ABSTRACT

Purpose. To evaluate results of the modified Boytchev procedure for recurrent anterior dislocation of the shoulder in 60 patients.

Methods. Medical records of 45 men and 15 women aged 20 to 44 years who underwent the modified Boytchev procedure for recurrent anterior dislocation of the right (n=44) and left (n=16) shoulders were reviewed. The mean number of dislocations was 14. Outcome was evaluated using the Burkhead and Rockwood criteria.

Results. The mean follow-up period was 56 months. Outcome was excellent in 32 patients, good in 21, and fair in 7. None had poor outcome. The mean external rotation deficit at 0º and 90º of abduction improved from 14º to 7º (p=0.04) and 18º to 7º (p=0.03), respectively. Two patients had fragmentation of the coracoid process, which was fixed with non-absorbable suture. Two patients had traction injury to the musculocutaneous nerve, which recovered after 6 months. One patient had recurrent dislocation that ruled out the chance of revision surgery.

Conclusion. The modified Boytchev procedure is a viable and simple treatment for recurrent anterior shoulder dislocation.

Key words: osteotomy; shoulder dislocation

INTRODUCTION

Surgical treatments for recurrent anterior dislocation of the shoulder include passive interventions using capsuloligamentous or bone block to create barriers and active interventions using muscle action. Major disadvantages of these treatments are long immobilisation and loss of external rotation of shoulder. The Boytchev procedure can overcome these disadvantages by re-routing the coracoid process with its attached conjoined tendon of the short head of the biceps and coracobrachialis with the pectorals minor muscle deep to the subscapularis muscle and re-attachment to its anatomic location. It was then modified by rerouting the conjoined tendons of the short head of biceps and coracobrachialis only.
We evaluated the results of the modified Boytchev procedure in 60 patients.

MATERIALS AND METHODS

Medical records of 45 men and 15 women aged 20 to 44 (mean, 30; standard deviation [SD], 3) years who underwent the modified Boytchev procedure from 1996 to 2008 for recurrent anterior dislocation of the right (n=44) and left (n=16) shoulders were reviewed. The mean number of dislocations was 14 (SD, 6). Patients with epilepsy, multidirectional instability, neuromuscular disorders, and abnormal mental status were excluded, as were those who were unwilling to participate in rehabilitation.

Apprehension test for anterior dislocation was positive in 50 patients. Shift and load test and sulcus test indicating instability were negative in all patients. Radiographs taken during internal rotation of the shoulder raised suspicion of Hill-Sachs lesion in 18 patients, but computed tomography confirmed its presence in only 9 patients. Bone defect was <20% in patients with bone defect. Eight patients were suspected of having rotator cuff tears, but were not confirmed by magnetic resonance imaging (MRI). All these patients had evidence of Bankart’s lesion on MRI.

Patients were placed in a supine position under general anaesthesia, and a sand bag was placed under the medial border of the scapula. The standard deltopectoral approach was used. The anterior margin of the deltoid was exposed and sectioned transversely near its origin, while the pectoralis major was retracted medially to expose the horizontal part of the coracoid process that was the tendinous origin of the short head of the biceps and coracobrachialis (Fig. 1a). An anteroposterior drill hole was made in the coracoid process along its axis. The anterior 1 cm of the coracoid process along with the origin of short head of biceps and coracobrachialis was osteotomised and moved distally (Fig. 1b). With the shoulder in internal rotation, a plane was developed between the joint capsule of shoulder and the subscapularis starting just proximal to the lower border of the subscapularis. Care was taken not to damage the anterior circumflex humeral vessels. The detached tip of the coracoid process along with the attached muscles was passed through the plane and fixed to the predrilled proximal counterpart of the coracoid process using a 3.5-mm AO cancellous screw (about 25 mm in length) [Fig. 1c], while the arm was maintained in internal rotation. After haemostasis, the wound was closed in layers. The arm was immobilised by the side of chest with the shoulder in internal rotation. The position of the screw was assessed using radiographs (Fig. 2).

At week 2, pendulum shoulder exercises were started after removal of the sutures. At week 3, active-assisted shoulder mobilisation was started aiming to achieve full shoulder movements at week 8 (Fig. 3). The patients were evaluated every 12 weeks during the first year. Outcome was evaluated using the Burkhead and Rockwood criteria (Table); a score of 90 to 100 was considered excellent, 70 to 89 good, 40

![Figure 1](image-url) (a) The coracoid process and the 3 muscles attached to it are seen through the deltopectoral approach. (b) The coracoid process is osteotomised and the tunnel between the joint capsule and the subscapularis is prepared after distal reflection of the coracoid process along with the attached long head of biceps and coracobrachialis. (c) The coracoid process with the attached muscle is rerouted between the subscapularis and the joint capsule. The osteotomised tip of the coracoid process is fixed with a screw at its original place.
to 69 fair, and ≤39 poor.³

RESULTS

The mean follow-up period was 56 (SD, 20; range, 12–96) months. Outcome was excellent in 32 patients, good in 21, and fair in 7. None had a poor outcome. The mean external rotation deficit at 0° and 90° of abduction improved from 14° (SD, 4°) to 7° (SD, 2°) [p=0.04] and 18° (SD, 5°) to 7° (SD, 2°) [p=0.03], respectively (student’s paired t-test).

Five patients developed superficial wound infection, which was treated with antibiotics. Two patients had fragmentation of the coracoid process, which was fixed with non-absorbable suture. Two patients had traction injury to the musculocutaneous nerve, which recovered after 6 months. One patient had recurrent dislocation that ruled out the chance of revision surgery. No patient had evidence of loosening, migration of coracoids screw, or glenohumeral arthritis.

DISCUSSION

Treatment for recurrent anterior dislocation of shoulder should provide an active corrective force that pushes the humeral head into the glenoid fossa. The Boytchev procedure achieves this objective in 3 ways. First, the increased muscle bulk of the subscapularis, coracobrachialis, and the short head of biceps augments the bracing effect over the anteroinferior aspect of the glenohumeral joint, and thus prevents anterior dislocation. The dynamic contribution of the conjoined tendon after the Boytchev procedure in a cadaveric study has been reported.⁴ Second, the muscle bellies of 2 strong muscles are rerouted to lie more directly in contact with the joint capsule and humeral head so that their active contraction exerts a strong control on the anterior exertion of the humeral head, thereby balancing the deforming forces of dislocation. Third, the modified Boytchev procedure increases the pressure between the humeral head and subscapularis tendon, and thus increases proprioceptive stimuli in the subscapularis tendon, which accelerates the protective reflex needed to prevent shoulder dislocation.⁵
Lengthening of the subscapularis is the main cause of shoulder instability, whereas the capsular and bony defects are the subsidiary causes. This is contrary to the current trend of addressing mainly the intra-articular pathology of the unstable shoulder. Therefore, the recurrence rate is higher after arthroscopic repair than open procedure. However, limited range of motion was the main drawback of open procedures.

The recurrence rates after the Bankart procedure, Putti-Platt procedure, Magnuson-Stack procedure, and Bristow procedure for recurrent anterior dislocation of shoulder were 6%, 20%, 7%, and 13%, respectively, with restriction of external rotation and glenohumeral arthritis in long-term follow-up. The Boytchev procedure achieves comparable results, with lower recurrence rate, minimal restriction of external rotation, and no glenohumeral arthritis. However, this procedure may be contraindicated in epileptic patients and those with weak subscapularis or large glenoid defect. The outcome of modified Boytchev procedure is controversial. It results in fair or poor outcome in 41% of patients, recurrent dislocation in 18%, and loss of movement in 20%. One study reported an overall redislocation rate of 44%. However, results in our study were favourable. This procedure is relatively simple and can be performed by all orthopaedic surgeons without the need of specialised arthroscopic instruments. This is important particularly in developing countries.

**CONCLUSION**

The modified Boytchev procedure is a viable and simple treatment for recurrent anterior shoulder dislocation.

**DISCLOSURE**

No conflicts of interest were declared by the authors.

**REFERENCES**


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**Table**

**Burkhead and Rockwood criteria** for evaluation of shoulder function

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Score</th>
</tr>
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<tbody>
<tr>
<td><strong>Function</strong></td>
<td></td>
</tr>
<tr>
<td>No limitation in sports or work, able to throw baseball and football, can swim, crawl, stroke</td>
<td>50</td>
</tr>
<tr>
<td>No limitation in work, slight limitation in throwing baseball, serving forcefully in tennis or swimming, crawl, stroke, can throw football normally</td>
<td>35</td>
</tr>
<tr>
<td>Moderate limitation in overhead work, throwing baseball and football, swimming, crawl, stroke or serving tennis</td>
<td>20</td>
</tr>
<tr>
<td>Marked limitation in throwing in all sports, unable to work with arm overhead</td>
<td>0</td>
</tr>
<tr>
<td><strong>Pain</strong></td>
<td></td>
</tr>
<tr>
<td>None</td>
<td>10</td>
</tr>
<tr>
<td>Moderate</td>
<td>5</td>
</tr>
<tr>
<td>Severe</td>
<td>0</td>
</tr>
<tr>
<td><strong>Stability</strong></td>
<td></td>
</tr>
<tr>
<td>Negative apprehension test, no subluxation</td>
<td>30</td>
</tr>
<tr>
<td>Negative apprehension test, but discomfort with arm in position of abduction and external rotation</td>
<td>15</td>
</tr>
<tr>
<td>Positive apprehensive test and sense of subluxation</td>
<td>0</td>
</tr>
<tr>
<td><strong>Range of motion</strong></td>
<td></td>
</tr>
<tr>
<td>Full</td>
<td>10</td>
</tr>
<tr>
<td>25% loss of motion in any plane</td>
<td>5</td>
</tr>
<tr>
<td>&gt;25% loss of motion in any plane</td>
<td>0</td>
</tr>
</tbody>
</table>

* A score of 90 to 100 is considered excellent, 70 to 89 good, 40 to 69 fair, and ≤39 poor


