BRIEF REPORT

Safety and Efficacy of Attempts to Reduce Shoulder Dislocations by Non-medical Personnel in the Wilderness Setting

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Objective.—The objectives of this study were to explore the success rate and the complication rate for shoulder reduction attempts by non-medical personnel in the wilderness setting, and to compare the average time to reduction for those done on scene versus those that waited for reduction at a medical facility.

Methods.—In this study we solicited online survey responses from users of wilderness sports forums between October 2008 and April 2009. These surveys asked respondents to describe previous wilderness sports injuries they experienced. Descriptive statistics were calculated, and the Mann-Whitney *U* test was used to compare average reduction times, with an alpha of .05 selected as the significance threshold.

Results.—Overall, there were 112 responses with 56 describing shoulder dislocations that were reduced either on scene or at a medical facility. Reduction on scene, in the absence of a medically trained person, was attempted in 39 of these 56 cases with a success rate of 71.8% (28/39). The median time to reduction on scene was 5 minutes, compared to 135 minutes from the time of injury for those that were reduced at a medical facility ($P < .001$). Other than pain during the reduction, there were no reports of serious complications associated with the reduction attempts.

Conclusions.—These data suggest that reduction of dislocations in the wilderness setting by non-medical personnel may be safe and effective, and significantly decreases the time to reduction. These findings may help guide future instruction of participants in high-risk wilderness sports.

Key words: shoulder dislocation, wilderness medicine, reduction

Introduction

Shoulder dislocations are common in wilderness sports such as kayaking, skiing, mountain biking, and climbing.^{1–4} Participants in these activities, with no formal medical training, have often attempted reduction of these dislocations on scene, with an unknown degree of success and safety. Many wilderness medicine education courses teach shoulder reduction as part of their curriculum, but the safety and efficacy of on scene reduction by non-medical personnel is currently unknown.

Medical procedures performed in the wilderness environment by non-medical personnel can be a controversial topic, with conflicting recommendations in the medical literature.^{5,6} Many urban emergency medical services (EMS) protocols dictate that injuries such as a shoulder dislocation should be immobilized and transported to a medical facility for radiographic evaluation and reduction by a physician, rather than incur the risk of further injury from undiagnosed fractures and inappropriate manipulation attempts.⁶ However, it is generally accepted that early reduction of the dislocated shoulder dramatically relieves the patient's pain, and may reduce the risk of vascular and neurologic complications.⁷ A reduced shoulder may increase the likelihood of a safe evacuation from the wilderness environment. It can improve the patient's ability to assist in the evacuation, decrease the

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need for complicated devices to support and immobilize the extremity, and limit the need to involve and endanger other rescue personnel. Potential risks of inappropriate reduction attempts for non-dislocated shoulders include iatrogenic shoulder dislocations, displacement of fracture fragments, or neurovascular injury, which could lead to the need for surgical repair, shoulder instability, or chronic pain.⁸

In our experience, many patients with this injury are often able to identify the diagnosis of shoulder dislocation prior to evaluation by a medical professional. There is evidence that for some patients in the emergency department setting, radiographs may not be necessary prior to reduction when the mechanism of injury and exam findings suggest this diagnosis.⁹ Furthermore, when reduced in a medical facility, complications related to shoulder reduction are rare.⁷ This suggests that clinically evident dislocations might be safely managed in the wilderness setting by medical personnel. However, medical personnel are often not on scene during these incidents. We have heard many anecdotal reports of successful and unsuccessful reduction attempts on scene by non-medical personnel. Knowledge of the safety and efficacy of this practice might help guide our teaching of participants in high-risk wilderness sports.

The objectives of this study were to explore the success rate and the complication rate for shoulder reduction attempts by non-medical personnel in the wilderness setting, and to compare the average time to reduction for those done on scene versus those that waited for reduction at a medical facility.

Methods

In this study we solicited online survey responses from users of wilderness sports forums between October 2008 and April 2009. The survey (available at www.wemjournal.org) asked respondents who had suffered shoulder injuries during participation in wilderness sports to describe details about their injury. Questions included the mechanism of injury, type of injury, narrative description of reduction attempts on scene, level of medical training of people involved, complications (immediate and delayed), and time to reduction. The survey questions were intentionally broad to attempt to capture reports of not only dislocations, but any injury such as a fracture that might have had misguided reduction attempts on scene. The specific websites from which surveys were solicited were www.boatertalk.com, www.mountainbuzz.com, www.rock-climbing.com, www.mtbr.com, and www.ridemonkey.com (all selected due to familiarity with these websites by the authors).

STATISTICS

Descriptive statistics were calculated using SPSS version 13.0 (SPSS, Inc, Chicago, IL), and the Mann-Whitney *U* test was used to compare average shoulder reduction times (on scene vs at the hospital) due to the skewed distribution of the time data, with an alpha of .05 selected as the significance threshold. We excluded from final analysis reduction attempts on scene by medical personnel, defined as physicians, nurses, physician assistants, nurse practitioners, and emergency medical technicians.

INSTITUTIONAL REVIEW BOARD APPROVAL

The West Virginia University Institutional Review Board for the Protection of Human Subjects approved the research protocol and waived the requirement to document informed consent.

Results

Overall, there were 112 responses, with 56 describing shoulder dislocations that were reduced either on scene or at a medical facility. Reduction on scene, in the absence of a medically trained person, was attempted in 39 of these 56 cases with a success rate of 71.8% (28/39) (Figure 1). The median time from injury to reduction on scene was 5 minutes, compared to 135 minutes from the time of injury for those that were reduced at a medical facility ($P < .001$).

In a separate analysis, we also reviewed all 112 surveys to determine if inappropriate reduction attempts occurred for injuries other than shoulder dislocations. In all, there were 58 reports of reduction attempts on scene. Of these, 51 were identified by the participant as a shoulder dislocation, and 7 were identified as other injuries: 1 as a fracture/dislocation, 2 as shoulder strain injuries, 3 as rotator cuff tears, and 1 as an acromioclavicular separation. Medical professionals were involved in 3 of these 7 inappropriate reduction attempts. The 1 report of fracture/dislocation was subsequently reduced at a medical facility with "pain" as the only significant complication related to the reduction attempts reported by the respondent. It is unclear from the report if the fracture was a true proximal humerus fracture or a minor Hill-Sachs deformity.

Other than pain during the reduction, there were no reports of serious complications associated with the reduction attempts. Many respondents reported typical delayed complications related to the dislocation, such as recurrent dislocations, shoulder laxity, chronic pain, and need for delayed surgery for labral tears.

Figure 1. Diagram of respondents meeting final inclusion criteria for success rate analysis.

The majority of our respondents were injured during whitewater kayaking, with lesser numbers in skiing, climbing, mountain biking, or other activities (Figure 2). Those participants engaged in climbing ($n = 4$) had a 75% field reduction success rate, compared to mountain bikers and skiers (only 1 participant each) who both had a 100% success rate, and rafters ($n = 2$) who had a 50% success rate. When combined, these 8 participants had a success rate of 75% versus 71% for kayakers ($P = .821$ by Fisher's exact test). Eighteen percent of those injured had experienced prior dislocations of the same shoulder (5 of 7 of these patients had successful on-scene reductions). Traction/counter-traction, Stimson technique, and external rotation were the most common attempted reduction techniques (Figure 3). Although not statistically significant ($P = .94$), the Stimson technique had the highest success rate of 77.8% versus 72.7% for external rotation and 71.4% for traction.

Of the 39 cases that met our criteria to determine the rate of successful reductions, 38% of someone on scene (either the survey respondent or another person present during the reported injury) had prior training in wilderness first aid (WFA) or wilderness first responder (WFR)

courses. For this subset, the success rate was not significantly different at 73% (11/15).

Discussion

These data suggest that reduction of dislocations in the wilderness setting by non-medical personnel may be safe and effective, and significantly decreases the time to reduction. The on-scene success rate of 71.8% is comparable to success rates for single reduction attempts in the emergency department (70%–96% depending on the method used for reduction).¹⁰ It is remarkable that this is successful without the aid of sedation and without the benefit of a trained medical professional on scene. This result was also comparable to the proportion of successful on-scene reductions that occurred in the presence of a medically trained person (70%).

The time from injury to reduction was much faster for those that were reduced on scene. This is not surprising, but the additional delay of more than 2 hours for those that were reduced at a medical facility highlights the benefit of attempting treatment on scene.

Figure 2. Type of wilderness activity causing shoulder dislocation (N = 39).

There were no serious complications identified related to the reduction attempts. Nearly all of the respondents reported delayed complications related to the dislocation, such as recurrent dislocations, chronic pain, joint laxity, and need for surgical repair of the joint capsule. This is consistent with the expected prognosis for typical anterior shoulder dislocations.¹¹ The sample size in this study is small, and rare complications associated with reduction may not be recognized. We attempted to capture all possible shoulder injuries (including fractures, acromio-

clavicular separations, clavicle fractures, etc), which may have had inappropriate reduction attempts on scene, by advertising the survey as a shoulder injury survey, rather than a survey specifically asking about dislocations.

Our data were collected from self-reported surveys solicited from Internet forums, and therefore are subject to recall and selection bias. There was no mechanism to verify any of the reported injuries or claims from respondents, and we did not have the ability to review actual medical records to confirm the diagnosis of the respon-

Figure 3. Shoulder reduction methods used on scene by laypersons (N = 39).

dents. In many cases, the respondent did not seek medical care for the injury, so no such medical record would exist. There may be significant errors in self-diagnosis of these injuries, knowledge of the level of medical training of those present on scene, and recall of the events surrounding the injuries, and this must be taken into consideration when interpreting our results.

We attempted to collect surveys from multiple wilderness sports participants, but the majority of the respondents were injured during whitewater kayaking. Dislocation is a common injury in kayaking,¹ and many kayakers may have some knowledge of reduction techniques, even if no formal medical training. The mechanism of shoulder injury in kayaking is more likely to result in dislocation rather than fracture,¹ which also may lead to safer reduction attempts when the injury is associated with this activity. With higher velocity mechanisms, and direct impacts to the shoulder from sports such as mountain biking, rock climbing, or skiing, fractures may be more common. This could lead to a higher complication rate for misguided reduction attempts. In our study we found that of the 48 “other injuries” shown in Figure 1, 46% were injured during non-kayaking activities such as mountain biking, skiing, and rock climbing. The field reduction success rate of those injured in non-kayaking activities was 75% versus 71% for kayakers ($P = .821$). However, more data are needed to determine if the success rate and safety seen in this study would be applicable to injuries incurred in all types of wilderness sports.

While we excluded reduction attempts by medical professionals from the analysis, some of our respondents (38%) had received WFA or WFR training. These training courses have variable amounts of teaching about shoulder reduction, and a larger study would be needed to determine if WFA or WFR training leads to higher success rates.

Although the survey was not intended to determine layperson knowledge of specific reduction techniques, we found it interesting that there were no reports of scapular manipulation used in any of these reduction attempts. This is an ideal technique for use in the wilderness setting, as it is often well tolerated by patients (requires little arm movement), is considered to be very safe, and it can be combined with other methods such as the Stimson technique to increase the likelihood of a successful reduction.¹⁰

Shoulder dislocations and reductions performed by non-medical personnel will continue to be a reality for people involved in a variety of wilderness activities. Our findings may help guide future instruction of participants in high-risk wilderness sports, particularly in whitewater kayaking. Caution should be used in applying these data to other high-risk wilderness sports due to the low number of responses from other groups in this study. Larger prospective studies should confirm these findings in other settings, to determine the factors that are most associated with success or failure of these reductions, and to evaluate for complications related to this practice.

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References

1. Fiore DC. Injuries associated with whitewater rafting and kayaking. *Wilderness Environ Med.* 2003;14:255–260.
2. Flores AH, Haileyesus T, Greenspan AI. National estimates of outdoor recreational injuries treated in emergency departments, United States, 2004–2005. *Wilderness Environ Med.* 2008;19:91–98.
3. Kronisch RL, Pfeiffer RP. Mountain biking injuries: an update. *Sports Med.* 2002;32:523–537.
4. Kocher MS, Feagin JA. Shoulder injuries during alpine skiing. *Am J Sports Med.* 1996;24:665–669.
5. Flinn SD. On-field management of emergent and urgent extremity conditions. *Curr Sports Med Rep.* 2006;5:227–232.
6. Bowman W. The development and current status of wilderness prehospital emergency care in the United States. *J Wilderness Med.* 1990;1:93–102.
7. Pasila M, Jaroma H, Kiviluoto O, Sundholm A. Early complications of primary shoulder dislocations. *Acta Orthopaed.* 1978;49:260–263.
8. Hersche O, Gerber C. Iatrogenic displacement of fracture-dislocations of the shoulder. A report of seven cases. *J Bone Joint Surg Br.* 1994;76:30–33.
9. Shuster M, Abu-Laban RB, Boyd J. Prereduction radiographs in clinically evident anterior shoulder dislocation. *Am J Emerg Med.* 1999;17:653–658.
10. Ufberg JW, Vilke GM, Chan TC, Harrigan RA. Anterior shoulder dislocations: beyond traction-countertraction. *J Emerg Med.* 2004;27:301–306.
11. Simonet WT, Cofield RH. Prognosis in anterior shoulder dislocation. *Am J Sports Med.* 1984;12:19–24.

Wilderness sports shoulder injury survey:

Please complete this survey if you have had a significant shoulder injury while participating in wilderness sports.

1. What type of activity were you involved in when your injury occurred?
 - a. kayaking or canoeing
 - b. skiing
 - c. mountain-biking
 - d. rock climbing
 - e. other (describe)
2. Approximately how far away was the nearest medical facility (including evacuation time and driving)?
 _____ Minutes
3. What type of injury did you have?
 - a. shoulder dislocation (anterior)
 - b. humerus fracture
 - c. AC separation
 - d. clavicle fracture
 - e. scapula fracture
 - f. fracture-dislocation of humerus
 - g. rotator cuff tear
 - h. shoulder strain
 - i. other (describe)
 - j. don't know
4. If your shoulder was thought to be dislocated, did anyone try to reduce or manipulate the shoulder (put it back in place) prior to going to a medical facility?
 - a. yes
 - b. no
5. What level of medical training did that person have?
 - a. physician
 - b. nurse
 - c. EMT or paramedic
 - d. physicians assistant
 - e. wilderness first responder
 - f. other (describe)
 - g. none
 - h. don't know
6. Had they ever been taught how to reduce a shoulder?
 - a. yes
 - b. no
 - c. don't know
7. What method was used to reduce the dislocation?
 - a. pulling traction on arm away from body
 - b. lying face-down with arm hanging towards ground
 - c. manipulating the scapula (shoulder blade)
 - d. externally rotating the arm
 - e. don't know
 - f. other (describe)

8. Were these attempts to reduce the dislocation successful (the shoulder joint was back in place and pain improved significantly)?

- a. yes
- b. no

9. Did these attempts lead to any immediate complications or problems?

- a. pain
- b. fracture
- c. nerve injury
- d. blood vessel injury
- e. none
- f. other (describe)

10. If you had a dislocation that was reduced (put back in place) in the wilderness setting, how long did it take (in minutes) from the time of injury until the time of reduction? (leave blank if your injury was not reduced on scene)

_____ Minutes

11. If you had a dislocation that was reduced (put back in place) at a medical facility, how long did it take from the time of injury until the time of reduction? (leave blank if you answered question 10.)

_____ Minutes

12. Did you have any long-term or permanent problems with the shoulder or arm after the injury?

- a. yes
- b. no

13. If so, what?

- a. nerve damage
- b. limited range of motion
- c. muscle or tendon damage
- d. blood vessel injury
- e. chronic pain
- f. recurrent dislocations
- g. other (describe)?
- h. none

14. Did your injury require immediate surgery?

- a. yes
- b. no

15. Did your injury require delayed surgery? (What kind of surgery?)

- a. yes (describe)
- b. no

16. For shoulder dislocations, had you ever dislocated the same shoulder before?

- a. Yes
- b. No

17. Did you have any medical training prior to this injury?

- a. physician
- b. nurse
- c. EMT or paramedic
- d. physicians assistant
- e. wilderness first responder
- f. other (describe)
- g. none

18. How old were you when the injury occurred?

19. (Optional) Please describe any other important details about how the injury occurred, attempts to deal with it in the wilderness setting, complications, or long-term outcome.