Subscapularis and deltid preserving anterior approach for reverse shoulder arthroplasty

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ABSTRACT

Hypothesis: We hypothesize that performing a RSA using an anterior approach without cutting the subscapularis tendon and the deltid muscle could provide patients with superior short-term clinical outcomes and immediate active range of motion (ROM) without immobilization.

Methods: Between August 2013 and June 2015, all patients who had a primary RSA were considered potentially eligible for inclusion in this prospective study.

Results: No immediate intra- or postoperative complications were noted. A statistically significant improvement of VAS (from 6.7 to 1; P < 0.01), SANE (from 34 to 80; P < 0.01), and elevation (from 103° to 128°; P = 0.02) was observed. In some cases, patients who had pseudoparalysis preoperative were able to achieve full anterior elevation few days after the operation.

Discussion: Using a subscapularis and deltid preserving anterior approach is an option for patients requiring RSA. Leaving this tendon intact and preserving the deltid minimize the need for immediate postoperative immobilization and allow for faster recovery of shoulder ROM, without risking the concern of humeral anterior dislocation. Overall duration of hospital stay as well as length of postoperative physical therapy may be minimized, with substantial long-term economic gain. Longer follow-up and comparison with standard approaches is necessary in the future.

Level of evidence of the study: Level IV, case series with no comparative group.

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1. Introduction

In recent years, reverse shoulder arthroplasty (RSA) has become an operative treatment option for various shoulder conditions. The deltopectoral and transdeltoid approaches are the most common, each with their advantages and disadvantages. The deltopectoral approach allows for increased visibility and accessibility of the humerus, better positioning of the glenoid component, reduced loosening and scapular notching [1]. However, it necessitates detaching and subsequent repairing of the subscapularis tendon that seems important for postoperative forward flexion [2] and stability [3–5]. Postoperatively, even if the repaired tendon is protected for four to six weeks, signs of decreased function and partial defects are observed in more than 25% of the patients [6]. Moreover, as this approach is associated with risk of anterior dislocation, surgeons can be susceptible to overtension the deltid [7] and put the patient at risk for a neurological lesion [8].

An alternative technique that surgeons have developed to avoid cutting the subscapularis tendon is to perform the surgery using a superior approach [9]. While this technique has shown good results and improved range of motion (ROM), it does involve the splitting of the deltid muscle [7], which is the key future muscle for the shoulder. This approach has the advantage of obtaining better postoperative stability, in particular, because the anterior structures including ligament complex are preserved. Moreover, the subscapularis muscle, which has been shown to play an important role in forward elevation, is also preserved [2]. Theoretically, if one tendon must be detached, it should be the supraspinatus as its intra- and postoperative lengthening (up to 2 cm) is not physiological compared to other tendons of the rotator cuff [10].

Subscapular-sparing approaches for anatomic total shoulder replacements are already being used [11,12]. Early results show...
that patients have favorable clinical outcomes without performing a tenotomy of the subscapularis tendon [13]. We hypothesize that performing a RSA using an anterior approach without cutting the subscapularis tendon and the deltoid muscle could provide patients with superior short-term clinical outcomes and immediate active ROM without immobilization.

The aim of this study was to present the indications, technique and preliminary results of this new approach.

2. Materials and methods

2.1. Patient selection

Between August 2013 and June 2015, all patients who had a primary RSA performed by the senior author (A.L.) with postoperative follow-up of more than 3 months were considered potentially eligible for inclusion in this retrospective review of prospectively collected data. Inclusion criteria were all primary RSA with preor intraoperative intact subscapularis. We excluded patients with previous infection and revision surgery. The study protocol was approved by the hospital ethics committee (AMG: 12–26), and all patients gave informed written consent. Thirty-four patients met inclusion criteria. Among them, 11 were excluded because subscapularis tendon was damaged, 2 for shoulder malignancy, and 1 for previous glenohumeral septic arthritis. Thus, there were 20 patients (20 prostheses) for the final analysis at a mean follow-up of 10 ± 7 months (range, 3 to 26 months). There were 6 men and 14 women, with mean age of 78 ± 7.8 years (range, 60 to 87 years). The dominant side was involved in 45% of cases. The indications for RSA were Hamada 1 or 2 rotator cuff arthropathy in 11 cases, Hamada 3 to 5 rotator cuff arthropathy in 5 cases, and malunion in 4 cases.

2.2. Surgical technique

After induction of anesthesia, the patient was placed in the beach chair position. The surgical technique was standardized as the deltopectoral approach [14]. After confirmation of an intact subscapularis (Fig. 1), deep dissection was carried superiorly, through the supraspinatus tear. The arm was held in extension and adduction and two long wide tip Hohmann retractors were placed around the humeral head, allowing clear exposure of the proximal humerus (Fig. 2). The humerus was prepared to accommodate a short curved anatomical 132.5° stem (Aequalis Ascend Flex; Tornier Montbonnot, France) at 20° of retroversion (Fig. 3) [15–17]. A retroversion guide was placed, the cut was marked on the humeral head with an electrocoagulation. Following humeral head removal, preparation of the humeral shaft is completed using only compactors.

![Fig. 1](image1.png) Intraoperative view of a left shoulder. The superior long wide tip Hohmann is placed on the coracoid process. Posterior Browne-Deltoid and medial Langenbeck retractors retract the deltoid and the conjoint tendon, respectively. This allowed confirmation of an intact subscapularis.

![Fig. 2](image2.png) Lateral view of a left shoulder. The arm being held in extension and adduction, two long wide tip Hohmann retractors are placed around the humeral head, retracting the subscapularis and the remnant posterior rotator cuff and allowing clear exposure of the proximal humerus.

![Fig. 3](image3.png) A 20° retroversion guide is placed and the cut is marked on the humeral head with an electrocoagulation.

![Fig. 4](image4.png) Lateral view of a left shoulder. Following humeral head removal, preparation of the humeral shaft is completed using only compactors.
A stem having an inclination of 132.5° was combined with a 12.5° angled polyethylene insert to achieve a final 145° onlay construct. This stem is modular and can be combined with either a concentric or eccentric (1.5 mm or 3.5 mm) onlay humeral tray. While exposing the glenoid, tight inferior glenohumeral ligaments may prevent proper shoulder mobility, so these were released in order to provide increased glenohumeral range of motion as well as improving the surgical visualization. The scapula was prepared according to the recommended surgical technique to obtain neutral inclination and version. Fig. 5. Lateral view of a left shoulder. An inferior forked retractor is used to maintain visualization and accessibility of the glenoid. The scapula is prepared according to the recommended surgical technique to obtain neutral inclination and version.

2.5. Clinical evaluation

Visual analogue scale for pain (VAS), single assessment numeric evaluation for shoulder (SANE), and ranges of motion were evaluated preoperatively and 3 months after surgery.

2.6. Statistical analysis

Statistical analysis was performed with R v3.1.2 Portable (Free Software Foundation Inc, Vienna, Austria). Basic descriptive statistics (mean, standard deviation and percentages) were used for baseline clinical parameters and functional evaluation (VAS, SANE and ROM). Functional evaluation before and after prosthesis implantation was compared with two-tailed paired Student T test for all parameters, except internal rotation that was compared with two-tailed unpaired Wilcoxon rank test. Unpaired analysis was chosen because of the high rate of missing values for internal rotation.

3. Results

No immediate intra- or postoperative complications were noted. Three months after surgery, we observed a statistically significant improvement of VAS (from 6.7 to 1; \( P < .001 \)), SANE (from 34 to 80; \( P < .001 \)), and elevation (from 103° to 128°; \( P = .02 \)). No significant difference was observed for external rotation (from 18° to 16°; \( P = .10 \)) and internal rotation (from T11-L2 to L5-L3; \( P = .30 \)). In 6 cases, patients who had pseudoparalysis preoperative were able to achieve full anterior elevation few days after the operation, as illustrated by the movie 1.

4. Discussion

The previously described subscapular-sparing approach for anatomic total shoulder arthroplasties allows for accelerated postoperative therapy and rehabilitation by maintaining the integrity of the subscapular tendon, and immediate active ROM [11,12]. Standard techniques for RSA typically involved cutting muscles or tendons in order to maximize visualization or accessibility to the glenohumeral joint [9,14]. The present article introduces a novel, less-invasive technique for performing RSA in patients with an intact subscapularis muscle that does not require violating the native tendon. It is this detachment and the subsequent repair of the subscapularis that necessitates postoperative immobilization and restriction in initial active motion [12]. Despite being technically more demanding, the senior author is now using this approach for all patients that have an intact subscapularis preoperatively.
Effectively, no specific complication has been noted and theoretical benefits of this approach include increased anatomic stability due to the intact subscapularis muscle with lower rate of dislocation, and lessened postoperative stiffness. As early as 3 months after surgery, we were able to observe substantial benefits in pain reduction and functional recovery. By allowing patients to immediately begin working on their active ROM, overall duration of hospital stay as well as length of physical therapy following the procedure may be minimized or avoided entirely, with substantial long term economic gain.

4.1. Limitations

The limitation of this technique is the technical difficulty of the exposure. The humeral head exposure, glenoid exposure as well as removal of inferior humeral osteophytes are more difficult compared to the conventional deltopectoral approach. The authors do not recommend using 42 mm or bony or metallic increased-offset RSA with this technique, as the additional laterization makes humeral exposure more difficult. This also indicates that the surgeon must make a free-hand cut of the humeral head, which may lead to re-cutting. Moreover, similar to the recent reports of subscapularis-sparing approach for total anatomic shoulder arthroplasty [13], long term clinical and radiological follow-up are required to validate the short-term results.

5. Conclusion

Using a subscapularis and deltoid preserving anterior approach is an option for patients requiring RSA. Leaving this tendon intact and preserving the deltoid minimizes the need for immediate post-operative immobilization and rehabilitation, and leaves the patient with greater shoulder ROM faster, without increasing the occurrence of humeral anterior dislocation. Overall duration of hospital stay as well as length of physical therapy following the procedure may be minimized, with substantial long term economic gain. Longer follow-up and comparison with standard approaches is necessary in the future.

Ethical approval

Ethical Committee Approval: Ethical committee approval was received from Association des Médecins du Canton de Genève et Société Médicale; protocol 12-26; November 12, 2012

Disclosure of interest

The authors declare that they have no competing interest.

Appendix A. Supplementary data

Supplementary data associated with this article can be found, in the online version, at http://dx.doi.org/10.1016/j.otrsr.2016.06.005.

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