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ORIGINAL ARTICLE

Is Revision Bankart Repair with Remplissage a Viable Option for Failed Bankart Repair in Non-contact Sports Person Aiming to Return to Sports?

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Abstract

Purpose Failure of a well-executed Bankart repair in non-contact athletes is difficult to predict and its management is a lesser investigated area with uncertain outcome in terms of return to sports (RTS). This study analyses effectiveness of revision Bankart repair with remplissage for failed Bankart repair in non-contact athletes, focusing on time and level of RTS.

Materials and Methods Fifty-five consecutive non-contact athletes with evidence of instability after primary arthroscopic Bankart repair having glenoid loss < 25% and off-track Hill-Sachs lesion were included in the study according to algorithm mentioned. All cases underwent revision arthroscopic Bankart repair with remplissage and followed-up for 24 months. Rowe, UCLA, WOSI and Quick-DASH scores were recorded preoperative and at 24 months. RTS was allowed after unilateral seated shot-put test.

Results Out of 55 cases, 6 were excluded because of poor tissue quality, 7 were lost to follow-up. Forty-two cases with a mean age of 28.2 ± 5.2 years were included. Mean duration between primary surgery and failure was 7.3 ± 1.4 months with a mean 1.9 redislocations. The mean Rowe, WOSI, UCLA, Quick-DASH scores improved from 37 to 89, 39.3 to 83.7%, 18.4 to 30.5, 45.3 to 18.7 at 24 months. Thirty-five cases could RTS in a mean time 15.4 ± 1.4 months. Out of seven cases who could not RTS, four had instability, one had pain and two voluntarily quit sports.

Conclusion Revision Bankart repair with remplissage is a feasible option for failed primary Bankart repair in non-contact athletes who have glenoid bone loss < 25% with off-track Hill-Sachs.

Level of evidence Level IV.

Keywords Failed Bankart · Non-contact sports · Revision Bankart repair with remplissage · Return to sports

Introduction

The arthroscopic Bankart repair has been the most common procedure performed for the management of recurrent anterior instability of shoulder [1, 2]. Despite excellent results at trained hands, failure have also been reported. With increasing cases of failed Bankart repair, causes of failure and their logical treatment options are constantly being evaluated. Under-appreciation of bipolar defects pre and per-operative, recurrent traumatic episodes, younger age, poor surgical techniques, poor quality capsule and failure to recognize capsular laxity remain most important causes of failure [1, 3, 4].

The cases of failed Bankart repair with glenoid loss of more than 25% are classically treated by Latarjet procedure [5]. But in cases having glenoid loss of less than 25% with/with-out humeral head loss have been treated with various

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surgical revision procedures depending upon indications and surgeon preferences of which open/arthroscopic Latarjet, revision arthroscopic Bankart repair and revision arthroscopic Bankart repair with remplissage have been reported [6–9].

Most of the causes of failure of Bankart repair lie in improper case selection or execution but failure of ideally indicated and well-executed Bankart repair in set of non-contact athletes is still a lesser investigated area.

This study analyses outcome of revision Bankart repair with remplissage for failed Bankart repair (glenoid loss < 25% and off-track Hill-Sachs lesion) in non-contact athletes, according to treatment algorithm (Fig. 1). It also investigates time and level of return to sports (RTS) after surgery.

Research Question: Does revision Bankart repair with remplissage for failed Bankart repair (glenoid loss < 25% and off-track/engaging Hill-Sachs lesion) in non-contact sports persons provide satisfactory clinical outcome with same level of return to sports?

Material and Methods

This retrospective analysis of a prospective case series was conducted on 55 consecutive non-contact sports persons who had recurrence of anterior instability after primary arthroscopic Bankart repair, from 2015 to 2017. Informed consent was obtained from all patients.

Thorough clinical examination, MRI (3 T Magnetic Resonance Imaging) and CT scan (64 slice Multidetector Computed Tomography scan with 3-Dimensional reconstruction) was performed.

Inclusion was based on pre-operative, radiological and per-operative assessment (Fig. 1). Cases with subjective and objective (clinico-radiological) evidence of failed arthroscopic Bankart repair, who had suffered ≤ 2 episodes of dislocation (defined as dislocation with spontaneous relocation or dislocation requiring a reduction) were included only after confirmation of glenoid bone loss of less than 25% and an off-track Hill-Sachs lesion [Hill-Sachs Interval (HSI) > Glenoid track (GT)] on CT scan. The method of CT assessment used in this study was the perfect circle method [10, 11] and 3D reconstruction to assess bipolar bone loss [12]. Location of suture anchors of previous Bankart repair were also assessed. The inclusion was further narrowed down per-operatively. If the capsulo-labral quality was found healthy, only then the patients were included. Patients with poor labral tissue quality and non-engaging Hill-Sachs lesion were excluded from the study.

The patients involved in contact sports, treated with a previous open surgery, multi directional instability (Beighton score ≥ 4), glenoid defect of > 25%, HSI < GT, evidence of degenerative arthritis, glenoid dysplasia, concurrent fractures, rotator cuff tears, SLAP (superior labral tear from anterior to posterior) tear, PASTA (partial articular supraspinatus tendon avulsion) lesions and neuromuscular disorder were excluded.

Surgical Technique

All surgeries were performed by the same surgical team in lateral decubitus position. Standard posterior, antero-superior-lateral and antero-inferior portals were established and arthroscopic evaluation was done. During arthroscopic evaluation, the patient's limb was freed of lateral traction and shoulder flexion, abduction and external rotation was performed for dynamic assessment of Hill-Sachs engagement. Furthermore, assessment of labral tissue was also done. Cases who had poor labral tissue underwent Latarjet procedure in same sitting. Cases with non-engaging Hill-Sachs per-operatively and with a good labral tissue underwent isolated Bankart repair.

An additional postero-lateral accessory portal was made by penetrating the capsule and tendon of infraspinatus using outside in technique after ensuring that the needle was perpendicular to the Humeral lesion. Remplissage was done using two single loaded 5.5 mm bioresorbable suture anchors 1 cm apart (Fig. 2a). Before tying mattress sutures for completion of remplissage (Fig. 2b), Bankart lesion was addressed and repair done using minimum of three single loaded 2.3 mm bioabsorbable suture anchors (Fig. 2c, d).

After surgery, follow-up was done every month for first 6 months and thereafter every 2 months till the end of minimum of 24 months. Shoulder immobilizer was given for 3 weeks. Patients were allowed elbow flexion/extension, forearm strengthening, gentle scapular glides and proprioceptive training after pain subsided. The ROM exercises of shoulder were initiated after 4 weeks. From 8 weeks onwards, the aim was to achieve up to 80% of normal ROM. After 3 months of surgical procedure, emphasis was laid on strength and endurance training followed by conditioning to sports at 6 months onwards. Exercises involving the physiological load were instituted after the 6 months and return to training for respective sports was recommended after 8 months. Return to competitive sports was recommended after the 12 months, when they gained full confidence in their shoulder and were pain free. Functional assessment for every patient prior to return to sports was done by unilateral seated shot-put test [13].

Rowe [14], UCLA (University of California Los Angeles) scores [15], WOSI (Western Ontario Shoulder Instability Index) score [16] and Quick-DASH (The Disabilities of the Arm, Shoulder and Hand Score) score [17] and ROM (by goniometer) were recorded preoperative and at 24 months.

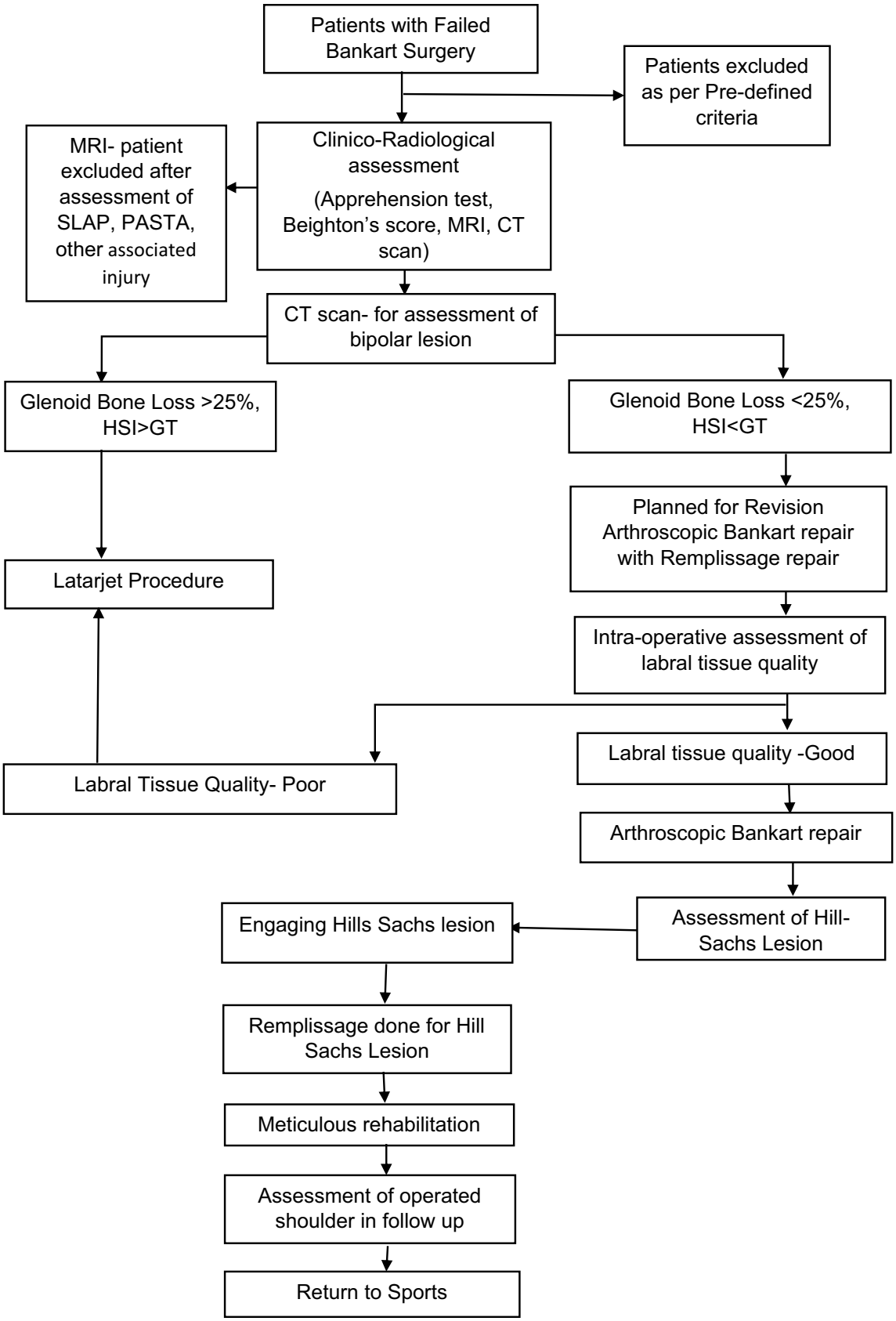

Fig. 1 Treatment algorithm. *HIS* Hill-Sachs Interval, *GT* glenoid track

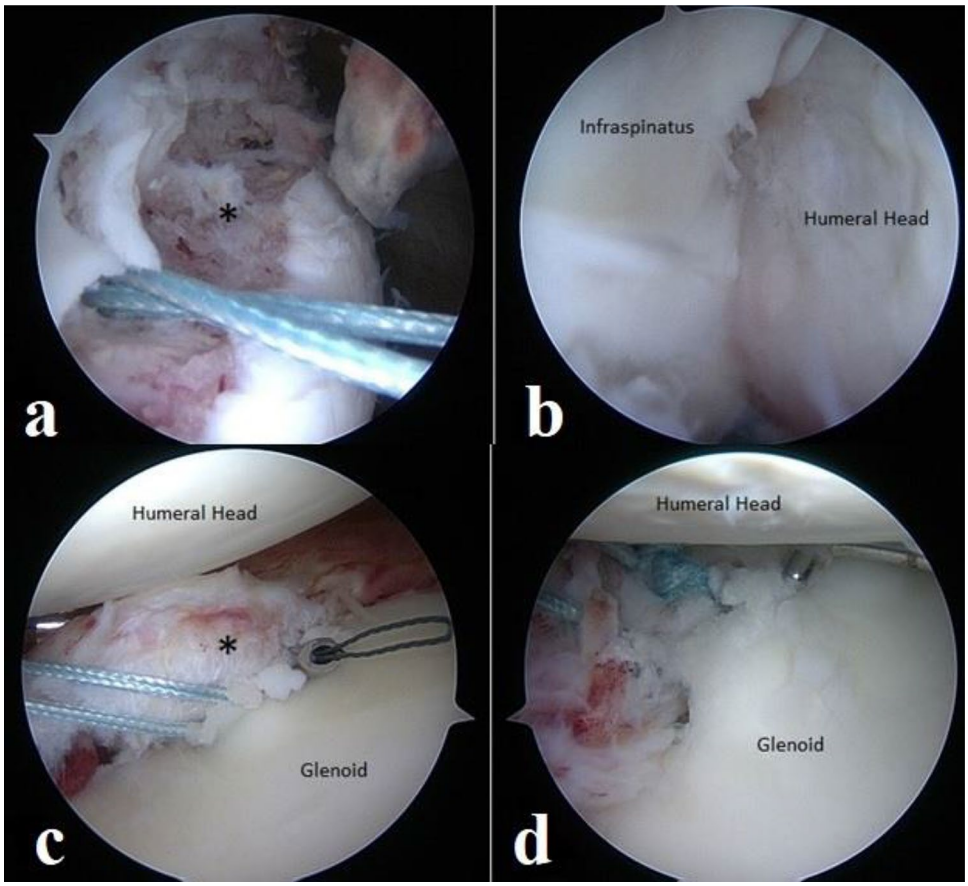

Fig. 2 Intra-operative images. **a** Suture Placed in Hill-Sachs Defect for remplissage, *Hill-Sach's Defect. **b** Final remplissage, **c** intraoperative image showing first suture bite for Bankart repair, *Capsulo-labral complex. **d** Final Image of Bankart repair

Statistical Analysis

Statistical analysis was carried out by SPSS software (version 13). Chi-square statistical test and Wilcoxin–Mann–Whitney test were applied for comparison of various scores with pre-operative and final follow-up values. The continuous data were reported as mean ± standard deviation. The significance level *P* was less than 0.05.

Results

Demographic characteristics of patients are mentioned in Table 1.

Mean Glenoid Bone loss on 3D CT scan by perfect circle method was 17.6% ± 2.2% (range 12–22%). In our study, 88 percent of the patients had glenoid bone loss less than 20% (Table 2).

The mean Rowe, WOSI, UCLA and Quick DASH scores improved from 37 ± 3.9 to 89 ± 16.9 ($p < 0.05$), 39.3% ± 6.9 to 83.7% ± 10.4 ($p < 0.05$), 18.4 ± 2.1 to 30.5 ± 2.7 ($p < 0.05$) and 45.3 ± 13.1 to 18.7 ± 7.2 ($p < 0.05$), respectively (Table 3).

Although, Stability was achieved in 38 out 42 cases (90.5%) at final follow-up, 7 cases (17%) could not return to sports. Four (9.5%) out these seven cases complained of subluxation/dislocation and had positive apprehension test after second surgery within the first year of the surgery. Out of these four cases two were later lost to follow-up and the other two quit their respective sports and refused surgery the third time.

Apart from these four cases there were three (7.5%) more cases who could not return to sports due to reasons not related to instability. Two cases had quit their respective sports voluntarily while one developed pain due to internal impingement that did not resolve despite conservative management and he had to quit sports (Table 4). The mean time to return to sports at competitive level was 15.4 ± 1.4 months (range 13–21 months).

At final follow-up, 37 cases had regained full range of motion except external rotation. The mean decrease in external rotation at 90 degrees of abduction was 6.2 ± 2.30 degrees in comparison to normal side. Four cases who had recurrence and one who had pain could not regain full range of motion.

Discussion

The most obvious finding of this study was that when proper case selection is done with ruling out of all causes of potential failure during preoperative work up and surgery, an

Table 1 Demographic data

Number of cases with failed arthroscopic stabilization procedure	55
Number of cases excluded due to poor quality labral tissue intraoperative	6
Number of cases lost to follow-up	7
Number of cases included in study after completing minimum follow-up of 24 months	42
Male	26
Female	16
Dominant side	32
Non-dominant side	10
Mean age at second surgery ± SD (range) in years	28.2 ± 5.2 (20–40)
Mean number of dislocations after primary surgery	1.9
Mean interval between first surgery and re-dislocation ± SD (range) in months	7.3 ± 1.4 (5–13)
Mean follow-up after surgery ± SD (range) in months	30.2 ± 2.8 (24–36)
Reduction of dislocation	
Health care professional	35 (83.3%)
Self-reduction/spontaneous	7 (16.7%)
Median anchors used, *n* (range)	4.8 (4–5)

Table 2 Percentage of Glenoid bone loss on 3D CT scan by perfect circle method

Percentage of glenoid bone loss	Number of patients
10–< 15%	9
15–< 20%	28
20–< 25%	5

arthroscopic revision Bankart repair with remplissage for failed primary Bankart repair in non-contact athletes provides good to excellent results.

Revision Bankart repair with or without remplissage is established treatment of failed Bankart surgery [9]. By addition of remplissage stability can be imparted to failed primary Bankart repair. Stability was achieved in majority of cases in this study (90.5%). For successful outcome case selection according to preoperative clinical and radiological parameters, is paramount. We strictly followed the mentioned treatment algorithm and narrowed down case selection according to existing norms.

Number of dislocations for case selection was restricted to ≤ 2 as the number of dislocations is directly proportional to glenoid bone loss which in turn is related with increased risk of recurrence [18, 19]. Studies have shown that > 2 successive anterior dislocations are associated with higher incidence of recurrence [1, 19].

Soft tissue (capsulo-labral) status is equally important for a successful revision. It may be difficult to accurately evaluate the quality of labrum and capsule on MRI that is why we evaluated it arthroscopically and excluded cases with poor soft tissues. Terry et al. suggested soft tissue quality assessment by correlating to translation of head of humerus under anaesthesia but we depended on arthroscopic assessment only, as translation was found to be increased in most of the cases even when sulcus sign was absent [20].

The edge loading forces on gleno-labral repair are high during abduction and external rotation in cases of glenoid

Table 3 Functional outcome scores at 24 months

Functional score	Pre-operative	24 months Postoperative	*p* value
Rowe score (mean ± SD)	37 ± 3.9	89 ± 16.9	< 0.05
UCLA score (mean ± SD)	18.4 ± 2.1	30.5 ± 2.7	< 0.05
WOSI score (mean% ± SD)	39.3% ± 6.9	83.7% ± 10.4	< 0.05
Quick-DASH score (mean ± SD)	45.3 ± 13.1	18.7 ± 7.2	< 0.05

Table 4 Time and level of return to sports

Meantime of return to sports ± SD (range) in months	15.4 ± 1.4 (13–21)
Number of cases returning to same competitive level as before primary surgery	20
Number of cases returning to higher Competitive level than prior to primary surgery	15
Number of cases not able to return to prior Competitive level	7

bone deficiency. These stresses can be even higher in athletes. The edge loading is reduced by remplissage as the filling of Hill-Sachs defect exteriorizes the engaging area.

Revision Bankart repair is a fairly successful procedure with low recurrence rates and addition of remplissage for Hill-Sachs makes it more secure. We had only 4 cases out of 42 who had recurrence of instability that is comparable to results of other reported studies. Barnes CJ reported a success rate of 94% in cases of revision Bankart repair without Remplissage but all subjects were not athletes [21]. The recurrence rate following revision Bankart repair reported was 3 out of 16 by Arce et al. [22], 3 out of 11 cases Neri et al. [23], 3 out of 23 by Buckup et al. [24], 6 out of 56 by Bart et al. [25] and 5 out of 23 by Kim et al. [26]. A high failure rate of 8 out of 21 was reported by O' Neill et al. in a set of 21 cases of revision Bankart procedure but they had done remplissage in only 8 cases and 19 cases were contact athletes [27]. In contrast to O'Neill, this study has low failure rate because remplissage was added to all cases and only no-contact sports person were selected.

Success of this procedure is depicted by return to sports. In this series, 83% of cases returned to same or higher level of competitive of sports they were involved in prior to first surgery that is substantial considering the study population comprised only of sports persons. The reported rate of return to sports was 76% by Bartl et al. [25]. Out of 67 cases of Cordasco et al., 75% could return to same or higher competitive level in a mean time of 7.1 months [28]. Out of 20 cases, Buckup et al. reported 70% return to sports [24].

The mean time of RTS in this study was 15.4 ± 1.4 months but it could be because the patients were allowed RTS only after they were confident about their shoulder, regained near complete ROM, had cleared unilateral seated shot-put test and were pain free.

The improvement post-surgery was established by statistically significant improvement in mean Rowe, WOSI, UCLA and Quick-DASH scores that is comparable to reported by various authors [7–9, 22, 25, 28].

As it is associated with remplissage, there was slight restriction of ER in abduction (6.2 ± 2.30 degrees) but had no impact on outcome or RTS. To minimize restriction of ER, we had inserted anchors in centre of width of Hill-Sachs, avoiding being close to articular margin. Also, all these cases were put to supervised rehab only.

Using the algorithm mentioned, patients having risk of failure are excluded, thus improving the outcome of surgery.

Limitation of Study

There was no control group because it is difficult to get high number of failed Bankart cases that too in a small subset of non-contact athletes.

Conclusion

Revision Bankart repair with remplissage is a feasible option for failed primary Bankart repair in non-contact athletes who have glenoid bone loss < 25% with off track lesion. This allows return to competitive sports with minimal risk of failure but slight limitation of external rotation.

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Author Contributions Conceptualization: SS, DJ; methodology: DJ, RG; formal analysis and investigation: NM, AG; writing—original draft preparation: AG, NM; writing—review and editing: SS, RG; supervision: RKA.

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Declarations

Conflict of Interest The authors declare that they have no conflict of interest.

Ethical Approval The study was in compliance with the ethical standards of our institutional ethical committee.

Informed Consent Informed consent was obtained from all the participants in the study.

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