Parkinson’s disease (PD) is a progressive neurologic disorder that affects the musculoskeletal system. Currently, the use of reverse shoulder arthroplasty (RSA) for patients with PD has not been adequately studied. The authors sought to determine if RSA provided similar functional outcomes for patients with PD compared with a matched cohort of patients without PD. Between 2004 and 2011, 10 patients with PD (4 men, 6 women) underwent RSA. Patients with PD were matched to patients without PD at a 1:4 ratio based on age (average, 76 years; range, 63-85 years), sex (16 men, 24 women), preoperative diagnosis, and length of follow-up (average, 43 months; range, 24-128 months). Outcome measures included range of motion, visual analog scale (VAS) score, Simple Shoulder Test (SST) score, American Shoulder and Elbow Society (ASES) score, and complication rates. Patients with PD had improvements in SST scores, ASES total scores, and forward flexion; however, they did not show statistically significant improvements in VAS scores, ASES function scores, or other range of motion parameters. There was a significant difference in postoperative functional outcome scores, SST scores, and internal/external rotation between the 2 groups, but no difference in postoperative pain scores, ASES total scores, forward flexion, or abduction. Complications occurred in 4 of 10 patients with PD and 6 of 40 patients without PD. Compared with the matched cohort, patients with PD achieved similar reduction of pain but inferior clinical function following RSA. Improvement in range of motion was less predictable and complication rates were significantly higher in patients with PD. [Orthopedics. 2017; 40(4):e675-e680.]
the tremor. There has been little reported in the literature on the outcomes of shoulder surgery for patients with PD. Authors have reported success in relieving pain, but inconsistent results in functional outcome, with early instability being a concern after total shoulder arthroplasty.

Currently, the use of RSA for patients with PD has not been adequately studied. The purpose of this study was to determine if RSA provided similar functional outcomes for patients with PD compared with a matched cohort of patients without PD.

**MATERIALS AND METHODS**

**Study Design**

After approval from the institutional review board, the authors’ prospective database and hospital medical records were retrospectively searched for patients diagnosed with PD who had undergone RSA. Between February 2004 and May 2011, 10 patients with PD were identified who underwent RSA with a minimum of 24-month follow-up. These patients were then matched to a cohort of 40 patients without PD. The authors used a matched ratio of 1:4 to improve statistical power and significance while decreasing the chance of bias selection between the 2 groups.

Parkinson’s disease presents in 5 different stages, with the advanced stages having severe functional limitations. Stage 1 presents with mild symptoms of tremors and shaking in one limb. Stage 2 presents with bilateral limb symptoms and more walking and balance problems. Stage 3 presents with more severe symptoms and the inability to walk straight or stand. Stage 4 presents with the inability to complete day-to-day tasks or live on one’s own. Stage 5 is the last stage, as patients are no longer able to care for themselves. In this study, patients with PD undergoing RSA presented with stage 1 or 2 PD. Patients with advanced stages of PD were not considered candidates for the operation.

All patients included in this study had undergone a RSA with the Reverse Shoulder Prosthesis (DJO Surgical, Austin, Texas) performed by the senior author.

Figure 1: Preoperative anteroposterior radiographs showing rotator cuff arthropathy in a patient with Parkinson’s disease (A) and 4 matched control patients (B-E).

Figure 2: Anteroposterior radiographs after reverse shoulder arthroplasty in a patient with Parkinson’s disease (A) and 4 matched control patients (B-E).
(M.A.F.) after nonoperative treatment had failed and they reported moderate to severe shoulder pain, had reduced ability to perform daily functions, and had evidence of advanced rotator cuff deficiency or failed previous arthroplasty (Figures 1-2).

Matching Criteria

Each patient with PD was matched to 4 control patients based on age, sex, length of follow-up, preoperative diagnosis, and severity of disease. Preoperative diagnoses for both cohorts included cuff tear arthropathy (PD=5, control=24), osteoarthritis (PD=1, control=1), failed hemiarthroplasty (PD=2, control=11), and failed total shoulder arthroplasty (PD=2, control=4).

The severity of the disease was determined from data collected during the preoperative visit and radiographs. The reason for surgery was determined from the patient’s operative report, medical record, and radiographs. All radiographs were performed at the authors’ institution using a standardized protocol including anteroposterior, scapular Y, Grashey (true anteroposterior in the plane of the scapula), and axillary views.

Each patient with PD was further matched to a set of 4 controls based on the preoperative radiographs using the following criteria: severity of osteoarthritis according to Hamada et al,11 amount of subluxation, and reason for revision, including mode of failure and previous implant (ie, hemiarthroplasty or total shoulder arthroplasty). The radiographs were then anonymized and presented to a group of 4 orthopedic shoulder surgeons for concurrence. Any control who the group thought was not similar enough was removed and a new control was identified by the first author (M.C.C.). This process was repeated until a consensus based on the above criteria was met.

Outcomes

Outcome scores were collected and analyzed during the preoperative visit and final follow-up for all patients. Patient questionnaires were used to calculate the American Shoulder and Elbow Surgeons (ASES) pain, function, and total scores, the visual analog scale (VAS) pain and function scores, and the Simple Shoulder Test (SST) scores. Range of motion (ROM) in all 4 planes was digitally measured using videotaped ROM by an independent third party. In cases where the preoperative ROM video was not available, patient-indicated ROM from questionnaires was used (Table 1).

RESULTS

Functional outcomes and ROM are listed in Table 2 and Table 3.

Functional Outcome and Pain

Patients with PD had statistically significant improvements in postoperative SST scores and ASES total scores, while approaching significance in VAS pain and ASES pain scores. They did not show statistical improvement in ASES function scores. Control patients had statistically significant improvements in all parameters measured.

Range of Motion

Patients with PD showed statistically significant improvements in postoperative forward elevation but no other ROM parameter. Control patients showed statistically significant improvements in all planes of motion (forward elevation, \( P<.0001 \); abduction, \( P<.0001 \); external rotation, \( P=.018 \); and internal rotation, \( P=.001 \)).

Complications

Complications occurred in 4 of 10 patients with PD (40%) and 6 of 40 patients without PD (15%). Two patients with PD sustained a postoperative acromial fracture: 1 had glenoid baseplate failure and 1 developed postoperative instability. The patient with glenoid baseplate failure was
a 79-year-old woman with advanced PD, although she was still ambulatory with assistance. She was noted intraoperatively to have significant deltoid spasticity. She was treated postoperatively with deltoid botulinum toxin type A injections and elected for nonoperative treatment of her glenoid component failure. One patient had 2 episodes of postoperative instability and required 1 revision surgery for his initial episode. Both patients with acromial fractures were treated nonoperatively. In the control group, there were 4 acromial fractures, 1 failed baseplate due to a broken central screw, and 1 case of instability with an associated dislocated polyethylene insert. All 4 acromial fractures were treated nonoperatively. The baseplate failure and dislocated polyethylene component were both revised. The reoperation rate was 10% in the group with PD and 5% in the control group.

**DISCUSSION**

Parkinson’s disease presents a challenge in the surgical treatment of orthopedic conditions, particularly in the use of shoulder arthroplasty. Koch et al described 15 patients with PD who underwent 16 unconstrained shoulder arthroplasties. Although
the patients had significant pain relief, functional outcomes were poor and complications were more frequent, especially for patients older than 65 years.

Likewise, Kryzak et al. described 43 unconstrained shoulder arthroplasties for patients with PD. Total shoulder arthroplasty resulted in significant long-term pain relief. However, 8 of 43 required revision shoulder arthroplasty, while 20 (47%) achieved unsatisfactory functional results.

Because unsatisfactory functional results and early instability are concerns with unconstrained shoulder arthroplasty for patients with PD, the use of RSA, which is inherently more stable, may be a better option. However, the use of RSA for this patient population has been underreported.

Dunn et al. reported on Grammont-style RSA for 3 patients with PD in whom pain relief was reliably achieved but functional outcomes were poor. However, none of the patients presented with glenohumeral arthritis or rotator cuff arthropathy. Two were revision arthroplasty cases (failed hemiarthroplasty and deep infection) and 1 was a RSA for proximal humerus fracture. All patients developed significant scapular notching and subsequent poor clinical function.

In the current study, patients with PD undergoing RSA achieved improvements in pain scores and forward elevation and abduction but not internal or external rotation. Only postoperative forward elevation reached statistical significance compared with its preoperative state. There was no difference between patients with PD and patients without PD regarding postoperative forward elevation and abduction, but there was a significant difference in internal and external rotation. There was a significant difference in functional outcome scores between the 2 groups, with the control group performing better. Also, there was a much higher complication and reoperation rate in the patients with PD.

There were limitations to this study. First, the authors’ experimental group was small, with only 10 patients with PD undergoing RSA. However, this is the largest group of patients with PD undergoing RSA reported in the literature and provides preliminary evidence to guide surgeons in counseling patients with PD on the outcomes of RSA. Second, the authors did not evaluate the stage of PD for each patient. It is likely that the worse patients’ disease state, the worse their clinical outcome would be. It has been recommended that shoulder arthroplasty be considered only for patients with a mild stage of the disease, as more severe cases likely would result in higher complication rates and worse functional outcomes because of their increased muscle rigidity, tremors, unsteady gait, and dementia.

The current control group showed good outcomes postoperatively, with statistically significant improvements in both pain and function. Outside of surgical technique, the authors believe the medical management of the disease can play a significant role in these patients’ overall outcomes. For this reason, the authors recommend a multidisciplinary approach to the patient with PD requiring shoulder replacement surgery. Patients with more advanced disease preoperatively should not be considered candidates for surgery. Collaboration with neurology and optimization of the patient’s disease from a medical standpoint can optimize the postoperative course. The authors recommend preoperative optimization of PD by the neurologist and close follow-up postoperatively for optimal control of PD, which can translate into improved outcomes. The authors currently routinely consult neurology both pre- and postoperatively for these patients. The role of intraoperative or postoperative botulinum toxin type A injections is still unclear.

CONCLUSION

Compared with control patients without PD, patients with PD achieved similar reductions of pain but inferior clinical function following RSA. Improvement in ROM was less predictable and complication rates were significantly higher in patients with PD. It is important to counsel patients with PD and carefully educate them on their risks and potential outcomes before selecting RSA as the treatment for their shoulder pathology.

REFERENCES

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