SCIENTIFIC ARTICLE

Shoulder Arthroplasty for Sequelae of Obstetrical Brachial Plexus Injury

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Purpose Shoulder arthroplasty following obstetrical brachial plexus injury (OBPI) is technically challenging because glenoid morphology, muscle balance, and humeral version are substantially altered compared with the neurologically intact shoulder. The purpose of this study is to report the outcome of shoulder arthroplasty in a group of patients with end-stage arthritis secondary to OBPI.

Materials and methods Seven patients with OBPI and secondary glenohumeral arthritis were treated with shoulder arthroplasty between 1976 and 2014. Two underwent hemiarthroplasty (HA), 2 underwent total shoulder arthroplasty (TSA), and 3 underwent reverse shoulder arthroplasty (RSA). One HA was lost to follow-up and was excluded. The remaining 6 patients (mean age, 62.5 years old at the time of surgery) were followed for a minimum of 2 years (mean, 7.5 years; range, 2−13 years) Outcome measures included pain, range of motion, and postoperative modified Neer ratings.

Results Pain improved in all shoulders. Mean forward flexion was unchanged. No shoulders treated with HA/TSA regained forward elevation above 90°, compared with 1 out of the 3 RSAs. External rotation improved from a mean of −10° to 20°. Active internal rotation decreased from L1 to L5. Immediate postoperative radiographs showed either severe posterior or posterosuperior subluxation in all 3 patients treated with nonconstrained implants.

Conclusions Shoulder arthroplasty is an acceptable option to relieve pain in patients with symptomatic shoulder arthritis as a sequel of OBPI. However, range of motion improvements are not expected. *(J Hand Surg Am. 2018;■(■):1.e1-e7. Copyright © 2018 by the American Society for Surgery of the Hand. All rights reserved.)*

Type of study /level of evidence Therapeutic V.

Key words Shoulder arthroplasty, Erb palsy, obstetrical brachial plexus injury, glenoid dysplasia, humeral dysplasia.

Online Exclusive

OBSTETRIC BRACHIAL PLEXUS INJURY (OBPI) occurs in 0.3 to 4 per 1000 live births in developed countries.[1−5] Most patients experience full nerve recovery in the first few months of life and develop full upper extremity function without sequalae.[6] However, patients with incomplete nerve recovery may experience variable degrees of shoulder and upper extremity dysfunction. This commonly

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includes internal rotation contractures of the shoulder with progressive posterior subluxation. This, in turn, results in significant distortion of the anatomy around the shoulder joint, including a retroverted and dysplastic glenoid, epiphysiolysis of the humeral head, downsloping of the acromion, and an elongated, lateralized coracoid. The presence of glenoid dysplasia has previously been associated with progressive degenerative arthritis[7] and arthropathy of the shoulder in patients with OBPI, as a result of glenohumeral joint dysplasia. This is more complicated in patients with OBPI because residual paralysis may lead to a significant imbalance of the forces around the severely dysplastic glenohumeral joint.

The combination of soft tissue contractures, muscular imbalance, and bone deformities poses significant challenges when shoulder arthroplasty is considered as treatment for arthritis in patients with this uncommon shoulder deformity. The purpose of this study is to report the outcome of shoulder arthroplasty in a small group of patients with OBPI who underwent the procedure for end-stage shoulder arthritis.

MATERIALS AND METHODS

Following institutional review board approval, the total joint registry database from 2 institutions was reviewed for patients with OBPI who had undergone shoulder arthroplasty between 1976 and 2014. All patients undergoing arthroplasty had failed nonsurgical management including activity modification, over-the-counter analgesics, and periodic corticosteroid injections. Our database did not allow us to capture the number of patients treated with nonarthroplasty procedures or those treated nonsurgically. Seven patients were identified: 2 hemiarthroplasties (HAs), 2 total shoulder arthroplasties (TSAs), and 3 reverse shoulder arthroplasties (RSAs). All HAs and TSAs were performed prior to the introduction of the RSA in 2004. One HA was lost to follow-up and was excluded from the study. The remaining 6 patients (four men: mean age, 60.5 years old at the time of surgery; and 2 women: mean age, 66.5 years old at the time of surgery) with a minimum follow-up of 2 years were included in this study. A detailed review of the medical records, surgeon's clinical notes, and operative reports was performed. The 6 patients were followed at routine intervals for examination and radiographic evaluation.

Clinical evaluation

At the time of last follow-up, pain was graded using the visual analog scale (VAS). Patients were asked to rate their average daily pain using the VAS pain scale, with 0 representing no pain and 10 representing their worst imaginable pain. Active elevation and external rotation were recorded in degrees. Internal rotation was determined by the highest vertebral segment that could be reached by the thumb.

Radiographic evaluation

Preoperative, initial postoperative, and most recent radiographs were reviewed. Three projections were used for radiographic analysis: anteroposterior, with the arm in internal and external rotation, and an axillary radiograph. These were used before surgery to evaluate the extent of dysplastic changes associated with glenohumeral subluxation. Glenoid dysplasia was assessed using the Walch classification,[7] and glenoid retroversion was evaluated using the radiographic classification of glenohumeral dysplasia described by Waters et al.[8] Posterior glenohumeral joint subluxation was assessed by measuring the distance from a bisecting scapular line to the anterior portion of the humeral head, divided by the circumference of the head, multiplied by 100 as described by Waters et al.[8]

After surgery, the same views were used to evaluate glenohumeral joint subluxation, periprosthetic lucency, and component shift in position. Postoperative glenohumeral subluxation was assessed as a percentage of humeral head translation on the glenoid as follows: none; mild ($<$ 25% translation); moderate (25%−50% translation); and severe ($>$ 50% translation).

Periprosthetic radiolucency was defined with 6 grades (0-5): grade 0, no radiolucent line; grade 1, incomplete and $\leq$1-mm line; grade 2, complete and $\leq$1 mm line; grade 3, incomplete and $\leq$1.5-mm line; grade 4, complete and $\leq$1.5-mm line; and grade 5, complete and $\geq$2-mm line.[9]

Surgical technique

Two patients underwent anatomical TSAs using the Cofield system (Smith and Nephew, Memphis, TN) using an all-polyethylene cemented glenoid component and uncemented ingrowth humeral component. One patient underwent HA using a Cofield 2 uncemented humeral stem (Smith and Nephew) and the 3 remaining shoulders were treated with a reverse shoulder prosthesis (RSP; DJO Surgical, Austin, TX). All surgeries were performed by 2 of the senior authors (M.F. and R.C.). When TSA or HA was performed, special attention was directed toward the exposure. Chronic posterior shoulder subluxation and deficient external rotation in OBPI patients may lead to shortening and hypertrophy of the anterior and