Journal Pre-proof

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PII: S0736-4679(23)00003-3
DOI: https://doi.org/10.1016/j.jemermed.2023.01.009
Reference: JEM 13387

To appear in: *Journal of Emergency Medicine*

Received date: 13 July 2022
Revised date: 29 November 2022
Accepted date: 6 January 2023

TITLE

Successful glenohumeral shoulder reduction with combined suprascapular and axillary nerve block

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ABSTRACT

Introduction: Anterior glenohumeral dislocation is a common injury seen in the Emergency Department (ED) that sometimes requires procedural sedation for manual

reduction. When compared to procedural sedation for dislocation reductions, peripheral nerve blocks provide similar patient satisfaction scores but have shorter ED length-of-stays. In this case report, we describe the first addition of an ultrasound-guided axillary nerve block to a suprascapular nerve block for reduction of an anterior shoulder dislocation in the ED.

Case Report: A 34-year-old male presented to the ED with an acute left shoulder dislocation. The patient was a fit rock climber with developed muscular build and tone. An attempt to reduce the shoulder with peripheral analgesia was unsuccessful. A combined suprascapular and axillary nerve block was performed with 0.5% bupivacaine allowing appropriate relaxation of the patient's musculature while providing excellent pain control. The shoulder was then successfully reduced without procedural sedation.

Why Should an Emergency Physician Be Aware of This?: Procedural sedation for reduction of anterior shoulder dislocations is time-consuming, resource-intensive, and can be risky in some populations. The addition of an axillary nerve block to a suprascapular nerve block allows for more complete muscle relaxation to successfully reduce a shoulder dislocation without procedural sedation.

INTRODUCTION

Anterior glenohumeral dislocation is a common injury seen in emergency departments (EDs) that is managed with manual reduction prior to discharge. Procedural sedation (PS) is frequently required to provide necessary analgesia and muscle relaxation. Sedation in the ED is time-consuming, risky, and requires staff, space, and monitoring. Increasingly, emergency physicians (EPs) are avoiding PS and attempting reduction with peripheral analgesics, intra-articular blocks, or peripheral nerve blocks (PNBs; 1–3). Regional anesthetic techniques have long been performed in the operating room to selectively block the brachial plexus and provide peri-operative analgesia, and ED physicians routinely use other PNBs for a variety of indications. When compared to procedural sedation for reduction, PNBs have been shown to provide similar patient satisfaction with a dramatically shorter ED length-of-stay (4–7). Intra-articular anesthetic injections have similar, if not slightly inferior, degrees of pain relief as PNBs, but frequently do not reach the joint space or provide the muscle relaxation that is needed for easy reduction (8–10).

The upper extremity has multiple nerve targets that can be blocked with both blind and ultrasound-guided methods. The interscalene block (ISB) is one ultrasound-guided technique performed in the lateral neck that provides both motor and sensory blockade of the C5, C6, and C7 nerve roots of the brachial plexus. The proximal nature of this block provides extensive sensorimotor blockade to the upper extremity and is routinely used perioperatively (11). This block can be safely taught to EPs and has been used in the ED for reduction of anterior shoulder subluxations on a case reportable basis, with excellent outcomes (12–16). Unfortunately, the ISB has several risks; notably, local spread of anesthetic can result in Horner’s syndrome, phrenic nerve paralysis with hemidiaphragm elevation, and hoarseness (17). Inadvertent injection into the adjacent epidural spaces or vascular structures can result in neurologic complications (18). Blockade of the suprascapular nerve (SSNB), which provides the majority of shoulder innervation, has been described in the ED literature for shoulder dislocation reduction, with variable degrees of analgesia and motor relaxation achieved (8, 15, 19, 20). While the suprascapular nerve provides the majority of the shoulder innervation, multiple other nerves, most predominantly the axillary nerve, contribute to the shoulder muscles and sensory structures. It follows that adding a complementary PNB may provide better outcomes for both patient and provider. The perioperative anesthesia literature has demonstrated equipoise in pain relief and patient satisfaction in patients undergoing total shoulder arthroplasty when the SSNB was combined with an axillary nerve block (ANB) compared to the ISB alone (11, 21).

We present a case where the addition of an ultrasound-guided ANB to a SSNB provided near complete sensorimotor blockade to facilitate safe and rapid reduction of an anterior shoulder dislocation in the ED setting.

CASE REPORT

A 34-year-old left hand dominant male presented to the ED with an acute left shoulder dislocation sustained while rock climbing. He had a prior history of two shoulder subluxations and one shoulder dislocation that occurred 1.5 years previously, that was rehabilitated with physical therapy.

The patient was neurovascularly intact. Radiographs demonstrated an anterior-inferior glenohumeral joint dislocation with evidence of Hill-Sachs lesion. The patient was a fit rock climber, with developed muscular build and tone. An attempt to reduce the shoulder with intravenous hydromorphone analgesia was attempted without success. The patient elected to trial a nerve block prior to the use of PS. A combined suprascapular and axillary nerve block was offered due to concern that the patient would have incomplete muscle relaxation with only a suprascapular nerve block.
The patient was placed in a sitting position and the skin prepped with chlorhexidine and sterile drapes.

Anatomic landmarks for the suprascapular nerve (Figure A) and axillary nerve (Figure B) were identified on ultrasound. The linear probe was placed parallel to the supraspinous fossa to identify the suprascapular nerve. The suprascapular nerve was identified lying superior to the fossa and beneath the supraspinatus muscle. The axillary nerve was identified within the quadrilateral space by placing the probe parallel to the long axis of the humeral shaft. The nerve was identified next to the circumflex artery.

The skin was anesthetized with 1% lidocaine using a 27-gauge needle at each site. A 25-gauge 3.5-inch needle was inserted percutaneously and advanced under out-of-plane ultrasound guidance to inject 5 mL of 0.5% bupivacaine around the axillary and suprascapular nerves respectively. The patient experienced no paresthesia, and aspiration prior to injection was negative.

Shoulder reduction was then successfully performed without procedural sedation. The reduction was confirmed with X-ray and the patient was placed in a sling. A referral to orthopedics clinic was placed and the patient attended a follow-up appointment three days later.

DISCUSSION

The majority of the shoulder innervation is provided by the C5 and C6 nerve roots via the suprascapular and axillary nerves, with lesser and variable contributions from the musculocutaneous, subscapular, and lateral pectoral nerves (22). The suprascapular nerve innervates the supraspinatus and infraspinatus muscles, while the axillary nerve supplies the deltoid, long head of the triceps, and teres minor. Collectively, these muscles stabilize the glenohumeral joint. Regional nerve blocks can target these downstream nerves or aim more proximally, to block the nerve roots or proximal trunks of the brachial plexus. Compared to the interscalene block (ISB), the suprascapular nerve block (SSNB) has fewer complications due to the location of the injection and may be performed with or without ultrasound guidance. The SSNB targets the nerve as it passes through the suprascapular notch, providing a safe bony backdrop to prevent inadvertent damage to local structures and is only associated with a theoretical risk of iatrogenic pneumothorax (23, 24). The suprascapular nerve provides 70% of the shoulder’s sensory innervation along with motor input to two of the four rotator cuff muscles; it presents a natural and safe target for emergency physicians (EPs) seeking a PNB for anterior shoulder subluxation reduction (25). Unfortunately, the SSNB does not block sensory input from the axillary or other local nerves and thus has inconsistent results for reduction with regards to pain relief and muscle relaxation (11, 21, 26). The perioperative anesthesia literature has shown equipotent pain relief and muscle relaxation of a combined SSNB with axillary nerve block (ANB) when compared with the ISB (11, 21). In theory, applying anatomic principles and these results, a combined block could potentially improve outcomes in shoulder reductions when compared to the sole SSNB.

The axillary nerve block (ANB) has occasionally been used in the emergency department (ED) to facilitate dislocation reduction, fracture manipulation, and for abscess incision and drainage (27, 28). Targeting the axillary nerve through the quadrilateral space formed by the humeral shaft, long head of the triceps, and teres muscles allows the nerve to be blocked at the division of the anterior and posterior branches while using the humeral shafts as a safe and bony backdrop. These branches provide the cutaneous sensory input and motor control of the teres minor, deltoid, and subscapularis muscles. The axillary nerve in the quadrilateral space is adjacent to the suprascapular nerve and targets can be blocked together without repositioning the patient (28–30). In our case, the patient had well-developed shoulder musculature and reduction attempts prior to the nerve block were unsuccessful due to patient discomfort and tone of the developed musculature. In this case, both the SSNB and ANB were performed under ultrasound guidance with resultant motor and sensory blockade and a successful shoulder relocation.

Further investigation is needed to determine the ED safety profile of combined SSNB and ANB, training pathways for EPs and emergency medicine residents to increase procedural confidence and competence, development of simulation-based models, and consistency of results in a variety of patient populations, including the elderly and those with proximal humeral fractures, cutaneous abscesses, and complex fracture-dislocations. Pilot trials to better characterize efficacy and complications are needed as well.

Consent: Patient consent was obtained.

REFERENCES

1. Hendey GW: Managing Anterior Shoulder Dislocation. *Ann Emerg Med* 67(1):76–80, 2016.

2. Nejati A, Teymourian H, Behrooz L, Mohseni G: Pain Management via Ultrasound-guided Nerve Block in Emergency Department; a Case Series Study. *Emerg* 5(1):12, 2016.

3. Bhoi S, Chandra A, Galwankar S: Ultrasound-guided nerve blocks in the emergency department. *J Emergencies Trauma Shock* 3(1):82–88, 2010.

4. Tezel O, Kaldirim U, Bilgic S, Deniz S, Eyi YE, Ozyurek S, Durusu M, Tezel N: A comparison of suprascapular nerve block and procedural sedation analgesia in shoulder dislocation reduction. *Am J Emerg Medicine* 32(6):549–552, 2014.

5. Doost ER, Heiran MM, Movahedi M, Mirafzal A: Ultrasound-guided interscalene nerve block vs procedural sedation by propofol and fentanyl for anterior shoulder dislocations. *Am J Emerg Medicine* 35(10):1435–1439, 2017.

6. Blaivas M, Adhikari S, Lander L: A Prospective Comparison of Procedural Sedation and Ultrasound- guided Interscalene Nerve Block for Shoulder Reduction in the Emergency Department. *Acad Emerg Med* 18(9):922–927, 2011.

7. Alimohammadi H, Azizi M-R, Safari S, Amini A, Kariman H, Hatamabadi HR: Axillary nerve block in comparison with intravenous midazolam/fentanyl for painless reduction of upper extremity fractures. *Acta Medica Iranica* 52(2):122–4, 2014.

8. Gleeson AP, Graham CA, Jones I, Beggs I, Nutton RW: Comparison of intra-articular lignocaine and a suprascapular nerve block for acute anterior shoulder dislocation. *Inj* 28(2):141–142, 1997.

9. Omer T, Perez M, Berona K, Lam CN, Sajed D, Brandon C, Falkenstein J, Kang T, Mailhot T: Accuracy of Landmark-guided Glenohumeral Joint Injections as Assessed by Ultrasound in Anterior Shoulder Dislocations. *West J Emerg Medicine* 22(6):1335–1340, 2021.

10. Singelyn FJ, Lhotel L, Fabre B: Pain Relief After Arthroscopic Shoulder Surgery: A Comparison of Intraarticular Analgesia, Suprascapular Nerve Block, and Interscalene Brachial Plexus Block. *Anesthesia Analgesia* 99(2):589–592, 2004.

11. Faiz SHR, Mohseni M, Imani F, Attaee MK, Movassaghi S, Rahimzadeh P: Comparison of Ultrasound-Guided Supra-scapular Plus Axillary Nerve Block with Interscalene Block for Postoperative Pain Management in Arthroscopic Shoulder Surgery; A Double-Blinded Randomized Open-Label Clinical Trial. *Anesthesiol Pain Medicine* 11(2):e112540, 2021.

12. Underhill TJ, Wan A, Morrice M: Interscalene brachial plexus blocks in the management of shoulder dislocations. *Arch Emerg Med* 6(3):199, 1989.

13. Blaivas M, Lyon M: Ultrasound-guided interscalene block for shoulder dislocation reduction in the ED. *Am J Emerg Medicine* 24(3):293–296, 2006.

14. Brant-Zawadzki G, Herring A: Urgent interscalene brachial plexus block for management of traumatic luxatio erecta in the ED. *Am J Emerg Medicine* 33(7):986.e3-986.e5, 2015.

15. Kaya M, Eksert S, Akay S, Kantemir A, Keklikci K: Interscalene or suprascapular block in a patient with shoulder dislocation. *Am J Emerg Medicine* 35(1):195.e1-195.e3, 2017.

16. Beals T, Odashima K, Haines LE, Likourezos A, Drapkin J, Dickman E: Interscalene brachial plexus nerve block in the emergency department: an effective and practice-changing workshop. *Ultrasound J* 11(1):15, 2019.

17. Lim YC, Koo ZK, Ho VivianW, Chang SS, Manohara S, Tong QJ: Randomized, controlled trial comparing respiratory and analgesic effects of interscalene, anterior suprascapular, and posterior suprascapular nerve blocks for arthroscopic shoulder surgery. *Korean J Anesthesiol* 73(5):408–416, 2020.

18. Brull R, McCartney CJL, Chan VWS, El-Beheiry H: Neurological Complications After Regional Anesthesia: Contemporary Estimates of Risk. *Anesthesia Analgesia* 104(4):965–974, 2007.

19. Herring AA, Stone MB, Nagdev A: Ultrasound-guided suprascapular nerve block for shoulder reduction and adhesive capsulitis in the ED. *Am J Emerg Medicine* 29(8):963.e1-963.e3, 2011.

20. Edeland HG, Stefánsson T: Block of the Suprascapular Nerve in Reduction of Acute Anterior Shoulder Dislocation: Case Reports. *Acta Anaesth Scand* 17(1):46–49, 1973.

21. Zhao J, Xu N, Li J, Liang G, Zeng L, Luo M, Pan J, Yang W, Liu J: Efficacy and safety of suprascapular nerve block combined with axillary nerve block for arthroscopic shoulder surgery: A systematic review and meta-analysis of randomized controlled trials. *Int J Surg* 94:106111, 2021.

22. C. AO, Lee DA, T. BB, G. ME: Innervation of the Human Shoulder Joint and Its Implications for Surgery. *Clin Orthop Relat R* 330(NA;):202–207, 1996.

23. White L, Reardon D, Davis K, Velli G, Bright M: Anterior suprascapular nerve block versus interscalene brachial plexus block for arthroscopic shoulder surgery: a systematic review and meta-analysis of randomized controlled trials. *J Anesth* 36(1):17–25, 2022.

24. Peng PWH, Wiley MJ, Liang J, Bellingham GA: Ultrasound-guided suprascapular nerve block: a correlation with fluoroscopic and cadaveric findings. *Can J Anesthesia J Can D'anesthésie* 57(2):143–148, 2010.

25. Vorster W, Lange CPE, Briët RJP, Labuschagne BCJ, Toit DF du, Muller CJF, Beer JF de: The sensory branch distribution of the suprascapular nerve: An anatomic study. *J Shoulder Elb Surg* 17(3):500–502, 2008.

26. Messina C, Banfi G, Orlandi D, Lacelli F, Serafini G, Mauri G, Secchi F, Silvestri E, Sconfienza LM: Ultrasound-guided interventional procedures around the shoulder. *Br J Radiology* 89(1057):20150372, 2016.

27. Kriwanek KL, Wan J, Beaty JH, Pershad J: Axillary Block for Analgesia During Manipulation of Forearm Fractures in the Pediatric Emergency Department A Prospective Randomized Comparative Trial. *J Pediatr Orthoped* 26(6):737–740, 2006.

28. Lyons C, Herring AA: Ultrasound-guided axillary nerve block for ED incision and drainage of deltoid abscess. *Am J Emerg Medicine* 35(7):1032.e3-1032.e7, 2017.

Figure A

(i) Linear ultrasound probe parallel to the supraspinous fossa. (ii) Ultrasound image in transverse plane. Individual pictured is a model volunteer and is not the patient described in our case.

Figure B

(i) Linear ultrasound probe parallel to the long axis of the humeral shaft. (ii) Ultrasound image with color Doppler in longitudinal plane. Individual pictured is a model volunteer and is not the patient described in our case.


GE
Venue
Cephalad
Caudad
Deltoid
Axillary nerve
Teres minor
Circumflex artery