

Modified Boytchev procedure for treatment of recurrent anterior dislocation of shoulder

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ABSTRACT

Background: More than 200 different operations have been described for the treatment of recurrent anterior dislocation of shoulder. The Modified Boytchev procedure employs rerouting of the detached tip of coracoid process with its attached conjoined tendon (short head of biceps and coracobrachialis) deep to subscapularis and reattaches to its anatomical location. We conducted a study on evaluation of long-term effect of modified Boytchev procedure and to compare our results with other studies published in literature. **Materials and Methods:** Since June 2002, modified Boytchev procedure was performed on 48 patients, who presented with recurrent anterior dislocation. 45 were men and 3 were women and were in the age group of 18-40 years (mean 27.83±4.95 years). Forty patients were affected on the dominant side and rest on the non-dominant side. The mean number of dislocations in these patients was 18.22±12.08. The mean followup period was 58.13±19.06 months (range 18-96 months). The patients were evaluated by visual analogue score, modified American Shoulder and Elbow Surgeon's Score (ASES), and Single Assessment Numeric Evaluation (SANE) score at the last followup.

Results: All the patients regained almost preoperative range of forward flexion at the last followup. In the preoperative period the mean external rotation deficit at 0° and at 90° of abduction was 13.22°±5.16° and 18.06°±6.50°, respectively. At the last followup, the mean external rotation deficit at 0° and at 90° of abduction was 8.06°±2.47° and 8.95°±2.07°, respectively. This improvement in external rotation deficit was statistically significant ($P < .05$). Preoperative scores were compared with the most recent followup scores for all variables with use of a paired t test. All patients had significant improvement in visual analogue score, modified American Shoulder and Elbow Surgeon's Score (ASES), and Single Assessment Numeric Evaluation (SANE) score at the last followup. Four of the patients developed superficial infection which got resolved after treating with antibiotics, and two of the patients developed transient musculocutaneous nerve paresis. There was no radiological evidence of loosening and migration of coracoid screw or any glenohumeral arthritis on subsequent followup of skiagrams in any of our patients.

Conclusion: Modified Boytchev procedure is an efficacious and technically simple procedure to treat recurrent anterior dislocation of shoulder.

Key words: Boytchev procedure, recurrent shoulder dislocation, modified Boytchev

INTRODUCTION

Recurrent anterior dislocation of shoulder is not uncommon and more than 200 different operations have been described for its treatment.¹ Though the

etiology of recurrent anterior dislocation of shoulder is dubious till date, three lesions are usually thought to be responsible for its recurrence; Bankart lesion, Hill and Sachs lesion and posttraumatic laxity of the subscapularis.²⁻⁴

Amongst most of the operative procedures for recurrent anterior dislocation of shoulder; relatively few of them have good result in terms of recurrence and loss of shoulder movement in followup period. Most of the surgical procedures described for recurrent anterior dislocation of shoulder are based mainly on two basic active (rotator cuff and biceps) and passive (capsuloligamentous) mechanisms. About half a century ago, Boytchev (1951),⁵ a Bulgarian orthopaedic surgeon, described a surgical technique for recurrent anterior dislocation of the shoulder. This procedure involves rerouting of the detached tip of coracoid process with its attached conjoined tendon (short head of biceps and coracobrachialis) along with the pectoralis minor muscle deep to subscapularis and reattaching to

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its anatomical location. Later, Conforty modified this procedure by rerouting the conjoined tendon of the short head of biceps and coracobrachialis only.⁶

On reviewing the literature and different scientific studies, theoretically it stands out that this procedure would be very effective in preventing the recurrence.⁶⁻¹⁶ However, there are few studies which criticize the procedure.^{17,18} In order to overcome the ambiguity over the procedure, we conducted a study on an evaluation of long-term result of Modified Boytchev Procedure and to compare our results with other studies published in literature.

MATERIALS AND METHODS

Since June 2002, the modified Boytchev procedure was performed on 48 patients, who presented with recurrent anterior dislocation of shoulder and were in the age group of 18-40 years. 45 were men and 3 were women, the mean age being 27.83 ± 4.95 years. Forty patients were affected on the dominant side. Three of the male patients were professional district level football player. The mean number of dislocations in these patients was 18.22 ± 12.08 times [Table 1]. Patients who had less than three anterior dislocations, bilateral dislocation, multidirectional instability, neuromuscular disorders, epilepsy, abnormal mental status, and those lost to followup were excluded from the study. All patients had a traumatic onset of symptoms and had a failure of initial nonoperative management. One of them had initial failure of Putti Platt operation, which was done three years ago. Thirty-eight patients presented with radiographs taken before reduction, which showed an anterior dislocation, however, radiographs of six shoulders showed anterior instability with small Hill-Sachs lesion (less than 15% of the humeral head).

Each of them had objective and subjective measurements in preoperative and followup period at 1 month, 3 months, 6 months, 1 year, and yearly thereafter. All recording of data was done on case record form. The case record form included patient's questionnaire, subjective and objective clinical measurements for analysis of result. Each subject underwent a physical examination after he or she had completed the patient questionnaire, which included the patients profile, pain and functional status of the affected shoulder in comparison to the normal shoulder in terms of 100 percentages scale (ASES Score, SANE Score). The affected shoulder was compared with the contralateral shoulder in terms of range of motion, strength (Manual Muscle Testing), and shoulder stability (apprehension test, load and shift, sulcus sign).¹⁹ Range of motion was examined in forward flexion, and external rotation at 0° and 90° of abduction.

Table 1: Demographic data

	Range	Mean \pm SD	Median
Age (yr)	18-40	27.83 \pm 4.95	28
Preinjury activity	1-3	1 \pm .62	1
Age at initial dislocation (yr)	15-30	20.56 \pm 4.6	20
Duration at presentation-to initial dislocation	2-20	7.27 \pm 4.41	5
No. of dislocation	5-58	18.22 \pm 12.08	13
Followup period (months)	18-96	58.13 \pm 19.06	56.00

Operative procedure

Under general anesthesia and in supine position, 10 to 12 cm skin incision was made over the deltopectoral groove starting proximally between the clavicle and coracoid process and extending distally. Deep fascia was divided and the dissection was carried deep in the deltopectoral groove, taking care of cephalic vein. Pectoralis major was retracted medially and deltoid laterally to expose the coracoid process with attached conjoined tendons of coracobrachialis and short head of biceps brachii muscles. From anterior end of horizontal part of coracoid process, a drill hole was made along its axis. Osteotomy was done at about 1.5 cm proximal to the tip of coracoid process. The free part of coracoid along with attached conjoined tendons was mobilized distally, taking extreme care to avoid injury to musculocutaneous nerve. Just proximal to lower border of subscapularis, its fibers were split carefully (taking care of anterior circumflex humeral vessels) and a tunnel was created between subscapularis and shoulder capsule. The osteotomised tip of coracoid process with attached conjoined tendons was passed through this tunnel and fixed to the predrilled proximal part of coracoid process with a screw, while the assistant held the arm in flexion internal rotation at shoulder and flexion at elbow [Figure 1]. Hemeostasis was achieved, suction drain placed, and the wound was closed in layers. Arm was immobilized by arm to chest bandage maintaining flexion, adduction, and internal rotation of shoulder. After removal of stitch at 2nd week, passive pendular movement and abduction was allowed and from third week onwards active movement was advocated. After 8 weeks, the patient was allowed to do the normal activities.

Comparisons were made between preoperative and postoperative outcome scores. All comparisons were analyzed with use of a paired Student t test for significance.

RESULTS

Our followup period ranged from 18 months to 96 months with a mean of 58.13 ± 19.06 months. Results were analysed in terms of recurrence, range of motion, VAS score, modified ASES score, and SANE score.²⁰⁻²² None of the patients had recurrence. All the patients regained almost preoperative

range of forward flexion at the last followup. In the pre-operative period, the mean external rotation deficit at 0° and at 90° of abduction was 13.22°±5.16° and 18.06°±6.50°, respectively. At the last followup, the mean external rotation deficit at 0° and at 90° of abduction was 8.06°±2.47° and 8.95°±2.07°, respectively [Table 2]. This improvement in external rotation deficit is statistically significant ($P < .05$). Pre-operative deficit in external rotation of shoulder was due to apprehension of dislocation, which increased in immediate postoperative period due to pain. Evaluation of the patients in preoperative and at followup showed that neither of them had any decrease in strength, nor anyone showed a positive load and shift test, sulcus test or any signs of hyperlaxity. Thirty-eight patients demonstrated a positive apprehension sign in the preoperative period.

Preoperative scores were compared with the most recent followup scores for all variables with use of a paired- t test. All patients had significant improvement in VAS score, modified ASES score, and SANE score at the last followup after the procedure. Analysis using Pearson's coefficient correlation of data between modified ASES score and SANE score show statistically significant linear correlation [Table 3]. Each of the patients, including the professional football players, returned to the preoperative level of their respective activity. Four patients developed superficial infection, which got resolved after antibiotics as per the culture and sensitivity report. Two patients developed transient musculocutaneous nerve paresis that got resolved spontaneously within three months. There was no radiological evidence of Lossening, migration of coracoid screw or any glenohumeral arthritis on subsequent followup in any of our patients [Figure 2].

DISCUSSION

The modified Boytchev procedure is biomechanically sound that acts by two possible mechanisms: dynamic muscular sling effect^{8,9} and improved shoulder joint proprioception.¹⁰

The subscapularis is pulled forward by the rerouted conjoined tendon during elevation of the shoulder thereby causing an increase in the lever arm and enhancing the internal rotational moment arm. When the arm is in the vulnerable position of abduction and external rotation, the rerouted muscles prevent the superior displacement of the subscapularis and dislocation. The anterior dislocation of the humeral head is prevented by the increased muscle bulk composed of the subscapularis, coracobrachialis and the short head of the biceps which enhances the bracing effect over the anteroinferior aspect of the glenohumeral joint. Since the rerouted muscles have to pass through a longer course, deep to the subscapularis, the tension within them increases which counteracts the physiological dislocation action of the subscapularis which is responsible for anterior dislocation of the shoulder. Biomechanical study of Halder *et al.*²³ and cadaveric study of Jiang *et al.*⁷ provides valid scientific reason for prevention of recurrence after modified Boytchev procedure. Study by Shibata *et al.*¹⁰ revealed that the efficacy of modified Boytchev procedure was not only due to the muscular sling effect but improved shoulder proprioception also played an important role in prevention of shoulder dislocation. Conjoined tendon transfer led to an increase in the pressure between the humeral head and the subscapularis tendon, which leads to stimulation of mechanoreceptors which in turn improves shoulder joint

Table 2: Loss of motion compared to opposite normal side - Mean ± standard deviation (range)

Time period	Forward elevation deficit	External rotation deficit at 0° abduction of shoulder (in degrees)	External rotation deficit at 90° abduction of shoulder (in degrees)
Preop	0.81±0.78 (0-3)	13.22±5.16 (4-25)	18.06±6.50 (5-26)
4 wks	15.60±5.31 (8-25)	17.68±5.52 (9-29)	22.79±6.34 (10-32)
12 wks	9.66 ±3.49 (1-18)	11.12±2.69 (6-17)	12.97±2.45 (7-18)
24 wks	1.75±1.03 (0-3)	9.91±2.76 (5-15)	10.95±2.59 (5-16)
1 yr	1.1±0.85 (0-3)	8.50±2.78 (5-15)	9.89±2.51 (3-14)
Last followup	0.77±0.87 (0-3)	8.06±2.47 (4-13)	8.95±2.07 (3-13)

Preop = preoperative

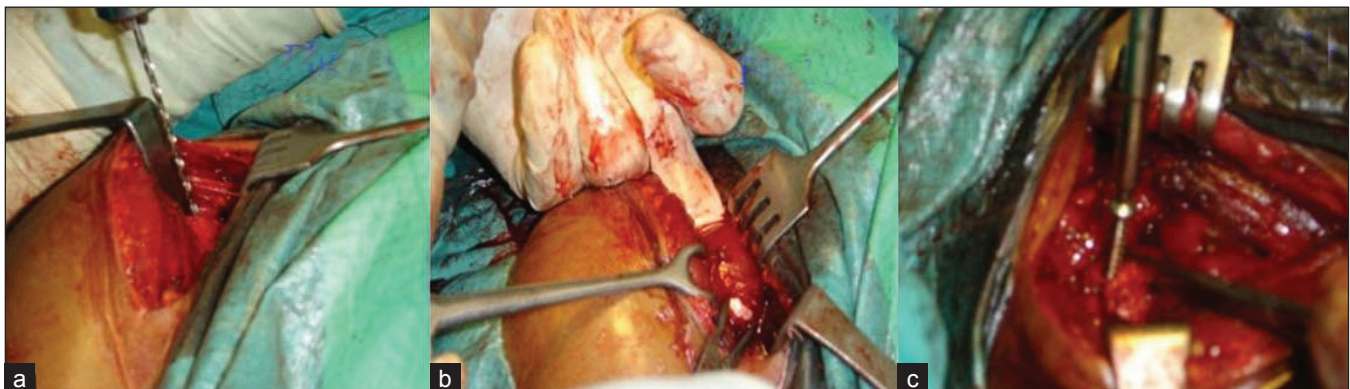


Figure 1: (a) Intraoperative photograph showing drilling of coracoid process before osteotomy. (b) Preparation of path for rerouting of detached conjoined tendon deep to subscapularis. (c) Reattachment of detached conjoined tendon by one cortical screw in anatomical position

proprioception. This improvement in proprioception led to improvement of reflex which was responsible for protection against shoulder dislocation.

Review of scarce literature on Boytchev procedure [Table 4] and our study indicates that modified Boytchev procedure is no more controversial.⁶⁻¹⁶ Most of studies show good result in terms of recurrence and restriction of movement. We think that this operative procedure did not gain popularity because it was originally described in Bulgarian language and that made it inaccessible in most of the countries. The



Figure 2: Preoperative (a,c) and followup (b,d) skiagrams of shoulder (anteroposterior views) of two patients showing no glenohumeral osteoarthritis, screw migration in followup period

First Scandinavian-Japanese Shoulder Congress²⁴ held in 1989 and thereafter successive meetings made this procedure known to the Asian countries. Since 1990 till date, most studies from this part of the world have given good results and valid scientific study has led us to recommend modified Boytchev as an efficacious operative procedure for treatment of recurrent anterior dislocation of shoulder.

The prime goal of any operative procedure for recurrent anterior dislocation of shoulder is directed towards prevention of recurrence. On review of literature,²⁵ many studies show that low Rowe Score following an open procedure was not due to high recurrence but was due to diminished range of motion or function, whereas a low Rowe Score following an arthroscopic procedure is due to high recurrence. When the individual recurrence score of these two procedures are matched open procedures gain superiority over the arthroscopic procedures. In spite of high Rowe score associated with arthroscopic procedures, open procedures are better as because more than half of the Rowe score is attributed to functional evaluation, while the stability contributes to less than 1/3rd of the total Rowe score. So the use of Rowe Score to compare the results in term of recurrence is one of the limitations. Systemic review and meta-analysis of literature shows open procedure for recurrent anterior shoulder instability are more reliable than arthroscopic procedures. Pooled data demonstrates significantly lower risk of recurrent instability, dislocation, and re-operation after open procedure. On comparison with other common open procedures, it was found that low Rowe score was due to diminished range of motion. So in

Table 3: Shoulder score and statistical analysis

Time period	VAS score	ASES score	SANE score	Pearson's coefficient correlation (ASES and SANE score)
Preop	3.5±1.11 (2-7)	57.98±10.8 (28.33-76.27)	30.63±11.62 (10-50)	+.36 (significant linear correlation)
4 wks	5.64±1.31 (3-8)	41.00±9.31 (21.66-63.32)	27.39±9.45 (10-50)	+.42 (significant linear correlation)
12 wks	3.33±0.80 (2-5)	71.97±5.19 (56.67-81.67)	79.16±4.49 (65-90)	+.52 (significant linear correlation)
24 wks	1.02±0.80 (0-3)	85.46±5.68 (69.99-94.98)	86.45±6.76 (70-95)	+.39 (significant linear correlation)
1 yr	0.92±0.76 (0-3)	87.70±5.96 (69.99-98.30)	88.23±7.76 (70-100)	+.45 (significant linear correlation)
Last followup	0.83±0.82 (0-3)	87.84±6.51 (70-98.33)	88.75±8.00 (70-100)	+.50 (significant linear correlation)
P value (Preop and Last followup)	<0.001	<0.001	<0.001	

Table 4: Reported results of modified Boytchev procedure

Authors	Year	No. of shoulder	Recurrence	Followup	Comment
Conforty ⁶	1980	17	No recurrence	Mean-6yr	Excellent
Ha'Eri GB ⁸	1986	26	No recurrence	Mini-2yr	Excellent
Yozo S et al ¹¹	1999	63	3.1 percent	Mean-50months	Excellent
Dalsgaard HL et al ¹⁸	2000	27	44 percent	Mean-7yr follow-up	Controversial technique need more study
Zamora-Navas P et al ¹⁷	2001	27	20 percent	Mean-13.3yr	Attractive but might be avoided
Chatterjee ND et al ⁹	2002	46	One subluxation	Mean-88months	Excellent
Deng J et al ¹²	2003	8	No recurrence	Mean-20month	Simple and effective
Yozo S et al ¹⁰	2004	32	One subluxation	Mean-31 months	Excellent
Li SP et al ¹³	2007	15	No recurrence	Mean-4yr 5month	Simple and effective
Han TY et al ¹⁴	2008	18	One subluxation	10 month to 4.5 yr	Simple and effective

order to minimise it, we followed a rehabilitation program²⁶ with special attention to strengthening exercises of the conjoined tendon that probably resulted in good range of motion with minor restriction in our study.

The incidence of recurrence reported after the Bankart, Putti-Platt, and Bristow laterjet procedure ranged from 2 to 10%, 0 to 12.5%, and 2-10% respectively, with restriction of external rotation (average 10°) and glenohumeral osteoarthritis in long term followup study. Athletic individuals with involvement of the dominant shoulder were not capable of returning to high performance levels of overhead sports activity (particularly throwing) after the operation in followup period. All these procedure require expertise and long learning curve. On comparison with other procedures for treatment of recurrent anterior dislocation of shoulder, modified boytchev procedure had comparable result in term of recurrence, range of motion, and complications.

Hence this procedure fulfils most of the criteria of an ideal procedure²⁷ for recurrent anterior dislocation of shoulder and allows us to conclude that this procedure is an effective procedure, technically simple, and does not require expert skills or any sophisticated instruments and can be performed by all orthopaedic surgeons where basic operative facility is present.

REFERENCES

- Saha AK: Recurrent anterior dislocation of shoulder- A New Concept. Calcutta: Academic publisher; 1969.
- Symeonides PP. Thesignificance of subscapularis muscle in the pathogenesis of recurrent anterior dislocation of shoulder. *J Bone Joint Surg Br* 1972;54:476-83.
- Karadimas J, Rentis G, Varouchas G. Repair of recurrent anterior dislocation of shoulder using transfer of the subscapularistendon. *J Bone Joint Surg Am* 1980;62:1147-9.
- Ahmadian AM. The Magnuson-stack operation for recurrent anterior dislocation of the shoulder, a review of 38 cases. *J Bone Joint Surg Br* 1987;69:111-4.
- Boytchev B. Treatment of recurrent shoulder instability. *Minerva Orthop* 1951;2:377-9.
- Conforty B. The results of the Boytchev procedure for treatment of recurrent dislocation of the shoulder. *Int Orthop* 1980;4:127-32.
- Jiang LS, Cui YM, Zhou ZD, Dai LY. Stabilizing effect of the transferred conjoined tendon on shoulder stability. *Knee Surg Sports Traumatol Arthrosc* 2007;15:800-5.
- Ha'Eri GB. Boytchev procedure for the treatment of shoulder instability. *Clin Orthop Relat Res* 1986;206:196-201.
- Chatterjee ND, Nath C, Pal AK, Baksi DP. Modified Boytchev procedure for the treatment of recurrent anterior dislocation of the shoulder. *Int Orthop* 2002;26:7-9.
- Shibata Y, Honjo N, Shinoda T, Kumano T, Naito M. Pressure between the humeral head and the subscapularis tendon after the modified Boytchev procedure. *J Shoulder Elbow Surg* 2004;13:170-3.
- Shibata Y, Midorikawa K, Ogata K, Izaki T. Modified Boytchev and its combined operation for traumatic unstable shoulder. [In Japanese] *Shoulder Joint* 1999;23:327-1.
- Deng J, Package J. Lau good source; Botchev procedure for treatment of recurrent anterior dislocation of shoulder joint. *Orthopaedic J China* 2003;9:604-05.
- Ping L, Chen F. Impoved Boytchev treatment of habitual anterior dislocation of 15 cases. *J Integr Tradit West Med China* 2007;2:513-14.
- Han TM, Zu Q, Xiang LB, Xian M. Modified Boytchevprocedurefor treatment of recurrent anterior dislocation of shoulder joint. *J Clin Orthopaedics* 2008;6:519-20.
- Bernal-González M, Cabrera VN, Dávila X Remon J, Alvarez LP. Surgical treatment of recurrent dislocation of shoulder Boytchevtechnique. *Rev Cubana Ortop Traumatol* 2000;14:36-40.
- Riad JA, Montoya J, Treatment of anterior shoulder instability. *Hondur Rev Med* 2009;77:16-8
- Zamora-Navas P, Borrás Verdera A, Porras Garcia J, Padilla Marquez A, Linares P. Long-term results of the Boytchev procedure for the treatment of recurrent dislocation of the shoulder. *Acta Orthop Belg* 2001;67:233-5.
- Dalsgaard HL, Gothgen CB, Hoogmartens MJ. The Boytchev procedure for recurrent anterior dislocation of the shoulder: A controversial technique. *Acta Orthop Belg* 2000;66:248-50.
- Tokish JM, Krishnan SG, Hawkins RJ. Clinical examination of the overhead athlete: The "differential directed" approach. In: Krishnan SG, Hawkins RJ, Warren RF, Editors. *The shoulder and the overhead athlete. A holistic approach.* Philadelphia: Lippincott Williams and Wilkins; 2004. p 23-49.
- Richards RR, An KN, Bigliani LU, Friedman RJ, Gartsman GM, GristinaAG, et al. A standardized method for the assessment of shoulder function. *J Shoulder Elbow Surg* 1994;3:347-52
- Sallay PI, Reed L. The measurement of normative American Shoulder and Elbow Surgeons scores. *J Shoulder Elbow Surg* 2003;12:622-7
- Williams GN, Gangel TJ, Arciero RA, Uhorchak JM, Taylor DC. Comparison of the Single Assessment Numeric Evaluation Method and Two Shoulder rating scales. *Outcomes measures after shoulder surgery.* *Am J Sports Med* 1999;27:214-21.
- Halder AM, Halder CG, Zhao KD, O'Driscoll SW, Morrey BF, An KN. Dynamic inferior stabilizers of the shoulder joint. *Clin Biomech (Bristol, Avon)* 2001;16:138-43
- Saikku K, Partio EK, Patiuua H. Erkki Lassonen Boytchev procedure in anterior shoulder stability, First Scandinavian –Japanese shoulder meeting, Helsinki, Finland, Jun 26-29, 1989
- Lenters TR, Franta AK, Wolf FM, Leopold SS, Matsen FA 3rd. Arthroscopic Compared with Open Repairs for Recurrent Anterior Shoulder Instability: A Systematic Review and Meta-Analysis of the Literature. *J Bone Joint Surg Am* 2007;89:244-54.
- Burkhead WZ Jr, Rockwood CA Jr. Treatment of instability of shoulder with an exercise program. *J Bone Joint Surg Am* 1992;4:890-6.
- Terry CS, James BH. Campbells operative orthopaedics. Pennsylvania 19103-2899, International 11th ed. Vol. 3. Philadelphia: Mosby Elsevier publication; 2008. p. 2655.

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