

# Tips & Tricks: The Saline Load Test is Effective in Detecting Traumatic Arthrotomies of the Shoulder

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## Introduction:

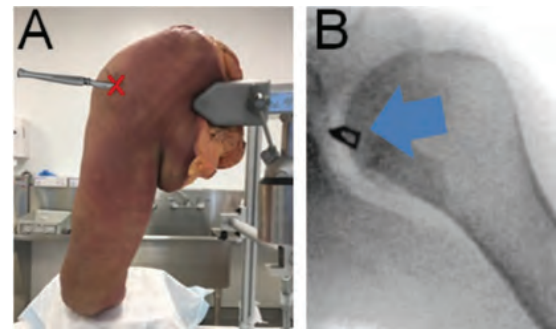
Penetrating injuries about the shoulder girdle may be challenging to discern intra-articular involvement, yet these injuries are common, as 9% of gunshot wounds involve the shoulder girdle<sup>1</sup>. Early diagnosis of a traumatic arthrotomy is paramount, and surgical debridement is the standard of care to prevent morbidity. The saline load test is a frequently-used diagnostic tool to assess for traumatic arthrotomies in the knee, ankle, and elbow.<sup>2-4</sup> However, there is a paucity of information in the current literature in regard to the amount of fluid infusion required to reliably detect a traumatic glenohumeral arthrotomy. The purpose of this study was to investigate the amount of fluid required during a saline load test to detect intra-articular glenohumeral involvement of traumatic wounds about the shoulder girdle with high sensitivity.

## Methods:

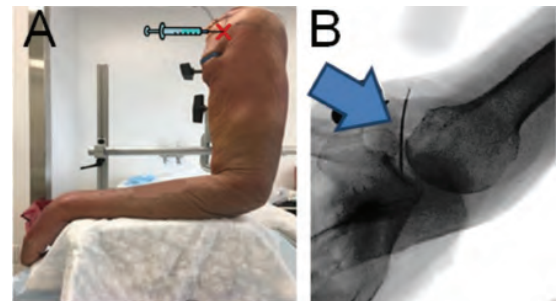
A cadaveric study was conducted using 18 thawed, fresh-frozen forequarter amputations from 10 different donors (2M, 8F). Specimen age (mean 75.5 years, range 56-93 years), laterality (8 right, 10 left), body weight (mean 134.6 lbs, range 77-187lbs), and glenohumeral range of motion (ROM) was assessed prior to testing. The glenohumeral capsule was punctured with an 11-blade scalpel through the posterior portal site under fluoroscopic guidance to ensure the injury was intra-articular (Fig 1). A 19G needle was then placed through the anterior portal site and confirmed with fluoroscopy to ensure intra-articular placement (Fig 2). Normal saline was then injected until frank extravasation from the posterior portal site was observed. The volume of saline required to detect the arthrotomy was recorded, a histogram of saline volumes (by percentile) was created, and a logarithmic distribution was calculated.

## Results:

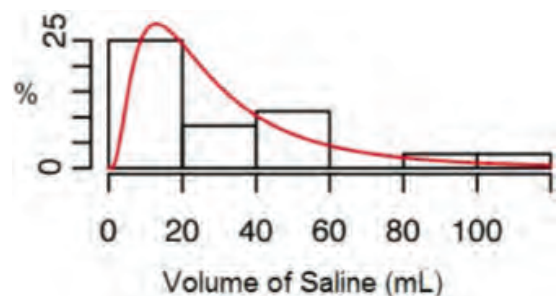
The average amount of saline that resulted in extravasation was 34 mL (range 8-105mL). In order to identify 75%, 90%, 95% and 99% of the simulated glenohumeral arthrotomies, 42 [95% CI: 28-59] mL, 68 [42-106] mL, 90 [53-151] mL and 156 [80-289] mL were required, respectively (Figure 3). Pre-test ROM did not correlate with saline volume.



**Figure 1.** (A) Photograph of the experimental setup from a posterior view. The cartoon scalpel and "X" indicates the anatomic location where the traumatic arthrotomy was created. (B) A fluoroscopic image confirming the 11-blade scalpel position for creation of traumatic arthrotomy. The location of the blade is highlighted by a blue arrow.



**Figure 2.** (A) Photograph of the experimental setup from a lateral view. The cartoon of a syringe and "X" indicates the anatomic location where the saline was injected. (B) A fluoroscopic image confirming the 19G needle was in the glenohumeral joint space. The location of the needle is highlighted by a blue arrow.



**Figure 3.** Logarithmic transformation showing distribution of saline volumes required to detect traumatic arthrotomy.

## Discussion:

The saline load test has previously been shown to be an effective tool to diagnose traumatic arthrotomies.<sup>2-4</sup> This study demonstrates the efficacy of the saline load test in detecting traumatic arthrotomies of the glenohumeral joint with high sensitivity. Penetrating injuries involving joints must be treated aggressively. Gunshot wounds are

common in urban environments and may cause devastating sequelae with significant morbidity. Retained intra-articular bullets may lead to arthropathy. Furthermore, synovial fluid may dissolve bullets and lead to arthrofibrosis, chondrolysis, and hypertrophic arthropathy. Other foreign bodies may also be entrapped in the joint and must be debrided to prevent septic arthritis. Consequently, prompt and accurate diagnosis of traumatic arthrotomies is paramount to guide management and optimize post-injury outcomes.

### Significance:

Glenohumeral joint traumatic arthrotomies may be detected with high sensitivity with the saline load test when injecting at least 68 mL of fluid.

### References:

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3. **Feathers T, et al.** Effectiveness of the saline load test in diagnosis of traumatic elbow arthrotomies. *J Trauma.* 2011 Nov;71(5):E110-3
4. **Bariteau JT, et al.** Evaluation of saline load test for simulated traumatic arthrotomies of the ankle. *Injury.* 2013 Nov;44(11):1498-501.