Closed reduction techniques in acute anterior shoulder dislocation: modified Milch technique compared with traction-countertraction technique

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Background: To perform closed manual reduction of acute anterior shoulder dislocation using the traction-countertraction technique requires sedation (TCTS) and the participation of 2 people. We studied the modified Milch (MM) technique, a positional reductive maneuver that requires 1 operator, without patient sedation or analgesia.

Materials and methods: The study comprised 56 prospective nonrandomized consecutive patients, of whom 31 were in group A (MM, nonsedated) and 25 in group B (TCTS).

Results: The success rate of MM technique was 83.9% (26 of 31), which increased to 96.3% (26 of 27) when 4 patients with associated greater tuberosity fractures were excluded. The success rate was 100% in the TCTS group, with 5 patients with associated greater tuberosity fractures. The reduction in pain from the preprocedural to intraprocedural phases in MM group was significant (P < .001), at a reduction rate of 2.07 (29%) on the numeric rating scale pain score. There was a greater pain reduction rate of 2.43 (34%) on the numeric rating scale when patients with greater tuberosity fractures were excluded. The MM group had a significantly shorter hospital stay (mean, 35 minutes) than the TCTS group (mean, 4 hours). No postreduction neurovascular or fracture complications occurred in either group.

Conclusions: The results showed that the Milch technique was effective, safe, shortened hospital stay, and was well tolerated. We recommend the modified Milch technique as a first-line maneuver for acute anterior shoulder dislocations without associated fractures.

Level of evidence: Level II, Prospective Cohort Study, Treatment Study.

Keywords: Shoulder dislocation; closed manual reduction; Milch technique; traction-counter traction techniques; sedation; cost

Acute anterior dislocation of the glenohumeral joint is a common injury that comes into an orthopedic surgeon’s care. Hippocrates’ technique of anterior shoulder reduction, described in Corpus Hippocrates, has been in use for the past 2000 years. It was not until the past 150 years that...
other less traumatic techniques have been reported for the reduction of anterior shoulder dislocation, ranging from methods with sedation (Hippocratic technique, Kocher maneuver, Rockwood traction-countertraction technique), methods without sedation (Stimson technique, Milch technique), to methods after intra-articular injection. However, reports comparing the effectiveness of these methods are limited. The ideal shoulder reduction technique should be effective, safe, well tolerated, and gentle, with minimal pain. It should be fast and easy to perform with minimal personnel, shorten hospital stay, and not expose patient to further risk of sedation or narcotics. The Milch technique, described by Dr Henry Milch, appears to meet all of these requirements and was chosen in our study. This technique was compared with the traction–countertraction technique, which is widely used at our center.

Materials and methods

The aim of the study was to compare the effectiveness of the modified Milch (MM) technique with the traction–countertraction technique under sedation (TCTS). Our primary objective was to investigate if the MM technique is comparable to the TCTS technique in the rate of reduction of anterior shoulder dislocation. Our secondary objective was to compare length of hospital stay and cost of treatment between MM and TCTS. A prospective nonrandomized study was conducted at University of Malaya Medical Centre Accident and Emergency unit during a 12-month period from October 2006 to September 2007.

Inclusion criteria for the study were patients aged age 16 years or older, acute anterior dislocations (within 24 hours), including those complicated by greater tuberosity fractures only, mentally capable of giving informed consent, and with no other life-threatening or limb-threatening injuries. The exclusion criteria included patients aged younger than 16 years, prior sedation or analgesia, dislocation associated with fractures apart from greater tuberosity fracture, mental confusion or impairment, refusal to consent, presenting more than 24 hours after dislocation, requiring hospital admission, or presenting with other fractures or medical illnesses that could prolong hospital stay.

During this period, 71 patients with anterior shoulder dislocation presented to the Accident and Emergency Department. Patients who presented during the first 6 months underwent closed manual reduction using TCTS techniques. Shoulder reduction using the MM technique was attempted in patients who presented during the second half of the study. After the exclusion of 15 patients who did not meet our criteria, we had 31 patients in MM technique group and 25 in TCTS group.

Clinical and neurovascular examinations were performed. Anteroposterior and lateral x-ray images were taken to confirm the diagnosis and detect periarticular fractures. Patients provided informed consent before treatment commenced. The reduction via MM technique was performed by our primary author (S.S.) with no assistant. The orthopedic residents posted in Accident and Emergency Department performed all the reduction of shoulder dislocations with patients under sedation in the TCTS technique group. The author and the residents performing the TCTS were orthopedic residents at the time of the study and therefore of similar experience.

The TCTS technique was performed with an assistant providing countertraction by using an approximately 5-inch swath of folded cloth slung across the patient’s chest. The resident applied traction on the affected arm and gradually increased the traction until reduction was achieved. Gentle internal and external rotation was sometimes required to disengage the head. This technique is used widely at our Accidents and Emergency Department. Intravenous midazolam was given as initial bolus dose of 2.0 to 2.5 mg and increased, if necessary, in 1.0 mg increments to a maximum dose of 3.5 to 5.0 mg. Similarly, intravenous pethidine was given with an initial dose of 50 mg and titrated to a maximum dose of 100 mg.

In the MM technique group, the patient was placed supine and the head of the bed was elevated to approximately 30°. The affected arm was held by the wrist and was slowly abducted and externally rotated while the other hand was placed over the shoulder to feel for muscle spasm (Fig. 1). The patient was constantly reassured. The procedure was halted briefly when resistance or pain was encountered by the patient. This maneuver was continued until the arm had reached approximately 90° of abduction, 90° of external rotation, and approximately 30° forward flexion. If the dislocation remained unreduced after this position was reached, a gentle amount of longitudinal traction was applied in line with the humerus. The physician’s free hand could be held against the patient to apply greater countertraction. If this was not sufficient, the physician’s free hand was placed into the axilla and used to exert lateral and superior pressure on the humeral head to complete the maneuver (Fig. 2). The above description is a modification of Milch’s technique.

There was no crossover in technique between the 2 groups. If reduction was unsuccessful, the treatment was recorded as unsuccessful and the patient was not crossed-over to the other group. The primary outcome measure was a clinical impression of reduction, which was confirmed radiographically. A clinical examination was repeated.

Details recorded included patient demographic data, hand dominance, side and number of previous shoulder dislocations,
mechanism of injury, time of injury, length of time from injury to consultation, length of time of consultation, neurovascular examination, presence of greater tuberosity fracture, and length of time from consultation to discharge.

Pain was assessed in the MM group during the prephase, intraphase, and postphase of the procedure using numeric rating scale (NRS). The pain score was explained to the patient before the procedure was performed, with 0 representing “no pain at all” and 10 representing “the worst pain imaginable.” The gradation from 0 to 10 was a progressively increasing severity score of the pain. The prephase pain score was defined as a measurement of the pain obtained before the start of the procedure, and the intraphase score was assessed at 2 points of the procedure, at the midway point of 45° abduction and at 90° abduction. The higher of the 2 scores was taken. The postphase pain scoring was conducted 5 minutes after the procedure was completed.

Other parameters evaluated in this study included recognition of reduction whether by pain, clunk, or examination, the requirement of analgesia, and the patient’s satisfaction (graded from 1 to 10, with higher score denoting increased satisfaction) with the procedure. Patients were also asked if they would prefer or recommend this procedure again in the future. The time taken from the start to completion of the MM maneuver was recorded. Beighton scoring was performed in all patients to determine global ligamentous laxity. The difficulty in the procedure was then recorded as easy, moderate, or difficult (Table I).

All data were analyzed using SPSS 14.0 software (SPSS Inc, Chicago, IL, USA). The independent 2-sample t test was used when continuous data were compared between groups. Categoric data were analyzed using the \( \chi^2 \) test with the Yates correction or the Fisher exact test. Two-tailed values of \( P < .05 \) were considered significant.

## Results

During the period of study, 71 patients with anterior shoulder dislocation presented to the Accident and Emergency Department. Of these, 15 did not meet our inclusion criteria and were excluded. Of the remaining 56 patients, the reduction in 31 was performed using the MM technique and in the remaining 25 with the TCTS technique (Fig. 3).

The groups did not differ significantly in demographic details, the incidence of first time or recurrent dislocations, hand dominance, presence of greater tuberosity fracture, side, and cause of dislocation (Table II). The success rate for patients in the MM group was 83.9% and was 100% in the TCTS group. Although this was not statistically significant (\( P = .058 \)), there appears to be some disparity. An interesting observation was that most of the unsuccessful reductions in the MM group were associated with greater tuberosity fractures. When these patients were removed from the analysis, the success rate of the Milch technique was 96%.

The incidence of greater tuberosity fracture in our study was approximately 16%. There were no vascular complications; however, 8 patients (14%) presented with a neurologic deficit. Axillary nerve was the most common nerve injured. There were 5 patients with involvement of axillary nerve alone, 1 patient with axillary nerve and ulnar nerve injury, 1 patient with axillary nerve and brachial plexus (C8, T1) involvement, and 1 patient with radial nerve injury.

Right-sided dislocations were more common (76.8%), possibly because 91% of the patients were right handed (91%). The most common cause for dislocation was

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**Table I** Grades of reduction difficulty and description

<table>
<thead>
<tr>
<th>Difficulty grade</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Easy</td>
<td>Mild traction only; no “pulsion” of the head using the opposite hand was required</td>
</tr>
<tr>
<td>Moderate</td>
<td>Strong traction on the affected arm was required</td>
</tr>
<tr>
<td>Difficult</td>
<td>Traction and “pulsion” were required</td>
</tr>
</tbody>
</table>

**Figure 2** The arm is shown at approximately 90° or more of abduction, 90° of external rotation, and approximately 30° flexion.

**Figure 3** Distribution of patients in each group.

**Group A**
- N=31
- MILCH’S TECHNIQUE

**Group B**
- N=25
- ROCKWOOD TECHNIQUE WITH SEDATION

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**Group A**
N=31
MILCH’S TECHNIQUE

**Group B**
N=25
ROCKWOOD TECHNIQUE WITH SEDATION

71 PATIENTS total number of patient presented during the study period with anterior shoulder dislocation.
56 PATIENTS INCLUDED
15 PATIENTS EXCLUDED
sports-related injuries (26.8%), and 3% to 5% of the patients sustained shoulder dislocation secondary to an epileptic event.

The duration of hospital stay was taken from the time of the orthopedic consultation to the time the patient was discharged. There was a significant difference between these groups ($P < .01$). The median duration was 0.59 hours (interquartile range, 0.25 hours) for the MM group compared with 4 hours (interquartile range, 4.25 hours) for the TCTS group. This had repercussions on the cost that would be incurred by the patient and the hospital (Table III). The estimate of the cost of a patient undergoing uncomplicated reduction under sedation with monitoring in the observation ward would be approximately €24.30, in contrast to the Milch technique, which would translate to €7.15. From the estimates given, the MM technique resulted in a significant cost-saving.

In the MM group, the pain scores using the NRS showed significant reduction of pain between all 3 phases ($P < .001$; Fig. 4). A greater drop in the pain score was noticed if patients with greater tuberosity fractures were excluded. The mean drop in pain score from the preprocedural to the intraprocedural phase was 2.43, translating to a 34% improvement. The mean difference from preprocedure to postprocedure was 5.18, translating to a 73% reduction in pain. Those with greater tuberosity fractures did not show any decline in pain (Fig. 5).

In the MM group, there was no significant difference in the preprocedural pain score between those with first time dislocation and recurrent dislocations, with mean score of 6.94 and 7.43 each. Similarly, there was no significant difference in difficulty of the procedure between those with a first-time dislocation and those with a recurrent dislocation (Table IV).

The patients were divided into 2 groups according to their body mass index and compared against difficulty in reduction. Patients in the overweight and obese categories were clumped in 1 group. There were no underweight patients. The difficulty of reduction did not differ significantly between the 2 groups ($P > .99$).
As assessed by the Beighton score for laxity, only 3 patients had a score of more than 6. The mean ± standard deviation time of the MM maneuver was 13.5 ± 6.8 minutes. The shortest time for reduction was 3 minutes and the longest was 30 minutes.

**Discussion**

There have been many variations and alterations in the techniques of reduction of shoulder dislocations. Almost all are accepted as credible techniques with good success rates. Milch’s technique, described by Dr Henry Milch in 1938, is a maneuver that has withstood the test of time. It has a good success rate, is well tolerated, safe, easy to perform, and has credible anatomic and biomechanical reasoning to support it. We provided a slight modification to a previous alteration by O’Connor et al by adding a 30° forward flexion.

The rationale for Milch’s original description was to bring the muscle about the shoulder joint to a more linear alignment in a conical arrangement to negate the spasm and displacing ability of these muscles. This was true if the arm was placed in an overhead abducted and externally rotated position. This was later confirmed by Saha et al in their description of the “zero position” of the glenohumeral joint where the humerus was in alignment with the scapular spine. In this position, the rotatory forces of the muscle were neutralized. We believe an addition of 30° of flexion is advantageous in recreating the “zero position.” Furthermore, in pure abduction, the shoulder joint is in an anterolateral position in relation to the trunk, in a range that is orthogonal to the flexion/extension arc, which is in an anteromedial position. We do not recommend abducting the shoulder more than 90° to 100° because further strain is exerted to the already injured anteroinferior structures and causes undue discomfort to the patient. Further abduction would also predispose to the axillary nerve injury by the taut tendon of the long head of the triceps.

Most of our patients were young, with sports activity being the most common cause of injury, predominantly in males. Motor vehicle accidents were the third highest

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**Table III** Cost overview

<table>
<thead>
<tr>
<th>Cost overview</th>
<th>No sedation (€)</th>
<th>Sedation (€)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A &amp; E registration and consultation</td>
<td>4.75</td>
<td>4.75</td>
</tr>
<tr>
<td>Observation ward per night</td>
<td>–</td>
<td>15.50</td>
</tr>
<tr>
<td>Radiograph</td>
<td>2.40</td>
<td>2.40</td>
</tr>
<tr>
<td>Medication</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Midazolam (IV)</td>
<td>0.50</td>
<td>0.40</td>
</tr>
<tr>
<td>Pethidine (IV)</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Gloves</td>
<td>–</td>
<td>0.30</td>
</tr>
<tr>
<td>Syringe (5 mL)</td>
<td>–</td>
<td>0.10</td>
</tr>
<tr>
<td>Branula</td>
<td>–</td>
<td>0.35</td>
</tr>
<tr>
<td>Estimated cost</td>
<td>7.15</td>
<td>24.30</td>
</tr>
</tbody>
</table>

* A & E, accident and emergency; IV, intravenous.

Approximate cost at our institution, might vary at other hospitals.

**Table IV** Difficulty of procedure compared with number of dislocations

<table>
<thead>
<tr>
<th>Variable</th>
<th>Difficulty of procedure</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Easy (No. (%)</td>
<td>Moderate</td>
</tr>
<tr>
<td>First time</td>
<td>5 (35.7)</td>
<td>7 (50.0)</td>
</tr>
<tr>
<td>Recurrent</td>
<td>4 (33.3)</td>
<td>7 (58.3)</td>
</tr>
<tr>
<td>Total</td>
<td>9 (34.6)</td>
<td>14 (53.8)</td>
</tr>
</tbody>
</table>

**Figure 4** Pain scores in the modified Milch group.

**Figure 5** Pain scores of patients with (red line) or without (blue line) tuberosity fractures.
cause, probably higher than in other studies, because of the greater number of motorcycle accidents in Malaysia.

The MM technique is easy to perform and can be performed by a single person, with a saving of cost and time. The mean time taken was 13.5 minutes. Furthermore, the patients are not exposed to the complications of using a sedative or an opioid analgesia. There was a cost-saving of €17.15 per patient in MM group. This was primarily because sedation was not required; therefore, hospital stay and monitoring were unnecessary.

The pain scores in the MM group illustrate how well this procedure was tolerated by the patients. There was a drop in mean NRS pain score of 2.07 (29%) from the preprocedural to the intraprocedural phase and a drop of 4.40 (61%) from the preprocedural to the postprocedural phase. Excluding patients with greater tuberosity fractures resulted in an even greater drop in the NRS pain score, at 2.43 (34%) and 5.18 (73%), respectively. A study by Soledad et al\(^2\) showed that a decrease of 1.3 or a drop of 20% in the NRS pain score corresponded to the patient experiencing “minimal” improvement, a decrease of 2.4 or 35% corresponded to “much improvement,” and finally, a drop of 3.5 units or 45% reduction corresponded to “very much improvement.” There was no appreciable drop in NRS pain score among patients with greater tuberosity fractures. The application of the MM maneuver did not augur well in these patients.

Neither technique resulted in any immediate neurovascular complications after the procedure. There was no statistical difference in the difficulty of the procedure between the recurrent dislocator group and the first-time dislocator group (Table IV). This could be because those with a recurrent dislocation were more apprehensive and anxious and therefore more guarded during the procedure because their previous reductions were done under sedation. There was also no difference in the body mass index of the patients and the difficulty of the procedure (Table V). Patients in the MM group, including those with recurrent dislocations, evaluated the procedure highly, with a mean score of 8.4 showing acceptance from the patients.

### Conclusion

The MM technique is a proven technique with a good track record for the reduction of anterior shoulder dislocation. This technique is well tolerated by patients and has been shown to reduce pain significantly during and after the procedure. It is safe, saves time and costs, and does not expose patients to risks associated with sedatives and opioids. The procedure is easy to perform by one person without additional assistance. We strongly recommend that this procedure be used as a first-line reduction method in all anterior shoulder dislocations that are not complicated by any shoulder periarticular fractures.

### References


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**Table V** Difficulty of procedure compared with BMI

<table>
<thead>
<tr>
<th>Group</th>
<th>BMI (kg/m²)</th>
<th>Difficulty of procedure</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Easy</td>
<td>Moderate</td>
</tr>
<tr>
<td>Normal (18.5 - 24.9)</td>
<td>6 (46.2)</td>
<td>5 (38.5)</td>
<td>2 (15.4)</td>
</tr>
<tr>
<td>Overweight/obese (&gt;25)</td>
<td>3 (23.1)</td>
<td>9 (69.2)</td>
<td>1 (7.7)</td>
</tr>
<tr>
<td>Total</td>
<td>9 (34.6)</td>
<td>14 (53.8)</td>
<td>3 (11.5)</td>
</tr>
</tbody>
</table>

BMI, body mass index. * Data are presented as counts (% within BMI).