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ORIGINAL ARTICLE

Reverse shoulder arthroplasty for complex fractures of the proximal humerus in elderly patients: impact on the level of independency, early function, and pain medication

Fabian Wolfensperger, MD^{a,*}, Patrick Grüniger, MD^b, Michael Dietrich, MD^b, Mathias Völlink, MD^c, Emanuel Benninger, MD^d, Michel Schläppi, MSc^d, Christoph Meier, MD^d

^aDepartment of Surgery, Zuger Kantonsspital, Baar, Switzerland

^bDepartment of Surgery, Stadtsipital Waid, Zürich, Switzerland

^cDepartment of Orthopedics, Kantonsspital Frauenfeld, Frauenfeld, Switzerland

^dDepartment of Orthopedics and Traumatology, Kantonsspital Winterthur, Winterthur, Switzerland

Background: This study investigated early functional outcome, quality of life, and the level of independency in elderly patients after primary reverse shoulder arthroplasty (RSA) for complex fractures of the proximal humerus.

Methods: This was a prospective case series that included 33 patients, aged ≥ 70 years, with a high level of independency who received RSA for complex fractures of the humerus (Orthopaedic Trauma Association B2/C) from January 2012 to April 2014.

Results: Level of independency, quality of life (Short Form 36 Health Survey score), early functional outcome (Constant-Murley score, Disabilities of the Arm, Shoulder and Hand Outcome Measure), and pain medication (World Health Organization grading) were obtained at the 6-month follow-up and 1 year after surgery. The Constant-Murley score was 64 ± 14 after 6 months and 71 ± 12 at 1 year ($P < .001$), reaching 87% compared with the contralateral shoulder. The Disabilities of the Arm, Shoulder and Hand score reached 29 ± 20 at 6 months and 30 ± 21 at 1 year. The Short Form 36 score was comparable to normative data. After 6 months, 84% of our study group were back at their previous level of independency. Within 1 year, this rate increased to 91%. At the 1-year follow-up, analgesia intake was back at the level before the injury in 97% of the patients.

Conclusions: Primary RSA provides good early functional results, reliable pain control, and excellent restoration of an independent life style in elderly patients. Thus, RSA may be considered for active patients with a high demand on shoulder function.

The Kantonale Ethik-Kommission Zürich approved this study (KEK-ZH-Nr. 2016-01184).

*Reprint requests: Fabian Wolfensperger, MD, Department of Surgery, Zuger Kantonsspital, Landhausstrasse 11, CH-6340 Baar, Switzerland.

E-mail address: fwolfi@gmx.ch (F. Wolfensperger).

Level of evidence: Level IV; Case Series; Treatment Study

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Fractures of the humeral head are among the most common fractures in elderly patients. The treatment of these fractures is known to be prone to various complications, such as humeral head necrosis and loss of function of the rotator cuff.^{7,16,33,34} Thus, functional outcome is frequently poor.

A relevant decrease of shoulder function may be associated with a decreased quality of life and a potential loss of an independent life, in particular for elderly patients. For these patients, the preservation of an independent life is the most important goal among others such as function, pain control, and a low complication rate. Preservation of an independent life may also be the most important factor to lower overall costs. Thus, not only purely functional outcome but also the degree of an independent life should be taken into consideration for the assessment of different therapeutic modalities for complex fractures of the proximal humerus.

The purpose of this study was to prospectively assess reverse shoulder arthroplasty (RSA) as the primary treatment option in elderly patients with complex fractures of the humeral head, focusing on early functional outcome and its influence on potential social implications such as a partial or total loss of independence. Our hypothesis was that RSA may provide good functional results associated with preservation of the patient's social situation as it presented before trauma.

Materials and methods

Patients

This prospective single-center study included all patients aged ≥ 70 years who were treated with primary RSA for acute complex fractures of the proximal humerus between January 2012 and April 2014. Fracture patterns treated with RSA included 3- and 4-part fractures according to Neer²⁷ or 11-B and 11-C fractures according to the Orthopaedic Trauma Association (OTA)/Arbeitsgemeinschaft für Osteosynthesefragen (AO) classification, respectively.^{23,25} These fracture patterns are generally associated with a high risk of subsequent avascular necrosis of the humeral head.¹³ Patients aged < 70 years and patients with RSA for sequelae of failed nonoperative treatment, osteosynthesis, or fracture hemiarthroplasty (HA) were excluded ($n = 10$) from further evaluation. Informed consent was obtained from all patients entering the study and for the operative treatment and the follow-up investigations.

Preoperative assessment

The preoperative evaluation included a clinical examination and the patient's history, with a focus on the pretraumatic shoulder function and the preoperative way of life. The level of independency was

defined as follows: independently living at home, depending on some help at home, living in a retirement home, living in a nursing home with additional support.⁸ Only patients with higher levels of independency (living at home or in a retirement home) were included, patients living in a nursing home were excluded. The use of analgesia before trauma was recorded and classified according to the official World Health Organization (WHO) analgesic ladder.³⁷

All patients received a standard series of x-rays (true anteroposterior shoulder view in neutral rotation [Grashey view], scapular Y view). All fractures were additionally assessed by a computed tomography (CT) scan (128-slice technology with 3-dimensional reconstructions) for a better understanding of the injury regarding fracture classification and potential compromise of humeral head perfusion.¹³

Operative technique and rehabilitation

All patients received the same RSA model (Aequalis-Reversed Fracture; Tornier S.A.S., Montbonnot Saint Martin, France). All operations were performed with the patient in the beach chair position by the second (P.G.) or last (C.M.) author. General anesthesia was combined with a continuous interscalene block in all patients.

A standard deltopectoral approach was used. The base plate was attached to the glenoid surface in an inferior position with a 10° inferior tilt. The stem was placed in the proximal humerus using third-generation cementing technique (TBCem G1, Tornier) in the determined height and a retrotorsion of 25° . Tuberosity fixation was performed with 4 doubled-over strands of heavy nonabsorbable braided polytetrafluoroethylene-impregnated polyester suture (NiceLoop, Tornier) according to the technique described by Boileau et al.² Cancellous bone grafts harvested from the resected humeral head were used to fill any remaining osseous defects.

All patients were immobilized postoperatively on an abduction pillow (30°) for 6 weeks. Patients were encouraged to perform active wrist and elbow movements from the beginning, but no mobilization of the shoulder was allowed for 6 weeks. This was followed by physiotherapy of the shoulder with free active range of motion. Strengthening exercises were started at week 13.

Follow-up

Intraoperative and postoperative complications and reinterventions were recorded. Follow-up investigations were performed after 6 and 12 months. The clinical evaluation included the Constant-Murley score (CMS).⁵ The age-adjusted and gender-adjusted CMS¹⁷ and the CMS of the contralateral shoulder were assessed as well. The Disabilities of the Arm, Shoulder and Hand (DASH) Outcome Measure¹⁵ and Short Form 36 Health Survey (SF-36)³⁶ questionnaires were completed by the patients at home after receiving proper instructions by the investigators and were returned by mail. The social situation and intake of analgesic medication were assessed using the

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