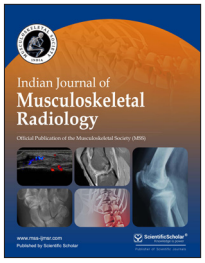
www.mss-ijmsr.com

ScientificScholar®
Knowledge is power
Publisher of Scientific Journals

Indian Journal of Musculoskeletal Radiology



Original Article

Effect of Arm Position on Visualization of Target Zone for Posterior Glenohumeral Joint Injection

James Kho[1], Ghassan Almeer[1], Christine Azzopardi[1], Ravneet Singh[1], Steven James[1], Rajesh Botchu[1]

[1]Department of Musculoskeletal Radiology, Royal Orthopedic Hospital, Birmingham, West Midlands, United Kingdom.

***Corresponding author:**
Rajesh Botchu,
Department of Musculoskeletal Radiology, Royal Orthopedic Hospital, Birmingham, West Midlands, United Kingdom.

drbrajesh@yahoo.com

Received : 10 June 2020
Accepted : 16 November 2020
Published : 22 December 2020

DOI
10.25259/IJMSR_43_2020

Quick Response Code:

ABSTRACT

Objectives: Glenohumeral injections can be performed using a variety of approaches. We hypothesize that the position of the ipsilateral arm affects the target zone for posterior approach of glenohumeral joints.

Material and Methods: We performed ultrasound on three volunteers with arm with in neutral and varying degrees of flexion and extension.

Results: We found that target zone is increased on flexion and decreased with arm in extension.

Conclusion: Considering patient comfort, target zone, and operator ergonomics, we conclude that the posterior glenohumeral US-guided injections should be performed with patient lying on the contralateral side with the ipsilateral arm in neutral, and hand rested on the thigh (Birmingham Royal Orthopedic Hospital (BROH) position).

Keywords: Arm, Position, Glenohumeral, Joint, Ultrasound

INTRODUCTION

The prevalence of shoulder pain in the community ranges from 14% to 25% and can be associated with significant morbidity.[1-4] Common management strategies include physiotherapy and injection therapy. Glenohumeral joint injections can be performed with or without image guidance (ultrasound or fluoroscopy), using a variety of approaches. One common approach is the posterior glenohumeral approach, but the optimum positioning of the patient for this approach is uncertain. We hypothesize that the position of the ipsilateral arm affects the size of the target zone for the posterior approaches to the glenohumeral joint and performed a prospective study using ultrasound evaluate this.

MATERIAL AND METHODS

Three volunteers without any clinical history of shoulder symptoms were recruited for this study after obtaining informed consent. An experienced musculoskeletal radiologist with over 10 years of experience performed all the examinations. This was performed using an ACUSON S2000 ultrasound system employing a 9.4 MHz transducer (Siemens Medical Solutions, Malvern, PA, USA). To visualize the posterior glenohumeral joint, the US transducer was placed just inferior to the spine of the scapula, with its orientation parallel to the spine of the scapula. The transducer was then translated laterally until the posterior glenoid rim, posterior glenoid labrum, and the

posterior humeral head with overlying infraspinatus muscle and tendon were visualized. The posterior labrum is identified as a hyperechoic triangular structure between the glenoid rim and the posterior humeral head. The target zone was defined as the posterior humeral head between the medial end of the footprint of infraspinatus and the labrum, deep to the infraspinatus muscle and tendon, as this approximates the posterior joint capsule. The ipsilateral arm was moved into different positions including in neutral, in flexion (10°, 20°, and 30°), and in extension (10°, 20°, and 30°). The size of the target zone was measured in all positions [Figures 1 and 2]. The extent of visualization of the target zone was further assessed on a scale of 1–5 by two radiologists undergoing musculoskeletal fellowship. The data were analyzed and *P* value calculated using ANOVA test.

RESULTS

All volunteers were male with an average age of 39 years (rage 31–45 years).

The average size of the target zone in the neutral position was 18 mm (range 14–22 mm). This increased to 25 mm in flexion and decreased in extension with an average of 9.6 mm in 30° extension. These changes in target area sizes were statistically significant with $P = 0.00042$ [Figure 3 and Table 1]. The visualization was better in neutral (4.7) and flexion (4.2) when compared to extension (1.7).

DISCUSSION

There is a wide variety of clinical indications for performing a glenohumeral joint injection. These injections may be performed for diagnostic purposes, for example, injection of contrast media before computed tomography and magnetic resonance arthrogram, or for therapeutic purposes with injection of steroid, local anesthetic, and/or hyaluronic acid. Posterior, anterior, and superior approaches to the glenohumeral joint have been described, either performed blind or with imaging (US, fluoroscopy, or magnetic resonance imaging) guidance.[5-10] Although a number of studies have attempted to compare these different approaches, it is difficult to draw firm conclusions as to the relative accuracy, patient tolerability, or complication rates of these different approaches, given that these may vary with

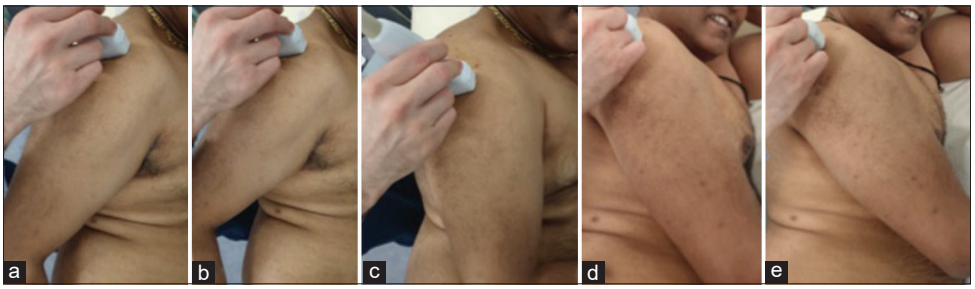


Figure 1: Examination of the posterior glenohumeral joint with arm in different degrees of extension (a and b), neutral (c) and different degrees of flexion (d and e).

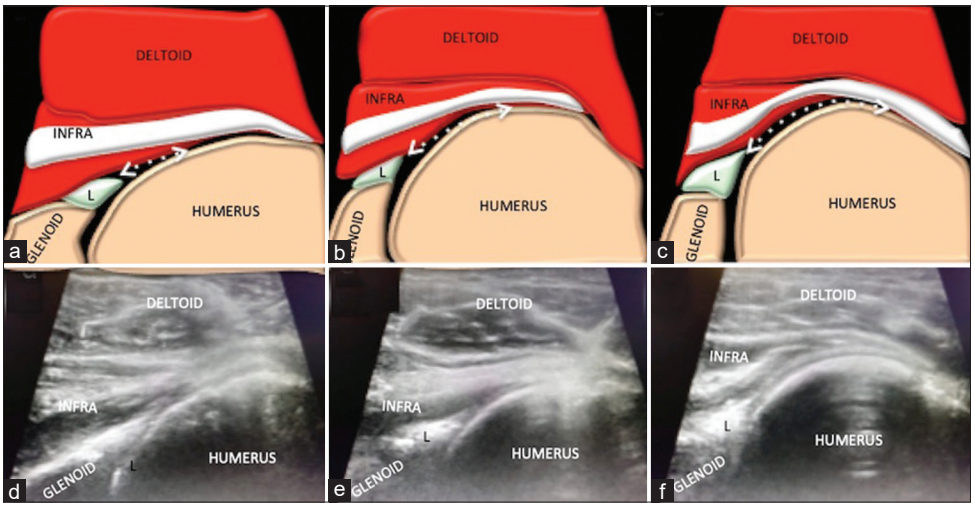


Figure 2: Animation and ultrasound images with arm in extension (a and d), neutral (b and e) and flexion (c and f).

Table 1: Position of the arm in degrees (positive values = flexion, negative values = extension) and target zone in mm for three volunteers.

Position of arm	Target zone in mm		
	Volunteer 1	Volunteer 2	Volunteer 3
30	33	27	29
20	31	27	29
10	29	24	24
0	22	14	19
−10	22	14	13
−20	17	13	8
−30	13	8	8

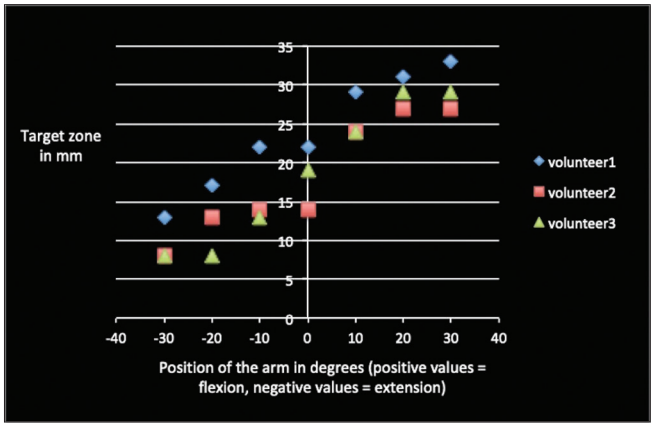


Figure 3: Chart showing the target zone size in different positions of the arm.

operator experience and slight differences in techniques between centers.[5-7,11-13]

Our findings demonstrate that changes in position of the ipsilateral arm have a significant effect on the size of the target zone for a posterior approach to glenohumeral injection. Therefore, careful consideration has to be made to the arm position regardless of the specific technique utilized or whether the injection is performed blind or image guided. In the literature, described arm positions include with the arm in neutral, across the shoulder, and on the abdomen, although the relative merits of different positions have not been proven.[8,9,14,15]

Previously, Lee *et al*. have shown on US that the posterior glenohumeral joint space did not change with a number of different positions in a cohort of patients with adhesive capsulitis.[14] Our findings do not contradict this, but we argue that the target zone for injection need not only be limited to the posterior glenohumeral joint space between the posterior labrum and humeral head but also includes the posterior humeral head between the medial end of the footprint of infraspinatus and lateral edge of the labrum, which approximates the posterior joint capsule. In support of this argument, it is worth noting that it is the posteromedial humeral head and not the joint space *per se* that is targeted for fluoroscopy-guided posterior injections.[15] For US-guided injections, techniques targeting the posterior capsule lateral to the joint space[7] or the posterior joint space itself have been described.[8,14]

Our findings also demonstrate that visualization of the target zone on ultrasound is improved in neutral and flexion compared to extension. On ultrasound, the key structures that need to be visualized for a posterior approach to injection are the posterior labrum, posterior humeral head, and overlying infraspinatus muscle and tendon. The effect on arm flexion on sonographic visualization of these structures has not previously been described, though Krzyżanowski *et al*. described an arm adducted position for visualization of the posterior labrum.[16]

The size of the target zone and the visualization of this target zone are not the only factors when considering one's technique of posterior glenohumeral joint injection. Flexing the arm increases the size of the target area, but may also result in increased tension across the posterior joint capsule, theoretically making it more likely that the injectate extravasates into the infraspinatus muscle rather than entering the posterior joint capsule.[17] Other factors that need to be considered are patient comfort and operator ergonomics. As far as the authors are aware, the effect of arm position on these factors has not been previously investigated. In the authors' institution, posterior glenohumeral US-guided injections are performed with patient lying on the contralateral side with the ipsilateral arm in neutral, and hand rested on the thigh (Birmingham Royal Orthopedic Hospital (BROH) position). This provides a comfortable position for the patient and the target zone for the injection is favorable as per our findings in this study. Our pilot study provides an objective assessment of the target zone in various positions, which could allow the radiologist/sonographer to decide the best position for his/her case.

The effect of rotation (internal and external rotation) of the arm on the target zone was not assessed in this paper. Further studies with larger cohort of patients looking at the effect of rotation of the arm as well as other factors, age, sex, and morphological abnormalities (like osteoarthritis of shoulder) on the target zone are advised.

CONCLUSION

Changes in the position of the ipsilateral arm affect the size of the target zone for a posterior approach to glenohumeral injection, with the target zone being largest in arm flexion. Careful consideration has to be made to the ipsilateral arm position when injecting the glenohumeral joint through a posterior approach, regardless of the specific technique utilized or whether

the injection is performed blind or image guided. If ultrasound guidance is used, visualization of the target zone is better in ipsilateral arm flexion and neutral compared to extension.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent.

Financial support and sponsorship

Nil.

Conflicts of interest

Dr. Rajesh Botchu is on the Advisory Board of this journal. He does not have any competing interests.

REFERENCES

1. Urwin M, Symmons D, Allison T, Brammah T, Busby H, Roxby M, *et al*. Estimating the burden of musculoskeletal disorders in the community: The comparative prevalence of symptoms at different anatomical sites, and the relation to social deprivation. Ann Rheum Dis 1998;57:649-55.
2. Hasvold T, Johnsen R. Headache and neck or shoulder pain-frequent and disabling complaints in the general population. Scand J Prim Health Care 1993;11:219-24.
3. Boppana S, Rajakulasingam R, Azzopardi C, Botchu R. Ultrasound of glenoid labrum with MR arthrographic correlation. J Ultrasound 2020. Doi: 10.1007/s40477-020-00428-z.
4. Robotti G, Draghi F, Bortolotto C, Canepa MG. Ultrasound of sports injuries of the musculoskeletal system: Gender differences. J Ultrasound 2020;23:279-85.
5. Tobola A, Cook C, Cassas KJ, Hawkins RJ, Wienke JR, Tolan S, *et al*. Accuracy of glenohumeral joint injections: Comparing approach and experience of provider. J Shoulder Elbow Surg 2011;20:1147-54.
6. Mattie R, Kennedy DJ. Importance of image guidance in glenohumeral joint injections: Comparing rates of needle accuracy based on approach and physician level of training. Am J Phys Med Rehabil 2016;95:57-61.
7. Kim DY, Lee SS, Nomkhondorj O, Cho MG, Lee JJ, Hwang JK, *et al*. Comparison between anterior and posterior approaches for ultrasound-guided glenohumeral steroid injection in primary adhesive capsulitis: A randomized controlled trial. J Clin Rheumatol 2017;23:51-7.
8. Zwar RB, Read JW, Noakes JB. Sonographically guided glenohumeral joint injection. AJR Am J Roentgenol 2004;183:48-50.
9. Vierola H. Ultrasonography-guided contrast media injection to shoulder joint using a posterior approach: A technique worth trying. Acta Radiol 2004;45:616-7.
10. Soh E, Bearcroft PW, Graves MJ, Black R, Lomas DJ. MR-guided direct arthrography of the glenohumeral joint. Clin Radiol 2008;63:1336-41.
11. Chernchujit B, Zonthichai N. Comparison of accuracy of anterior and superomedial approaches to shoulder injection: An experimental study. SICOT J 2016;2:13.
12. Ogul H, Bayraktutan U, Ozgokce M, Tuncer K, Yuce I, Yalcin A, *et al*. Ultrasound-guided shoulder MR arthrography: Comparison of rotator interval and posterior approach. Clin Imaging 2014;38:11-7.
13. Toit MN, de Villiers R. Anterior approach v. posterior approach-ultrasound-guided shoulder arthrogram injection. SA J Radiol 2008;12:60-2.
14. Lee CH, Nam HS, Lee SU. Usefulness of a hanging position with internal rotation of shoulder in ultrasonography-guided intra-articular steroid injection for adhesive capsulitis. Ann Rehabil Med 2016;40:520-7.
15. Farmer KD, Hughes PM. MR arthrography of the shoulder: Fluoroscopically guided technique using a posterior approach. AJR Am J Roentgenol 2002;178:433-4.
16. Krzyżanowski W. The use of ultrasound in the assessment of the glenoid labrum of the glenohumeral joint. Part I: Ultrasound anatomy and examination technique. J Ultrason 2012;12:164-77.
17. Laudner KG, Sipes RC, Wilson JT. The acute effects of sleeper stretches on shoulder range of motion. J Athl Train 2008;43:359-63.

How to cite this article: Kho J, Almeer G, Azzopardi C, Singh R, James S, Botchu R. Effect of Arm Position on Visualization of Target Zone for Posterior Glenohumeral Joint Injection. Indian J Musculoskelet Radiol 2020;2(2):104-7.