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The WAVE Sign: A Dynamic Intraoperative Indicator of Adequate Capsulolabral Mobilization during Arthroscopic Repair of ALPSA Lesions

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Abstract

Background: Arthroscopic Repair of Anterior Labrum Periosteal Sleeve Avulsion (ALPSA) lesions require complete mobilization of the medially healed capsulolabral complex before fixation. In our previously described modified technique, adequacy of release was judged by spontaneous reduction of the capsulolabral complex after discontinuation of pump pressure. The present technical note formalizes a dynamic intraoperative finding observed during that technique.

Purpose: To describe the WAVE sign as a real-time intraoperative indicator of adequate capsulolabral mobilization during our previously described arthroscopic ALPSA repair technique.

Technique: With the patient in the beach-chair position, a posterior viewing portal and two anterior working portals are established. After identification of the ALPSA lesion, progressive release of the capsulolabral complex is performed from the 6-o'clock position to the biceps anchor. The shaver is then positioned adjacent to the anterior glenoid to create controlled alternating negative and positive pressure. When mobilization is adequate, the capsulolabral complex shows a characteristic wave-like excursion and spontaneous reduction toward the anterior glenoid rim. Repair is then completed using the previously described anchor configuration and capsular shift strategy.

Conclusion: The WAVE sign may serve as a simple real-time adjunct for judging adequacy of release during arthroscopic repair of ALPSA lesions. Its presence is interpreted as suggesting adequate separation from the subscapularis and readiness for lower-tension anatomic reduction, but its reliability and clinical impact remain to be established.

Level of evidence: Level V, technical note.

Keywords: Arthroscopy, Shoulder, Labral repair

Introduction

Traumatic anterior shoulder instability is commonly associated with injury to the capsulolabral complex. In ALPSA lesions, the labrum and intact periosteal sleeve heal medially along the glenoid neck, creating a nonanatomic and often scarred configuration that can make arthroscopic reduction technically demanding.

Arthroscopic stabilization is an accepted treatment for anterior shoulder instability, although recurrent instability remains a concern in selected high-risk patients [1]. Risk factors for recurrence after arthroscopic Bankart repair include young age, hyperlaxity, and osseous defects [2].

In our previously published case series of 72 shoulders, we described a modified arthroscopic technique for ALPSA repair that emphasized extensive release of the medially healed capsulolabral complex, separation from the subscapularis, limited anterior glenoid cartilage resection, and a combined medial and superomedial capsular shift [4]. Using that technique, postoperative recurrence occurred in 4 of 72 shoulders (5.6%), and the mean ASES score improved from 66.44 preoperatively to 89.85 at latest follow-up [4].

In that prior report, adequacy of release was assessed by discontinuing pump pressure and observing whether the capsulolabral complex spontaneously reduced to its anatomic position [4]. What was not specifically described was a dynamic suction-induced phenomenon that can be reproducibly elicited once complete mobilization has been achieved.

The purpose of this technical note is therefore not to introduce a new ALPSA repair technique, but rather to describe the WAVE sign as an adjunct to the previously described technique and as a practical intraoperative indicator of adequate capsulolabral mobilization before fixation.

Surgical Technique

Patient positioning and diagnostic arthroscopy

The patient receives an interscalene nerve block followed by general anesthesia and is positioned in the beach-chair position. The cervical spine is supported, and the trunk is stabilized on the ipsilateral side. After examination under anesthesia, the shoulder and entire upper extremity are prepared and draped in the standard sterile fashion. Longitudinal traction is then applied with the arm in slight abduction and forward flexion [4].

A posterior viewing portal is created inferior and medial to the posterolateral corner of the acromion, and a 30-degree arthroscope is introduced into the glenohumeral joint. Diagnostic arthroscopy includes assessment of the labrum, articular cartilage, biceps tendon and anchor, subscapularis tendon, and the intra-articular portions of the rotator cuff. Particular attention is paid to the quality of the inferior capsular tissue because poor tissue quality may contribute to recurrent instability after repair [4].

Portal placement and capsulolabral release

Two anterior rotator interval portals are established under direct visualization without cannulas. The anterosuperior portal is placed at the superior border of the rotator interval, just anterior to the supraspinatus and biceps tendon, and the anteroinferior portal is placed just superior to the subscapularis on the humeral side of the interval. This configuration facilitates glenoid preparation, release of the capsulolabral complex, anchor placement, and suture management [4].

A Polydioxanone (PDS) suture is passed through the anteroinferior capsulolabral tissue using a suture lasso, and tension on this suture is used to improve exposure during release. Under controlled tension, an arthroscopic elevator is used to free the capsulolabral complex from the anterior glenoid neck. A 90-degree ablator and shaver are used to complete soft-tissue debridement. Release proceeds from the inferior glenoid at the 6-o'clock position toward the superior labrum at the level of the bicep's anchor [4].

The extent of release is tailored to the degree of instability and the pattern of scarring. As in our prior report, discontinuation of pump pressure is used to assess whether the capsulolabral complex will spontaneously reduce toward its native position [4]. Failure of spontaneous reduction prompts additional release, particularly of adhesions to the subscapularis.

Description of the WAVE sign

Once the surgeon believes release is nearly complete, the shaver is positioned adjacent to the anterior glenoid rim and used to generate controlled alternating negative and positive pressure. When adequate mobilization has been achieved, the capsulolabral complex shows a distinct wave-like excursion, followed by spontaneous reduction over the anterior glenoid rim. We refer to this dynamic phenomenon as the WAVE sign. It is clearly shown in the **Supplementary Video 1**. This sign in our series is reproducible as the observer are apt at identifying it.

The sign is interpreted as suggesting 3 intraoperative conditions: (1) the capsulolabral complex has been sufficiently separated from the subscapularis and anterior glenoid neck; (2) capsular mobility is adequate to permit anatomic reduction; and (3) fixation can likely be performed in a lower-tension position. In the absence of the sign, further release is performed until spontaneous dynamic excursion and reduction are observed.

Preparation and fixation

After adequate release, the anterior glenoid neck is lightly debrided with a burr to create a bleeding surface. An additional 2 to 3 mm of articular cartilage is removed from the anterior glenoid rim to promote healing and to facilitate the desired capsular shift [4].

Three 3-mm double-loaded absorbable anchors are placed between the 2- and 6-o'clock positions. The most inferior anchor is placed first, typically at the 5-o'clock position and approximately 45 degrees to the anterior glenoid plane. The remaining anchors are inserted in parallel fashion at least 1 cm apart [4].

Using a curved suture-passing device, the inferior aspect of the capsulolabral complex is grasped at inferolateral and lateral points. The inferolateral bite creates a superomedial shift, whereas the lateral bite contributes additional medialization, thereby producing a combined medial and superomedial capsular shift. Superior anchors are managed in the same manner [4]. This construct conceptually parallels previously described capsular shift techniques for recurrent anterior instability [6].

When an engaging Hill-Sachs lesion is present, posterior capsulodesis or remplissage is performed to reduce the risk of persistent instability [5]. Engaging Hill-Sachs lesions have previously been associated with higher rates of recurrent instability in shoulders with ALPSA lesions [7].

Postoperative rehabilitation

The arm is placed in an abduction sling for 4 weeks. Pendulum exercises and elbow and wrist motion are started immediately. Progressive passive motion begins at 4 weeks, followed by active motion. Strengthening is deferred for the first 3 months and return to sports is generally allowed at 6 months [4].

Advantages and limitations

The principal advantages and limitations of the WAVE sign are summarized below.

Potential Advantages	Potential Limitations
Provides a real-time visual adjunct for deciding whether further release is required	Observation is still subjective and has not yet been formally validated
Builds directly on the previously described spontaneous-reduction endpoint rather than replacing the established repair technique	There may be a learning curve in recognizing the sign consistently
May help the surgeon judge when anatomic reduction can be achieved in a lower-tension position	Excessive release still carries a risk of soft-tissue trauma, bleeding, or stiffness
Requires no additional implants or major changes to the existing portal strategy	The sign does not by itself prove improved healing, lower recurrence, or better patient-reported outcomes

Discussion

The technical challenge in Anterior Labroligamentous Periosteal Sleeve Avulsion (ALPSA) repair is not simply fixation of the labrum, but restoration of a medially healed capsulolabral complex to its anatomic position without creating excessive tension. In our previously reported technique, adequacy of release was judged by spontaneous reduction after discontinuation of pump pressure [4]. The WAVE sign builds on that observation by providing a dynamic intraoperative maneuver that can be used immediately before fixation.

The sign should be framed as an adjunct rather than as proof of technical success. Its presence is interpreted as suggesting adequate mobilization and lower-tension readiness for repair, but the sign has not been correlated with direct tension measurements, interobserver reliability, postoperative range of motion, or recurrence. Accordingly, claims that the sign confirms successful repair or improves outcomes would be premature.

This distinction is important because the evidence for the operative technique already comes from the previously published case series, whereas the present report introduces a previously undescribed intraoperative indicator within that technique [4]. The novelty of the current manuscript therefore lies in formalizing the sign itself, not in re-presenting the entire repair construct as new.

Incomplete release may prevent anatomic reduction and can leave the repair under higher tension, whereas over tensioning or over constraint may contribute to postoperative stiffness and loss of motion [4]. For that reason, a practical real-time indicator that helps the surgeon decide whether mobilization is sufficient may be valuable, provided it is used with appropriate caution.

Furthermore, modern surgical techniques that focus on aggressive mobilization and anatomical re-fixation; demonstrate that ALPSA repairs can achieve functional results and stability profiles just as favorable as traditional Bankart repairs [8–10].

Future studies should assess the interobserver reliability of the WAVE sign, its relationship to capsular tissue quality and associated bone defects, and whether its presence is associated with lower recurrence rates or improved functional outcomes.

Conclusion

The WAVE sign is a dynamic intraoperative phenomenon observed during arthroscopic repair of ALPSA lesions when the mobilized capsulolabral complex demonstrates wave-like excursion and spontaneous reduction toward the anterior glenoid rim under controlled pressure changes.

Within the context of the previously described ALPSA repair technique, the sign may serve as a simple real-time adjunct for judging whether additional release is required before fixation [4]. Its presence is interpreted as suggesting adequate capsulolabral mobilization and the ability to obtain an anatomic repair in a lower-tension position.

Because the sign has not yet been independently validated, its reliability and clinical impact remain to be established in future prospective studies.

Declarations

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Conflicts of Interest

None.

Data availability statement

Upon request.

Ethics approval

Written informed consent was given. All authors have read and complied with the ethical approval/informed consent requirements and that all ethics statements have been added to the manuscript.

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