A s a complement to the total shoul-
der arthroplasty (TSA), the re-
verse TSA (RTSA) has had suc-
cess for patients with rotator cuff-related
arthropathy, avascular necrosis, postra-
umatic arthritis, failed shoulder replace-
ment, or proximal humerus fractures.1,2
However, the reported rates with RTSA
for complications, reoperations, and re-
visions have been as high as 24%, 3.5%,
and 10%, respectively.3 Clinically relevant
postoperative complications include insta-
tility, aseptic/septic component loosening,
acromion/septic component disassembly,
dislocation, and peri-
prosthetic fracture.3 Alterations have been
made to the standard RTSA components
to decrease adverse events, leading to the
advent of a short humeral stem prosthesis.
Although the standard humeral prosthesis
has a long stem extending down the medul-
lar bone, the short stem design eliminates
canal-based constraints that might other-
wise prevent re-creation of native proximal
humerus anatomy. Its use requires less in-
tramedullary reaming and allows easier re-
vision if necessary. Additionally, the short
stem preserves native host bone stock at
the humeral metadiaphysis and potentially
limits the consequences of stress shielding
seen in some patients with standard long
stem RTSA.4,5

To the authors’ knowledge, there are
no reports describing the complication

**abstract**

Alterations have been made over the years to the standard reverse total shoul-
der arthroplasty (RTSA) prosthetic components in an effort to decrease adverse
events; this has led to the advent of a short humeral stem prosthesis. To the
authors’ knowledge, there are no reports describing the complication of a tra-
umatic peri prosthetic Wright and Cofield classification type A fracture with use
of a short metaphyseal humeral stem component for RTSA. The authors describe
a 49-year-old woman with this pathology who was treated with open reduction
and internal fixation using a proximal humerus locking plate, unicortical and
bicortical screw fixation, and a cerclage wire construct without the need to vi-
late the shoulder joint or revise components. Three months postoperatively,
she was instructed to begin active range of motion in physical therapy. At 13 months
postoperatively, the patient rated her pain level at an average 5 of 10 in sever-
ity, with active assisted scaption to 125°, external rotation to 15°, and internal
rotation to L5. Radiographs at this time revealed a well-healed fracture. This not
only indicates the previously unreported occurrence of such a complication
pattern, which was thought rare with the advent of the short humeral RTSA
stem, but also provides a viable intraoperative strategy for open reduction and
internal fixation with a proximal humerus locking plate, unicortical and bicorti-
cical screw fixation, and a cerclage wire construct without the need to violate the

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Dr Saltzman, Dr Leroux, Mr Collins, and Mr
Arns have no relevant financial relationships to
disclose. Dr Forsythe is a paid consultant for So-
noma; is a paid presenter/speaker for Arthrosur-
face and Sonoma; has received research support
from Arthrex, Smith & Nephew, and Stryker; and
holds stock in Jace Medical.

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Received: November 18, 2016; Accepted:
February 20, 2017.
do: 10.3928/01477447-20170404-05

**Short Stem Reverse Total Shoulder Arthroplasty Periprosthetic Type A Fracture**

BRYAN M. SALTZMAN, MD; TIMOTHY LEROUX, MD; MICHAEL J. COLLINS, BS; THOMAS A. ARNS, BS; BRIAN FORSYTHE, MD
of a traumatic periprosthetic Wright and Cofield classification type A fracture with use of a short metaphyseal humeral stem component for RTSA. The authors describe a 49-year-old woman with this pathology who was treated with open reduction and internal fixation using a proximal humerus locking plate, unicortical and bicortical screw fixation, and a cerclage wire construct without the need to revise components.

**CASE REPORT**

The patient was a 49-year-old woman who initially underwent a left RTSA with a metaphyseal short humeral stem device (Aequalis Ascend Flex Stem; Tornier, Inc, Bloomington, Minnesota) and concurrent open biceps tenodesis in the setting of massive left shoulder rotator cuff tear arthropathy after multiple failed repairs. Prior to this intervention, her range of motion measured 50° of active scaption (145° of passive scaption), external rotation to 50°, and internal rotation to the level of the sacrum. She rated her pain as 0 of 10 in severity at baseline. An uncemented, size 4B short humeral stem with a low offset tray and a 36x6-mm polyethylene insert were implanted. The surgery was completed without complication.

Eight months postoperatively, she rated her pain as 0 of 10 in severity at baseline, but 10 of 10 in severity at its worst. Her range of motion measured 120° of active scaption, external rotation to 15°, and internal rotation to the level of her greater trochanter. However, at this time, the patient suffered a low-energy mechanical fall from standing height onto the left shoulder. Radiographs revealed a short oblique Wright and Cofield classification type A fracture with significant displacement, comminution, and a short spiral component at the distal end of the stem (Figure 1).

The patient was brought to the operating room and the fracture site was exposed through a deltopectoral interval. Interposed soft tissue was removed with a rongeur. The tip of the humeral prosthesis was visualized (Figure 2A); the prosthesis was grossly stable and well fixed within the metaphyseal bone. There was displacement of the shaft by 100%, with several comminuted fragments of cortical bone within the distal canal that blocked reduction. These were carefully removed. There was a segmental region of cortical bone anteromedially measuring approximately 3x2 cm that was invested within its muscular attachments and well vascularized. Using lobster clamps, a provisional reduction was obtained.

A proximal humerus locking plate was applied provisionally to the anterolateral humerus with K-wires. Once the position of the plate was satisfactory, 7 unicortical locking screws were placed through the
proximal aspect of the plate and into the bony tuberosity and proximal metadiaphysis. Three bicortical screws were placed distal to the fracture site, and stable fixation was achieved. A cerclage wire was placed just proximal to the fracture site and was engaged into an empty locking hole (Figures 2B-D). The shoulder was brought through an anatomic range of motion with excellent stability maintained at the fracture site. At the site of bone loss, an area measuring 1×2 cm was filled with 2.5 cm² of demineralized bone matrix putty graft. The anatomic layers were closed and the skin was reapproximated. The patient was placed in a sling with an abduction pillow.

The patient did well during the postoperative period, with therapy initiated at 1 month postoperatively for gentle passive range of motion exercises. Ultimately, 13 months postoperatively, the patient rated her pain level at an average 5 of 10 in severity, with active assisted scapular raise to 125°, external rotation to 15°, and internal rotation to L5. Radiographs at that time revealed a healed fracture and intact prosthetic joint (Figure 3).

**DISCUSSION**

The results of short humeral stem use in shoulder arthroplasty have been promising, with low complication rates. Jost et al. retrospectively reviewed 49 patients who underwent TSA with a short stem prosthesis for primary osteoarthritis and reported 2 complications: an acute subscapularis rupture requiring revision surgery and a nonfatal pulmonary embolism. Schnetzke et al. reported the multicenter results of 82 TSAs in 80 patients with an uncemented short humeral stem. The complication rate was 7.3%, with 1 major (posterior dislocation necessitating revision surgery) and 5 minor (secondary rotator cuff insufficiency) complications. Giuseffi et al. retrospectively reviewed their cohort of 44 patients who underwent primary RTSA with a short uncemented stem. At a mean follow-up of 27 months, the only complications reported by the authors were a transient brachial plexus abnormality, a dislocation requiring closed reduction, and a superficial infection that resolved with oral antibiotics. Atoun et al. evaluated 31 patients who underwent RTSA with a short metaphyseal stem design at a mean follow-up of 36 months. Complications included 2 cases of grade 1 to 2 glenoid notching; 3 intraoperative fractures, which did not affect completion of the operation as planned; and 5 late traumatic periprosthetic fractures. The latter consisted of 1 glenoid fracture after a fall; 3 metaphyseal humerus fractures following a fall, which were nondisplaced to minimally displaced and amenable to conservative treatment with full healing; and 1 fully displaced proximal metaphyseal fracture necessitating revision to a long stem prosthesis.

To the authors’ knowledge, this is the first report of a traumatic periprosthetic type A fracture at the distal aspect of a short metaphyseal RTSA humeral stem component. This was amenable to open reduction and internal fixation without revision of the humeral prosthesis. It is important first to note the occurrence of this complication and its existence, as it may occur with higher incidence as the use of short stem designs increases. This region of metadiaphyseal humeral bone may be at risk for fracture with low-energy mechanism due to a persistent stress riser within the metaphysis at the tip of the short stem. Further design modifications to the short humeral prosthesis stem may be needed to adjust this biomechanical concern.

The authors also show that the uncemented short stem can remain well fixed within the metadiaphyseal bone and thus be appropriate to retain during open reduction and internal fixation. The authors suggest using a proximal humerus locking plate with 5 distal screw holes to allow for 3 bicortical screws to be placed distal to the fracture site. Such a plate will additionally allow for numerous unicortical locking screws to be placed into the bony tuberosity and proximal metadiaphysis. A cerclage wire provides additional stability proximal to the fracture site, where forces are most concentrated. The authors believe this provides a dynamically stable construct to address this complicated periprosthetic fracture pattern.

**CONCLUSION**

This case presents the first traumatic periprosthetic type A fracture at the distal aspect of a short metaphyseal humeral stem component within a RTSA construct. The pathology was amenable to open reduction and internal fixation without revision of the stable humeral prosthesis. This indicates the previously unreported occurrence of this fracture pattern with the short humeral RTSA stem, but provides a viable strategy for fixation.

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