

Modified Boytchev Procedure for Recurrent Anterior Dislocation of Shoulder- Experience from a Tertiary Care Institute

SACHIN AVASTHI¹, PANKAJ AGGARWAL², SWAGAT MAHAPATRA³, VINEET KUMAR⁴, AMMAR ASLAM⁵

ABSTRACT

Introduction: Post traumatic shoulder dislocation has very high recurrence rates. Most surgical procedures described lead to decreased range of motion and have high complication rates. Modified Boytchev technique is one of the popular techniques for recurrent shoulder dislocation.

Aim: To see functional results of Modified Boytchev procedure along with anterior capsular plication.

Materials and Methods: This was an open prospective study in which patients presenting with recurrent anterior dislocation of shoulder were enrolled from January 2014 to December 2017. It was conducted in the Department of Orthopaedics in a tertiary care teaching hospital. In the series, 41 patients underwent Modified Boytchev procedure with capsular plication. Follow-up was done using Oxford Instability Shoulder Score (OISS) and objective range of motion measurements. All data was tabulated and statistically analysed with paired t-test using recent version of SPSS.

Results: Five patients in the study were lost to follow-up and hence excluded from the study. Mean age in the series was 30.8 years. A total 33 (91.6%) of patients were male and 3 (8.3%) were females. Out of 36 patients, 32 (88.9%) had dominant

shoulder involvement. Average number of dislocations at presentation was 5. Mean follow-up period was 38 months (24 to 62 months). Mean OISS score before surgery was 21.2 ± 6.86 which improved to 41.08 ± 4.01 at six months ($p < 0.05$) after surgery, 42.22 ± 3.04 at one year and 42.4 ± 2.78 at two years ($p < 0.05$), respectively. Mean external rotation deficit at 0° improved from $16.72^\circ \pm 5.12$ preoperatively to $8.91^\circ \pm 2.52$ at 6 months, $7.83^\circ \pm 2.38$ at one year and $7.30^\circ \pm 2.26$ at two years ($p < 0.05$). Mean external rotation deficit at 90° improved from $20.72^\circ \pm 4.60$ preoperatively to $10.30^\circ \pm 2.73$ at six months ($p < 0.05$), $8.38^\circ \pm 2.69$ at one year and $7.72^\circ \pm 2.01$ at two years after surgery ($p < 0.05$). Average forward flexion deficit was $0.61^\circ \pm 0.84$ preoperatively which increased postoperatively to $6.25^\circ \pm 4.14$, $3.36^\circ \pm 2.67$ and $2.41^\circ \pm 2.06$ at six months, one year and two years respectively ($p < 0.05$). There were no major complications reported.

Conclusion: Modified Boytchev procedure with capsular plication is a reliable and reproducible procedure with excellent results. Technically, it is less demanding than other procedures and has minimal complication rates. Procedure involves minimal cost and is an acceptable method of treatment in countries with limited resources.

Keywords: Capsular plication, Conjoint tendon, Coracoid, Rerouting, Shoulder dislocation

INTRODUCTION

Shoulder is the most unstable joint in the body accounting for nearly 50% of dislocations [1]. Studies have shown rate of recurrence for shoulder dislocation up to 90% in younger athletic adults with overall recurrence rate after first time traumatic dislocation at 39% [2-4]. Many surgical procedures have been described to treat recurrent shoulder dislocation. The major disadvantage with most of the procedures is that either they are technically demanding or there is high recurrence rate and loss of shoulder movement mainly external rotation due to prolonged immobilisation [5-7].

Boytchev B described a technique to treat recurrent shoulder dislocation comprising of rerouting of the coracoid process with its attached conjoint tendon (short head of biceps and coracobrachialis muscle) along with pectoralis minor muscle deep to subscapularis muscle and reattaching it to anatomical location [8]. Conforty modified the technique by using conjoint tendon of coracobrachialis and short head of biceps and only vertical fibres of the pectoralis minor muscle [9].

There are usually several factors acting together responsible for recurrent anterior shoulder dislocation. The subscapularis muscle provides most of the stability against anterior dislocation when arm moves in abduction and external rotation [10,11]. The laxity of the subscapularis along with torn anterior glenoid labrum and lengthened anterior joint capsule together are responsible for recurrent dislocation [12]. Shoulder joint capsular plication has

shown good results when combined with labral repair procedure [13-15].

There are few studies that support Modified Boytchev procedure in preventing recurrent shoulder dislocation [16-18] but there are few studies that quote higher recurrence rate and loss of motion with the procedure [19,20]. There are no studies which have combined Modified Boytchev procedure with anterior capsular plication. The study was conducted combining Modified Boytchev procedure with anterior capsular plication for recurrent dislocation of shoulder and the results were observed.

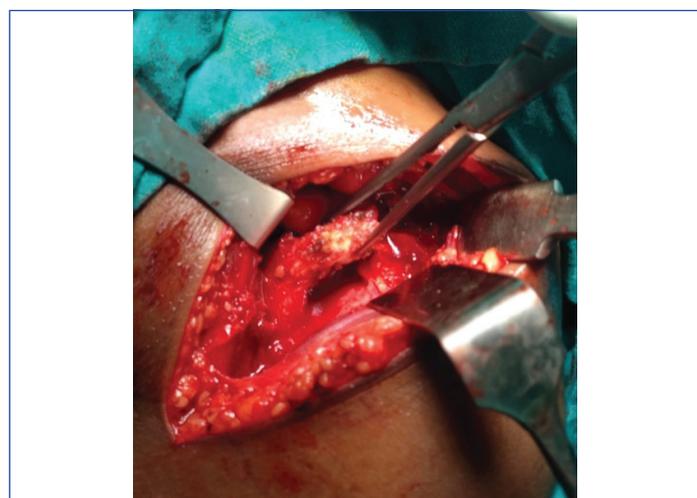
MATERIALS AND METHODS

This was an open prospective study in which patients presenting with post-traumatic recurrent anterior dislocation of shoulder were enrolled from January 2014 to December 2017. In the series, 41 patients underwent Modified Boytchev procedure with capsular plication. All surgeries were performed by the same surgical team. Patients with epilepsy, generalised joint laxity, neuromuscular disorders and previous shoulder dislocation surgery were excluded from the study. All patients had post traumatic onset of dislocation and developed recurrent dislocation after conservative treatment. Written and oral consent was taken from the patient explaining clearly to the patient in their local language the procedure, risks and anticipated benefits. All the procedures were followed according to the guidelines of the Declaration of Helsinki.

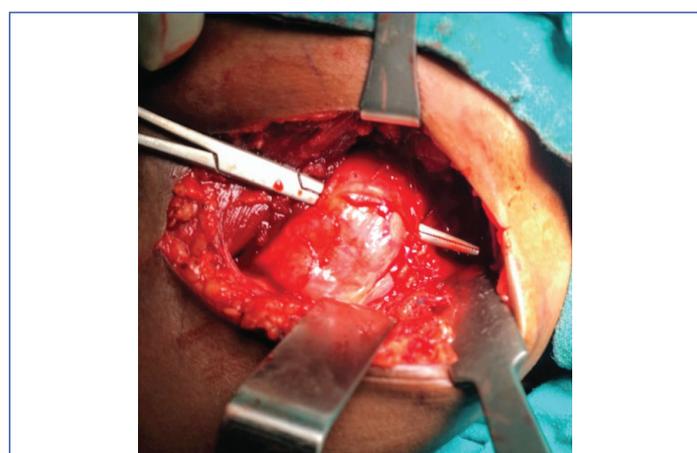
All the patients undergoing surgery were evaluated using subjective and objective measurements preoperatively and postoperatively at six months, one year and two years OISS [21] was used for subjective measurements and range of motion was examined in terms of forward flexion deficit and external rotation deficit at 0 and 90 degree of abduction. Shoulder stability was assessed preoperatively and postoperatively using Apprehension test in all patients. Shoulder X-ray and MRI was done for all patients. Bankart lesion was present in MRI in all patients.

Operative Technique

Patients were placed in supine position on the operating table with sandbag placed under the operative shoulder. General anaesthesia was given with endotracheal tube placed on the opposite side. After antiseptic preparation a standard 10 cm deltopectoral incision was made starting proximal to the tip of coracoid process extending distally along deltopectoral groove. Cephalic vein was identified and retracted along with deltoid muscle laterally and Pectoralis major was retracted medially exposing the tip of coracoid process with its attached muscles. Pectoralis minor muscle was erased from the coracoid process medially leaving behind coracobrachialis and short head of biceps attached to coracoid process. A hole was predrilled and tapped from anterior part of coracoid process along the axis of coracoid. Coracoid process was osteotomised along with attached coracobrachialis and short head of biceps muscle at a point 2 cm from the tip of coracoid process [Table/Fig-1]. The conjoint tendon was elevated till the lower border of subscapularis muscle taking care to protect musculocutaneous nerve and anterior circumflex vessels. Shoulder was rotated externally and Subscapularis muscle was identified and split along fibres at upper two-third and lower one-third junction of its width and retracted superiorly and inferiorly exposing the shoulder joint capsule [Table/Fig-2]. Joint capsule was incised

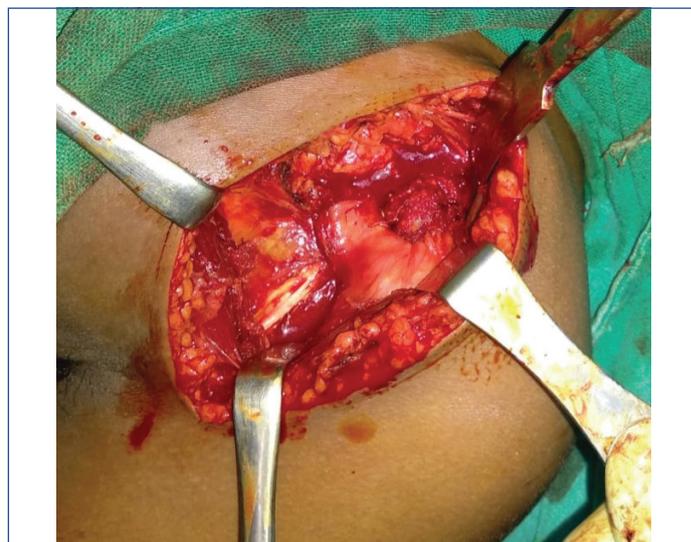


[Table/Fig-1]: Coracoid osteotomy done and conjoint tendon mobilised.

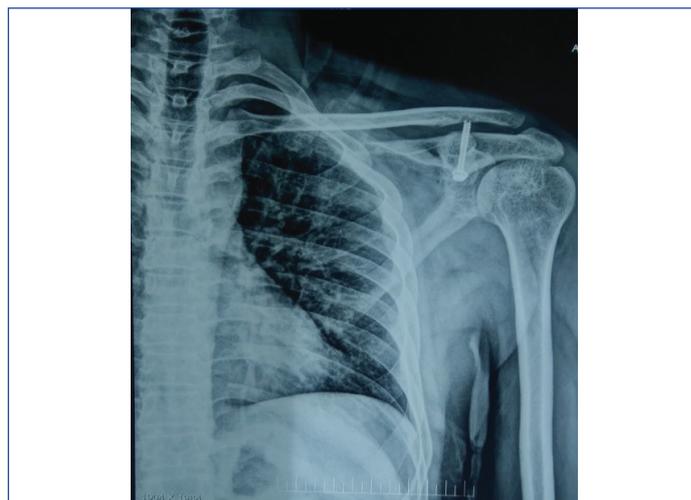


[Table/Fig-2]: Subscapularis muscle identified and split at upper 2/3rd and lower 1/3rd junction.

vertically for 2 cm and sutured back with medial flap over the lateral flap. A tunnel was created between the superior part of subscapularis and joint capsule and the osteotomised coracoid process along with conjoint tendon attachment was passed through the tunnel superiorly and reattached to the original predrilled osteotomy site with 4.0 mm cancellous cannulated screw while the arm was maintained in internal rotation [Table/Fig-3,4]. The wound was closed in layers and arms was strapped to chest in full internal rotation.



[Table/Fig-3]: Coracoid process with conjoint tendon passed between upper subscapularis and shoulder joint and fixed at the osteotomy site.



[Table/Fig-4]: Screw fixation of rerouted coracoid process.

All patients were given Valpeau strapping in immediate postoperative period. Pendulum exercises were initiated on 10th day. Active assisted range of motion exercises were begun at three weeks and active shoulder strengthening exercises were started at six weeks. Subsequently patients were called at monthly intervals for six months followed by three monthly intervals till two years and their progress was recorded.

STATISTICAL ANALYSIS

Data was entered into excel sheet and statistical analysis of data was done using SPSS version 21. Continuous data was reported as mean±standard deviation and was compared using paired t-test. The p-value was considered significant at <0.05.

RESULTS

A total of 41 patients underwent Modified Boytchev procedure at the institute from 2014-2017. Five patients were lost to follow-up and were excluded from the study. The age of patients operated was from 15-45 years (average 30.8 yrs.). Among them 33 (91.6%) were male and 3 (8.3%) were female.

All the patients had unilateral shoulder dislocation. Dominant shoulders were involved in 32 (88.9%) and 4 (11.1%) were non-dominant shoulders. Average number of dislocations at presentation was 5 with minimum number at 2 and maximum at 15. The mean duration between first dislocation and surgery was 19.8 months (6 to 42 months) [Table/Fig-5]. Mean follow-up period was 38 months (24 to 62 months). Mean OISS score before surgery was 21.2 ± 6.86 which improved to 41.08 ± 4.01 at six months ($p < 0.05$) after surgery, 42.22 ± 3.04 at one year ($p < 0.05$) and 42.44 ± 2.78 at two years ($p < 0.05$). Maximum improvement in the OISS score, occurred in the first six months post surgery with no statistically significant difference between the scores at six months and one and two years ($p > 0.05$). As compared to preoperative measurements, there was significant improvement in mean external rotation deficit at 0° and 90° of abduction at six months, one year and two years postoperatively ($p < 0.05$). Average forward flexion deficit increased in immediate postoperative period but improved at subsequent follow-ups, however loss of flexion remained significant even at two years ($p < 0.05$) [Table/Fig-6-9].

Variable	Value
Age (in years)	
15-25	6 (16.6%)
26-35	21 (58.3%)
36-45	9 (25%)
Gender	
Male	33 (91.6%)
Female	3 (8.3%)
Mechanism	
Road traffic accident	20 (55.5%)
Injury	8 (22.2%)
Sports	4 (11.1%)
Others	4 (11.1%)
Side involved	
Dominant	32 (88.9%)
Non-dominant	4 (11.1%)
Mean duration since first episode	19.8 months
Mean follow up period	38 months (24-62 months)
Average number of dislocation	5

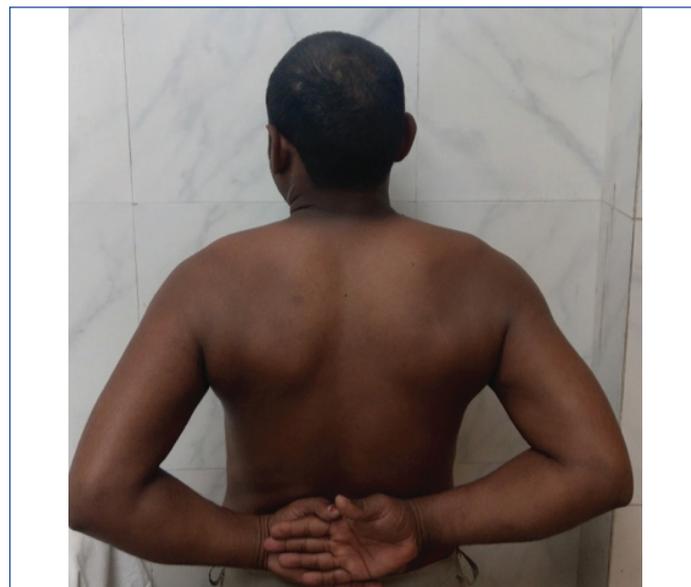
[Table/Fig-5]: Baseline characters of patients.



[Table/Fig-6]: Showing external rotation at three months.

A total of 31 patients showed excellent result, five patients showed good result based on OISS score at both one and two years of follow-up [Table/Fig-10]. Apprehension test became negative in all patients at six months. None of the patients complained of any dislocation episode till last follow-up. There were no major complications seen with this procedure. There was crushing of coracoid process in two patients while screw tightening which was managed by using 2-0

ethibond to additionally fix the conjoint tendon to stump of coracoid process. Postoperatively, three patients developed superficial wound infections which was managed by antibiotics and debridement and two patients complained of screw site irritation which was managed by screw removal after union of osteotomy site.



[Table/Fig-7]: Showing internal rotation at three months.



[Table/Fig-8]: Showing forward flexion at three months.

Parameters	Pre-Op	Post-Op six Months	Post-Op one Year	Post-Op two Year
Mean OISS Score	21.2 ± 6.86	41.08 ± 4.01 ($p < 0.05$)	42.22 ± 3.04 ($p < 0.05$)	42.44 ± 2.78 ($p < 0.05$)
Mean Ext-Rotation Deficit at 0° of Abduction	$16.72^\circ \pm 5.12$	$8.91^\circ \pm 2.52$ ($p < 0.05$)	$7.83^\circ \pm 2.38$ ($p < 0.05$)	$7.30^\circ \pm 2.26$ ($p < 0.05$)
Mean Ext-Rotation Deficit at 90° of Abduction	$20.72^\circ \pm 4.60$	$10.30^\circ \pm 2.73$ ($p < 0.05$)	$8.38^\circ \pm 2.69$ ($p < 0.05$)	$7.72^\circ \pm 2.01$ ($p < 0.05$)
Mean Forward Flexion Deficit	$0.61^\circ \pm 0.84$	$6.25^\circ \pm 4.14$ ($p < 0.05$)	$3.36^\circ \pm 2.67$ ($p < 0.05$)	$2.41^\circ \pm 2.06$ ($p < 0.05$)

[Table/Fig-9]: Pre-op and post-op observed values in patients.

Oxford instability score (OISS)	Poor (0-19)	Fair (20-29)	Good (30-39)	Excellent (40-48)
Preoperative	14	18	4	0
Post-op at six months	0	1	8	27
Post op at one year	0	0	5	31
Post op at two years	0	0	5	31

[Table/Fig-10]: Oxford Instability Shoulder Score (OISS).

DISCUSSION

Treatment of recurrent shoulder dislocation should provide a corrective force anteriorly to prevent the humeral head from coming out of the glenoid fossa. Many procedures have been described in literature to attain this. The major limitations of surgical correction of recurrent shoulder dislocation remains recurrence and limitation of external rotation and glenohumeral arthritis [5-7]. The present study describes a novel technique, in which the Modified Boytchev procedure was combined with anterior capsular plication.

A retrospective study by Chandra R et al., assessing the results of Modified Boytchev procedure in 60 patients, demonstrated excellent results in 32 (53.3%), good in 21 (35%), and fair in 7 patients using the Burkhead and Rockwood criteria [17]. They reported one recurrence in a mean follow-up of 56 months. The limitation in external rotation was 7 degrees at 0 and 90 degrees of abduction. In the present study, excellent results were observed in a much higher percentage (86%) and good results in 5 patients (13.8%). No recurrence was seen in the mean follow-up period of 38 months.

Chatterjee ND et al., in a retrospective analysis, showed excellent results after Modified Boytchev procedure in 42 patients after a mean follow-up period of 88 months with one incidence of immediate dislocation [22]. The results of this study compares well with the present study. The limitation in external rotation was 10 to 15 degrees which is much higher than observed in this study (2.5 to 8 degrees).

Anterior capsular plication has been shown to reduce the capsular laxity and decrease the glenohumeral range of motion to near normal [23,24]. A study by Wirth MA et al., showed good or excellent results in 93% when repair of the capsular labral injury was combined with capsular plication/imbrication [25].

Similarly, in this study, the addition of capsular plication with Modified Boytchev procedure has demonstrated reduced recurrence rate with excellent results in most of the patients. There was no significant loss of range of motion due to capsular plication. This technique is a simple procedure and provided the added advantage of decreasing capsular laxity along with providing strong dynamic stability to the shoulder joint. Maximum improvement in the OISS score occurred during the first six months post-surgery with minimal further improvement at one year and two year emphasising the importance of the role of early rehabilitation in the postoperative period. Early rehabilitation is possible with this procedure as it does not involve any prolonged immobilisation. This study has shown good results with this new technique.

Limitation(s)

Limitations of the study include smaller sample size, no control group and a short duration follow-up. Larger, randomised case control studies are required to establish its advantage over the traditional Modified Boytchev procedure.

CONCLUSION(S)

Modified Boytchev procedure with capsular plication is a reliable procedure for treatment of recurrent dislocation of shoulder with reproducible results. Technically, it is easier than arthroscopic Bankart repair and many other open procedures and results in minimal loss of motion with low recurrence rate.

REFERENCES

- [1] Blake R, Hoffman J. Emergency department evaluation and treatment of the shoulder and humerus. *Emerg Med Clin North Am.* 1999;17(4):859-76.
- [2] Olds M, Ellis R, Donaldson K, Parmar P, Kersten P. Risk factors which predispose first-time traumatic anterior shoulder dislocations to recurrent instability in adults: a systematic review and meta-analysis. *Br J Sports Med.* 2015;49(14):913-22.
- [3] Bottoni CR, Wilckens JH, DeBerardino TM, D'Alleyrand JC, Rooney RC, Harprtridge JK, et al. A prospective, randomized evaluation of arthroscopic stabilization versus nonoperative treatment in patients with acute, traumatic, first-time shoulder dislocations. *Am J Sports Med.* 2002;30(4):576-80.
- [4] Wheeler JH, Ryan JB, Arciero RA, Molinari RN. Arthroscopic versus nonoperative treatment of acute shoulder dislocations in young athletes. *Arthroscopy.* 1989;5(3):213-17.
- [5] Hovelius L, Thorling J, Fredin H. Recurrent anterior dislocation of the shoulder. Results after the Bankart and Putti-Platt operations. *J Bone Joint Surg Am.* 1979;61(4):566-69.
- [6] Halley DK, Olix ML. A review of the Bristow operation for recurrent anterior shoulder dislocation in athletes. *Clin Orthop Relat Res.* 1975;(106):175-79.
- [7] Salomonsson B, Abbaszadegan H, Revay S, Lillkrona U. The Bankart repair versus the Putti-Platt procedure: a randomized study with WOSI score at 10-year follow-up in 62 patients. *Acta Orthop.* 2009;80(3):351-56.
- [8] Boytchev B. Treatment of recurrent shoulder instability. *Minerva Orthop.* 1951;2:377-79.
- [9] Conforty B. The results of the Boytchev procedure for treatment of recurrent dislocation of the shoulder. *Int Orthop.* 1980;4(2):127-32.
- [10] Magnuson PB, Stack JK. Recurrent dislocation of the shoulder. *JAMA.* 1943;123(14):889-92.
- [11] Osmond-Clarke H. Habitual dislocation of the shoulder; The Putti-Platt operation. *J Bone Joint Surg Br.* 1948;30B(1):19-25.
- [12] Moseley HF, Overgaard B. The anterior capsular mechanism in recurrent anterior dislocation of the shoulder. *J Bone Joint Surg Br.* 1962;44:913-27.
- [13] Wirth MA, Blatter G, Rockwood CA Jr. The capsular imbrication procedure for recurrent anterior instability of the shoulder. *J Bone Joint Surg Am.* 1996;78(2):246-59.
- [14] Boselli KJ, Cody EA, Bigliani LU. Open capsular shift: there still is a role!. *Orthop Clin North Am.* 2010;41(3):427-36.
- [15] Kim KC, Rhee KJ, Shin HD, Kim YM. Arthroscopic separate labral repair and capsular plication with a suture anchor. *Arch Orthop Trauma Surg.* 2008;128(5):535-38.
- [16] Ha'Eri GB. Boytchev procedure for the treatment of anterior shoulder instability. *Clin Orthop Relat Res.* 1986;(206):196-201.
- [17] Chandra R, Sharma VK, Mahajan S, Bansal M, Arora S. Modified Boytchev procedure for recurrent anterior dislocation of shoulder. *J Orthop Surg (Hong Kong).* 2014;22(2):204-08.
- [18] Garg AK, Ayan S, Keshari V, Kundu D, Mukhopadhyay KK, Acharyya B. Modified Boytchev procedure for treatment of recurrent anterior dislocation of shoulder. *Indian J Orthop.* 2011;45(4):336-40.
- [19] Zamora-Navas P, Borrás Verdura A, Porras García J, Padilla Márquez A, Linares P. Long-term results of the Boytchev procedure for the treatment of recurrent dislocation of the shoulder. *Acta Orthop Belg.* 2001;67(3):233-35.
- [20] Dalsgaard HL, Gøthgen CB, Hoogmartens MJ. The Boytchev procedure for recurrent anterior dislocation of the shoulder. A controversial technique. *Acta Orthop Belg.* 2000;66(3):248-50.
- [21] Dawson J, Fitzpatrick R, Carr A. The assessment of shoulder instability. The development and validation of a questionnaire. *J Bone Joint Surg Br.* 1999;81(3):420-26.
- [22] 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(1):07-09.
- [23] Sodl JF, McGarry MH, Campbell ST, Tibone JE, Lee TQ. Biomechanical effects of anterior capsular plication and rotator interval closure in simulated anterior shoulder instability. *Knee Surg Sports Traumatol Arthrosc.* 2016;24(2):365-73.
- [24] Mayer SW, Kraszewski AP, Skelton A, Kontaxis A, Warren R. What are the effects of capsular plication on translational laxity of the glenohumeral joint: A study in cadaveric shoulders. *Clin Orthop Relat Res.* 2018;476(7):1526-36.
- [25] Wirth MA, Blatter G, Rockwood CA Jr. The capsular imbrication procedure for recurrent anterior instability of the shoulder. *J Bone Joint Surg Am.* 1996;78(2):246-59.

PARTICULARS OF CONTRIBUTORS:

1. Associate Professor, Department of Orthopaedics, Dr Ram Manohar Lohia Institute of Medical Sciences, Lucknow, Uttar Pradesh, India.
2. Assistant Professor, Department of Orthopaedics, Dr Ram Manohar Lohia Institute of Medical Sciences, Lucknow, Uttar Pradesh, India.
3. Assistant Professor, Department of Orthopaedics, Dr Ram Manohar Lohia Institute of Medical Sciences, Lucknow, Uttar Pradesh, India.
4. Associate Professor, Department of Orthopaedics, Dr Ram Manohar Lohia Institute of Medical Sciences, Lucknow, Uttar Pradesh, India.
5. Assistant Professor, Department of Orthopaedics, Dr Ram Manohar Lohia Institute of Medical Sciences, Lucknow, Uttar Pradesh, India.

NAME, ADDRESS, E-MAIL ID OF THE CORRESPONDING AUTHOR:

Dr. Pankaj Aggarwal,
Assistant Professor, Department of Orthopaedics, Dr Ram Manohar Lohia Institute of Medical Sciences, Vibhuti Khand,
Gomti Nagar, Lucknow-226010, Uttar Pradesh, India.
E-mail: pankaj.doc@gmail.com

Date of Submission: **Jan 26, 2020**

Date of Peer Review: **Feb 06, 2020**

Date of Acceptance: **Mar 02, 2020**

Date of Publishing: **Apr 01, 2020**

FINANCIAL OR OTHER COMPETING INTERESTS: None.