

Patient satisfaction and incidence of adverse events during a trial of sonographer administered musculoskeletal injections

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Abstract

Introduction: Increases in demand for therapeutic ultrasound-guided musculoskeletal injections have led to longer waiting times for appointments. With the right training, sonographers are well placed to perform these low-risk procedures. This study evaluated the effect of musculoskeletal injections administered by trained sonographers with respect to patient safety and satisfaction.

Methods: Patients were recruited from three radiology clinics staffed with appropriately trained sonographers. Patients who agreed to have their injection completed by a sonographer completed satisfaction surveys immediately after their appointment, with adverse reactions also recorded. Longer-term outcomes were recorded 7–10 days later.

Results: 97% of 804 participating patients were completely satisfied with the service they received. Reported adverse events were low, with <1% and 8% immediately and at follow up respectively. There was demonstrated patient satisfaction with staff and the service, and support for the importance of this service in reducing the extensive waiting times experienced.

Conclusion: This study indicates that appropriately trained sonographers can provide ultrasound-guided musculoskeletal injections at a level of safety which is comparable to similar injection procedures explored in the literature. The high level of satisfaction of the patients suggest that this service should be extended and expanded to address patient concerns regarding long waiting times.

KEYWORDS

adverse events, musculoskeletal injections, satisfaction, sonography

1 | INTRODUCTION

The demand for therapeutic ultrasound guided musculoskeletal injections (TUGMIs) in medical imaging departments has increased over the last decade.¹ These injections are usually prescribed for patients with musculoskeletal (MSK) conditions to relieve local pain and inflammation, and may be administered intra-articularly, peri-

articularly or within specific soft tissues.² TUGMIs are commonly used to manage conditions such as inflammatory and non-inflammatory arthritides and musculoskeletal conditions across multiple anatomic areas, such as the shoulder, elbow, wrist, knee, ankle, hands, feet, and hip. These conditions are common clinical presentations in Australia with an estimated 29% of Australians reporting a musculoskeletal condition in 2017–2018, and 15% suffering from arthritis.³

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The increased demand for TUGMIs may be the result of a shift from medical practitioners performing anatomically guided MSK injections (without imaging guidance) to referring patients to imaging departments for injections guided by medical imaging modalities, such as ultrasound.⁴ While studies have shown comparative effectiveness between ultrasound-guided and anatomically-guided injections of the shoulder,^{5,6} others have demonstrated improvements in accuracy as well as clinical outcomes at least as good as anatomically-guided MSK injections for several injection sites with the use of ultrasound guidance.⁷ The shift to secondary referrals may reflect increasing awareness of the evidence that TUGMIs can provide improved accuracy and effectiveness than anatomically guided MSK injections, or be a coping strategy as the workload of general practitioners increases.^{8,9}

This increased demand for TUGMIs has coincided with an expanded volume and complexity of workload for radiologists, secondary to the emergence of other interventional procedures that they are required to undertake.¹ In regional and rural/remote areas of Australia this demand is further compounded by radiologist accessibility problems, with these communities' having fewer radiologists than are required for their populations.¹⁰

All of these factors have the potential to contribute to longer waiting times for patients requiring a TUGMI, increasing the time they have to suffer pain.⁴ This has been shown to diminish the quality of the patient's healthcare experience, treatment and health outcomes.¹¹

With the increasing demands on health services, such as TUGMIs, health and medical professionals need to work collaboratively to identify evidence-based effective and efficient solutions that support improved access for patients, while ensuring patient safety and high-quality health outcomes. Professional role substitution, using allied health professionals in roles traditionally undertaken by medical practitioners, has been effective in improving patient access to health services while releasing medical specialists to see more complex patients.¹² Evidence suggests that these extended scope of practice roles for allied health practitioners are a cost-effective and consumer-accepted solution to improve patient outcomes for services under strain.¹³

As a solution to the increased demand for TUGMIs, sonographers could perform these low-risk procedures as an extension of their current scope of practice. Sonographers are well placed to undertake this professional role substitution as they commonly work with radiologists in medical imaging departments and have expert skills in ultrasound technology. In the United Kingdom, sonographers are already performing these procedures, and role extension has resulted in reduced waiting times, and improvements in patient care and service provision without loss of therapeutic efficacy.^{1,14} The success of this role substitution has been underpinned by the support of local medical clinicians, formal risk assessment, structured supervised practical training, theoretical study, and on-going professional and service audit for practice and outcome.¹⁴

In 2014, the Queensland Government Ministerial Taskforce on Health Practitioner Expanded Scope of Practice final report recognized that training sonographers to perform MSK therapeutic steroid injections was a possible extended scope of practice that would build capacity in the health system and reduce outpatient department

waiting time.¹⁵ In support of this, the Australasian Sonographers Association (ASA) facilitated a small cohort of experienced MSK sonographers to undertake a course of education and training to perform MSK therapeutic steroid injections under the supervision of a medical practitioner (Post-graduate Certificate of Ultrasound Guided Interventions). The experienced MSK sonographers completed this course of education in 2017.

The aim of this study was to evaluate two aspects of the effectiveness of sonographers administering ultrasound-guided MSK injections at three pilot sites. These aspects were the effect of sonographer administered MSK injections in terms of patient safety and of patient satisfaction.

2 | METHODS

2.1 | Sites

Three radiology clinics in Queensland were approached and invited to participate in the study. These clinics were identified as they were staffed by experienced MSK sonographers who had completed a Post-graduate Certificate of Ultrasound Guided Interventions. In Queensland, only specified health practitioners are permitted by law to administer restricted drugs, unless authorized and licensed to by the Minister. Therefore, to allow these trained sonographers to administer these restricted medicines, Ministerial approval was granted through a Section 18 approval (under the Health [Drugs and Poisons] Regulation 1996).

Research ethics was approved by the University of South Australia Human Research Ethics committee (UniSA HREC) (approval number 202440).

2.2 | Participants

All patients who presented to these three radiology clinics with a referral for a TUGMI were approached to volunteer for the study.

2.3 | Outcome measures

2.3.1 | Patient satisfaction

A survey which explored aspects of the patient satisfaction with the sonographer administered TUGMI was developed. The survey asked questions about:

1. Patient's age and previous experience with MSK injection (number of previous injections).
2. The patient's satisfaction (on a 5-point Likert scale) with,
 - The information provided about the injection process
 - The professionalism of the injection service

- Their comfort with the skills of the sonographer providing the injection
 - The post-injection information
 - The overall injection experience.
3. Whether they would they recommend the service.
 4. Whether they would be happy to have the service again by the sonographer.

All patients were also offered the opportunity to provide open text responses to the question “Can you think of anything that could be done to improve the injection service?”

This survey was available in hard copy or as an e-survey using a commercially available on-line survey tool (Survey Monkey®). The hard copy paper version was available to be completed in the waiting room post-injection, while the e-survey could be emailed out to the patient to be completed electronically. The choice of completing a paper versus e-survey was offered to each patient.

2.3.2 | Adverse events

Adverse events were recorded at two time points in the patient journey. Immediately following the injection, the occurrence of any adverse event was reported by the sonographer, and all patients who agreed to participate in follow-up interviews were contacted by the researcher by telephone 7–10 days following the injection. The interviewer followed a script to guide the patient through their reporting of any adverse reactions they had as a result of the injection.

2.4 | Protocol

Patients were provided with a patient information sheet about the study, by the clinic receptionist and invited to ask the sonographer/radiologist questions to clarify any issues. Patients were free to choose to have the injection performed by the radiologist or the sonographer. If the patient chose to have the injection from the radiologist, they were excluded from this study.

If the patient chose to have the injection performed by the sonographer, they were provided with a consent form that they were requested to sign. In this consent form they were also asked to provide their contact details if they consented to be followed up within 10 days by telephone to assess for longer term adverse events.

The patient was then screened using a pre-administration checklist that reviewed their suitability for the procedure through clearing common contraindications and precautions to the injection. Any patients identified as being at risk were referred to the radiologist for further discussion as necessary. If the patient provided informed consent and was deemed low risk from the pre-administration checklist they were imaged and injected by the sonographer. Only corticosteroids/local anesthetic were administered, based on the referral request and condition.

Following the injection, the patient was requested to remain in the waiting area for at least 15 minutes to ensure there were no acute adverse events from the injection. During this time, they were offered the choice of a paper copy patient satisfaction questionnaire or to provide contact details so a link to the on-line version of the satisfaction questionnaire could be emailed to them. With immediate adverse events recorded by the injecting sonographer, the survey completed by patients at this stage captured their satisfaction with their treatment throughout the procedure, as well as their willingness to return to the same department for future treatments.

The patients who agreed to the follow up interview were contacted by telephone up to 10 days later by a researcher and the incidence of adverse events were reported using a structured interview script to reduce interviewer bias.

All paper copy questionnaires were sent back to the research team using a pre-paid addressed reply envelope. Upon receipt of the patient datasheet the researchers contacted the patient via telephone for an interview regarding adverse events experienced by the patient 10 days after their injection and their satisfaction with the service.

2.5 | Statistical analysis

All hard copy data was manually transferred, and all electronic survey data downloaded, into a spreadsheet for analysis using MedCalc® (Version 19.1.5, MedCalc Software, Ostend, Belgium) statistical analysis software.

The relationship between the patient's age and their previous experience with MSK injections and patient satisfaction data was analyzed using the Kruskal-Wallis test (H-test). The Kruskal Wallis (H Test) reports an H statistic. To accommodate the multiple analyses and prevent a type 1 error a Bonferroni correction was applied, and results were interpreted using a significance level of $p < .005$.

3 | RESULTS

A total of 884 patients were invited to participate in the study between June 2020 and July 2021, of which 823 (93%) consented to participate (Table 1). Data was only available from 804 patients, as 19 participants who provided signed consent and asked for on-line surveys did not respond to the email invitation. Due to the anonymous nature of data collection, it was not possible to identify and follow up these patients. Data on the body area injected with the TUGMSI was available from 687 patients.

3.1 | Patient satisfaction

Patient satisfaction immediately following injection is presented in Table 2. Analysis of the effect of age/previous experience with injections and patient satisfaction data was analyzed using the Kruskal-

Wallis test (H-test). No significant relationship ($P > .005$) was found between any of the patient satisfaction results and age or if the patient had any previous experience with injections (Table 3).

TABLE 1 Patient characteristics

Patient characteristics		% (n=)
Invited to participate		884
Consented to participate		93% (823/884)
Refused to participate		7% (61/884)
Completed survey from those who consented to participate		98% (804/823)
Completed paper survey		95% (761/804)
Completed on-line survey		5% (43/804)
Age	<18 years	0
	18–30 years	4% (32/804)
	31–45 years	14% (113/804)
	46–65 years	49% (394/804)
	>65 years	33% (265/804)
Area of injection	Hip	12% (94/804)
	Knee	4% (30/804)
	Ankle/foot	9% (71/804)
	Shoulder	42% (341/804)
	Elbow	7% (53/804)
	Wrist/hand	12% (96/804)
	Other	<1% (2/804)
	Not reported	15% (117/804)
Previous experience with injections	No previous history	24% (196/804)
	One previous injection	25% (200/804)
	More than one previous injection	45% (359/804)
	No response	6% (49/804)

The open text responses were thematically analyzed to explore factors related to the satisfaction with the service. Two key themes emerged from the open text responses:

Satisfaction with the staff,

1. “Always happy to attend this practice, staff always polite and professional.”
2. “[sonographers name] very reassuring, professional, explaining the differences in the inflammation areas of the shoulder.”
3. “Everyone was very friendly and worked in a professional manner, very happy.”
4. “Everything at this practice is amazing including frontline staff. Thank you for making me feel welcome.”

Satisfaction with the service,

1. “A very welcome experience - I felt well prepared and was made to feel comfortable throughout and the procedure was administered in a professional manner and was exceptionally explained.”
2. “After one experience at a GP for injection to the knee I would never do that again. Today was so professional - thorough and seemed to take no time at all. I would never consider going anywhere else. The doctor and staff need to be recommended for their assistance and care.”
3. “Comfortable with staff and procedures, explanation of process involved and brochure supplied for reference”.
4. “Generally felt very confident and given more information about my condition than I have ever received in 4–5 years I have had it.”
5. “I was completely satisfied with the whole service provided it was professionally delivered in every way and have no hesitation in recommending this service to others” (sic).

TABLE 2 Patient satisfaction immediately post-injection

Question	n=	Scores (n=)					Ave.
		1	2	3	4	5	
Were the details of the injection process explained adequately?	762	0	0	5	26	731	4.95
Was the injection provided in a professional manner?	765	0	0	0	9	756	4.97
Did you feel comfortable with the skills of the professional providing the injection?	764	0	0	0	10	754	4.97
Were you provided with enough information about monitoring any potential reactions from the injection?	730	0	1	4	13	712	4.95
Overall, how satisfied are you with your injection experience?	731	0	0	1	19	711	4.94
		Yes			No		
Would you be happy to receive your musculoskeletal injection here in the future?	730	729			1		
Would you recommend this service to others requiring a musculoskeletal injection?	732	731			1		

Note: Scores ranked as a 5-point Likert scale where 1 = completely dissatisfied and 5 = completely satisfied.

TABLE 3 Kruskal–Wallis H test results from analysis of the effect of age/previous experience and patient satisfaction data

Question	Age ^a	Previous experience with injections
Were the details of the injection process explained adequately?	H (3) = 0.73; P = .10	H (2) = 0.08; P = .69
Was the injection provided in a professional manner?	H (3) = 0.09; P = .48	H (2) = 0.06; P = .44
Did you feel comfortable with the skills of the professional providing the injection?	H (3) = 0.12; P = .39	H (2) = 0.28; P = .03
Were you provided with enough information about monitoring any potential reactions from the injection?	H (3) = 0.36; P = .18	H (2) = 0.38; P = .07
Overall, how satisfied are you with your injection experience?	H (3) = 0.48; P = .11	H (2) = 0.17; P = .35

^aParentheses following H indicate degrees of freedom.

TABLE 4 Reported adverse events immediately following injection

Injection area	Adverse event
Hip	Temporary leg weakness
Shoulder	Mild vasovagal episode
Shoulder	Facial flushing
Wrist	Mild vasovagal episode

6. “Overall I was very happy with the injection process. I had heard some awful comments but my sonographer was very thorough in explaining the procedure and the procedure was both quick and quite painless.”
7. “There needs to be more trained people to provide these injections like this guy here. The wait list to see him is so long, But it would wait as I have had a few of these injections over the years and have had severe pain from and during the injections and have felt they aren't worth having. So I was very nervous having to have the few I have had here. But this guys here has proved he is worth the wait as I've had no pain or reactions from the injection or injected site. Would be good if people could train with him” (sic).

While most patients were satisfied with the sonographer administered ultrasound-guided MSK injection service, a significant number of patients reported concerns about access to the service, with the extended wait times for appointments for MSK injections an area of significant concern:

1. “Less of a wait to get into see sonographer for injection.”
2. “From seeing the dr I had to wait 3.5 weeks to get the injection. During that time I have been in an extreme amount of pain. No radiology clinics were able to provide an earlier appointment.”
3. “Waiting list time is very long for injuries that can become permanent. This is a major issue.”
4. “It is apparent that there are more sonographers needed at this practice to meet the demands placed on this service. There is currently a 3 month waiting list for appointments.”
5. “As a regular patient at this practice with the need for 3 monthly musculoskeletal injections ongoing, more sonographers are vital to my ability to receive ongoing timely care.”

TABLE 5 Reported adverse events at interview follow-up, up to 10 days post injection

Adverse event	Incidence
Pain at site of injection	5/110 (4.5%)
Redness at site of injection	3/110 (2.7%)
Elevated blood sugar	1/110 (<1%)

6. “I have always been satisfied with the service I have received. Just feel we need more sonographers whom can inject that would make the appointments so much to access.”
7. “If there were more sonographers practicing in Qld the wait time would be much shorter.”
8. “It is a long time between available appointments. This causes extreme concerns regarding the pain and the ability to cope mentally and physically - something needs to be done to increase the sonographers in numbers.”

3.2 | Patient safety

Data on the incidents of adverse events immediately following injection (as reported by the sonographer) was available from 823 patients. Adverse events were reported for four patients (<1%) (Table 4)

A total of 110 ($n = 110$) patients agreed to participate in the follow up interviews and were contacted by telephone up to 10 days following the injection. Adverse events were reported by nine patients (8%) (Table 5).

4 | DISCUSSION

The results of this study, undertaken in a large group of patients attending three radiology clinics who were piloting sonographer administered TUGMSIs, demonstrate high rates of patient satisfaction and only mild adverse effects.

Almost all patients (97%) who had the sonographer administered TUGMSIs reported being completely satisfied with the service. No patients reported being unsatisfied. This satisfaction with the service was not affected by the patient's previous experience with MSK

injections, including history of recurrent injections, and location of previous injections (i.e., another radiology clinic or other clinic).

Three themes emerged from the open text responses. Patients reported satisfaction with both the staff and the service provided, particularly related to the professionalism of the service. A third notable theme was the extended wait times for appointments for TUGMSIs that the patients reported.

All adverse events reported by the patients undergoing sonographer administered ultrasound guided MSK injections were minor, or Grade 1 (NIH Common Terminology Criteria for Adverse Events),¹⁶ representing an adverse event that is considered mild, that is, asymptomatic or with mild symptoms, requiring clinical or diagnostic observations only with no intervention required.

When compared to the literature, the range of adverse events aligned with those reported by other studies. Brinks et al, in their systematic review of extra-articular corticosteroid injections (including 87 studies: 44 case reports, 37 prospective, and 6 retrospective studies), reported an incidence of major adverse events ranging from 0% to 5.8%, and that of minor adverse events from 0% to 81%.¹⁷ Combes et al explored the rate of adverse events from corticosteroid injections and other injections for management of tendinopathy ($n = 2672$) and identified a rate of minor adverse events of post injection pain (4%–51%), burning sensation (13%), depigmentation (2%–3%), facial flushing (3%) and gastrointestinal upset (5%).¹⁸ Anderson et al, in an observational study of 1708 patients who underwent intra-articular corticosteroid injections of the ankle or subtalar joint, identified that the most prevalent types of adverse events were post-injection flare in 78 patients (4.6%), followed by skin reaction in 10 patients (0.6%).¹⁹

In a client centered health care system, such as in Australia, it is important that any new model of health care is acceptable to the users of that health service. The use of experienced, trained, MSK sonographers to administer TUGMSI as an extended scope of practice to help alleviate the increased demands for this health service is a new initiative in Australia. Before it can be considered a viable health care model it is important that the use of a sonographer administered TUGMSI are acceptable to the patients, both in terms of the satisfaction with, and safety of the service.

While the dataset represents a significant cohort of patients undergoing TUGMSIs a limitation of the study is the small number of sonographers who were involved in providing the service, all of whom had undertaken specialist postgraduate training in providing TUGMSI. The results of this study, which investigated the sonographer-led injections at three pilot sites, are therefore not extrapolatable to the general population of sonographers unless they have had similar training. Innes et al stress the importance of a structured education framework for the training of sonographers in MSK injection procedures.¹ As the majority of Sonographers in Australia do not operate with an extended scope of practice, such a training program would initially lie within a postgraduate certification level. Ongoing registration and regular audit procedures are also vital to ensure patient safety and satisfaction continues.¹

The clinics involved in this program had a radiologist on-site, and while the severity and number of adverse events related to sonographer administered TUGMSIs were low the study results do not

suggest that this service should be provided without a radiologist being on-site.

Finally, the number of patients who were involved in the longer term follow up interview represented only 13% of the total population of patients who undertook the sonographer administered TUGMSIs in this study. Demographic data was not collected as part of this interview, as such, we are unable to comment on the representative nature of this sub-population of participating patients.

5 | CONCLUSION

The findings from this study indicate that the sonographer administered ultrasound-guided MSK injection service provided a quality health-care service model as viewed from the patients' perspective. Patient satisfaction was high, and the risk of adverse events were no worse than that reported in the literature.

The high level of satisfaction from the patients who attended the service may reflect the use of experienced and specially trained sonographers in the three radiology clinics. As an extended scope of practice, it is important that the sonographers who are involved in providing the service have the appropriate level of experience, support, and training to undertake the role. The high level of satisfaction of the patients suggest that this service should be extended and expanded to address patient concerns regarding long waiting times.

It was beyond the scope of this study to measure a direct comparison between sonographer administered TUGMSIs and those performed by other medical and health practitioners. Future Australian studies are called for which directly compare patient satisfaction and outcomes directly between TUGMSIs performed by appropriately trained sonographers and those performed by radiologists. Further exploration into health service outcomes, with clinical audits of practice, and education and training models for extending the scope of practice for sonographers will also be beneficial.

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CONFLICT OF INTEREST

Kerry Thoires is an editorial board member for Sonography and co-author on this article. This co-author is not involved in the peer review process; management of the peer review process and decision-making for this article. These instead were handled by a Handling Editor who is not a co-author on this article.

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