

Reverse Total Shoulder Arthroplasty in Patients With Parkinson Disease: A Case Series and Review of the Literature

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Abstract

Parkinson disease (PD) is a chronic degenerative neurologic disorder with both motor and nonmotor facets. The motor symptoms, including increased risk for falls, fractures, and stiffness, contribute to the morbidity of arthroplasty. In this article, we report 3 cases of reverse total shoulder arthroplasty in patients with PD. All patients achieved poor functional outcomes with mean (range) active forward flexion of 40° (20°-60°) at follow-up. Although each patient obtained significant pain relief—mean (range) visual analog scale score was less than 1 (0-2)—range of motion was poor. In addition, each patient developed significant glenoid notching, though no component loosening or migration was observed. Mean (range) postoperative follow-up was 17 (4-32) months. A patient who has PD and requires an inverse arthroplasty should be counseled that pain relief may be reliably achieved, while functional outcomes are poor.

Parkinson disease (PD) was first described by James Parkinson in 1817.¹ Patients with PD classically present with a spectrum of clinical findings consisting of asymmetric limb tremor at rest, muscle rigidity, bradykinesia, postural instability, and flexed posture.² These motor impairments are a consequence of chronic wasting of dopaminergic neurons in the substantia nigra pars compacta.³ It is widely reported that oxidative stress is the primary cause of neural damage at the molecular level in this region of the brain.⁴⁻⁶ Injuries to the shoulder girdle are commonly a result of falls, a consequence of the gait disturbances accompanying the progressive nature of PD.

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Reverse total shoulder arthroplasty (RTSA) was first described by Grammont and colleagues⁷ in 1987. This procedure is used effectively to manage irreparable rotator cuff tears, revise failed shoulder arthroplasty, and fixate proximal humeral fractures. Despite it being used for almost 25 years, RTSA was approved by the US Food and Drug Administration only in 2003, and, therefore, US experience has been limited. Although this procedure has the potential for substantial clinical benefit, it is technically challenging and has complication rates of 7% to 47%, and reoperation rates of 4% to 33%.⁸⁻¹⁴

PD has been linked to several interrelated factors that may contribute to failure of arthroplasty. Compared with age- and sex-matched controls, patients with PD are at considerably higher risk for fracture.¹⁵ They also have lower levels of vitamin D, C-terminal telopeptide (a bone resorption marker), and bone mineral density, all of which contribute to lower bone density and increase the risk for fracture.¹⁵⁻¹⁷ Falls can be attributed to the motor disturbances associated with PD and are very common in these patients.¹⁸ Koller and colleagues¹⁹ reported that 38% of patients with PD report falls, 13% fell more than once per week, and 17% sustained fall-related fractures. The rate of femoral neck fractures was found to be 5 times higher in patients with PD than in patients without PD.²⁰ Levodopa-induced postural hypotension could conceivably induce falls.²¹ All these factors contribute to increased risk for RTSA failure in patients with PD.

Scapular notching occurs often after RTSA but has not been statistically correlated with postoperative outcomes.^{8,10,22} Plain radiographs were assessed for notch-

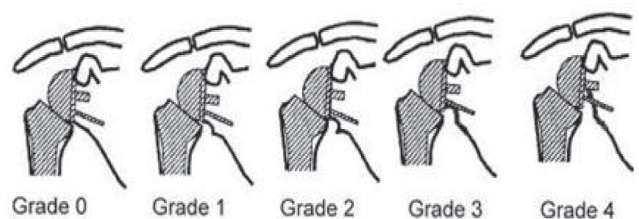


Figure 1. Nerot progressive scale ranges from 0 to 4: 0, no notching; 1, small notch confined to pillar; 2, small notch infringing on inferior screw; 3, evolution of notching with erosion of bone past inferior screw; 4, significant medial notching under baseplate causing notable glenoid instability.^{23,24}



Figure 2. Case 1. Anteroposterior radiograph 10 months after right reverse total shoulder arthroplasty. Grade II notching appears along inferior border of glenoid.

ing in all 3 of our cases at a mean (range) of 18 (8-36) months. The scapular notch, a defect in the inferior portion of the glenoid, is evaluated radiographically using the Nerot classification (Figure 1).^{23,24}

There has been no account of the morbidity of RTSA in patients with PD. In this article, we report 3 cases of RTSA in patients with PD. Mean (range) follow-up was 17 (4-32 months). Compared with those of historical controls who had undergone reverse arthroplasty, the functional outcomes of these patients with PD were poor, and substantial glenoid notching was visible early in the postoperative course.

These 3 patients provided written informed consent for print and electronic publication of their respective case reports.

CASE REPORTS

Case 1

A 72-year-old woman who had osteoarthritis, PD, and shoulder pain for 6 years underwent arthroscopic debridement, acromioplasty, distal clavicle resection, and biceps tenotomy of the long head of the biceps for management of an irreparable right rotator cuff 4.5 years earlier. Persistent pain and poor function precipitated insertion of a hemiarthroplasty 2 years after the arthroscopic

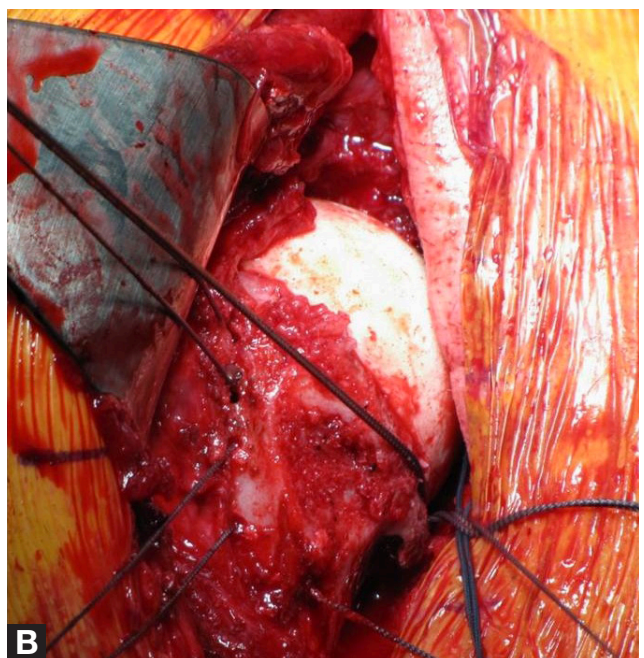
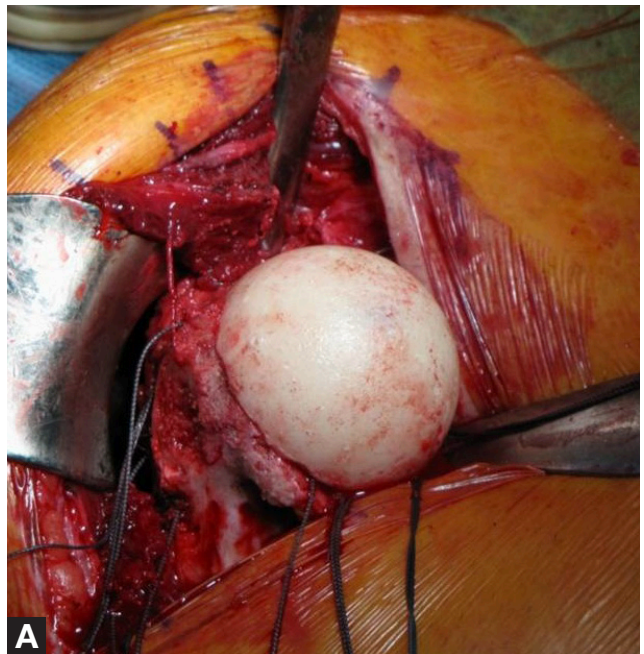


Figure 3. Case 2. Lateral intraoperative images (A,B) of open rotator cuff repair and placement of a prosthesis with antibiotic-loaded acrylic cement. Placement and repair were performed to manage infected open reduction and internal fixation for proximal humerus fracture.

procedure. During this period, function did not improve and pain increased. A year after the hemiarthroplasty, conversion to an RTSA was required. The humerus was split to remove the cemented stem. A press-fit stem was used with a 36-mm glenosphere. The perioperative course, evaluated at 2 weeks, 6 weeks, and 6 months, was uneventful, and the components reduced and positioned well. By 6 months, forward flexion was 70° and external rotation was 10°.



Figure 4. Case 2. Anteroposterior radiograph 2 months after right reverse total shoulder arthroplasty. Grade II notching appears at inferior border of glenoid.

At 8 months after the conversion, the patient reported shoulder pain. Forward flexion had decreased to 60° and external rotation increased to 20°. Radiographically, the prosthesis remained well positioned (with no evidence of loosening), and neurovascular structures were intact. However, range of motion (ROM) and strength were noticeably reduced.

At 10 months, the patient presented with moderate ecchymosis over the left eye—the result of a fall. Passive forward flexion remained at 60°, but external rotation was now reduced to 0° (45° in supine position). As before, the neurovascular structures were intact, and there was no evidence of loosening. A radiograph showed grade II glenoid notching (Nerot classification, Figure 1)²³ after the patient's fall (Figure 2). By 18 months, notching had progressed to Nerot 3 without evidence of component loosening or migration.



Figure 5. Case 3. Anteroposterior radiograph 3 years after right reverse total shoulder arthroplasty. After patient fell more than 100 times, grade III notching of inferior scapula and radiolucencies were visible along medial aspect of shaft in zones 1 and 2.

With ROM worsening, physical therapy was changed to include lawn-chair exercises and aqua-therapy. At 12 months, the patient rated her pain only 1 to 2 out of 10, but she continued to struggle with ROM (42° of active forward flexion compared with 95° contralaterally) and could not actively externally rotate the arm.

Case 2

A 79-year-old woman with a long history of PD was evaluated for persistent right shoulder pain. The patient had undergone open rotator cuff repair and was seen after a second revision had failed. Before her visit, the patient sustained a proximal humerus fracture with nonunion, and, because of concerns regarding infection, hardware was removed and a prosthesis with antibiotic-loaded cement (PROSTALAC) was inserted (Figures 3A, 3B). Pain relief was excellent, forward flexion was 80°, and active external rotation was 15°. Nine months after insertion of the cement spacer, the patient presented with markedly increased pain and essentially a flail shoulder with no active flexion or abduction.

Radiographs showed a fractured (PROSTALAC) with anterior dislocation of the articular surface of the component. Given the significant pain and acute loss of motion, the loose and fragmented spacer was removed,

Table. Three Notching Cases Graded With Nerot Classification System, Time of Follow-Up/Classification, Amount of Forward Flexion, and Pain Score on Visual Analog Scale

Case	Nerot Grade	Follow-Up	Forward Flexion	Pain Score
1	II	1 y, 7 mo	42°	0.1
2	II	1 y, 9 mo	60°	0.1
3	III	3 y, 8 mo	20°	0.1

and an RTSA was inserted and secured with antibiotic-impregnated cement and a 38-mm eccentric glenosphere. The patient tolerated this complex procedure relatively well and her postoperative course was unremarkable.

At 6 weeks, active forward flexion was 60°. At 4 months, active forward flexion was 60° and passive forward flexion was 90°. At this point, improvement plateaued. The patient reported no pain and was pleased with her progress. Grade II glenoid notching was noted radiographically (Figure 4).

Case 3

A 74-year-old woman with PD was in her usual state of health when she fell on an outstretched hand. Radiographs showed a comminuted 4-part fracture-dislocation with head split. The patient underwent RTSA and followed routine postoperative therapy. One month after index RTSA, she fell off the toilet while wearing a sling and experienced significant pain. Radiographically, it was determined she sustained an anterior dislocation, so revision RTSA was performed immediately. Revision included reducing components and increasing the size of the glenosphere from 36 mm to 40 mm.

The patient tolerated the procedure well and her postoperative course was uneventful. At 6 weeks, passive forward flexion was 40°. At 6 months, active forward flexion was 60°, passive forward flexion 90°, active external rotation 10°, and passive external rotation 20°. Radiographs showed a well-positioned prosthesis with minimal grade I notching.

During a follow-up visit nearly 3 years after surgery, the patient admitted to having fallen more than 100 times. However, the shoulder had not been dislocated and she had not experienced any pain. Although her neurovascular structures were intact, active forward flexion was 20°, abduction approximately 25°, and external rotation 5°.

Radiographs showed grade III notching of the inferior scapula with a radiolucency that extended to the body of the prosthesis. Radiolucencies were present along the medial aspect of the shaft in zones 1 and 2 (Figure 5). The patient was encouraged to participate in physical therapy to try to expand her extremely limited ROM. Despite concerted efforts, active motion did not improve, though the patient did not experience any discomfort with this shoulder.

DISCUSSION

In this article, we have reported 3 cases of RTSA in patients with PD and early substantial notching (grade II in 2 cases, grade III in 1). Although all 3 reported pain reduction, postoperative active ROM remained significantly limited compared with what has been reported for patients without PD. Boileau and colleagues²⁵ reported mean active forward flexion of 120° a mean of 40 months after surgery. However, none of our 3 patients with PD achieved more than 90° of active forward flexion (Table).

Although glenoid notching is exceptionally common in RTSA, its significance remains unclear. The literature both implicates and dismisses notching as an independent factor affecting RTSA outcome and longevity. Grammont and colleagues⁷ reported that grade III and grade IV notching significantly affected the Constant score in an RTSA series in which 49 of 77 cases (64%) demonstrated notching after a mean follow-up of 44 months. Lévine and colleagues²⁶ recently reported identifying notching in 209 of 337 shoulders (62%) after RTSA at a mean follow-up of 47 months. They correlated the mechanical failure with improper positioning and cautioned against high positioning of the baseplate and superior tilting.

There are no conclusive data linking scapular notching and postoperative outcome. Werner and colleagues¹⁰ reported finding notching on 46 of 48 RTSA shoulders (96%) available for interpretation at a mean follow-up of 38 months; no correlation was found between notching and any measure of clinical outcome. Young and colleagues²² noted notching in 12 of 49 reverse arthroplasties (24%) at a mean follow-up of 38 months, but there was no statistical significance between mean outcome scores and notching. Boileau and colleagues²⁵ found no correlation, at a mean follow-up of 40 months, between notching (26/45 cases, 58%) and American Shoulder and Elbow Surgeons scores or Constant scores. Interestingly, Lévine and colleagues²⁶ reported notching in 10% of shoulders at 6 weeks and in 64% at 36 months, whereas Werner and colleagues¹⁰ reported that 79% of notching did not progress after 1 year.

In the PD population, complications of RTSA are largely unreported, but there are some data regarding total shoulder arthroplasty (TSA). Kryzak and colleagues²⁷ reported following 43 TSAs in patients with PD over a mean of 8 years. Eight of these TSAs underwent revision arthroplasty; 3 of the 8 were revised within 1 year of the index repair because of instability. Overall, 20 of the 43 patients (47%) reported unsatisfactory results, though pain was significantly reduced, from a preoperative mean of 4.6 to a postoperative mean of 1.8. Earlier, Koch and colleagues²⁸ followed 13 TSA cases in patients with PD over a mean of 5.3 years. Although pain relief was significant, functional results were poor. Only 6 patients reported satisfactory or better results, and 3 cases required revision surgery (2 for symptomatic subluxation, 1 for glenoid loosening).

RTSA in patients with PD is precarious, as the procedure already limits internal rotation. Falls, weak musculoskeletal structures, and onset of dementia further limit functional benefits in these patients. RTSA should only be considered in patients with mild PD, uncompromised cognitive function, and home support. Physically, the ideal patient has a functioning deltoid, limited muscle rigidity, little to no tremor, and stable gait and posture with few falls. As with any RTSA, ample glenoid bone stock of quality is a prerequisite for surgery, and component positioning is paramount to optimization of function.

In conclusion, RTSA offers tremendous gains in ROM and pain reduction for the painfully arthritic shoulder with rotator cuff arthropathy. The complication rate may be higher for RTSA than for other, more established replacement procedures. In our limited series, patients with PD are likely at higher risk for complications with any type of arthroplasty because of both motor and cognitive factors. Although pain was reduced in our 3 patients, functional recovery was poor. Although it is impossible to determine the link between PD and development of scapular notching in RTSA from this short series, it is conceivable that the scapular notching in these 3 cases was secondary to the PD characteristics of rigidity, tremor, bradykinesia, and akinesia, all of which may, together, potentially precipitate significantly limited ROM compared with that in RTSA cases in patients without PD. Patients with PD must be well advised and carefully educated before RTSA is selected as treatment.

AUTHORS' DISCLOSURE STATEMENT

The authors report no actual or potential conflict of interest in relation to this article.

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