

Original Article

Success rate of anterior shoulder dislocation reduction by emergency physicians: a retrospective cohort study

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Aim: Emergency physicians (EPs) often treat anterior shoulder dislocation, but epidemiology of anterior shoulder dislocation in the emergency department of Japan remains unclear. In this study, we clarified the success rate of anterior shoulder reduction performed by EPs.

Methods: This single-center cohort study included patients with anterior shoulder dislocation for whom the EP performed initial reduction. The period was from January 2006 to March 2021 and we used the electronic medical record data of the tertiary care hospital. Our primary outcome was the success rate of the shoulder reduction performed by EP. The secondary outcome was to compare the success of reduction with the failure of the reduction.

Results: In total, 293 eligible patients were identified. Of these patients, 244 were included in this study. The success rate of the shoulder reduction performed by EP was 92.2% (225/244). EPs failed in successfully performing reduction in 19 (7.8%) cases of anterior shoulder dislocations. The failure group was older ($P = 0.017$), had a higher frequency of fall down in the mechanism of dislocation ($P = 0.019$), used intravenous analgesics more frequently ($P = 0.004$), used peripheral nerve blocks more frequently ($P = 0.006$), and had fewer patients who did not use drugs ($P = 0.002$). We could not perform statistical adjustment because the sample size was small.

Conclusion: The success rate of the shoulder reduction performed by EPs was 92.2%. Older age might be associated with failure of shoulder reduction.

Key words: Anterior shoulder dislocation reduction, emergency department, epidemiology, reduction failure, shoulder injuries

INTRODUCTION

SHOULDER DISLOCATION ACCOUNTS for 50% of all dislocations and is the most common type of dislocation in emergency departments (EDs). The incidence of dislocations is the highest in the 15–29-year age group, accounting for 46.8% of all dislocations [1]. Most shoulder dislocations are anterior (95%–97%), followed by posterior (2%–4%) and inferior (0.5%) [2]. Emergency physicians (EPs) often treat anterior shoulder dislocation, but there is no consensus on the best technique for anterior shoulder dislocation reduction. Moreover, there is no consensus on the optimal use of sedatives or analgesics. Approximately 30%

patients with shoulder dislocation, most commonly Hill–Sachs lesions and Bankart lesions, have associated fractures [3]. However, there is no consensus on the target population, location, and method for shoulder dislocation reduction associated with fracture [4,5].

There are many reduction techniques, with a success rate of 70%–100% [6]. The reduction techniques can be classified into three categories based on their mechanisms of action. First, the traction–counter traction technique applies a longitudinal force to the humerus, allowing relocation of the humeral head. Second, the leverage technique combines traction and rotation to manipulate the humeral head back into the glenoid fossa. Third, the scapular manipulation technique manipulates the glenoid fossa to allow the humeral head to return to its place [7].

Shoulder dislocation is painful and should be treated immediately. Pain and muscle spasms around the dislocated shoulder cause shoulder reduction failure [8]. For pain relief and muscle relaxation, procedural sedation and analgesia or an intra-articular injection of lidocaine are often

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administered [9]. In recent years, ultrasound-guided peripheral nerve blocks, such as interscalene brachial plexus nerve block or suprascapular nerve block, have been used [10,11]. It is important to select an appropriate sedative, analgesic, and reduction technique for successful shoulder reduction. EPs often treat anterior shoulder dislocation, but there is limited information on the epidemiological and clinical characteristics of anterior shoulder dislocation in the Japanese ED.

Therefore, the present study analyzed single-center ED visit data to clarify the success rate of anterior shoulder reduction performed by EPs.

METHODS

THIS RETROSPECTIVE COHORT study used data from the medical records of Fukui Prefectural Hospital between January 1, 2006, and March 31, 2021. Fukui Prefectural Hospital is a tertiary care center with approximately 22,000 ED visits annually. We included patients who presented to the ED with a dislocated shoulder. Shoulder dislocation was diagnosed using radiographs taken in the anteroposterior and scapular lateral views. All patients with shoulder dislocation underwent an initial reduction performed by EPs. The use of sedatives or analgesics was dependent on the EP. If the EPs succeeded in reduction, the arm was slung and instructions were followed up at the orthopedic outpatient clinic. If the EP failed to achieve reduction, we consulted an orthopedic surgeon urgently. The number of times to perform reduction is dependent on the EP and crowdedness of the ED. This study was approved by the Institutional Review Board of Fukui Prefectural Hospital, which waived the need for informed consent because of the retrospective study design.

Population

The inclusion criteria were as follows: (i) anterior shoulder dislocation, (ii) initial reduction performed by an EP, and (iii) aged ≥ 15 years. The exclusion criteria were as follows: (i) initial reduction performed by orthopedic surgeons, (ii) shoulder dislocation with associated fractures, and (iii) multiple trauma.

Outcome

Our primary outcome was the success rate of shoulder reduction performed by EPs. We defined success as achievement of shoulder dislocation reduction by EPs. Failure of reduction was defined as orthopedic consultation because the EPs failed to achieve reduction. The decision to consult an orthopedic surgeon was dependent on the EP.

The secondary outcome was to compare the success of reduction with the failure of reduction.

Statistical analyses

Categorical variables are reported as percentages and continuous variables as medians (interquartile range) unless otherwise specified. Univariate analysis of variables was performed using the chi-square test for categorical variables and the Mann–Whitney U test for continuous variables. A two-sided P value of <0.05 was considered statistically significant. All statistical analyses were performed with EZR, which is a graphical user interface for R (version 4.0.3; The R Foundation for Statistical Computing, Vienna, Austria). More precisely, it is a modified version of R commander (version 2.7-1) designed to add statistical functions frequently used in biostatistics [12].

RESULTS

DURING THE STUDY period, 293 patients were identified from the database. Among them, 49 patients were excluded—16 who underwent initial reduction by orthopedic surgeons, 27 with associated fracture, 3 with posterior dislocation, 1 with inferior dislocation, 1 with traumatic cardiac arrest, and 1 with other reason. We included 244 patients in the analysis (Fig. 1).

Overall, the median age was 51 years (interquartile range, 31–73 years), and 54.9% patients were men. In total, 69.6% patients had right-sided dislocation, and 44.2% patients had first-time dislocations. Only 25% patients did not use sedatives or analgesics for dislocation reduction. No data were available for 48.7% reduction techniques (Table 1).

The EP succeeded in anterior shoulder reductions in 225 patients, with a success rate of 92.2%. The EP failed to achieve shoulder reduction in 19 patients and urgently consulted the orthopedic surgeons. Among these 19 patients, the EP administered intravenous analgesics in 6 patients, intra-articular lidocaine in 10 patients, peripheral nerve block in 4 patients, sedatives in 4 patients, and no drugs in 2 patients. Further, successful reduction was performed by orthopedic surgeons in the ED in 17 patients. One patient received brachial plexus nerve blocks, eight patients were administered with new sedatives, and the remaining eight patients did not require any additional sedatives or analgesics. In two patients the reduction could not be achieved in the ED and underwent reduction under general anesthesia in the operating room (Fig. 2).

Table 2 shows a comparison between the success of reduction and failure of reduction. The failure group was older ($P = 0.017$), had more fall down as the mechanism of

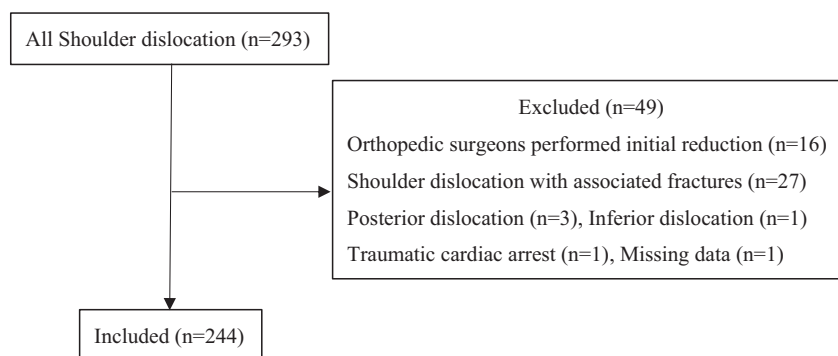


Fig. 1. Patient flowchart. We included 244 patients in the analysis.

Table 1. Patient characteristics

Characteristics	Values (N = 244)
Age (years), median (IQR)	51.05 (31–73)
Sex: Men, n (%)	134 (54.9)
Right side, n (%)	170 (69.6)
First time dislocation, n (%)	108 (44.2)
Mechanism of dislocation, n (%)	
Fall down	93 (38.1)
Nontraumatic	93 (38.1)
Sports	43 (17.6)
Fall (from high place)	5 (2.0)
Unknown mechanism	5 (2.0)
Traffic accident	4 (1.6)
Other [†]	1 (0.4)
Intravenous analgesic, n (%)	28 (11.4)
	Pentazocine (n = 16), acetaminophen (n = 12), fentanyl (n = 1)
Oral analgesic, n (%)	14 (5.7)
Intra-articular lidocaine, n (%)	137 (56.1)
Peripheral nerve block, n (%)	22 (9)
	Brachial plexus block (n = 15), suprascapular nerve block (n = 7)
Sedative, n (%)	31 (12.7)
	Thiopental (n = 29), midazolam (n = 2), propofol (n = 1)
No drug, n (%)	61 (25)
Reduction technique, n (%)	
Unknown	119 (48.7)
Traction-counter traction	17 (6.9)
	Stimson (n = 8), FARES (n = 4), Hippocratic (n = 3), Spaso (n = 1), hand-shaking (n = 1)
Leverage, n (%)	37 (15.1)
	Milch (n = 35), Kocher (n = 2)
Scapular manipulation, n (%)	70 (28.6)
Other, n (%)	Cunningham 1 (0.4)

Abbreviations: FARES; fast, reliable and safe; IQR; interquartile range.

[†]Direct external force from kicking.

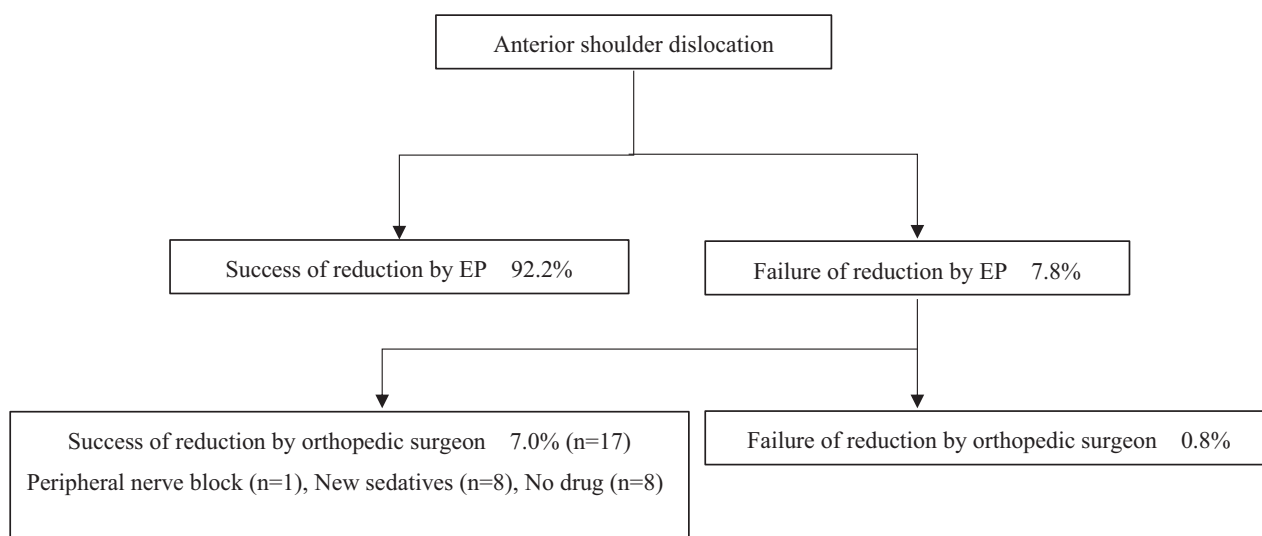


Fig. 2. The success rate (92.2%) of the shoulder reduction performed by emergency physician (EP).

Table 2. Comparison between the success of reduction and failure of reduction

	Success of reduction ($n = 225$)	Failure of reduction ($n = 19$)	<i>P</i> value
Age (years), median (IQR)	47 (31.0–72.0)	68 (45.5–83.5)	0.017*
Sex: Men, <i>n</i>	121	13	0.21
Right side, <i>n</i>	158	12	0.52
First time dislocation, <i>n</i>	98	10	0.44
Mechanism of dislocation, <i>n</i>			
Fall down	81	12	0.019*
Nontraumatic	89	4	0.11
Sports	42	1	0.14
Fall (from high place)	4	1	0.3
Unknown mechanism	4	1	0.3
Traffic accident	4	0	0.55
Other [†]	1	0	0.77
Intravenous analgesic, <i>n</i>	22	6	0.004*
Oral analgesic, <i>n</i>	13	1	0.92
Intra-articular lidocaine, <i>n</i>	127	10	0.74
Peripheral nerve block, <i>n</i>	16	6	0.006*
Sedative, <i>n</i>	27	4	0.25
No drug, <i>n</i>	59	2	0.002*
Reduction technique, <i>n</i>			N/A
Unknown	106	13	
Traction–counter traction	16	1 (Hippocratic)	
Leverage	34	3 (Milch)	
Scapular manipulation	68	2	
Other	1	0	

Abbreviations: N/A, not applicable; IQR, interquartile range.

[†]Direct external force from kicking.

*Statistically significant.

dislocations ($P = 0.019$), used more intravenous analgesics ($P = 0.004$), used more peripheral nerve blocks ($P = 0.006$), and had fewer patients who did not use drugs ($P = 0.002$) compared with the success group.

DISCUSSION

THE SUCCESS RATE for reduction of anterior shoulder dislocation by EPs was 92.2%. The significant differences between the success of reduction and failure of reduction were age, fall down, intravenous infusion, peripheral nerve block, and no administration of drugs. To the best of our knowledge, this is the first study on the success rate of anterior shoulder dislocation reduction by EPs in Japan.

The success rate of anterior shoulder dislocation reduction by EPs in our study was similar to or higher than that reported in these previous studies [7,13]. In our study, the scapular rotation method was the most common reduction technique at 28.6%. However, no data were available for 48.7% of reduction techniques. A previous meta-analysis showed that there was no difference in the success rate of reduction according to reduction techniques [7]. In our study, EPs used intra-articular lidocaine 56.1% for pain relief but used sedatives only 12.7%. In another meta-analysis, there was no difference in the success rate of reduction according to the administration of drugs (intra-articular lidocaine: 79.4% versus intravenous sedatives and analgesics: 88.9%; relative risk 0.92; 95% confidence interval 0.83–1.03) [13]. The use of drugs and reduction techniques were dependent on the EPs. In our hospital, at least one or more emergency medicine attendings cover 24 h in the ED. In most shoulder dislocations, residents attempted initial shoulder reduction. If they failed, emergency medicine attendings attempted reduction again. The reduction skills between attendings were not investigated, which might affect the success rate.

An epidemiological study of shoulder dislocation in the United States showed that the mean patient age was 35.4 years. Men accounted for 71.8% of the study population. Sports or recreation injuries accounted for 34.5% of participants. The distribution was bimodal, with peaks between the age of 20 and 29 years for men and between the age of 80 and 89 years for women [1]. Our study cohort was older, had a female predominance, and had a low proportion of sports injuries. In 2019, Japan's population aged ≥ 65 years was the highest worldwide at 28% [14]. This may be associated with the aging of the population.

Our study showed that the failure group was older, had a higher frequency of fall down in the mechanism of dislocation, used intravenous analgesics more frequently, used peripheral nerve blocks more frequently, and had fewer

patients who did not use drugs. These might be confounding variables, but we could not perform statistical adjustment because the sample size was small. Similar to our study, a recent retrospective cohort study showed that age ≥ 55 years was a risk factor for failure of reduction [15]. However, it included dislocation-associated fractures, which may have influenced the outcomes. Two studies have shown that the risk factors for reduction failure are time intervals from injury to the first attempted reduction [16,17]. Our study was a chart review and did not record the time from injury to reduction.

EPs failed to achieve shoulder dislocation in 19 patients. Reduction techniques were one Traction-counter traction (Hippocratic) method, three Leverage (Milch) methods, and two Scapular manipulation methods. However, there were 13 unknown methods, thus we did not know which method caused the most failures of reduction. Among the 17 patients in whom the EP failed to achieve shoulder reduction and in whom orthopedic surgeons succeeded in achieving reduction, only 2 patients, an 84-year-old woman and an 87-year-old man, did not use drugs. It was not reported if this was because they were old and at high risk for drugs use or because of ED overcrowding. A previous study showed that landmark-guided shoulder joint injections were misplaced in 41.1% of cases by EPs [18]; the success rate of the interscalene brachial plexus nerve block by EPs was 71% [19]; shoulder dislocation reduction required a moderate depth of sedation [20]. Our study did not record pain score and sedation depth, although the 15 patients who used sedatives or analgesics may have had inadequate pain relief or sedation. Orthopedic surgeons failed two dislocation reductions in the ED. A 44-year-old man had a first dislocation, mechanism of dislocation was a fall, and came to the ED 5 h after injury. A long period from injury to reduction might affect the failure of reduction [16,17]. The other 55-year-old man was a case of recurrent dislocation, mechanism of injury was fall down, and immediately came to the ED after injury. He had a previous history of difficult shoulder dislocation reduction. Orthopedic surgeons tried various reduction techniques using thiopental, but they failed reduction in the ED and succeeded in a manual reduction under general anesthesia in the operating room.

Our study has several limitations. First, a small number of patients were included and there was uncontrolled bias related to the retrospective chart review study. Second, the lack of a uniform definition of reduction failure might have affected the results. Third, our hospital is a tertiary care center, and at least one or more emergency medicine attendings cover 24 h in the ED. Fourth, the age of the patients in our study was high. Our finding might have limited generalizability to other clinical settings.

CONCLUSION

THE SUCCESS RATE of shoulder reduction performed by EPs was 92.2%. Older age might be associated with shoulder reduction failure.

DISCLOSURE

APPROVAL OF THE research protocol with approval No. 22-01 and committee Name: The protocol was approved by the Institutional Review Board of Fukui Prefectural Hospital.

Informed consent: The requirement for informed consent of the patients was waived.

Registry and the registration no. of the study/trial: N/A.

Animal studies: N/A.

Conflict of interest: None declared.

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