

## Closed reduction techniques for acute anterior shoulder dislocation: from Egyptians to Australians

急性肩關節前方脫位之閉合復位術：從埃及人至澳洲人

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Acute anterior shoulder dislocation is a common presentation to emergency departments. A standard technique for reduction does not exist. Most dislocations can be reduced by one or more simple manoeuvres involving traction-countertraction, leverage and/or pulsion. The better-known methods are discussed, highlighting the manoeuvres, virtues and drawbacks. (*Hong Kong j.emerg.med.* 2004;11:178-188)

急性肩關節前方脫位是急症室常見的病況之一，但現時仍未有標準的復位技巧。大部份的脫位可經由一種或多種簡單的手法成功復位，包括牽引-反牽引術、槓桿術及/或推進法。本章旨在討論一些較為人熟悉的方法，並強調其中的手法、優點及缺點。

**Keywords:** Emergencies, orthopaedic manipulation, shoulder joint, traction

**關鍵詞：**緊急情況、骨科操作法、肩關節、牽引術

### Introduction

Approximately 50-60% of dislocations of large joints involve the shoulder (glenohumeral) joint.<sup>1-5</sup> Up to 90-96% of shoulder dislocations are anteroinferior, being subcoracoid (90%), subglenoid (7%), subclavicular, or intrathoracic.<sup>6,7</sup> Other types include posterior, inferior (luxatio erecta), superior (supraglenoid) and fracture dislocations.<sup>7</sup> The following discussion will be confined to anterior shoulder dislocations, in particular the subcoracoid type. As there are numerous similar techniques with only minor variations, only the better-known and more evidence-based methods will be elaborated on.

Most dislocations can be reduced in the emergency department using simple methods. The ideal method should be simple, easy, quick, effective, atraumatic, pain-free, require little assistance or medication, and cause no additional injury to the shoulder joint, musculoskeletal or neurovascular structures.<sup>8,9</sup> However, a standard procedure for managing this injury is still lacking. Many methods have been advocated for reduction of this common dislocation with varying success rates and complications. In general, success rates are between 70-90% regardless of technique.<sup>9</sup> Occasionally, dislocations will require the use of more than one method. In 5-10% of cases, emergency department reduction cannot be accomplished.<sup>10</sup> A search in the medical literature yielded essentially only uncontrolled case series or reviews. Few studies compare the efficacy of one reduction technique over another.<sup>8</sup> As no single shoulder reduction technique is infallible, the emergency physician should be proficient in several methods in case of failed first attempts.<sup>9</sup>

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## Methods

The techniques usually involve one or more manoeuvres – traction, rotation, pulsion and/or abduction. They can be classified according to their principal mode of action as follows: -

- A. Traction-countertraction<sup>11,12</sup>
  - In adduction – exemplified by Hippocrates
  - In forward flexion – exemplified by Stimson and Spaso
  - In lateral elevation – exemplified by the Eskimos
- B. Leverage – exemplified by Kocher and Milch
- C. Scapular manipulation
- D. Miscellaneous, including direct pressure or pulsion

Other classifications may use patient's position e.g. supine, prone, seated or the number of operators e.g. self, one, two or three.

### *Traction-countertraction*

#### *Hippocratic method* (Figure 1)

Hippocrates (460-377 BC)<sup>13</sup> described several techniques of reducing shoulder dislocations – all involve downward traction of the injured arm in a position of slight abduction, while different methods of counter-traction were used (long stick, ladder rung, back of a chair, surgeon's shoulder – interestingly, all

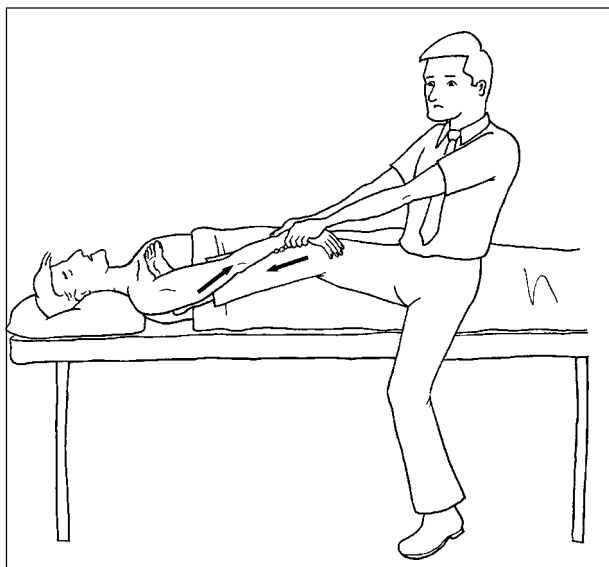


Figure 1. Hippocratic method.

these methods were described in traditional Chinese medical literature dating back to the Tang (618-907 AD) and Qing (1644-1911 AD) Dynasties.<sup>14,15</sup> In the classical technique, the patient lies supine. The physician's foot is placed in the patient's axilla against the chest wall while leaning backward. Slow, steady and gentle longitudinal traction is applied to the affected arm in 30-40° abduction for about one minute. The foot acts as a counterforce and as a lever to push the humeral head laterally while the physician pulls the head toward the patient's foot along the surface of the glenoid, effectively adducting the affected arm.<sup>9</sup> It has been suggested that the elbow should be flexed 90° to relax the biceps muscle. Internal or external rotation of the shoulder may also facilitate reduction. It has been claimed to be most effective for subglenoid dislocations. The method requires one operator only. However, it is painful, alarming to the patient and fatiguing to the physician. Brachial plexus and vessel injuries are common. Because of the risks of complications, this method is no longer popular nowadays.

Modifications include the "ladder method" elaborated by Ambroise Pare,<sup>11</sup> the use of a fist in the axilla,<sup>12</sup> direct knee pressure (traditional Chinese medicine),<sup>14,15</sup> and longitudinal traction in the prone position.

#### *Strap methods* (Figure 2)

The patient lies supine. A sheet (Rockwood)<sup>8</sup> or a strap (Boger)<sup>16</sup> wraps around the patient's chest under the

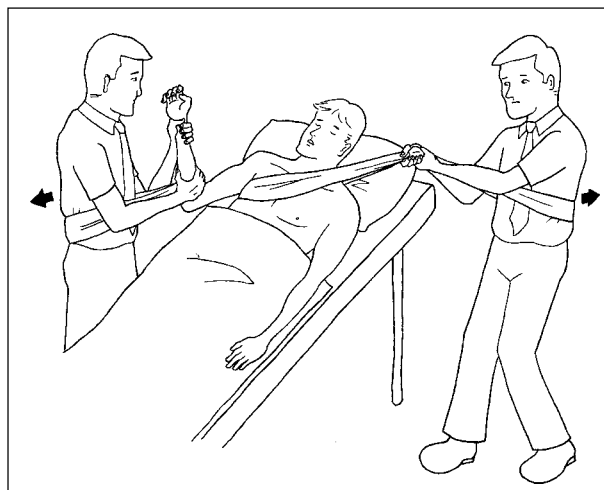


Figure 2. Strap method.

axilla and also around the assistant's waist for countertraction. The assistant pulls on the sheet toward the point of the opposite shoulder. With the elbow of the dislocated shoulder bent to 90 degrees, a second sheet is tied loosely around the physician's waist and looped over the patient's forearm. Steady traction along the axis of the arm in 30-40° abduction is exerted by the surgeon leaning back against the sheet while grasping the forearm.<sup>9</sup> Upward lateral traction on the dislocated arm at 30° with a sling by a third person can also be added. The strap method can also be applied to patients in the sitting position. A strap is placed under the axilla and across the chest. An assistant pulls the strap across the chest. The patient's elbow is flexed at 90°. A second strap is placed around the patient's forearm. The other end of the strap is placed under the physician's foot. Downward traction is applied to the forearm via the strap. The arm may be rotated 20° externally to facilitate reduction. A similar method is the Snowbird reduction technique.<sup>16</sup> This 'looped technique' was developed at the Snowbird Emergency Clinic of Utah. Downward traction is applied through a loop of stockinette hung from the patient's elbow using the physician's foot. Countertraction is provided by a chair with an assistant standing adjacent to the unaffected shoulder and clasping his hands around the chest in the axilla of the affected side. Certainly for female patients, a female assistant is preferred.

These methods are simple, easy, safe, effective, quick, and may be less painful. However, they require adequate space and at least two persons. Towels or sheets can cause friction injury to the fragile skin of the elderly.

#### *Chair methods* (Figure 3)

The patient sits upright on a chair with a well-padded backrest. The affected arm is allowed to hang over the backrest. Using the backrest as fulcrum in the axilla, gentle downward traction with external rotation is applied to the wrist. The patient is either asked to stand,<sup>18</sup> or direct outward pressure is exerted on the upper part of the shaft of the humerus.<sup>19</sup> A similar

method was found in Chinese medical literature in the Tang Dynasty around 846 AD.<sup>14</sup>

#### *Stimson or hanging arm (gravity) method* (Figure 4)

This was described by Stimson in 1900. The patient lies prone. Appropriate weights around 5-7 Kg are taped to the wrist, forearm or above the elbow. The affected arm hangs free over the edge of the stretcher. It may take 20-30 minutes for reduction to occur.<sup>8,9</sup> If reduction does not occur spontaneously, gentle

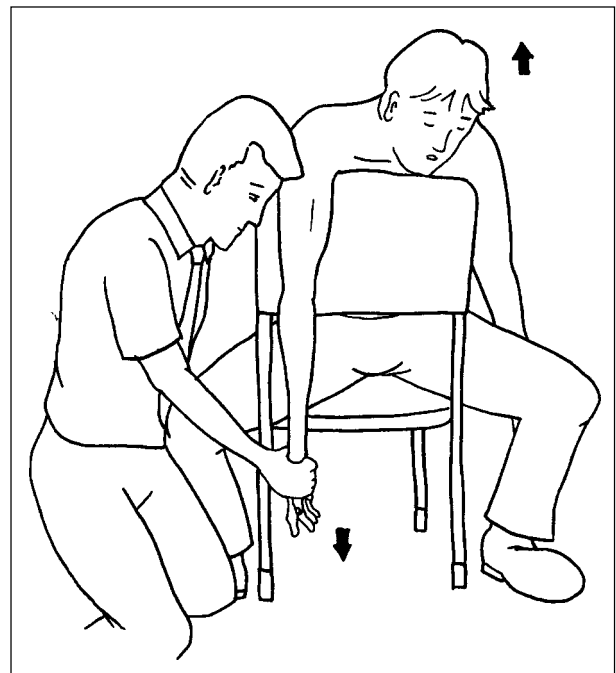


Figure 3. Chair method.

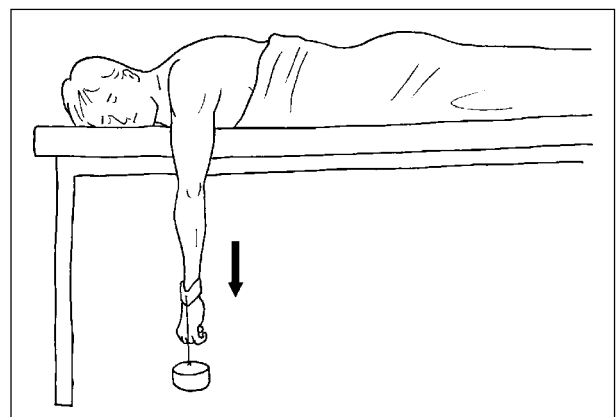


Figure 4. Stimson hanging arm method.

longitudinal traction (with elbow at 90°) and internal or external rotation are applied to the arm or direct pressure applied on the humeral head (flexed elbow modification).<sup>11,20,21</sup> Modified techniques with the help of a hydraulic stretcher, crutch or chair have also been described.<sup>11</sup> The Stimson method is simple, easy to learn, safe, atraumatic, and effective. It is advocated for the elderly, flail or obese patient, and is ideal for the very apprehensive. However, it is slow, time consuming, fatiguing, unsuitable for tall patients, and requires patient cooperation and monitoring. In addition, patients with a dislocated shoulder will have difficulty in attaining the prone position. Moreover, the prone position is uncomfortable and awkward for airway access. As a result, this method is not very popular.

*Spaso ("reversed Stimson") method* (Figure 5)

This is the most recently introduced method. Spaso Miljesic et al described in 1998 a technique which had been in use in the Western Hospital, Footscray, Australia for more than 15 years.<sup>22-25</sup> The steps are as follows: -

- I. With the patient in supine position, grasp the affected arm at the wrist or forearm and lift gently vertically.
- II. When the affected arm is vertical, apply traction.
- III. While maintaining vertical traction, rotate externally.
- IV. In case of difficulty, palpate and gently push the humeral head posteriorly with the opposite hand while still maintaining traction.

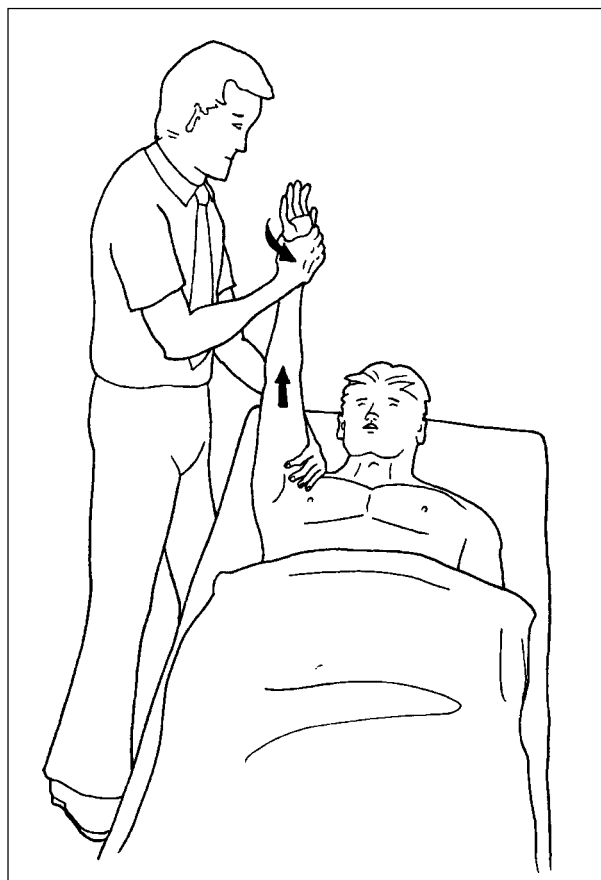


Figure 5. Spaso method.

This is a simple, effective, atraumatic, and safe reduction technique, requiring minimal force and a single operator only.

*Boss-Holzach-Matter self-reduction method* (Figure 6)

The patient sits on a hard surface or floor. The fingers

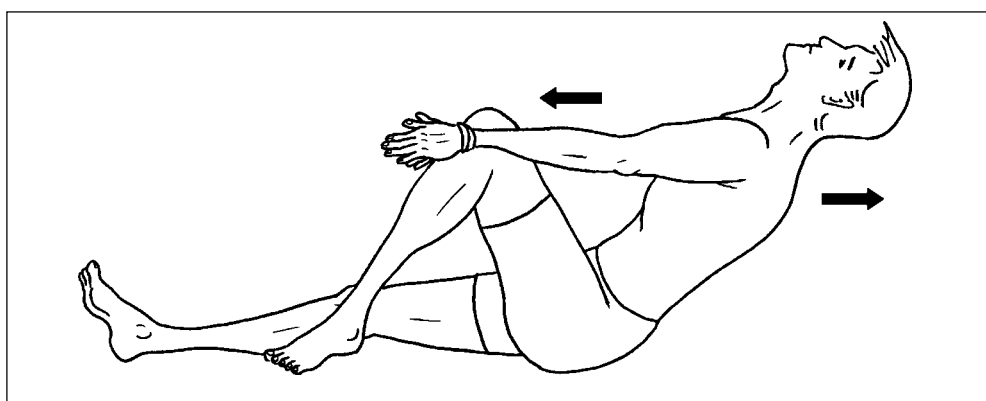


Figure 6. Self-reduction method.

of both hands are locked together or the wrists bound together with a bandage. The hands or wrists then clasp around the 90° flexed ipsilateral knee. The patient then leans backward with neck in hyperextension, extending the elbows and hip.<sup>1,11,26</sup> Shoulders are shrugged anteriorly, thus rotating the scapula around a vertical axis to facilitate reduction. It is simple, quick, safe, atraumatic, and possible without analgesics, with success rates of about 60%. It is less successful in patients greater than 60 years of age, subclavicular and especially subglenoid dislocations.

#### *The Eskimo (hanging patient) method (Figure 7)*

Stimson also described the 'pendle method' in which the patient was placed on the ground lying on his unaffected side.<sup>11</sup> The standing assistant (or physician) grasped the dislocated arm, pulled upwards and lifted the shoulder a couple of centimetres off the ground. If unsuccessful, the physician might be required to press the humeral head towards its socket. It was later found that the method had been used by Eskimos in Greenland for a long time. The method is simple, atraumatic, requires no facilities, and can be applied by nonmedical personnel.<sup>27</sup> However, it requires at least two persons for traction against gravity.

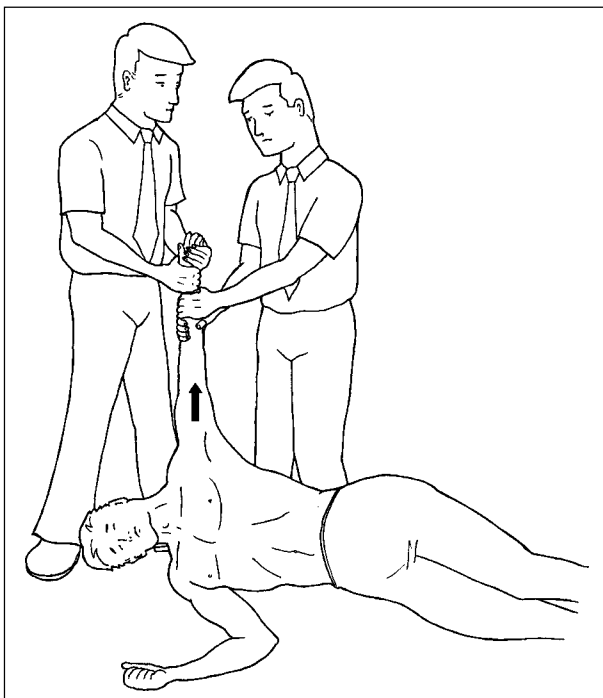


Figure 7. The Eskimo (hanging patient) method.

### **Leverage**

#### *Milch method (Figure 8 a-c)*

This method was initially outlined by Sir Astley Cooper in 1825<sup>11,28-32</sup> and later reintroduced and popularised by Milch in 1938 in the "zero position".<sup>11,32-34</sup> With the arm in this forward flexion and overhead abduction position, the resultant of force of all the perihumeral muscles about the shoulder lies in a line which is parallel to the shaft of the humerus, thereby reducing the cross-stresses of the different muscles to a minimum. The steps are as follows: -

- I. The patient lies supine, or head elevated 30°. The physician stands on the side of the dislocation. In a right-sided dislocation, the physician places his right hand upon the patient's right shoulder so that the fingers support the top of the shoulder, while the thumb is applied to the undersurface of the dislocated humeral head to hold it in place.
- II. The elbow of the affected arm may be put into 90° flexion.<sup>35</sup> The physician's left hand gently *abducts* the arm into the overhead position.
- III. As the arm is abducted, it is *externally rotated*.
- IV. The humeral head in the axilla is then pushed over the glenoid rim with direct pressure of the physician's thumb.
- V. Axial traction may be applied, with countertraction via the hand or a foot upon the top of the shoulder.<sup>32</sup> (This was not in Milch's original description).<sup>7,11</sup>
- VI. Occasionally, internal rotation<sup>11</sup> or adduction<sup>35</sup> is required.

The method is relatively painless, safe, and free from complications. It is also physiological, effective, and requires little sedation. However, the manoeuvres are complex.

This method can also be done in the prone position with the elbow flexed to 90°. It has been claimed to have a very high success rate.<sup>10,30</sup>

#### *Kocher method (Figure 9 a-c)*

This technique was described in Egyptian hieroglyphs 3,000 years ago (1200 BC).<sup>11,36</sup> It uses external rotation

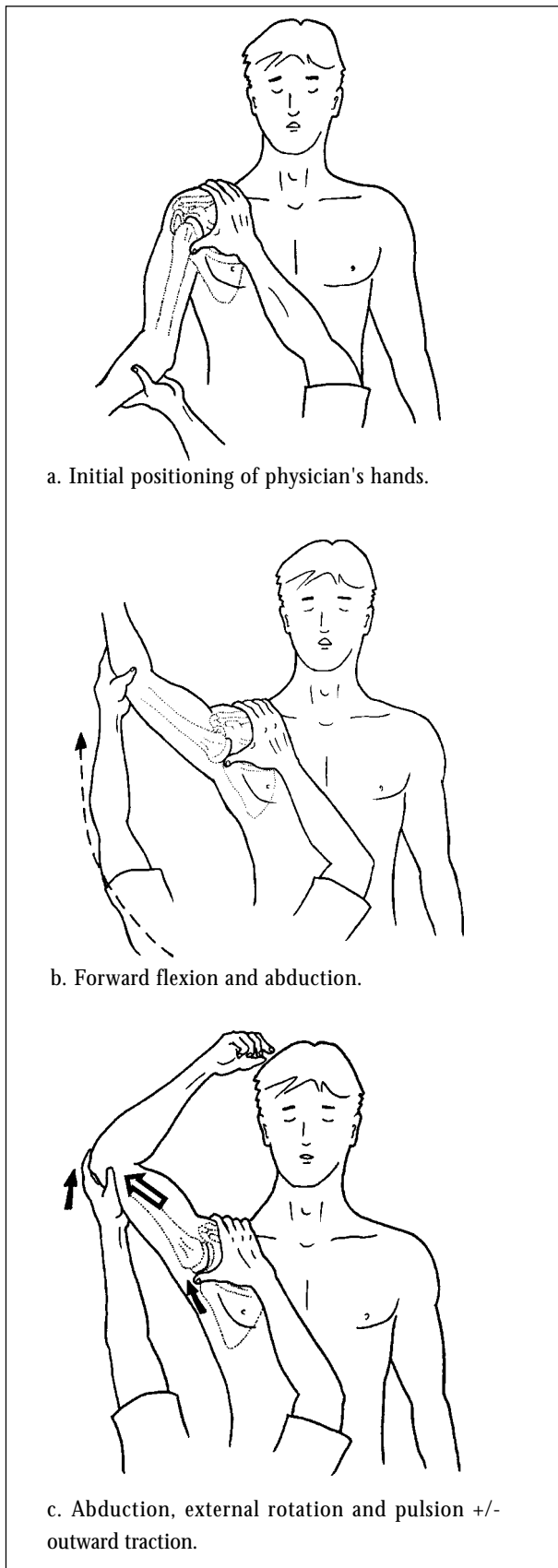


Figure 8. Milch method.

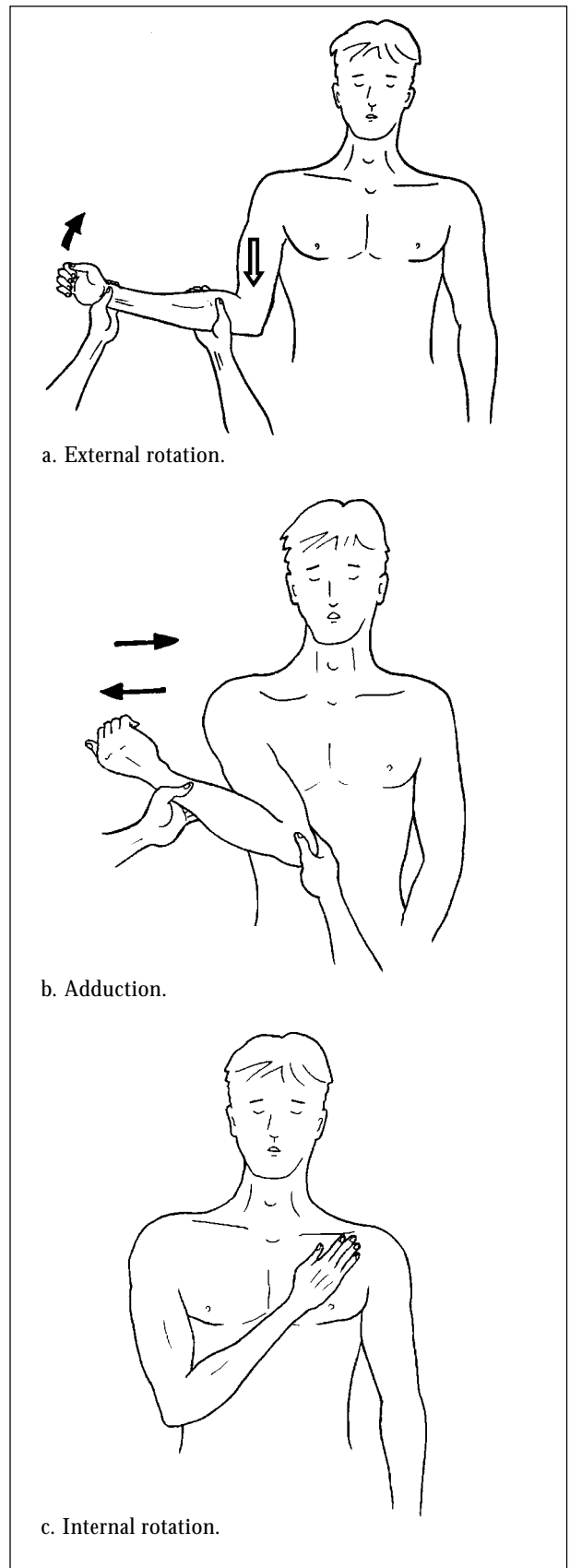


Figure 9. Kocher method.

to roll the humeral head over the anterior glenoid rim. Kocher described in 1870: "Bend arm at the elbow, press it against the body, rotate outwards until resistance is felt. Lift the externally rotated upper arm in the sagittal plane as far as possible forwards and finally turn inwards slowly".<sup>7,37</sup> Kocher did not recommend traction which was added later.<sup>7,11,37,38</sup>

The usual description is as follows: -

- I. Gentle, firm, downward, longitudinal *traction* is applied to the humerus, with the arm slightly away from the patient's side.
- II. With the elbow flexed to 90°, the wrist and point of elbow are gently grasped by the physician, and at all times the arm is pressed (adducted) against the body. The forearm is then brought to full *external rotation* until resistance is felt (up to 70-85°).<sup>37</sup>
- III. The point of the elbow is lifted in the sagittal plane as far as possible, and the arm is *adducted* across the chest wall, until the elbow approaches the midline.
- IV. The affected hand is then placed on the opposite shoulder (*internally rotated*).

Without traction,<sup>37,39</sup> the method is gentle, requiring no assistance, with minimal discomfort and a low complication rate. However, the manoeuvres are complex, more difficult in obese and heavy patients, not appropriate in the elderly and there is an increased incidence of recurrent dislocation, spiral fractures of the humerus and axillary nerve injuries when compared to other techniques.<sup>40</sup> With traction, it is excessively painful. Because of the risks of complications, this method is no longer popular nowadays.

#### *External rotation method of Leidelmeier*

This method was described by Leidelmeier in 1977<sup>41</sup> and popularised by the Hennepin County Medical Center of Minneapolis.<sup>6</sup>

The patient can be supine, sitting or 45° recumbent. The affected arm is adducted against the torso. The elbow is flexed to 90°. The upper arm is 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 is halted as pain is produced and before reaching the coronal plane. If reduction does not occur, the arm should be elevated and the humeral head lifted or pressed into the socket.

This method is simple, easy to learn, safe, atraumatic, well tolerated, reliable, effective, rapid, free from complications and requires only a single physician, little force, and little sedation.<sup>42</sup>

#### *Scapular manipulation methods* (Figure 10)

This technique, described by Bosley and Miles in 1979, manipulates the scapula so that the glenoid rotates down to meet the humeral head.<sup>2,11</sup> It is popular in the United States of America.

The patient lies prone with the shoulder in 90° of forward flexion and external rotation. The forearm is suspended from the stretcher with the wrist secured and the elbow flexed. Forward traction is maintained



Figure 10. Scapular manipulation method.

with about 5-7 Kg of hanging weight to the wrist or with manual traction for 5-10 minutes. With the patient relaxed, the physician pushes medially on the tip of the scapula with both thumbs (lifting it occasionally)<sup>43</sup> while externally rotating the superior and medial aspects of the scapula.<sup>2,44</sup> It is claimed to be simple, easy, fast, effective, safe, atraumatic, relatively painless, often requiring no sedation or analgesia, and with success rate greater than 90% and no complications.<sup>2,3,44,45</sup> However, difficulty and discomfort may be encountered in getting into the prone position.<sup>11</sup> Airway access may be compromised. The manoeuvre may be difficult in obese patients.

Modifications include the seated and supine positions. In the sitting position, an assistant provides forward traction by pulling on the forearm with countertraction over the clavicle/chest. This method has been claimed to be simple, rapid, and relatively painless.<sup>3</sup> The supine modification is technically difficult and painful.<sup>45</sup>

### *Miscellaneous or combinations*

#### *"Hanging arm" with modified Milch manoeuvres*

The patient lies prone. After 10 minutes of 'hanging arm', apply slight downward traction, begin external rotation and abduction, and lift the head of the humerus upward and outward. McNair claimed a 90% success rate in a series of 100 patients.<sup>46</sup>

#### *Shoulder reduction in the elderly* (Figure 11)

The physician stands behind the seated patient and inserts his flexed forearm into the axilla of the affected shoulder. Gentle traction on the flexed forearm of the patient is applied by his free hand. The physician's forearm pulls in a proximal and lateral direction and levers the head of the humerus into the socket. It is simple, atraumatic, direct and effective.<sup>47</sup> Similar methods using the fingers of both hands or one wrist in the axilla were described in traditional Chinese medical literature of the Qing Dynasty.<sup>14</sup>

## Conclusion

Acute anterior shoulder dislocation is a common presentation to emergency departments. Most dislocations can be reduced in the emergency department using simple methods. The success rates and complication rates of the various techniques are summarised in Table 1. Because no single shoulder reduction technique is infallible, the emergency physician should be proficient in several methods in case of failed first attempts.

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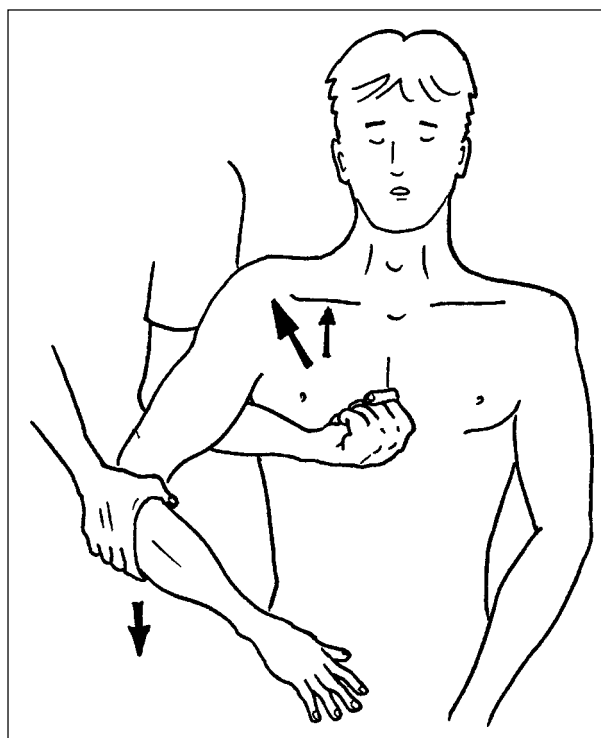


Figure 11. Shoulder reduction in the elderly.

**Table 1.** Success rate, complication rate and no premedication rate of shoulder reduction techniques.

Reduction method	Year	Author (references in superscript)	Study type	No. of patients	Success no. (rate)	Complication rate	Without premed
Traction-countertraction	1984	Boger et al <sup>16</sup>	Case series	47	43 (92%)	0%	0%
Snowbird looped technique	1995	Westin et al <sup>17</sup>	Case series	118	114 (97%)	0%	93%
Chair	1992	Noordeen et al <sup>18</sup>	Case series	32	23 (72%)	0%	0%
Spaso	2001	Yuen et al <sup>22</sup>	Case series	16	14 (88%)	0%	0%
Eskimo	1988	Poulsen <sup>27</sup>	Case series	23	17 (74%)	0%	0%
Auto-reduction	1997	Ceroni et al <sup>1</sup>	Case series	100	60 (60%)	0%	70%
Milch	1981	Russel et al <sup>30</sup>	Case series	76	68 (89%)	0%	69%
Milch	1982	Janecki et al <sup>28</sup>	Case series	50	50 (100%)	0%	34%
Milch	1986	Beattie et al <sup>31</sup>	RCT*	56	39 (70%)	0%	NA
Milch	1992	Johnson et al <sup>29</sup>	Case series	142	122 (86%)	0%	73%
Modified Milch	1989	Canales Cortes et al <sup>32</sup>	Case series	128	107 (84%)	NA	33%
Modified Milch	1992	Garnavos <sup>35</sup>	Case series	75	71 (95%)	0%	100%
Kocher	1973	Royle <sup>48</sup>	Case series	39	37 (95%)	0%	0%
Kocher	1986	Beattie et al <sup>31</sup>	RCT*	55	40 (73%)	2%	NA
Kocher without traction	2000	Berkenblit et al <sup>39</sup>	Case series	28	23 (82%)	4%	96%
External rotation	1977	Leidelmeyer <sup>41</sup>	Case series	50	50 (100%)	0%	0%
External rotation	1979	Mirick et al <sup>49</sup>	Case series	85	68 (80%)	0%	NA
External rotation	1986	Danzl et al <sup>42</sup>	Case series	100	78 (78%)	1%	0%
External rotation	1990	Thakur et al <sup>37</sup>	Case series	14	14 (100%)	NA	100%
External rotation	1991	Jeyarajan et al <sup>38</sup>	Case series	42	40 (95%)	NA	100%
External rotation with traction	1990	Banerjee <sup>50</sup>	Case series	44	38 (86%)	0%	77%
Scapular manipulation	1982	Anderson et al <sup>44</sup>	Case series	51	47 (92)	0%	34%
Scapular manipulation	1992	Kothari et al <sup>2</sup>	Case series	48	46 (96)	0%	2%
Scapular manipulation-seated	1993	McNamara <sup>3</sup>	Case series	61	48 (79%)	0%	64%
Pulsion & traction – elderly	1980	Manes <sup>47</sup>	Case series	39	35 (90%)	0%	0%

\* The same and only RCT study.

NA=not available; Premed=premedication (analgesic and/or sedative); RCT=randomised controlled trial.

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