Video Article

Reverse Total Shoulder Arthroplasty

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Abstract

Reverse total shoulder arthroplasty was initially approved for use in rotator cuff arthropathy and well as chronic pseudoparalysis without arthritis in patients who were not appropriate for tendon transfer reconstructions. Traditional surgical options for these patients were limited and functional results were sub-optimal and at times catastrophic. The use of reverse shoulder arthroplasty has been found to effectively restore these patients function and relieve symptoms associated with their disease. The procedure can be done through two approaches, the deltopectoral or the superolateral. Complication rates associated with the use of the prosthesis have ranged from 8-60% with more recent reports trending lower as experienced is gained. Salvage options for a failed reverse shoulder prosthesis are limited and often have significant associated disability. Indications for the use of this prosthesis continue to be evaluated including its use for revision arthroplasty, proximal humeral fracture and tumor. Careful patient selection is essential because of the significant risks associated with the procedure.

Protocol

1. Introduction:

The glenohumeral joint is a complex articulation. It has minimal bony constraints and relies on a complex balance of tensions between supporting soft tissues for normal function. This essential relationship allows the shoulder to have a large functional range of motion. When this balance is uncoupled, varying degrees of dysfunction occur. A loss of function of the rotator cuff, such as a large tear, can cause superior translation of the humeral head on the glenoid. This changes the center of rotation of the glenohumeral joint and subsequently, the tension and moment arms of the remaining musculature, decreasing function. Additionally, the changes in position of the humeral head and subsequent changes in contact pressures can lead to progressive damage to the articular cartilage and resulting painful arthritis. The use of standard shoulder arthroplasty in these cases has provided sub-optimal and sometimes catastrophic results.

Reverse total shoulder arthroplasty (RTSA) provides a solution for these complex problems providing significant improvements in pain, range of motion and function. The RTSA design medializes the center of rotation and brings the humerus to a more inferior position. This change in biomechanics restores tension in the deltoid muscle belly and the functional lever arm, improving the deltoids ability to move the arm in space. Additionally, the painful arthritic cartilage is removed with the process, significantly improving the patient's pain.

2. Case Presentation:

This patient is a 71 year-old, healthy female with a history of a "mini-open" rotator cuff fifteen years prior. Over the past year, she has experienced increased pain and weakness in her shoulder with an associated decrease in his range of motion. Her active abduction was 30°, active forward flexion was 40°, active external rotation was 10° and active internal rotation to her gluteus. Her modified bear-hug test demonstrated minimal weakness in the subscapularis tendon and she had a negative horn-blower's sign and negative lag test. Her passive range of motion showed 75° of forward flexion with a positive drop arm test. The neurovascular exam was otherwise normal and there were no signs of infection associated with the previous rotator cuff repair.

3. Treatment/diagnostic Procedure:

Initial radiographic evaluation of this patient should include a scapular outlet view, a Grashey view, and an axillary view. Depending on the appearance of the glenoid, further study with a CT scan may be need to evaluate the amount of bony erosion, presence of dysplasia and available bone stock. In our patient, initial radiographs exhibited moderate degenerative changes with superior migration of the humerus evidenced by a decreased acromio-humeral distance. There was not significant bony loss associated with the glenoid. The combination of the patient's history, physical examination and radiographic analysis are consistent with rotator cuff arthropathy with pseudoparalysis. Further diagnostic studies would not be indicated in this patient.

Prior to consideration of any major arthroplasty in any patient a course of conservative measures should be undertaken. These should include medical treatment with anti-inflammatory medications, corticosteroid injections into the communicating subacromial and intracapsular spaces and physical therapy for strengthening and range of motion. After this course of treatment, the patient must be evaluated for their pain, current function, realistic functional needs and desires, quality of life and associated comorbidities. If the risks associated with the procedure are determined to be acceptable for the patients expected benefit, the follow technique for reverse total shoulder arthroplasty can be used.

4. Reverse Total Shoulder Arthroplasty

1. The patient is placed into the beachchair position and the arm is prepped and draped free in standard fashion.
2. The standard deltopectoral incision and approach is done exposing the rotator cuff and subacromial space. Blunt dissection is used to free the inferior surface deltoid from any adhesions to the underlying tissues.

3. The rotator cuff is examined for tear and evaluated for the possibility of repair. If the tissues appear to be repairable, repair and conventional arthroplasty can be considered. Otherwise, any useless cuff can be excised
4. The axillary nerve is identified and protected The subscapularis tendon is identified and released from the lesser tuberosity and the tendon is freed proximally from any adhesions without releasing the origin
5. The inferior capsule is released from the proximal humerus and the humerus is externally rotated dislocating the humeral head from the joint
6. The medullary canal is located using the entry awl which is the replaced by the humeral head resection guide and the proximal humeral cut is made at 0° of version. The intramedullary guide will need to be removed to complete the cut
7. Metaphyseal and diaphyseal reaming is the done at the size appropriate to the patient's anatomy
8. Trial components are then assembled and placed into the humerus at the appropriate version with a cut protector for glenoid preparation
9. The labrum is excised, the anterior and inferior capsule are released from the glenoid and retractors are placed exposing the glenoid
10. The drill guide is the used to place the central drill hole using the 6mm drill
11. The glenoid is reamed in preparation for the base plate creating a peripheral groove
12. The central hole is then enlarged to 7.5mm for the 8mm central peg and the base plate is placed, impacting flush with the reamed glenoid
13. Screws are then placed into the base plate with trans cortical fixation. The anterior and posterior screws have a 30° arc for placement and are standard cortical screws. The superior and inferior screws are fixed locking screws with a 30° arc in the superior and inferior planes respectively
14. The glenosphere is then impacted onto the base plate and the central screw is tightened securing the glenosphere
15. A trial liner is then placed into the trial humeral stem and the shoulder is reduced. Examination for ROM and stability is then done and adjustments made as necessary
16. Trial implants are then removed from the humerus, the final components are assembled and inserted and impacted into the humerus in the appropriate version
17. The shoulder is reduced and an final examination of ROM and stability is done
18. The subscapularis tendon is then repaired to the proximal humerus and the wound is closed in standard fashion

5. Outcomes:

At 6-months follow-up this patient ranked her post-operative pain as a zero out of ten on the Visual Analog Scale. Her active range of motion included forward flexion to 140°, active external rotation of 25° and internal rotation to her gluteus. This patient had no intra-operative or post-operative complications at last follow-up.

6. Conclusion:

In the author's experience, RTSA provides a patient with rotator cuff arthropathy with reliable pain relief and improvements in range of motion and functional outcomes. This patient was satisfied with the outcomes of this surgery.

Discussion

The use of RTSA for rotator cuff arthropathy provides significant improvements in pain, range of motion and functional outcomes scores. Overall patient satisfaction has ranged from 80-95% in the current literature. Like all procedures, RTSA is not without risk. Initial reports of complication were as high as 60%. As techniques have improved the complication rates have decreased.

Disclosures

No conflicts of interest declared.

Acknowledgements

This procedure was performed using the Aequalis Reversed Total Shoulder Prosthesis by Tornier Inc. Please refer to Tornier Inc. for more information: http://www.tornier-us.com/.

References

1. Boileau, P., Sinnerton, R.J., Choinard, C., & Walch, G. Arthroplasty of the Shoulder. *J Bone Joint Surgery Br.* **88**, 562-575 (2006).
2. Boileau, P., Watkinson, D., Hatzidakis, A.M., & Hovorka, I. Neer Award 2005: The Grammont reverse shoulder prosthesis:results in cuff tear arthritis, fracture sequelae, and revision arthroplasty. *J Shoulder Elbow Surg.* **15**, 527-540 (2006).
3. Boileau, P., Watkinson, D.J., Hatzidakis, A.M., & Balg, F. Grammont reverse prosthesis: design, rationale, and biomechanics. *J Shoulder Elbow Surg.* **14**, 147S-161S (2005).
4. Cuff, D., Pupello, D., Virani, N., Levy, J., & Frankle, M. Reverse shoulder arthroplasty for the treatment of rotator cuff deficiency. *J Bone Joint Surg Am.* **90**, 1244-1251 (2008).
5. Edwards, T.B., Boulahia, A., Kempf, J.F., Boileau, P., Nemoz, C., & Walch, G. The influence of rotator cuff disease on the results of shoulder arthroplasty for primary osteoarthritis: results of a multicenter study. *J Bone Joint Surg Am.* **84**, 2240-2248 (2002).
6. Frankle, M., Siegal, S., Pupelo, D., Saleem, A., Mighell, M., & Vasey, M. There reverse shoulder prosthesis for glenohumeral arthritis associated with severe rotator cuff deficiency. A minimum two-year follow-up study of sixty patients. *J Bone Joint Surg Am.* **87**, 1697-1705 (2005).
7. Guery, J., Favard, L., Sirveaux, F., Oudet, D., Mole, D., & Walch, G. Reverse total shoulder arthroplasty. Survivorship analysis of eighty replacements followed for five to ten years. *J Bone Joint Surg Am.* **88**, 1742-1747 (2006).
8. Martin, T.G., & Lanotti, J.P. Reverse total shoulder arthroplasty for acute fractures and failed management after proximal humerus fractures. *Orthop Clin North Am.* **39**, 451-457 (2008).
9. Wall, B., Nove-Josserand, L., O'Conner, D.P., Edwards, T.B., & Walch, G. Reverse total shoulder arthroplasty: a review of results according to etiology. *J Bone Joint Surg Am.* **89**, 1476-1485 (2007).
10. Werner, C.M., Steinmann, P.A., Gilbart, M., & Gerber, C. Treatment of painful pseudoparesis due to irreparable rotator cuff dysfunction with the delta III reverse-ball-and-socket total shoulder prosthesis. *J Bone Joint Surg Am.* **87**, 1476-1486 (2005).

