

## **Clin-IQ Project**

Clinical Question: In patients receiving joint injections, does ultrasound guidance increase the probability that the injection is in the correct location compared to using anatomical landmarks?

Authors: Jason Deck, MD (PGY-3) and Jose Murillo, MD (PGY-2)

Faculty Mentor: Kathryn Reilly, MD

Residency Program: University of Oklahoma Health Sciences Center, Department of Family and Preventive Medicine, Oklahoma City, OK.

Answer: Yes

Level of Evidence for the Answer: A

Search Terms: 1. Injections, Intra-Articular, 2. Ultrasound

Date Search was Conducted: 7/11/12

Inclusion and Exclusion Criteria:

Inclusion Criteria: Ultrasound guided joint injections, Humans

Exclusion Criteria: Imaging modalities other than ultrasound, no comparison to non-ultrasound guided injections

Summary of the Issues: (word count=200-300) (Needs citations)

Ultrasound guided joint injections have become much more popular in recent years. Other imaging modalities such as fluoroscopy, CT, and MRI have been used to guide injections as well, but none are as well suited to use in the office setting as ultrasound. The primary motivation for the use of image guided injections is the thought that the medication is more likely to be in the desired location, and therefore more likely to be successful, if one of these modalities is used to confirm the needle placement. However, the use of an

ultrasound for office based injections is more time consuming and more costly to the patient, as an ultrasound guided injection is often reimbursed at a higher rate than an injection done with anatomic landmarks only. Some providers are hesitant to invest in the resources required to do these procedures in the office due to the aforementioned costs, as well as several lingering questions: In some cases the anatomic landmarks are difficult to locate, making ultrasound guidance more obviously beneficial, but even in a patient with good landmarks, does ultrasound guidance make the needle placement significantly more accurate? Does the amount of training and experience the provider has in ultrasonography make a difference? If an increase in accuracy can be demonstrated, then can this increase in accuracy be correlated with improved long term outcomes?

#### Summary of the Evidence: (word count=500-700)

A meta analysis in 2012 by Berkoff et al. looking at the clinical utility of ultrasound guided injections found 13 studies that met their inclusion criteria. Of these studies, five look at the knee, seven at the shoulder (either the acromioclavicular joint, the glenohumeral joint, or the subacromial bursa), and one looked at both. Seven of the studies utilized ultrasound, and the remainder used air arthrography, fluoroscopy, MRI, or MR arthrography. They found that any image guidance improved the accuracy of intra-articular knee injections over utilization of anatomic landmarks from 81.0% to 96.7% ( $p < 0.001$ ), and shoulder injections from 65.4% to 97.3% ( $p < 0.001$ ). When the analysis was focused solely on ultrasound versus anatomic landmarks, the accuracy of intra-articular knee injections increased from 77.8% to 95.8% ( $p < 0.001$ ), and shoulder injections increased from 61.1%

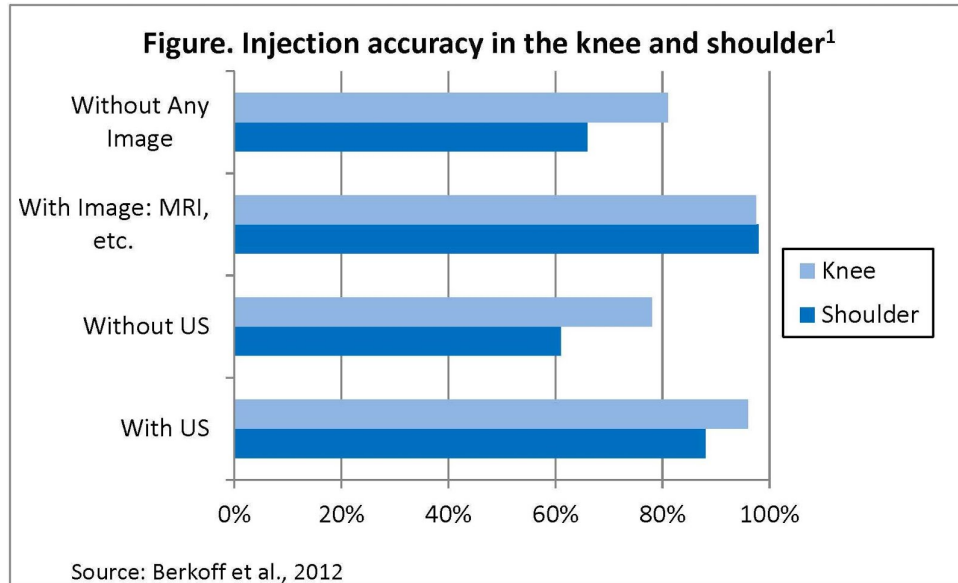
to 88.8% ( $p < 0.001$ ). They further utilized the five studies that compared ultrasound guidance with anatomic guidance of knee injections to show that superior accuracy of ultrasound had an odds ratio of 6.4 (95% CI 2.9-14).<sup>1</sup>

In 2010 Muir, et al. did a small trial to assess the use of ultrasound for peroneal tendon sheath (PTS) injections. A single investigator injected 20 unembalmed adult cadaveric lower limbs using both ultrasound guidance, and palpation guidance. A different color of latex was injected for each modality. One week later the specimens were dissected and the accuracy of the injections were assessed by an investigator blinded to the injection technique. They found the ultrasound guided injections to be 100% accurate (95% CI 81-100) at placing all of the latex within the PTS, but the palpation guided injections to be only 60% accurate (95% CI 39-78). If the injection was partially accurate (meaning the latex was found in both the PTS and the adjacent structures), it was counted as accurate, then the palpation guided accuracy increased to 90% (95% CI 68-98).<sup>2</sup>

In 2010 Sabeti-Aschraf et al. did a study (which was included in the meta analysis by Berkoff et. al.) to assess the importance of experience when doing ultrasound guided injections of the acromioclavicular joint. Two shoulder surgeons, two orthopedic surgeons without special training in the shoulder, and two medical students each injected the AC joints of 10 cadavers using ultrasound guidance on one side and palpation guidance on the other. Overall the ultrasound guidance was 95% accurate, whereas the palpation guidance was 72% accurate. The shoulder surgeons were 90% accurate with ultrasound and 80% accurate with palpation, the non-specialists were 100% accurate with ultrasound and 75% accurate with palpation, and the students were 95% accurate with ultrasound and 60%

accurate with palpation, but they found no statistically significant difference between the three levels of experience.<sup>3</sup>

A Cochrane review from 2012 synthesized five studies with a total of 290 participants to compare outcomes of ultrasound guided shoulder injections to landmark guided injections or systemic intramuscular steroids. In two trials with 146 participants, there was no significant difference in pain at one to two weeks, showing a standard mean difference (SMD) of -1.44 with a 95% CI of -4.14 - 1.26. Those 2 trials also showed no significant difference in function at one to two weeks with a SMD of 0.95 and a 95% CI of -1.29 - 3.20. Three trials with a total 207 participants showed no significant difference in function at six weeks with a SMD of 0.63 and a 95% CI of 0.06 - 1.33. Over all of the studies they found no significant difference in adverse events with a risk ratio of 0.55 (95% CI 0.17-1.85). The one significant difference they did find was in pain at 6 weeks (3 trials, 207 participants) with a SMD of -0.80 and a 95% CI of -1.44 - 0.24, but after removing studies they deemed to have inadequate methods, the one remaining trial with 106 participant did not show a difference with a mean difference on a 9-point scale of -0.60 and a 95% CI of -1.44 - 0.24.<sup>4</sup>



Conclusion: (word count=50-100)

There is significant evidence that ultrasound guidance does increase the accuracy of joint injections over anatomically guided techniques. Furthermore, there is evidence that shows even physicians untrained in the use of ultrasound can successfully utilize this modality. There are very few outcome directed studies in the literature, but currently they do not appear to demonstrate that improved accuracy leads to superior outcomes, however more studies will be needed before a conclusion can be certain. This will change the way we practice because it shows that even injections that may be considered highly accurate with palpation can be improved upon with ultrasound guidance.

Reference List (1-2 review articles, 2 evidence articles):

1. Berkoff DJ, Miller LE, Block JE. Clinical utility of ultrasound guidance for intra-articular knee injections: a review. *Clinical Interventions in Aging*. 2012;7: 89-95.

2. Muir JJ, Curtiss HM, Hollman J, et al. The Accuracy of Ultrasound-Guided and Palpation-Guided Peroneal Tendon Sheath Injections. *Am. J. Phys. Med. Rehabil.* 2011;90(7): 564-571
3. Sabeti-Aschraf M, Lemmerhofer B, Lang S, et al. Ultrasound guidance improves the accuracy of the acromioclavicular joint infiltration: a prospective randomized study. *Knee Surg Sports Traumatol Arthrosc.* 2011;19(2):292-295
4. Gates JE, Rischin A, Johnston RV, Buchbinder R. Image-guided versus blind glucocorticoid injection for shoulder pain. *Cochrane Database of Systematic Reviews* 2012, Issue 8. Art. No.: CD009147. DOI: 10.1002/14651858.CD009147.pub2.