



# Functional and radiologic outcomes of uncemented reverse shoulder arthroplasty in proximal humeral fractures: cementing the humeral component is not necessary

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**Background:** Our aim was to determine the radiologic and functional outcomes of patients who underwent reverse shoulder arthroplasty (RSA) for proximal humeral fractures and to assess whether the uncemented humeral components put them at risk for early loosening and failure.

**Methods:** Thirty-three patients were identified in our hospital database (January 2004–December 2012). Twenty patients were assessed using American Shoulder Elbow Surgeons (ASES) score, Constant Shoulder Score (CSS), and the Oxford Shoulder Score (OSS). Up-to-date shoulder radiographs were evaluated for evidence of radiologic loosening.

**Results:** The mean follow-up period was 3.0 years (range, 2.5–7.8 years), and the mean age at the time of surgery was 76.5 years (range, 62–87 years). The mean ASES was 75.9 of 100 (range, 55–98.3), with a mean visual analog scale pain score of 2 of 10. The mean OSS was 42.5 of 48 (range, 35–48), and the mean CSS was 54.1 of 100 (range, 32–72). Upon radiographic assessment of the humeral component, 6 patients (30%) had 3 or more lucent zones, and 12 patients (60%) had a lucent zone measuring more than 2 mm in width; however, only 2 patients (10%) had 3 or more lucent zones measuring 2 mm or more in width and were identified as “at risk of loosening.” No patients had tilt or subsidence of the humeral prosthesis.

**Conclusions:** Our study demonstrated satisfactory functional and radiologic outcomes of patients compared with other studies, suggesting that RSA is a good management option for elderly patients with these fractures. The uncemented nature of the humeral component did not result in early loosening or failure.

**Level of evidence:** Level IV, Case Series, Treatment Study.

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**Keywords:** Proximal humeral fractures; uncemented; reverse shoulder arthroplasty; humeral prosthesis; shoulder function; radiological outcome; lucency; loosening

Ethics Committee approval was not applicable to this study according to the Health and Disability Ethics Committee (New Zealand) guidelines.

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Proximal humeral fractures continue to be a difficult and controversial management problem. The incidence increases with age, which adds to the complexity of the treatment, because most of these fractures occur in elderly individuals. Recent projections have suggested that there may be an estimated 32% increase in the number of these fractures by 2030.<sup>15</sup>

Most proximal humeral fractures may still be satisfactorily managed nonoperatively.<sup>12</sup> In those fractures not amenable to nonsurgical management, several treatment options exist, which can be grouped into internal fixation/osteosynthesis or arthroplasty. Although the techniques and technology of internal fixation have improved, significant risks of complications exist in the more complex fracture patterns that include fixation failure, nonunion, and avascular necrosis (AVN). This risk is greater for internally fixed fractures in the elderly population due to osteoporotic bone.

Hemiarthroplasty has traditionally been used to surgically manage these patients, but its outcomes may be unreliable, with reported unacceptable patient satisfaction and significant complication rates.<sup>9,17,25,27</sup> To achieve a good functional result, hemiarthroplasty heavily relies on tuberosity healing,<sup>4</sup> which may be particularly difficult in the elderly population.

Reverse shoulder arthroplasty (RSA) was developed as a surgical option for patients with arthritis and rotator cuff deficiency (ie, rotator cuff arthropathy).<sup>26</sup> The RSA reverses the ball and socket parts of the joint to maintain humeral depression and uses the deltoid mechanics to provide humeral elevation around the glenosphere. With time, the surgical indications for RSA have expanded and have included the treatment of proximal humeral fractures. RSA has gained popularity in recent years as a treatment for proximal humeral fractures because it may rely less on the anatomic restoration of the tuberosities.<sup>1,5,6,16,17,19,30,31</sup>

Although a few studies have shown favorable or reasonable early outcomes of the use of RSA in fractures, some studies have also shown mixed outcomes and a significant complication rate.<sup>8,17</sup> Most of the earlier studies reported outcomes on the use of cemented RSA prostheses.<sup>7,17</sup>

An uncemented humeral prosthesis may provide several advantages over a cemented prosthesis, including a shorter operative time, avoiding morbidity associated with the use of cement, and conferring the ability to change intraoperatively the alignment of the humeral prosthesis.<sup>18</sup> However, because the RSA is a semiconstrained prosthesis, the increased stress on the humeral component and the comminuted fracture of the proximal humerus may compromise the fixation of an uncemented humeral prosthesis and lead to early mechanical loosening.

At our institution, uncemented RSAs have become the preferred therapeutic approach for comminuted proximal humeral fractures in elderly patients. The aim of this study was to determine the functional and radiologic outcomes of



**Figure 1** SMR (Shoulder Modular Replacement; Lima Corporate, San Daniele del Friuli, Italy).

this prosthesis and, in particular, to assess whether an uncemented humeral component led to an increased risk of early loosening of the prosthesis, which, to the best of our knowledge, remains unknown.

## Materials and methods

All patients who underwent RSA for proximal humeral fractures at our institution between January 2004 and December 2012 were examined in our study. The database of the implant manufacturer was also checked as a cross-reference to ensure that all eligible patients were identified. We initially identified 33 patients.

Our inclusion criteria were acute RSA performed for any type of proximal humeral fractures in which the humeral components were uncemented. Our exclusion criteria were patient death or loss to follow-up, RSA with cemented humeral components, RSA performed for malunion or AVN after fracture (in a nonacute setting), and noncompliance for any reason with clinical assessment during follow-up.

We excluded 13 patients: 6 patients had died, 2 were lost to follow-up, 3 received a fully cemented implant, 1 developed nonacute AVN after open reduction and internal fixation 2 years after the initial fixation, and severe Parkinson disease in 1 patient greatly compromised preoperative shoulder function and compliance with our clinical assessment during follow-up. A total of 20 patients were eligible for inclusion in the study.

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