seen as an important and effective treatment option, within the overall management for some patients with shoulder pain, it could be argued at times a local steroid injection may not be the most appropriate choice or only option. However, the use of alternative injection therapy approaches in the management of shoulder pain, such as local anaesthetic alone or SSNB injections, although showing some evidence for effectiveness in chronic shoulder pain, are not widely reported in the literature (Chang et al, 2016, Bryceland et al, 2015, Buchbinder et al, 2013, Littlewood et al, 2012, Chan and Peng 2011, Hanchard et al, 2011, Murphy and Carr 2010).

Peripheral nerve block injections

Peripheral nerve block injections have been shown to provide prolonged pain relief for patients with chronic pain, including patients with peripheral neuralgia (Arnér et al, 1990), headaches (Gale et al, 2002, Rothbart et al, 2000) as well as wider musculoskeletal conditions (Jankovic & Peng 2015) including shoulder pain (Chan and Peng 2011) although the mechanism that produces its prolonged effect on pain perception is unknown.

A peripheral nerve block injection involves the blockade of a specific peripheral nerve or nerves by a nerve blocking agent. In clinical practice, local anaesthetic agents are often used in combination with a glucocorticosteroid (Shanthanna et al, 2016). For a long lasting local anaesthetic agent such as 0.25% Bupivacaine, the duration of nerve blockade is reported to be from 2.5 to 20 hrs (Jankovic 2008). Blockade of sodium channels within the nerve cell membrane, results in the transient interruption of propagation of nerve impulses along the nerve axon, thereby modulating afferent input into the CNS from the periphery and efferent input from the CNS to the periphery.

The use of glucocorticosteroid combined with local anaesthetic agents, administered within nerve block injections is widely reported in the literature (Shanthanna et al, 2016, Chan and Peng 2011). However, the rationale for adding glucocorticosteroid to a local anaesthetic agent for a nerve block injection is not clear and has not been widely investigated. The actual mechanism by which the addition of glucocorticiosteroid improves the efficacy of a nerve block injection may be related to prolonging the duration of nerve blockade through its local actions on the nerve, its wider anti-inflammatory

properties and systemic effect that reaches the local tissue, its effects on the CNS or even placebo (Shanthanna et al, 2016).

The mechanisms by which nerve block injections, with or without the addition of glucocorticosteroid, provide prolonged pain relief, beyond the pharmacological duration of action of the drugs used is unknown. In patients with chronic pain, especially with a sensitised pain system, it may be hypothesised that temporarily blocking afferent impulses into the spinal cord, could result in a 'resetting' of this sensitised pain state. By blocking this input, even temporarily, may modulate pain activation thresholds and revert the pain system to a lower level of activation. Basbaum (2009) argued that prolonged pain relief, following peripheral nerve blocks, may be the result of a transient quieting of central sensitization that is driven by ongoing aberrant peripheral nerve activity.

The Suprascapular Nerve (SSN)

The SSN is a mixed motor and sensory nerve originating from the upper trunk of the brachial plexus of C5-C6 nerve roots and in 15-22% of cases also the C4 nerve root (Vorster *et al*, 2008) and is reported to supply up to 70% of the sensory innervation to the shoulder joint complex, as well as supplying motor innervation to both the supraspinatus and infraspinatus muscles (Chan and Peng 2011).

The SSN travels from the brachial plexus, through the posterior triangle of the neck and passes through the suprascapular notch of the scapular into the suprascapular fossa (Blum et al, 2013). The accompanying suprascapular artery and vein tend to cross above the transverse ligament (Bigliani et al, 1990). Once entering through the suprascapular notch, the main trunk of the

SSN travels along the floor of the suprascapular fossa before it curves around the lateral border of the scapular through the spinoglenoid notch to supply the infraspinatus muscle (fig.1). Although anatomical variation does exist, generally the lateral floor of the supraspinatus fossa contains all the sensory components of the SSN that supply the coracoclavicular ligament, coracohumeral ligament, acromioclavicular joint, subacromial bursae and posterior glenohumeral capsule (Blum et al, 2013; Dean et al, 2013, Ebraheim et al, 2011; Vorster et al, 2008; Ide et al, 1996; Aszmann et al, 1996). Thus, the location of the sensory component of the SSN, lying on the floor of the suprascapular fossa, provides specific access for needle placement that allows delivery of the drug close to the SSN. Blockade of the SSN has the potential to modulate afferent and efferent pathways that may reduce symptoms in the management of shoulder pain.

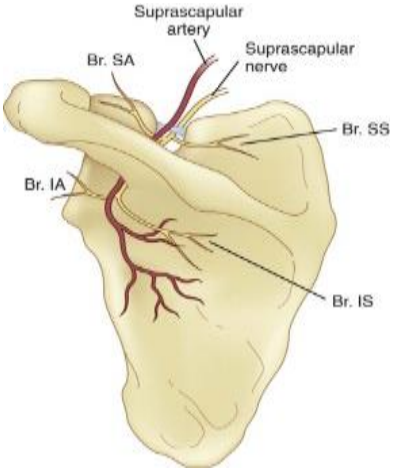


Fig 1. Suprascapular nerve and its branches of the left shoulder. The superior articular branch (Br. SA) supplies the coracohumeral ligament, subacromial bursa, and posterior aspect of the acromioclavicular joint capsule. The inferior articular branch (Br. IA) supplies the posterior joint capsule. Br. IS, branch to the infraspinatus muscle; Br. SS, branch to the supraspinatus muscle. (Huntoon et al, 2011).

Suprascapular nerve block (SSNB) injections

The use of SSNB injections for the treatment of shoulder pain was first reported in the literature by Wertheim and Rovenstine (1941). The procedure was reported to be 'useful as an adjunct in the treatment of chronic shoulder pain' and to enable other treatments such has 'traction, manipulation and massage to be applied to a painful shoulder' (Wertheim and Rovenstine 1941 p.541). A recent meta-analysis on the effectiveness of SSNB's reported that SSNB injections were an effective treatment option for patients with chronic shoulder pain (Chang et al, 2016) and a recent narrative review by Chan and Peng (2011) reported that SSNB injections were effective for short term pain relief and improvements in shoulder function in a variety of shoulder problems including arthritic conditions, rotator cuff disease and frozen shoulder. Recent reviews of the management of shoulder pain report SSNB injections were reported as 'likely to be beneficial' in patients with glenohumeral joint disease including patients with frozen shoulder (Favejee et al, 2011, Murphy and Carr 2010). Furthermore, a National Institute for Clinical Excellence (NICE) accredited commissioning guide reported that SSNB injections were a treatment option that may be considered within secondary care, for patients with subacromial pain, that were not appropriate for surgery (Kulkarni et al, 2015, Kulkarni & Rees 2015).

A number of research studies have been published investigating the effectiveness of SSNB injections. A comprehensive literature search was undertaken within electronic data bases AMED, CiNAHL, MEDLINE, and Embase from the year of inception to March 2016 (see appendix 1). Twenty-four studies investigating the effectiveness of SSNB injections were found.

These studies are presented below in Table 1. Although many of these studies report that SSNB injections may be an effective treatment option for some patients with chronic shoulder pain, there are a lack of randomised placebo controlled trials to provide robust evidence in this area. Many studies are observational and have been undertaken on heterogeneous populations. It is therefore unclear which shoulder conditions respond well to SSNB injections. A variety of different injection therapy approaches and drugs are also used in the published literature. Some studies combined SSNB injections with physiotherapy and exercises whilst others investigate SSNB as a stand-alone treatment. The data from published studies is captured in table 1 below and described in the following sections.

Table 1. Data extracted from studies investigating effectiveness of SSNB injections.

Study Title	Subjects	Design	Outcome Measures	Findings
1.Mitra, P. K. and Bhattacharya, D. (2016) 'Comparison of Clinical Effects of Ultrasound Guided Suprascapular Nerve Block and Oral Pregabalin Versus Suprascapular Nerve Block Alone for Pain Relief in Frozen Shoulder'. *Indian Journal of Pain* 30 (1), 49	Frozen shoulder 8-9 mths n100 n50 each group. Age 50 M 38 F 62	RCT. US guided SSNB & oral pregabalin vs US guided SSNB alone. 3 SSNB injection 1 weeks apart. 40mg methylprednisolone & 9ml 0.25% Bupivacaine) 75mg Pregabalin @ night. Both gps HEP.	Pain (VAS) ROM Baseline, Weeks 4, 6 &12	Both gps ss improvements in pain and ROM @ 4, 6 & 12 weeks. ss additional benefit with pregabalin both OM @ week 4,6 & 12
2.Chansoria, M., Das, G., Mathankar, N., Chandar, D., Vyas, N., and Upadhyay, S. (2015) 'A Preliminary Study of a Novel Technique of Suprascapular Nerve Block in Treating Chronic Shoulder Pain'. *Indian Journal of Pain* 29 (2), 91	Chronic shoulder pain. Non-specific. onset 4/52 or more n40 Age 48 M30 F 10	Observational. 10ml 1% lidocaine % 40mg depomedrol SGN approach	Pain (VAS) SPADI Non validated pain score 1-4 Week 1& 4	ss improvements @ weeks 1 and 4 all outcome measures
3.Dorn, C., Rumpold-Seitlinger, G., Farzi, S., Auer, J., and Bornemann-Cimenti, H. (2015) 'The Effect of the Modified Lateral Suprascapular Block on Shoulder Function in Patients with Chronic Shoulder Pain'. *Anesthesiology and Pain Medicine* 5 (6), e31640	Chronic shoulder pain Imping 6 Cal tend 6 Rot cuff 6 Arthrosis 2 duration of Sx? n20 Age 52 M 9 F 11	Observational. One injection and observe. 5ml 0.5% ropivacaine. Indirect approach- Feigl.	CMS Pain NRS (VAS) @ rest and on mvt. 1hr and 24 hrs post injection.	All outcomes sig improvement to baseline at both 1hr and 24 hr.

Study Title	Subjects	Design	Outcome measures	Findings
4.Klc, Z., Filiz, M. B., Cakr, T., and Toraman, N. F. (2015) 'Addition of Suprascapular Nerve Block to a Physical Therapy Program Produces an Extra Benefit to Adhesive Capsulitis: A Randomized Controlled Trial'. *American Journal of Physical Medicine & Rehabilitation / Association of Academic Physiatrists* 94 (10 Suppl 1), 912-920	Frozen shoulder @ least 1 mth Duration of Sx unknown n41 SSNB + physio n19 Physio alone n22 Age 55 & 61 M 31 F 10	RCT. SSNB (followed by physiotherapy) Vs physiotherapy alone. Physiotherapy included 15 sessions. 5 days a week for 3 weeks. Hot packs, tens, US, manual therapy, Ex's, HEP. SSNB -ml prilocaine & 1ml triamcinolone) Approach unclear.	Pain (BPI-SF) CSS Baseline, 3 & 7 weeks.	Both gp's showed ss improvements in BPI-SF and CSS at 3 & 7 weeks compared to baseline. SSNB plus physiotherapy gp has ss greater improvement than physiotherapy alone in the CSS, and in 4 domains of the BPI-SF at week 3 and 3 domains of BPI-SF at 7 weeks. No difference in CSS between gps at 7 weeks.
5.Bayram, K., Bal, S., Safa Satoglu, I., Kocyigit, H., Gürgan, A., Akcay, S., and Kazimoglu, C. (2014) 'Does Suprascapular Nerve Block Improve Shoulder Disability in Impingement Syndrome? A Randomized Placebo-Controlled Study'. *Journal of Musculoskeletal Pain* 22 (2), 170-174	Impingement syndrome. Onset 3/12 or more. Avg duration 9 mths. n96 SSNB n51 Control n45 Age 53 M 69 F 27	RCT. 9ml 2% prilocaine & 40mg triamcinolone Vs Saline. Indirect approach.	Pain (VAS) CSS @ Baseline, 30 min, 2/52 & 3/12.	SSNB gp sig. improvement in pain and function @ 2/52 & 3/12.
6.El-Badawy, M. A. and Fathalla, M. M. (2014) 'Suprascapular Nerve Block Followed by Codman's Manipulation and Exercise in the Rehabilitation of Idiopathic Frozen Shoulder'. *Egyptian Rheumatology and Rehabilitation* 41 (4), 172	Frozen shoulder 4 weeks or more avg onset 7/12 n20 Age 52	Observational. SSNB injection followed by Codman exercises 15 minutes later. 9ml 0.5% bupivacaine 1ml 0.4% dexamethasone sodium phosphate. Indirect approach. Home exercises.	ROM SDQ score VAS at rest and mvt 1/52, 6/52 & 12/52	sig improvement in ROM weeks 1, 6 & 12. sig decrease in pain at rest weeks 1, 6 & 12. sig decrease in pain on mvt weeks 6 & 12. sig decrease in SDQ weeks 1, 6 & 12.
7.Salgia, A., Agarwal, T., Puri, S. R., Sanghi, S., and Mohapatra, A. (2014) 'Role of Suprascapular Nerve Block in Chronic Shoulder Pain: A Comparative Study of 60 Cases'. *Medical Journal of Dr.DY Patil University* 7 (1), 44	Chronic shoulder pain SS 22 FS 18 RA 4 RCT 10 AC 4 GHJ 2 3 mths or more	RCT. SSNB Vs saline. 10ml 0.5% bupivacaine & 40mg Depomedrone. Indirect approach. n60 n30 each gp. Age 50-51 M 31 F 29	Pain (VAS) ROM Baseline, day 2, 7, 21 & 3 mths.	ss improvement in both OM SSNB group to baseline all days. ss difference between gps all days. No improvement with saline.

Study Title	Subjects	Design	Outcome measures	Findings
8.Lotero, M. A. A., Díaz, R. C. R., Escobar, D. C., Aguilar, M. A. M., and Ramírez, S. M. M. (2013) 'Efficacy and Safety of Ultrasound-Guided Suprascapular Nerve Block in Patients with Chronic Shoulder Pain'. *Revista Colombiana De Anestesiologia* 41 (2), 104-108	Chronic shoulder pain More than 6 months Rotator cuff Non-specific OA FS Spasticity n46 Age 55 M 10 F 36	Observational. 8ml 0.5% bupivacaine US guided	Pain (VAS) Baseline, 2 days, 1 month	Ss improvement in pain @ 2 days and 1 month
9.Ozkan, K., Ozcekic, A. N., Sarar, S., Cift, H., Ozkan, F. U., and Unay, K. (2012) 'Suprascapular Nerve Block for the Treatment of Frozen Shoulder'. *Saudi Journal of Anaesthesia* 6 (1), 52-55	Frozen shoulder (Diabetic patients who failed to improve with 3 LSI). Duration unknown n10 Age 56 M 2 F 8	Observational. 40mg methylprednisolone & 5ml 1& lidocaine. Fluoroscopic guidance. HEP.	Pain ROM Baseline, week 1, 4 & 12.	SS improvements all outcome measures to baseline.
10.Kang, S. S., Jung, J. W., Song, C. K., Yoon, Y. J., and Shin, K. M. (2012) 'A New Anterior Approach for Fluoroscopy-Guided Suprascapular Nerve Block-a Preliminary Report'. *The Korean Journal of Pain* 25 (3), 168-172	Chronic shoulder pain Imp 15 FS 3 CT 2 Duration of Sx unknown n20 Age 50 M 12 F 8	Observational. 2ml 1% mepivacaine Fluoroscopy guided	Pain (NRS) VAS 5 minutes after block.	Ss improved pain after block.
11.Shanahan EM (1), Shanahan KR, Hill CL, Ahern MJ, Smith MD. (2012) 'Safety and Acceptability of Suprascapular Nerve Block in Rheumatology Patients. '. *Clin Rheumatol* 31 (1), 145-9	Chronic shoulder pain (RA) RCD 105 GHJ 63 RA 28 FS 12 MND 6 Other 49 n289 (n1005 SSNBs) age 78 M 103 F 186	Case note observations / patient telephone interviews. Indirect approach. (10ml 0.5% bupivacaine 1 mg methylprednisolone)	Patient reported satisfaction and adverse effects.	6 adverse effects (3 transient dizziness, 2 transient arm weakness - hrs, 1 facial flushing) 80% patient satisfaction.
12.Gorthi, V., Moon, Y. L., and Kang, J. H. (2010) 'The Effectiveness of Ultrasonography-Guided Suprascapular Nerve Block for Perishoulder Pain'. *Orthopedics* 33 (4)	Non-specific shoulder pain. Non specific Duration Sx unknown n50 US n25 Unguided n25 Mean Age 51& 55 F 27 M 23	RCT. US guided SSNB Vs unguided SSNB. Approach for unguided unclear.US gp SS notch. 8ml 12.5% dextrose sol. & 2ml 0.2% lidocaine.	Pain (VAS) CSS Baseline, immediately after injection and 1/12	Both gps had ss improvements same day and 1/12. SS difference between gps at 1/12 in favour of US gp.

Study Title	Subjects	Design	Outcome Measures	Findings
13.Di Lorenzo, L., Pappagallo, M., Gimigliano, R., Palmieri, E., Saviano, E., Bello, A., Forte, A., DeBlasio, E., and Trombetti, C. (2006) 'Pain Relief in Early Rehabilitation of Rotator Cuff Tendinitis: Any Role for Indirect Suprascapular Nerve Block?'. *Europa Medicophysica* 42 (3), 195-204	Rotator cuff tendinitis Avg duration 4.5 weeks n40 gp 1 n20 gp 2 n20 Age 46 M 18 F 40	Randomised - crossover. gp1- Two SSNB injections 1 week apart, followed by physiotherapy . gp2- physiotherapy followed by two SSNB injections one week apart. 10ml 2% lidocaine diluted with 5-10ml saline. Indirect approach.	UCLA scale Pain (VAS) Self-reported scale. Baseline Pain daily. Disability day 28.	Gp1 had sig improvement in pain during physiotherapy session than gp2. gp1 reported better outcomes at 28 days but not sig.
14.Taskaynatan, M. A., Yilmaz, B., Ozgul, A., Yazicioglu, K., and Kalyon, T. A. (2005) 'Suprascapular Nerve Block Versus Steroid Injection for Non-Specific Shoulder Pain'. *The Tohoku Journal of Experimental Medicine* 205 (1), 19-25	Non-specific shoulder pain Sx duration range 7-16 mths n60 30 each gp. Age 52 M 23 F 37	RCT. SSNB Vs Subacromial injection. SSNB -Direct approach 10ml 1% lidocaine. SAI – 40mg depomedrol & 6ml 1% lidocaine anterior and lateral route.	Pain (VAS) ROM. Pennsylvania shoulder score. Within 5-7 days of injection and 1 month.	Both gps SS improvements from baseline all outcome measures. No ss difference between gp's.
15.Schneider-Kolsky, M., Pike, J., and Connell, D. (2004) 'CT-Guided Suprascapular Nerve Blocks: A Pilot Study'. *Skeletal Radiology* 33 (5), 277-282	Chronic shoulder pain. FS 10 RCT 12 Inflam 2 Trauma 5 OA 2 Unknown 9 Duration mean 30 mths n40 Age 44 M16 F 24	Observational. CT guided SSNB 3ml Bupivacaine & 1ml Celestone Chronodose.	SPADI Baseline, immediately after, 3 days, 3 weeks, 6 weeks.	ss improvements in both pain day 3, 3 weeks and 6 weeks and disability domain of SPADI day 3 and 6 weeks.

Study Title	Subjects	Design	Outcome Measures	Findings
16.Dahan, T. H., Fortin, L., Pelletier, M., Petit, M., Vadeboncoeur, R., and Suissa, S. (2000) 'Double Blind Randomized Clinical Trial Examining the Efficacy of Bupivacaine Suprascapular Nerve Blocks in Frozen Shoulder'. *The Journal of Rheumatology* 27 (6), 1464-1469	Frozen Shoulder Onset 1/12 or more Avg duration 12 mths n34 SSNB n17 Control n17 Age 52 M 11 F 23	RCT. 3 injections @ 7 day intervals. 10ml 0.5% bupivacaine Vs Saline. Indirect approach. Both groups given shoulder exercises to complete at home.	MPQ PPI Pain (VAS) SST ROM @ Baseline & 1/12.	SSNB sig improvement in pain @ 1/12.
17. Emery, P., Bowman, S., Wedderburn, L., and Grahame, R. (1989) 'Suprascapular Nerve Block for Chronic Shoulder Pain in Rheumatoid Arthritis'. *BMJ (Clinical Research Ed.)* 299 (6707), 1079-1080	Bilateral chronic shoulder pain Non specific Duration unknown n17 34 shoulders SSNB n17 GHJ n17 Age 67 M 3 F 14	RCT. 1 shoulder receives sham GHJ injection the other active SSNB or 1 shoulder receives sham SSNB the other active GHJ injection. SSNB (2ml - 40mg methylprednisolone & 0.5% bupivacaine and adrenaline). Approach unknown. GHJ (2ml - 40mg methylprednisolone & 1% lidocaine).	Pain (VAS). Stiffness (VAS). ROM. Pain index (modified Richie index). Baseline, week 1, 4 & 12.	SSNB gp sig improvement in pain week 1 & 4, with GHJ gp only week 1. Both SSNB and GHJ sig improvement in stiffness week 1 & 4. (12 patients felt SSNB more effective than IAI)
18. Gado, K. and Emery, P. (1993) 'Modified Suprascapular Nerve Block with Bupivacaine Alone Effectively Controls Chronic Shoulder Pain in Patients with Rheumatoid Arthritis'. *Annals of the Rheumatic Diseases* 52 (3), 215-218	Rheumatoid arthritis. Bilateral shoulder pain. Non specific Duration Sx unknown n29 58 shoulders SSNB n29 SSNB with P n29 Age 60 F20 M 9	RCT. (SSNB - LA with or without Steroid). 2ml 0.5% Bupivacaine Vs 2ml 0.5% Bupivacaine with 40mg Prednisolone. Worse shoulder randomised to treatment. Modified indirect and direct approach.	Pain (VAS) Stiffness (VAS) ROM Baseline, weeks 1,4 & 12	Sig improvements in pain & stiffness from baseline both groups @ weeks 1, 4 & 12. Variability in ROM but overall improvements both gps. No difference between gps. The addition of Prednisolone provide no further benefit.

Study Title	Subjects	Design	Outcome Measures	Findings
19. Jones, D. S. and Chattopadhyay, C. (1999) 'Suprascapular Nerve Block for the Treatment of Frozen Shoulder in Primary Care: A Randomized Trial'. *The British Journal of General Practice : The Journal of the Royal College of General Practitioners* 49 (438), 39-41	Frozen shoulder Duration Sx unknown n30 SSNB n15 GHGJ n15 Age 53 & 60 M15 F 15	RCT. Single SSNB Vs GHJ injections. GHJ - 20mg triamcinolone & 4.5 ml 2% lidocaine. Avg. no of GHJ injections 2.2. SSNB - 20mg triamcinolone & 9.5ml 0.5% bupivacaine. Indirect approach. Shoulder ex's at home.	Pain score (not validated?) ROM Baseline, 1, 3, 7 & 12 weeks.	More complete resolution of Sx in SSNB gp. Stats ?
20. Shanahan, E. M., Smith, M. D., Wetherall, M., Lott, C. W., Slavotinek, J., FitzGerald, O., and Ahern, M. J. (2004) 'Suprascapular Nerve Block in Chronic Shoulder Pain: Are the Radiologists Better?'. *Annals of the Rheumatic Diseases* 63 (9), 1035-1040	Chronic shoulder pain No specified diagnosis Mean Duration of Sx 64 & 62 mths n67 (n77 shoulders) age 75-76 M 38 F 39	RCT. CT guided vs non guided. CT – 3ml 0.5% bupivacaine & 40 mg methylprednisolone. Non- guided 10ml 0.5% bupivacaine & 40mg methylprednisolone	SPADI Pain at night, pain at rest, pain on mvt. Weeks 1, 4 & 12	Both groups improved. ? ss No sig dif between gps.
21. Shanahan, E. M., Ahern, M., Smith, M., Wetherall, M., Bresnihan, B., and FitzGerald, O. (2003) 'Suprascapular Nerve Block (using Bupivacaine and Methylprednisolone Acetate) in Chronic Shoulder Pain'. *Annals of the Rheumatic Diseases* 62 (5), 400-406	Chronic shoulder pan No specified Diagnosis Mean duration of Sx 146 & 119 mths n83 108 shoulders Age 73-74 M 56 F 52	RCT. SSNB Vs placebo (saline). 10ml 0.5% bupivacaine & 40mg Methylprednisolone. Indirect approach.	ROM. Pain (VAS) at rest, at night & on mvt. SPADI. SF-36. Week 1, 4 & 12.	ss improvements in all pain scores SSNB gp compared to baseline and to control at week 1, 4 & 12. Some ss improvement in ROM scores at week 1, 4 & 12 compared to control and baseline.
22. Karataş, G. K. and Meray, J. (2002) 'Suprascapular Nerve Block for Pain Relief in Adhesive Capsulitis: Comparison of 2 Different Techniques'. *Archives of Physical Medicine and Rehabilitation* 83 (5), 593-597	Frozen shoulder @ least 4 weeks Duration of Sx unknown n41unguided n22 EMG n19 Age 57 M16 F25	RCT. Unguided SSNB (indirect) Vs EMG guided SSNB. 10ml 1% lidocaine.	AROM PROM Pain on PROM (VAS) @ Baseline, 10 minutes & 60 minutes.	Both gps sig improvements in AROM, PROM & pain at 10 & 60 min. EMG block had a greater reduction in pain at 10 & 60 minutes - SS compared to unguided.

Study Title	Subjects	Design	Outcome Measures	Findings
23. Vecchio, P. C., Adebajo, A. O., and Hazleman, B. L. (1993) 'Suprascapular Nerve Block for Persistent Rotator Cuff Lesions'. *The Journal of Rheumatology* 20 (3), 453-455	Rotator cuff tendinitis & tears. Mean duration of Sx (30 / 33) (48 /40) mths n28 tendinitis n15 tear n13 tendinitis SSNB n10 Vs tendinitis placebo n5 tear SSNB n5 Vs tear placebo n8 Age (54 / 47) (70 / 70) M13 F 15	RCT. i. SSNB Vs placebo (saline) for tendinitis group. ii. SSNB Vs placebo (saline) for tear group. 40mg methylprednisolone & 1ml 0.5% bupivacaine. 2ml saline. Direct approach.	Pain at night, pain on mvt, pain at rest (VAS). Presence of painful arc graded (0 no painful arc, 1 slight pain, 2 moderate pain and weakness, 3 severe pain and weakness). AROM. PROM. Weeks 1, 4 & 12	SSNB Tendinitis gp had ss improvement in night pain @ weeks 1, 4 & 12 compared to baseline. SSNB Tear gp Has ss improvement in night pain week 1 & 4 and ss improvement in pain on mvt week 1, 4 &12. No between gp analysis.
24. Rowlingson and Arasi (1986) 'The use of Suprascapular Nerve Blocks in the Management of Shoulder Pain.'. *Regional Anesthesia* 11 (4), 156-159	Mixture of shoulder conditions Duration 1months -10 years n36 101 injections mean no. blocks per pt. 2.8 (1-20) age 56 M 16 F 20	Retrospective observational Both SSNB and SAI 6-7 ml 0.25% bupivacaine indirect approach	No OM	Positive outcome. No OM

SSNB injection techniques and approaches used in clinical studies

A variety of injection therapy approaches and techniques have been used in published clinical studies, including both surface landmarked, nerve stimulator Electromyography (EMG) and image guided injections such has ultrasound (US), computerised tomography (CT) and fluoroscopy (Chang et al, 2016, Fenandes et al, 2012a, Fenandes et al, 2012b, Chen and Peng 2011).

Anatomical landmarked approaches are the most common approach in the studies retrieved. The literature describes mainly two landmarked approaches; the direct approach and the indirect approach. The direct approach aims to guide the needle tip into the suprascapular notch to deliver the drug close to the SSN. The documented risks associated with using the direct approach were trauma to the SSN, suprascapular artery and vein, injection of bolus into a blood vessel, and pneumothorax (Fernandes et al, 2012b, Chan and Peng 2011). The direct approach was reported to have the greatest potential serious risk of causing a pneumothorax due to the trajectory of needle and possibility of the needle passing through the notch into the thoracic cavity (Parris 1990). However, from reviewing the published clinical studies presented in table 1. no cases of pneumothorax were reported.

In contrast to the direct approach, the indirect approach does not aim to deliver the drug within the suprascapular notch. After entry though the skin the needle is directed perpendicularly and towards the lateral half of the floor of the suprascapular fossa, the drug is then delivered to diffuse and flood the area around the SSN (Chen and Peng 2011). The indirect landmarked approach was the approach used in eleven out of sixteen studies that utilised a landmarked

anatomical approach (Dorn et al, 2015, Bayram et al, 2014, El-Badawy and Fathalla 2014, Salgia et al, 2014, Shanahan et al, 2012, Di Lorenzo et al, 2006, Dahan et al, 2000, Shanahan et al, 2003, Karatas and Meray 2002, Jones and Chattopadadhyay 1999, Rowlingson and Arasi 1986). The indirect landmarked approach was found to be an effective and safe approach in a double blind, RCT, by Shanahan et al, (2003) that compared SSNB injection (10ml 0.5% Bupivacaine & 40mg Depomedrone) to SSNB placebo injection (saline) in eighty-three patients (108 shoulders) with chronic shoulder pain. Furthermore, the same authors reported the indirect landmarked approach to be safe and effective, based on the findings of a large observational cohort study of over one thousand injections (Shanahan et al, 2012).

Various guided techniques are reported in the literature, such has CT (Schneider- Kolsky et al, 2004, Shanahan et al, 2004) fluoroscopy (Kang et al, 2012, Ozkan et al, 2012), EMG (Karatas and Meray 2002) and ultrasound (Mitra and Bhattacharya 2016, Lotero et al, 2013, Gorthi et al, 2010). Shanahan et al, (2004) undertook a RCT in seventy-seven patients and demonstrated that the use of CT guidance provided no additional benefit to a landmarked approach. However, on reviewing the intervention method, the CT group received a smaller dose (3ml of 0.5% bupivacaine) compared to the unguided landmarked group (10ml of 0.5% bupivacaine).

Gorthi et al, (2010) under took a RCT in fifty patients comparing US guided SSNB to a landmarked approach. They reported that although both groups had statistical significant improvements in pain and function at 1 month, the US group had statistically significant greater improvements compared to the landmarked group. However, the above study has limitations due to the low

number of participants recruited, the poorly defined study population and the potential effects of placebo due to lack of blinding of participants and researchers.

Although US guided SSNB injections were reported to be more effective and the preferred option in a meta-analysis by Chang et al, (2016) these recommendations appear to be based upon the results of two trials investigating the effectiveness of pulsed radiofrequency (prf) denervation of the SSN (Wu et al, 2014) and continuous SSNB with an indwelling catheter (Abdelshafi et al, 2011) not a SSNB injection.

Therapeutic agents used for SSNB injections

A variety of different local anaesthetic agents combined with or without steroid have been used for SSNB injections within published clinical studies (Fernandes et al, 2012a, Fernades et al, 2012b, Chan and Peng 2011). The addition of steroid to local anaesthetic was reported in fourteen clinical studies (Mitra and Bhattacharya 2016, Chansoria et al, 2015, Klc et al, 2015, Bayram et al, 2014, El-Badaway and Fathalla 2014, Salgia et al, 2014, Ozkan et al, 2012, Shanahan et al, 2012, Schneider- Kolsky et al, 2004, Shanahan et al, 2004, Shanahan et al, 2003, Jones and Chattopadhy 1999, Vechio et al, 1993, Emery et al, 1989). However, findings from nine further studies indicate that using local anaesthetic alone may provide effective pain relief and the addition of steroid may not be necessary (Dorn et al, 2015, Lotero et al, 2013, Kang et al, 2012, Di Lorenzo et al, 2006, Taskaynatan et al, 2005, Karatas and Meray 2002, Dahan et al, 2000, Gado and Emery 1989, Rowlingson and Arasi 1986). Only one study was found that compared using local anaesthetic alone to using local

anaesthetic combined with steroid (Gado and Emery 1989). Gado and Emery (1989) recruited twenty-nine patients with RA with chronic bilateral shoulder pain. For each patient, their worst shoulder was identified and then randomized to receive a SSNB injection with local anaesthetic alone (2ml 0.5 % Bupivacaine) or a SSNB injection with local anaesthetic combined with steroid (2ml 0.5% bupivacaine & 40mg prednisolone). Of note all participants received both injections with their worst shoulder randomized to different treatment groups. The findings indicated that the addition of steroid provided no additional benefit in pain relief or function at weeks 1, 4 and 12. The potential systemic effects of receiving a dose of steroid in the contralateral shoulder were dismissed by the authors based on the assumption that the level of absorbed steroid would be too low to have a systemic effect and improve symptoms in the contralateral shoulder.

No studies were retrieved investigating the optimal drug dosage or volumes for a SSNB injection. A study in cadavers by Feigl et al, (2007) reported that a volume of 5ml may be adequate to flood the lateral suprascapular fossa. In addition, a further study in surgical patients reported that a volume of 10ml is sufficient to flood the suprascapular fossa (Jerosch et al, 2008).

Patient sub-groups and SSNB injections

Clinical studies investigating SSNB injections have been undertaken in a variety of patient groups with chronic shoulder pain, including non-specific shoulder pain (Chansoria et al, 2015, Salgia et al, 2014, Schneider-Kolsy et al, 2004, Gorthi et al, 2010, Taskaynatan et al, 2005), frozen shoulder (Mitra and Bhattacharya 2016, Klc et al, 2015, El-Badawy and Fathalla 2014, Ozkan et al,

2012, Karatas and Meray 2002, Dahan et al, 2000, Jones and Chattopadhyay 1999), subacromial impingement / rotator cuff disease (Bayram et al, 2014, Di Lorenzo et al, 2006, Vecchio et al, 1993) and RA with degenerative glenohumeral joint disease (Shanahan et al, 2004, Shanahan et al, 2003, Gado and Emery 1993, Emery et al, 1989). In addition to specific sub groups, other studies have investigated the effectiveness of SSNB injections in heterogenous groups of patients with chronic shoulder pain, that included patients diagnosed with frozen shoulder, degenerative glenohumeral joint disease, subacromial pain and non-specific shoulder pain (Dorn et al, 2015, Lotero et al, 2013, Shanahan et al, 2012, Kang et al, 2012, Rowlingson and Arasi 1986).

Physiotherapy and shoulder exercises after SSNB injection

No studies were retrieved that investigated the application of physiotherapy intervention following SSNB injections. Kilic et al, (2015), however demonstrated that SSNB injections added to a program of physiotherapy was more effective than physiotherapy alone, in terms of pain relief and improved function, for patients with frozen shoulder at weeks 1, 4 and 12 post injection. A number of studies reported that shoulder exercises were advised post SSNB injection although the actual application of the exercises and physiotherapy treatments in studies were not widely reported (Mitra and Bhattacharya 2016, Kilic et al, 2015, Ozkan et al, 2012, El-Badawy and Fathalla 2014, Mitra et al, 2009, Di Lorenzo et al, 2005, Dahan et al, 2000, Jones and Chattopadhyay 1999, Rowlingson and Arasi 1986).

Summary of published literature on SSNB injections

The published literature indicates that SSNB injections may be an effective treatment option for some patients with chronic shoulder pain irrespective of the underlying shoulder condition or disease. Considering that the SSN supplies 70-80% of the sensory innervation to the shoulder complex, it may not be surprising that SSNB injections offer pain relief for different conditions affecting the shoulder complex. Although different guided and landmarked approaches are described in the literature no specific approach has been shown to be more effective. The indirect landmarked approach is the most commonly used approach in published studies and is reported to be easily performed, effective, safe and acceptable for patients (Shanahan et al, 2012). A variety of local anaesthetic agents used alone or in combination with steroids have been used in clinical studies. However, no specific drug or combination of drugs have been proven to be any more effective. Furthermore, the addition of steroid to local anaesthetic may offer no additional benefit, however the only study investigating this may have methodological flaws with low participant numbers and each treatment group receiving a dose of steroid in the contralateral shoulder (Gado and Emery 1989).

No studies have been undertaken regarding the timing of application of SSNB injections in patients with shoulder pain to investigate if SSNB injections are effective in patients before chronicity is established. The long-term benefits of SSNB injections are unknown and the optimal frequency of repeat injections has not been investigated. SSNB injections combined with physiotherapy may

be beneficial for patients with frozen shoulder (Kilic et al, 2015) however there is a lack of quality research investigating the optimal application of SSNB injections combined with physiotherapy interventions for different shoulder conditions. Although the literature indicates that SSNB injections may be an effective treatment option for some patients with chronic shoulder pain, its optimal application in clinical practice is unclear.

Research question: What are the experiences and views of clinicians regarding the use and role of suprascapular nerve block injections in the non-surgical management of shoulder pain?

Aim:

- To explore the experiences and views of rheumatologists, pain consultants and physiotherapists on the role and use of SSNB injections in the non-surgical management of shoulder pain.

Objectives:

- To explore and gain an understanding of how clinicians decide which patients with shoulder pain are selected to receive a SSNB injection.
- To identify and describe the approaches, techniques, drugs, dosages and frequency of injection used by clinicians in the administration of SSNB injection and their reasons for choice.
- To explore how clinician's determine if SSNB injections are effective.
- To explore clinicians' views on the role of SSNB injections combined with other adjunct treatment modalities (for example physiotherapy, shoulder exercises and other injections).
- To identify any areas of clinical uncertainty, gaps in knowledge and areas where future research is needed to support clinical practice.

Chapter 2

Literature Review

Search strategy

The aim of this literature review was to identify research relating to the use and application of SSNB injections in clinical practice, in order, to synthesise existing knowledge, and to identify any gaps in knowledge, in this topic area. Both qualitative and mixed-methods / survey studies were considered for inclusion, as it was felt these research approaches may reveal important knowledge around the subject area. Due to the exploratory nature of the research question, it was also felt appropriate to consider wider published research, relating to the use and clinical application of other nerve block injections, used in the treatment of musculoskeletal pain, that may provide relevant and important background knowledge in this area. In addition, qualitative research studies, that explored clinicians' views and experiences of managing shoulder pain were also considered. The methodological approach and methods used in the included studies, were reviewed to inform the authors own research approach. Searching for and identifying appropriate qualitative research can be challenging due to the subjective nature of qualitative research study titles and variation and inconsistency of indexing qualitative research studies (Cooke et al, 2012). A literature search was initially conducted in March 2016, with a more extensive search repeated in January 2017, due to major amendments being required from viva examiners.

In order, to capture as many relevant articles as possible, the SPIDER tool, presented by Cooke et al, (2012), was utilised as a framework to identify the most appropriate key words for the literature search (Table 2).

Table 2. SPIDER search strategy framework. (Cooke et al, 2012).

Articles listed in electronic databases AMED, CiNAHL, MEDLINE, Embase were searched through accessing NHS Evidence, Journals and Databases. Articles were limited to English language. No date limit was applied, as it was anticipated a paucity of published literature would be available on the subject matter. Reference lists of retrieved articles were screened for additional literature and articles that were not identified from within the electronic search.

Search results

Nine hundred and seventy-two articles were initially identified from the search undertaken in January 2017, using the key words presented in table 2. These nine hundred and seventy-two articles were screened by title and abstract. Nine hundred and fifty-five articles were excluded at this point as they were not associated with the clinical application of nerve block injections in clinical practice or explored clinician's experiences or views on the management of shoulder pain.

Seventeen articles were identified from title and abstract screening as possibly being associated with the application and use of nerve block injections in clinical practice or explored clinician's experiences and views on the management of patients with shoulder pain. These seventeen studies were retrieved in full text and were screened in more detail for consideration within this review. Table 3 below shows the study selection process that was followed. Data from the seventeen full text studies retrieved was extracted and presented in table 4.

Table 3. Search strategy and study selection process.

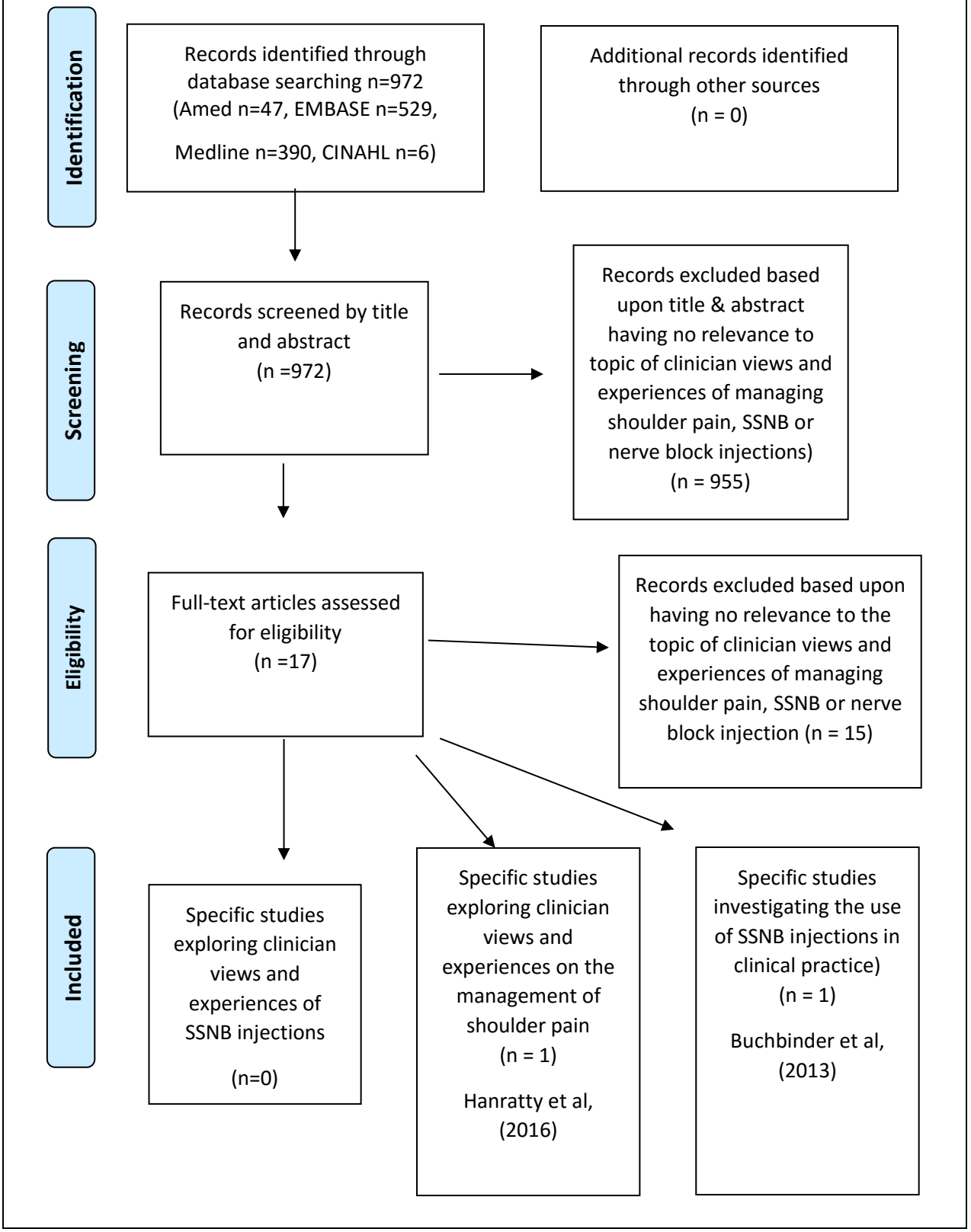


Table 4. Data extraction table. Full Text articles screened.				
Author	Title	Participants	Methods	Relevant Findings
Hanratty et al (2016)	Physical Therapists' perceptions and use of exercise in the management of subacromial shoulder impingement syndrome: focus group study.	Physiotherapist n20	Focus group	Types of exercise. Manual therapy & taping.
Kraal et al, (2016).	How to treat a frozen shoulder? A survey among shoulder specialists in the Netherlands and Belgium	Shoulder surgeons n100	Survey	In painful stage 80% consider LSI, NSAIDs, Advice & Education. Thawing phase 68% consider Physio
Bryceland et al (2015)	Current UK practices in the management of subacromial impingement.	Shoulder surgeon (BESS) n157	Survey	82% consider Physio and LSI
Littlewood et al (2015)	Understanding the barriers and enablers to implementation of a self-managed exercise intervention: a qualitative study.	Physiotherapists n13	Semi structured interviews	No relevance Related to a treatment protocol
Kwaees and Charalambous (2014)	Surgical and non-surgical treatment of frozen shoulder. Survey on surgeon's treatment preferences	Shoulder surgeons (BESS) n87	Survey	Based on stiffness stage. 68% consider PT and 54 % consider LSI before surgery
Littlewood et al, (2014)	Patients with rotator cuff tendinopathy can successfully self-manage, but with certain caveats: a qualitative study.	Physiotherapists n2 Patients n6	Interviews	No relevance Related to a treatment protocol
Ottenheijm, R. P., et al, (2014)	GP's perspectives on the diagnostic work-up in patients with shoulder pain: a qualitative study.	GPs n18	Interviews	No relevance Related to investigations
Griffiths and Yoannes (2014)	Surgical Referral Criteria for Degenerative Rotator Cuff Tears: A Delphi Questionnaire Study.	Shoulder surgeon n41	Delphi	Consensus set at 80% 75% consider Physio & Injection tried prior to surgical opinion
Buchbinder et al (2013)	General Practitioner Management of Shoulder Pain in Comparison with Rheumatology Expectation of Care and Best Evidence: An Australian National Survey.	Australian GPs n611 Rheumatologists n64	Survey	Multiple treatments Physio, LSI guided LSI & SSNB inj. 10% Rheum consider SSNB in later stage FS.
Randelli et al (2012)	Current practice in shoulder pathology: results of a web-based survey among a community of 1,084 orthopaedic surgeons.	Shoulder surgeons n412 (ESSKA)	Survey	Multiple conservative management Physio, LSI, Hyaluronic acid

Hanchard et al (2011)	A questionnaire survey of UK physiotherapists on the diagnosis and management of contracted (frozen) shoulder.	Physiotherapists n89	Survey	Multiple physio Rx 80% consider LSI
Littlewood et al (2012)	Rotator cuff disorders: a survey of current UK physiotherapy practice	Physiotherapists n110	Survey	Multiple Physio Rx's 30% consider LSI.
Dennis et al, (2010)	Managing idiopathic frozen shoulder: a survey of health professionals' current practice and research priorities.	GPs, Physiotherapists, Surgeons. n303	Survey	Early stage Physio 33%, 18% LSI late stage Physio 19% LSI 12%
May et al (2008)	Expert therapists use specific clinical reasoning processes in the assessment and management of patients with shoulder pain: a qualitative study.	Therapists n20 (physiotherapist and occupational therapists)	Delphi	No relevance Related to model of clinical reasoning
Dunn et al (2005)	Variation in Orthopaedic Surgeons Perceptions about the Indications for Rotator Cuff Surgery.	Surgeons n539	Survey	79% consider physio prior to surgery 73% consider LSI prior to surgery
Johansson et al (2002)	A combination of systematic review and clinicians' beliefs in the interventions for subacromial pain.	Gps n129 Physiotherapists n 57	Comparing systematic review with Survey findings	No relevance
Johansson et al (1999)	Attitudes toward management of patients with subacromial pain in Swedish primary care.	Gps n129 Physiotherapists n 57	Survey	LSI 61% GP PT exs' No relevance

No studies exploring the views and experiences of clinicians on the use of SSNB injections in the non-surgical management of shoulder pain were found. Furthermore, no studies could be found exploring the views and experiences of clinicians on the use of nerve blocks in the management of wider musculoskeletal pain. From the seventeen full text studies retrieved only one study was found which reported on the use and application of SSNB injections in clinical practice (Buchbinder et al, 2013). In addition, only one study was

retrieved that explored clinician's views and experiences on managing shoulder pain and focussed on the use of exercise in the treatment of subacromial shoulder pain (Hanratty et al, 2016). Only two studies, Buchbinder et al, (2013) and Hanratty et al, (2016) were selected for inclusion in this literature review.

Discussion of selected studies

Buchbinder et al, (2013) undertook a survey questionnaire with Australian General Practitioners (GP's) and Rheumatologists in the year 2009. A total of six hundred and eleven GPs and seventy Rheumatologists participated in the survey. Clinicians were surveyed on the management approaches they would advocate for patients with four different shoulder conditions when treated in primary care. The survey findings highlighted that clinicians considered a variety of different management approaches for patients with shoulder pain, including general advice on self-management, referral to physiotherapy, prescription of medication, administration of glucocorticoid injection into the; subacromial space, glenohumeral joint, acromioclavicular joint, area of maximum tenderness, referral for ultrasound guided injection, referral for arthrographic distention (hydrodilatation) and SSNB injection. The use of SSNB injection was consider by very few clinicians for the different vignettes. Clinicians preferred choice of injections for the different clinical vignettes are presented in table 5 to table 8 below.

Table 5. Vignette – A 77 year-old female patient with a six-week history of rotator cuff tendinopathy.

Choice of injection	GP's n = out of 613 **n (%)**	Rheumatologists n= out of 64 **n (%)**
SSNB injection	1 (<1)	0 (0)
Subacromial LSI	208 (34)	44 (69)
Glenohumeral joint LSI	15 (2)	2 (3)
Acomioclavicular joint LSI	10(2)	2 (3)
Area of maximum tenderness LSI	51 (8)	0
Image guided LSI	145 (24)	21 (33)
Hydrodilatation	9 (2)	1 (2)

Table 6. Vignette - A 45 year-old patient with an acute rotator cuff tear.

Choice of injection	GP's n = out of 609 **n (%)**	Rheumatologists n= out of 59 **n (%)**
SSNB injection	0 (0)	0 (0)
Subacromial LSI	47 (8)	11 (19)
Glenohumeral joint LSI	6 (1)	1 (2)
Acomioclavicular LSI	9 (2)	1 (2)
Area of maximum tenderness LSI	23 (4)	1 (2)
Image guided LSI	62 (10)	7 (12)
Hydrodilatation	5 (1)	0 (0)

Table 7. Vignette - A 50 year-old female patient with a three-week history of frozen shoulder

Choice of injection	GP's n = out of 612 **n (%)**	Rheumatologists n= out of 59 **n (%)**
SSNB injection	5 (1)	6 (10)
Subacromial LSI	61 (10)	12 (20)
Glenohumeral joint LSI	80 (13)	33 (56)
Acomioclavicular LSI	6 (1)	0 (0)
Area of maximum tenderness LSI	17 93)	0 (0)
Image guided LSI	87 (14)	15 (25)
Hydrodilatation	79 (13)	10 (17)

Table 8. Vignette - A 50 year-old female patient with a three-month history of frozen shoulder.

Choice of injection	GP's n = out of 606 **n (%)**	Rheumatologists n= out of 59 **n (%)**
SSNB injection	3 (1)	4 (7)
Subacromial LSI	58 (10)	5 (9)
Glenohumeral joint LSI	78 (13)	18 (31)
Acomioclavicular LSI	5 (1)	0 (0)
Area of maximum tenderness LSI	29 (5)	0 (0)
Image guided LSI	106 (17)	6 (10)
Hydrodilatation	115 (19)	24 (41)

The findings from Buchbinder et al, (2013) indicate that from the sample of GPs and Rheumatologists who participated in their survey, undertaken in Australia in 2009, only a small percentage of GPs (1%) and Rheumatologists (7-10%) considered SSNB injections as a treatment option for patients with shoulder pain, with frozen shoulder being the main condition they would consider using it

in. Clinicians considered using SSNB injections in both early and later stage frozen shoulder. The findings from Buchbinder et al, (2013) offers only minimal insight into the application and use of SSNB injection in clinical practice. The survey provided no information on the choice of drugs used by clinicians for SSNB injections or the injection technique / approach utilised by clinicians. The survey provided no indication on the frequency of SSNB injections given in clinical practice or whether SSNB injections are given as stand-alone treatments or combined with other interventions such has physiotherapy or shoulder exercises. No further studies that provided information on the clinical application of SSNB injections were retrieved. No studies were found that explored the views and experiences of clinicians on the use of SSNB injections in the management of shoulder pain and only one study was retrieved that explored clinician's views and approaches to managing shoulder pain in clinical practice (Hanratty et al, 2016).

Although the use of injection therapy treatment did not feature or form part of the study findings by Hanratty et al, (2016), the study was reviewed to inform the authors own study methodology and research approach moving forward. Hanratty et al, (2016) undertook a focus group study, to explore physical therapist's perceptions and use of exercise in the management of subacromial impingement syndrome with the aim of informing an exercise treatment protocol. Three focus group sessions were undertaken with physical therapists in Northern Ireland and the Republic of Ireland. Each focus group contained between six to eight experienced physical therapists, with at least five years post graduate experience, with the total number of physical therapists in all groups being 20.

The aims of Hanratty et al, (2016) were very specific to understanding clinician's views and perspectives on the use of exercise therapy treating subacromial shoulder pain, therefore recruiting physical therapists with expertise in exercise therapy for their study, was appropriate. Hanratty et al, (2016) utilised a purposive sampling approach where participants were recruited based upon their experience of managing musculoskeletal conditions. All 20 participants held formal post-graduate training qualifications in manual therapy with at least five years clinical experience. Although utilising a purposive sampling approach is important to ensure that the participants recruited will be able to contribute to the topic area and provide the in-depth information required in exploratory research, limiting participation to one professional group or to participants with specific qualifications and experience arguable may also limit and introduce bias to the findings. Furthermore, including participants with a variety of clinical experiences and skills may provide additional concepts, ideas and themes that would not have be captured by limiting participation to a very selective sample. Hanratty et al, (2016) in fact recognised that including clinicians with different experiences may have enhanced their own study findings. Transferability of findings from qualitative research is an important factor that researchers and clinicians need to acknowledge and reflect upon. The views of participants from a very selective and specific group, recruited from one locality may not necessarily reflect the views of participants recruited from wider afield. Hanratty et al, (2016) recruited participants from Northern Ireland and the Republic of Ireland and recognised that widening the geographic region where their focus groups were undertaken, with a larger pool of potential participants to recruit from, may have strengthened the credibility of their findings.

Hanratty et al, (2016) report adopting a collaborative consensus approach with co-researchers when developing their focus group topic guide. Adopting a collaborative approach reduces the potential bias that could be introduced by any one researcher and improves the overall credibility and trustworthiness of the findings. Although a topic guide clearly needs to align with the overall aims of the study, it also needs to be flexible enough to give participants enough scope to explore their own ideas. This flexibility may allow new concepts and ideas to be revealed that were unknown to the researcher beforehand.

Hanratty et al, (2016) reported utilising an experienced and unbiased focus group facilitator with little knowledge of the subject matter. Having an unbiased facilitator is important to allow participants the freedom to discuss their own ideas without undue pressure from the facilitator. There is however a counter argument to consider for using a facilitator with a good understanding of the topic area being discussed. A facilitator with some expertise in the area being discussed may be able to facilitate further discussions and clarification of participant comments and ideas that a facilitator with little knowledge of the subject matter could not.

Hanratty et al, (2016) reported additional strategies that demonstrated dependability of their research approach and their findings. Focus groups were both audiotaped and videotaped. Non-verbal data, such has participant nodding in agreement to verbal comments and ideas formed part of the data analysis process. Verification and confirmation of the transcript against the recording by co-researchers and participants was also undertaken. Collaboration with co-researchers on generating and developing themes through consensus meetings and final verification on themes with participants was also undertaken. Although

the focus group study by Hanratty et al, (2016) was not associated with the use of SSNB injections, the exploratory approach undertaken by the researchers offers a framework for the authors own study. The exploratory approach adopted by Hanratty et al, (2016) clearly facilitated the collection and generation of more in-depth information and data than what would have been captured from a survey study design.

Conclusion

Although SSNB injections may be an effective management approach for some patients with chronic shoulder pain (Chang et al, 2016, Chan and Peng 2011, Murphy and Carr 2010) this review has revealed a paucity of literature on the use and application of SSNB injections in clinical practice. The published literature does not provide any answers regarding the authors research question - *What are the experiences and views of clinicians' regarding the use and role of SSNB injections in the non-surgical management of shoulder pain?* In fact, the literature appears to indicate that SSNB injections are not widely used in clinical practice for the non-surgical management of shoulder pain (Bryceland et al, 2015, Buchbinder et al, 2013, Littlewood et al, 2012, Hanchard et al, 2011).

Only one study was retrieved capturing the use of SSNB injections in clinical practice; where a survey study was undertaken with a sample of GPs and Rheumatologists in Australia in 2009 (Buchbinder et al, 2013). The findings indicated that only a small percentage of the GPs and Rheumatologist surveyed considered using SSNB injections in the management of patients with shoulder pain, and for those that did, mainly in patients with frozen shoulder (Buchbinder et al, 2013). A limitation of the survey may have been the limited clinical

vignettes proposed to clinicians. If more chronic shoulder conditions were presented, it is possible that more clinicians would have considered SSNB injections. Although survey research can provide an overview of clinical practice, the findings from Buchbinder et al, (2013) indicated that a survey study may not necessarily provide the right approach and flexibility needed to capture the in-depth and detailed information required to answer the research question in the author's own study.

Even though the study by Hanratty et al, (2016) provided no information on the views and experiences of clinicians regarding the use of SSNB injections in clinical practice, the research approach and focus group method utilised by Hanratty et al, (2016) provided a favourable framework to consider for use in the author's own study. Research adopting and utilising this flexible exploratory approach may retrieve more detailed information, that is relevant to clinical practice, than a survey study approach could. Information gathered from clinicians may lay the foundation for future research in this area that could inform and guide clinical practice and ultimately improve outcomes for patients with shoulder pain.

Chapter 3

Methodology

The literature review identified a paucity of research on the application and role of SSNB injections in clinical practice. The aim of this study was to explore the views and experiences of clinicians who currently use SSNB injections in the non-surgical management of shoulder pain, with the purpose of developing knowledge and informing future research in this area. At the start of this research project I had no conscious commitment to any specific philosophical research paradigm in which to address or align my research question. My approach to answering my research question evolved throughout the development of this thesis and MRes program. Although my own world views and experiences of research were more aligned with a 'positivists' world view and paradigm, I realised that searching for a single answer and objective 'truth' did not align with the fundamental purpose, principles and aims of the research question in this study. The in-depth information I sought from participants could not have been captured effectively through either a quantitative / experimental or a mixed method / survey approach. I believed a more flexible, qualitative approach, allowing for the generation of in-depth, rich understanding and exploration of participant experiences and views would be more appropriate.

Although I recognised that my research aims broadly aligned within an overarching 'interpretivist' paradigm, I also recognised that the information I sought was 'priori' driven, using a topic guide designed to address my questions and research objectives. Therefore, the various methodological approaches commonly associated within an interpretivist paradigm, such as; grounded

theory, phenomenology, ethnography and participatory action research would not necessarily provide the most appropriate methodological approach moving forward (Carpenter and Suto 2008, p60- 76). Pragmatism, as a philosophical research approach, allows the researcher to conduct and undertake research in a manner that aligns with the purpose, aims and objectives of their study (Rorty 1982). Pragmatism essentially provides a philosophical approach and framework that puts the aims and purpose of the research as the primary focus, so that the research question can be answered and addressed in the best way possible (Wahyuni 2012, Rorty 1982). A 'pragmatic qualitative approach', that provides a framework for presenting descriptive content from an interpretivist perspective, described by Savin-Baden & Major (2013 p.171) was therefore adopted for this study. The main focus, in this exploratory study, was to gain an in-depth understanding regarding the application of SSNB injections in clinical practice. I therefore felt it was important to seek the views and experiences of clinicians from different professional backgrounds who use SSNB injections. I felt that involving participants from different professional backgrounds would enhance this study and provide richer information around the topic area than participants from a single professional group. Initially both individual interviews and group interviews were considered for data collection methods. Both provide flexibility in data collection and a platform for participants to express their own views. It is however recognised that group interviews that involve participant discussion and interactions, have the potential to provide and generate richer data than one to one interviews (Offredy and Vickers 2010 p86-87, Redmond and Curtis 2009). For this reason, a focus groups method was chosen as the most appropriate data collection method for this study.

Ethical consideration

Ethical approval for this study was granted by Coventry University Ethics Committee (P38675) and NHS R&D approval (16EDUC58) from Sandwell and West Birmingham Hospital NHS Trust R&D department (Appendix 2 and 3). All ethical research in the UK should adhere to the principles and standards set out in the Research Governance Framework (DOH 2005). All researchers involved in this study had previously undertaken Good Clinical Practice (GCP) prior to being involved in the study. The four underlying ethical principles that underpin research ethics and governance; respect for autonomy, non-maleficence, beneficence and justice (Beauchamp and Childress 2001) apply equally to both qualitative and quantitative research and were adhered to in this study.

Written informed consent was obtained prior to the start of the focus group session from all participants (see appendix 4). Participants were made aware that participation was completely voluntary and they could withdraw at any time. A participant information leaflet (PIL) was emailed to all potential research participants during recruitment stage, several weeks before the anticipated focus group date. The PIL was also provided just prior to obtaining consent on the day of the focus group session on the 21st April 2016, that fully explained the aims of the study, that the study formed part of the researchers MRes programme and would be written up for hopeful publication in a peer-reviewed journal (Appendix 5 and 6). The topic under discussion in the focus group was not viewed as sensitive and it was not anticipated that participating in the focus group would pose any physical or emotion risk to research participants. However, it is recognised that one of the major concerns and risks undertaking a focus group study is confidentiality (Plummer D-Amato 2008a, Plummer D-

Amato 2008b). To mitigate and manage this risk, research participants were made aware of their responsibilities to respect and maintain other research participants' anonymity by the focus group facilitator when establishing ground rules prior to starting the focus group session. Furthermore, the informed consent form also clearly set out participants' responsibilities in maintaining confidentiality and anonymity of the other study participants. In addition, transcription documents and reports that were available to people outside the research team, contained no participant identifiable information. Participant data within the transcripts were anonymised and assigned a participant label, i.e. (P.1). All data was securely kept by the main researcher on a password encrypted USB memory stick during the study. All study data was kept within a locked file cabinet within the authors NHS Trust premises and will be destroyed after 5 years of the completion date of the study in adherence to Hospital NHS Trust R&D policy. No personal identifiable information of the research participants was or will be presented in any written report.

Chapter 4
Methods

Sample and recruitment

Both purposive and snowball sampling strategies were utilised to recruit research participants in this study. This is an accepted approach when recruiting participants for a focus group study, as this ensures that individuals capable of providing insightful answers to the research question are recruited (Plummer-D' Amato 2008a). Specifically, physiotherapists, pain consultants, orthopaedic surgeons, interventional radiologists and rheumatologists, from across West Midlands NHS Trusts, who had expertise and experience of administering SSNB injections, in the non-surgical management of shoulder, were targeted. From the author's clinical experience these were the main professional groups undertaking SSNB injections at that time, in a clinical practice setting.

A cross-section of clinicians were targeted as it was considered that participants from different professional backgrounds could offer different perspectives, experiences and views that would stimulate greater discussion and provide greater depth of information than a single professional group. Although, Morgan and Bottorff (2010) argued that variability in focus group member characteristics and group composition can negatively affect the group dynamics and limit discussion, it was felt that the recruitment strategy utilised for this focus group was an important aspect of the study, as members would be united by the commonality of the topic under discussion. Furthermore, one of the facilitator's

roles was to ensure equal participant engagement and moderate any adverse dynamics within the group.

The ideal size of a focus group when participants have expertise in the topic under discussion is usually between five and eight participants (Krueger and Casey 2015 p82). However, it is recommended that researchers allow for participant drop out prior to the start of the focus group and should therefore try to over recruit by 20% (Morgan 1997). Therefore, it was the authors aim to recruit up to twelve participants to allow for potential drop out. The inclusion and exclusion criteria for participants are presented below in table 9.

Table 9. Inclusion and exclusion criteria.

Inclusion Criteria	Exclusion Criteria
- Healthcare professional in the NHS - Recent experience of using SSNB - Consent - Able to attend a 1 hr focus group - English speaking - Time to validate themes and findings	- Non English speaking

Following ethical approval, clinicians locally who currently undertake SSNB injections in their clinical practice were contacted by email by the author and invited to participate in the focus group. An outline of the research project was provided in the email along with an attachment containing the PIL. The email advised potential participants that the study was completely voluntary and that the researcher would be happy to meet face to face to discuss and clarify any details of the study. The author also requested that the email be forwarded on to other colleagues in the West Midlands area, that the recipients were aware of, who undertake SSNB injections in their clinical practice. It was hoped that

this snowballing strategy would reach out to other potential participants' unknown to the researcher. It was anticipated that clinicians working outside the West Midlands area would not have been able to attend a focus group at the researchers NHS Trust premises due to the logistics of arranging a focus group session for busy working clinicians.

The initial response to the email was encouraging with three pain consultants, one rheumatologists, three interventional radiologists and three physiotherapists from within the researchers own NHS trust and one physiotherapist from a neighbouring NHS trust, all indicating, that if they were available, they would be willing to participate in the focus group. Unfortunately, no orthopaedic surgeon responded to the initial email. A second email was sent out, again without any response. At this point it was decided that any further emails or contact could be classed as coercion or pressurising potential participants to take part, so no further emails were sent.

In total, eleven potential participants indicated they would like to participate in the focus group. Emails were sent to the eleven potential participants requesting and suggesting dates that would be suitable for them to attend. From email responses, it was decided that the focus group session would take place on the 21st April 2016 starting at 4.30 in the afternoon in a meeting room of a local hospital.

Although eleven clinicians initially indicated that they could attend the focus group on the 21st April, unfortunately in the days leading up to the focus group session seven clinicians dropped out because of clinical commitments and personal reasons. In addition, immediately prior to the start of the focus group

on the 21st April, a phone call was received from another clinician advising that they were delayed but would join the focus group session when able.

Thus, at the start of the focus group session only three participants were in attendance; two physiotherapists and one rheumatologist. Due to these low numbers and following discussion with the facilitator and group members, it was decided that myself, the main researcher should now participate in the focus group, rather than my original role as an observer / note taker. Fifteen minutes into the focus group the delayed participant arrived and joined the group. In total five clinicians participated in the focus group, three physiotherapists, one pain consultant and one rheumatologist.

Focus Groups

A focus group is a group interview involving discussion centred on a specific topic (Plummer-D Amato 2008a). Redmond and Curtis (2009) reported that focus groups allow participants the opportunity to explore each other's reasoning and to listen to and consider other participant views that may stimulate further discussion on the chosen topic. It was considered that this would be a valuable aspect of the study considering the cross-section of clinicians involved. Furthermore, it is also recognised that focus groups are particularly suited to exploratory research where there may be an absence of theory (Stewart and Shamdasani 2014). This was a further reason and justification for utilising this method of data collection in this research project. Individual interviews were initially considered as a method of data collection and in hindsight, it is possible that more participants would have been available for individual interviews than a focus group session because of the flexibility of

arranging individual time slots. However, individual interviews would not have incorporated the positive group dynamics and interactions that focus groups can facilitate. Also, considering the time constraints of conducting and completing the write-up of this study (within one academic year) it was decided that a focus group would be a more realistic and achievable method of providing a rich data-set within the confines of a MRes study.

The Focus Group Session

The focus group session took place on Thursday 21st April 2016 within the Research and Development department, of a local NHS Hospital. The focus group was conducted around a good size round table that could comfortably fit six people. Prior to the start of the focus group session the PIL was reissued again for each participant to review and discuss with the researcher as required. The background to the study was also presented by the author so that participants had the opportunity to discuss any queries. Informed consent was obtained immediately prior to the start of the session. It is recognised that the focus group facilitator plays a pivotal role, if a focus group session is to run smoothly and achieve its aims (Krueger and Casey 2015). At the start of the session the facilitator asked participants for introductions as not all members of the group were known to each other. The facilitator also ran through the process of the focus group and the ground rules that included responsibilities in terms of confidentiality and maintaining participant anonymity. They also encouraged openness and engagement. The facilitator also asked the participants to be mindful of talking over one another during discussions as this could cause issues and errors with transcription if different people talked at the same time. To mitigate audio-equipment failure, the focus group session was

recorded on two digital devices. Questions from the focus group topic guide displayed in table 10 below, were presented to the group by the facilitator to stimulate discussion.

Table 10. Focus Group Topic Guide

Question	Cues
From your experience could you explain how you would decide which patients with shoulder pain receive a SSNB injection?	Diagnostic criteria- (subacromial pain, frozen shoulder, rotator cuff tears). Does duration or severity of symptoms / pain form part of the decision-making process. Do you have any concerns with other shoulder injections that influences your decisions to consider a SSNB? Are there any age restrictions. If they have failed other treatments does this influence your decision? If a patient is awaiting surgery would you consider a SSNB?
Once you've decided that a patient is appropriate for consideration of a SSNB injection what normally happens next?	Consent. Patient information. Discussion of risks & contraindications. Advise following injection given.
Could you describe what's involved when you perform a SSNB injection?	How do you perform the procedure? Patient position / injection approach / medication used. Positioning patient. Land marked or ultrasound guided injection. Techniques / aseptic. Drugs, dosages, volumes. Aftercare advice.
How do you know if the injection has helped?	Follow up. Outcome measures. Audit.
Do you give your patients any advice following the injection? If so what?	Rest. Exercise. Potential adverse effects. Wait after injection. What to do if concerned. How often would you repeat a SSNB injection?
Do you teach any shoulder exercises or refer to any other services after the injection?	Physiotherapy referral. Where. Concerns regarding delays. When to start exercises.
Do you feel research is needed to answer any uncertainties or gaps in knowledge regarding SSNB injections?	What kind of research would help in the future? Would further research help you decide which patients would benefit from a SSNB rather than subacromial injection / glenohumeral joint injection?

Throughout the focus group session, the facilitator periodically summarised key components of the discussions and asked for verification from participants on specific points, thereby allowing further contributions from participants and allowing clarification of the key discussion points through paraphrasing.

Throughout the focus group the facilitator prompted and encouraged engagement from all participants in a sensitive respectful manner but was also able to distance themselves from the topic discussions, and did not overly influence the research participants, mitigating 'moderator bias' described by (Stewart and Shamdasani 2014 p94). The facilitator closed the focus group session once participants could not add anything further to the discussions. The focus group session lasted for 55 minutes. Participants were informed that once initial analyses had been undertaken, copies of the main themes would be sent for them to verify. All participants were in agreement with this. Immediately following the focus group session reflective field notes were captured by the author whilst the discussions and focus group dynamics were still fresh in their memory (Appendix 8). The focus group recording was transcribed verbatim by a professional transcribing company with previous experience of transcribing focus group research within the NHS (Appendix 15). The transcript was returned from the transcribing company, in Microsoft word format, five days after the focus group session.

Data analysis

Jackson (1998) reported that there is no universally accepted method of data analysis for focus group research. Data analysis is described by Carpenter and Suto (2008) as the process of moving from narrative data to evidence based interpretations that are the foundation for published reports. The purpose of this study was to gain an in-depth understanding of clinician's views and experiences of the role and use of SSNB injections in the non-surgical management of shoulder pain. Although the focus group study was driven by the focus group topic guide, which was constructed by the researcher and their supervision team, the fundamental underpinning principles and purpose of the study were that it was essentially exploratory in nature. It was therefore anticipated and expected that participants would reveal ideas and concepts that were not necessarily facilitated or drawn out by the questions in the focus group topic guide. Therefore, the data analysis process used needed to be flexible and reflect the wider views and experiences of the participants not just their responses to the topic guide questions.

Thematic analysis, presented by Braun and Clarke (2006) was the chosen data analysis framework used within this study. It was felt that thematic analysis offered a structured and flexible approach and was an ideal starting place for the novice researcher. The chosen framework has six phases that were followed and are presented below in Table 11 below.

Table 11. Six phases of thematic analysis Braun and Clarke (2006)

As stated in the previous sections, the focus group recording was transcribed verbatim by a professional transcribing company and was returned to the author five days after the focus group session (Appendix 15). During these five days the author was able to repeatedly listen to the digital recording and start to 'immerse' themselves within the data. In addition, the reflective field notes (made immediately following the focus group session) were also considered at the same time as listening to the recording. Any interesting comments and

commonly occurring views and experiences were captured on additional notes during this period (Appendix 14). On reflection, even at this early stage, some initial subconscious analysis took place. Once the transcript was returned the 6 phases of thematic analysis described by Braun and Clarke (2006) were followed. A more detailed account of the analysis in these 6 phases are provided in appendix 10 and 11. A systematic approach to coding was adopted throughout the whole transcript. This initial phase involved highlighting sections of associated text which were felt to be important, recurring, interesting and / or relevant to the purpose, aims and objectives of the study. The highlighted sections of text were tagged with codes. To gain a wider context of the coded data, the coded sections were then re-analysed through repetitive engagement, by re-reading the transcript, listening to the recording and reviewing any reflective comments captured on field notes. These codes were then extracted from the transcript and collated in tables (Appendix 11). At this point collaborative analysis was undertaken with members of the supervision team. The researcher initially met with their director of studies (DOS) (AG) to discuss codes and potential themes to facilitate the formation of thematic maps. These constructed maps aimed to provide the author with a visual ‘concept’ of the main themes and categories (Appendix 12). Further collaboration to verify themes took place with the focus group facilitator (JP). Once themes were constructed all the research participants were emailed to validate and verify that the main themes identified were a true and accurate reflection of their views and experiences (Appendix 13).

Trustworthiness and Rigor in research

Demonstrating trustworthiness in qualitative research requires alternate strategies to those in quantitative research (Shenton 2004). Within qualitative research concepts of trustworthiness such as credibility, transferability, dependability and confirmability, described initially by Guba (1981), are often considered equivalent to the concepts; internal validity, external validity / generalisability, reliability and objectivity employed to minimise bias in quantitative research (Lincoln and Guba 1985) (see table 12 below).

Table 12. Constructs of trustworthiness and bias in research taken from Lincoln & Guba (1985).

Strategies adopted to establish trustworthiness in this study

Various strategies were adopted in this study to demonstrate rigor and ensure trustworthiness of the findings. These strategies are presented in table 13. below and were described within the previous methods and data analysis sections.

Table 13. Strategies adopted to demonstrate and ensure trustworthiness in this study

Trustworthiness concept / criteria	Strategy employed
Credibility	• Use of accepted methods of data collection (Focus group). • Collaborative consensus approach during the development of the topic guide. • Use of an experienced facilitator in focus group methods. • Collaboration on coding and generation of themes with supervision team. • Member checking and validation of themes. • Reflexivity – position of researcher acknowledged, reflexive notes after focus group.
Transferability	• Purposive sampling. • Cross section of clinicians. • Presented thick descriptions of participant views in the findings.
Dependability	• Transcripts were compared to recording. • Data analysis process was transparent and clearly described. • Collaboration on coding and generation of themes with supervision team. • Member checking and validation of themes by participants.
Confirmability	• Member checking and validation of themes by participants.

In qualitative research, it is widely recognised and accepted that the researcher themselves is an instrument within the research process (Carpenter and Suto 2008). It may not be possible for the researcher to completely detach themselves from the research process in the same way that researchers remain objective within quantitative research. A researcher's beliefs, experiences, views, values, goals and personal ambitions may all influence the way their research is constructed, designed, undertaken, analysed and presented within

qualitative research (Finely and Gough 2008). Reflexivity is the process which captures the position and background of the researcher. It captures the pre-existing views, and facilitates self-critical analysis of the researcher throughout the whole research process (Savin-Baden and Major 2013). Reflexivity aims to provide a level of transparency to the reader to increase the trustworthiness of research findings (Savin-Baden and Major 2013, Finlay and Gough 2008, Shenton 2004).

Reflexivity

As stated in the background section of this thesis, this research project evolved from my own experiences, questions and uncertainties treating patients with chronic shoulder pain in clinical practice. I have used local steroid injections, within my physiotherapy management of patients with chronic shoulder pain, since 2007. In 2014 I also started to administer SSNB injections in patients with chronic shoulder pain, however as a service we have no criteria regarding which patients should be considered for a SSNB injection. Furthermore as a service we are also unsure on the most appropriate long term management of these patients. In my own practice I generally reserve SSNB injections for patients with chronic shoulder pain that have gained little benefit from previous local steroid injections and physiotherapy.

The uncertainties and questions that I encountered in my clinical practice shaped and framed my research question and research approach in this MRes programme. My own view and belief is that injection therapy offers most patients' with chronic shoulder pain short term benefit, however I believe more long term benefits can often be realised when injection therapy is used in

combination with shoulder exercises. Furthermore, I have often been faced with the dilemma of whether to repeat a local steroid injection in a patient with persistent shoulder pain, considering the potentially negative effect it may have on tendon tissue, balanced alongside the individual needs and views of the patient (Ackermann and Hart 2016 page 229 and 239, Dean *et al*, 2014a, Dean *et al,* 2014b, Coombes et al, 2010). I am however uncertain if and when a SSNB injection would be more appropriate in many of the patients I see that may request a repeat local steroid injection.

Although my research is located within a qualitative paradigm, at the start of this research project I struggled to consolidate and articulate my philosophical stance or my chosen theoretical framework. I wanted to gain a wider and in-depth understanding of the clinical application of SSNB injections. I wanted to know the 'who' and the 'how'. I also wanted to explore the 'why'. I used a 'priori driven' topic guide to facilitate discussion on the key topics associated with my research question and objectives, with a purposive sample. Although at the outset of my project I was unconscious to my philosophical stance, I now feel a 'qualitative pragmatic approach' best describes the theoretical framework I adopted (Savin-Baden and Major 2013 p. 60). On refection the theoretical and philosophical approach I apply in my every day clinical practice somewhat aligns with the approach I adopted in my research project. Although I have never previously acknowledged it, this most likely reflects my own world views and the belief that no single approach is right in clinical practice or research. My own belief is that the right approach is a flexible approach and the one that best suits the situation or problem in front of you.

One of the main problems associated with undertaking focus group research are uncertainties regarding participant numbers. Although six participants confirmed they were attending my focus group, at the start of the focus group session only three participants were present. This presented a dilemma as whether to continue with the focus group session or cancel. A decision was made to continue with the focus group due to it being unrealistic to rearrange a future date within the time constraints of completing my study, within one academic year, and the fact that clinicians had taken time out of their busy schedules to attend. As a result of the low numbers, and although I was the main researcher in the study, following discussion with the facilitator and the group, it was agreed and decided that I should now become a participant in the focus group. Although the reasons for participating in the group felt justified at the time, upon later reflection, the decision added a level of tension and conflict regarding my role as a researcher and participant.

One of the main challenges and personal tensions that I encountered in this study centred around my involvement as a participant. Qualitative data analysis requires the researcher to immerse themselves within the data in order to explore and identify emerging themes. I wanted to and needed to demonstrate that the findings were an accurate representation of the views and experiences of the participants and not mine as the researcher. I was conscious and unsure of how these findings would be interpreted considering my conflicting role as a participant and researcher. Clearly the data that was collected and which I subsequently analysed was in part a product of my own personal experiences and views. I adopted a systematic approach to data analysis and used verification and collaboration to improve the trustworthiness of my findings. By

being transparent, in the reasons for the decision made, regarding my involvement as a participant and by documenting my own clinical experiences and views allows the reader to form a judgement on the credibility of my findings. The use of an experienced focus group facilitator who was able to ensure that discussions were not centred specifically around my own experiences and views also improved the credibility of the findings. Immediately following the focus group session, I made reflective notes capturing my thoughts on the dynamics and engagement of the group, along with what I felt were important and recurrent discussion topics (Appendix 8). These field notes were emailed to the facilitator for verification who agreed they were an accurate reflection of the group dynamics and topics discussed. Documenting immediate reflections also allowed me to consider some of my earlier concerns and anxieties around clinicians expressing their views and experiences openly, within a group of peers. I felt my previous concerns and anxieties were unfounded as participants openly engaged within the focus group.

As an inexperienced researcher this study has provided me with the opportunity to develop my understanding of different research approaches and its application to different problems and questions. This learning experience has made me question my previous assumptions on what constitutes knowledge and on how knowledge is constructed. It has also made me reflect upon my own assumptions and beliefs especially in the way I view and interpret research and the way research informs and has the potential to inform my own clinical practice. In the future I recognise that a research reflective diary would improve my critical analysis of ‘myself’ and the way I approach, conduct, analyse and report research to ensure trustworthiness of findings.

Chapter 5

Findings

Participant profiles

A total of five clinicians participated in the focus group. Three physiotherapists, one pain consultant and one rheumatology consultant. Participants experience of administering SSNB injections varied from 1 year to over 20 years, and from 5 injections per year to 300 injections per year. The group included a mixture of community and secondary care based clinicians. The type of training undertaken in relation to administering SSNB injection varied from in-house training (within trust training) to specific formal training on ultrasound guided injections. The participant profiles are presented below in table 14.

Table 14. Participant profiles

Participant number	Profession	Year qualified	Type of service	First started using SSNB injections	Approximate no. of SSNB injections per year	Specific training for SSNB injection	Injection approach	Drugs used in SSNB
P1	Physiotherapist	2002	MSK Therapy. iCATS	2014	50	Injection Therapy MSc module. In house training on SSNB injections from pain consultant.	Landmarked, indirect	40mg Depoemdrone, 10 ml 0.25% Bupivacaine
P2	Physiotherapist	1999	MSK Therapy. iCATS	2014	150	Injection Therapy MSc module. In house training on SSNB injections from Pain Consultant.	Landmarked, indirect	40mg Depoemdrone, 10 ml 0.25% Bupivacaine
P3	Physiotherapist	1994	Secondary Care. MSK / Orthopaedics	2015	10	Injection Therapy module- society orthopaedic medicine. Ultrasound post graduate diploma.	Ultrasound guided	2ml 1% lidocaine, 20mg Depomedrone
P4	Consultant Rheumatologist	1979	Secondary care. Rheumatology	1992	5	Taught by Rheumatology colleagues.	Landmarked, indirect	10ml 0.25% Bupivacine
P5	Pain Consultant. Anaesthetist	1991	Secondary care. Pain Management	2000	300	Training within Pain rotation. Ultrasound guided block through U/S guided regional anaesthesia course.	Ultrasound guided	2ml 0.25% bupivacaine, 20mg Depomedrone / Kenalog

Group dynamics and interactions

The focus group lasted for 55 minutes. All participants had equal opportunity to provide their views and experiences, without any one participant dominating the discussions. This was verified by the facilitator.

The interactions and dynamics between the group members acted as a catalyst with clinicians providing rich and in-depth information and justified the focus group approach over one to one interviews. This group environment allowed clinicians to engage in discussion and conversations with each other that provided an added dimension.

Throughout the focus group session there were many examples of group interaction and discussions between participants, where commonality and variability of practice was discussed. This arguably would not have been captured in one to one interviews. One such example, were discussions around the practice of one of the clinicians using local anaesthetic alone for SSNB injections compared to other clinicians using local anaesthetic and steroid (Appendix 15, line no. 412 – 427).

Themes

Using a thematic analysis framework three main themes were identified:

Patient Selection

The Intervention

Patient Management

The ‘Patient Selection’ theme is concerned with ‘who’ received the intervention. The theme captures the characteristics of patients that undergo SSNB injections within clinicians practice. It also captures the factors that clinicians felt were important in determining ‘who’ should be considered for a SSNB injection.

‘The Intervention’ theme captures aspects and details of ‘how’ SSNB injections are carried out by different clinicians. The theme captures the technical aspects of the intervention, along with the clinician’s considerations for their choices. It also captures the drugs and dosages and factors influencing clinician’s choices. Potential risks were also discussed for the different approaches.

The ‘Patient Management’ theme captures and describes aspects of patient pathways, any adjunct treatments that are involved in the patient care and clinician’s views on the overall management of patient’s care. Essentially this theme is concerned with overall patient management and the ‘what next’.

Initially two further themes relating to ‘effectiveness’ and ‘future research’ were identified. However, from re-analysing the codes and transcript, and along with collaborative discussion with co-researchers, it was decided that the codes and categories grouped under ‘effectiveness’ were more aligned within the three main themes. After further exploration of the themes, it was also decided that the theme ‘future research’ was a cross-cutting theme and should be captured within each of the three main themes rather than a separate distinct theme all of its own.

Patient Selection; (who)

The main observations made by clinicians, for patients that undergo a SSNB injection, were the long duration of symptoms that patient present with, at the point of being considered for a SSNB injection. Clinicians reported a number of factors that they considered were important when considering a SSNB injection in patients, such has failure to improve with other treatments, a SSNB injection has previously helped, a direct referral for a SSNB injection, the patient is unsuitable for surgery, the patient doesn't want surgery and the associated risks of repeat local steroid injections. Clinicians identified key areas, within the theme of patient selection, where they felt future research was required including; identifying if SSNB injections are as effective as local steroid injection in specific shoulder conditions, and if SSNB injections are effective in patients with less established chronic pain.

Initial patient evaluation forms part of the process, when determining which patients with shoulder pain are selected for a SSNB injection. This evaluation involves a clinical assessment and establishing previous management and treatments. The clinicians view below, demonstrates, that a wide range of management options and factors may be considered when deciding if a SSNB injection is appropriate in a patient with shoulder pain.

P4	*'Personally when I've evaluated the patients clinically, I've obviously examined their shoulder and I first establish what I feel the anatomical or the other explanation for their shoulder is and I would personally divide up my pathologies into inflammatory problems that are, I think, amenable to a different type of approach which is a steroid injection or a mechanical problem that needs further investigation….' (line 4-10).*

Clinicians consistently identify ‘failure to respond to other treatments’ as a factor and ‘a long duration of symptoms’ as a common observation in patients who undergo a SSNB injection.

P2	*‘So it was a similar situation probably by assessing the patient and how far the pain is there, that is one of the important factors, like if it has been there for ages and not responded for physiotherapy, previous injections, manipulations….’ (line 21-24).*
P1	*Yes, I think I'm in a similar position that the majority of patients I've chosen to have a nerve block have, almost tried everything else first… (line 35-36).*

These observations were further supported by the views and experiences of other clinicians when faced with patients who have not responded to any other treatment over a prolonged period of time.

P4	*‘I personally reserve it for patients who have got more prolonged symptoms and have failed to respond to other therapies…’ (line 91-92).*

Clinicians report that it is not unusual for patients to have had symptoms for 6 months at the point when they are considered for a SSNB injection.

P4	*‘all my patients would have had the symptoms ongoing for at least six months and been refractory to other modalities’ (line 100*).

One clinician described a situation when they had concerns about undertaking repeated local steroid injections in patients with persistent shoulder pain. In these circumstances, they report they may consider administering a SSNB injection instead.

P1	*'When you start to get a little bit concerned about the side effects of steroids locally, maybe around the rotator cuff and potential weakening effects on tendon tissue, then I've probably thought a suprascapular nerve block may be more appropriate' (line 118-121)*

At times, clinicians report they are presented with patients who are either not suitable for surgery, do not wish to consider surgery and have tried many other treatments without success. Some clinicians consider a SSNB injection a last resort.

P5	*'There are two group of patients I normally go for a suprascapular nerve block. Number one, the group is those patients who have had previous shoulder surgery for pain which hasn't improved and their left where the surgeon doesn't want to do anything, so they are left with pain…… and another group of patients complains of shoulder pain and the surgeons can't find anything' (line 262-270).*
P3	*'We tend to use it as almost like an injection of last resort, particularly in the patients that have comorbidities which means they are unsuitable for surgery, so we will try suprascapular nerve block if everything else has failed'. (line 30-33).*

Clinicians also report times when SSNB injections have been specifically requested by a Consultant.

P2	*'Depending on some of the consultants, they put them on the waiting list and then try the injection first and there will be a formal appointment in six months' time and ask them to come for one or two injections and see how they are and if they are going to get better or not.' (line 60-63)*

Future Research:

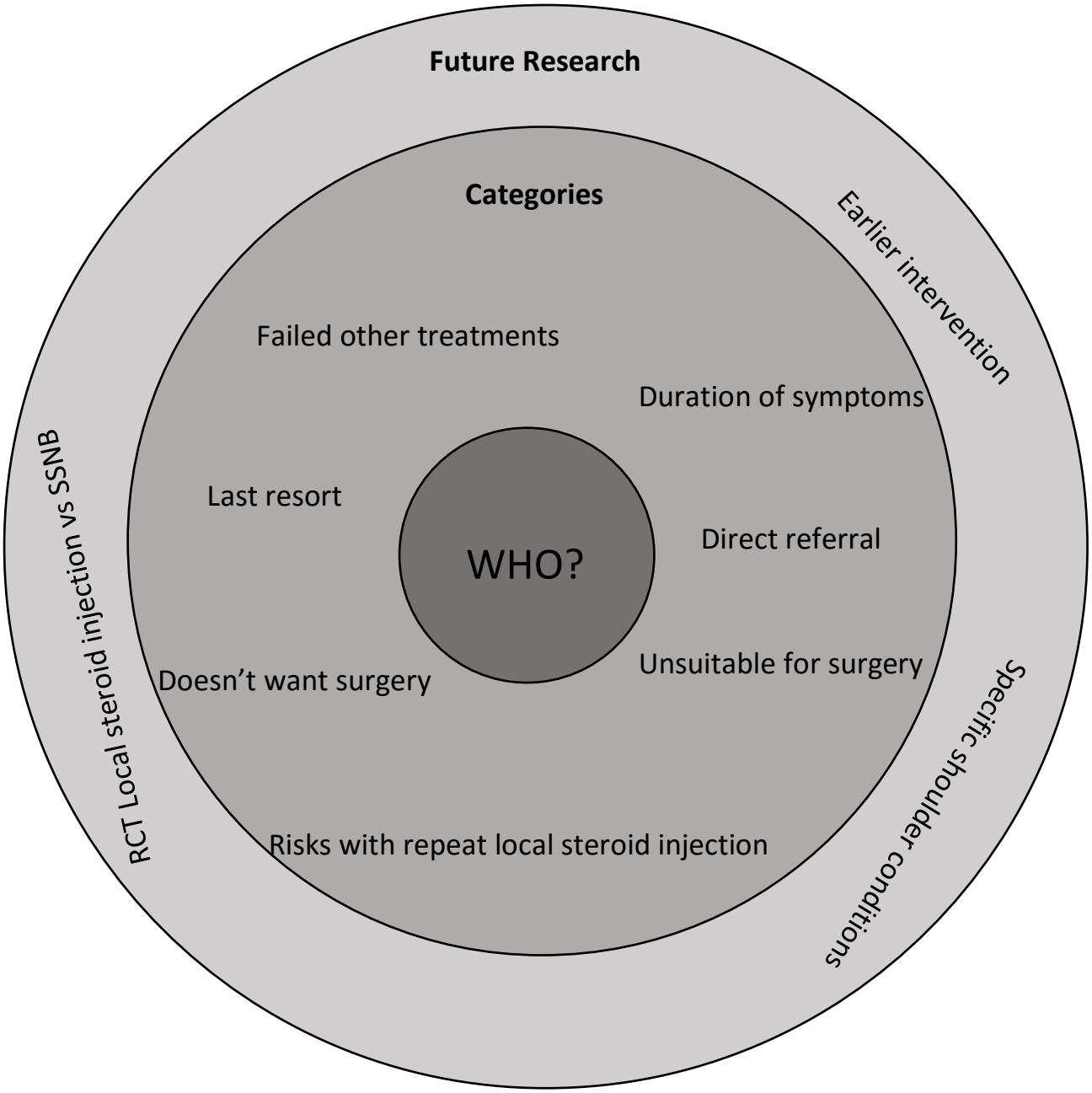
Even though at this time, SSNB injections appear to be reserved for patients with longstanding shoulder pain, clinicians felt that identifying if SSNB injections were effective in less established pain, was an area for future research.

P1	*'so we're kind of labelling this injection used for chronic pain, long term persistent pain and they've tried everything else first. So I think some options are to do with actually chronic pain being the only criteria. (734-736)*
P4	*'you could probably make a good case for early intervention with this in other shoulder pathologies, as a sort of an adjunct and would it add any value to the outcome' (line 738-740)*

Another potential future research area discussed was comparing the effectiveness of SSNB injections to local steroid injections in specific shoulder conditions, such as patients diagnosed with subacromial pain.

P1	*'I haven't come across studies that compare a nerve block to a subacromial injection for subacromial pain. I've not seen any study. I've seen frozen shoulder' (line 765-767).*

Model Patient Selection



The intervention (how?)

Clinicians describe a number of important aspects and considerations that are involved within the delivery of a SSNB injection. Different techniques and approaches were described, along with different drugs and dosages. The associated risks of the procedure are also described and discussed. Both surface land-marked and ultrasound guided approaches are used. In this focus group three clinicians use the indirect, surface land-marked approach, described in Chan and Peng (2011) and two clinicians utilise an ultrasound guided technique. Clinicians that use ultrasound guided approaches use less drug volumes and have more confidence mitigating the potential risks of undertaking SSNB injections due to needle positioning and placement accuracy afforded by ultrasound guided techniques. Discussions in the focus group were generally centred around the benefits and risks of the different approaches used by clinicians when administering a SSNB injection. All clinicians tended to follow the same informed consent procedure, discussing the risks and benefits with the patient. Clinicians generally advised patients that a SSNB injection can improve symptoms very quickly and have been shown to be effective at three months in some patients. They also advised patients that repeat injections are an option after three months. All clinicians generally administered the injection with the patient in a seated position and the clinician standing behind. Clinicians report the major risks they discussed with patients were injury to the SSN and artery, injection of bolus into the artery, pneumothorax, depigmentation and infection.

Clinicians discussed ideas for future research in relation to the method of delivery of drug to the SSN, such as lidocaine patches and longer lasting

injectable local anaesthetic. One clinician also suggested repeating a previous study that demonstrated that local anaesthetic agents given alone were as effective as local anaesthetic combined steroid in SSNB injections (Gado & Emery 1993). It was unclear why the clinician felt repeating this study was necessary and was not explored any further in the focus group. Clinicians also felt research furthering our understanding on the basic science of pain and specifically our understanding on how SSNB injections improve symptoms beyond the pharmacological action of the drug used was important.

There was general consensus and agreement that informed consent is gained prior to administering a SSNB injection. Some clinicians capture written informed consent, others only verbal. The process of consent involved discussing the risks, and benefits of the procedure with the patient.

P1	*'I would talk through the procedure with a patient, I would discuss the potential risks and the risks that I would normally discuss would be potential nerve damage…the potential risks of needle injury to the nerve, to the blood vessels is there. I also discuss about pneumothorax, I explain that it is a very small risk, but it is in the literature and it's been documented that has happened' (line 190-198).*

Clinicians described both surface land-marked and ultrasound guided approaches when administering a SSNB injection. The focus group consisted of two clinicians who use ultrasound guided techniques in their practice and three clinicians who use a surface land-marked approach. Clinicians utiliing surface land-marked approach generally reported injecting larger volumes, up to 10ml

of local anaesthetic, usually 0.25% Bupivacaine. They felt a large volume was needed to flood the area around the SSN to ensure that the drug diffuses and reaches the target. All clinicians reported that patients are generally seated when they administer a SSNB injection. The injection is administered from behind targeting the SSN in the suprascapular fossa after it has entered through the suprascapular notch.

P4	*'if you're injecting a larger volume and it just sort of diffuses around anyway, so you're going to hit the target aren't you, you don't have to be so precise. So that's one of the advantages of using the 10 ml.. '(line 490-492)*

Clinicians utilising an ultrasound guided approach felt that a large volume was not necessary as the ultrasound guided approach allows them to be more precise with needle placement close to the SSN. Clinicians utilising ultrasound for needle placement reported using volumes of 2-3 ml of local anaesthetic.

P5	'*Because I use ultrasound, I probably give between 2 – 5 ml max' (line 430)*
P3	*'I guess like Dr xxxx, we think sniper rifle rather than shot gun …' (line 494)*

Further discussions continued around which drugs were used in SSNB injections. One clinician reported that based on the literature they use local anaesthetic alone for SSNB injections whilst the four other clinicians reported using a mixture of local anaesthetic and steroid.

In fact, clinicians who used mixed local anaesthetic and steroid, acknowledged that they were aware of the research supporting the use of local anaesthetic alone in SSNB injections, and as far as they were aware there was no evidence to support the use of steroid for nerve block injections. However, they reported that the use of steroid with local anaesthetic for nerve block injections was common practice although not evidence based.

P4	*'I reviewed the literature and there was a follow up paper published that shows that you don't need to use a depomedrome, so if you keep on giving 80 mg or 40 mg of depomedrone every three months, cumulatively that could be amounting to a fair whack of steroid …' (line 420-423)*
P2	*'I'm using the same from what xxxx was talking about 9 mil of bupivacaine and 1 ml of Kenalog (40mg). Why? Because our pain management consultants set out this, they trained us and we are still continuing.' (line 445-448).*
P5	*'I do use local anaesthetics, probably Bupivacaine and I do use steroids and we discussed there is no literature evidence that steroid works, but it is a practice.* ***(Laughter)*** *and I don't use 40 I use small amount, probably 20 mg.' (line 431-434).*

The potential risks of a SSNB injection were discussed in detail by clinicians. Clinicians generally felt that there were potential risks with a SSNB injection but side effects and any harm caused by a SSNB injection to patients were not regularly observed.

The potential risks reported by clinicians included infection, skin depigmentation, injury to the suprascapular artery and suprascapular nerve by the needle tip, potential to inject a bolus of drug into the suprascapular artery, temporary weakness of the shoulder if the motor branches of the SSN were effected and pneumothorax if the pleural cavity was punctured if the needle tip slipped to deep through the suprascapular notch. Clinicians who utilised ultrasound reported less concerns regarding potential risks due to lower drug volumes used and the accuracy of needle placement that is afforded by visualising the needle positioning and placement with this approach.

P2	*'Yes you should have advice about any infections, if they feel they have any other problems or if they are concerned about infections, either they have to speak to their GP or come back to A & E for some antibiotics. But we've never had any problems. I think, in 15 to 20 years no one has come back with any infections.' (line 581-585).*
P4	*'I have seen motor effect, so the patient says I can't move my arm. It's a bit worrying, but it always comes back but I guess that's a hazard of using a larger volume isn't it, infiltrating all the nerves and then blocking the motor fibres as well..'(line 467-470).*
P1	*'I think some of my anxiety when I do an injection is because we use a long needle, occasionally the long green needle, and what we discussed earlier about pneumothorax, going through the suprascapular notch and possible needle stick injury on the blood vessels, that's always in the back of my mind, that probably isn't in the back of your two minds if you use an ultrasound I guess. But it's always in my mind.' (line 471-477)*

Future Research:

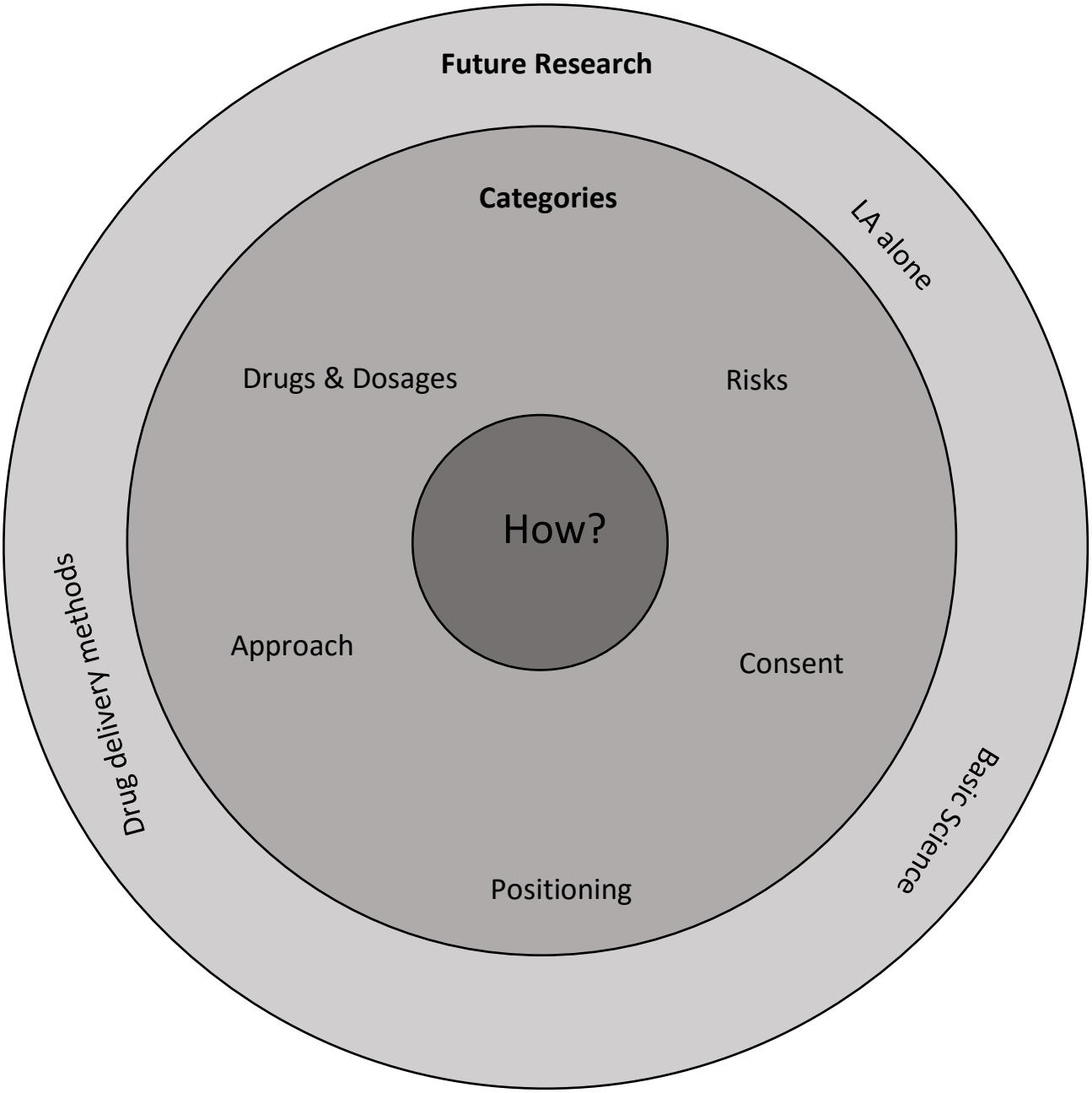
Clinicians felt that investigating new ways of drug delivery, such as application of local anaesthetic patches covering the skin overlying the area of the SSN, and developing injectable slow acting local anaesthetics that have a longer lasting duration of action are areas for future research.

P4	*'The other thing, I don't know whether it's ever been tried but if you could get, you know, you get these lignocaine patches don't you, like a plaster, so has anyone tried just sticking one of those over the same spot?' (line 792-795)*
P1	*'What you talked about earlier about the slow release.' (line 800)*
P3	*'The slow release yes.' (line 801)*
P3	*'Maybe that's something to study next.' (line 803)*

Clinicians acknowledged that there was still a lack of understanding on how SSNB injections work beyond the pharmacological effect of the drug. They felt that research that furthered our understanding on the basic science of pain neurophysiology and pain management was still important.

P4	*'I guess the actual more at the basic science level, how does it give pain relief lasting for three months when it's only a very short lived effect?' (line 715-718).*
P5	*'There is a big debate of why. The reason being in chronic pain, for example we do an injection called facet median nerve block for back pain. It is just for blocking a nerve and some patients get six months pain relief. We don't know. One theory is that, what we call pain cycle, so you get a constant barrage impulses going into your spinal cord where it modulates and then we call plasticity and once you shut off, say a few days of input, we believe it takes a long time before it re-establishes but no one has proved that yet.' (line 719-726)*
P4	*'Interesting yes.' (line 727)*
M	*'Any thoughts on how you would prove it?' (line 728)*
P5	*'That's very much molecular at spinal cord level isn't it.' (line 729)*

Model of the Intervention



Patient management (what now?)

Within the theme of ‘patient management’ clinicians discussed topics such has physiotherapy and shoulder exercises, repeat injections, self-management, patient outcomes, clinical audit, local service delivery pathways and limited resources.

Physiotherapy and shoulder exercises were viewed has an integral part of the overall patient management although there were different models and experiences of how physiotherapy was delivered in the overall package of care.

Clinicians felt that it was appropriate to repeat SSNB injections at a minimum three month intervals and repeat injections could be ongoing if seen to be beneficial to the patient. If the relief provided by a SSNB injection was short lived consideration for a SSN denervation procedure is considered for some patients.

Outcome measures and clinical audit data are not routinely collected by clinicians with the exception of one clinician who reports the regular use of the Disabilities of the Arm, Shoulder and Hand (DASH) and the Shoulder Pain and Disability Index (SPADI) outcome measures with SSNB injections.

Clinicians identified research establishing the value and benefit of combining SSNB injections with physiotherapy intervention and adding a SSNB injection to other injection therapy procedures as important areas that needs investigating in future research.

All clinicians felt that physiotherapy and shoulder exercises had an important adjunct role following a SSNB injection. Clinicians reported that, from their experience, SSNB injections can give almost immediate relief of symptoms. They viewed this as an opportunity for the patient to get the shoulder moving immediately. Some clinicians tended to advise patients to simply move their shoulder, others would teach shoulder exercises, whilst others would refer patients to physiotherapy to be taught shoulder exercises after a SSNB injection. In some cases patients had already seen a physiotherapist and were advised to continue with self-management and follow the advice and exercises previous given. The general consensus from clinicians was that a SSNB injection provided a window of pain relief to exploit by getting the shoulder moving better.

P1	*I tell them to start their exercise straight away (line 645)*
P4	*Same here yes. (line 647)*
All	*Yes. (line 648)*
M	*Is there a reason for that? (line 650)*
P4	*Well it has an immediate effect so you might as well get the benefit. (line 651)*

Most clinicians felt that SSNB injections can be effective, at, and up to, three months. Clinicians agreed that they would repeat a SSNB injection at a minimum of three months, if the previous SSNB injection provided benefit.

P4	*I tell them I'd expect it to last for up to three months and that I would be happy to repeat it, if it proves successful, and it is something that you could continue to do on a regular basis' (line 359).*

Other clinicians would consider a denervation procedure to the SSN, if the SSNB injection was beneficial but had limited duration or if patients had problems attending for repeat injections.

P5	*Again I tell them that this is sometimes just a diagnostic, just to see what we can do further and if it doesn't help, then we move them onto something else, or if it works on the shorter time, they need to go on to denervation. (line 282-285)*
P5	*If it works three months we carry on, but if the patient tells us it's not, it's too much coming and going back, because the procedure is exactly the same, the only thing is, they have to wait there for four or five minutes for the denervation to build. (line 662-665)*

Measuring the effectiveness of a SSNB injection was discussed by the group. One clinician reported that they regularly collect outcome measures when administering a SSNB injection and were able to follow up their patients. Other clinicians reported that this was not feasible or possible within their service due to limited resources as they often do not follow up their patients.

P3	*Yes so what we do is on the day of the injection we will do the SPADI and DASH and then we will review them one to two weeks later (line 518-519)*
M	*So how do you know they work? (line 552)*
P5	*When they come back, after GP's have referred back saying that it worked, can you please repeat it again. (line 553)*

Clinicians reported that clinical audit was something that was undertaken in the past, however with limited resources this was discontinued.

P1	*We had a spell where we would audit patients by telephone review, but due to the resources required to do that, we stopped it because we could be seeing patients for when we were doing reviews over the phone so that was stopped. (line 568-570)*
P5	*Yes we used to do the same. Our nurses used to call every single injection patient and we were told that it's not funded any more. (line 572-573)*

Future Research:

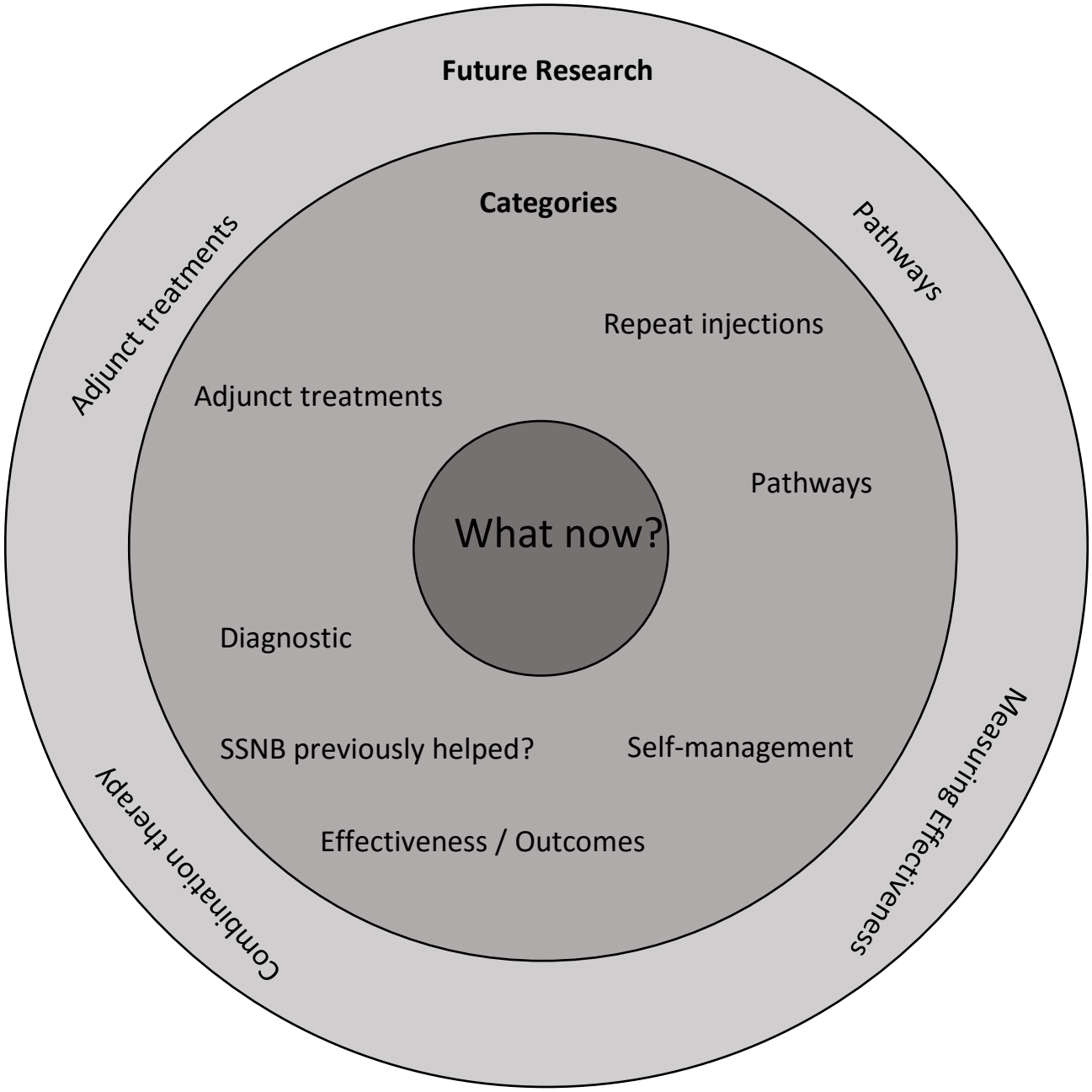
An area where clinicians felt future research would be helpful included looking at the value of combining a SSNB injection with physiotherapy rehabilitation.

P3	*'Even maybe in rotator cuff tear, because if the motor component has torn, if you block the suprascapular nerve, maybe you'd get better function because we get a lot of people that have quite significant rotator cuff tears and you put them on an anterior deltoid protocol, then they improve, but they're still painful so you end up doing a subacromial injection or intraarticular injection with steroid and local anaesthetic, which settles their pain down. Maybe if you block the suprascapular nerve to knock out the sensory … (line 773-780)*.

Clinicians also identified combination of injection therapy procedures as an area of future research, such as combining a SSNB injection with another injection technique such has hydro-distension for frozen shoulder as an area that needs exploring.

P3	‘whether it's any value adding it into, if you combine it with a hydro-dilatation’ (line 744)

Model of Patient Management



Chapter 7

Discussion

Chronic and persistent shoulder pain is a major problem in the UK affecting the quality of life of many patients (Murphy & Carr 2010). The literature indicates that clinicians consider a variety of interventions in the management of shoulder pain and the most effective and optimal approach is unknown (Bryceland et al, 2015, Littlewood et al, 2012, Hanchard et al, 2011). The pathogenesis and mechanisms underlying chronic pain are complex, most likely involving local tissue pathology and a complex interplay of pain pathways and sensory signalling that may lead to central sensitisation as result of temporary and long-term neuroplasticity (Shanthanna et al, 2016). The changes associated with sensitisation may lead to modulation of afferent sensory signals, that contribute to the development and maintenance of chronic pain. Blocking aberrant afferent inputs, even temporarily, in some patients with chronic pain, may provide prolonged pain relief (Arnér et al, 1990). SSNB injections may be an effective treatment option for some patients with chronic shoulder pain (Chang et al, 2016, Chan and Peng 2011) however little is known regarding the use and clinical application of SSNB injections in clinical practice. From the literature search no information could be found regarding the use and clinical application of SSNB injections in clinical practice in the UK. In fact, surveys investigating the management of shoulder pain in clinical practice in the UK, indicated that SSNB injections were not widely considered, with local steroid injections into the subacromial space and glenohumeral joint being the main injections of choice for different shoulder conditions (Bryceland et al, 2015, Littlewood et al,

2012, Hanchard et al, 2011,). This also appears to correlate with clinical practice in Australia, where a survey of GP's and Rheumatologists undertaken between 2003 and 2009, also indicated that clinicians mainly considered local steroid injections into the subacromial space or glenohumeral joint for different shoulder conditions, although SSNB injections were considered by some clinicians in this survey, mainly for patients with frozen shoulder (Buchbinder et al, 2013).

The main objective of this study was to develop an in-depth understanding of the use and application of SSNB injections, from the perspective of clinicians who use SSNB injections in their clinical practice. A secondary aim was to identify if and where future research in this area was needed. This discussion aims to bring together the findings from this focus group and consider them alongside the current literature, theory and evidence base, in order, to build a knowledge base around this topic and identify if and where future research is needed.

Patient selection

One of the main objectives of this study was to develop an understanding of how clinicians decide which patients were considered appropriate for SSNB injections within their practice. Identifying and predicting which patients respond to specific treatments has clear benefits for patients and healthcare resources.

Clinicians were recruited purposively to this focus group study based upon their experience, profession and the locations and sectors they practiced. The clinicians involved were based within community, intermediate and secondary care services and from Pain Management, Rheumatology and Physiotherapy

professional groups. It was anticipated that clinicians from different professions and working in different sectors may give different perspectives.

The factors influencing a decision to consider a SSNB injection, in a patient referred to a secondary care pain or rheumatology clinic, could be different to the factors influencing a decision made by a clinician working in the community or an intermediate care service. Patients referred to secondary care may have received multiple interventions before referral, therefore limiting the remaining viable options available for treatment. Clinicians working in community and intermediate care, that see and treat patients earlier in their journey, may have the opportunity to consider a SSNB injection earlier for a patient compared to those clinicians working in secondary care.

Interestingly, all the clinicians in this study reported that SSNB injections were generally reserved for patients that had failed to improve with other treatments first, including local steroid injections, physiotherapy and surgery, rather than specifically identifying which patients they felt were more appropriate for a SSNB injection. SSNB injections appeared to be viewed as a treatment of last resort by clinicians and consequently, the majority of patients that they treated with SSNB injections, had long standing shoulder pain, often for more than six months and had previously received multiple interventions with minimal or no success. It was unclear why clinicians adopted this approach.

It may be that clinicians have uncertainty regarding the effectiveness of SSNB injections compared to the effectiveness of local steroid injections. Local steroid injections are widely used in clinical practice and may be perceived and accepted, within a battery of first line treatment options in the management of

shoulder pain (Bryceland et al, 2015, Littlewood et al, 2012, Hanchard et al, 2011). This view appears to be supported in the literature. A recent NICE accredited commissioning guide on the management of subacromial shoulder pain, suggested that SSNB injections may be considered in secondary care, as part of a complex package of care for patients that are not considered fit or choose not to have surgery. Conversely, the commissioning guide suggested local steroid injections, could be considered as a treatment option delivered alongside physiotherapy in primary and intermediate care (Kulkarni et al, 2015, Kulkarni & Rees 2015).

Clinicians in the focus group felt that future research investigating the effectiveness of SSNB injections, compared to local steroid injections, given much earlier to patients, may be helpful in guiding and informing clinical practice in this area. Three RCT show favourable outcomes of SSNB injections compared to local steroid injections for patients with chronic shoulder pain (Emery et al, 1989), frozen shoulder (Jones and Chattopadhyay 1999) and non-specific shoulder pain (Taskaynatan et al, 2005). However, all these studies had small sample sizes. Therefore, more robust research, that is adequately powered, is required to investigate the effectiveness of SSNB injections compared to local steroid injections.

Although clinicians indicated that SSNB injections were generally considered after other treatments had failed, one clinician provided some further insight into their clinical reasoning and the challenges of deciding the most appropriate treatments for patients. They reported that, if they considered the shoulder condition to have an inflammatory component they would consider a local steroid injection. The assessment approach or criteria used by the clinician, to

inform their decision and determine the main pain driver i.e. ‘inflammatory’ in this case, was not discussed. Clearly, establishing the ‘mechanisms’ and main ‘pain drivers’ underpinning a patient’s condition, in clinical practice, could be advantageous and may help target treatments more effectively. If an inflammatory component is seen has the main pain driver, then a local steroid injection may be the most appropriate injection. If an inflammatory component is not seen as the main pain driver, then arguably, a local steroid injection may not be the treatment of choice and targeting treatments at peripheral tissue pathology or inflammation, using a local steroid injection may be futile.

Chronic pain is complex. Some patients with chronic shoulder pain may have ongoing local tissue pathology and inflammation that may be driving their symptoms. Other patient’s symptoms however may be more associated with central sensitisation. Some patients may have elements of both. However, being able to determine the mechanisms involved in chronic pain, in order, to target those mechanisms with more specific treatments, remains a challenge, due to the lack of validated clinical diagnostic tools available in clinical practice (O'Leary et al, 2017, Woolf 2011, Smart et al, 2011).

The concept of central sensitisation was briefly discussed by participants in this focus group in relation to pain neurophysiology and the theory of how nerve block injections may provide prolonged pain relief; by interrupting the constant barrage of afferent input and modulation of central processing. Although not discussed in detail within this focus group, it may be advantageous to explore further the concepts surrounding the assessment and treatment of chronic shoulder pain, in patients with central sensitisation, in future exploratory research. No clinical trials could be found investigating the effects of SSNB

injections in patients with recognised central sensitisation. Clinical trials involving sub-grouping patients have mainly been based upon categories such has frozen shoulder and subacromial pain. Evidence suggests SSNB injections are effective in reducing pain and improving function in patients with frozen shoulder (Klc et al, 2015; Dahan et al, 2000; Jones & Chattopadhyay 1999) and in patients with subacromial pain (Bayram et al, 2014; Di Lorenzo et al, 2006; Vecchio et al, 1993). A SSNB injection could block the sensory fibres of up to 70-80% of the shoulder and peri-shoulder structures and therefore, in theory, may be an effective treatment option for relieving symptoms for a number, of shoulder conditions. None of the clinicians in the focus group expressed any views on whether they limited SSNB injections to patients with specific shoulder conditions or from their experience whether SSNB injections were any more effective for any specific shoulder conditions. They did however feel that future research identifying if specific shoulder conditions were more amenable to a SSNB injection as potentially important future research.

One clinician in the focus group expressed concerns regarding repeating local steroid injections due to the potential side effects that glucocorticoid steroids may have on the rotator cuff tissue. They reported that a SSNB injection was sometimes considered for patients, who had already received multiple local steroid injections in the same shoulder. Experimental studies suggest glucocorticosteroids may have a negative effect on tendon tissue (Dean et al, 2014a, Dean et al, 2014b). This emerging evidence therefore questions whether repeated local steroid injections at the shoulder are a sensible approach for some patients. Arguably injections other than local steroid injections may be a more reasonable approach for a number of patients, including those patients

that may ultimately be considered for surgery, such as a rotator cuff repair, are on a waiting list for surgery but pain is not well controlled, as well as those patients where surgery is not being considered but pain is not well managed and are struggling with rehabilitation. Currently, there is little evidence to guide and inform clinical decision making regarding which patients are more appropriate for a SSNB injection rather than a local steroid injection. Clinicians in this focus group feel SSNB injections may have a wider role to play in the non-surgical management of shoulder pain then waiting to treat chronic persistent shoulder pain, that is unresponsive to other treatments. Clinicians feel further research is needed to investigate the effectiveness of SSNB injections compared to local steroid injections in treating patients with different shoulder conditions. Further consideration may also need to be given regarding the underlying mechanisms involved in patients symptoms and whether sub grouping patients based on the mechanisms involved such has inflammatory or sensitisation for example is more appropriate than sub grouping patients based on a clinical diagnosis. Further exploratory and preliminary research may also be needed to develop further understanding on how to identify, recognise and categorise patients with shoulder pain in order to target treatments more specifically.

The intervention

A further objective of this study was to identify the techniques, approaches, drugs and dosages used by clinicians in this focus group when administering a SSNB injection, as well as exploring and establishing clinicians' reasons and choices. The purpose for this objective was to identify and explore any

differences and commonalities in practice, but also to explore any uncertainties that clinicians may have that may go on to inform future research in this area.

A variety of local anaesthetic agents, used alone or in combination with steroids have been used for SSNB injections in published clinical studies (Table 1, page 23). However, no specific drug or combination of drugs have been proven to be any more effective. The rationale for using local anaesthetic agents for nerve block injections, is to block aberrant afferent signals from the symptomatic region, with the aim of reducing central sensitisation associated with chronic or persistent pain (Basbaun 2009). However, the rationale for using steroids within nerve block injections (or intra-articular / periarticular injections) in the management of chronic pain is unclear (Shanthanna et al, 2016).

Even within this focus group of only five clinicians, significant variation existed regarding the injection approach and drugs used when administering a SSNB injection. Three clinicians used the indirect, surface land-marked approach, described in Chan and Peng (2011) and two clinicians utilise an ultrasound guided approach. Four clinicians used a mixture of local anaesthetic and steroid, with one clinician choosing to inject local anaesthetic alone. The two clinicians that utilised ultrasound guidance used less drug volumes and steroid concentration (2-3 ml of local anaesthetic and 20 mg steroid) compared to the three clinicians utilising a surface land-marked approach (10 ml local anaesthetic +/- 40 mg steroid). The rationale for using ultrasound guidance surrounded concepts of safety and efficacy. Ultrasound guidance offers more accurate needle placement close to the SSN therefore reducing the risk of needle stick injury to the SSN and blood vessels, avoidance of pneumothorax as well as reducing the volume of drug needed to gain the desired blockade.

Clinicians using land marked approaches injected larger volumes to flood the area around the SSN with some clinicians expressing some concerns about potential side effects and safety when using a larger volume of local anaesthetic that may cause transient weakness of the shoulder muscles. The literature suggests that ultrasound guided approaches have become a more accepted approach for SSNB injections (Chan and Peng 2011, Cheng et al, 2016). Ultrasound guided approaches were also reported to be more effective then land-marked approaches in a meta-analysis by Cheng et al, (2016). However, these claims were based upon studies investigating SSN denervation and continuous indwelling catheters not SSNB injections. Although different guided and landmarked approaches are described in the literature no specific approach has been shown to be more effective. The indirect land-marked approach used by three clinicians in this study was the land-marked approach used in 9 out of 16 studies involving land-marked approaches that were discussed within the introduction of this thesis and presented in table 1 (page 23). The indirect land-marked approach is reported to be safe and acceptable to patients based upon an observation study of over 1000 SSNB injections performed in Australia between 2003 and 2009 (Shanahan et al, 2012). From the 1005 SSNB injections performed no serious side effects were reported, with only three episodes of transient dizziness, two episodes of transient arm weakness and one episode of facial flushing. Although none of the participants in this focus group had experienced any serious side effects in their patients following SSNB injections, they recognised that ultrasound guidance provides clinicians with a level of confidence that land-marked approaches did not.

One participant in this focus group reported using local anaesthetic alone when administering SSNB injections, with all other clinicians using a combination of local anaesthetic and steroid. The clinician who administer local anaesthetic alone felt that the addition of steroid was not necessarily for a SSNB to be effective. In fact, various studies indicate that SSNB injections using local anaesthetic alone may provide effective pain relief beyond the pharmacological action of the drug (Dorn et al, 2015, Lotero et al, 2013, Kang et al, 2012, Di Lorenzo et al, 2006, Taskaynatan et al, 2005, Karatas and Meray 2002, Dahan et al, 2000, Gado and Emery 1989, Rowlingson and Arasi 1986). However, only one study investigated whether the addition of steroid provides any further benefit to local anaesthetic alone (Gado and Emery 1993). In this study twenty-nine patients with RA and chronic bilateral shoulder pain were recruited. The patients worst shoulder was randomised to receive 2 ml of 0.5% bupivacaine or 2 ml 0.5% bupivacaine combined with 40 mg of prednisolone. The contralateral shoulder to the treatment shoulder was however also injected with 40 mg of prednisolone. Both groups improved with no difference between groups. The authors therefore claimed that the addition of steroid within a SSNB injection provided no additional benefit over SSNB injection with local anaesthetic alone. However low participant numbers and with the treatment group receiving a dose of steroid in the contralateral shoulder, that may have a systemic effect, questions the methodological quality and findings in this study. Using local anaesthetic alone in SSNB injections may have clinical benefits where the injection could to be administered and repeated without any of the risks associated with repeat steroid administration. This may have important implications for rehabilitation and be an appropriate option for patients where

administration of steroid is not recommended i.e. uncontrolled diabetes. Future research investigating whether the addition of steroid to local anaesthetic provides any additional benefit to local anaesthetic alone for SSNB injections may be an important future study that could guide and inform clinical practice in this area. In addition, further consideration may need to be given regarding the use of ultrasound guidance if considering the use of local anaesthetic alone. There may be different outcomes for SSNB injections administered with or without steroid when using ultrasound guidance, due to the potential systemic effects of steroid. Within this theme clinicians also briefly discussed future potential developments in pain management, such has the use of slow acting, long lasting local anaesthetics within injections, as well as novel ways of drug delivery such has applying local anaesthetic patches over a target area.

Patient Management

Arguably the management of patients with chronic shoulder pain can be complex often involving multiple modalities and interventions. A further objective of this study was to identify which aspects of clinical care, including addition interventions, are associated with the management of patients who receive SSNB injections. In addition, participants were asked to explore how future research could consider overall management and adjunct interventions for patients with chronic shoulder pain receiving SSNB injections.

Participants discussed topics such has combined interventions, physiotherapy, shoulder exercises, self-management, patient outcomes, clinical audit, local service delivery pathways and limited resources. Essentially participants

discussed how these aspects of clinical care fit within the overall concept of ‘Patient Management’ when a patient is considered for a SSNB injection.

All the clinicians in this focus group felt that physiotherapy and especially shoulder exercises play an important part in the overall management of patients that undergo SSNB injections. They felt that the objective of a SSNB injection was to reduce pain and following a SSNB injection shoulder exercises were essential in restoring or improving function in patients with chronic shoulder pain. One clinician shared their views on how a SSNB injection may facilitate rehabilitation in patients with rotator cuff tears. Much debate and uncertainty exists regarding the safe use of local steroid injections to facilitate rehabilitation in the management tendonopathy due to the potentially negative effects that glucocorticosteroid may have on tendon tissue (Coombes et al, 2010). One study investigating the combined effects of physiotherapy and local steroid injection, for subarcomial shoulder pain, showed that patients who received both subacromial injection and physiotherapy had a quicker recovery than those that received physiotherapy alone (Crawshaw et al, 2010). Although long term outcomes at three months were similar earlier recovery may have important implications for some patients. A study investigating SSNB injections combined with physiotherapy compared to physiotherapy alone, in patients with frozen shoulder, showed that the SSNB group had greater improvements in outcomes than the physiotherapy alone group at seven weeks (Klç et al, 2015). However, a limitation of this study was the small sample size of only 40 patients and the short follow up to only seven weeks.

One of the benefits of a SSNB injection reported by clinicians in the focus group was that it can produce almost immediate relief of symptoms in some patients.

They felt that this was very rewarding for clinicians and highly valued by patients particularly when all other treatments had failed. The potential implications regarding quick resolution of pain for physiotherapy management, after a SSNB injection, could be advantageous and quite significant. Patients may be able to start shoulder exercises immediately after SSNB injections, this may not be the case following a local steroid injection considering the potential risks associated with altered tendon homeostasis (Dean et al, 2014a, Dean et al, 2014b). In theory, other physiotherapy treatments including manual therapy may also be facilitated and supplemented by a SSNB injection and initiated after a successful SSNB injection. In fact, this appears to be the rationale for the procedure initially reported by Wertheim and Rovenstine (1941 p.541) i.e. the procedure may be 'useful as an adjunct in the treatment of chronic shoulder pain' and to enable other treatments such has 'traction, manipulation and massage to be applied to a painful shoulder'. In fact, two recent review articles suggest that future studies should aim to identify the optimal timing of SSNB injections in combination and integration with physiotherapy, in order to improve long term benefits of SSNB injection (Cheng et al, 2016, Chan and Pend 2011).

Some clinicians in the focus group also report that some of their patients felt more confident with self-management and were able to continue with home exercises independently after a SSNB injection. Clinicians generally felt SSNB injections were effective in their patients up to three months and would be prepared to repeat a SSNB injection at three month intervals if required. Although these observations were anecdotal and were generally based on patients that were re-referred and considered for a repeat injection, the literature indicates that improvements in pain and function following SSNB

injections in patients with non-specific chronic shoulder pain, frozen shoulder and subacromial pain are maintained up to three months (El-Badawy et al, 2104; Bayram et al, 2014; Emery et al, 1989). No study could be found that measured outcomes beyond three months (Table 1, page 22).

Clinicians also identified that SSNB injection used in combination with other treatments including hydro-distension for frozen shoulder was worth exploring within future research. SSNB injection may make a procedure such a hydro-distension more comfortable for patients but also improve effectiveness of the procedure. Outcome measures were not routinely collected by clinicians in this focus group due to lack of resources in clinical practice that allow them to regularly follow up patients. One clinician reported collecting short term outcomes, using SPADI and Quick DASH, at two to three weeks post SSNB injection. Furthermore, one clinician in the focus group felt that return to work should be considered an outcome measure in future research and clinical practice. The main finding within this theme centred around the importance of combining a SSNB injection with physiotherapy and shoulder exercises.

Study strengths

Previous research investigating clinical practice surrounding the management of shoulder pain has generally used survey methods to provide an overview of clinical practice. No exploratory or mixed method research, specifically regarding the clinical application of SSNB injections, was identified by the author in which to build upon. Focus groups are particularly suited to an exploratory approach and this method provided clinicians in this study with an interactive platform to discuss and share their views and experiences. This study included a purposive sample of participants from different clinical sectors

and from different professional backgrounds who provided different perspectives and experiences around the use of SSNB injections. Several strategies were adopted to improve the trustworthiness of the findings in this study including collaboration with co-researchers, use of an experienced facilitator, providing thick descriptions and member checking.

Limitations

Only one focus group was undertaken for this exploratory study. Undertaking further focus groups across a wider geographical region involving orthopaedic consultants, radiologists and general practitioners would have improved the credibility of the findings. Only five participants were involved in the focus group including the main researcher and their involvement in the focus group had the potential to introduce bias. Further data collection and triangulation with other data collection methods, such has individual interviews or even a survey would also have strengthened the findings. Pilot testing the topic guide and having the research methods peer-reviewed by an expert independent researcher before the start of the study would have also improved the dependability of the findings.

Next stage

Participants in this study identified future clinical research that could ultimately guide and inform clinical practice in the area of SSNB injections in the non-surgical management of shoulder pain. However, further exploratory research undertaken with clinicians using SSNB injections from across a wider geographical region would be useful first. In addition it would also be useful to gain the views, experiences and perspectives of patients living with chronic

shoulder pain. The findings from this initial focus group could be used to construct questions within a survey, that would reach a wider sample within the UK and further afield, or be used to construct further questions in a topic guide used for further exploratory research.

Chapter 8
Conclusions

This study aimed to investigate and explore the views and experiences of clinicians that use SSNB injections in the non-surgical management of shoulder pain. Clinicians in this focus group currently reserve SSNB injections for patients with long standing shoulder pain that has been refractory to other treatments including local steroid injections, physiotherapy and surgery. Clinicians report that most patients have had symptoms for at least six months before considering a SSNB injection and they were happy to repeat SSNB injections at three month intervals if necessary. No specific shoulder conditions are excluded from having a SSNB injection and SSNB injections were not reported to be any more effective, in any specific shoulder condition. Clinicians used both land-marked and ultrasound guidance and used local anaesthetic alone or in combination with glucorticosteroid.

All clinicians felt that physiotherapy and shoulder exercises were an important part in the overall management of patients with chronic shoulder pain, following a SSNB injection. The optimal timing of these interventions may be important component for effective management and future research exploring this concept would be useful. Clinicians also identified that future research investigating the effectiveness of SSNB injections compared to local steroid injections for different shoulder conditions as an important area. Consideration however may need to be given regarding sub grouping patients based upon condition and whether patients have elements of central sensitisation. They also identified future research to investigate if SSNB injections given earlier to patients are effective, if SSNB injection administered with local anaesthetic alone is as

effective as SSNB injections administered with glucocorticoid combined with local anaesthetic and if SSNB injection adds any further benefit to other treatments like hydro-distension for frozen shoulder? Future research in this area has the potential to guide clinical practice and improve the quality of life of patients living with chronic shoulder pain, however further exploratory research is required in advance.

References

Abdelshafi, M. E., Yosry, M., Elmulla, A. F., Al-Shahawy, E. A., Adou, A. M., & Eliewa, E. A. (2011). Relief of chronic shoulder pain: a comparative study of three approaches. *Middle East journal of anaesthesiology*, *21*(1), 83-92.

Ackermann, P. W., & Hart, D. A. (2016). Metabolic Influences on Risk for Tendon Disorders. *Advances in experimental medicine and biology.* DOI:10.1007/978-3-319-33943-6. *(ISSN 0065-2598*, *920)*.

Akgün, K., Birtane, M., & Akarırmak, Ü. (2004). Is local subacromial corticosteroid injection beneficial in subacromial impingement syndrome? *Clinical rheumatology*, *23*(6), 496-500.

Alvarez, C. M., Litchfield, R., Jackowski, D., Griffin, S., & Kirkley, A. (2005). A prospective, double-blind, randomized clinical trial comparing subacromial injection of betamethasone and xylocaine to xylocaine alone in chronic rotator cuff tendinosis. *The American journal of sports medicine*, *33*(2), 255-262.

Arnér S., Lindblom U., Meyerson B.A., et al (1990). Prolonged relief of neuralgia after regional anesthetic blocks. A call for further experimental and systematic clinical studies. *Pain*; 43: pp. 287-297.

Aronoff, G. M. (2016). What Do We Know About the Pathophysiology of Chronic Pain? Implications for Treatment Considerations. *Medical Clinics of North America*, *100*(1), 31-42.

Aszmann, O. C., Dellon, A. L., Birely, B. T., and McFarland, E. G. (1996). 'Innervation of the Human Shoulder Joint and its Implications for Surgery.' *Clinical Orthopaedics and Related Research.* 330, 202-207.

Basbaum, A. I., Bautista, D. M., Scherrer, G., & Julius, D. (2009). Cellular and molecular mechanisms of pain. *Cell*, *139*(2), 267-284.

Bayram, K., Bal, S., Safa Satoglu, I., Kocyigit, H., Gürgan, A., Akcay, S., and Kazimoglu, C. (2014). 'Does Suprascapular Nerve Block Improve Shoulder Disability in Impingement Syndrome? A Randomized Placebo-Controlled Study'. *Journal of Musculoskeletal Pain* 22 (2), 170-174.

Beauchamp, T. L. Childress, J. F. (2001). *Principles of biomedical ethics*. Oxford University Press, USA.

Bigliani, L. U., Dalsey, R. M., McCann, P. D., and April, E. W. (1990). 'An Anatomical Study of the Suprascapular Nerve'. *Arthroscopy: The Journal of Arthroscopic & Related Surgery* 6 (4), 301-305.

Blum, A., Lecocq, S., Louis, M., Wassel, J., Moisei, A., and Teixeira, P. (2013). 'The Nerves Around the Shoulder'. *European Journal of Radiology* 82 (1), 2-16.

Borstad, J., & Woeste, C. (2015). The role of sensitization in musculoskeletal shoulder pain. *Brazilian journal of physical therapy*, *19*(4), 251-257.

Bradnam, L., Shanahan, E. M., Hendy, K., Reed, A., Skipworth, T., Visser, A., & Lennon, S. (2016). Afferent inhibition and cortical silent periods in shoulder primary motor cortex and effect of a suprascapular nerve block in people experiencing chronic shoulder pain. *Clinical Neurophysiology*, *127*(1), 769-778.

Braun, V. and Clarke, V. (2006). 'Using Thematic Analysis in Psychology'. *Qualitative Research in Psychology* 3 (2), 77-101.

Brinks, A., Koes, B. W., Volkers, A. C., Verhaar, J. A., & Bierma-Zeinstra, S. M. (2010). Adverse effects of extra-articular corticosteroid injections: a systematic review. *BMC musculoskeletal disorders*, *11*(1), 206.

Bryceland, J. K., Drury, C., & Tait, G. R. (2015). Current UK practices in the management of subacromial impingement. *Shoulder & Elbow*, *7*(3), 164-167.

Buchbinder, R., Green, S., and Youd, J. M. (2003). 'Corticosteroid Injections for Shoulder Pain'. *Cochrane Database Syst Rev* 1 (1).

Buchbinder, R., Staples, M. P., Shanahan, E. M., & Roos, J. F. (2013). General practitioner management of shoulder pain in comparison with rheumatologist expectation of care and best evidence: an Australian national survey. *PloS one*, *8*(4), e61243.

Carpenter, C. and Suto, M. (2008). *Qualitative Research for Occupational and Physical Therapists: A Practical Guide*.: Blackwell Pub.

Chan, C. W. and Peng, P. W. (2011). 'Suprascapular Nerve Block: A Narrative Review'. *Regional Anesthesia and Pain Medicine* 36 (4), 358-373.

Chang, K. V., Hung, C. Y., Wu, W. T., Han, D. S., Yang, R. S., & Lin, C. P. (2016). Comparison of the effectiveness of suprascapular nerve block with physical therapy, placebo, and intra-articular injection in management of chronic shoulder pain: A meta-analysis of randomized controlled trials. *Archives of physical medicine and rehabilitation*, *97*(8), 1366-1380.

Chansoria, M., Das, G., Mathankar, N., Chandar, D., Vyas, N., and Upadhyay, S. (2015). 'A Preliminary Study of a Novel Technique of Suprascapular Nerve Block in Treating Chronic Shoulder Pain'. *Indian Journal of Pain* 29 (2), 91.

Chard, M., Hazleman, R., Hazleman, B. L., King, R. H., & Reiss, B. B. (1991). Shoulder disorders in the elderly: a community survey. *Arthritis & Rheumatology*, *34*(6), 766-769.

Chester, R., Shepstone, L., Daniell, H., Sweeting, D., Lewis, J., and Jerosch-Herold, C. (2013). 'Predicting Response to Physiotherapy Treatment for Musculoskeletal Shoulder Pain: A Systematic Review'. *BMC Musculoskeletal Disorders* 14 (1), 1.

Cooke, A., Smith, D., & Booth, A. (2012). Beyond PICO the SPIDER tool for qualitative evidence synthesis. *Qualitative Health Research*, *22*(10), 1435-1443.

Coombes, B. K., Bisset, L., & Vicenzino, B. (2010). Efficacy and safety of corticosteroid injections and other injections for management of tendinopathy: a systematic review of randomised controlled trials. *The Lancet*, *376*(9754), 1751-1767.

Crawshaw, D. P., Helliwell, P. S., Hensor, E. M., Hay, E. M., Aldous, S. J., and Conaghan, P. G. (2010). 'Exercise Therapy After Corticosteroid Injection for Moderate to Severe Shoulder Pain: Large Pragmatic Randomised Trial'*. BMJ (Clinical Research Ed.)* 340, c3037.

Dahan, T. H., Fortin, L., Pelletier, M., Petit, M., Vadeboncoeur, R., and Suissa, S. (2000). 'Double Blind Randomized Clinical Trial Examining the Efficacy of Bupivacaine Suprascapular Nerve Blocks in Frozen Shoulder'*. The Journal of Rheumatology* 27 (6), 1464-1469.

Dean, B. J. F., Lostis, E., Oakley, T., Rombach, I., Morrey, M. E., and Carr, A. J. (eds.) (2014a). 'The Risks and Benefits of Glucocorticoid Treatment for Tendinopathy: A Systematic Review of the Effects of Local Glucocorticoid on Tendon' *Seminars in Arthritis and Rheumatism 43, 570-576.*

Dean, B. J., Franklin, S. L., Murphy, R. J., Javaid, M. K., and Carr, A. J. (2014b). 'Glucocorticoids Induce Specific Ion-Channel-Mediated Toxicity in Human Rotator Cuff Tendon: A Mechanism Underpinning the Ultimately Deleterious Effect of Steroid Injection in Tendinopathy?'*. British Journal of Sports Medicine* 48 (22), 1620-1626.

Dean, B. J., Gwilym, S. E., and Carr, A. J. (2013). 'Why does My Shoulder Hurt? A Review of the Neuroanatomical and Biochemical Basis of Shoulder Pain'*. British Journal of Sports Medicine* 47 (17),1095-1104.

Dennis, L., Brealey, S., Rangan, A., Rookmoneea, M., & Watson, J. (2010). Managing idiopathic frozen shoulder: a survey of health professionals' current practice and research priorities. *Shoulder & Elbow*, *2*(4), 294-300.

Department of Health (2005). Research Governance Framework for Health and Social Care,2nd edition. [online] available from http://www.dh.gov.uk/en/Publicationsandstatistics/Publications/PublicationsPolicyAndGuidance/DH_4108962 [10 June].

Di Lorenzo, L., Pappagallo, M., Gimigliano, R., Palmieri, E., Saviano, E., Bello, A., Forte, A., DeBlasio, E., and Trombetti, C. (2006). 'Pain Relief in Early Rehabilitation of Rotator Cuff Tendinitis: Any Role for Indirect Suprascapular Nerve Block?'*. Europa Medicophysica* 42 (3), 195-204.

Dorn, C., Rumpold-Seitlinger, G., Farzi, S., Auer, J., and Bornemann-Cimenti, H. (2015). 'The Effect of the Modified Lateral Suprascapular Block on Shoulder Function in Patients with Chronic Shoulder Pain'*. Anesthesiology and Pain Medicine* 5 (6), e31640.

Dunn, W. R., Schackman, B. R., Walsh, C., Lyman, S., Jones, E. C., Warren, R. F., & Marx, R. G. (2005). Variation in orthopaedic surgeons' perceptions about the indications for rotator cuff surgery. *J Bone Joint Surg Am*, *87*(9), 1978-1984.

Ebraheim, N. A., Whitehead, J. L., Alla, S. R., Moral, M. Z., Castillo, S., McCollough, A. L., Yeasting, R. A., and Liu, J. (2011). 'The Suprascapular Nerve and its Articular Branch to the Acromioclavicular Joint: An Anatomic Study'*. Journal of Shoulder and Elbow Surgery* 20 (2), e13-e17.

Ekeberg, O. M., Bautz-Holter, E., Tveitå, E. K., Juel, N. G., Kvalheim, S., & Brox, J. I. (2009). Subacromial ultrasound guided or systemic steroid injection for rotator cuff disease: randomised double blind study. *Bmj*, *338*, a3112.

El-Badawy, M. A. and Fathalla, M. M. (2014). 'Suprascapular Nerve Block Followed by Codman's Manipulation and Exercise in the Rehabilitation of Idiopathic Frozen Shoulder'*. Egyptian Rheumatology and Rehabilitation* 41 (4), 172.

Emery, P., Bowman, S., Wedderburn, L., and Grahame, R. (1989). 'Suprascapular Nerve Block for Chronic Shoulder Pain in Rheumatoid Arthritis'*. BMJ (Clinical Research Ed.)* 299 (6707), 1079-1080.

Favejee, M. M., Huisstede, B. M. A., & Koes, B. W. (2011). Frozen shoulder: the effectiveness of conservative and surgical interventions—systematic review. *British journal of sports medicine*, *45*(1), 49-56.

Feigl, G. C., Anderhuber, F., Dorn, C., Pipam, W., Rosmarin, W., and Likar, R. (2007). 'Modified Lateral Block of the Suprascapular Nerve: A Safe Approach and how Much to Inject? A Morphological Study'.*Regional Anesthesia and Pain Medicine* 32 (6), 488-494.

Fernandes, M. R., Barbosa, M. A., Sousa, A. L. L., and Ramos, G. C.(2012a). 'Suprascapular Nerve Block: Important Procedure in Clinical Practice'*. Revista Brasileira De Anestesiologia* 62 (1), 96-104.

Fernandes, M. R., Barbosa, M. A., Sousa, A. L. L., and Ramos, G. C. (2012b). 'Suprascapular Nerve Block: Important Procedure in Clinical Practice. Part II'*. Revista Brasileira De Reumatologia* 52 (4), 616-622.

Finlay, L., & Gough, B. (Eds.). (2008). *Reflexivity: A practical guide for researchers in health and social sciences*. John Wiley & Sons.

Flurin, P. H., Landreau, P., Gregory, T., Boileau, P., Lafosse, L., Guillo, S., ... & Laprelle, E. (2007). Cuff integrity after arthroscopic rotator cuff repair: correlation with clinical results in 576 cases. *Arthroscopy: The Journal of Arthroscopic & Related Surgery*, *23*(4), 340-346.

Gado, K. and Emery, P. (1993). 'Modified Suprascapular Nerve Block with Bupivacaine Alone Effectively Controls Chronic Shoulder Pain in Patients with Rheumatoid Arthritis'*. Annals of the Rheumatic Diseases* 52 (3), 215-218.

Gale, G., Nussbaum, D., Rothbart, P., Hann, B., Leung, V., & Kanetz, G. (2002). A randomized treatment study to compare the efficacy of repeated nerve blocks with cognitive therapy for control of chronic head and neck pain. *Pain Research and Management*, *7*(4), 185-189.

Gifford, L. (1998). Pain, the tissues and the nervous system: a conceptual model. *Physiotherapy*, *84*(1), 27-36.

Gorthi, V., Moon, Y. L., and Kang, J. (2010). 'The Effectiveness of ltrasonography-Guided Suprascapular Nerve Block for Perishoulder Pain'*. Orthopedics* 33 (4), 238-238.

Green, S., Buchbinder, R., and Hetrick, S. (2003). 'Physiotherapy Interventions for Shoulder Pain (Review)'*. The Cochrane Database Syst Rev* 2, CDOO4258.

Griffiths, S., & Yohannes, A. M. (2014). Surgical referral criteria for degenerative rotator cuff tears: a delphi questionnaire study. *Musculoskeletal care*, *12*(2), 82-91.

Guba (1981). Criteria for assessing trustworthiness of naturalistic inquiries. Educational Technology research and development. 29(2), 75-91.

Gwilym, S. E., Oag, H. C. L., Tracey, I., & Carr, A. J. (2011). Evidence that central sensitisation is present in patients with shoulder impingement syndrome and influences the outcome after surgery. *J Bone Joint Surg Br*, *93*(4), 498-502.

Hanratty, C. E., McVeigh, J. G., Kerr, D. P., Basford, J. R., Finch, M. B., Pendleton, A., & Sim, J. (2012). The effectiveness of physiotherapy exercises in subacromial impingement syndrome: a systematic review and meta-analysis. In *Seminars in arthritis and rheumatism* (Vol. 42, No. 3, pp. 297-316).

Hanchard, N. C., Goodchild, L., Thompson, J., O'Brien, T., Davison, D., & Richardson, C. (2011). A questionnaire survey of UK physiotherapists on the diagnosis and management of contracted (frozen) shoulder. *Physiotherapy*, *97*(2), 115-125.

Hanratty, C. E., Kerr, D. P., Wilson, I. M., McCracken, M., Sim, J., Basford, J. R., & McVeigh, J. G. (2016). Physical Therapists' Perceptions and Use of Exercise in the Management of Subacromial Shoulder Impingement Syndrome: Focus Group Study. *Physical therapy*, *96*(9), 1354.

Hench, P. S., Kendall, E. C., Slocumb, C. H., & Polley, H. F. (1949). The effect of a hormone of the adrenal cortex (17-hydroxy-11-dehydrocorticosterone: compound E) and of pituitary adrenocortical hormone in arthritis: preliminary report. *Annals of the rheumatic diseases*, *8*(2), 97-104.

Huntoon, M., Benzon, H., Nauroze, S., & Deer, T. (2011). *Spinal Injections & Peripheral Nerve Blocks: Volume 4: A Volume in the Interventional and Neuromodulatory Techniques for Pain Management Series;(Expert Consult Premium Edition--Enhanced Online Features)*. Elsevier Health Sciences.

Ide, K., Shirai, Y., Ito, H., and Ito, H. (1996). 'Sensory Nerve Supply in the Human Subacromial Bursa'*. Journal of Shoulder and Elbow Surgery* 5 (5), 371-382.

Jackson, P. (1998). Focus group interviews as a methodology. *Nurse Researcher*, *6*(1), 72-84.

Jankovic, D. (Ed.). (2008). *Regional Nerve Blocks and Infiltration Therapy: Textbook and Color Atlas*. John Wiley & Sons.

Jankovic, D., & Peng, P. (2015). *Regional Nerve Blocks in Anesthesia and Pain Therapy: Traditional and Ultrasound-Guided Techniques*. Springer.

Jerosch, J., Saad, M., Greig, M., and Filler, T. (2008). 'Suprascapular Nerve Block as a Method of Pre-emptive Pain Control in Shoulder Surgery'*. Knee Surgery, Sports Traumatology, Arthroscopy* 16 (6), 602-607.

Johansson, K., Adolfsson, L., & Foldevi, M. (1999). Attitudes toward management of patients with subacromial pain in Swedish primary care. *Family Practice*, *16*(3), 233-237.

Johansson, K., Oberg, B., Adolfsson, L., & Foldevi, M. (2002). A combination of systematic review and clinicians' beliefs in interventions for subacromial pain. *Br J Gen Pract*, *52*(475), 145-152.

Jones, D. S. and Chattopadhyay, C. (1999) 'Suprascapular Nerve Block for the Treatment of Frozen Shoulder in Primary Care: A Randomized Trial'*. The British Journal of General Practice: The Journal of the Royal College of General Practitioners* 49 (438), 39-41.

Jowett, S., Crawshaw, D. P., Helliwell, P. S., Hensor, E. M., Hay, E. M., and Conaghan, P. G. (2013). 'Cost-Effectiveness of Exercise Therapy After Corticosteroid Injection for Moderate to Severe Shoulder Pain due to Subacromial Impingement Syndrome: A Trial-Based Analysis'*. Rheumatology (Oxford, England)* 52 (8), 1485-1491.

Kang, S. S., Jung, J. W., Song, C. K., Yoon, Y. J., and Shin, K. M. (2012). 'A New Anterior Approach for Fluoroscopy-Guided Suprascapular Nerve Block-a Preliminary Report'*. The Korean Journal of Pain* 25(3), 168-172.

Karatas, G. K. and Meray, J. (2002). 'Suprascapular Nerve Block for Pain Relief in Adhesive Capsulitis: Comparison of 2 Different Techniques'. *Archives of Physical Medicine & Rehabilitation* 83 (5), 593-597.

Klc, Z., Filiz, M. B., Cakr, T., and Toraman, N. F. (2015). 'Addition of Suprascapular Nerve Block to a Physical Therapy Program Produces an Extra Benefit to Adhesive Capsulitis: A Randomized Controlled Trial'. *American Journal of Physical Medicine & Rehabilitation / Association of Academic Physiatrists* 94 (10 Suppl 1) 912-920.

Kraal, T., Visser, C., Sierevelt, I., & Beimers, L. (2016). How to treat a frozen shoulder? A survey among shoulder specialists in the Netherlands and Belgium. *Acta orthopaedica Belgica*, *82*(1), 78-84.

Krueger, R. A. and Casey, M. A. (2015). *Focus Groups: A Practical Guide for Applied Research*.: Sage publications.

Kuhn, J. E. (2009). 'Exercise in the Treatment of Rotator Cuff Impingement: A Systematic Review and a Synthesized Evidence-Based Rehabilitation Protocol'. *Journal of Shoulder and Elbow Surgery* 18 (1), 138-160.

Kulkarni, R. and Rees, J. L. (2015) 'BESS Patient Care Pathways and Commissioning Guidelines'. *Shoulder & Elbow* 7 (2), 75-75.

Kulkarni, R., Gibson, J., Brownson, P., Thomas, M., Rangan, A., Carr, A. J., & Rees, J. L. (2015). Subacromial shoulder pain. *Shoulder & Elbow*, *7*(2), 135-143.

Kwaees, T. A., & Charalambous, C. P. (2014). Surgical and non-surgical treatment of frozen shoulder. Survey on surgeons treatment preferences. *Muscles, ligaments and tendons journal*, *4*(4), 420.

Lewis, J. (2016). 'Rotator Cuff Related Shoulder Pain: Assessment, Management and Uncertainties'. *Manual Therapy* 23, 57-68.

Lewis, J., McCreesh, K., Roy, J. S., & Ginn, K. (2015). Rotator cuff tendinopathy: navigating the diagnosis-management conundrum. *journal of orthopaedic & sports physical therapy*, *45*(11), 923-937.

Linsell, L., Dawson, J., Zondervan, K., Rose, P., Randall, T., Fitzpatrick, R., and Carr, A. (2006). 'Prevalence and Incidence of Adults Consulting for Shoulder Conditions in UK Primary Care; Patterns of Diagnosis and Referral'. *Rheumatology (Oxford, England)* 45 (2), 215-221.

Littlewood, C., Mawson, S., May, S., & Walters, S. (2015). Understanding the barriers and enablers to implementation of a self-managed exercise intervention: a qualitative study. *Physiotherapy*, *101*(3), 279-285.

Littlewood, C., Malliaras, P., Mawson, S., May, S., & Walters, S. (2014). Patients with rotator cuff tendinopathy can successfully self-manage, but with certain caveats: a qualitative study. *Physiotherapy*, *100*(1), 80-85.

Littlewood, C., Malliaras, P., Bateman, M., Stace, R., May, S., & Walters, S. (2013). The central nervous system–an additional consideration in 'rotator cuff tendinopathy'and a potential basis for understanding response to loaded therapeutic exercise. *Manual therapy*, *18*(6), 468-472.

Littlewood, C., Lowe, A., & Moore, J. (2012). Rotator cuff disorders: a survey of current UK physiotherapy practice. *Shoulder & Elbow*, *4*(1), 64-71.

Lotero, M., Carlo Rivera Díaz, R., Campuzano Escobar, D., Adelaida Mejía Aguilar, M., and Milena Martínez Ramírez, S.(2013) 'Efficacy and Safety of Ultrasound-Guided Suprascapular Nerve Block in Patients with Chronic Shoulder Pain.'. *Colombian Journal of Anesthesiology/Revista Colombiana De Anestesiología* 41 (2).

Lowe, C. J. M., Moser, J., and Barker, K. (2014) 'Living with a Symptomatic Rotator Cuff Tear 'bad Days, Bad Nights': A Qualitative Study'. *BMC Musculoskeletal Disorders* 15 (1), 1.

Luime, J. J., Koes, B. W., Hendriksen, I. J. M., Burdorf, A., Verhagen, A. P., Miedema, H. S., & Verhaar, J. A. N. (2004). Prevalence and incidence of shoulder pain in the general population; a systematic review. *Scandinavian journal of rheumatology*, *33*(2), 73-81.

May, S. (2003) 'An Outcome Audit for Musculoskeletal Patients in Primary Care'. *Physiotherapy Theory and Practice* 19 (4), 189-198.

May, S., Greasley, A., Reeve, S., & Withers, S. (2008). Expert therapists use specific clinical reasoning processes in the assessment and management of patients with shoulder pain: a qualitative study. *Australian Journal of Physiotherapy*, *54*(4), 261-266.

Merskey, H. E. (1986). Classification of chronic pain: Descriptions of chronic pain syndromes and definitions of pain terms. *Pain*.

Merton, R. K. (2008). *Focused interview*. Simon and Schuster.

Mitra, P. K. and Bhattacharya, D. (2016). 'Comparison of Clinical Effects of Ultrasound Guided Suprascapular Nerve Block and Oral Pregabalin Versus Suprascapular Nerve Block Alone for Pain Relief in Frozen Shoulder'. *Indian Journal of Pain* 30 (1), 49.

Mitra, R., Harris, A., Umphrey, C., Smuck, M., & Fredericson, M. (2009). Adhesive capsulitis: a new management protocol to improve passive range of motion. *PM&R*, *1*(12), 1064-1068.

Morgan, D. L. and Bottorff, J. L. (2010). 'Advancing our Craft: Focus Group Methods and Practice'. *Qualitative Health Research* 20 (5), 579.

Morgan, D. L. (1997). *The Focus Group Guidebook*.: Sage publications.

Murphy, R. J. and Carr, A. J. (2010) 'Shoulder Pain'. *BMJ Clinical Evidence* 2010, 1107.

Offredy, M. and Vickers, P. (2010). *Developing a Healthcare Research Proposal: An Interactive Student Guide*.: John Wiley & Sons.

O'Leary, H., Smart, K. M., Moloney, N. A. and Doody, C. M. (2017), Nervous System Sensitization as a Predictor of Outcome in the Treatment of Peripheral Musculoskeletal Conditions: A Systematic Review. Pain Practice, 17: 249–266. doi:10.1111/papr.12484

Ottenheijm, R. P., Hesselmans, N. J., Kemper, A., Moser, A., Bie, R. A., Dinant, G. J., & Cals, J. W. (2014). GPs' perspectives on the diagnostic work-up in patients with shoulder pain: a qualitative study. *Journal of evaluation in clinical practice*, *20*(3), 239-245.

Ozkan, K., Ozcekic, A. N., Sarar, S., Cift, H., Ozkan, F. U., and Unay, K. (2012). 'Suprascapular Nerve Block for the Treatment of Frozen Shoulder'. *Saudi Journal of Anaesthesia* 6 (1), 52-55.

Parris, W. C. (1990). 'Suprascapular Nerve Block: A Safer Technique'. *Anesthesiology* 72 (3), 580-581.

Paul, T. M., Hoo, J. S., Chae, J., & Wilson, R. D. (2012). Central hypersensitivity in patients with subacromial impingement syndrome. *Archives of physical medicine and rehabilitation*, *93*(12), 2206-2209.

Plummer-D'Amato, P. (2008a). 'Focus Group Methodology Part 1: Considerations for Design'. *International Journal of Therapy and Rehabilitation* 15 (2), 69.

Plummer-D'Amato, P. (2008b). 'Focus Group Methodology Part 2: Considerations for Analysis.'. *International Journal of Therapy &Rehabilitation* 15 (3).

Randelli, P., Arrigoni, P., Cabitza, F., Ragone, V., & Cabitza, P. (2012). Current practice in shoulder pathology: results of a web-based survey among a community of 1,084 orthopedic surgeons. *Knee Surgery, Sports Traumatology, Arthroscopy*, *20*(5), 803-815.

Redmond, R. and Curtis, E. (2009). 'Focus Groups: Principles and Process'*. Nurse Researcher* 16 (3), 57-69.

Roddy, E., Zwierska, I., Jordan, K. P., Dawes, P., Hider, S. L., Packham, J., ... & Hay, E. M. (2013). Musculoskeletal clinical assessment and treatment services at the primary-secondary care interface: an observational study. *Br J Gen Pract*, *63*(607), e141-e148.

Rorty, R. (1982). *Consequences of pragmatism: Essays, 1972-1980*. University of Minnesota Press.

Rothbart, P., Fiedler, K., Gale, G. D., Nussbaum, D., & Hendlerb, N. (2000). A descriptive study of 100 patients undergoing palliative nerve blocks for chronic intractable headache and neck ache. *Pain Research and Management*, *5*(4), 243-248.

Rowlingson, J. C. and Arasi, R. (1986). 'The use of Suprascapular Nerve Blocks in the Management of Shoulder Pain.'*. Regional Anesthesia and Pain Medicine* 11 (4), 156-159.

Salgia, A., Agarwal, T., Puri, S., Sanghi, S., and Mohapatra, A. (2014). 'Role of Suprascapular Nerve Block in Chronic Shoulder Pain: A Comparative Study of 60 Cases'*. Medical Journal of Dr.DY Patil University* 7 (1), 44.

Sanchis, M. N., Lluch, E., Nijs, J., Struyf, F., & Kangasperko, M. (2015). 'The role of central sensitization in shoulder pain: A systematic literature review'. *Seminars in arthritis and rheumatism* 44 (6), 710-716.

Saunders, S., & Longworth, S. (2006). *Injection Techniques in Orthopaedic and Sports Medicine: A Practical Manual for Doctors and Physiotherapists*. Elsevier Health Sciences.

Savin-Baden, M., & Major, C. H. (2013). *Qualitative research: The essential guide to theory and practice*. Routledge.

Schneider-Kolsky, M., Pike, J., and Connell, D. (2004). 'CT-Guided Suprascapular Nerve Blocks: A Pilot Study'*. Skeletal Radiology* 33 (5), 277-282.

Shanahan, E. M., Shanahan, K. R., Hill, C. L., Ahern, M. J., and Smith, M. D. (2012) 'Safety and Acceptability of Suprascapular Nerve Block in Rheumatology Patients'*. Clinical Rheumatology* 31 (1), 145-149.

Shanahan, E. M., Ahern, M., Smith, M., Wetherall, M., Bresnihan, B., and FitzGerald, O. (2003). 'Suprascapular Nerve Block (using Bupivacaine and Methylprednisolone Acetate) in Chronic Shoulder Pain'*. Annals of the Rheumatic Diseases* 62 (5), 400-406.

Shanahan, E. M., Smith, M. D., Wetherall, M., Lott, C. W., Slavotinek, J., FitzGerald, O., & Ahern, M. J. (2004). Suprascapular nerve block in chronic shoulder pain: are the radiologists better?. *Annals of the rheumatic diseases*, *63*(9), 1035-1040.

Shanthanna, H., Busse, J. W., Thabane, L., Paul, J., Couban, R., Choudhary, H., ... & Harsha, P. (2016). Local anesthetic injections with or without steroid for chronic non-cancer pain: a protocol for a systematic review and meta-analysis of randomized controlled trials. *Systematic reviews*, *5*(1), 18.

Shenton, A. K. (2004). Strategies for ensuring trustworthiness in qualitative research projects. *Education for information*, *22*(2), 63-75.

Smart, K. M., Blake, C., Staines, A., & Doody, C. (2011). The Discriminative validity of “nociceptive,”“peripheral neuropathic,” and “central sensitization” as mechanisms-based classifications of musculoskeletal pain. *The Clinical journal of pain*, *27*(8), 655-663.

Stewart, D. W., & Shamdasani, P. N. (2014). *Focus groups: Theory and practice* (Vol. 20). Sage publications.

Taskaynatan, M. A., Yilmaz, B., Ozgul, A., Yazicioglu, K., and Kalyon, T. A. (2005). 'Suprascapular Nerve Block Versus Steroid Injection for Non-Specific Shoulder Pain'*. The Tohoku Journal of Experimental Medicine* 205 (1), 19-25U.

Vardeh, D., Mannion, R. J., & Woolf, C. J. (2016). Toward a mechanism-based approach to pain diagnosis. *The Journal of Pain*, *17*(9), T50-T69.

Vecchio, P. C., Adebajo, A. O., and Hazleman, B. L. (1993.) 'Suprascapular Nerve Block for Persistent Rotator Cuff Lesions'*. The Journal of Rheumatology* 20 (3), 453-455.

Vecchio, P., Kavanagh, R., Hazleman, B. L., & King, R. H. (1995). Shoulder pain in a community-based rheumatology clinic. *Rheumatology*, *34*(5), 440-442.

Vorster, W., Lange, C. P., Briët, R. J., Labuschagne, B. C., du Toit, D. F., Muller, C. J., and de Beer, J. F. (2008). 'The Sensory Branch Distribution of the Suprascapular Nerve: An Anatomic Study'*. Journal of Shoulder and Elbow Surgery* 17 (3), 500-502.

Wahyuni, D. (2012). The research design maze: Understanding paradigms, cases, methods and methodologies. Journal of Applied Management Accounting Research, Vol. 10, No. 1, pp. 69-80.

Wertheim, H. and Rovenstine, E. (1941). 'Suprascapular Nerve Block'. *The Journal of the American Society of Anesthesiologists* 2 (5), 541-545.

Woolf, C. J. (2011). Central sensitization: implications for the diagnosis and treatment of pain. *Pain*, *152*(3), S2-S15.

Wu, Y. T., Ho, C. W., Chen, Y. L., Li, T. Y., Lee, K. C., & Chen, L. C. (2014). Ultrasound-guided pulsed radiofrequency stimulation of the suprascapular nerve for adhesive capsulitis: a prospective, randomized, controlled trial. *Anesthesia & Analgesia*, *119*(3), 686-692.

Yang Jr, J., Robbins, M., Reilly, J., Maerz, T., & Anderson, K. (2016). The clinical effect of a rotator cuff retear: A meta-analysis of arthroscopic single-row and double-row repairs.*The American Journal of Sports Medicine,*Vol 45, Issue 3, pp. 733 – 741.

Appendix 1: Literature search strategy

Data sources and search strategy

A literature search was conducted in March 2016. Articles listed in electronic databases AMED, CiNAHL, MEDLINE, Embase, were retrieved through accessing NHS Evidence, Journals and Databases. The Cochrane Library, Pedro and Scopus were also accessed online. Furthermore, both Academic Search Complete and SportDiscus were also accessed through Coventry University EBSCOhost. A web based search of Google scholar from 2012 onwards was also conducted to identify possible further studies. Reference lists of retrieved articles and reviews were also screened for studies that were not identified by the electronic search of the databases. The subject heading and key words; suprascapular nerve block(s) were used for the search terms within all text of articles.

Inclusion criteria

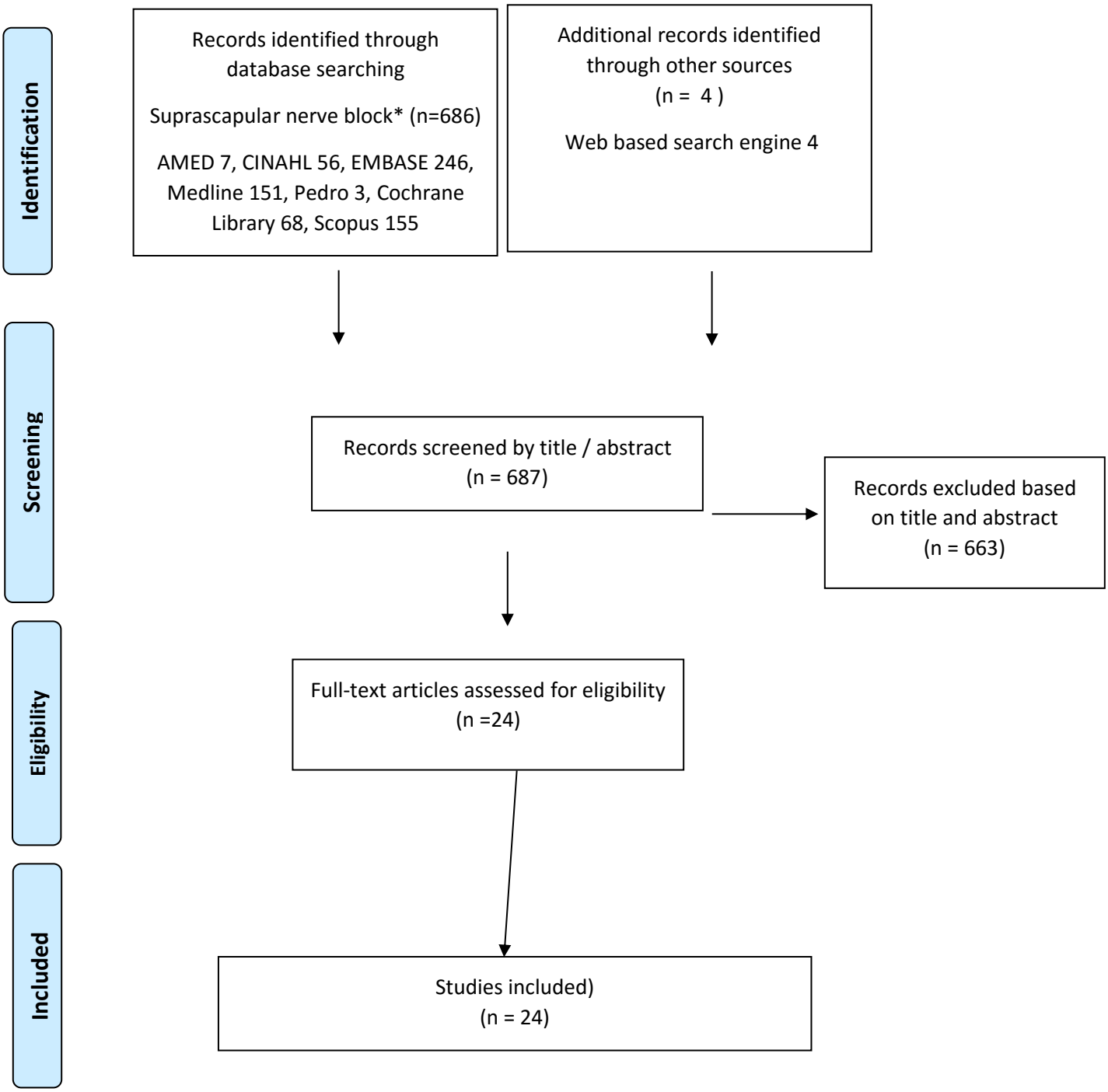
Both observational studies and randomised controlled trials (RCTs) of English language only were included in this review. Only studies that investigated the effectiveness of SSNB **injection** in the conservative management of **musculoskeletal** shoulder pain were included. Studies could investigate guided techniques such has CT, fluoroscopy, EMG and ultrasound or unguided approaches such has landmarked approaches. Study participants were required to be adults (over the age of 18 years) with a diagnosis of musculoskeletal shoulder pain. The diagnosis could be specific or non specific shoulder pain. Studies were required to report on at least one or more outcome measures of shoulder impairment, disability, pain or function.

Exclusion criteria

Studies not in English. Single case studies were not included. Studies looking at the effectiveness of SSNB injections in post surgery patients, in cancer related pain, post stroke shoulder pain, pain of cervical origin and neurological shoulder pain i.e. suprascapular neuropathy were not included. Studies looking at SSN denervation, the use of indwelling catheter for continuous nerve blockade and pulsed radiofrequency procedures were also not included.

Results

The initial electronic search of databases resulted in retrieval of 686 articles. Removal of duplicates from within each database reduced the number of articles by 3 to 683. These 683 articles along with the additional 4 other articles, retrieved through a web based search, were screened by title and abstract (n687). Of these 687, 663 articles were then excluded due to inappropriate subject, not meeting the inclusion criteria and being duplications not previously removed by the function within the database search platforms. The remaining 24 articles were then retrieved in full text for assessment of eligibility.


Identification
Screening
Eligibility
Included
Records identified through database searching
Suprascapular nerve block* (n=686)
AMED 7, CINAHL 56, EMBASE 246, Medline 151, Pedro 3, Cochrane Library 68, Scopus 155
Additional records identified through other sources (n = 4)
Web based search engine 4
Records screened by title / abstract (n = 687)
Records excluded based on title and abstract (n = 663)
Full-text articles assessed for eligibility (n =24)
Studies included) (n = 24)

Study Title	Subjects	Design	Outcome Measures	Findings
1.Mitra, P. K. and Bhattacharya, D. (2016) 'Comparison of Clinical Effects of Ultrasound Guided Suprascapular Nerve Block and Oral Pregabalin Versus Suprascapular Nerve Block Alone for Pain Relief in Frozen Shoulder'. *Indian Journal of Pain* 30 (1), 49	Frozen shoulder 8-9 mths n100 n50 each group. Age 50 M 38 F 62	RCT. US guided SSNB & oral pregabalin vs US guided SSNB alone. 3 SSNB injection 1 weeks apart. 40mg methylprednisolone & 9ml 0.25% Bupivacaine) 75mg Pregabalin @ night. Both gps HEP.	Pain (VAS) ROM Baseline, Weeks 4, 6 &12	Both gps ss improvements in pain and ROM @ 4, 6 & 12 weeks. ss additional benefit with pregabalin both OM @ week 4,6 & 12
2.Chansoria, M., Das, G., Mathankar, N., Chandar, D., Vyas, N., and Upadhyay, S. (2015) 'A Preliminary Study of a Novel Technique of Suprascapular Nerve Block in Treating Chronic Shoulder Pain'. *Indian Journal of Pain* 29 (2), 91	Chronic shoulder pain. Non-specific. onset 4/52 or more n40 Age 48 M30 F 10	Observational. 10ml 1% lidocaine % 40mg depomedrol SGN approach	Pain (VAS) SPADI Non validated pain score 1-4 Week 1& 4	ss improvements @ weeks 1 and 4 all outcome measures
3.Dorn, C., Rumpold-Seitlinger, G., Farzi, S., Auer, J., and Bornemann-Cimenti, H. (2015) 'The Effect of the Modified Lateral Suprascapular Block on Shoulder Function in Patients with Chronic Shoulder Pain'. *Anesthesiology and Pain Medicine* 5 (6), e31640	Chronic shoulder pain Imping 6 Cal tend 6 Rot cuff 6 Arthrosis 2 duration of Sx? n20 Age 52 M 9 F 11	Observational. One injection and observe. 5ml 0.5% ropivacaine. Indirect approach- Feigl.	CMS Pain NRS (VAS) @ rest and on mvt. 1hr and 24 hrs post injection.	All outcomes sig improvement to baseline at both 1hr and 24 hr.
4.Klc, Z., Filiz, M. B., Cakr, T., and Toraman, N. F. (2015) 'Addition of Suprascapular Nerve Block to a Physical Therapy Program Produces an Extra Benefit to Adhesive Capsulitis: A Randomized Controlled Trial'. *American Journal of Physical Medicine & Rehabilitation / Association of Academic Physiatrists* 94 (10 Suppl 1), 912-920	Frozen shoulder @ least 1 mth Duration of Sx unknown n41 SSNB + physio n19 Physio alone n22 Age 55 & 61 M 31 F 10	RCT. SSNB (followed by physiotherapy) Vs physiotherapy alone. Physiotherapy included 15 sessions. 5 days a week for 3 weeks. Hot packs, tens, US, manual therapy, Ex's, HEP. SSNB -ml prilocaine & 1ml triamcinolone) Approach unclear.	Pain (BPI-SF) CSS Baseline, 3 & 7 weeks.	Both gp's showed ss improvements in BPI-SF and CSS at 3 & 7 weeks compared to baseline.SSNB plus physiotherapy gp has ss greater improvement than physiotherapy alone in the CSS, and in 4 domains of the BPI-SF at week 3 and 3 domains of BPI-SF at 7 weeks. No difference in CSS between gps at 7 weeks.

5.Bayram, K., Bal, S., Safa Satoglu, I., Kocyigit, H., Gürgan, A., Akcay, S., and Kazimoglu, C. (2014) 'Does Suprascapular Nerve Block Improve Shoulder Disability in Impingement Syndrome? A Randomized Placebo-Controlled Study'. *Journal of Musculoskeletal Pain* 22 (2), 170-174	Impingement syndrome. Onset 3/12 or more. Avg duration 9 mths. n96 SSNB n51 Control n45 Age 53 M 69 F 27	RCT. 9ml 2% prilocaine & 40mg triamcinolone Vs Saline. Indirect approach.	Pain (VAS) CSS @ Baseline, 30 min, 2/52 & 3/12.	SSNB gp sig. improvement in pain and function @ 2/52 & 3/12.
6.El-Badawy, M. A. and Fathalla, M. M. (2014) 'Suprascapular Nerve Block Followed by Codman's Manipulation and Exercise in the Rehabilitation of Idiopathic Frozen Shoulder'. *Egyptian Rheumatology and Rehabilitation* 41 (4), 172	Frozen shoulder 4 weeks or more avg onset 7/12 n20 Age 52	Observational. SSNB injection followed by Codman exercises 15 minutes later. 9ml 0.5% bupivacaine 1ml 0.4% dexamethasone sodium phosphate. Indirect approach. Home exercises.	ROM SDQ score VAS at rest and mvt 1/52, 6/52 & 12/52	sig improvement in ROM weeks 1, 6 & 12. sig decrease in pain at rest weeks 1, 6 & 12. sig decrease in pain on mvt weeks 6 & 12. sig decrease in SDQ weeks 1, 6 & 12.
7.Salgia, A., Agarwal, T., Puri, S. R., Sanghi, S., and Mohapatra, A. (2014) 'Role of Suprascapular Nerve Block in Chronic Shoulder Pain: A Comparative Study of 60 Cases'. *Medical Journal of Dr.DY Patil University* 7 (1), 44	Chronic shoulder pain SS 22 FS 18 RA 4 RCT 10 AC 4 GHJ 2 3 mths or more	RCT. SSNB Vs saline. 10ml 0.5% bupivacaine & 40mg Depomedrone. Indirect approach. n60 n30 each gp. Age 50-51 M 31 F 29	Pain (VAS) ROM Baseline, day 2, 7, 21 & 3 mths.	ss improvement in both OM SSNB group to baseline all days. ss difference between gps all days. No improvement with saline.
8.Lotero, M. A. A., Díaz, R. C. R., Escobar, D. C., Aguilar, M. A. M., and Ramírez, S. M. M. (2013) 'Efficacy and Safety of Ultrasound-Guided Suprascapular Nerve Block in Patients with Chronic Shoulder Pain'. *Revista Colombiana De Anestesiologia* 41 (2), 104-108	Chronic shoulder pain More than 6 months (Rotator cuff,Non-specific OA, FS,Spasticity) n46 Age 55 M 10 F 36	Observational. 8ml 0.5% bupivacaine US guided	Pain (VAS) Baseline, 2 days, 1 month	Ss improvement in pain @ 2 days and 1 month

9.Ozkan, K., Ozcekic, A. N., Sarar, S., Cift, H., Ozkan, F. U., and Unay, K. (2012) 'Suprascapular Nerve Block for the Treatment of Frozen Shoulder'. *Saudi Journal of Anaesthesia* 6 (1), 52-55	Frozen shoulder (Diabetic patients who failed to improve with 3 LSI). Duration unknown n10 Age 56 M 2 F 8	Observational. 40mg methylprednisolone & 5ml 1& lidocaine. Fluoroscopic guidance. HEP.	Pain ROM Baseline, week 1, 4 & 12.	SS improvements all outcome measures to baseline.
10.Kang, S. S., Jung, J. W., Song, C. K., Yoon, Y. J., and Shin, K. M. (2012) 'A New Anterior Approach for Fluoroscopy-Guided Suprascapular Nerve Block-a Preliminary Report'. *The Korean Journal of Pain* 25 (3), 168-172	Chronic shoulder pain Imp 15 FS 3 CT 2 Duration of Sx unknown n20 Age 50 M 12 F 8	Observational. 2ml 1% mepivacaine Fluoroscopy guided	Pain (NRS) VAS 5 minutes after block.	Ss improved pain after block.
11.Shanahan EM (1), Shanahan KR, Hill CL, Ahern MJ, Smith MD. (2012) 'Safety and Acceptability of Suprascapular Nerve Block in Rheumatology Patients. '. *Clin Rheumatol* 31 (1), 145-9	Chronic shoulder pain (RA) RCD 105 GHJ 63 RA 28 FS 12 MND 6 Other 49 n289 (n1005 SSNBs) age 78 M 103 F 186	Case note observations / patient telephone interviews. Indirect approach. (10ml 0.5% bupivacaine 1 mg methylprednisolone)	Patient reported satisfaction and adverse effects.	6 adverse effects (3 transient dizziness, 2 transient arm weakness - hrs, 1 facial flushing) 80% patient satisfaction.
12.Gorthi, V., Moon, Y. L., and Kang, J. H. (2010) 'The Effectiveness of	Non-specific shoulder pain.	RCT. US guided SSNB Vs	Pain (VAS)	Both gps had ss improvements same

Ultrasonography-Guided Suprascapular Nerve Block for Perishoulder Pain'. *Orthopedics* 33 (4)	Non specific Duration Sx unknown n50 US n25 Unguided n25 Mean Age 51& 55 F 27 M 23	unguided SSNB. Approach for unguided unclear.US gp SS notch. 8ml 12.5% dextrose sol. & 2ml 0.2% lidocaine.	CSS Baseline, immediately after injection and 1/12	day and 1/12. SS difference between gps at 1/12 in favour of US gp.
13.Di Lorenzo, L., Pappagallo, M., Gimigliano, R., Palmieri, E., Saviano, E., Bello, A., Forte, A., DeBlasio, E., and Trombetti, C. (2006) 'Pain Relief in Early Rehabilitation of Rotator Cuff Tendinitis: Any Role for Indirect Suprascapular Nerve Block?'. *Europa Medicophysica* 42 (3), 195-204	Rotator cuff tendinitis Avg duration 4.5 weeks n40 gp 1 n20 gp 2 n20 Age 46 M 18 F 40	Randomised - crossover. gp1- Two SSNB injections 1 week apart, followed by physiotherapy. gp2- physiotherapy followed by two SSNB injections one week apart. 10ml 2% lidocaine diluted with 5-10ml saline. Indirect approach.	UCLA scale Pain (VAS) Self-reported scale. Baseline Pain daily. Disability day 28.	Gp1 had sig improvement in pain during physiotherapy session than gp2. gp1 reported better outcomes at 28 days but not sig.
14.Taskaynatan, M. A., Yilmaz, B., Ozgul, A., Yazicioglu, K., and Kalyon, T. A. (2005) 'Suprascapular Nerve Block Versus Steroid Injection for Non-Specific Shoulder Pain'. *The Tohoku Journal of Experimental Medicine* 205 (1), 19-25	Non-specific shoulder pain Sx duration range 7-16 mths n60 30 each gp. Age 52 M 23 F 37	RCT. SSNB Vs Subacromial injection. SSNB -Direct approach 10ml 1% lidocaine. SAI – 40mg depomedrol & 6ml 1% lidocaine anterior and lateral route.	Pain (VAS) ROM. Pennsylvania shoulder score. Within 5-7 days of injection and 1 month.	Both gps SS improvements from baseline all outcome measures. No ss difference between gp's.
15.Schneider-Kolsky, M., Pike, J., and Connell, D. (2004) 'CT-Guided Suprascapular Nerve Blocks: A Pilot Study'. *Skeletal Radiology* 33 (5), 277-282	Chronic shoulder pain. FS 10 RCT 12 Inflam 2 Trauma 5	Observational. CT guided SSNB 3ml Bupivacaine & 1ml Celestone Chronodose.	SPADI Baseline, immediately after, 3 days, 3 weeks, 6 weeks.	ss improvements in both pain day 3, 3 weeks and 6 weeks and disability domain of SPADI day 3 and 6 weeks.

	OA 2 Unknown 9 Duration mean 30 mths n40 Age 44 M16 F 24			
16.Dahan, T. H., Fortin, L., Pelletier, M., Petit, M., Vadeboncoeur, R., and Suissa, S. (2000) 'Double Blind Randomized Clinical Trial Examining the Efficacy of Bupivacaine Suprascapular Nerve Blocks in Frozen Shoulder'. *The Journal of Rheumatology* 27 (6), 1464-1469	Frozen Shoulder Onset 1/12 or more Avg duration 12 mths n34 SSNB n17 Control n17 Age 52 M 11 F 23	RCT. 3 injections @ 7 day intervals. 10ml 0.5% bupivacaine Vs Saline. Indirect approach. Both groups given shoulder exercises to complete at home.	MPQ PPI Pain (VAS) SST ROM @ Baseline & 1/12.	SSNB sig improvement in pain @ 1/12.
17. Emery, P., Bowman, S., Wedderburn, L., and Grahame, R. (1989) 'Suprascapular Nerve Block for Chronic Shoulder Pain in Rheumatoid Arthritis'. *BMJ (Clinical Research Ed.)* 299 (6707), 1079-1080	Bilateral chronic shoulder pain Non specific Duration unknown n17 34 shoulders SSNB n17 GHJ n17 Age 67 M 3 F 14	RCT. 1 shoulder receives sham GHJ injection the other active SSNB or 1 shoulder receives sham SSNB the other active GHJ injection. SSNB (2ml - 40mg methylprednisolone & 0.5% bupivacaine and adrenaline).	Pain (VAS). Stiffness (VAS). ROM. Pain index (modified Richie index). Baseline, week 1, 4 & 12.	SSNB gp sig improvement in pain week 1 & 4, with GHJ gp only week 1. Both SSNB and GHJ sig improvement in stiffness week 1 & 4. (12 patients felt SSNB more effective than IAI)

		Approach unknown. GHJ (2ml - 40mg methylprednisolone & 1% lidocaine).		
18. Gado, K. and Emery, P. (1993) 'Modified Suprascapular Nerve Block with Bupivacaine Alone Effectively Controls Chronic Shoulder Pain in Patients with Rheumatoid Arthritis'. *Annals of the Rheumatic Diseases* 52 (3), 215-218	Rheumatoid arthritis. Bilateral shoulder pain. Non specific Duration Sx unknown n29 58 shoulders SSNB n29 SSNB with P n29 Age 60 F20 M 9	RCT. (SSNB - LA with or without Steroid). 2ml 0.5% Bupivacaine Vs 2ml 0.5% Bupivacaine with 40mg Prednisolone. Worse shoulder randomised to treatment. Modified indirect and direct approach.	Pain (VAS) Stiffness (VAS) ROM Baseline, weeks 1,4 & 12	Sig improvements in pain & stiffness from baseline both groups @ weeks 1, 4 & 12. Variability in ROM but overall improvements both gps. No difference between gps. The addition of Prednisolone provide no further benefit.
19. Jones, D. S. and Chattopadhyay, C. (1999) 'Suprascapular Nerve Block for the Treatment of Frozen Shoulder in Primary Care: A Randomized Trial'. *The British Journal of General Practice : The Journal of the Royal College of General Practitioners* 49 (438), 39-41	Frozen shoulder Duration Sx unknown n30 SSNB n15 GHGJ n15 Age 53 & 60 M15 F 15	RCT. Single SSNB Vs GHJ injections. GHJ - 20mg triamcinolone & 4.5 ml 2% lidocaine. Avg. no of GHJ injections 2.2. SSNB - 20mg triamcinolone & 9.5ml 0.5% bupivacaine. Indirect approach. Shoulder ex's at home.	Pain score (not validated?) ROM Baseline, 1, 3, 7 & 12 weeks.	More complete resolution of Sx in SSNB gp. Stats ?
20. Shanahan, E. M., Smith, M. D., Wetherall, M., Lott, C. W., Slavotinek, J., FitzGerald, O., and Ahern, M. J. (2004) 'Suprascapular Nerve Block in Chronic Shoulder Pain: Are the Radiologists Better?'. *Annals of the Rheumatic Diseases* 63 (9), 1035-1040	Chronic shoulder pain No specified diagnosis Mean Duration of Sx 64 & 62 mths n67 (n77	RCT. CT guided vs non guided. CT – 3ml 0.5% bupivacaine & 40 mg methylprednisolone. Non- guided 10ml 0.5% bupivacaine & 40mg	SPADI Pain at night, pain at rest, pain on mvt. Weeks 1, 4 & 12	Both groups improved. ? ss No sig dif between gps.

	shoulders) age 75-76 M 38 F 39	methylprednisolone		
21. Shanahan, E. M., Ahern, M., Smith, M., Wetherall, M., Bresnihan, B., and FitzGerald, O. (2003) 'Suprascapular Nerve Block (using Bupivacaine and Methylprednisolone Acetate) in Chronic Shoulder Pain'. *Annals of the Rheumatic Diseases* 62 (5), 400-406	Chronic shoulder pan No specified Diagnosis Mean duration of Sx 146 & 119 mths n83 108 shoulders Age 73-74 M 56 F 52	RCT. SSNB Vs placebo (saline). 10ml 0.5% bupivacaine & 40mg Methylprednisolone. Indirect approach.	ROM. Pain (VAS) at rest, at night & on mvt. SPADI. SF-36. Week 1, 4 & 12.	ss improvements in all pain scores SSNB gp compared to baseline and to control at week 1, 4 & 12. Some ss improvement in ROM scores at week 1, 4 & 12 compared to control and baseline.
22. Karataş, G. K. and Meray, J. (2002) 'Suprascapular Nerve Block for Pain Relief in Adhesive Capsulitis: Comparison of 2 Different Techniques'. *Archives of Physical Medicine and Rehabilitation* 83 (5), 593-597	Frozen shoulder @ least 4 weeks Duration of Sx unknown n41unguided n22 EMG n19 Age 57 M16 F25	RCT. Unguided SSNB (indirect) Vs EMG guided SSNB. 10ml 1% lidocaine.	AROM PROM Pain on PROM (VAS) @ Baseline, 10 minutes & 60 minutes.	Both gps sig improvements in AROM, PROM & pain at 10 & 60 min. EMG block had a greater reduction in pain at 10 & 60 minutes - SS compared to unguided.
23. Vecchio, P. C., Adebajo, A. O., and Hazleman, B. L. (1993) 'Suprascapular Nerve Block for Persistent Rotator Cuff Lesions'. *The Journal of Rheumatology* 20 (3), 453-455	Rotator cuff tendinitis & tears. Mean duration of Sx (30 / 33) (48 /40) mths n28 tendinitis n15 tear n13 tendinitis SSNB n10 Vs	RCT. i. SSNB Vs placebo (saline) for tendinitis group. ii. SSNB Vs placebo (saline) for tear group. 40mg methylprednisolone & 1ml 0.5% bupivacaine.	Pain at night, pain on mvt, pain at rest (VAS). Presence of painful arc graded (0 no painful arc, 1 slight pain, 2 moderate pain and weakness, 3 severe pain and weakness). AROM. PROM. Weeks 1, 4 & 12	SSNB Tendinitis gp had ss improvement in night pain @ weeks 1, 4 & 12 compared to baseline. SSNB Tear gp Has ss improvement in night pain week 1 & 4 and ss improvement in pain on mvt week 1, 4 &12.

	tendinitis placebo n5 tear SSNB n5 Vs tear placebo n8 Age (54 / 47) (70 / 70) M13 F 15	2ml saline. Direct approach.		No between gp analysis.
24. Rowlingson and Arasi (1986) 'The use of Suprascapular Nerve Blocks in the Management of Shoulder Pain.'. *Regional Anesthesia* 11 (4), 156-159	Mixture of shoulder conditions Duration 1months -10 years n36 101 injections mean no. blocks per pt. 2.8 (1-20) age 56 M 16 F 20	Retrospective observational Both SSNB and SAI 6-7 ml 0.25% bupivacaine indirect approach	No OM	Positive outcome. No OM

Appendix 2: Ethics

Coventry University
Priory Street
Coventry CV1 5FB
Telephone 024 7688 7688

Prof Guy Daly
Dean of Faculty

Laura Strumidlo
Chair of Ethics Committee
Tel: (024) 7765 5831
Email: ethics.hls@coventry.ac.uk

9 February 2016

Dear Sir/Madam

Re: Ethical Approval – P38675

I am writing to confirm that **Neil Smith** has received ethical approval on 6 January 2016 for the research project: *A review of the effectiveness and current practice for suprascapular nerve block injections in the conservative management of shoulder pain*. Project end date 31/08/2016

The approval of a subsequent amendment to collect and report on anonymised participant professional profiles was granted on 5 February 2016.

The research project has addressed the main ethical issues appropriately, and has been approved by a member of the Faculty of Health & Life Sciences, Ethics and Governance Committee at Coventry University.

If you have any further queries please do not hesitate to contact me.

Yours sincerely

Laura Strumidlo

Faculty of Health & Life Sciences
Direct Line
Fax

www.coventry.ac.uk

Appendix 3: R&D approvals

Sandwell & West Birmingham Hospitals NHS
NHS Trust

RESEARCH AND DEVELOPMENT

K Rara, PhD, FRCP — R&D Director
J Bell , BSc, MSc, PhD — Head of R&D — (0121) 507 4811
Z Khalil BArch — RM&G Manager — (0121) 507 4092
C Phillips PgCert — RM&G Facilitator — (0121) 507 4946
B Baines BA (Hons) — Research Governance Co-ordinator — (0121) 507 4091
N Farooq-Iqbal BSc (Hons) — Research Governance Co-ordinator — (0121) 507 5529
Fax(0121) 507 5795

D46, Sheldon Block
City Hospital
Dudley Road
Birmingham
B18 7QH

JB/NF-I/R&D Ref: 16EDUC58

16 February 2016

Neil Smith
Physiotherapist
Sandwell Community Musculoskeletal Service & Community Orthopaedic Service

Dear Neil,

Study Title:	**A focus group exploring clinician views and experiences on the role of Suprascapular nerve block injections in the conservative management of shoulder pain**
University Ethics Ref:	**P38675**

Thank you for submitting your request to conduct this research in the Trust.

Conditions of Approval

I am pleased to inform you that the request is approved for the project you describe, and that your research can proceed subject to the following conditions:

1. That you keep an up to date and accurate record of your research in a study file, and that you make this file and other records available for audit by the Research and Development Office when requested.
2. That you inform the R&D office of any changes to the study, related documentation or study personnel.*
3. That you notify the R&D office of any serious adverse events arising from this research in accordance with Trust Procedure for safety reporting in research.*
4. That where the research continues for more that 1 year, you provide the R&D office with an annual report of your research progress, when approval will be reviewed.*
5. Recruitment will be monitored with the expectation that the first participant will be recruited within 30 days of this letter and the study will be delivered to time and target.

***Please send updates and documents to swbh.randd@nhs.net**

Documents approved by Research & Development Department

Documents	Version	Date
Protocol	1.1	27 January 2016
Participant Information Sheet	1.0	12 January 2016
Participant Consent Form	1.0	12 January 2016
Participant Profiles	1.1	26 January 2016
Topic Guide	1.2	01 February 2016
Evidence of Indemnity		04 August 2015
University Ethics Committee Favourable Opinion Letter		06 January 2016
University Ethics Committee Amendment Favourable Opinion Letter		09 February 2016

With best wishes for the success of this project.

Yours sincerely,

Jocelyn Bell

Dr Jocelyn Bell, BSc, MSc, PhD
Head of Research & Development

Appendix 4: Consent Form

A focus group exploring clinician views and experiences on the role of Suprascapular nerve block injections in the conservative management of shoulder pain.

Please initial box

1. I confirm that I have read the information sheet version 1.0 dated 12th January 2016 for the above study. I have had the opportunity to consider the information, ask questions and have had these answered satisfactorily. ☐

2. I understand that my participation is voluntary and that I am free to withdraw at any time without giving any reason. ☐

3. (If appropriate) I understand that the information collected about me will be used to support other research in the future, and may be shared anonymously with other researchers. ☐

4. I will respect the confidentiality of other research participants. ☐

5. I understand that the focus group session will be recorded for transcription. ☐

6. I agree to take part in the above study. ☐

_____	_____	_____
Name of Participant	Date	Signature
_____	_____	_____
Name of Person taking consent	Date	Signature

Appendix 5: Participant Information Sheet

Research Title: A focus group exploring clinician views and experiences on the role of Suprascapular nerve block injections in the conservative management of shoulder pain.

You are invited to take part in a study investigating the role of suprascapular nerve block (SSNB) injections in the conservation management of shoulder pain. The study is being undertaken by Neil Smith, Senior Physiotherapist, Sandwell and West Birmingham Hospitals NHS Trust within a NIHR MRes programme based at the University of Coventry.

1. What is the purpose of this study?

The purpose of this study is to explore the views, experiences and opinions of clinicians who currently undertake SSNB in the conservative management of shoulder pain in their clinical practice. The objectives are to identify and uncertainties in practice and areas where knowledge and research is lacking. The findings from the study may go on to inform future research in this area.

2. Why have I been invited to participate in this study?

You are invited to participate in this study because you are a clinician working in the NHS within the West Midlands and you currently administer SSNB in your clinical practice for the conservative management of shoulder pain.

3. What will the study involve?

If you agree to participate you will be asked to sign a consent form. The study will involve a Focus Group that will be held at City Hospital, Sandwell and West Birmingham Hospital NHS Trust at the beginning of February 2016. It is anticipated that the Focus Group will consist of between 6-10 participants from a variety of professional backgrounds such as Pain Consultants, Shoulder Surgeon, Rheumatologists, Nurses and Physiotherapists. The group will run for approximately 1-2 hour. The session will be run by Neil Smith, Jo Perry (Coventry University) and Ann Green (Coventry University). In the focus group session you will be asked questions by the facilitator (JP) relating to your clinical practice of treating patients with SSNB. You will be encouraged to discuss responses and themes within the group. The sessions will be recorded for transcription data analysis.

4. Are there any risks to me taking part?

There are no expected risks to taking part in this study.

5. How is the study being paid for?

The study is being funded by the NIHR. Part of an MRes project at Coventry University

6. Will I be paid?

There will be no payment for taking part in this study?

7. Do I have to take part in this study?

Taking part in this study is completely voluntary and you can withdraw from the study at any time. However once the data is collected and stored, any data that you have provided will not be able to be withdrawn.

8. Can I be identified in the study?

No. Any information you provide in the focus group will be collected in a de-identified form. The data will be stored on an encrypted USB. After completion of the study all data will be stored for 5 years and then destroyed.

9. What happens to the results?

The results will be analysed and presented in an academic report within a Thesis of the authors MRes. The findings may also be published in a scientific journal and may also be presented at a professional conference.

10. Who should I contact if I would like to know more about this study?

If you would like to know more about this study at any stage please contact Neil Smith at neilsmith2@nhs.net

Appendix 6: Email to potential participants

Dear all, many thanks for previously indicating that you would be interested in taking part in my NIHR funded research - a clinician focus group looking at the role of suprascapular nerve block injections in the conservative management of shoulder pain. I just received NHS ethically approval yesterday to start recruiting participants for the focus group session. I have attached the participating information leaflet (PIL) for your information.

The focus group will only include clinicians, no patients are involved. I have 3 provisional dates so far for the session: Tuesday 12th April, Monday 18th April and Thursday 21st April, times to be confirmed but probably late afternoon due to clinical commitments. (Please ignore the dates on the attached PIL).

I hope to get representation from all the professional groups undertaking SSNB injections - so your input would be very much appreciated if you are free to attend.

This initial research will lead onto an application for NIHR funding to undertake a larger clinical study.

Please let me know if you can make any of the dates or wish to have any further information. I am also very happy to come and talk to people individually to explain in more detail.

Kind Regards

Neil Smith
Physiotherapist
Sandwell Community Musculoskeletal Service & Community Orthopaedic Service
Sandwell & West Birmingham Hospitals NHS Trust

Appendix 7: Focus Group Topic Guide:

Clinician views / experiences on the role of SSNB injections in the conservative management of shoulder pain

Overview and background to research:

You are invited to this focus group as we would like you to share your views and experiences of the use and role of SSNB in the conservative management of shoulder pain.

Ground rules - confidentiality and respect, relaxed environment with discussion.

The session will be recorded and later transcribed. Key themes will be identified from the transcript and will be returned for your verification prior to writing up the full report.

Each participant introduces themselves and their professional role.

Topic Guide:

1. **From your experience could you explain how you would decide which patients with shoulder pain receive a SSNB injection.**

   Diagnostic criteria- (subacromial pain, frozen shoulder, rotator cuff tears).

   Does duration or severity of symptoms / pain form part of the decision making process.

   Do you have any concerns with other shoulder injections that influences your decisions to consider a SSNB.

   Are there any age restrictions.

   If they have failed other treatments does this influence your decision.

   If a patient is awaiting surgery would you consider a SSNB.

2. **Once you've decided that a patient is appropriate for consideration of a SSNB injection what normally happens next?**

   Consent.

   Patient information.

   Discussion of risks & contraindications.

   Advise following injection given.

3. **Could you describe what's involved when you perform a SSNB injection?**

   How do you perform the procedure? Patient position / injection approach / medication used.
   Positioning patient.

   Land marked or ultrasound guided injection.

   Techniques / aseptic.

   Drugs, dosages, volumes.

   Aftercare advise.

4. **How do you know if the injection has helped?**

   Follow up.

   Outcome measures.

   Audit.

5. **Do you give your patients any advice following the injection? If so what?**
   Rest.
   Exercise.
   Potential adverse effects.
   Wait after injection.
   What to do if concerned.
   How often would you repeat a SSNB injection.

6. **Do you teach any shoulder exercises or refer to any other services after the injection?**

   Physiotherapy referral. Where. Concerns regarding delays.

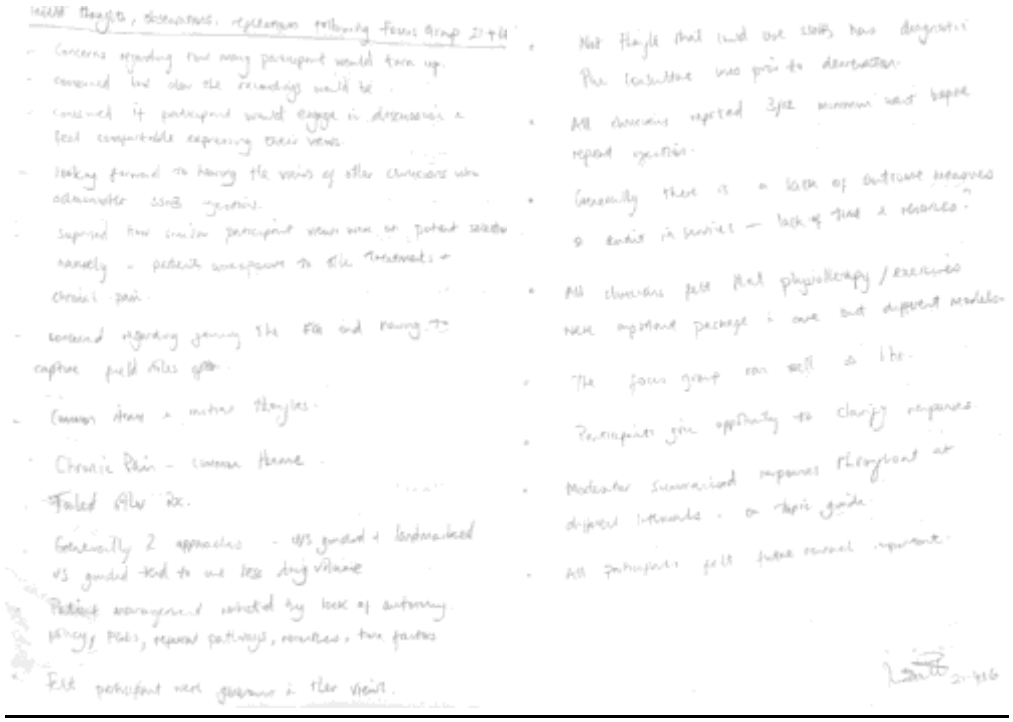
   When to start exercises.

7. **Do you feel research is needed to answer any uncertainties or gaps in knowledge regarding SSNB injections?**

   What kind of research would help in the future?

   Would further research help you decide which patients would benefit from a SSNB rather than subacromial injection / glenohumeral joint injection.

Appendix 8: Field notes.



Appendix 9: Email to moderator to verify field notes

Hi Jo
I have attached the paper notes / reflection that I made immediately after the focus group session. On reflection I think it would be useful for you to quickly review my notes to verify if you feel they accurately capture the focus group. Any comments are very welcome as I can put these in analysis section for triangulation etc.

thanks
neil

Hello Neil,
Yes, these seem to capture the pre-, peri- and post-event reflections.
I would agree that all the participants were very generous with their own experiences and reflections on the subject matter discussed
Regards,
Jo

Appendix 10: Data analysis coding strategy

Transcription	1. The data have been transcribed to an appropriate level of detail, and the transcripts have been checked against digital recording for accuracy
Coding	2. Each data item has been given equal attention in the coding process. 3. Themes have not been generated from a few vivid examples (an anecdotal approach), but instead the coding process has been thorough, inclusive and comprehensive. 4. All relevant extracts for each theme have been collated. 5. Themes have been checked against each other and back to the original data set. 6. Themes are internally coherent, consistent and distinctive.
Analysis	7. Data have been analysed – interpreted, made sense of – rather than just paraphrased or described. 8. Analysis and data match each other – the extracts illustrate the analytic claims. 9. Analysis tells a convincing and well-organised story about the data and topic. 10. A good balance between analytic narrative

	and illustrative extracts is provided.
Overall	11. Enough time has been allocated to complete all phases of the analysis adequately, without rushing a phase or giving it a once –over-lightly.
Written report	12. The assumptions about, and specific approach to, thematic analysis are clearly explicated. 13. 13. There is a good fit between what you claim you do, and what you show you have done – i.e., described method and reported analysis are consistent. 14. The Language and concepts used in the report are consistent with the epistemological position of the analysis. 15. 15. The researcher is positioned as active in the research process; themes do not just 'emerge'.

Table. 15-point checklist of criteria for good thematic analysis (Braun and Clarke 2006)

Detailed description of the data analysis process

Phase 1: Familiarising yourself with your data.

I read the transcript several times and checked for accuracy against the digital recording file. I made amendments were made to the transcript document due to transcription errors with transcriber misinterpretation of certain words of medical terminology; for example, the transcriber had written ‘innovation’ instead of ‘denervation’ and this was corrected.

The transcript was then re-formatted to facilitate the data analysis process. The margins of the word document were widened to enable codes to be captured next to the specific text that they related to. Line numbers were also added so that during later analysis, codes could be traced back to the transcript, that would provide context for the coded text in relation to the wider discussions it was taken from.

The returned original transcript had also been formatted by the transcriber with labels identifying the moderator text with Q (presumably for question) and participants text labelled A (presumably for answers).

From listening to the recording and verifying against the transcript document I was able to change these labels from Q to M for the moderator and from A to P1, for participant one, P2 for participant two, P3 for participant three, P4 for participant four and P5 for participant five, for the individual participant responses and comments respectively throughout the transcript. This process was implemented to facilitate the data analysis process and it was also felt that labelling the responses

in this way would maintain anonymity of the participants if transcripts were ever viewed by people outside of the research team at a later date.

Phase 2: Generating initial codes.

This phase involved me highlighting sections of text that I felt was important, recurring, interesting and / or relevant to the purpose, aims and objectives of the study. The highlighted text was given a descriptive ‘code’ in the right hand margin of the transcript (appendix). The original text and descriptive codes were colour coded with a highlighter pen to support the data extraction and collating process. Text and codes with similar meaning were all colour coded the same colour. I started this process from the beginning of the transcript and adopted the same systematic approach throughout the text.

Once this process was complete for a given code, the transcript was re-read from the beginning and the whole process repeated for the next different set of codes. This process was then repeated again and again until the whole document had been coded.

At times it was apparent that a section of text, that had previously been coded, also appeared to align with another new set of codes. If this the text was given a second code and colour.

Once the coding process was complete the codes and associated text were collated in tables (appendix). Codes of the same colour i.e. codes that had similar meanings or were related in some way, were grouped together in the table. In addition, line numbers relating back to the original text were included in the table

next to the codes to identify from where the code originated in the original transcript so to understand and appreciate the context of the code in relation to the original discussion taking place.

At the end of phase 2, five different groups had initially be identified, collated and tabulated. At this stage these groups were not yet given a heading name or potential theme name.

Phase 3: Searching for themes.

This phase of the data analysis process involved reviewing the five groups of codes and text with the objective of identifying potential themes. The codes were reviewed in relation to the transcript to provide context. This process was simplified by the line numbers as the code could be traced back to the transcript easily. At this point potential themes were generated and the groups of codes were given potential theme names.

Phase 4: Reviewing themes.

The grouped codes and text were then considered along with all the data items i.e.

the field notes, notes made whilst initially listening to the digital recording, the transcription document and the digital recording. In essence four data sets were used for triangulation. This combined approach of reviewing multiple sets of data was adopted to triangulate the data that was captured in different ways and at different times.

During this process, codes were further analysed and regrouped under potential themes. On reflection this process was very time consuming and challenging.

I continually deliberated on which codes fit under which potential theme. I moved backwards and forwards across the different data sets to gain a deeper appreciation of the context of the text and code within the wider discussions.

At the end of phase 4, I had identified five potential themes. A thematic map of the themes was now produced.

Phase 5: Defining and naming themes.

At this stage two meetings were arranged with two different members of my academic supervision team. (AG & JP). JP was also the focus group moderator.

The meeting with JP involved discussion of the process of theme construction and displaying themes.The meeting with AG involved collaboration and verification on themes. (AG) who had constructed themes independently to the researcher. This collaborative analysis allowed the researcher and the co-researcher to discuss and re-analyse the codes together to identify three main themes.

Phase 6: Producing the report.

This phase involved relating back the analysis to the research question and literature, producing the thesis document]

<u>Refection:</u>

In reality the data analysis process started much earlier than reading the transcript document. It could be argued that the analysis process started immediately after

the focus group session when documenting initial thoughts and reflections, or it could even be argued that some initial subconscious analysis took place during the focus group session itself, whilst contributing to the discussions with other participants.

The process of checking the transcript accuracy and reformatting the transcript to facilitate data analysis meant I had to read and re-read and listen and re-listen to the data several times. Although not necessarily regarded as data analysis directly the process of re-reading and re-listening meant that I became extremely familiarised and immersed within the data so that at a subconscious level data analysis was automatically taking place.

Coding strategy:

From re-reading the transcript over and over again, it also became apparent, that although text with similar content, tended to be grouped closely together in the transcript, that were based on and in response to the previous moderator question; this was not always the case. Throughout the transcript sections of text appeared, where the content was not directly related to the previous moderator question.

Although participants tended to respond to questions with related responses, at times they also expressed views and experiences unrelated to the immediate question or their initial responses led them and others onto new areas and topics of discussion. This observation required me to adopt a process and strategy for coding similar and related text throughout the transcript, in a systematic manner.

Without this systematic approach important data extracts and information may have been missed and omitted.

Appendix 11: Collated data and codes table

Line No.	Text	Descriptor / code
		Patient Selection?
4	Evaluation	Assessment
4,21	Examined	Assessment
7,8,10	Divide up pathologies Inflammatory /Mechanical problem Osteoarthritis / rotator cuff disease/ frozen shoulder	Clinician existing knowledge
12,13,14,24,45,47,82,92,98,124, 170,179,182,213,264	Failed to respond to other treatment modalities	Failed other treatments / no other options
22,23,66,101,152,176,178	Duration of pain & symptoms	Duration of pain / Sx
32,47,52,82,99,265,270	Unsuitable for surgery	No other options
36	Tried everything else	No other options
	Specific referral for SSNB	

44,66,69,72		Direct referral
51	Does not want surgery	Patient choice
60	Try injection before surgery	Diagnosis
95	Previous literature indicated chronic pain	Evidence
118,122	SSNB Less risks to rotator cuff	Best option?
150	Try subacromial injection in subacromial pain	Assessment?
291	No specific diagnostic criteria	Evaluation
359	Repeat injection	Previously helped
Line No.	Text	Descriptor / code
		Patient Management
28, 367, 683	Ref for phyio ex's after may have physio after	Adjunct treatment

216	May facilitate physiotherapy	Adjunct
282, 663	Diagnostic for denervation	Diagnostic - Pathways / Repeat injection / resources Benefit 3 mths
358, 359, 364,368,376 , 379, 383-406	Last up to 3 months? Pathways variable,	
373	Happy to continue on with ex's own	Self management
541, 555	Collecting outcomes, Resources	Ltd resources - Pathways
640 -655,676-695	Teach ex's after SSNB, Phsyio 3/12 gap between injections	Adjuct Rx, window of opportunity. Realise the benefit of the injection Benefit 3/12 Evidence / normal practice / pathways

657		Trust because of expertise?
77	because I can scan?	Communication / risk management
190-204,211-217, 227, 241, 310, 326,346, 583-634	Talk through procedure, benefit & risks, informed consent, practice, patient advice	
Line No.	Text	Descriptor / code
		The process / Intervention(SSNB)
38	Last choice	Intervention
70	PGD	Limits autonomy / restrictions
128	Pneumothorax	Risks
134,139	Inject artery / vein	Risks
190-204,211-217, 227, 241, 310, 326,346, 583-634	Talk through procedure, benefit & risks, informed consent, practice, patient advice	Communication / risk management
205,218,231	Landmarked	Technique / approach
224,230	Seated	Approach / position

242,355	Ultrasound	Approach / technique / risk management
330	Patient information	Communication / risk management
412, 441, 452	Drugs, volumes	Variable drugs, volumes, based on training, PGD, US vs landmarked
414,420	LA or LA + Depo	Evidence vs practice
430-440, 459-495, 501	U/S less volume	Safety vs effectiveness?
Line No.	Text	Descriptor / code
		Effectiveness/ outcomes?
512,653	Immediate response - less Sx	Patient reported - at rest / on movement? validated OM?
520	Specific outcome measures SPADI / Quick DASH	PROM / Effectiveness

533, 569 569	Ltd resources for OM Audit	Effectiveness. Pathways Resources
Line No.	Text	Descriptor / code
		Future Research?
704-715 716 721 732, 743 740, 768	Measuring effectiveness? LA alone Knowledge and understanding pain physiology Effective before chronic pain established Can we be more selective regarding pathologies or any shoulder condition. Compare to existing treatment i.e. SAI. Adjunct treatments SSNB + physio	Link to patient management / effectiveness Safety Basic science research / education of staff? Patient selection Patient selection Comparative Treatment

776-793 795	New drug delivery methods	Adjunct Rx. Novel ideas

Appendix 12: Thematic maps

Appendix 13: Email participant verification of themes

On Wed, May 25, 2016 at 2:00 AM -0700, "Smith Neil (SANDWELL AND WEST BIRMINGHAM HOSPITALS NHS TRUST)" <neilsmith2@nhs.net> wrote:

Hi all, thank you again for participating in my focus group on the role of SSNB injection in the non-surgical management of shoulder pain. I am currently busy writing up the findings for the 10th June!
We discussed that I would send you the themes that came out of the focus group for verification.
3 main themes were identified please let me know if you feel this was accurate representation of your view and experinces.

'Patient Selection'
2 main observations were, generally patients have 'failed other treatments' and have 'long standing shoulder pain' often several months or more. Other important factors considered were SSNB injection previously helped, direct referral for a SSNB injection, unsuitable for surgery, doesn't want surgery and risk of repeat local steroid injection.

'The Intervention'
Both surface landmarked and ultrasound guided approaches are used. Clinicians that use ultrasound guided approaches use less drug volume and have more confidence mitigating potential risks of undertaking SSNB injections due to needle positioning and placement accuracy afforded by ultrasound guided techniques. The major risks discussed were injury to the SSN and artery, injection of bolus into the artery, pneumothrorax, depigmentation, and infection.

'Patient Management'
Physiotherapy and shoulder exercises were viewed has an integral part of the overall patient management.
Clinicians felt that it was appropriate to repeat SSNB injections at a minimum 3 month intervals and repeat injections could be ongoing if seen to be beneficial to the patient.
If the relief provided by a SSNB injection was short lived consideration for a SSN denervation procedure is considered for some patients.
Outcome measures and clinical audit data are not routinely collected by the clinicians with the exception of one clinician who reports the regular use of the Disabilities of the Arm, Shoulder and Hand (DASH) and the Shoulder Pain and Disability Index (SPADI) outcome measures with SSNB injections.

Future research

- Identifying if SSNB injections were as effective as local steroid injection in specific shoulder conditions such as subacromial pain.
- If SSNB injections are effective in patients with less established chronic pain.
- Whether SSNB injections add further value if combined with other injections and procedures such has combining with hydrodistension for frozen shoulder.
- New methods of delivery of drug to the SSN such as lidocaine patches & long lasting LA
- Continued research to furthering our understanding of the basic science of Pain and specifically our understanding on how a SSNB injection could improve symptoms beyond the pharmacological effect of the drug used.
- Clinicians identified research establishing the value and benefit of combining SSNB injections with physiotherapy intervention
- Adding a SSNB injection to other injection therapy procedures as important areas that needs investigating.

Kind Regards

Neil Smith
Physiotherapist

Thank you Neil. It is probably a true representation of what we discussed.
Dr A T Arasu Rayen DA (Ind), DA (UK), FRCA, FFPMRCA, MSc (Pain Management), Cert Med Edu, FHEA
Consultant in Pain Management and Anaesthetics

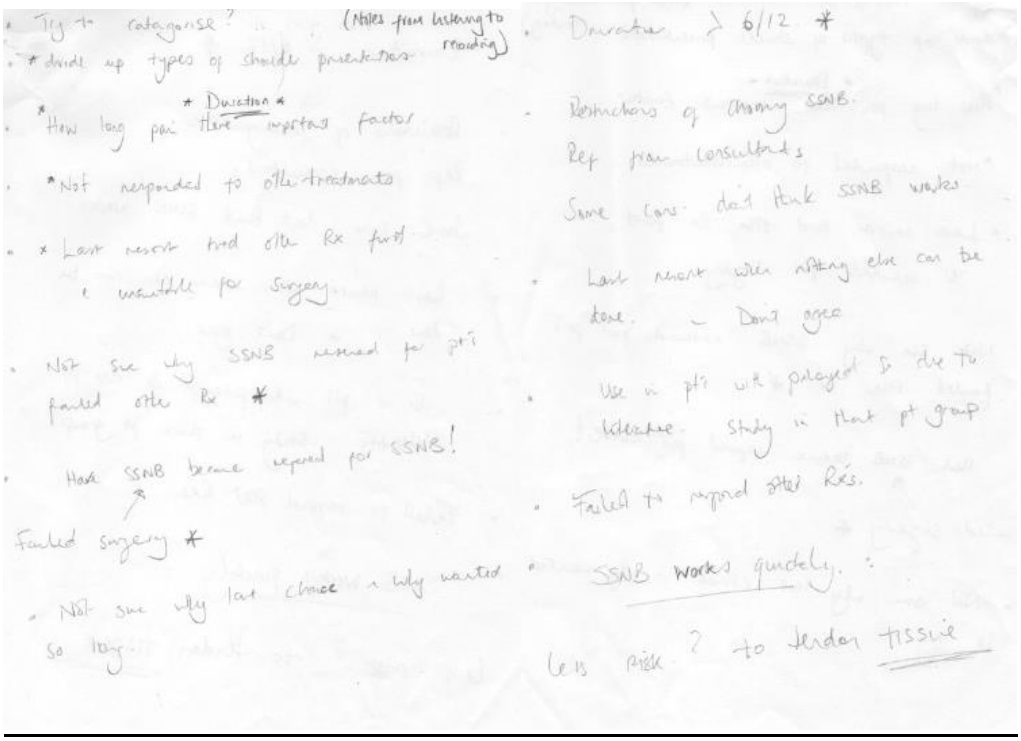
Hi Neil,

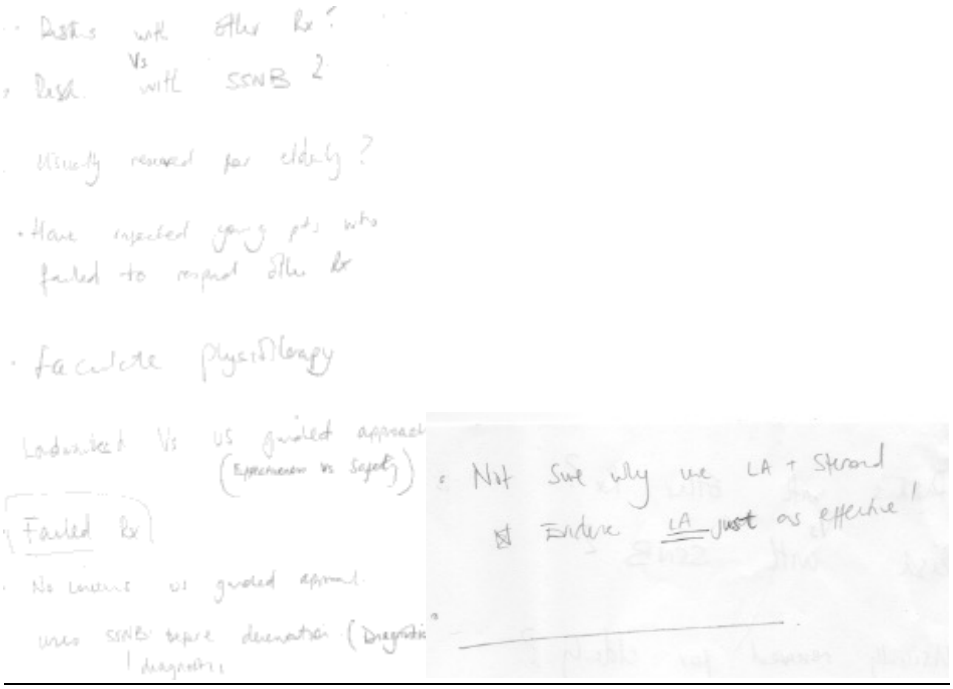
Thank you so much sending out the collected data. I think you have added almost all the points that we discussed on that day.

Thanks

Binu

Appendix 14: Notes made from listening to recording





Appendix 15: The transcript example

FOCUS GROUP MEETING

TRANSCRIBED ON BEHALF OF
NEIL SMITH
FOR
SANDWELL MUSCULOSKELETAL & ORTHOPAEDIC SERVICE

SUBJECT
SUPRASCAPULAR NERVE BLOCK INJECTION

DATE TRANSCRIBED
26/04/2016

NUMBER OF PEOPLE IN GROUP
SEVERAL

TRANSCRIPT STYLE
INTELLIGENT VERBATIM

DURATION
55 MINS

TRANSCRIPTIONIST - LESLEY NASH

THOSE PRESENT:	**IDENTIFIED AS:**
Questions by Facilitator	**Q**
Answers from Participants	**A**

Q Right then we will start off with question one. So from your experience, can you explain how you would decide which patients with shoulder pain were seen for a suprascapular nerve block injection?

A Personally when I've evaluated the patients clinically, I've obviously examined their shoulder and I've first established what I feel the anatomical or the explanation for what their shoulder is and I would personally divide up my pathologies into inflammatory problems that are I think amenable to a different type of approach which is a steroid injection or a mechanical problem that needs further investigation and then the mechanical problem has failed to respond to other modalities and that could be osteoarthritis or it could be severe rotated cuff disease where there's no surgical option for, or it could be a severe capsulitis of the shoulder or a frozen shoulder that hasn't responded to other therapies and if it falls into any of those categories, I would then consider them for a suprascapular nerve block, it would be a pain relieving procedure.

Q That's your core decision making then?

A Yes.

Q Another?

A So it was a similar situation probably by assessing the patient and how far the pain is there, that is one of the important facts and if it has been there for ages and not responded for physiotherapy, previous injections, manipulations and if they are still in pain and then after going through all the investigation procedures, other things that can be ruled out like **01:54**. In that case I'd consider a nerve block injection. That's mainly for pain relief as well as to improve the functions and then refer them for further physiotherapy, other exercises.

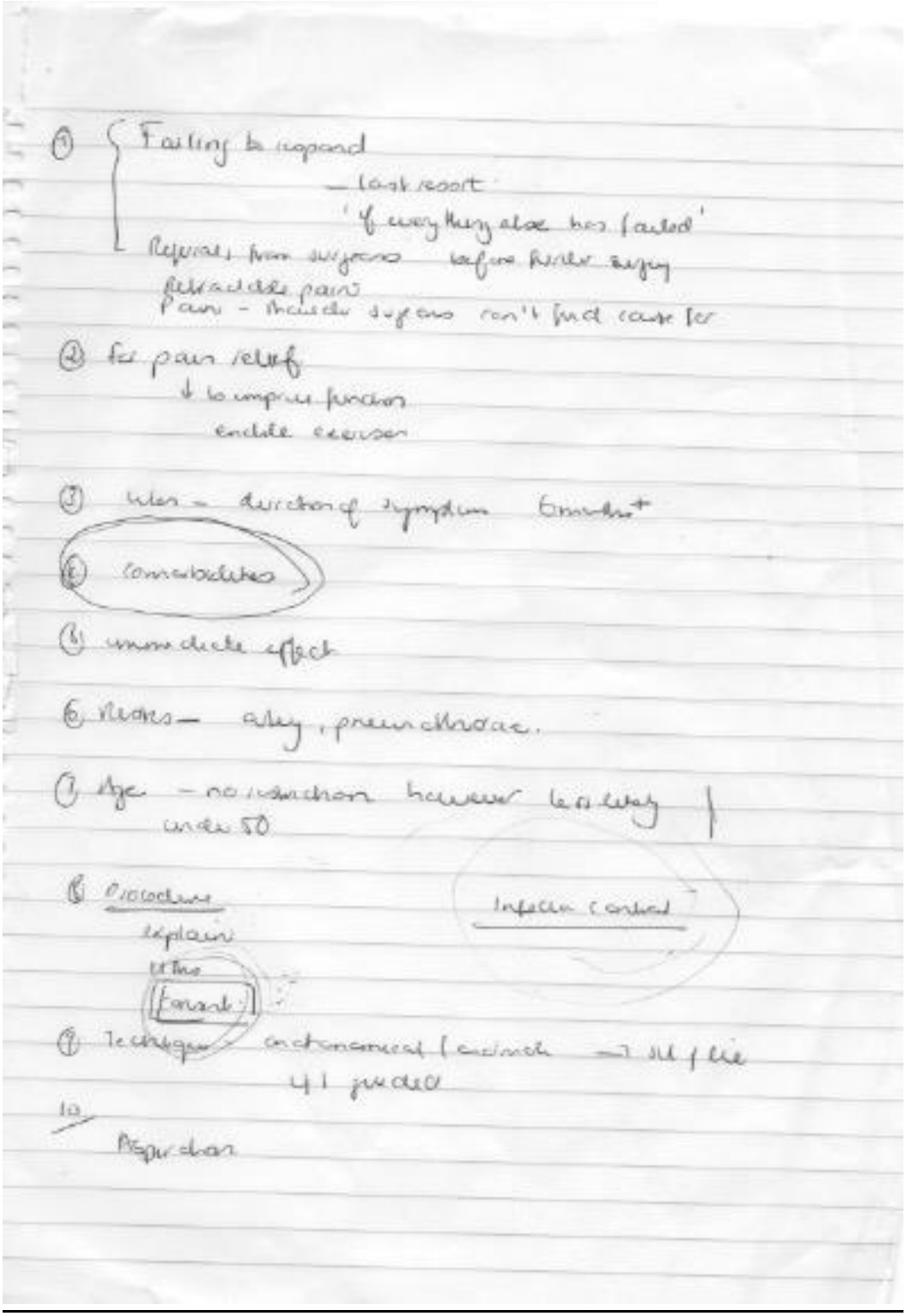
A We tend to use it as almost like an injection of last resort, particularly in the patients that have comorbidities which means they are unsuitable for surgery, so we will try suprascapular nerve block if everything else has failed.

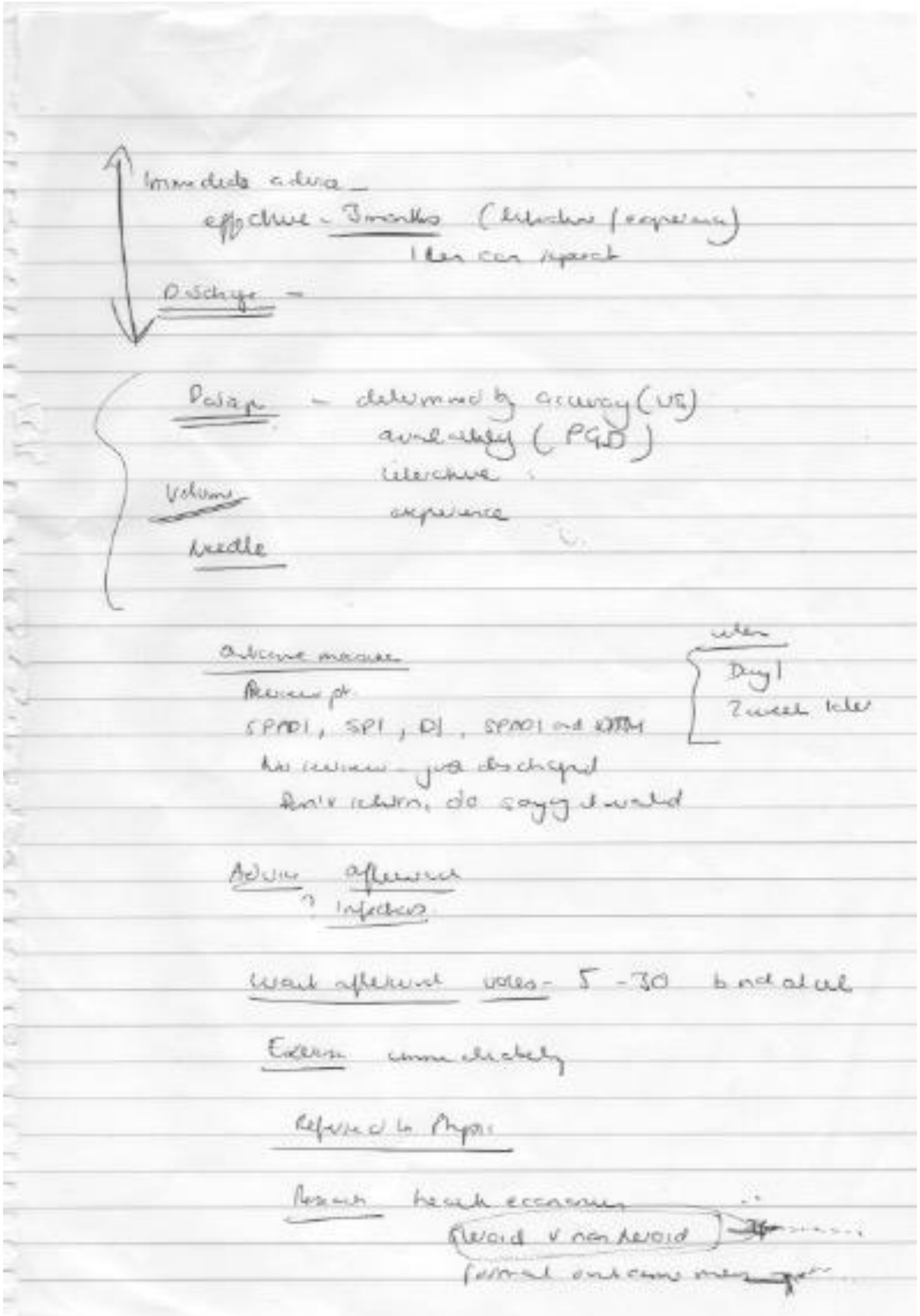
Q Right that's interesting, what about you?

A Yes I think I'm in a similar position that the majority of patients I've chosen to have a nerve block have almost tried everything else first, but when I reflect on that I don't know why that is the case because I don't know why it needs to be the last choice. In my practice I've often questioned myself why I haven't offered them a

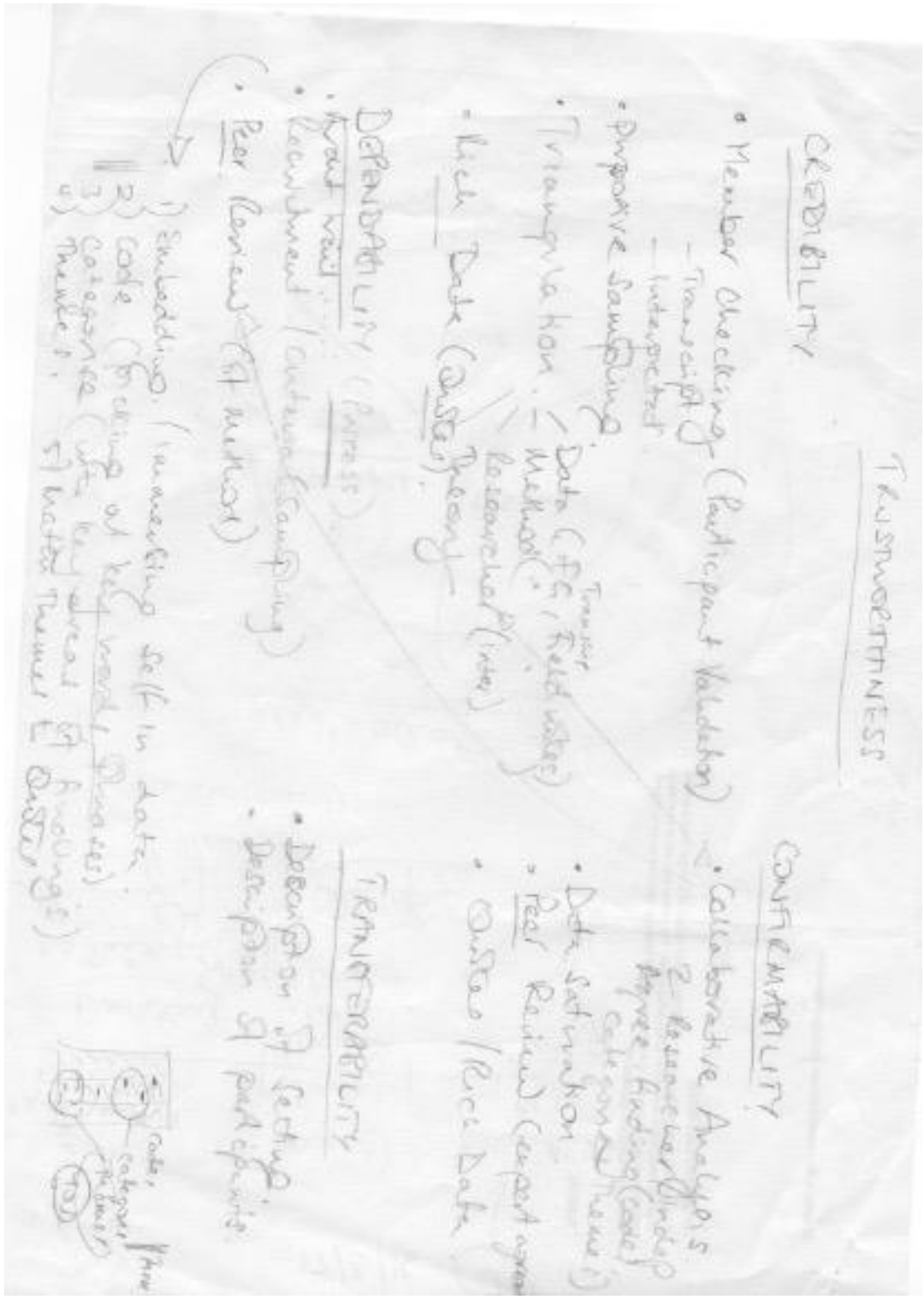
suprascapular nerve block before, a intraarticular or subacromial injection and I don’t know why.

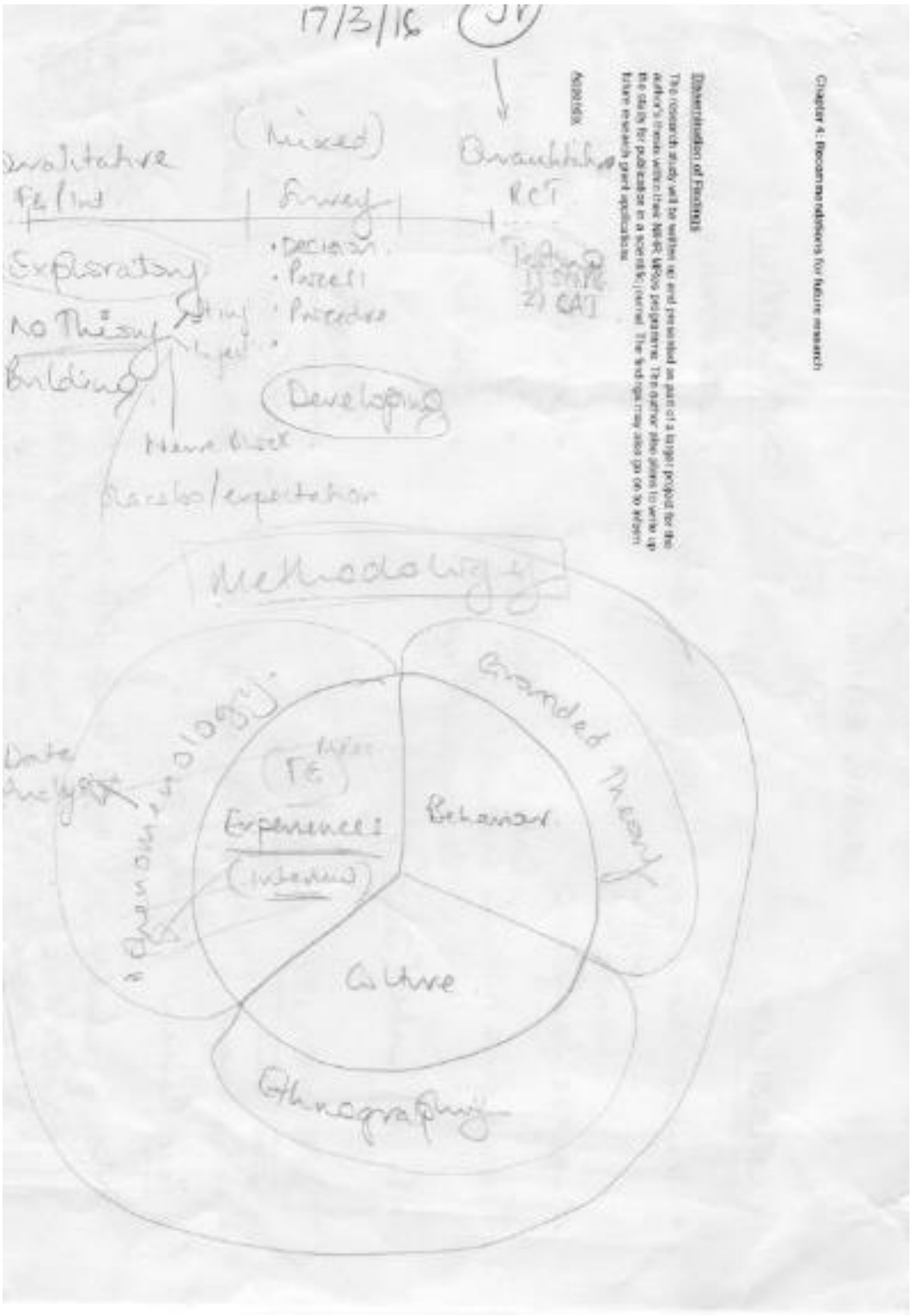
Appendix 16: Collaboration on themes (AG)




Immediate advice _
effective - 3 months (literature / experience)
less can repeat
Discharge -
Design - determined by accuracy (US)
availability (PGD)
literature
Volume
experience
Needle
Outcome measure
when
Day 1
2 week later
Review pt
SPADI, SPI, DI, SPADI and [illegible]
No review - just discharged
Don't return, do saying it worked
Advice afterward
? Infection
Wait afterward [illegible] - 5 - 30 [illegible]
Exercise immediately
Referred to Physio
Research health economics
Steroid v non steroid
formal outcome measure [illegible]

Appendix 17: Trustworthiness / Methodology / Data display (JP)





Chapter 4: Recommendations for future research

Dissemination of Findings

This research study will be written up and presented as part of a larger project for the author's thesis within the NHS Widening Participation Strategy. The author also aims to write up the study for publication in a scientific journal. The findings may also go on to inform future research grant applications.