Reverse Total Shoulder Replacement

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The reverse total shoulder is a relatively new type of shoulder arthroplasty specifically developed for patients that have a combination of both arthritis and loss of rotator cuff function, also known as rotator cuff arthropathy. Prior to the advent of this prosthesis a good solution was not available for this debilitating shoulder problem. Historically patients with this problem were treated with various nonoperative and operative modalities that did not completely address their underlying problem. Often times, treatment was able to achieve some pain relief but did not address the loss of the functional use of the shoulder. The reverse shoulder replacement offers a solution to a problem that prior to its development, was not available. This replacement allows good pain relief but also improves patient's functionality by allowing restoration of a patient's ability to raise their arm. Patients may be candidates for this procedure when they have a painful rotator cuff tear that is no longer repairable and have significant loss of shoulder function. The replacement has also been successfully used in severe fractures of the shoulder in older patients, where reconstruction utilizing plates and screws is not possible.

The Rotator Cuff

The rotator cuff is vitally important for normal shoulder function and is comprised of four different muscles. The muscles include the supraspinatus, infraspinatus, teres minor and subscapularis. These muscles contribute to two major functions in the shoulder, one is compressing the humeral head on the socket, keeping the joint centered, and the second involves controlling shoulder positioning. The rotator cuff controls the forward elevation as well as internal and external rotation of the shoulder. The loss of rotator cuff function results in weakness, pain, development of arthritis and the inability to functionally use the shoulder. When the function of the rotator cuff is severely compromised the patient may develop a pseudoparalysis, which is an inability of a patient to lift their arm up to 90 degrees.

Rotator cuff tears occur in both young and old patients but are increasingly common as patients become older. Younger patients often report a history of a traumatic event but in older patients rotator cuff tears can occur without an inciting traumatic event. Recent studies have demonstrated an increasing prevalence of rotator cuff tears in patients over the age of 55 even in the absence of trauma. Patients frequently notice progressive shoulder pain and weakness. This often effects their sleep and use of the shoulder.

Patient Presentation

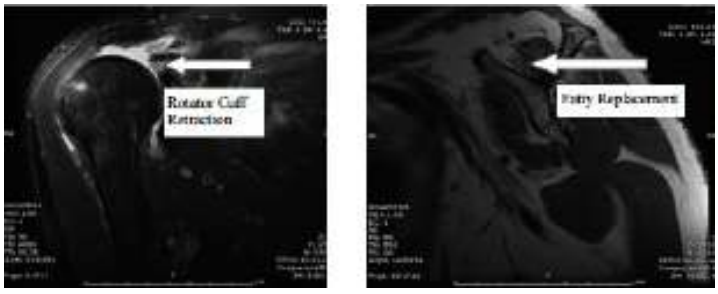
The typical patient presents with a long history of pain as well as a progressive impairment of their shoulder function. Patients are frequently able to perform activities at waist height but find it diffcult to impossible to perform many activities above shoulder height.

Radiographic Examination

While the rotator cuff cannot be directly visualized with plain radiographs, secondary changes can be seen. These changes include loss of the normal contour of the greater tuberosity, superior migration of the humeral head, gapping of the glenohumeral joint, and wearing of the acromion from the underlying humeral head.

The image on the left demonstrates a normal shoulder x-ray with the humeral head centered on the glenoid. The image on the right demonstrates superior migration of the humeral head. It has developed arthritis within the glenohumeral joint. In addition, the humeral head can be seen abrading the undersurface of the acromion.

MRI's of the shoulder frequently demonstrate a massive rotator cuff tear usually involving three or more tendons. MRI's also commonly demonstrate retraction of the rotator cuff to the level of the socket as well as significant fatty infiltration of the rotator cuff musculature. Fatty infiltration is a common occurrence in chronic rotator cuff tears and is the process where muscle transforms into fat. Unfortunately, this change is not reversible making diagnosis of acute rotator cuff tears that much more important.



Treatment of Rotator Cuff Arthropathy

Treatment of this condition depends on many factors including a patient's functional level, functional disability, other medical comorbidities, and expectations. Treatments can include both operative and non-operative modalities. The non-operative modalities include physical therapy, pain management, corticosteroid injections, and activity modification. Operative intervention has historically been treated with a humeral head replacement with an enlarged head. This surgery

resulted in satisfactory outcomes from patients in regard to some pain relief but offered little in improvement in overall shoulder function. This has led to the design and implementation of the reverse total shoulder replacement.

Reverse Total Shoulder Implant Design

The reverse total shoulder was FDA improved in 2004 in the United States but has been available for use in Europe for over 15 years. It provides both pain relief and improvement of shoulder function for patients that have a complete loss of their rotator cuff function. This loss of rotator cuff function often results in significant pain as well as an inability to raise one's shoulder over 90 degrees. The reverse prosthesis works by exchanging the position of the ball and socket portions of the shoulder joint. This design improves two important biomechanical properties of the shoulder. The replacement centralizes and distally translates the center of rotation of the shoulder thereby improving the power that the deltoid muscle can provide and allowing patients to lift their arms again.

The image on the left demonstrates a reverse shoulder replacement, while the image on the right demonstrates an anatomic shoulder replacement.

Post-Operative Protocol

The reverse total shoulder procedure requires surgery at the hospital and typically involves a two-day hospitalization. The procedure typically takes two hours to complete and has a low complication rate in primary surgeries. The immediate post-operative regimen includes sling use for the first two weeks followed by night sling use for two weeks. This allows rapid mobilization and allows the patient to achieve early functional recovery.

Reverse in Fracture Surgery

The reverse shoulder replacement has also been used successfully in older patients with severe humerus fractures. Before the advent of the reverse shoulder replacement patients were treated with a hemi-replacement (only the humeral head is replaced). While good pain relief was achieved in these patient's, this type of replacement required healing of the rotator cuff to the prosthesis in order for it to function properly. Unfortunately, the healing of the rotator cuff is unpredictable in this scenario and frequently leads to significant functional impairment in older

patients. The reverse shoulder prosthesis allows reconstruction of severe fractures while improving the functional outcome of the patients that undergo the procedure. The rotator cuff muscles are repaired in a similar technique as used in the hemi-replacement but unlike the hemi-replacement rotator cuff healing is not necessary to regain ability to perform overhead activities.

Summary

The reverse total shoulder is a good option for certain patients with arthritis and underlying rotator cuff tears as well as severe fractures. This design allows for a better functional outcome in comparison to historical treatment options. Short term studies have demonstrated reliable functional recovery as well as reduction in pain. This surgery has provided many patients with difficult problems a good solution, and we await long term studies to further validate these findings.