J Shoulder Elbow Surg (2015) 24, 601-605

ELSEVIER

Journal of Shoulder and Elbow Surgery

www.elsevier.com/locate/ymse

Reconstruction of rotator cuff tears in wheelchair-bound paraplegic patients

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Background: Rotator cuff surgery in wheelchair-bound patients is challenging, and clinical data on this condition are limited. We hypothesized that rotator cuff repair in these patients might improve functional outcomes.

Methods: In a retrospective study, data on 13 paraplegic patients (8 men and 5 women; 16 shoulders) who underwent rotator cuff repair were analyzed. The average age at the time of surgery was 48.7 years. The causes of paraplegia were poliomyelitis in 9 patients, spinal fracture in 4, and cerebral infarction in 2. Open rotator cuff repair was performed in 11 patients and arthroscopic repair in 2 patients. No wheelchair propulsion was allowed until 6 months postoperatively to protect the repaired cuffs. American Shoulder and Elbow Surgeons (ASES) score and Constant score were used for functional evaluation. To assess tendon integrity, magnetic resonance imaging or ultrasonography was used at an average of 31.2 months postoperatively.

Results: ASES scores improved from 53 to 85, and Constant scores improved from 48 to 75. Radiographic evaluation revealed healing in 88% of the cases and retear in 12%. In the retear group, functional scores improved.

Conclusion: Rotator cuff repair surgery for paraplegic wheelchair-bound patients provides satisfactory functional outcomes. Careful postoperative management can help in obtaining positive functional outcomes.

Level of evidence: Level IV, Case Series, Treatment Study.

Keywords: Rotator cuff tear; paraplegia; paraplegic patients; wheelchair-bound

Pain and limitation of movement of the shoulder are common symptoms in patients with paraplegia, and 30% to 67% of these patients present such symptoms.[1,4,9,13-15,17,18,20] A number of degenerative changes may occur with increased use of the shoulder in paraplegic patients. These include distal clavicular osteolysis, rotator cuff tear, osteonecrosis of the humeral head, and degenerative arthritis.

These problems are mostly related to the patients' frequent use of the wheelchair in daily activities and the associated use of their shoulders to shift their body weight.[1,4,9,14,15] When patients use their shoulders for wheelchair propulsion and transfers, the vertical force acting on the shoulder increases by more than 360% according to a biomechanical study.[11] The increased

The Institutional Review Board of Asan Medical Center approved this study.

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1058-2746/$ - see front matter © 2015 Journal of Shoulder and Elbow Surgery Board of Trustees.
http://dx.doi.org/10.1016/j.jse.2014.09.028

upward-directed force causes increased strain on the rotator cuff tendons as their muscle units contract forcefully to resist the superior forces. Superior translation of the humeral head may result from wheelchair use, and this may contribute to the development of rotator cuff tears by putting pressure on subacromial structures. Long-term overuse of the shoulders for propulsion and locomotion in paraplegic patients can result in degenerative lesions in the humeral heads and rotator cuff tears as well as subacromial bursitis, all of which cause pain and further limit shoulder motion.[2,3,7] Rotator cuff tears were found in 32% to 72% of patients with paraplegia.[3,7]

Paraplegic patients are reluctant to opt for rotator cuff surgery for various reasons, mainly because of the resulting impact on their independence due to the long period of rehabilitation, the severe challenge to mobility, and the dependence on family members for activities of daily living. At the same time, paraplegic patients have very high expectations of the surgeons. Rotator cuff surgery in paraplegic patients is difficult because of these high expectations and the greater degeneration of the shoulder.

Reports of the functional outcomes of rotator cuff repair in wheelchair-bound paraplegic patients are limited, with only anecdotal case reports. In this study, we describe our clinical experience with such surgery and present an analysis of the functional and radiographic outcomes. We believe our data from this retrospective study show that rotator cuff repair in wheelchair-bound paraplegic patients results in improved functional outcomes.

Materials and methods

We retrospectively reviewed the data of paraplegic patients who underwent rotator cuff repair between October 1995 and October 2011. All had presented with shoulder pain disturbing the activities of daily living, a decreased range of movement, and weakness of the shoulder. Physical examination and magnetic resonance imaging (MRI) had confirmed full-thickness rotator cuff tear. Those paraplegic patients who had a history of shoulder infection, those with general paralysis due to motor nerve disease, and those with syringomyelia were excluded from the study. All the included patients had been able to use their shoulders for wheelchair propulsion and transfers before the onset of symptoms. However, after the onset of pain and weakness, they had difficulty in using a wheelchair; all needed help in getting into the wheelchair from bed, in transferring their body weight from one position to another, and for the activities of daily living.

The final study group consisted of 8 men (8 shoulders) and 5 women (8 shoulders). Mean age of the patients was 61 years (range, 44-78 years).

The mean age of the patients at the time of surgery was 48.7 years (range, 42-59 years). The average duration of wheelchair use in these patients was 29.8 years (range, 1-58.2 years). The average duration of shoulder symptoms was 21.7 months (range, 10-42 months).

Preoperatively, all patients received conservative treatment comprising strengthening exercises, and 3 patients received steroid injections. The symptoms did not subside after the conservative therapy.

Preoperative assessment scores for shoulder muscle strength were grade 4 in 13 cases and grade 3 in 3 cases.

Tear size was measured intraoperatively by the DeOrio and Cofield classification.[6] There were 2 (12.5%) medium tears, 3 (18.8%) large tears, and 11 (68.7%) massive tears. Arthroscopic acromioplasty with minimal open rotator cuff repair was conducted in 2 cases; open acromioplasty with rotator cuff repair by the double mattress suture technique was performed in the other 14 cases. The patients were treated by a single surgeon using the standardized anterior deltoid-splitting approach. Acromioplasty was performed in all cases. Bursal, capsular, and interval releases were performed to mobilize the tendon adequately for repair. Tendons were repaired at the footprint by the transosseous double mattress suture technique with No. 2 Ethibond (Ethicon Inc., Johnson & Johnson, Somerville, NJ, USA). At least 5 knots were tied to prevent loosening of the repaired construct. Intraoperative tenodesis of the biceps long head was carried out for partial tears of more than 50%. We performed tenodesis in 9 patients who had tears of the upper part of the subscapularis with subluxation.

Postoperative rehabilitation

A shoulder abduction brace was applied for 8 weeks. The patients started passive forward elevation on the first postoperative day. On the third postoperative day, stretching exercises including pendulum exercises, passive forward elevation, and external rotation were initiated. After 4 weeks, patients started pulley exercises to gain full elevation. Strengthening exercises were advised immediately after removal of the shoulder abduction brace in the eighth postoperative week. Posterior capsular stretching exercises and internal rotation stretching were followed by strengthening exercises. Patients were strongly advised not to use the affected arm for strenuous activity, such as leaning or wheelchair pushing and propulsion, for 6 months.

For functional evaluation, we used preoperative and postoperative pain scales, calculated range of motion of the shoulder, muscle power, American Shoulder and Elbow Surgeons (ASES) score, and Constant score. The questions in the ASES score were explained to non-English speakers by a senior orthopedic surgeon.

Pain was scored on a visual analog pain scale. Muscle strength tests used a Nottingham Mecmesin Myometer (Mecmesin Co., Nottingham, UK), and the values were recorded in percentages of the unaffected shoulder. Maximum supraspinatus strength was measured with the arm elevated to 90° in the scapular plane, and maximum external rotation strength was measured with the arm in the neutral position. For anatomic evaluation, we used MRI or ultrasonography (US) to investigate the continuity of the repaired tendon at a minimum of 12 months postoperatively. The mean follow-up period was 31.2 months (range, 13-71 months).

Statistical analysis

We used the IBM SPSS version 20 for Windows (IBM Corp., Armonk, NY, USA) for statistical analysis and independent-sample t tests for preoperative-postoperative comparisons of clinical scores, range of motion, and muscle power. Statistical significance was considered at $P < .001$.