Comparison of Scapular Manipulation With External Rotation
Method of Reduction of Acute Anterior Shoulder Dislocation for Sedation Requirements and Success Rates

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ABSTRACT

Background: Anterior shoulder dislocation is a common sports-related musculoskeletal injury. Various methods have been described for reduction of the dislocation. A method that requires less sedation without compromising the success rate is likely to be highly useful in austere and prehospital settings. This study compares scapular manipulation with external rotation method for requirement of sedation and success rates.

Methods: Forty-six patients with anterior shoulder dislocation were allocated alternatively to reduction using either scapular manipulation (SMM) or external rotation (ERM) techniques. The groups were compared for sedation requirements, pain scores, and success rates. Results: Reductions using SMM had fewer requirements for sedation (13% versus 39%; p < .05) and higher first-pass success rates (87% versus 61%; p < .05) as compared with ERM for anterior shoulder dislocation reduction. The numeric rating score of pain during reduction procedures was less in SMM (mean, 1.65 [standard deviation, 1.6]) than in ERM group (mean, 4.30 [standard deviation, 1.8]; p < .01). Conclusion: The SMM required less sedation and had higher first-pass success rates than ERM for reduction of anterior shoulder dislocation. The SMM is thus likely to be of advantage in resource-limited austere settings.

Keywords: shoulder reduction, scapular manipulation, external rotation

Introduction

Shoulder dislocations are common in wilderness and outdoor settings.1 Closed reduction in the acute prehospital setting helps avoid potential complications and difficulty in reduction that can be caused by delay.2,3 Techniques of closed reduction involve manipulation of the humeral head back into the glenoid cavity by using either traction, leverage, or scapular manipulation.4-11 The external rotation method (ERM) is described as a simple, safe, well tolerated, and reliable technique.5,12,13 In the scapular manipulation method (SMM), the scapula is moved so that the glenoid rotates down to meet the humeral head.14,15 It is claimed to be simple, effective, relatively painless, without complication, often requiring no sedation or analgesia, and with a success rate >90%.10,16,17 SMM has been described as an ideal method to use in the wilderness setting because of safety and tolerability by patients.2

The use of procedural sedation and anesthesia in reducing a shoulder dislocation is a common practice but it carries some inherent risks of respiratory depression and cardiovascular compromise. It requires monitoring and extra staff.18-20

Various studies have compared different methods of reduction of shoulder dislocations.7,10,11,13-24 No study to date, to our knowledge, has compared the SMM with the ERM. The aim of this prospective study was to compare clinical outcomes of the two methods in the emergency department (ED) without anesthesia. The main outcomes were reduction success rates, requirement of sedation, and pain scores during reduction.

Methods

The study was done between January 2014 and March 2015 in the ED of Tribhuvan University Teaching Hospital, Kathmandu, Nepal, which is an urban tertiary care hospital with 1,000 beds. The ED has a total of 60 beds and receives approximately 110–125 patients daily. The study was approved by the Tribhuvan University Institute of Medicine Institutional Review Board on December 17, 2014, and was conducted in accordance with the latest version of the Helsinki Declaration. All patients were informed about the study and signed an informed consent form prior to enrollment.

All patients presenting with clinical and radiographic features of anterior shoulder dislocation (on standard anteroposterior and lateral views) during the study period and not meeting exclusion criteria were allocated either into the SMM group or the ERM group alternatively on the basis of presentation. Patients who had associated multiple injuries or dislocations with fractures other than greater tuberosity fracture of the humerus, and patients with duration of dislocation >24 hours were excluded from the study, because of the known difficulties in reducing such dislocations and the possibility of requiring sedation on the first attempt. Patients with severe cardiovascular or pulmonary disease (American Society of Anesthesiologists grade III and IV) were excluded from the study because of the departmental policy to sedate such patients for the procedure by an anesthesiologist for better control over the patient’s cardiopulmonary physiology.

Neurovascular status of the injured limb was documented before and after the reduction. Patients were included in the

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study regardless of presence or absence of neurologic deficits. Radiographs were obtained after the reduction to confirm reductions.

All the reductions were carried out by the same third-year resident physician who was familiar with both reduction methods and had performed both methods successfully multiple times before starting the study. All reduction procedures were supervised by the emergency attending physician on duty. A numeric rating scale (NRS) score was recorded for all attempts of reduction during and after the reduction.

Patients selected for scapular manipulation were placed in the prone position. The injured arm was placed overhanging from the edge of the bed and held at the elbow by an assistant with 90° of forward flexion of the shoulder. The elbow was flexed to relax the biceps tendon. After making sure that the patient was relaxed, the scapula was manipulated to effect reduction. This was accomplished by stabilizing the superior aspect of the scapula with one hand while adducting the inferior tip of the scapula using the thumb.

Patients selected for the ERM were placed supine. After making sure the patient was relaxed, the affected arm was adducted against the torso. The elbow was flexed to 90°. The upper arm was externally rotated slowly and gently, using the forearm as a lever by grasping the wrist with one hand and the elbow with the other hand. The rotation maneuver was halted if the patient described pain or upon the forearm reaching the coronal plane.

The first reduction attempt was carried out for each group without sedation or analgesia. The procedure was stopped and the first reduction attempt without sedation was considered to have failed if reduction was unsuccessful, the patient declared pain and asked us to stop the procedure at any time during the procedure, the patient stopped cooperating, or if muscle spasm was detected.

For the second attempt, 1–5mg of midazolam (0.02–0.1mg/kg) was given intravenously to achieve minimal to moderate sedation (as defined by American Society of Anesthesiologists). No analgesics were given at any point before or during the first and second attempts of reduction.

Failure at second attempt was recorded as failure of the method and the patient was prepared for reduction under sedation and analgesia using the traction-countertraction method. If sedation using the traction-countertraction method or the third attempt failed, reduction was done under general anesthesia in the operating theater.

SPSS, version 20 (IBM, www.ibm.com) was used for statistical analysis. Analysis of variance was used for analyzing the association of qualitative data with continuous variables. The $\chi^2$ square test was used to analyze association between qualitative data.

Results

Of the 51 patients presenting to the center with anterior shoulder dislocation during the study period, 46 met the inclusion criteria and were enrolled in the study. There were 23 patients each in the SMM group and ERM group. Both groups were similar in terms of age and sex distribution. A flowchart of the study is shown in Figure 1.

Most of the participants were 20–30 years old ($n = 10$ in the ERM group, $n = 12$ in SMM group). A fall on an outstretched hand was the commonest mechanism (75%; $n = 34$), followed by sports-related injuries and direct trauma. These and other findings have been summarized in Table 1.

Discussion

We found that the SMM requires less sedation and resulted in lower pain scores as compared with the external rotation technique for reduction of anterior shoulder dislocation. We found no difference in overall success rates of reduction between the two groups. However, the SMM group was more likely to achieve a successful reduction in the first attempt than the ERM group.

Previous studies that studied the SMM individually or compared it with another method also found a low requirement of sedation. NRS scores were lower with the SMM in our study. Findings from other studies have shown low pain scores during reduction by SMM when studied individually or in comparison with another method. However, other studies done comparing the SMM with other reduction techniques have shown slightly higher success rates of the SMM compared with the findings in our study.

The common methods used for reduction of shoulder dislocations in the ED include the Kocher, Spaso, external rotation, Milch, Chair, Stimson, and the scapular manipulation methods. The nontraditional techniques include the Boss-Holzach-Matter and the FARES (Fast, Reliable, Safe) methods. Manipulation without sedation or anesthetics allows rapid recovery, thus reducing time the patient spends in the ED and freeing medical and nursing staff for other tasks. Methods that do not require sedation are especially useful in the prehospital and wilderness environments, where a successful reduction can improve the likelihood of safe evacuation, allowing the patient to assist in evacuation. It simplifies rescue by avoiding use of

**FIGURE 1 Flowchart of comparison study of the external rotation manipulation (ERM) and the scapular manipulation method (SMM).**
TABLE 1 Characteristics of Patients and Shoulder Dislocation Reduction Methods

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Scapular Manipulation</th>
<th>External Rotation</th>
<th>Overall</th>
<th>P Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age, mean (range), years</td>
<td>36 (16–70)</td>
<td>36 (19–89)</td>
<td>32 (16–89)</td>
<td></td>
</tr>
<tr>
<td>Sex, no.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>19</td>
<td>17</td>
<td>36 (78%)</td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>4</td>
<td>6</td>
<td>10 (22%)</td>
<td></td>
</tr>
<tr>
<td>Greater tuberosity fracture, no.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Absent</td>
<td>20</td>
<td>17</td>
<td>27</td>
<td></td>
</tr>
<tr>
<td>Present</td>
<td>3</td>
<td>6</td>
<td>9</td>
<td></td>
</tr>
<tr>
<td>Neurologic deficit</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Absent</td>
<td>23</td>
<td>23</td>
<td>46</td>
<td></td>
</tr>
<tr>
<td>Present</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Sedation</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Required</td>
<td>3</td>
<td>9</td>
<td>11</td>
<td>.05</td>
</tr>
<tr>
<td>Not required</td>
<td>20</td>
<td>14</td>
<td>34</td>
<td></td>
</tr>
<tr>
<td>Mean pain score during reduction</td>
<td>1.65</td>
<td>4.30</td>
<td>2.98</td>
<td>&lt;.01</td>
</tr>
<tr>
<td>Success of reduction, no. (%)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Successful at first attempt (without sedation)</td>
<td>20 (87)</td>
<td>14 (61)</td>
<td>34 (73.9)</td>
<td></td>
</tr>
<tr>
<td>Unsuccessful at first attempt (without sedation)</td>
<td>3 (13)</td>
<td>9 (39)</td>
<td>12 (26.1)</td>
<td>.05</td>
</tr>
<tr>
<td>Overall reduction success rates</td>
<td>21 (91)</td>
<td>21 (91)</td>
<td>42 (91)</td>
<td></td>
</tr>
</tbody>
</table>

complicated devices and limits the need for other rescue personnel to be endangered. On long trips where medications are often in a limited supply, less need for analgesics and sedatives is likely to be beneficial. This might also be important in high-altitude scenarios where most sedatives are best avoided for fear of respiratory depression in an already-hypoxic environment and because of lack of proper evidence regarding safety of these.32

The ERM can be performed with the patient supine, sitting, or 45°C recumbent.8,12,13 The SMM is usually performed with the patient prone, although it can also be performed in the supine or seated positions.11 Positioning, airway issues due to prone positioning, and difficulty performing the technique on obese patients are some of SMM’s challenges.8

The limitations of this study were its small sample size and short duration, and that is was a single-center–based study. Patients were alternatively allocated into two groups on the basis of their arrival in the ED; they were not randomly assigned. Reduction procedures were carried out with the same protocol irrespective of age of the patient or prior history of dislocation. These are factors known to influence the outcome of reduction maneuvers. All the reductions were performed by a resident physician under training, accounting for the lower success rates in this study compared with those of other studies of these methods. Because all reductions were performed by the same physician, he might have become biased to either of the methods. And because this study was done in a hospital, some of the findings may not be generalizable to all austere medicine and prehospital settings.

Conclusion

We demonstrated greater success for reduction of anterior shoulder dislocation with the SMM when compared with the ERM as the initial attempt technique in nonsedated ED patients with anterior shoulder dislocation.

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The authors have no financial relationships relevant to this article to disclose.

Conflicts of Interest

The authors have no conflicts of interest to disclose relevant to this article.

Author Contributions

DK conceived the study concept and design. SA recruited participants and collected and analyzed the data. SA and PK wrote the first draft, and all authors read and approved the final manuscript.

References

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