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Shoulder linked arthroplasty in patients with obstetric brachial plexus palsy can improve quality of life and function at short-term follow-up

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Background: Patients with obstetric brachial plexus palsy (OBPP) are prone to develop degenerative shoulder disease at a younger age than the general population. To date, no reports have been published on the complexities or outcome of shoulder arthroplasty (SA) in this unique patient group.
Methods: We reviewed of 9 SAs in 9 patients (3 men and 6 women) with OBPP with mean follow-up 5.1 years (range, 2.6-7.6 years). Patients were a mean age of 29 years (range, 16-56 years). Patients had undergone a mean of 3 previous operations (range, 2-6). All patients underwent linked constrained SA.
Results: The mean Oxford Shoulder Score increased from 8 (range, 3-10) preoperatively to 21 (range, 12-32) at the final follow-up ($P < .001$) predominantly due to pain relief. Mean range of active forward elevation and abduction improved from 35° and 39° to 46° and 45°, respectively. Patients improved significantly in 2 of 8 Short-Form 36-Item health-related quality of life domains, bodily pain ($P = .013$) and mental health ($P = .035$), and the overall physical component summary score ($P = .006$). Range of motion had mild improvements. Three required reoperation (33%), comprising 1 excision of heterotopic ossification, 1 trimming of a prominent screw, and 1 deltoid rupture repair.
Conclusions: SA is effective at relieving pain and health-related quality of life for young patients with OBPP; however, compared with the general population, the complication rate is high and functional gains are small.
Level of evidence: Level IV, Case Series, Treatment Study.

Keywords: Shoulder arthroplasty; obstetric brachial plexus palsy

Obstetric brachial plexus palsy (OBPP) refers to upper limb paralysis secondary to a traction or compression injury to the brachial plexus sustained during birth.[19] The reported incidence in developed countries is 2 per 1000 live births.[8] Although 96% recover spontaneously, a subset of individuals demonstrate persistent neurologic and functional

No Investigational Review Board or ethical approval was required for this study.

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deficit due to muscle weakness, soft tissue contractures, and structural deformities.[8] Preganglionic injuries, total plexus involvement with multiple root ruptures/avulsions, lower plexus (C8/T1) injuries, and failure of recovery of biceps function at 3 months in upper plexus injuries (C5/6) are risk factors for worse function.[23]

The more common upper plexus injuries (C5/C6) result in weakness in abduction (deltoid and supraspinatus) and external rotation (infraspinatus) due to axillary and suprascapular nerve deficiencies. This muscular imbalance may lead to shoulder adduction and internal rotation contractures.[13] Longstanding muscular imbalance results in glenohumeral dysplasia, progressing to posterior humeral head subluxation and dislocation.[13,24] Posterior displacement of the head leads to humeral epiphysiolysis, retroversion of the head, and secondary changes in the lower part of the glenoid.[18,30] Extra-articular procedures, such as tendon transfer, do not appear to halt progression of this dysplasia but may improve limb function in selected patients.[26] Intra-articular procedures, such as derotational humeral osteotomy and open reduction with capsulorrhaphy, may allow joint remodeling; however, the long-term effect on glenohumeral morphology is unknown.[24,25]

When painful osteoarthritis (OA) resistant to conservative treatment develops, shoulder arthroplasty (SA) is indicated. The number of patients that progress to symptomatic degenerative joint disease is unknown; however, the lack of literature would suggest this is relatively low or that most are managed nonoperatively due to technical difficulties with SA. Characteristic bony features of the degenerate shoulder in OBPP include a retroverted and dysplastic glenoid, humeral head epiphysiolysis, a down-sloping acromion, and elongated and vertical coracoid. The posterior rotator cuff is slack, fibrotic and adherent to the glenoid rim, the subscapularis is often fibrotic and contracted, and the deltoid is frequently weak, short and non-functional. The challenge of SA in these cases is to restore a centre of rotation for the scapulohumeral joint relative to the insufficient deltoid in the presence of disordered bone stock and global but asymmetric soft tissue contractures.

No reports on the outcome of SA for such patients have been published. We therefore determined function and health-related quality of life (HRQoL), radiographic findings, and survival and complications after SA for young patients with OBPP.

Materials and methods

Between 2006 and 2010, 9 patients (3 men and 6 women) with OBPP and glenohumeral OA were treated with a linked constrained SA (CADCAM glenoid shell and humeral components, Stanmore Implants Worldwide, Elstree, UK) at our institution. Patients were a mean age of 29 years (range, 16-56 years; Table I). All patients had upper plexus involvement (C5/6/7). No patients were lost to follow-up, leaving 9 shoulders available for review at a mean of 5.1 years (range, 2.6-7.6 years). Indications for SA were painful end-stage shoulder OA affecting QoL refractory to nonoperative treatment. Contraindications to the procedure included infection. Combined deltoid and rotator cuff deficiency was not a contraindication. All patients had been referred to our institution with a mean duration of arthritic symptoms of 3.8 years (range, 2-8 years) before surgery.

Patients had undergone a mean of 3 previous shoulder operations (range, 2-6). All 9 had undergone subscapularis tendon release or lengthening. Other procedures included open reduction and posterior glenoid bone block stabilization for locked posterior dislocation in 5, humeral derotation osteotomy in 4, tendon transfers in 2, and open reduction and soft tissue stabilization for posterior dislocation in 1. The characteristic radiologic features of the shoulder included a retroverted glenoid with inferior or posteroinferior segmental dysplasia, a flattened humeral head, down-sloping acromion, and elongated coracoid (Fig. 1).

Patients were asked to evaluate subjectively their shoulder function at the final follow-up. Responses were recorded as very satisfied, satisfied, not sure, or dissatisfied. Functional scoring was performed using the Short-Form 36-Item (SF-36) HRQoL index[15] and the Oxford Shoulder Score (OSS).[5] All remaining data were collected from clinic reviews, medical records, and radiographs.

The SF-36 is a patient-completed health status measure designed for use in a broad range of patient populations and healthy subjects. It evaluates 8 dimensions of physical and mental health: physical functioning, physical role functioning, bodily pain (BP), general health, vitality, social functioning, emotional role functioning, and mental health (MH). Scores are coded, summed, and transformed onto a scale from 0 (worst possible health status) to 100 (best possible health status). Two summary scales, the physical component summary (PCS) and mental component summary scores are calculated. These are based on T-transformations with a normative population mean of 50 and standard deviation of 10, based on American and European standards.

The OSS is a patient-reported outcome measure specific to the shoulder that comprises 12 questions, each with 5 responses, to give a score between 0 (worst possible shoulder) and 48 (best possible shoulder).

Plain anteroposterior, axillary, and scapular Y-view radiographs were reviewed preoperatively, at 3 and 6 months, annually, and at the final follow-up. The most recent radiographs were evaluated by 2 independent reviewers, and a consensus was reached. Radiographs of the patient who had a hemiarthroplasty (HA) were reviewed to determine the presence or absence of glenohumeral subluxation, periprosthetic radiolucency, subsidence or a shift in the position of the humeral component, and glenoid erosion. Radiographs of patients who had a linked constrained SA were reviewed for the presence of periprosthetic radiolucency, subsidence, and migration or tilt of the glenoid component. Periprosthetic radiolucency was graded according to the system of Sperling et al[22] as grade 0 (no radiolucent line), 1 (incomplete line $\leq$1 mm), 2 (1-mm complete line), 3 (incomplete 1.5-mm line), 4 (complete 1.5-mm line), and 5 (2-mm complete line). If radiolucent lines were present, all previous radiographs were compared for evidence of progression.

Statistical analysis

Data were analyzed using SPSS 19 software (IBM Corp, Armonk, NY, USA). The paired *t* test was used to compare OSS and SF-36 scores before and after surgery. A P value of $<.05$ was considered significant.