Comparison of the Closed Shoulder Reduction Techniques: An Evidence-to-Practice Review

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ABSTRACT

The shoulder joint is one of the most dislocated joints in the body. It does not have substantial bony support which allows for a large range of motion. Shoulder joints most commonly dislocate anteriorly, and less often dislocate posteriorly and inferiorly. There is a myriad of ways to reduce a shoulder dislocation including closed and open techniques. The purpose of this evidence-to-practice review is to summarize which closed shoulder reduction techniques are most effective and apply those results to an athletic training setting. The authors of this guiding systematic review studied multiple articles that compared different closed shoulder reduction techniques on the following criteria: pain experienced by the patient, ease of technique for clinician (time to reduce the shoulder joint), success rate, and complication rates. The authors chose to include randomized control trials, prospective studies, and retrospective studies. The literature revealed that the scapular manipulation technique had the best outcomes in all the criteria, however, every patient that had a shoulder dislocation that was reduced using that method also had intravenous analgesics. The Fast, Reliable, and Safe (FARES) method was found to be the third most successful and least painful during relocation and was often used without intravenous analgesics. Based on rate of success and patient comfort during reduction, the FARES method is the best option, suggesting that it should be taught to healthcare providers more often. Depending on the state practice act and physician oversight, athletic trainers who are allowed to reduce dislocations should be informed and educated on how to properly reduce and also allow for the best possible outcome and comfort for the patient.

Key Phrases
General Medical Interventions, Clinic and Hospital Patient Population

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ORIGINAL REFERENCE

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SUMMARY

CLINICAL PROBLEM AND QUESTION

Shoulder dislocations account for over 50% of joint dislocations, making it the most commonly dislocated joint of the body.[1,2] In the United States, glenohumeral dislocations occur at a rate of 23.9 per 100,000 person-years, of which 95% occur in an anterior dislocation.[2,3] These injuries can cause a lot of pain for the patient, and improper relocation of the joint may cause complications such as tears of the biceps tendon, deep vein thrombosis, and iatrogenic fractures, and other neurological impairments.[2] Of the shoulder dislocations that presented to emergency departments in the United States between 2002-2006, 48.3% of them occurred during sport or recreation, and most of those occurring in sport or recreation occurred in males (86.7%).[4] Shoulder instability is often a result of a dislocation; an epidemiologic study of athletes at three universities demonstrated that football had the highest prevalence of shoulder instability at 29.3% of cases, followed by basketball, and wrestling.[5] The same study found that the most common type of instability was an occasional, traumatic anterior dislocations, and the majority of shoulder dislocations and instability were traumatic in nature.[5] The National Athletic Trainers' Association (NATA) does not recommend reduction by an athletic trainer if the shoulder joint has dislocated posteriorly or if a fracture is

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suspected.[1] Posterior dislocations account for approximately 1-5% of all glenohumeral dislocations and are not common in athletics.[1,2] The glenohumeral joint is the most commonly dislocated joint specifically in athletes competing in contact or collision sports.[1]

There are multiple ways that a clinician can choose to relocate a shoulder, all with varying levels of pain experienced by the patient, ease of technique for the clinician (time to reduce the joint), success rate, and complication rates. In this guiding systematic review, ease of the reduction technique for the clinician was determined by the time the technique took to reduce the dislocation.[2] Typically, the method chosen is a result of the provider's knowledge, comfort in performing, or guidance from a collaborating physician. Athletic trainers may come across an acute shoulder dislocation in the athletics setting, particularly in contact or collision sports. With the update to the 2020 Commission on Accreditation of Athletic Training Education (CAATE) Standards, specifically Standard 70 stating that students must learn how to manage emergent conditions such as reductions of dislocations, more athletic trainers will be educated on those techniques. But this, does mean that there are many athletic trainers who are already certified and practicing without that knowledge, unless they have been instructed outside of their primary education.[6] We believe there is a need for certified athletic trainers who were not taught these techniques to be knowledgeable on techniques to properly reduce joint dislocations to ensure improved patient outcomes. Athletic trainers also often work in rural areas, where oftentimes emergency personnel can take a long time to arrive. This knowledge of how to properly reduce a shoulder dislocation may save one of their patients a lengthy ride in an EMS truck and would also save the patient and their families money as the average cost of a closed shoulder dislocation is $2,200.7 Research has explored various individual techniques in reduction but has not compared the techniques to each other. The purpose of this article was to summarize what the systematic review states and compare what the literature indicates about closed reduction techniques in anterior shoulder dislocations, and determine which technique had the best score in each of the previously mentioned categories of pain experienced by the patient, ease of technique for the clinician (time to reduce the shoulder joint), success rate, and complication rates.

SUMMARY OF LITERATURE

The authors of this guiding article identified 2099 different studies. From that search, articles were included if they focused on shoulder reduction techniques written in English, German, Dutch, and Arabic. Exclusion criteria included open reposition techniques and case reports, systematic reviews, meta-analyses, animal/cadaver/in vitro studies, biomechanical reports, letters to editors, and instructional courses. Additionally, each article that was reviewed was graded and given a modified Coleman Methodology score, which assessed the included articles' methodology on a scale of 0-90.2 A modified Coleman Methodology score of less than 50 was considered poor, between 50-64 was fair, between 65-79 was good, and between 80-90 was excellent.[2] The Coleman Methodology score is a tool used by researchers to determine if a study's methods and outcomes are considered to be of high or low quality, specifically for studies involving orthopedic injuries, surgeries, and rehabilitations; the authors of this systematic comparison modified it for their specific study.[2] Any study that was given a score of less than 50 points was also excluded from the review. The article list was further narrowed down to 13 articles (9 randomized control trials, 2 retrospective studies, 2 prospective non-randomized comparative studies). Once each article was selected, a comparison was done looking at reduction success, mean reduction time, mean hospital stays, pain, and complications.

SUMMARY OF INTERVENTIONS

The systematic review identified 23 different closed shoulder reduction techniques. However, only 10 reduction techniques were included from the 13 articles selected for the systematic comparison because the other techniques did not meet inclusion criteria or have not been researched. These techniques were then categorized into two groups: traditional and non-traditional. **Table 1** provides the list of traditional and non-traditional techniques that were included in this systematic comparison. Table 2 provides the complete list of 10 reduction techniques including the name, procedure of each reduction technique, is accompanied by a photo demonstration of how each technique should be performed. There were three non-traditional techniques (Boss-Holzach-Matter, Bokor-Billmann, and Aufmesser's techniques) that were mentioned but not examined in the guiding review article, and for that reason are not in Table 2. However, due to the uniqueness of the methods, we have provided brief instructions on the methods. To perform the Boss-Holzach-Matter reduction technique, the patient sits with their hands around the knee on the same side of the affected shoulder, leans back, puts their neck into hyperextension, and shrugs the shoulders anteriorly creating a method of self-reduction.[8] The Bokor-Billmann technique involves the practitioner holding the patient's wrist in one hand, and their elbow in the other, the elbow is flexed to 90 degrees, followed by flexing the glenohumeral joint to 90 degrees, then the shoulder is adducted completely, and then an internal rotation pressure in applied until reduction is felt at about 30 degrees.[9] For the Aufmesser's method, the patient is supine, the clinician holds the patient's hand and fixes their acromion, applies traction to the arm while maintaining eye contact with instructions to relax, and if necessary the clinician's trunk can be used as a fulcrum to provide extra force.[10]

SUMMARY OF OUTCOMES

Best clinical practice, in this case, was defined by which techniques had the best scores in the following categories: pain experienced by the patient, ease of technique for clinician, success rate, and complication rates. Pain levels were determined using the Visual Analogue Scale (VAS) with a score between 1-10, with 1 being the least amount of pain and 10 being the greatest amount of pain.[2] Ease of technique was based on the length of time it took to complete the reduction; a reduction with a lower time was considered easier to perform.[2] The success rate was determined by the percentage of reductions that were completed without further intervention, like having to proceed into an open reduction.[2] Complication risks were determined by any condition that followed and was associated with the reduction such as fracture, deep vein thrombosis, and neuropraxia.[2] The aim of this guiding systematic comparison was to determine which closed reduction technique is the best in terms of success rate, ease of technique, complications, and patient reported pain.[2]

FINDINGS AND CLINICAL IMPLICATIONS

This guiding systematic comparison sought to determine which relocation technique was the most effective, efficient, least painful, and had the fewest complications for a patient with a shoulder dislocation. There are many techniques and maneuvers that a clinician needs to consider, along with their own comfort and experience with each. When looking at each article, there were some varying values for each outcome.

The highest values for successful reduction (**Table 1**) were the scapular manipulation (97%), the traction-countertraction (95%), the FARES method (92%), the Spaso technique (92%), and the external rotation maneuver (91%).2 The Stimson's technique was least likely to facilitate a successful reduction (28%).[2] Scapular manipulation was the quickest (mean time 1.75 min), while the Stimson's

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Table 1: Reduction Techniques

Techniques	Reduction Style	Pain Experienced by Patient (VAS 1-10)	Time to Reduce Shoulder (Minutes)	Success Rate (%)	Complications
Kocher Maneuver	Traditional	4.68 ± 2.00	4.19 ± 1.25	85	1
Spaso Technique	Traditional	4.69 ± 1.26	2.65 ± 0.59	92	0
External Rotation Technique	Traditional	3.39 ± 0.40	3.06 ± 0.28	91	0
Milch Maneuver	Traditional	5.28 ± 0.54	4.29 ± 0.14	80	0
Chair Method	Traditional	4.00 ± 0.60	3.00 ± 0.30	78	0
Traction-Countertraction	Traditional	4.75 ± 0.55	6.05 ± 2.49	95	0
Scapular Manipulation	Traditional	1.47 ± 0.44	1.75 ± 0.38	97	0
Stimson's Technique	Traditional	5.30 ± 0.14	8.84 ± 0.30	28	0
Hippocratic Maneuver	Traditional	4.88 ± 0.54	5.55 ± 0.39	73	0
Fast, Reliable, and Safe (FARES) Method	Non-Traditional	1.59 ± 0.46	2.24 ± 0.27	92	0

technique took the longest (mean time 8.84 min).[2] Only three studies looked at mean hospital stay.

Shoulders reduced with the Milch maneuver had the shortest hospital stay (35 min), followed by those who were treated with scapular manipulation (92.4 min), the Oxford Chair (141 min), and the traction-countertraction maneuver (320.4 min).[2]

For patient experienced pain, the scapular manipulation technique tends to be the least painful during the reduction (VAS=1.47 during reduction), followed by the FARES method (VAS=1.59 during reduction).[2] The Stimson's method (VAS=5.30; SD 0.14) and the Milch method (VAS=5.28) tend to be the most painful.[2] Only one study reported a complication which occurred during implementation of the Kocher reduction technique, which was a fracture of the humeral neck.[2] The authors of this systematic comparison also specifically mention that the Kocher method has previously been associated with a rupture of the pectoral muscles or humeral fractures and that the Hippocratic method has been associated with transient neuropraxia of the brachial nerve.[2]

Evidence in this review identified that the FARES method had the best outcomes without any analgesic use reported.[2] The scapular manipulation technique had a lower patient pain rating during relocation, but all patients receiving that technique on their dislocation were also given intravenous analgesics. It is evident that the scapular manipulation technique and FARES maneuver had the lowest amounts of pain during reduction and these two techniques also exhibited some of the highest rates of reduction success. The FARES method is new and considered non-traditional compared to the scapular manipulation technique, but clearly shows promising outcomes in patient pain and reduction success.[2]

However, there are many limitations to this systematic comparison that need to be addressed. Practitioner experience and bias were not examined, as some may be more likely to choose one method over another based-on patient characteristics or their own comfort and education in reduction. This analysis was done using studies that took place in the hospital setting, and therefore does not consider the hospital protocols, which could particularly influence the outcome of length of hospital stay. Furthermore, many

methods used accompanying analgesics or anesthetics and it was not determined if the use of these had been determined by hospital protocol, physician order, or upon patient request. The authors concluded that the techniques that also used analgesics or anesthesia generally had higher rates of successful reduction; it makes sense that a person in less pain would also have less muscle guarding, allowing for a better chance at a successful reduction. Along with the risks associated with closed reduction of a shoulder dislocation, the use of analgesics or anesthesia comes with its own set of concerns that affect patient comfort, such as vomiting and respiratory distress.[2]

This is relevant to athletic trainers because, depending on the standing orders from the team physician or laws of the state in which they are practicing, the athletic trainer may be in a situation in which they are called on to relocate a shoulder and knowledge of which technique to use is important for best patient outcomes. Joint relocation has become part of the 2020 CAATE Standards, leaving many athletic trainers who have already completed their education without this training. We believe that education on these shoulder reduction techniques should be taught to athletic trainers who are already certified; it may be possible to do so at either at a conference or as a professional development course, as this is likely where many athletic trainers can gather for education. However, an online class, while more attainable, may not be the best option as techniques like this require firsthand practice. Based on the findings of the guiding systematic comparison and our own clinical analysis, we believe that the FARES method is the most clinically applicable for athletic trainers while also being cautious of patient comfort. The FARES method is simple and does not require intravenous analgesics, which some athletic trainers are not allowed to provide based on state practice acts and physician oversight. In our experience, athletic trainers may come across an acute shoulder dislocation in the athletics setting, particularly in contact or collision sports.

CLINICAL BOTTOM LINE

There are several techniques to reduce a shoulder dislocation. Choosing which technique to use depends on clinician training, access to extraneous assistance such as intravenous analgesics, the direction of dislocation, and the setting that the clinician is providing care. According to this review, the FARES technique was the most successful, least painful, and quickest when the use of intravenous analgesics was not available.[2] Although the scapular manipulation method of reduction had the best results across all categories, all patients were treated with intravenous analgesics, which is not readily available in many athletic training settings. Also, athletic trainers are often not able to provide the intravenous analgesics so additional assistance may be required and is not always an option. The other techniques are valid but are not as effective based on the criteria. We believe that athletic trainers need more access to education on joint reduction techniques. Further research should include dislocation reductions involving athletic trainers and their prehospital care in a variety of patients that reflect an athletic trainers' patient population.

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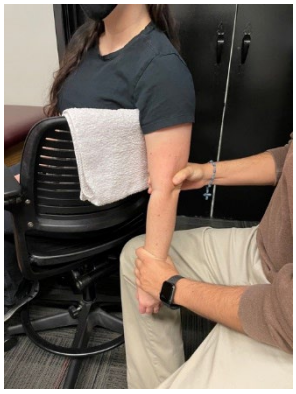
Table 2: How to perform each reduction technique included in systematic comparison

Technique Name	Performance Process	Photo of Technique
1. Kocher Maneuver	1. Patient is supine, arm adducted, and elbow flexed to 90 degrees 2. Clinician externally rotates arm until resistance is felt 3. Clinician flexes arm in external rotation 4. Clinician returns to adducted position	
2. Spaso Technique	1. Patient is supine, shoulder flexed to 90 degrees 2. Clinician pulls traction 3. Clinician externally rotates shoulder while maintaining traction until relocation is felt	
3. External Rotation Technique	1. Patient is supine with arm adducted and elbow flexed to 90 degrees each 2. Clinician flexes shoulder to 20 degrees 3. Clinician moves shoulder into external rotation until reduction is felt	

4. Milch Maneuver	1. Patient is supine 2. Clinician holds arm at the wrist 3. Clinician abducts and externally rotates arm until relocation is felt	
5. Chair Method	1. Patient's axilla is placed over back of a chair 2. Clinician holds arm from wrist and elbow 3. Clinician pulls downward traction until relocation occurs	
6. Traction-Countertraction	1. Patient lies supine with a sheet or belt around thorax and around contralateral side of affected shoulder and clinician 2. Patient elbow and shoulder are each flexed to 90 degrees 3. Clinician applies traction 4. Typically requires two clinicians	

7. Scapular Manipulation	1. Patient is prone with shoulder hanging off the table at 90 degrees of flexion 2. Patient holds weight in hand to provide traction 3. Clinician rotates scapula medially	
8. Stimson's Technique	1. Patient is prone 2. Arm hangs off edge of the table 3. Manual or weighted traction is placed on the hanging arm 4. Held for 10-20 min until shoulder relocates	
9. Hippocratic Maneuver	1. Patient is supine 2. Clinician places foot into injured side axilla 3. Traction is applied while arm is abducted to 30 degrees	
10. Fast, Reliable, and Safe (FARES) Method	1. Patient is supine 2. Clinician holds arm at the wrist 3. Clinician slowly abducts the arm while providing constant traction and oscillation