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ORIGINAL RESEARCH

Effect of Using the Modified Milch Technique on Quality of Life in Patients with Anterior Dislocation of the Shoulder Joint

Liqiang Li, MD; Zhigang Wen, MM; Peng Wang, MM; Junge Dong, MM

ABSTRACT

Objective • To evaluate the effect of the Milch technique on quality of life (QoL) in patients with anterior dislocation of the shoulder joint.

Methods • A total of 126 patients undergoing manual reduction for anterior dislocation of the shoulder in our hospital from January 2021 to January 2022 were prospectively enrolled in this study. The randomized number table method was used to divide patients into the study group (63 patients) and the control group (63 patients). The study group was treated with a modified Milch technique while the control group was treated with the Hippocratic method. Success rate and complications were compared to evaluate the effectiveness of manual reduction. Clinical assessment of shoulder function included the Constant-Murley Score and visual analog scale (VAS) before, during and after manual reduction.

Results • The success rate of primary and secondary reduction in the study group was significantly higher than in the control group (87.30% vs 61.90, respectively; $P = .001$; 11.11% vs 25.40%, respectively; $P = .038$). The failure rate in the study group was significantly lower than in the control group (1.59% vs 12.70%, respectively; $P = .015$). The time required for reduction in the study and control groups was 58.87 ± 7.92 seconds and 93.09 ± 8.01 seconds, respectively; a significant difference ($t = -24.113$; $P < .001$). There was no statistically significant difference in VAS scores before and during reduction in the 2 groups. After reduction, VAS scores in the study group were significantly lower than in the control group (1.02 ± 0.01 vs 1.14 ± 0.26, respectively; $P < .001$). There were no significant differences in pain level, activities of daily living, joint range of motion or muscle strength between the 2 groups before and after reduction ($P > .05$). After reduction, health status, emotional function, mental health, physiological function, physiological function, physical pain, vitality and social function scores in the study group were significantly higher than in the control group ($P < .05$). There were 4 avulsion fractures and 2 humeral fractures in the control group; no complications occurred in the study group, with a significant difference ($\chi^2 = 6.289$; $P = .012$).

Conclusion • The Milch technique can improve the QoL in patients with anterior dislocation of the shoulder, and the success rate of the reduction is high. (*Altern Ther Health Med.* 2023;29(1):144-149).

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INTRODUCTION

There is a high incidence of shoulder dislocation, which accounts for approximately 45% to 50% of large joint dislocations in the entire body and forward dislocation is the most common type, accounting for more than 95% of shoulder dislocation.[1] The occurrence of shoulder dislocation is closely related to its unique anatomical structure and physiological characteristics.[2] Due to the shallow, small surface of the glenoid pelvis and the large round shape of the humeral head, the glenoid pelvis can only accommodate a small portion of the humeral head. In addition, the shoulder capsule is more relaxed than other joints in the body. All these anatomical factors make the shoulder the most mobile joint in the body, and more prone to joint injury.[2]

In the selection of clinical treatment, manual reduction is usually the first step for shoulder dislocation. Hippocrates' technique of anterior shoulder reduction, described in *Hippocratic Corpus*, is one of the most adopted methods and has been used for the past 2000 years.[4] Other methods include the external rotation method, extension traction method, external rotation and abduction method, lateral draping method, chair back reclining method, etc. All of these methods have their advantages, but at present in the treatment of patients with a shoulder dislocation, the manual

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reduction method is not unified.[3] There is a risk for complications associated with traditional manipulative reduction, including labrum injury, partial tear of the subscapularis tendon and Bankart injury.[4]

Manual reduction is the primary method for treating dislocation of the shoulder joint. As the patient's requirement for pain management in the restoration process is gradually reduced, more convenient, less cooperative, safe and effective treatment are becoming more and more favorable for both the patients and the orthopedic doctors.[5] Based on the anatomical and biological characteristics of the shoulder joint, this paper aims to discuss the method of pushing up the external development of Kocher's method, which uses the lever biomechanics and traction characteristic of the shoulder joint. Because the force of the reposition process can reduce the resistance of the internal absorption muscle group to the minimum, so that the effect of the reposition can be equal to the effect of the reposition.[6]

Therefore, in order to effectively avoid the occurrence of complications, it is of great clinical significance to explore a safe and effective manual reduction method. Our department adopted the modified Milch method to treat patients with anterior dislocation of the shoulder joint and achieved satisfactory clinical efficacy. The aim of this study was to compare the clinical efficacy of the modified Milch method and Hippocrates' technique in the treatment of anterior dislocation of the shoulder joint, and to evaluate the improvement in patients' quality of life (QoL) after surgery.

MATERIALS AND METHODS

Study Patients

This study prospectively enrolled 126 patients with anterior dislocation of the shoulder who were treated in our hospital between January 2021 and January 2022. The randomized number table method was used to assign patients to either the study group (63 cases; modified Milch method) or the control group (63 cases; Hippocrates' technique). The study flowchart is shown in Figure 1.

Inclusion criteria. (1) shoulder x-ray was performed immediately upon admission and shoulder dislocation was confirmed (Figure 2A); (2) the time interval between the injury and medical treatment was within 24 hours; (3) patients did not receive analgesics prior to manual reduction; (4) patients signed an informed consent form.

Exclusion criteria. Patients (1) with associated with glenoid fracture, ipsilateral rib fracture, proximal humerus fracture or fracture of the scapula and clavicle; (2) with previous cervical spondylosis and other shoulder pathologies like frozen shoulder, rotator cuff tears and superior labrum anterior to posterior (SLAP) lesions that can cause shoulder pain; (3) with mental diseases or serious cardiovascular and cerebrovascular disease; (4) with congenital hypoplasia of the upper limb or shoulder, deformity of the shoulder or history of shoulder surgery; (5) patients unable to complete regular functional rehabilitation and follow-up.

This study was approved by the ethics committee of Hebei Hospital of Traditional Chinese Medicine, Shijiazhuang, China (No. 2021083), and signed informed consent forms were obtained from all patients.

Figure 1. The flowchart of research objects

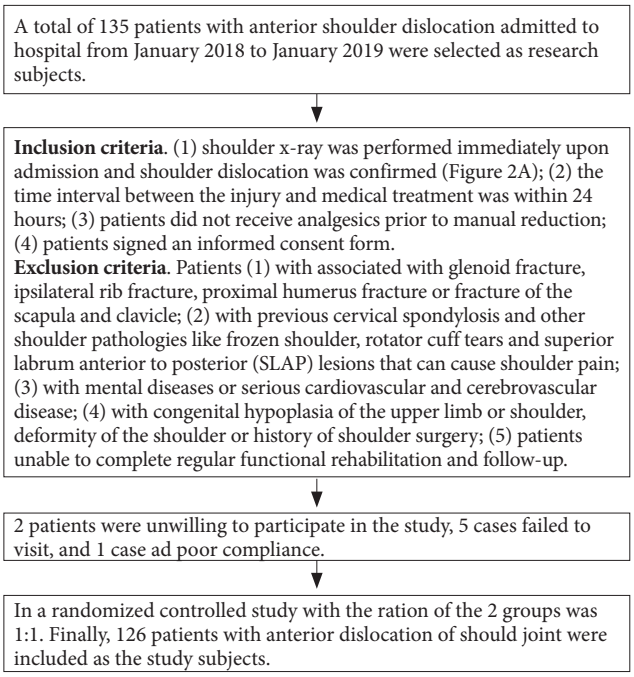
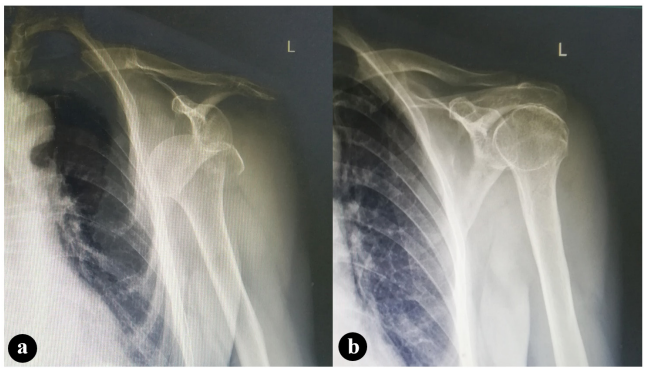


Figure 2 Radiographs of the shoulder of an elderly female patient a. Before manual reduction, the humeral head was anteriorly and posteriorly dislocated; b. After manual reduction, the glenohumeral joint was restored to normal anatomic relationship



Manual Reduction Protocols

The study group adopted the modified Milch technique for manual reduction. The procedure was conducted by a certificated surgeon or emergency medicine physician. The patient was placed in the supine or upright position, the surgeon stood on the affected side and the physician assistant immobilized the shoulder blade on the affected side. The patient's forearm was straightened, and slowly abducted and rotated 90°, and traction was continued for 3 to 5 minutes (Figure 3). The surgeon pushed the humerus head outward and upward with his thumb in the axilla and stopped the reduction when he heard a popping sound. Once the square

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shoulder deformity disappeared, functional activities had returned to normal and the Dugas sign was negative, X-ray examination was used to confirm that the anatomical structure of the shoulder joint had returned to normal (Figure 2B).

The control group adopted Hippocrates' technique. The patient was placed in a supine position and the surgeon stood on the patient's affected side. The surgeon held the wrist of the affected limb and pressed against the armpit with their foot against the patient's chest wall on the side of the affected limb. The surgeon pulled the upper arm along the vertical axis of the upper limb in the outer booth and gradually rotated it outward. The shoulder joint was gradually adducted during traction, with the surgeon's heel pushing the humeral head laterally. Once a snap—indicating the humeral head entering the joint—was heard, surgeon stopped traction. The criteria for confirming the success of manual reduction was the same as in the study group.

Figure 3. Schematic diagram of manual reduction a. The surgeon slowly abducts the patient's upper limbs, rotates them outward 90° and continues to pull them for 3-5 minutes; b. The surgeon's thumb pushed the humeral head outward and upward in the patient's axilla, stopping reduction when the head was felt entering the glenohumeral joint and a popping sound was heard

Rehabilitation Protocols

The first stage of the protocol was immobilization. After successful manipulation reduction, cotton pads were placed on the patient's affected side under the armpit and inside the elbow joint, so that the chest wall and the inner skin of the upper arm could be kept separate, and thus dermatitis or skin ulceration caused by compression could be prevented. The patient maintained the shoulder adduction, internal rotation and elbow flexion at 90°, the forearm was attached to the chest, the upper arm was fixed to the chest wall with bandages, and the forearm was suspended on the patient's chest with a triangular towel to limit the abduction and external rotation of the shoulder joint. The fixation time was 2 to 3 weeks.

In the second stage, the fixed bandages were removed and the triangle towel remained on the forearm. The patient gradually began elbow flexion and extension activities and shoulder flexion and extension, as well as pendulum-like exercises.

In the third stage, which was initiated at approximately 3 weeks, the patient began active functional exercise of the shoulder joint in all directions.

Outcome Assessment

The success rate of reduction, time of manual reduction procedure and incidence of complications were compared in the 2 groups. QoL was considered to be the primary study outcome.

Reduction success rate

The success rate of patients achieving the reduction effect in 1 reduction procedure and the ratio of patients needing a second procedure to achieve successful reduction. The manual reduction was considered successful once the square shoulder deformity disappeared, functional activities had returned to normal, Dugas sign was negative and X-ray examination confirmed that the anatomical structure of the shoulder joint had returned to normal. If the reduction was not successful after 2 attempts, it was considered unsuccessful, and manual reduction under general anesthesia was performed in the operating room.

Definition of manual reset procedure time: the time of the whole process from the beginning of the reset to the completion of the reset, recorded in seconds.

The degree of pain before, during and at 30 minutes after reduction was recorded. Pain was assessed by visual analogue scale (VAS).[7]

Functional recovery of the shoulder joint was compared in the 2 groups before and 4 weeks after reduction. Shoulder function was assessed using the Constant-Murley Shoulder Evaluation Scale (CMS).[8] The CMS is composed of 4 subscales, including pain (15 points), daily activity function (20 points), joint range of motion (including 4 items of flexion, abduction, external rotation and internal rotation, for a total of 40 points) and muscle strength (25 points). The total score was 100 points. The higher the score was, the better the shoulder joint function was. Flexion and abduction angles were measured using an Elink electronic protractor (Biometrics Corp, UK).

QoL was assessed with the 36-Item Short Form Survey (SF-36).[9] The scale contains 8 items, including health status, emotional functioning, mental health, physical functioning, physiological functioning, physical pain, vitality and social functioning, with a total score of 100 for each dimension. The higher the score, the better the QoL. The occurrence of vascular injury, skin tear, iatrogenic fracture, axillary nerve injury and other complications during treatment in both groups was recorded and compared.

Statistical Analysis

Statistical analysis was performed using the IBM® SPSS software program (version 21.0; IBM Corporation, Armonk, New York, USA). The sample size calculation was:

$$nc = (\mu 1\text{-}\alpha/2+\mu 1\text{-}\beta)\ 2S2\ (1+1/\ K)/(\mu t\text{-}\mu c)2$$

nc, as the number of cases in the control group represents the percentage of the corresponding 1-α/2 and 1-β in the standard

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Table 1. General Demographics of Patients in Both Groups

Index	Study group (n = 63)	Control group (n = 63)	t/χ^2	*P* value
Age (years)	49.92 ± 7.09	49.89 ± 7.11	0.024	.981
Gender (male/female)	46/17	48/15	0.168	.682
Disease course (hours)	4.76 ± 0.23	4.71 ± 0.26	1.143	.255
Affected side			0.032	.859
Left	33	32		
Right	30	31		
Diagnosis of dislocation			0.368	.544
Primary dislocation	56	58		
Recurrent dislocation	7	5		
Etiological factors			0.183	.980
Traffic accident	10	11		
Fall	28	29		
Falling accident	19	18		
Others	6	5		
Classification of dislocation			1.753	.416
Subcoracoid	37	39		
Subglenoid	19	21		
Infraclavicular	7	3		

Table 2. Comparison of VAS Scores in the Two Groups

	Study group (n = 63)	Control group (n = 63)	*t*	*P* value
Before reduction	7.83 ± 0.23	7.81 ± 0.25	0.467	.641
During reduction	5.09 ± 1.92	5.36 ± 1.98	-0.777	.439
30 minutes after reduction	1.02 ± 0.01	1.14 ±0.26	-3.661	<.001

Table 3. Comparison of Shoulder Function in the 2 Groups

Index	Study group (n = 63)	Control group (n=63)	*t*	*P* value
Pain				
Before reduction	3.28 ± 0.23	3.31 ± 0.19	-0.798	.426
4 weeks after reduction	12.29 ± 1.01	12.01 ± 1.03	1.541	.126
Daily activity				
Before reduction	5.83 ± 0.37	5.92 ± 0.39	-1.329	.186
4 weeks after reduction	15.23 ± 1.18	15.11 ± 1.19	0.568	.571
Forward elevation				
Before reduction	5.12 ± 0.34	5.09 ± 0.31	0.518	.605
4 weeks after reduction	8.28 ± 1.82	8.09 ± 1.75	0.597	.552
Abduction				
Before reduction	5.07 ± 0.31	5.08 ± 0.27	-0.193	.847
4 weeks after reduction	8.33 ± 1.32	8.13 ± 1.39	0.828	.409
External rotation				
Before reduction	5.03 ± 0.29	5.07 ± 0.13	-1.127	.262
4 weeks after reduction	8.18 ± 1.44	8.09 ± 1.42	0.353	.725
Internal rotation				
Before reduction	5.05 ± 0.25	5.07 ± 0.26	-0.440	.661
4 weeks after reduction	8.21 ± 1.89	8.04 ± 1.92	0.501	.617
Muscle force				
Before reduction	5.01 ± 0.22	5.04 ± 0.25	-0.715	.476
4 weeks after reduction	8.27 ± 1.67	8.18 ± 1.61	0.308	.759

normal distribution. T is the mean of the experimental group, C is the mean of the control group, S is the combined standard deviation (SD) in the 2 groups and K is the percentage of the number of cases in the 2 groups. As $\alpha = 0.05$, $\beta = 0.01$, S = (n1 and n2 were the number of cases in the 2 groups, and s1 and s2 were the SD in the 2 groups, respectively). According to the provisions of the State Food and Drug Administration, 15% was the abruption rate, so the grouped sample size of this study was determined to be $n = 54 \times 1/(1–0.15) = 63.52 \approx 63$. Therefore, 126 patients with anterior dislocation of the shoulder joint treated in our hospital from January 2021 to January 2022 were selected as the research patients, and they were divided into the study group (63 patients; received the Milch technique) and the control group (63 patients; received hand-holding and the Hippocrates' technique) via the random number table method. The ratio of the 2 groups was 1:1. Normally distributed measurement data were expressed as mean ± SD and the comparisons were examined by Student *t* test. Categorical variables were presented as numbers with percentages and compared with the χ^2 test. The test level α was 0.05 on both sides, and $P < .05$ was considered statistically significant.

RESULTS

General Data

A total of 126 patients were prospectively included in this study. The study group consisted of 46 men and 17 women with an average age of 49.92 ± 7.09 years (range, 23 to 59 years). The control group consisted of 48 men and 15 women with an average age of 49.89 ± 7.11 years (ranging from 22 to 58 years). There was no significant difference in age, gender or disease course between the 2 groups ($P > .05$) (see Table 1).

Comparison of Therapeutic Effects of Manual Reduction

Follow-up evaluation was conducted 3 months after treatment and there was no recurrence of shoulder dislocation in either group. In study group, the one-time reduction success rate (87.30%) was significantly higher than in the control group (61.90%; $P = .001$), and the success rate of twice reset of in the study group (11.11%) was lower than in the control group (25.40%; $P = .038$). The failure rate in the study group (1.59%) was lower than in the control group (12.70%; $P = .015$). The manual reduction required less time (58.87 ± 7.92 vs 93.09 ± 8.01, respectively; $P < .001$). In the control group, there were 4 avulsion fractures and 2 humeral fractures, while no complications occurred in the study group, with a significant difference ($\chi^2 = 6.289$; $P = .012$).

Comparison of Pain Levels During Manual Reduction

There was no significant difference in pain levels before or during the reduction in the 2 groups ($P > .05$), while after reduction the pain level in the study group was significantly lower than in the control group ($P < .05$) (see Table 2).

Comparison of Shoulder Joint Function

There was no statistical difference in shoulder function in the 2 groups before manual reduction ($P < .05$). After manual reduction, the functional scores in the study group were higher than in the control group, but the differences were not statistically significant ($P < .05$) (see Table 3).

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Comparison of QoL

Before reduction, there was no significant difference in health status, emotional function, mental health, physiological function, physical pain, vitality or social function between the 2 groups ($P < .05$). At 4 weeks, after manual reduction these indices showed better results in the study group than in the control group ($P < .05$) (see Table 4).

Table 4. Comparison of Quality of Life in the 2 Groups

Index	Study group (n=63)	Control group (n=63)	*t*	*P* value
Physical condition				
Before reduction	32.09 ± 4.39	32.23±4.32	-0.180	.857
4 weeks after reduction	78.93 ± 5.34	72.98±5.21	6.330	<.001
Emotion function				
Before reduction	30.76 ± 5.09	31.03±5.02	-0.300	.765
4 weeks after reduction	76.67 ± 5.26	70.98±5.65	5.851	<.001
Mental health				
Before reduction	32.78 ± 5.23	32.87±5.18	-0.097	.923
4 weeks after reduction	77.65 ± 5.13	69.87±5.08	8.553	<.001
Physiological conditions				
Before reduction	33.87 ± 5.17	33.76±5.12	0.120	.905
4 weeks after reduction	76.83 ± 5.08	70.56±5.42	6.699	≤.001
Physiological function				
Before reduction	32.17 ± 5.09	32.22±5.11	-0.055	.956
4 weeks after reduction	79.71 ± 5.23	72.18±5.18	8.119	<.001
Body pain				
Before reduction	31.08 ± 5.12	31.76±5.07	-0.749	455
4 weeks after reduction	78.37 ± 5.19	70.31±5.13	8.767	<.001
Activity				
Before reduction	31.76 ± 5.32	31.86±5.43	-0.104	.917
4 weeks after reduction	79.92 ± 5.64	72.18±5.87	7.547	<.001
Social function				
Before reduction	31.67 ± 5.19	31.79±5.43	-0.127	.899
4 weeks after reduction	79.38 ± 5.42	73.28±5.32	6.375	<.001

DISCUSSION

The shoulder joint is the most movable joint in the human body, and is also the most affected by external force. It is surrounded by the pectoralis major, deltoid and other muscle groups, and combined with the rotator cuff provides dynamic stability. The shoulder capsule and surrounding ligaments together provide static stability that maintains the stability of the glenohumeral joint.[10] Anatomic studies suggested that the depth of the glenoid pelvis is only 2.5 mm and the depth behind the labrum is only 5 mm.[11] The pelvis is small and shallow, while the humeral head is large, the anterior and inferior tissues are weak and the joint capsule is relatively loose, all of which lead to poor stability of the glenohumeral joint, which is prone to dislocation when subjected to a sudden high energy blow. Anterior dislocation of shoulder is the most common type of dislocation. Clinical symptoms include swelling and pain in the shoulder with limited movement of the affected limb, square shoulder deformity and positive Dugas sign on physical examination.[12] Manual reduction is the main treatment for acute anterior dislocation of the shoulder. It is simple, safe and fast, and can effectively restore the normal anatomical position of the shoulder, decrease patients' pain level and improve the function of the shoulder joint on the affected side. Early reduction can restore the anatomical structure and avoid muscle, nerve and blood vessel injury caused by prolonged prolapse of the humeral head.[13]

Reduction Methods for Shoulder Dislocation

There are multiple reduction methods for treating shoulder dislocation in clinic, including traction cyclotomy, hand-holding and foot pedal, traction against traction, suspension and so on. Zhang, et al. proposed using Tu's pushing technique,[14] which was reported to have the advantages of simple operation, simple and easy to learn, minor iatrogenic pain and high reduction success rate that can effectively restore patients' shoulder joint function. Tang, et al.[15] reported that the treatment of anterior dislocation of the shoulder joint with knee top extension and elbow external rotation and abduction was simple and easy to perform, and can shorten the reduction time, reduce secondary injury and had a high reduction success rate. However, this manual reduction method relies on the principles of biomechanics and may cause complications such as brachial plexus injury and humeral shaft or humeral neck fracture.[16,17] The traction maneuver could result in joint capsule lesions, humeral neck fracture and vascular injury.[18] The suspension reduction method can increase the risk for muscle spasms and require the physician to apply a significant amount of force during manual reduction. In addition, the reduction success rate of traction vs traction was lower, with only a 69.23% rate reported.[19]

Hippocrates' technique is a classic method for the reduction of shoulder dislocation. It can be completed by just 1 physician and has a high success rate. However, in patients with significant mental stress and muscle spasm, it requires a substantial amount of traction force and long duration of traction maintenance.[20] It was reported that traction may aggravate pain, and in severe cases can damage neurovascular systems and articular cartilage and cause iatrogenic fractures of the proximal humerus, especially in patients with osteoporosis.[20]

The treatment mechanism of the modified Milch technique is to reduce the tension of the subscapularis, biceps brachii and pectoralis major muscles under traction from the flexed elbow position. At the same time, traction is carried out along the direction of the protuberant humeral head, and then reduction is carried out in the opposite direction, using mechanical confrontation, so that the dislocated humeral head can be easily reduced. Compared with other reduction methods, the modified Milch technique is characterized by the combination of abduction and traction techniques, focusing on the reduction of the shoulder joint with the contrapuntal relationship of each structure, rather than relying on huge traction and leverage, so as to reduce the occurrence of iatrogenic injury.[14,21]

Previous studies have also shown that the modified Milch technique has a good efficacy and safety profile. Zhang, et al.[22] reported that abduction and external rotation in the reduction of anterior dislocation of the shoulder joint in the elderly achieved an acceptable clinical outcome. Our study results showed that the success rate of primary and secondary reduction in the study group was significantly higher than in

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the control group, while the failure rate was lower than in the control group ($P < .05$). In clinical operation, when muscle spasm occurs in the patient and the surgeon pulls the muscle involuntarily, the pain is aggravated and the reduction fails. In our study, treatment of 1 patient in the study group with anterior dislocation of the shoulder joint was unsuccessful because of the patient's fear of pain, which resulted in significant mental tension and muscle contraction. The patient was eventually switched to an adversarial traction reduction under intravenous anesthesia; this treatment was successful. Therefore, patients' pain level should be noted during reduction of anterior dislocation of the shoulder joint. The results of our study showed that the pain level in patients in the study group was significantly lower than in the control group after reduction, suggesting that the occurrence of reduction-related injury caused by the modified Milch technique was smaller ($P < .05$). This may be because the modified Milch technique makes good use of the characteristics of shoulder joint lever and traction biomechanics, and minimizes the pulling effect of the adductor muscle and the contraction blocking effect of the biceps brachii during the reduction process, so as not to increase the patients' pain level.

Functional evaluation suggested that the modified Milch technique can help patients achieve good QoL. The Constant-Murley Shoulder Assessment Scale is widely used in the evaluation of shoulder diseases, and evaluates patients' own feelings regarding the degree of shoulder pain they are experiencing and its impact on their daily life.[8] At present, there are few studies on the effect of the modified Milch technique on QoL in patients with anterior dislocation of the shoulder joint. The results of this study revealed that after reduction, the health status, emotional function, mental health, physical function, physiological function, physical pain, vitality and social function in the study group were all higher than in the control group ($P < .05$). These results suggested that the Milch technique can effectively improve the QoL in patients with anterior dislocation of the shoulder. There were 4 avulsion fractures and 2 humeral fractures in the control group, while no complications occurred in the study group ($\chi^2 = 6.289$; $P = .012$), indicating that the modified Milch technique is more secure than the traditional Hippocrates' technique.

SUMMARY

To summarize, the modified Milch technique has the following advantages: (1) it can be performed by a single doctor; (2) the procedure is simple and of short duration; (3) the reduction process does not require a significant external force, so it will not cause secondary damage, and the damage to the surrounding tissues is minimal; (4) patients with functional recovery after reduction experience high satisfaction rates. It should be noted that this method is not suitable in elderly patients with osteoporosis.

Study Limitations

This study had the following limitations. The first is the sample size. A good prospective study should include a matching sample size, and the sample size in this study was limited. Second, the patients included in this study were from a single center, so there may be some bias in patient selection. Third, the follow-up period was relatively short. Therefore, a larger, more scientific sample size and more comprehensive study design are needed to improve the quality of the research results.

CONCLUSION

The modified Milch technique can improve the success rate of reduction, shorten the duration of the reduction, decrease the pain level, and be beneficial in recovery of shoulder function. This manual reduction method has a low complication rate and is easy to perform. It has good practicability and is worthy of clinical application.

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AUTHOR CONTRIBUTIONS

Liqiang Li and Zhigang Wen contributed equally to this paper.

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