Right Total Shoulder Replacement with Reverse Delta Prosthesis, Complicated by a Brachial Plexus Injury

Amin Madani, Hon. BSc. (Meds 2011), Dr. Richard M. Holtby, MD, MB, BS, FRCSC

Abstract/Introduction

When conventional total shoulder replacements are not considered to be an effective surgical management to improve patients’ quality of life, a reverse total shoulder arthroplasty is considered. The reverse total shoulder replacement is where a prosthesis with a convex articular surface is fixed to the lateral aspect of the glenoid, and a prosthesis with a concave articular surface is fixed to the proximal aspect of the humerus (Figure 1).\(^1\) This procedure was initially indicated for patients with rotator cuff arthropathy, for whom a traditional total shoulder replacement has a relatively high rate of failure.\(^1,2\)

Today, they are also indicated for patients with failed arthroplasty, or for selected patients with shoulder fractures whose prosthesis has failed.\(^3\) Despite its high success rate, this procedure is also prone to complications.\(^1,2,3,4\) It is estimated that 1-4% of shoulder arthroplasty cases produce neurologic complications.\(^1,2\) In this type of patient who has a history of rotator cuff arthropathy and a full-thickness rotator cuff tear that was repaired and subsequently degenerated, it is shown that a total shoulder arthroplasty with a reverse prosthesis can be used to provide improved function and quality of life. It is furthermore shown that patient recovery and functional outcome can be complicated by radial nerve palsy.

Case

Mrs. W is a 74-year-old woman seen in the clinic for assessment of her right shoulder. She has a thirteen-year history of pain, where she was diagnosed with a rotator cuff tear and had surgical repair nine years ago. Although she felt this helped significantly, there was gradual increase in pain and weakness of the shoulder. Examination showed that she was able to get her arm to 150° of flexion with some catching and pain. External rotation was 45° with internal rotation to the thoracolumbar junction. She had pain, crepitus coming from the subacromial space, and significant weakness of forward flexion. X-rays were also done, which showed degenerative changes at the glenohumeral joint with marked superior migration of the humeral head with respect to the glenoid fossa, consistent with rotator cuff arthropathy.
Rotator cuff arthropathy is characterized by irreparable loss of the rotator cuff, severe osteoarthritis of the glenohumeral joint, pain, and minimal function of the shoulder.\textsuperscript{1,2,3} It was felt that a reverse prosthesis would not only effectively help her pain and provide more function, but unlike the traditional shoulder replacements, would resist superior translation of the humeral head due to a lack of stability of the joint from degeneration of the supraspinatus rotator cuff muscle.

### Surgical Technique

The shoulders were examined with the patient under general anaesthesia, where the range of motion of the right side was noted to be sub-optimal (Table 1).

<table>
<thead>
<tr>
<th>Table 1. Pre-Operative Range of Motion of the Right Shoulder</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Forward Flexion</strong></td>
</tr>
<tr>
<td><strong>Abduction</strong></td>
</tr>
<tr>
<td><strong>External Rotation (with 0° abduction)</strong></td>
</tr>
<tr>
<td><strong>External Rotation (with 90° abduction)</strong></td>
</tr>
<tr>
<td><strong>Internal Rotation (with 90° abduction)</strong></td>
</tr>
</tbody>
</table>

With the patient in the beach position, draping was done to expose the shoulder with the arm free, allowing the surgeon and his assistants to manoeuvre the arm in different positions. The incision was a saber-cut incision, which is made 4 cm from the superior border of the anterior and middle deltoid fibers, passing just above the acromioclavicular joint, extending 5 cm inferiorly on the posterior side and creating a reverse U-shape.\textsuperscript{1,2} A deep deltoid incision was subsequently done to get access to the joint. Operative findings included a massive rotator cuff tear of the supraspinatus estimated at 5 cm medial to lateral and 5 cm anterior to posterior, bone erosion and eburnation of bone on the articular surface of the humeral head and glenoid consistent with osteoarthritis, degeneration of subscapularis and teres minor muscles, and rupture of the long head of the biceps tendon.

Initial neck cut was made removing the head component at the surgical neck of the humerus, providing exposure of the glenoid with a fork retractor. The capsule was then released around the articular margins, and the labrum and biceps tendon remnant removed. Once the centre of the glenoid was demarcated, a drill hole was made into the glenoid medullary cavity. This allowed the insertion of the glenosphere reamer and metaglene (glenoid components of the prosthesis), which were hammered into place, and fixated with four screws.

After drilling a canal for the humeral component’s stem, trial humeral components were inserted to determine the correct size of the prosthesis. After appropriate trial reductions, the canal was prepared for irrigation, filled with cement, and the humeral stem cemented into place. Finally, the definitive glenosphere and humeral polyethylene components were inserted, and the joint reduced, which showed stability with good range of motion. After a routine closure, the patient returned to the recovery room with a simple blue sling and in satisfactory condition. Ancef was given as prophylactic antibiotic with two doses given intra-operatively.
Post-Operative Results and Discussion

Specimen sent with fragments of bone and soft tissues from the joint, as well as post-operative x-rays revealed no apparent complications (Figure 2). However, the day following surgery she was noted to have a right finger and wrist drop with numbness in the posterior arm, despite regaining significant range of shoulder movement. Examination revealed absent right brachioradialis and triceps reflex with normal biceps reflex. There was marked weakness of right shoulder external rotation and abduction, almost no triceps function, no visible brachioradialis function and only slight wrist extension with total finger drop. Sensation to pin was also reduced in the posterior hand, forearm and upper arm.

Electromyography workup showed normal right median and ulnar nerve conduction. The radial sensory response was absent and lateral cutaneous nerve of forearm normal. Needle electrode examination revealed marked and moderate denervations of the infraspinatus and deltoid muscles, respectively, and severe denervation throughout the radial nerve distribution. Although musculocutaneous, median and ulnar nerve function were normal, there was partial denervation in suprascapular, axillary and mostly radial nerve distribution. As there were some surviving neurons, the nerves appeared to be in continuity but with axonal deterioration. It is likely that the lesion was at the border of the teres muscle or more proximally in the superior trunk. With severe axonal loss in the radial nerve distribution, recovery proceeded slowly over a number of months with appropriate physiotherapy, and the patient eventually regained brachial plexus function with total reinnervation.

Acknowledgements

Amin Madani would like to thank Dr. Richard M. Holtby, Orthopaedic Surgeon at Sunnybrook Health Sciences Centre, Orthopaedic & Arthritic Centre, and Assistant Professor of Surgery at the University of Toronto, for his assistance throughout the case study.

References


5. Norris T, Iannotti J. A prospective outcome study comparing humeral head replacement and total shoulder replacement for primary osteoarthritis of the shoulder. Presented at the 12th Opening Meeting of the American Shoulder and Elbow Surgeons; Atlanta, Ga; February 1996.


Inspiration
Location: Sunnybrook Health Sciences Centre, Orthopaedic & Arthritic Centre in Toronto, ON.
Program: Non-credit elective.