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Effectiveness of Closed Reduction Techniques for Anterior Shoulder Dislocation in the Emergency Department: Systematic review

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ABSTRACT

Background: The most frequent major joint dislocations seen in emergency rooms are anterior shoulder dislocations. The dislocation is often caused by falls at home or sports accidents. We aimed to determine the most effective closed reduction technique for anterior shoulder dislocations in the emergency department. *Method*: Original research that assessed closed reduction techniques using a different mechanism of action in patients with anterior shoulder dislocations who were 16 years of age or older were included. Reduction success rates should be documented in studies. Study was conducted according to PRISMA standards. Three reviewers independently searched the PubMed, Embase, and Scopus electronic databases between 2014 and 2024. *Result and conclusion*: The chair approach is less painful and appropriate in emergency situations. Additionally, aided self-reduction is a pleasant, easy, and very effective method that works well in emergency situations. Compared to Kocher's approach, the Spaso maneuver is more effective and well-tolerated. The Chair approach, the Spaso maneuver, Prakash's method, and aided self-reduction procedures were all easy to use, had low discomfort levels, and had excellent success rates. Due to higher power requirements and patient discomfort, traditional traction-based techniques (Kocher and Matsen) were less effective.

Keywords: Closed reduction approach, anterior shoulder dislocation, emergency room

1. INTRODUCTION

With a frequency of over 23 per 100,000 person-years, anterior shoulder dislocations are the most common major joint dislocations encountered in emergency departments (Leroux et al., 2014; Zacchilli and Owens 2010). Sports injuries or falls at home are frequently the cause of the dislocation (te Slaa et al., 2004; Zacchilli and Owens 2010). There are two peaks in the age distribution: one for women around the age of 50 and one for males around the age of 30 (Leroux et al., 2014; Liavaag et al., 2011). 19–26% of individuals had a recurrence within 5

years following a shoulder dislocation, with patients under 25 years old experiencing the most frequent occurrences (Leroux et al., 2014; te Slaa et al., 2004).

Numerous closed shoulder reduction procedures are employed in routine clinical practice; the selection of one approach appears to be based on the preferences of the physician (Cunningham, 2005). The three primary concepts of reduction strategies are traction, leverage, and biomechanically based procedures (Baden et al., 2017). The Hippocratic, Kocher, and Stimson procedures were the most commonly employed among surgeons employed in Dutch emergency departments, according to a 2003 study (te Slaa et al., 2003). The Kocher and Hippocratic approach was still widely employed among Dutch emergency doctors in a 2016 follow-up survey (Baden et al., 2020). But there were also more and more reports of biomechanical methods like Cunningham (Cunningham, 2003). This study aims to determine the most effective approach to closed reduction procedures for anterior shoulder dislocations in the emergency department.

2. METHODS

We include original studies that evaluated closed reduction procedures from a separate principle of action in patients with anterior shoulder dislocations aged 16 and above. Studies should record the reduction success rates. The reduction procedures have to be clearly specified and executed without the use of sedation, opiates at a higher than usual analgesic dosage, or intra-articular pain treatment in the emergency room. If an article was written in English, it was included. Letters, comments, conference papers, case reports, reviews, research protocols, animal studies, biomechanical studies, and studies conducted outside of hospitals were all excluded. The Preferred Reporting Items for Systematic reviews and Meta-Analyses (PRISMA) statement

From 2014 to 2024, three reviewers conducted separate searches in the electronic databases of PubMed, Embase, and Scopus. The reviewers' disagreement about eligibility was settled through dialogue. Potentially appropriate publications were reviewed in full after the identified records were initially filtered based on title and abstract. The references of the included studies underwent eligibility screening. The associated authors were emailed if a full-text version of the work was not accessible, and a follow-up email was sent if they did not respond.

Three reviewers independently extracted the data for each trial, and the outcomes were then compared and discussed. The reviewers did not dispute with one another. The initial author, research design, and year of publication were retrieved. The following data were also extracted: study design, study aim, study method, main findings, outcomes, and pain scales.

Quality assessment was performed according to the MINORS score (Table 1). The study with the highest score is due to randomization, adequate control groups, and thorough statistical analysis (20/24) (Rezende et al., 2015). Good-quality scores were (18/24 and 17/24, respectively) (Guler et al., 2015; Turturro et al., 2014) but lacked randomization and long-term follow-up. Moderate-quality studies were conducted by Anjum et al., (2019), Kuru et al., (2020) and Laik et al., (2023).

Table 1: MINORS quality assessment of the included studies

Study	Aim	Inclusion Criteria	Data Collection	Endpoints	Unbiased Assessment	Follow-up	Loss to Follow-up	Study Size	Adequate Control Group	Contemporary Groups	Baseline Equivalence	Adequate Statistical Analysis	Total Score
Anjum et al., 2019	2	2	2	2	1	1	1	1	0	0	0	1	12/16
Guler et al., 2015	2	2	1	2	1	1	1	2	2	2	1	2	18/24
Kuru et al., 2020	2	2	2	2	1	1	1	1	0	0	0	1	12/16
Laik et al., 2023	2	2	2	2	1	1	1	2	0	0	0	2	13/16
Rezende et al., 2015	2	2	2	2	2	2	2	2	2	2	2	2	20/24
Turturro et al., 2014	2	2	2	2	1	1	1	2	2	2	1	2	17/24

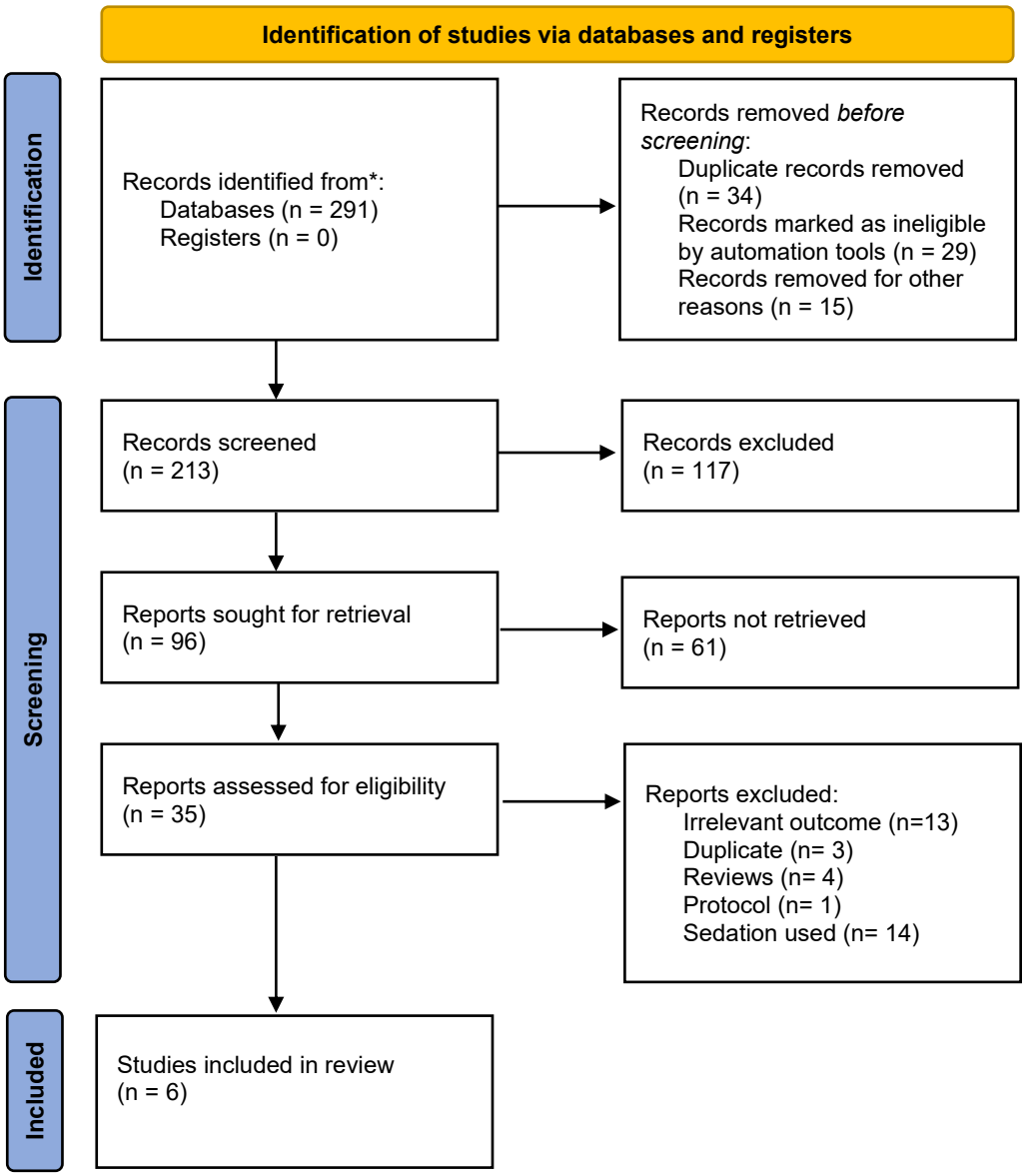

Fig 1: PRSIMA consort chart of selected studies

3. RESULTS

We included 6 articles in this systematic review study (Fig 1). Studies evaluated different shoulder reduction techniques, on the efficacy, safety, and feasibility of specific maneuvers. Anjum et al., (2019), Kuru et al., (2020) and Laik et al., (2023), aimed to assess the effectiveness of Prakash's method for anterior shoulder dislocations, its success rate, the need for sedation, and safety. Their findings were consistent, showing that Prakash's method had a high success rate (ranging from 94.7% to 97.06%), painless, required no sedation or traction, and easy to perform, even by relatively inexperienced physicians.

Guler et al., (2015) conducted a comparative study to evaluate four different reduction techniques—Chair, Kocher, Spaso, and Matsen methods—in terms of reduction time, force required, and patient experience. The chair method was the fastest and easiest, causing the least pain, while Kocher and Matsen methods required more force, increasing discomfort for patients. Rezende et al., (2015) compared the Spaso and Kocher maneuvers in a randomized prospective study. Spaso maneuver had a higher success rate (88.9%) compared to Kocher's method (69.77%).

Turturro et al. (2014) tested the effectiveness of an assisted self-reduction technique in comparison to the traditional traction-countertraction method. The assisted self-reduction technique was highly effective (98.4% success rate), painless, and decreased the

need for sedation. The characteristics of the included studies are presented in Table 2, and the main findings are summarized in Table 3.

Table 2: characteristics of the included studies

Article	Study Type	Aim	Outcome	Person Who Performed Reduction
Anjum et al., 2019	Prospective single-center study	To evaluate the effectiveness of Prakash's method for acute anterior shoulder dislocations	Success rate: 95.08% on first attempt; no sedation needed	Orthopedic residents
Guler et al., 2015	Retrospective comparative study	To compare different reduction techniques (Chair, Kocher, Spaso, and Matsen)	Chair method had the shortest reduction time; all methods had high success rates	Third-year orthopedic residents
Kuru et al., 2020	Prospective observational study	To assess the safety and success of Prakash's method for anterior shoulder dislocations	Success rate: 94.7%; mean procedure time: 243 ± 38 seconds	Single physician (not specified if a resident or attending)
Laik et al., 2023	Prospective study	To evaluate Prakash's method for anterior shoulder dislocations without anesthesia	Success rate: 97.06%; 91.18% successful on the first attempt; no complications	Orthopedic surgeons and emergency care providers
Rezende et al., 2015	Prospective randomized study	To compare the Spaso and Kocher maneuvers for shoulder reduction	Spaso: 88.9% success, faster and less painful than Kocher (69.77%)	Orthopedic surgery residents (1st, 2nd, and 3rd-year)
Turturro et al., 2014	Prospective case-control study	To evaluate the effectiveness of assisted self-reduction vs. traction-countertraction	Assisted self-reduction: 98.4% success; traction-countertraction: 88.1%	Orthopedic residents, supervised by senior authors

Table 3: main findings of the included studies

Citation	Demographics	Type of Shoulder Dislocation	Method of Reduction	Number of Patients	Success Rate
Anjum et al., 2019	Mean age: 37.04 ± 12.63 years; 77.04% male, 22.95% female	Primary anterior dislocation	Prakash's method	61 patients	95.08% on first attempt
Guler et al., 2015	153 patients (36 females, 127 males)	Anterior shoulder dislocation	Chair, Kocher, Spaso, and Matsen methods	153 patients	Chair: 97.8%, Kocher: 97.5%, Spaso: 94.8%, Matsen: 92.5%
Kuru et al., 2020	Mean age: 37.3 ± 13.1 years; 63.2% male, 36.8% female	Anterior shoulder dislocation	Prakash's method	19 patients	94.7%

Laik et al., 2023	Mean age: 38.98 ± 13.73 years; 77.45% male, 22.55% female	Anterior shoulder dislocation	Prakash's method	102 patients	97.06%
Rezende et al., 2015	Mean age: 30.92 ± 12.32 years	Traumatic anterior glenohumeral dislocation	Spaso vs. Kocher maneuver	88 patients	Spaso: 88.9%, Kocher: 69.77%r and less painful than Kocher
Turturro et al., 2014	Mean age: 40.0 ± 18.3 years; 75.4% male, 24.6% female	Acute anterior shoulder dislocation	Assisted self-reduction (modified Kocher method) vs. Traction-countertraction	237 patients (61 in Kocher, 176 in Traction-countertraction)	Kocher: 98.4%, Traction-countertraction: 88.1%

4. DISCUSSION

Shoulder dislocations are one of the most common joint injuries in emergency departments. Reduction technique has to be effective, quick, minimally painful, and require little assistance or sedation. Various studies examined reduction maneuvers, investigated success rates, patient experience, and procedural complexity. This study analyzes findings from six original articles on closed reduction methods, offering a comprehensive perspective on methods for reducing anterior shoulder dislocations.

Rezende et al., (2015) found that the Spaso maneuver resulted in a higher success rate (88.9%) compared to the Kocher maneuver (69.77%), while Spaso being quicker and less painful. Guler et al., (2015) compared Chair, Kocher, Spaso, and Matsen methods. Chair method success rate was 97.8%, followed by Kocher (97.5%) and Spaso (94.8%). Regarding the assisted self-reduction technique, 98.4% of patients were treated successfully without the need of sedation, which is better than traditional traction–countertraction method (88.1%) (Turturro et al., 2014). Milch had a significantly higher success rate (82.8% vs. 28%) and a shorter reduction time according to a randomized trial (Amar et al., 2012). Biomechanical reduction techniques (BRTs), such as the Milch and Cunningham methods, were better than leverage-based and traction-based methods (Baden et al., 2023). Traction–countertraction methods produce less pain, and leverage methods resulted in faster reductions (Dong et al., 2021).

Regarding the assessment of pain perception, Bijur et al., (2010) found a 1.5-point minimum clinically significant difference in pain scores, an important benchmark for evaluating reduction techniques. Rezende et al., (2015) found that Spaso maneuver caused significantly less pain than Kocher, which are consistent with Dong et al., (2021) meta-analysis, who concluded that traction–countertraction methods, particularly the Spaso maneuver, were the least painful.

The Cunningham technique, assessed in Cunningham's systematic review, was pain-free due to its reliance on muscle relaxation rather than forceful manipulation (Cunningham, 2005). According to literature Milch and FARES methods were more effective in reducing discomfort compared to traditional traction-based methods (Alkaduhimi et al., 2016). Reduction technique should be efficient and simple to perform. Studies evaluating procedure time found that biomechanical methods (Milch and Cunningham) were quicker than leverage-based methods (Dong et al., 2021). Milch was not only more successful than Stimson but also significantly faster, with an average reduction time of 4.68 minutes compared to 8.84 minutes (Amar et al., 2012). Chair method required the least time in Guler et al., (2015) study, which go in line with Baden et al., (2023) findings who indicate that BRTs were the most time-efficient reduction techniques.

Complication rates were low among the included studies, with no significant neurovascular injuries detected. However, some methods were associated with an increased risk of complications. Kocher's technique, while effective, carried a risk of humeral fractures and neurovascular injury because it depends on rotational leverage (Guler et al., 2015). FARES and Milch techniques were associated with fewer complications, aligning with Dong et al., (2021) meta-analysis, which found biomechanical techniques had the lowest complication rates. Turturro et al., (2014) study on assisted self-reduction also emphasized its safety, as none of the patients' experienced complications.

In emergency departments (EDs), there is a need for reduction maneuvers that are easy to perform. Milch is an easily learned technique, making it practical for junior physicians and emergency providers (Amar et al., 2012). Alkaduhimi et al., (2016) identified

more than 20 reduction techniques, emphasizing that Milch, FARES, and Cunningham techniques require less force. Also, the assisted self-reduction techniques should be implemented in EDs, as they require minimal physician intervention, making them a reasonable first-line choice (Turturro et al., 2014).

Limitations

Our study had come limitations; first, the small sample sizes, which reduce statistical power and generalizability; second, lack of randomization and control groups, leading to potential selection bias and difficulty in comparing techniques objectively; third, short-term follow-up, preventing assessment of long-term recurrence rates and complications; and fourth, single-center study designs, which limit external validity and applicability to broader populations.

5. CONCLUSIONS

Prakash's method is highly effective, painless, and easy to perform, even for inexperienced residents. It's highly effective and should be adopted by both orthopedic and emergency care providers. The chair method causes less pain and is suitable for emergency settings. Assisted self-reduction is a highly effective, simple, and painless technique suitable for emergency settings. Spaso maneuver is more effective and better tolerated than Kocher's method. Prakash's method, the Chair method, the Spaso maneuver, and assisted self-reduction techniques had a high success rate, minimal pain, and ease of use. Traditional traction-based methods (Kocher and Matsen) were less effective due to increased force requirements and patient discomfort.

List of abbreviations

BRT, Biomechanical Reduction Technique
ED, Emergency Department
GHJ, Glenohumeral Joint
MCSD, Minimum Clinically Significant Difference
MINORS, Methodological Index for Non-Randomized Studies
NRS, Numeric Rating Scale
PRISMA, Preferred Reporting Items for Systematic Reviews and Meta-Analyses
RCT, Randomized Controlled Trial
TCT, Traction–Countertraction

Informed consent

Not applicable.

Ethical approval

Not applicable.

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Conflict of interest

The authors declare that there is no conflict of interest.

Data and materials availability

All data sets collected during this study are available upon reasonable request from the corresponding author.

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