Case Report

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Improving shoulder function and pain in a paraplegic patient with massive irreparable rotator cuff tear using a subacromial balloon spacer

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The subacromial balloon spacer is a promising treatment option for alleviating symptoms in patients with massive irreparable rotator cuff tears (MIRCTs). The balloon provides faster pain relief and easier rehabilitation than other options (such as arthroscopic partial rotator cuff repair). For a paraplegic MIRCT patient, the need for speedy recovery and rehabilitation is crucial, as these patients rely on their upper limbs for daily life activities and independence. In this report, we present a 60-year-old male paraplegic patient who presented to the clinic with an MIRCT of the right shoulder. After a holistic investigation and assessment of the patient, a subacromial balloon spacer with an upper border subscapularis repair was chosen as the treatment of choice. The patient had an uneventful recovery, and at the 1-year mark, had forward elevation of 170°, an American Shoulder and Elbow Surgeons score of 95, and a visual analog scale pain score of 0.

Keywords: Balloon; Paraplegia; Disability; Rehabilitation; Rotator cuff

The treatment of massive irreparable rotator cuff tears (MIRCTs) remains a challenge for shoulder surgeons worldwide [1]. Several treatment options exist, and management is dependent on many factors such as other pathologies of the shoulder, patient demographics, and patient expectations concerning treatment [1]. Recently, a novel treatment option (the "subacromial balloon spacer") was approved by the Food and Drug Administration in the United States [2-5]. This device involves the introduction of a bioabsorbable inflatable balloon into the glenohumeral joint and filled with saline to relieve acromiohumeral impingement in patients with MIRCTs [2].

When deciding on a management plan, accounting for patient factors is crucial for optimizing patient satisfaction and expectations during the treatment period. Some patients, like those with concurrent physical disabilities, may have different concerns regarding rehabilitation than the standard patient and can benefit from procedures that involve less invasiveness and shorter time to regain function [6]. Paraplegic patients rely more on their upper body than normal patients due to their dependence on their arms for wheelchair transportation. For these patients, the balloon is a potential solution, as it has been reported to entail an easier recovery and rehabilitation for MIRCT patients compared to more traditional procedures like arthroscopic partial rotator cuff repair [6]. In this report, we discuss a paraplegic patient who presented with bilateral MIRCTs. After exploring treatment options, the patient opted to undergo treatment with a subacromial balloon spacer. To our knowledge, this is the first report to discuss the use of a subacromial balloon spacer for paraplegic persons.

As this is a case report of a single patient, there was no require-

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ment for institutional review board review and approval. The patient provided informed consent for the case to be reported; therefore, all pertinent data were appropriately anonymized, de-identified, and included in this case presentation.

CASE REPORT

Our case is a 60-year-old male who presented with worsening right shoulder pain. The patient is a paraplegic as a result of a motor vehicle accident. He has bilateral posterosuperior rotator cuff tears and bicep tendon ruptures (as seen from previous magnetic resonance imaging). Although he was pain-free at rest and described a good range of motion, he described severe pain upon lifting or moving any object above shoulder height. The patient described occasional neck pain and spasms, with pain in the deep anterior biceps. He also reported difficulty with toileting. As mentioned earlier, full function of both shoulders is important for this patient in terms of maintaining his ability to self-transport with his wheelchair and to perform various activities of daily life. He had received 3–4 corticosteroid shoulder injections for pain and discomfort relief, the latest being approximately one month before presentation. The patient had undergone left triceps repair 5 months prior for an injury attributed to his wheelchair-bound lifestyle. He also had a history of cancer in the mouth, which had been treated surgically 3 years earlier. In addition, the patient has a history of high cholesterol and hypothyroidism. He had a weight of 91 kg and a height of 172 cm.

On physical examination, the patient demonstrated good shoulder mobility with forward flexion of 150° and abduction of 90° in the right arm. Range of motion testing showed 30° of external rotation on the right side and 40° of external rotation on the left side. The patient was able to internally rotate his right shoulder to his lower lumbar spine. Strength testing revealed well-compensated strength. The patient had a mildly positive belly press sign on both shoulders. Jobe's and Speed's testing revealed positive signs on both shoulders. The patient rated his right shoulder as worse than the left. His right shoulder had a visual analog scale (VAS) score of 5.5/10 and an American Shoulder and Elbow Surgeons (ASES) score of 37.8. He presented for a discussion of treatment options and for information regarding the subacromial balloon spacer.

Radiographic imaging of the right shoulder was performed during the first visit. On an anteroposterior view, mild degenerative changes were noted without severe osteoarthritis or rotator cuff arthropathy (Fig. 1). In order to gain a better understanding of the patient's anatomy and the extent of the articular cartilage damage, magnetic resonance imaging without contrast was ordered. The right shoulder had a massive posterosuperior rotator cuff tear with retraction of the tendons to the glenoid margin (Fig. 2). Some upper border subscapularis tearing with minimal osteoarthritis was noted (Fig. 2). A torn and retracted long head of the biceps was noted (Fig. 2). The sagittal view demonstrated grade 3 Goutallier fatty degeneration of the supraspinatus and infraspinatus tendons but robust muscle bellies for the subscapularis and teres minor tendons (Fig. 2). The patient was provided information about the different treatment options and their respective advantages and disadvantages. After careful consideration of the patient's goals, it was decided that the patient's right shoulder would be a good candidate for subacromial balloon placement. Preoperative medical clearance was necessary.

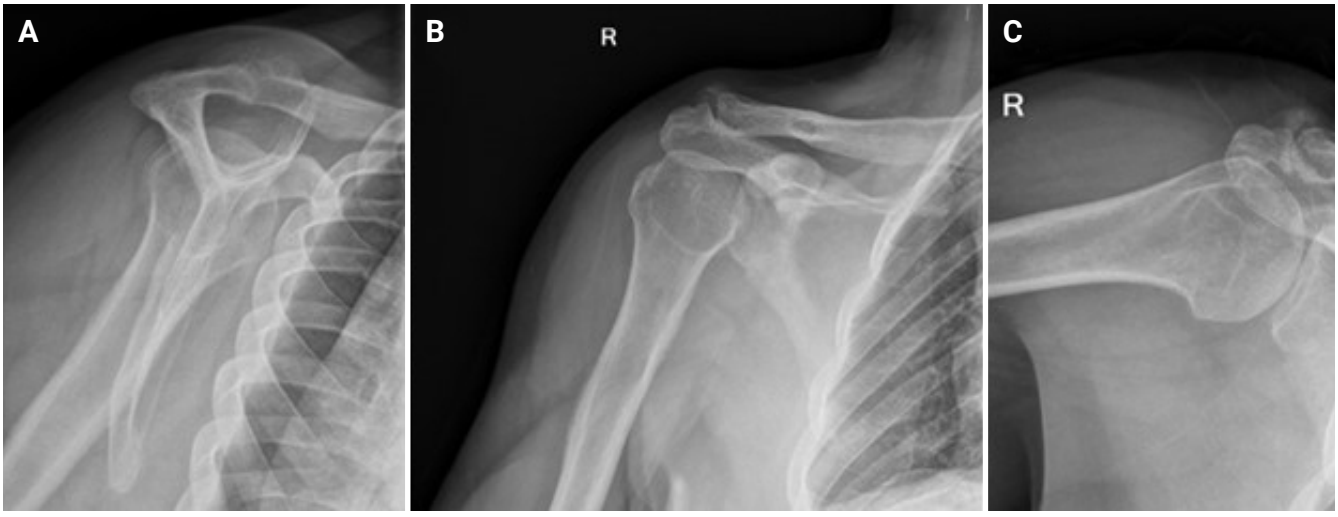

Fig. 1. X-ray imaging of 60-year-old male showing mild osteoarthritis of the shoulder with no signs of fractures or severe chondral degeneration according to the scapular-Y view (A), anteroposterior view (B), and the axial view (C).

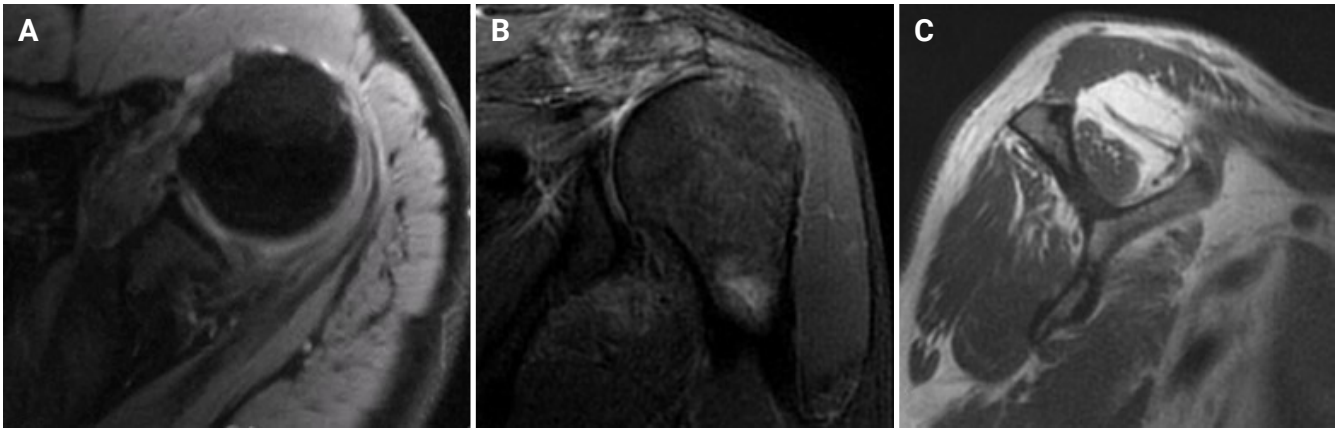

Fig. 2. Magnetic resonance imaging of 60-year-old male showing a minor reparable upper border subscapularis tear (A, axial view), a massive posterosuperior rotator cuff tear (B, anteroposterior view), and grade 3 Goutallier fatty degeneration of the supraspinatus and infraspinatus (C, sagittal view).

This outpatient surgery involved general anesthesia and a peripheral nerve block to aid with postoperative pain. Intraoperative arthroscopic evaluation was consistent with earlier imaging, displaying a tear of the upper border of the subscapularis, a retracted tear of the entire supraspinatus into the infraspinatus, and a chronically torn biceps tendon. The upper border of the subscapularis was repaired using one suture anchor, and a large subacromial balloon spacer was inserted into the subacromial space and filled with saline according to guidelines (Fig. 3). The patient tolerated the procedure well, was fitted with a sling, and was instructed to wear the sling until his follow-up appointment in 4–6 weeks. His rehabilitation and physical therapy progressed well and were uneventful. Approximately 3 months postoperative, on physical examination, the patient demonstrated forward elevation to 155°, abduction to 90°, and external rotation to 30°. During the 1-year follow-up, the patient demonstrated forward elevation to 170° (Fig. 4), reported a score of 0 on the VAS scale, and reported a 95 ASES shoulder score. While no confirmatory radiographic imaging was conducted at the 1-year mark, we predicted full resorption of the balloon with minimal to no change in acromiohumeral distance.

DISCUSSION

This case provides insights into the indications, efficacy, and mid-term benefits of the subacromial balloon spacer in patients with MIRCT. After completion of the procedure, the patient experienced improvement in pain and function, as shown by his clinical results and his self-reported outcome scores. The subacromial balloon spacer creates and sustains a gap between the acromion and humerus to reduce pain while improving function [7]. Biomechanical studies have shown that the spacer improves glenohumeral joint mechanics and restores the typical humeral head position [7].

The positive impacts of the balloon in patients with MIRCT have been demonstrated in multiple studies. Yallapragada et al. [8] found over an average follow-up of 12.6 months that patients improved range of motion in anterior elevation, abduction, and external rotation . They also reported improved Oxford Shoulder and Constant scores [8]. Similarly, another prospective study with a 3-year follow-up discovered that patients experienced significant and sustained pain reductions on the numerical rating scale [9]. A retrospective comparative study by Bilsel et al. [10] found that a greater proportion of patients who underwent arthroscopic partial cuff repair with implantation of the subacromial balloon spacer compared to partial cuff repair alone achieved substantial clinical benefit on the ASES and an acceptable symptomatic state based on the VAS, ASES, and Constant scores. Greater improvements were also noted in terms of range of motion and acromiohumeral distance [10]. Systematic reviews by Kunz et al. [11], Stewart et al. [12], and Daher et al. [4] further corroborated these findings, showing significant patient satisfaction and symptomatic improvements across metrics such as the Oxford, ASES, and Constant scores. In this case, our patient fit the subacromial balloon spacer procedure indications, demonstrating minimal osteoarthritis, a relatively intact subscapularis, no active joint infection, adequate forward elevation, and an irreparably torn supraspinatus tendon [2,13].

The unique features of the subacromial balloon spacer including minimal invasiveness, rapid rehabilitation, and strong evidence of reduced postoperative pain matched the needs of our patient [11]. This case exemplifies the benefits of the subacromial

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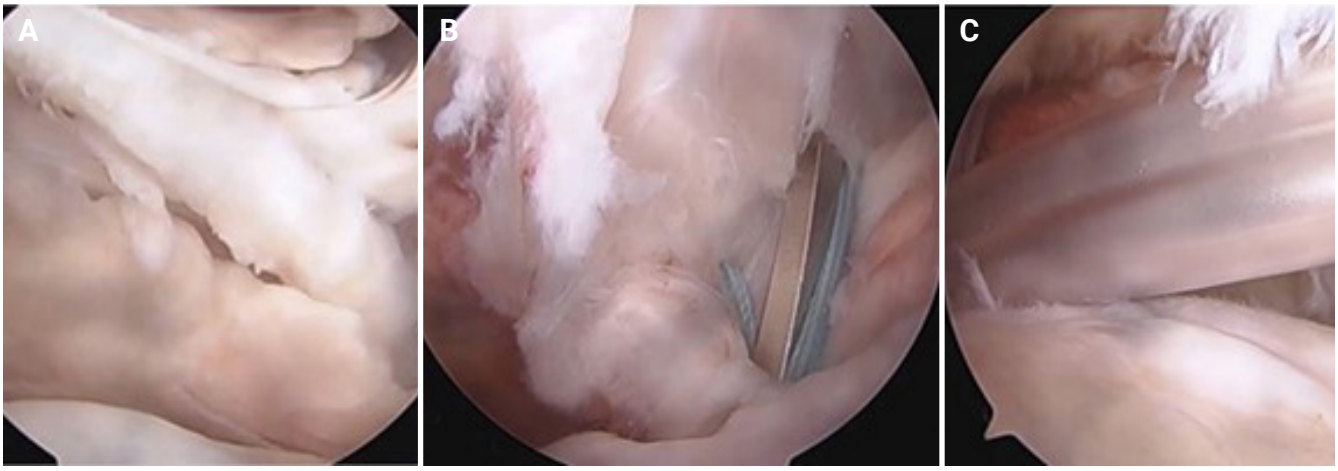

Fig. 3. Arthroscopic photos of 60-year-old male showing the upper border subscapularis tear (A) and its repair (B, posterior view). The introduction of the balloon occurs through the posterior portal (C, lateral view).

Fig. 4. Range of motion at the 1 year mark shows forward elevation of 170° (A), abduction of 100° (B), and external rotation of around 70° (C) in both arms (60-year-old male).

balloon spacer in patients with special needs or medical comorbidities: a rapid regain of activity; and a quick return to the previous quality of life [13]. Our paraplegic patient gained increased use of his arm (and was able to return to activities of daily life) faster than he would have if he had undergone a heroic repair, tendon transfer, or even a shoulder replacement. The balloon spacer is biodegradable and self-absorbed in 12 months. In addition, multiple studies (including a multicenter randomized controlled trial by Verma et al. [6]) indicated superior benefits in function and pain, with up to 2 years of follow-up, compared to alternative treatment management [13]. One report even described a patient who underwent subacromial balloon placement for an MIRCT and reported benefits for up to 5 years postop. After his shoulder symptoms re-emerged, the patient opted for a revision subacromial balloon procedure, demonstrating his satisfaction with the device and its therapeutic effects [14]. Other more intensive surgical interventions (including complete or partial repair, patch augmentation, superior capsular reconstruction, muscle/tendon transfer, and reverse total shoulder arthroplasty) would have resulted in longer operative and recovery times [6,15]. An extended period of disability would have had significant quality-of-life implications for our patient, possibly potentiating mental and physical fatigue [15]. Hence, the subacromial balloon spacer, with its rapid recovery and pain alleviation, was considered the best treatment for this case. As stated, it is of particular importance to ensure indications when consider-

ing the subacromial balloon spacer for prospective patients and to employ a case-by-case basis for patient care. It is also necessary to understand the role of the balloon and to educate patients regarding rehabilitation expectations. Aside from the spacer effect it produces, the balloon acts primarily as a rehabilitation accelerator. The pain relief provided by the balloon postoperatively and the alterations it imposes on adjacent musculature of the joint allow fast and efficient rehabilitation. This allows long-lasting effects that can extend beyond balloon resorption in the joint. Finally, while the subacromial balloon has notable benefits, restoring anatomy should always be the top surgical priority. Hence, in paraplegic patients with reparable rotator cuff tears, the subacromial balloon spacer would not be the recommended choice of treatment.

The subacromial balloon spacer was a suitable treatment option for a paraplegic MIRCT patient. It is important to highlight the applications of the subacromial balloon, especially in patients with physical limitations that can impact their recovery, rehabilitation, and daily life activities. Although the nature of the procedure is minimally invasive and low rates of complications have been demonstrated, proper patient education is key. Choosing the right patient for the procedure involves a thorough assessment of patient goals and a strict adherence to the clinical indications. Our patient underwent a successful procedure with an uneventful recovery and made steady progress in rehabilitation.

NOTES

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Conflict of interest

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Data availability

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