

EDUCATION ARTICLE

Ultrasound guided musculoskeletal interventions: professional opportunities, challenges and the future of injection therapy

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Abstract

The demand for ultrasound guided injections for musculoskeletal presentations has increased in recent years as practitioners and patients seek verification of needle position. Musculoskeletal management pathways regularly include injection therapy for pain relief and are sometimes indicated as a single intervention but may need to be supported by rehabilitation. Workload in radiology departments has expanded in volume and complexity as radiologists perform new interventional procedures that require medical expertise. Innovative responses are required to meet the demand for ultrasound guided musculoskeletal injections; one option is offering appropriate education to musculoskeletal sonographers, enabling them to extend their current scope of practice. The role of the extended scope physiotherapist in the United Kingdom provides evidence that role diversification can produce excellent patient outcomes whilst preserving financial resources. The professional, legal and clinical requirements of extending service provision to include new clinical staff presents challenges that have to be met with strong leadership and the provision of high quality education in ultrasound guided interventions. There are many indicators that the patient experience is enhanced by guiding musculoskeletal injections, and access to this service has impact on patients' confidence in their treatment pathway.

Ultrasound guided musculoskeletal interventions

Injection therapy for intra and extra-articular structures is one of the principal medical treatments available for musculoskeletal pain and has been a regular component of rheumatology, orthopaedic and general practice for the last 50 years.^{1–3} This discussion paper aims to present the demand for musculoskeletal injections, specifically those delivered under ultrasound guidance, and review some responses in the United Kingdom (UK) to this increasing workload. Role diversification has been employed successfully in the UK, enabling non-medical practitioners to perform ultrasound guided musculoskeletal injections; this paper explores the complex professional issues and educational requirements associated with this.

Musculoskeletal injections are commonly delivered 'blind' using clinical skills and anatomical landmarks, but the alternative of ultrasound guided injections (USGIs) has

become the preferred method for many practitioners.^{4,5} The accuracy of 'blind' injections has been shown to vary according to anatomical region and needle approach. Studies exploring accuracy of blind injections report a wide range of results; some suggest that blind injections typically fail to hit the target tissue with an accuracy rate of 29%,⁶ whereas others report extremely high rates of accuracy of 99%,⁷ There are many methodological factors to consider with research exploring accuracy that have been highlighted in systematic reviews and empirical studies,^{8–11} and it is evident that accurate needle placement from blind injections cannot always be guaranteed. The consequence of inaccurate needle placement may affect the efficacy of the medication and has resulted in clinicians seeking verification methods. Fluoroscopy was initially adopted as a verification method for anatomically challenging regions such as the hip which is a deep joint and difficult to palpate, but the disadvantage of a radiation dose to the patient must be evaluated and is not a concern with ultrasound guided procedures.^{12–15}

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In experienced hands, USGIs improve accuracy of placement and some outcomes in patients with musculoskeletal disease.^{8,16–19} Although long term improvement in pain has not been demonstrated conclusively,^{20–23} there are multiple influences that have resulted in an exponential increase in the use of guided injections in the last five years.

These include:

- Needle visualisation confirming placement in the joint or other targeted tissue (Figures 1–4)
- A medico-legal record of needle placement (Figures 1–4)
- Communication to patients includes evidence confirming treatment is in the correct location
- Accurate placement of specific targeted therapies, for instance hyaluronic acid
- Improves safety, avoiding neurovascular structures, less needle trauma
- Improves aspiration of effusions by seeing the fluid and enabling the clinician to target structures to confirm ‘dryness’.
- Influences patient experience by reducing procedural pain, increasing patient involvement in the procedure and potentially improving patient satisfaction.²⁴

USGIs are attractive to referrers and patients, but service providers report difficulties responding to the demand. The limited number of clinicians with the skills to provide USGIs can result in long waiting times for patients and delayed treatment pathways.^{25–27}

Non-radiologists performing ultrasound guided musculoskeletal interventions:

Referrals to many services in radiology departments have increased in recent years,²⁷ but this rise in demand has not consistently been matched by rises in service provision. Imaging workload has increased in complexity as well as volume, so radiologists are now performing a wide range of procedures, some of which are complicated and highly skilled interventional techniques. This has led to a reduction in capacity for the more routine radiological examinations including diagnostic ultrasound and guided steroid injections resulting in a rise in waiting times for patients.

Long waiting times are known to discourage general practitioners from referring patients into secondary care and has led to practices attempting to provide services ‘in house’.²⁸ A news bulletin²⁹ reported that overworked general practitioners were harming patients because of prescribing errors and other issues in patient care; it concluded that in the UK alone, an extra 3000 general practitioner are required to cope with the changes in population dynamic and patient expectations of the health care. An ageing population accompanied by increased demand and expectations from the public for improved health care has seen spiralling costs; these challenges necessitate innovation. Health care in the UK shares challenges with many other developed countries, in particular where there is state provision; central Governments are demanding high quality and efficient health care provision that is financially responsible.³⁰



Figure 1 Ultrasound guided injection of subacromial region, needle visualised in plane.

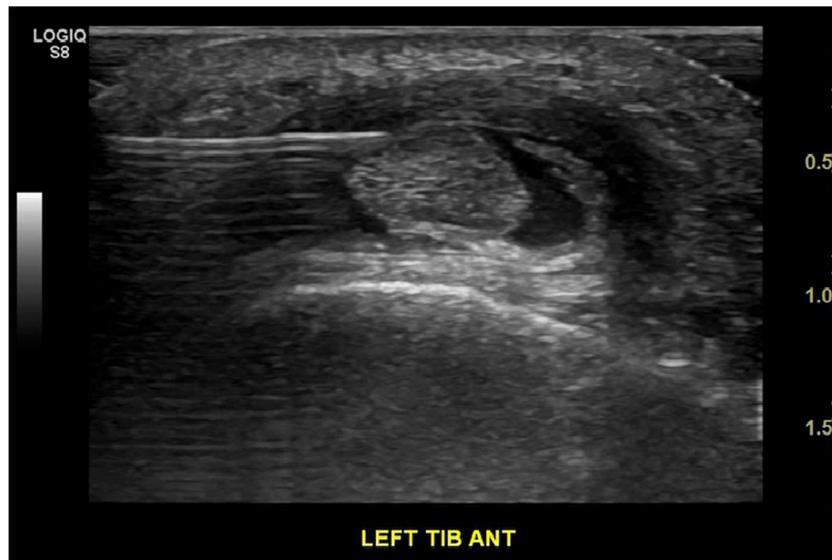


Figure 2 Ultrasound guided injection of tibialis anterior tendon, needle visualised in plane.



Figure 3 Ultrasound guided injection of elbow's common extensor origin, needle visualised in plane.

Innovative responses to optimise health care delivery have included role diversification whereby suitably trained and qualified staff adopt roles traditionally performed by medics and surgeons. Nurses along with allied health professionals such as podiatrists, physiotherapists, radiographers and sonographers have been identified as professionals ideally situated to expand their scope of practice. Extended-scope practitioners have increased in numbers in the UK's National Health Service (NHS) as professional development opportunities have been matched with service requirements. The historical development of the physiotherapist extended-scope

practitioner in the UK is worthy of review and may provide some guidance to professional groups internationally who are attempting to introduce similar roles.

Several important UK government policies at the start of the new millennium recognised that the delivery of future healthcare would require professionals to work differently, more effectively and in certain areas to extend their practice beyond their traditional professional boundaries.^{31,32} This was an opportunity for physiotherapists to both promote and develop their skills in the management of patients that would normally have been done by a doctor or other health care professional. Further drivers were *Meeting the*

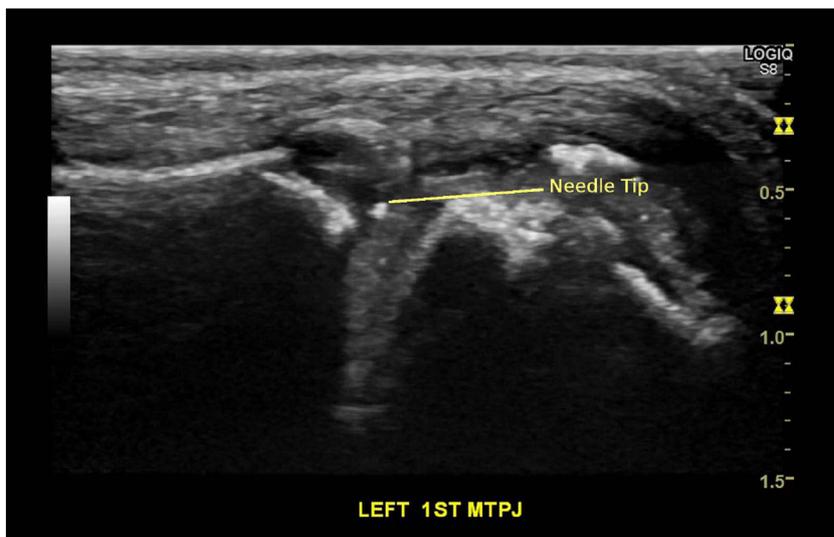


Figure 4 Ultrasound guided injection of first metatarsal–phalangeal joint, annotated needle tip out of plane.

*Challenge*³³ where patient care was to be centred on the skills required and not traditional professional roles and the *European Working Time Directive*³⁴ which now currently fully implemented limits the number of hours per week which junior doctors can work to 48, giving rise to physiotherapists further being able to extend their roles. Prior to this, long waiting lists mostly in the orthopaedic sector had led to physiotherapists working as ‘orthopaedic assistants’ with the ability to request x-rays and blood tests³⁵ or as part of a low back pain triage service,³⁶ with both of these innovative developments leading to improvements in each service.

The title extended scope practitioner has been used to describe physiotherapists who undertake such roles normally beyond their professional boundaries although the terms clinical specialist, advanced practitioner and consultant physiotherapist denote personnel with similar skills. The jobs these people do work best when they complement the roles of existing medical staff and are now found increasingly in primary care and musculoskeletal interface clinics as well as secondary care orthopaedic clinics, women’s/men’s health, pain management, Accident and Emergency and rheumatology. The UK’s professional body for physiotherapists, The Chartered Society of Physiotherapy, supports staff carrying out extended roles if they are educated, trained and competent to perform that activity. Such tasks may include running their own clinics, requesting x-rays, blood tests, magnetic resonance imaging, CT and ultrasound scans, nerve conduction studies, listing for surgery and referring onwards to other specialists. Injection therapy was accepted as being within ‘the scope of practice’ for physiotherapists in 1995 and clinical guidelines for its use published in 1999.³⁷ The Society of

Radiographers in the UK takes a similar stance and states that each clinician can develop their scope of practice professionally if they are supported by adequate training and are competent.³⁸

Physiotherapists have evaluated their roles as advanced practitioners thereby providing evidence of delivering services that were traditionally carried out by doctors. Various studies evidence the outcome of these services that have preserved financial resources and demonstrated high patient satisfaction along with excellent clinical outcome measures.^{39–43}

Turning our attention to specialist musculoskeletal sonographers, it is easily argued that they are well placed to deliver high quality diagnostics along with precise USGIs. In the UK, there are an increasing number of radiographer–sonographers fulfilling roles that include a diagnostic scan leading to a guided injection, and it is possible that more clinicians will see opportunities in healthcare, particularly in therapeutic services whereby with additional training, they can be involved in the delivery of services that are diagnostic and therapeutic. This sounds idyllic, but within established radiology departments, it encroaches on to the territory of radiologists who would traditionally perform these tasks. In order to develop the radiographer–sonographer into an interventionist requires specific training in injection therapy and management of complex musculoskeletal conditions. This training needs to be accompanied by strong leadership from professional bodies and organisations alongside sonography managers; collectively they need to address traditions of service delivery and hierarchy enabling boundaries to be crossed, new ones established and collective goals to be set.

Requirements of education in ultrasound guided musculoskeletal injections

The capability of clinicians' to perform ultrasound guided musculoskeletal interventions relies heavily on access to suitable education.⁴⁴ The educational format and content must include some key theoretical and practical elements but should also respond to local professional and legal requirements. A proposed framework for education has been summarised in Table 1; it reflects that whilst knowledge and understanding of certain factors such as theory and practice of needle visualisation are essential, other inclusions may vary in accordance with local policies and professional scope of practice.

The level of knowledge and depth of understanding regarding theoretical principles underpinning USGIs are a topic for debate; it is possible to argue that an injecting clinician can operate safely with a limited knowledge base if pathways of practice are robust. An alternative viewpoint is that an injecting clinician should have a comprehensive understanding of musculoskeletal medicine so they are able to discuss injection therapy as a treatment option and can provide detailed answers to questions regarding post-injection management including rehabilitation. The injecting clinician's responsibilities lack standardisation internationally and the guidance available is extremely limited. A relevant official statement from The American Institute of Ultrasound Medicine supports the viewpoint

that clinicians should have theoretical and clinical knowledge that enables them to review the 'anatomic, physiologic and pathophysiological characteristics of the area' before the procedure is performed.⁴⁵ A review of medical history and a focused physical examination could be regarded as essential to ensure the injection procedure is indicated.

Relevant professional issues will vary internationally but must include the legalities of prescribing frameworks and the contribution of the injecting practitioner to decision making in a treatment pathway. Professionals must have the capacity to decline administering an injection to a patient if they discover a contraindication or significant risk factor. The degree of decision making assigned to injecting clinicians in treatment pathways varies significantly, but some knowledge of musculoskeletal medicine and management is essential for safe practice. The injecting clinician's overall understanding of the patient and their ability to respond to questions regarding rehabilitation or risk factors for recurrence would be strengthened by advanced knowledge of musculoskeletal medicine including presentations, signs and symptoms, pathological features, treatment pathways and systems to evaluate change.

Developers of education in USGIs will need to justify their stance on establishing and assessing students' clinical competency. There are several approaches to clinical education and the role of assessment that are beyond the scope of this paper;^{46–51} it is a complex field that presents many challenges including parity of outcome for students

Table 1 Proposed educational framework for clinicians to perform ultrasound guided musculoskeletal injection (USGI)

Educational requirement		
Essential	Highly desirable	Inclusion will be based on local factors
Pathways of management for specified musculoskeletal presentations	Musculoskeletal medicine: <ul style="list-style-type: none"> • presenting features • clinical assessment • alternative treatment options for presentation 	Treatment options for musculoskeletal presentations—autonomous clinical decision making
Prescribing frameworks	Contribution to decision making regarding choice and dose of medication	Potential for independent prescribing
Pharmacology: <ul style="list-style-type: none"> • Local anaesthetics • Corticosteroids 	Drug interactions and role of non-prescribed medication (analgesia).	Access to and choice of medication.
Equipment preparation, drawing up medication.	Aspiration procedures.	Disposal of equipment, management of needle-stick injuries.
Pre-injection review, safety issues including contraindications	Management of anaphylaxis	Post-injection review and formal evaluation of outcomes.
Theory and practice of needle visualisation	Injection practice on phantoms, animal parts or human cadavers.	Injection of patients during formal teaching sessions.
Professional accountability	Formal assessment procedures	Quality assurance processes
Clinical supervision of USGI	Supervision of clinical reasoning underpinning USGI	Professional identity and role of clinical supervisor

and the standardisation of supervisors. Education may be undertaken that is linked to a university, or less formally via professional links; students should however always investigate the acceptance of these approaches for their employer, professional body and insurers. Formal accredited courses relating to USGIs are extremely hard to find: the first ever UK based university course took place at Essex University in 2015.

Professional issues

Professional groups face some common challenges when trying to bring about change; reticence from peers and colleagues can present as many barriers as legal and professional development requirements.

Multi-professional collaboration is required to bring about change;⁵² key players include radiology colleagues who can supervise practice and contribute to the formation of new care pathways for post-injection management. Further alliances with orthopaedic surgeons and physiotherapists should enable obstacle avoidance as they can advise and contribute to management following the injection which is generally viewed as only a part of the whole treatment package. Pharmacists and medics need to be accessed to formalise prescribing frameworks which must be aligned with local professional and legal regulation. In the UK, many AHPs administer medication under the legal framework of a Patient Group Direction (PGD). A PGD is a set of 'written instructions for the supply or administration of named medicines to specific groups of patients who may not be individually identified before presenting to treatment'⁵³ and enables practitioners to inject specified doses of medication to patients presenting with stated presentations; for instance, adhesive capsulitis, osteoarthritis of the knee or trigger finger. Independent prescribing is now available in the UK to physiotherapists, nurses and podiatrists who have completed suitable training and other professions are in the process of submitting applications.⁵⁴ Independent prescribing is not available to radiographers and is a politically sensitive area that has highlighted the impact of professional dependence and hierarchy.⁵⁵

Implementing these changes requires strong clinical leadership. In the UK the Leading an Empowered Organisation course was introduced to nursing and allied health professional staff.^{56,57} This aims to equip healthcare practitioners with the necessary skills to tackle and challenge the traditional medical hierarchical model, thereby transforming the NHS so that it is fit for purpose for the 21st Century. It introduces the concept of transformational leadership whereby clinical leaders can prompt and create a culture of professional responsibility, accountability and 'confident risk taking' resulting in

innovations in patient care. In order to engage in this process, these clinical leaders must manage change, which can be uncomfortable and at times destabilising during the transition period. This is particularly affecting for those who might lose out as a result of the changes, but those who might potentially gain are not immune to the discomfort. Nevertheless the changes brought about in the health care arena are often unavoidable, many being driven by external sources such as new government policy, population growth or increasing health care costs. To help, there are a number of health care models such as Kurt Lewin's force field analysis,⁵⁸ and John Kotter's eight-step approach⁵⁹ alongside lean and constraint theories used to evaluate and control radiology workload.⁶⁰ Whichever model is chosen, communication between all interested parties is required, including defining and discussing the problem, planning solutions, coordinating next steps and obtaining buy in to the idea and the need for change. Finally, it is insufficient to merely instigate change; the proposal must be seen to conclusion and the results sustained. Once accepted, a detailed plan must be produced prior to its implementation, along with an anticipated time scale for this to occur. There then needs to be regular audit of the scheme and consequent readjustment to optimise quality assurance and results.

Conclusion

The evidence base supporting the use of USGIs to improve outcome has limitations, but there are other benefits and demand for them is increasing. The impact on the patient's pathway is a key consideration for their role and was explored in a brief post-injection interview that was recorded with consent. A patient underwent a gleno-humeral injection and was asked afterwards if having ultrasound guidance had any impact on him—his response, 'it's about confidence, if you can't see something, you can't definitely tell me it is going to work – think about it logically, you can see where the needle is going, you can see where the fluid is going, it is going to where you want it to go...'. The patient experience warrants formal investigation, but there are indications that patients value the assuredness of needle placement from verified injections.⁶¹

As the clinical need for USGIs grows, it has become obvious that service provision is unable to match the demand in some departments. Service providers and managers may need to consider the role extension of some members of staff from a variety of professions to meet the demand, but must ensure that appropriate education is offered, enabling the safe expansion of services offering. High quality education that links theoretical principles, professional practice considerations and practical

skill acquisition is required to ensure high quality service provision—access to education is currently limited for non-medically qualified personnel. Several professional barriers and challenges may need to be addressed to enable service expansion and the ability of healthcare professionals to incorporate USGIs into their practice.

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