



## Review article

## A systematic and technical guide on how to reduce a shoulder dislocation



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## ABSTRACT

**Objectives:** Our objective is to provide a systematic and technical guide on how to reduce a shoulder dislocation, based on techniques that have been described in literature for patients with anterior and posterior shoulder instability.

**Materials and methods:** A PubMed and EMBASE query was performed, screening all relevant literature on the closed reduction techniques. Studies regarding open reduction techniques and studies with fracture dislocations were excluded.

**Results:** In this study we give an overview of 23 different techniques for closed reduction and 17 modifications of these techniques.

**Discussion:** In this review article we present a complete overview of the techniques, that have been described in the literature for closed reduction for shoulder dislocations. This manuscript can be regarded as a clinical guide how to perform a closed reduction maneuver, including several technical tips and tricks to optimize the success rate and to avoid complications.

**Conclusion:** There are 23 different reduction techniques with 17 modifications of these techniques. Knowledge of the different techniques is highly important for a good reduction.

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## 1. Introduction

Shoulder dislocations account for 50% of major joint dislocations.<sup>1–5</sup> The estimated incidence rate of shoulder dislocations in the United States was 23.9 per 100,000 persons-years and 56.3 per 100,000 person-years in Oslo.<sup>5,6</sup> The most frequent types of shoulder dislocations are the anterior type (95–97%), followed up by the posterior type (2–4%) and the inferior type (0.5%).<sup>7</sup> The relatively high risk for shoulder dislocations is due to the unstable anatomical properties of the shoulder joint.

Anterior dislocations are usually caused by an impact on the abducted, externally rotated and extended arm. Less common, impact on the posterior humerus or a fall on an outstretched arm dislocates the shoulder anteriorly.<sup>8,9</sup> Posterior dislocations are caused by impact on the anterior part of the shoulder, axial force on an adducted and internally rotated arm, or intense muscle contractions due to a seizure or electrocution.<sup>10–13</sup>

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The high impact that is often required to cause the initial dislocation can result in associated injuries. Vascular examination, neurologic examination of the axillary nerve and the brachial plexus and radiographic examination to assess bony defects are therefore essential.<sup>14,15</sup> Associated humeral neck fractures are a contra-indication for closed reduction methods and should therefore be excluded radiographically before the reduction in most patients.<sup>16</sup>

Over twenty different maneuvers have been described for closed reduction, consisting of traction, leverage, manipulation or a combination of these. The current systematic reviews on this topic describe only a selection of techniques for closed reduction,<sup>8,17–19</sup> whereas a complete overview of these reduction techniques lacks. A complete overview can promote knowledge regarding the different closed reduction techniques, which can help practitioners to perform the correct reduction maneuver. A well performed reduction is important to prevent complications and to reduce costs associated with shoulder dislocations. These costs range from € 686 in the Netherlands to between \$ 1000 and \$ 8000 dollars in the United States and can increase if the reduction is unsuccessful and sedation or additional radiographs are required.<sup>17,20</sup>

The aim of this systematic review is to provide a technical

guideline of the different techniques for closed reduction that have been described in literature for patients with shoulder instability in all directions. A full comparison of the success rates and complication risk for these reduction methods is beyond the scope of this study.

## 2. Methods

### 2.1. Literature search & study selection

A literature search in PubMed and EMBASE was performed on October 1st, 2015. Studies were included if they described a glenohumeral reduction technique, and if these were written in English, Dutch, German or Arabic. Articles concerning acromioclavicular dislocations were excluded. There was no limitation for the year of publication (Appendix A). Open reposition techniques, studies including fracture dislocations, animal/cadaver/in vitro studies, biomechanical reports, letters to editors and instructional courses were excluded. References from included studies were screened to identify missed references regarding reduction techniques.

## 3. Results

### 3.1. Study selection

A total of 2099 titles and abstracts were screened of which 217 full-texts were screened. Of these, 161 articles were not eligible (contained no description of a closed reduction technique) and thus excluded. Cross-referencing resulted in 4 articles, resulting in a total of 60 included studies (Fig. 1).

### 3.2. Study characteristics

Study populations varied from 7 to 404 patients and follow-up varied from an evaluation immediately following reduction to six

months after the reduction. From the 60 included studies, 17 were comparative, 18 were retrospective, 21 were prospective and 4 were systematic reviews. These systematic reviews described a selection of the reduction methods.<sup>8,17–19</sup>

### 3.3. Reduction techniques

We identified 23 different techniques for closed reduction and 18 modifications to either one of these. These techniques consist of traction, leverage, manipulation or a combination of these.

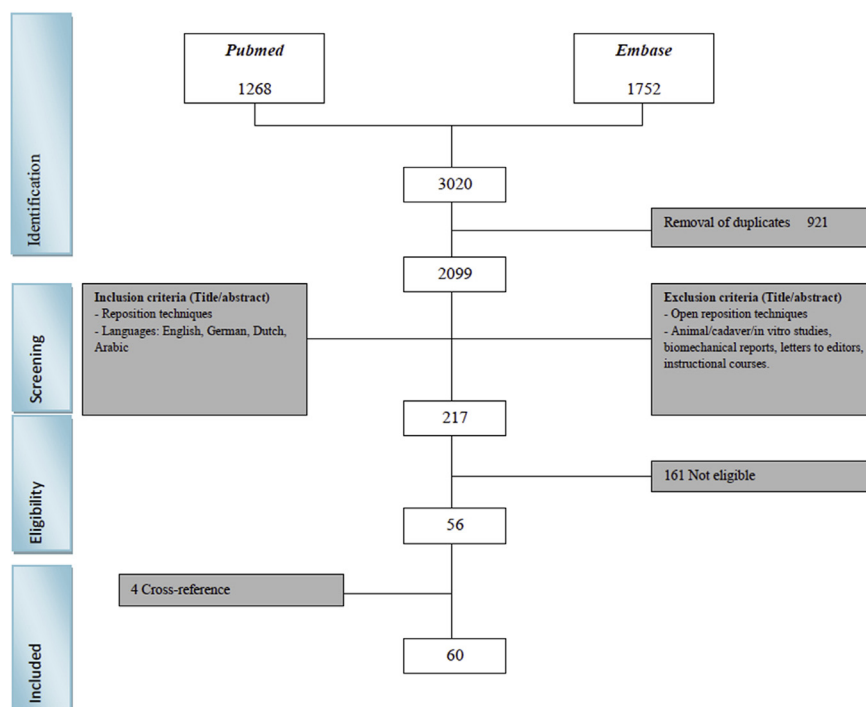
## 4. Techniques

### 4.1. Milch maneuver

The patient lies in a supine vertical position, with his shoulders slightly higher than his pelvic position. The practitioner holds the patient's arm at the wrist, abducting it to an overhead position and external rotating it to 90°. Subsequently, the practitioner pushes the humeral head into a superior and lateral direction (Fig. 2).<sup>21,22</sup> Traditionally this technique is performed without traction, but it can be modified by applying traction. In a self-reduction technique described by Dudkiewicz the patient abducts and externally rotates his affected arm with his other arm and pushes the humeral head himself in superior and lateral position.<sup>23</sup>

#### 4.1.1. Garnavos's modification

The patient lies in supine position with the affected limb in adduction and the elbow in 90° flexion. Similar maneuver as in the original Milch technique, whereas the practitioner now places his free hand on the affected limb to detect any muscle activities of the biceps. Once the patient is relaxed, ensuring a less painful maneuver, the practitioner applies gradual traction while abducting the affected limb. If the reduction fails, the practitioner adducts the arm while pushing the humeral head. This is done with all his



**Fig. 1.** Flow chart of study selection. This figure provides a flow chart of the study selection. 2099 titles and abstracts were screened, 217 studies were screened full-text and 60 studies were included.



**Fig. 2.** Milch maneuver. The patient lies in a supine position. The practitioner holds the patient's arm at the wrist abducting it to an overhead position, externally rotating it to 90°. Subsequently, the humeral head is pushed into a superior lateral position.

fingers, and not only the thumb, to minimize digital nerve injuries.<sup>24</sup>

#### 4.1.2. Canales Cortés's modification

The patient lies in a supine position with his affected shoulder in 45° abduction and his elbow in 90° flexion. The practitioner applies longitudinal traction in a gradually increasing manner while the arm is further abducted to 120° and forward flexed to 30°. Hereafter, the arm is gently externally rotated and the practitioner places his hand in the axilla of the patient and applies direct pressure on the humeral head in the direction of the acromion.<sup>21</sup>

#### 4.1.3. Singh's modification

The patient lies in a supine position with his head elevated to 30°. The arm is then abducted to 90°, externally rotated to 90° and forward flexed to 30°, initiating the reduction. If the shoulder remains unreduced, the practitioner applies longitudinal traction. If this is unsuccessful the practitioner can place his hand in the axilla of the patient and apply pressure to the humeral head, pushing it in superolateral direction.<sup>25</sup>

#### 4.1.4. Janecki's forward elevation technique

The patient lies in supine position while the practitioner holds his wrist and slowly and gradually lifts it to an overhead position with the arm externally rotated. The arm of the patient is then abducted while traction is applied, initiating reduction. If the reduction does not occur, the practitioner can internally rotate the arm and press on the humeral head.<sup>26</sup>

#### 4.1.5. Hanging arm technique

The patient lies in a prone position with a pillow beneath his head and chest with his affected arm hanging freely over the side of the examining table. The practitioner holds the epicondyle with one hand and the medial part of the upper arm in the other hand. The patient's arm, slightly flexed, rests on the forearm of the practitioner. Meanwhile the practitioner applies steady traction with abduction of the affected arm, forward flexion and internal rotation, initiating the reduction. If no reduction occurs, the

practitioner can lift the humeral head gently into the glenoid cavity.<sup>27,28</sup>

#### 4.2. Eskimo technique

The patient lies on the side of the unaffected shoulder. Two practitioners lift the patient by the dislocated arm, while the arm is abducted. By doing this, they elevate the patient slightly above the ground for a short time, initiating the reduction (Fig. 3). If no reduction occurs, the practitioner can place his hand in the axilla and apply pressure on the humeral head to reposition it in the glenoid rim.<sup>29</sup>

##### 4.2.1. Bhan's reduction maneuver for anterior and posterior shoulder dislocations

During this reduction method the patient lies on the unaffected side having the affected shoulder facing upward. The practitioner then holds the humerus with both hands and applies upward traction perpendicular to the long axis of the humerus. In the case of anterior dislocations posterior traction is performed alongside with the upward traction and in the case of posterior dislocations anterior traction is applied.<sup>30</sup>

#### 4.3. External rotation maneuver (Eachempati method)

The patient lies in a supine position with his arm adducted to the thorax, the elbow flexed in 90° and the shoulder flexed in 20° (Fig. 4). The practitioner, holding the hand of the patient in one arm



**Fig. 3.** Eskimo technique. The patient lies on the side of the unaffected shoulder. Two practitioners lift the patient by the dislocated arm, while the arm is abducted. If no reduction occurs, the practitioner can place his hand in the axilla and apply pressure on the humeral head to reposition it in the glenoid rim.

and the elbow in the other arm, slowly externally rotates the arm of the patient till it is parallel to the body of the patient without providing traction, which will initiate the reduction.<sup>31</sup>

#### 4.4. Kocher maneuver

The patient lies in supine position with his arm adducted to the thorax and his elbow flexed in 90° (Fig. 5). The practitioner then provides external rotation in the shoulder until resistance is felt. Then, the arm is flexed (lifted), retaining the external rotation in the shoulder, and adducted. The arm is then internally rotated, initiating the reduction.<sup>32,33</sup> A self-assisted method is described, in which the patient performs the reduction under guidance of the practitioner.<sup>34</sup>

##### 4.4.1. Bakhsi's modification

Two practitioners and one assistant are needed to perform this maneuver. The patient lies in a supine position and the first practitioner applies axial traction on the forearm of the affected side while an assistant applies counter-traction by placing his hand across the chest or using a traction strap fold around the chest of the patient, passing through the axilla. A second practitioner applies traction with a sling placed around the neck of the humerus. The direction of the traction is in line with the lateral border of the scapula (two o'clock for a left arm and ten o'clock for a right arm). If this fails then a sequence of external rotation, adduction and internal rotation is tried. Hereafter, a shortened version of the Kocher maneuver is performed (40° abduction, 40° external rotation, followed by 40–60° adduction in the externally rotated position and then full internal rotation).

In case of an inferior dislocation, the dislocation is first



**Fig. 4.** External rotation maneuver. The external rotation maneuver is performed with the patient in supine position with the arm of the patient adducted to the thorax, the elbow flexed at 90° and the shoulder flexed at 20°. (A) The practitioner then holds the hand of the patient in one arm and the elbow in the other arm and slowly externally rotates the arm of the patient till it is parallel to the body of the patient without providing traction. (B) After the reduction the arm should be rested on the patient in extended position of the shoulder and flexed position of the elbow. (C).

converted to a subcoracoid type by flexing the affected arm 15–20° and lowering the affected shoulder in the coronal plane by 15–20° by tilting the table or placing a sandbag under the unaffected shoulder. Then, the dislocation can be reduced in the same manner as an anterior dislocation.<sup>35</sup>

#### 4.5. Hippocratic method

The patient lies in supine position, while the practitioner holds the affected limb by the forearm and hand (Fig. 6). The practitioner then places his heel in the axilla of the affected shoulder, acting as a fulcrum while the arm is adducted, initiating reduction.<sup>36</sup>

##### 4.5.1. Caudevilla Polo's variation

The patient must be in a position in which he can collaborate by relaxing and breathing normally. The most common position for this maneuver is the patient sitting up. The practitioner holds the affected arm by the humerus near the elbow while the patient's arm lies on the forearm of the practitioner. With the hand, the practitioner holds the lateral caudal aspect of the prominent acromion process. Axial traction is applied while stabilizing the acromion. No abduction or rotation is performed during this technique.<sup>37</sup>

#### 4.6. Spaso technique

The patient lies in a supine position with his shoulder flexed at 90° and the elbow in extended position (Fig. 7). The practitioner should first initiate longitudinal traction until the patient is comfortable enough to tolerate the scapula touching the examination table. Then, the practitioner should provide external rotation to the shoulder to facilitate reduction.<sup>38</sup>

#### 4.7. Sitting method

The patient is seated while facing the practitioner.<sup>39</sup> The practitioner then holds the forearm of the affected limb and flexes the shoulder to 90° while having the elbow of the patient slightly flexed. The patient should be fully relaxed during this maneuver. Then, the practitioner places his other arm on the anterior chest wall at the side of the affected limb, to control the glenoid tilt by manipulating a part of the scapula such as the acromion or coracoid process. Finally, the practitioner applies longitudinal traction to initiate the reduction (Fig. 8). If this fails, the practitioner can additionally rotate the affected limb internally or externally.

##### 4.7.1. Snowbird technique

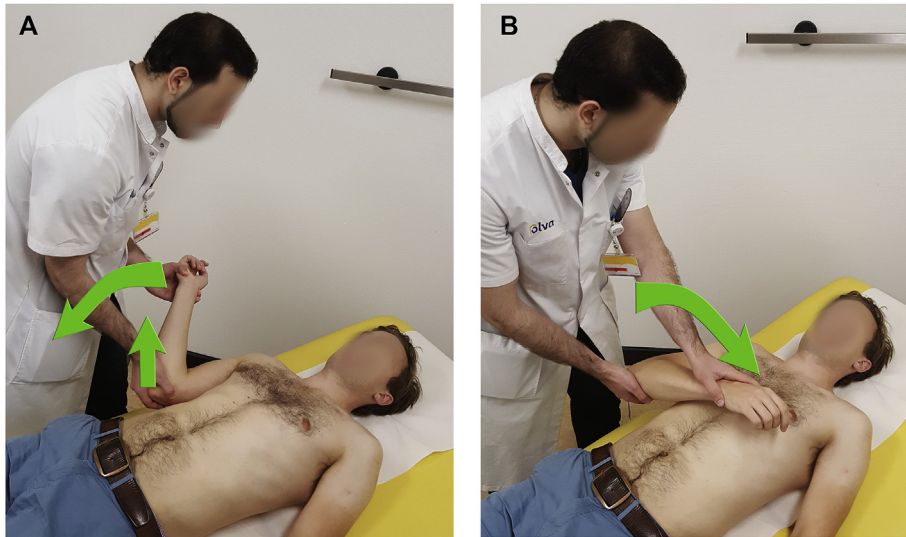
This is a variation of the sitting method, in which an assistant holds and fixates the patient and the practitioner provides longitudinal traction by placing his feet in a stockinet, wrapped around the forearm of the patient.<sup>40</sup>

#### 4.8. Stimson's maneuver

The patient lies in prone position with his arm hanging aside the examining table (Fig. 9). A downward traction to the arm is applied for 10–20 min by the practitioner or by attaching weights to the wrist of the patient. Then, the weights are released allowing the humerus to fall back into its position, thus reducing the glenohumeral joint.<sup>41</sup>

##### 4.8.1. Stimson's maneuver with the help of traction devices

Boger et al. proposed traction devices which could be of additional help in the Stimson's maneuver.<sup>42</sup> The patient lies in prone position with a countertraction strap attached to the center of his chest with the large pad in the axilla of the dislocated shoulder and



**Fig. 5.** Kocher maneuver. During the Kocher maneuver the patient lies in a supine position with arm adducted and elbow flexed in 90°. The practitioner then provides external rotation in the shoulder till a resistance is felt. Hereafter, the shoulder is adducted and flexed in external rotation. (A) After the reduction the arm should be rested on the patient in extended position of the shoulder and flexed position of the elbow. (B).

the strap is attached to the other side of the examining table. A second strap is loaded with weights (approximately 10–15 pounds for adults) and attached to the patients arm. Then, the same steps as in the original Stimson's maneuver are followed.<sup>42</sup>

**4.8.2. Hanging method**

The hanging method is the same as the Stimson's maneuver except that no downward traction is applied during the 10–20 min. In case this fails, the arm is gently pulled downward and the humeral head is pushed back into position.<sup>43</sup>

**4.8.3. Doshi's method**

The patient lies in prone position in a medical bed with his arm hanging from the bed, holding the brake handle of the trolley. After he is comfortable in this position the practitioner raises the bed

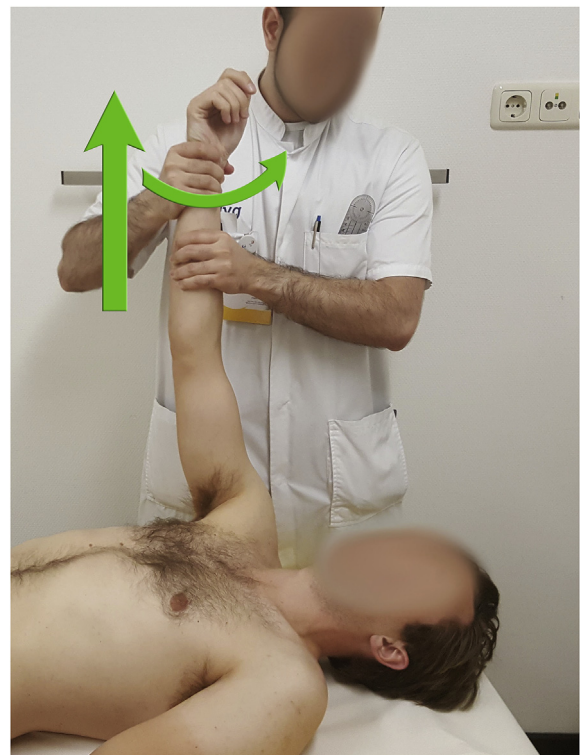
trolley with a controlled motion of 1 inch at a time, initiating the reduction.<sup>44</sup>

**4.9. Chair method**

The patient sits sideways on a chair having the backrest of the chair in his axilla. A small bed sheet or a stiff pillow can be rested on



**Fig. 6.** Hippocratic maneuver. The Hippocratic method is performed with the patient lying in supine position. The practitioner holds the affected limb by the forearm and hand of the patient. The practitioner then places his heel in the axilla of the patient, acting as a fulcrum while the arm of the patient is adducted. This initiates the reduction.

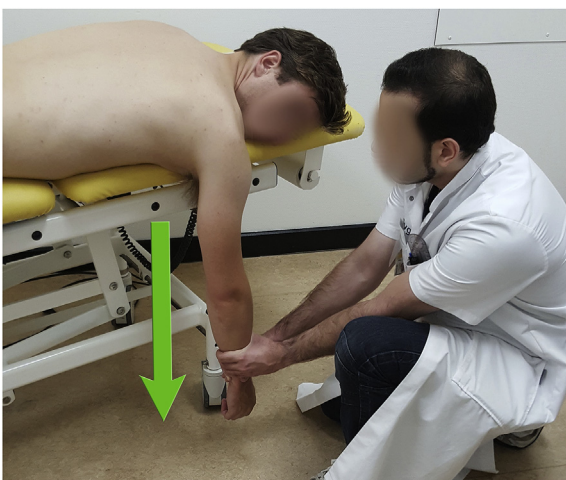


**Fig. 7.** Spaso. During the Spaso technique the patient lies in a supine position with arm extended and shoulder flexed to 90°. Longitudinal traction is applied. At the same time, the reduction is initiated by external rotation in the shoulder. (A) After the reduction the arm should be rested on the patient in extended position of the shoulder and flexed position of the elbow.



**Fig. 8.** Sitting method. The patient is seated while facing the practitioner. The practitioner holds the forearm of the affected limb and flexes the shoulder to 90° while having the elbow of the patient slightly flexed. Then, the practitioner places his other arm on the anterior chest wall at the side of the affected limb, to control the glenoid tilt by manipulating a part of the scapula such as the acromion or coracoid process. Finally, the practitioner applies longitudinal traction to initiate the reduction.

the backrest of the chair to avoid complications. The practitioner holds the hand of the patient in one hand and the elbow of the patient in the other while he ensures that the elbow of the patient is gently flexed. After calming the patient, downward traction is applied by the practitioner or by an attached sling with weights, facilitating reduction (Fig. 10).<sup>45</sup> If the humeral head is stacked at the inferior margin of the glenoid, a slight amount of external



**Fig. 9.** Stimson's maneuver. During the Stimson maneuver the patient lies in prone position with his arm hanging from the examining table. A downward traction to the arm is applied for 10–20 min by the practitioner or by attaching weights to the wrist of the patient to fatigue the shoulder musculature. (B) Thereafter the weights are released allowing the humerus to fall back into its position.

rotation in combination with gentle forward flexion can be applied by the right hand of the physician.<sup>46,47</sup> The same technique can be performed using an Oxford Chair, from which the front rest could be positioned in a 45° angle, permitting the patient to lean to the back rest.<sup>48</sup>

#### 4.9.1. Noordeen's method

Noordeen has described a variation in which the downward traction is facilitated by having the patient standing up while the practitioner holds his arm.<sup>49</sup>

#### 4.9.2. Arlt's method

In this variation the patient sits sideways with the padded backrest of the chair resting in the axilla of the affected arm. The dislocated arm is then repositioned in the glenoid with a circulating and pulling motion. The only contra-indication that is described for this method is a subscapular fracture.<sup>50</sup>

#### 4.10. Aufmesser's method

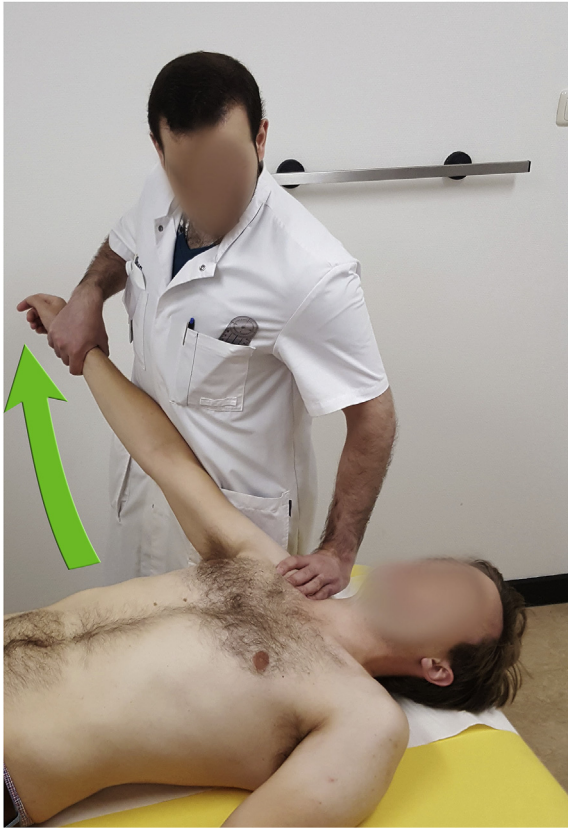
The patient lies in supine position.<sup>51</sup> The practitioner holds the hand of the patient in one hand and fixates the acromion of the patient with the other hand. The practitioner performs axial traction of the affected arm, while considering the muscular tension of the patient. Additionally, the practitioner can use his body as a fulcrum to add more lever force (Fig. 11).<sup>51</sup>

#### 4.10.1. Surfer's method

The patient lies in a supine position with his affected arm adducted to his body. The practitioner holds the wrist of the patient and leans back and away to provide axial traction and adduction of the arm. A clicking sound can be heard if the arm is reduced.<sup>19</sup>



**Fig. 10.** Chair method. The patient sits sideways on a chair with the backrest of the chair in his axilla. The practitioner holds the hand of the patient in one hand and the elbow of the patient in the other while he ensures that the elbow of the patient is gently flexed. After calming the patient, downward traction is applied by the practitioner or by an attached sling with weights, facilitating reduction. A slight amount of external rotation in combination with gentle forward flexion can be applied by the right hand of the physician.



**Fig. 11.** Aufmesser's method. The patient lies in supine position. The practitioner holds the hand of the patient in one hand and fixates the acromion of the patient with the other hand. The practitioner performs axial traction of the affected arm, while considering the muscular tension of the patient. Additionally, the practitioner can use his body as a fulcrum to add more lever force.

#### 4.11. Matsen's traction-countertraction maneuver

The patient lies in supine position with a sheet around his thorax and also around the waist of the assistant standing at the contralateral side of the affected shoulder. Another sheet is wrapped around the waist and forearm of the practitioner standing on the side of the dislocated shoulder near the waist of the patient, while holding the elbow of the patient in 90° flexion and the shoulder in 90° abduction. The practitioner applies traction to the affected arm by leaning back while the assistant provides countertraction (Fig. 12).<sup>8,52</sup>

##### 4.11.1. Traction-countertraction maneuver with traction devices

The traction straps of Boger et al. can also be used for the traction-countertraction maneuver.<sup>42</sup> In this maneuver two straps are used. The first strap is attached with one end around the patient's chest with the center of the large pad in the axilla while the other end is attached to the unaffected shoulder's side of the examining table. The second strap is attached to the practitioners waist with a 30 cm latency while the pad is rested 2–3 cm distal of the elbow of the affected arm. This is followed by the same procedure as the original traction-countertraction maneuver, except that assistance to provide countertraction in this way is not necessary.

#### 4.12. Bokor-Billmann's shoulder reduction technique

Bokor-Billmann has described a shoulder reduction technique

preferably used in remote environments.<sup>53</sup> During this technique the patients sits upright with his back against a firm surface to minimize movements of the upper body. The practitioner holds the wrist of the patient in one hand and the elbow in the other maintaining 90° flexion of the elbow and 90° flexion of the shoulder. The arm is then adducted until it reaches the midline of the thorax. Maintaining the arm in midline position the shoulder is internally rotated (Fig. 13). At 25°–30° a resistance is felt, the practitioner should maintain constant pressure to overcome this resistance, inducing reduction.

#### 4.13. Cunningham technique

The patient sits in a chair with his back straight and his arm adducted to the body with his arm in neutral position and his elbow in 90° flexion. The practitioner kneels on the side of the affected arm facing the opposite direction. The practitioner then slides his hand between the patients forearm and body having the hand of the patient resting on the upper arm of the practitioner. The practitioner applies gentle downward traction (if this initiates spasms or pain the practitioner stops and starts over). The practitioner should massage the trapezius, deltoid and biceps muscle sequentially with his other hand initiating the reduction (Fig. 14). The reduction occurs without any audible indication. Therefore the shoulder should be observed closely.<sup>54</sup>

#### 4.14. Scapular manipulation technique

The scapular manipulation technique is performed with the patient lying in prone position with his shoulder flexed to 90° and his arm hanging in external rotated position from an examining table. A downward traction is applied by hanging weights on the wrist of the patient or by having an assistant apply traction. Thereafter the practitioner pushes the tip of the inferolateral scapular edge medially rotating upward, initiating the reduction (Fig. 15). This technique can be modified by having the patient in supine or seated position.<sup>55–57</sup>

##### 4.14.1. Combination of Stimson's maneuver and scapular manipulation

This variation combines the Stimson's maneuver and the scapular manipulation technique; Stimson's maneuver is tried first, if that fails the scapular manipulation technique is added.<sup>58</sup>

##### 4.14.2. Best of both technique

During the best of both technique the patient sits on the examining table with the hip of the unaffected side tightly pressed against the head of the examining table, while the head of the examining table is elevated to 90°. The practitioner stands on the end of the examining table and holds the hand of the patient in one hand and the forearm of the affected limb in the other hand, close to the antecubital fossa, while holding this arm straight. The practitioner leans over his straight arm allowing the gravity to apply longitudinal traction on the arm of the patient. Meanwhile, a second practitioner standing on the affected side applies scapular manipulation.<sup>59</sup>

#### 4.15. FARES method

During the FARES method the patient lies in supine position with the practitioner standing at the side of the dislocated shoulder. The practitioner holds the wrist of the patient with both arms keeping the elbow of the patient extended and the forearm in neutral position. Then, the arm is slowly abducted in an oscillating movement (approximately 5 cm up- and downward movement)



**Fig. 12.** Matsen's traction-countertraction. The patient lies in supine position with a sheet around his thorax and also around the waist of the assistant standing at the contralateral side of the affected shoulder. Another sheet is wrapped around the waist and forearm of the practitioner standing on the side of the dislocated shoulder near the waist of the patient, while holding the elbow of the patient in 90° flexion and the shoulder in 90° abduction. The practitioner applies traction to the affected arm by leaning back while the assistant provides countertraction.

while constant longitudinal traction is applied. The arm is externally rotated when abducted beyond 90° (Fig. 16). Reduction usually takes place at approximately 120°.<sup>33</sup>

#### 4.16. Legg maneuver

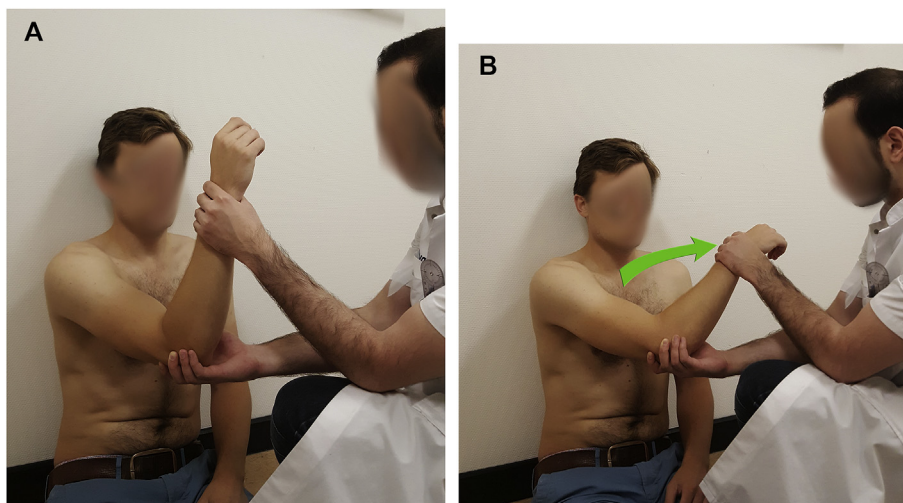
The patient is seated in a straight-backed chair to minimize movement while the assistant stabilizes the unaffected shoulder by applying downward pressure.<sup>60</sup> The patient actively abducts his affected arm to 90°, with the help of the practitioner as needed. Subsequently, the arm is externally rotated until the palm faces forward. The practitioner then flexes the elbow to 90° and stabilizes the affected arm behind the patient's head. Then, the arm is adducted to the patient's side while fully flexing the elbow. The patient is then asked to internally rotate his arm across the chest (Fig. 17). The actual reduction occurs during the adduction and internal rotation.

#### 4.17. Manes' method

This method is introduced by Manes et al. as a reduction maneuver for the elderly.<sup>61</sup> The patient is seated in a chair while the practitioner stands behind him and places his flexed forearm in the axilla of the affected shoulder of the patient. He then presses the forearm in the axilla in a super lateral direction while applying gentle traction on the flexed forearm of the affected arm of the patient with his other hand (Fig. 18).

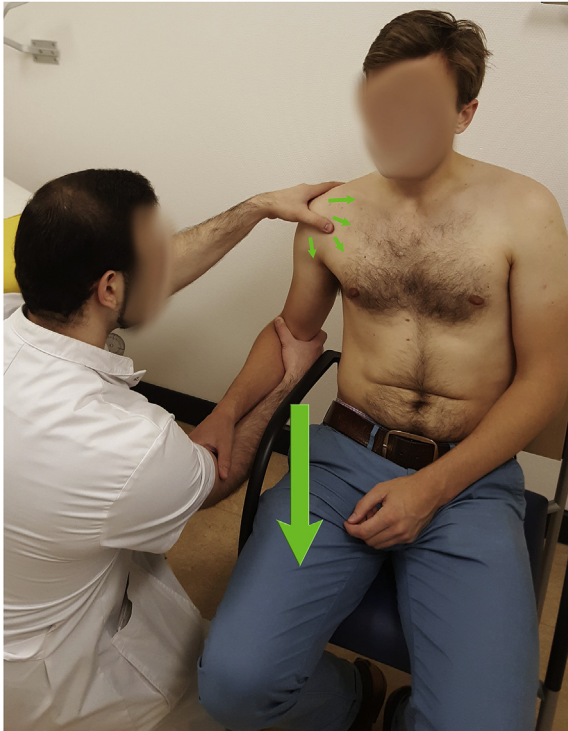
#### 4.18. Walz method

During this method the patient sits straight-backed on a chair while the practitioner stands behind him.<sup>62</sup> The practitioner then places one hand in the axilla making a fist and having his thumb facing upward, making contact with the humeral head. With the other hand, the practitioner holds the forearm of the patient and



**Fig. 13.** Bokor-Billmann's technique. The patients sits upright with his back against a firm surface to minimize movements of the upper body. The practitioner holds the wrist of the patient in one hand and the elbow in the other maintaining 90° flexion of the elbow and 90° flexion of the shoulder. The arm is then adducted until it reaches the midline of the thorax. Maintaining the arm in midline position the shoulder is internally rotated. At 25°–30° a resistance is felt, the practitioner should maintain constant pressure to overcome this resistance, inducing reduction.





**Fig. 14.** Cunningham technique. The patient sits in a chair with his back straight and his arm adducted to the body with his arm in neutral position and his elbow in 90° flexion. The practitioner kneels on the side of the affected arm facing the opposite direction. The practitioner then slides his hand between the patients forearm and body having the hand of the patient resting on the upper arm of the practitioner. The practitioner applies gentle downward traction and massages the trapezius, deltoid and biceps muscle sequentially with his other hand initiating the reduction.

applies downward traction, usually initiating the reduction (Fig. 19). If no reduction occurs, the practitioner can rotate his hand externally in the axilla, pushing the humeral head laterally in the glenoid fossa.

#### 4.19. Boss-Holzach-Matter method

During the reduction the patient sits on the examination table with his leg straight while his wrists are protected by cotton wool and bound together. The knee on the same side of the dislocated arm is then flexed to 90° and the patient places his forearms around this knee. The head of the examination table is then lowered slowly and the patient is asked to lean back hyperextending his neck, providing anterior axial traction to the dislocated shoulder, and pushing the shoulders anteriorly, thus creating a rotational movement of the scapula in the vertical axis (Fig. 20).<sup>16,63</sup>

#### 4.20. DePalma's method for posterior shoulder dislocation

The affected arm is adducted and internally rotated. Then, caudal traction is performed while the medial side of the upper arm is pushed laterally (Fig. 21). This method can be modified by applying longitudinal traction instead of caudal traction (lever principle).<sup>64</sup>

#### 4.21. Slump method

The patient sits in a chair leaning forward in a slump position (leaning forward from the waist) letting the assistant support all of the body weight, which allows the assistant to assess the muscle tonus of the patient (Fig. 22).<sup>65</sup> When the patient is fully relaxed the



**Fig. 15.** Scapular manipulation. The patient is lying in prone position with his shoulder flexed to 90° and his arm hanging in external rotated position from an examining table. A downward traction is applied by hanging weights on the wrist of the patient or by having an assistant apply traction. Thereafter the practitioner pushes the tip of the inferolateral scapular edge medially rotating upward, initiating the reduction.

assistant gives a sign to the practitioner to initiate the reduction maneuver. The practitioner then holds the elbow of the affected arm and applies longitudinal traction together with external rotation if necessary. Additionally, the inferior tip of the scapula can be pushed medially by the forearm of the assistant.

#### 4.22. Reduction of posterior dislocation by forward pressure of the humeral head

This method is performed under general anesthesia while the affected arm is flexed, adducted and internally rotated. The humeral head is gently pressed anteriorly while an assistant provides cross-body traction to the arm. Reduction is then achieved by external rotation of the arm (Fig. 23).<sup>66</sup>

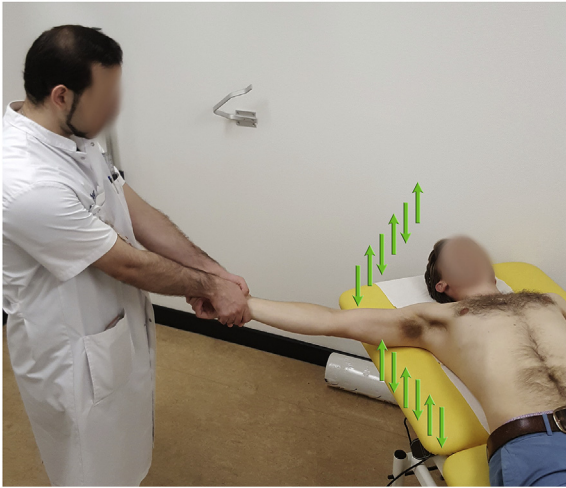
Wilson and McKeever described a variation of this technique in which longitudinal traction and internal rotation is applied on the adducted severed arm accompanied by gentle pressure on the humeral head.<sup>67,68</sup>

#### 4.23. Caudal traction

Mattick has described a case in which a posterior shoulder dislocation was reduced while pulling the affected arm caudally to perform a swimmer's view radiograph (Fig. 24).<sup>69</sup>

## 5. Discussion

In this article an overview was presented of the currently



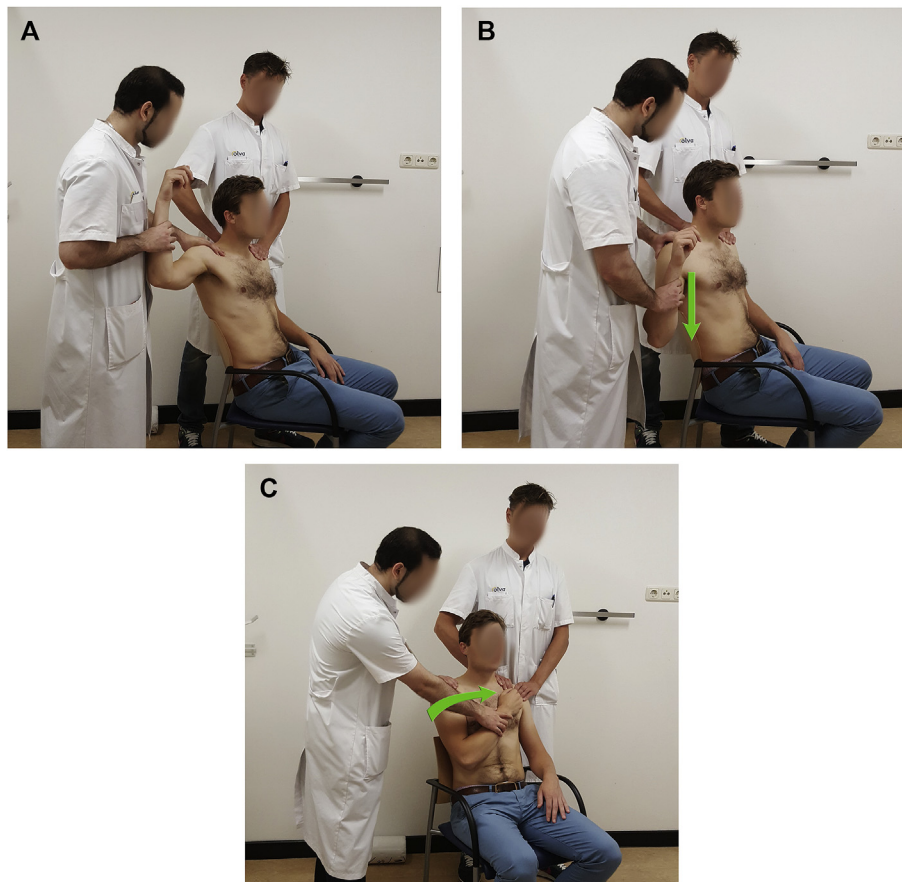
**Fig. 16.** FARES method. The patient lies in supine position with the practitioner standing at the side of the dislocated shoulder. The practitioner holds the wrist of the patient with both arms keeping the elbow of the patient extended and the forearm in neutral position. Then, the arm is slowly abducted in an oscillating movement (approximately 5 cm up- and downward movement) while constant longitudinal traction is applied. The arm is externally rotated when abducted beyond 90°. Reduction usually takes place at approximately 120°.



**Fig. 18.** Manes' method. The patient is seated in a chair while the practitioner stands behind him and places his flexed forearm in the axilla of the affected shoulder of the patient. Thereafter, the practitioner presses the forearm in the axilla in a super lateral direction while applying gentle traction on the flexed forearm of the affected arm of the patient with his other hand.

available techniques for closed reduction for shoulder dislocations, that have been described in the literature. This manuscript was based on a sound methodology and should act as guide how to

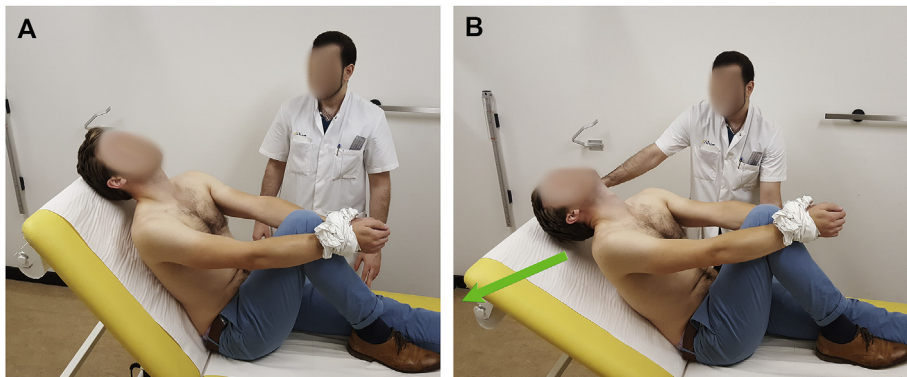
perform a reduction maneuver with several technical tips and tricks to optimize success rate and to avoid complications. As stated before, all reduction techniques are based on four main maneuvers



**Fig. 17.** Legg maneuver. The patient is seated in a straight-backed chair to minimize movement while the assistant stabilizes the unaffected shoulder by applying downward pressure. The patient actively abducts his affected arm to 90°. Subsequently, the arm is externally rotated until the palm faces forward. The practitioner then flexes the elbow to 90° and stabilizes the affected arm behind the patient's head. (A) Then, the arm is adducted to the patients side while fully flexing the elbow. (B) The patient is then asked to internally rotate his arm across the chest. (C).



**Fig. 19.** Walz method. The patient sits straight-backed on a chair while the practitioner stands behind him. The practitioner then places one hand in the axilla making a fist and having his thumb facing upward, making contact with the humeral head. With the other hand, the practitioner holds the forearm of the patient and applies downward traction, usually initiating the reduction. (A) If no reduction occurs, the practitioner can rotate his hand externally in the axilla, pushing the humeral head laterally in the glenoid fossa.(B).

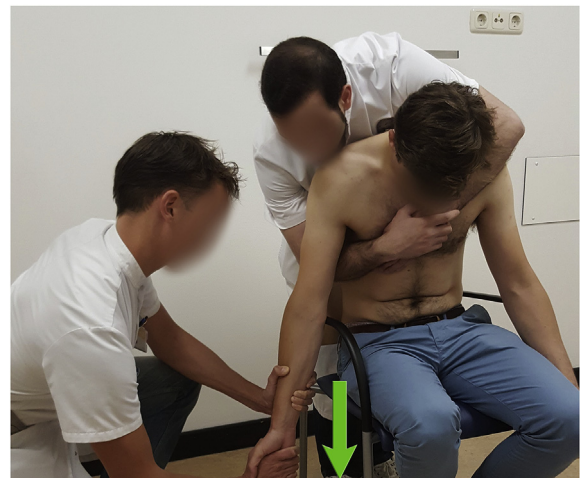


**Fig. 20.** Boss-Holzach-Matter method. The patient sits on the examination table with his leg straight while his wrists are protected by cotton wool and bound together. The knee on the same side of the dislocated arm is then flexed to 90° and the patient places his forearms around this knee. (A) The head of the examination table is then lowered slowly and the patient is asked to lean back hyperextending his neck. (B).

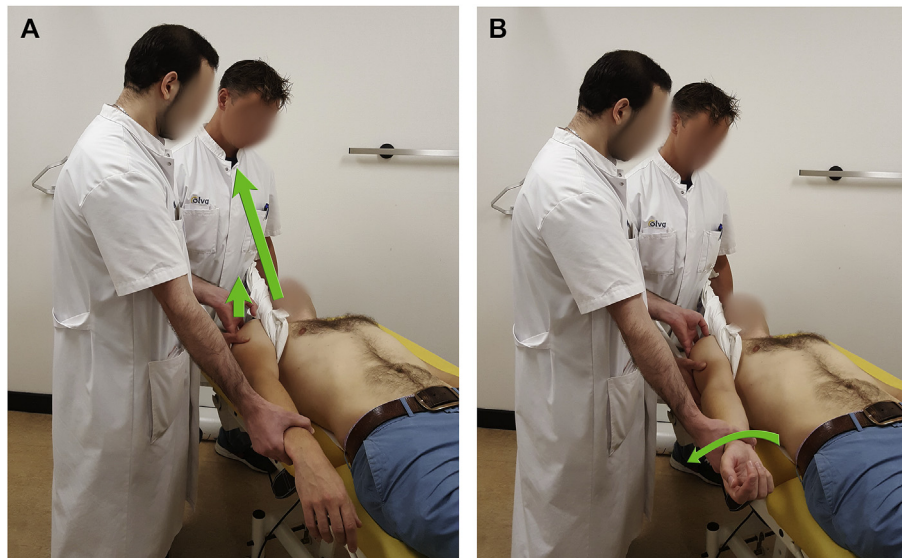
including traction, leverage, scapular manipulation or a combination of these maneuvers. The patient's position varies between the maneuvers and is either performed in seated, prone or supine



**Fig. 21.** DePalma's method. The affected arm is adducted and internally rotated. Then, caudal traction is performed while the medial side of the upper arm is pushed laterally.



**Fig. 22.** Slump method. The patient sits in a chair leaning forward in a slump position letting the assistant support all of the body weight. When the patient is fully relaxed the assistant gives a sign to the practitioner to initiate the reduction maneuver. The practitioner then holds the elbow of the affected arm and applies longitudinal traction together with external rotation if necessary. Additionally, the inferior tip of the scapula can be pushed medially by the forearm of the assistant.



**Fig. 23.** Forward pressure of humeral head. This method is performed under general anesthesia while the affected arm is flexed, adducted and internally rotated. The humeral head is gently pressed anteriorly while an assistant provides cross-body traction to the arm. (A) Reduction is then achieved by external rotation of the arm. (B).

position. The selected maneuver depends on the practitioners preference and the ability of the patient to stay in the desired position.<sup>44,70</sup>

Based on the current review, which was focused on the technical details, it is not possible to conclude which technique is most successful, provokes less pain and leads to a minimal number of complications. Because drawing conclusions based on a meta-

analysis was not the focus of the current review, the risk of bias is only small.

#### Author's contribution

HA participated in data collection, design of the study, editing of the manuscript and drafting the manuscript. JA participated in the design of the study, and editing the manuscript. MF participated in editing the manuscript. DD and MB participated in the design of the study and editing the manuscript.

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There is no funding for this study.

#### Conflicts of interest

None declared.

#### APPENDIX

##### Appendix 1

##### Pubmed search:

(reduct\* OR reposit\*) AND shoulder AND (dislocat\* OR instabil\*)

##### Embase search:

(reduct\* OR reposit\*) AND shoulder AND (dislocat\* OR instabil\*)

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**Fig. 24.** Caudal traction. The patient is standing. The practitioner pulls the arm caudally.

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