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Original Article

Long-term follow-up of the Copeland mark III shoulder resurfacing hemi-arthroplasty

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ABSTRACT

Background: Shoulder humeral resurfacing is being performed in increasing numbers. We report the long-term outcome of patients with the Copeland mark III humeral resurfacing hemi-arthroplasty.

Methods: Ninety-five shoulder hemi-arthroplasties were performed in 85 patients, from 1994 to 2003. Oxford Shoulder Score (OSS) and short form 12 (SF-12) questionnaires were administered.

Results: At 12-year follow-up, 49 patients were alive. The OSS was 35.2 and SF-12 score was 83. There were 3 revision operations and 95% survivorship at 18 years.

Conclusion: This prosthesis has a low revision rate with few post-operative complications and good patient-reported outcome in an elderly population.

1. Introduction

Arthritis of the shoulder is associated with significant morbidity and loss of function. While conservative management has a role, arthroplasty can provide significant pain relief and functional improvement.[6,7,10,14,19,23] With increasing number of patients undergoing primary shoulder arthroplasty[5] and with an ageing population, long-term functional outcome is even more important.

Shoulder arthroplasty has evolved over the last 50 years since Neer introduced a stemmed prosthesis for four-part fractures in 1955.[18] One of the more recent developments is resurfacing, which has the advantages of minimal bone resection, avoidance of humeral canal penetration and low risk of peri-prosthetic fracture. Resurfacing has been shown to be at least comparable to stemmed prostheses in terms of function.[12–14] These replacements more accurately approximate the native shoulder geometry compared with stemmed options.[9,11]

The Copeland hemi-arthroplasty (Biomet, Warsaw, Indiana) is a resurfacing prosthesis, which has itself evolved over the last 25 years undergoing two major improvements. The first prosthesis, developed in 1986, was the mark I, which had a central pegged metal humeral component and a polyethylene glenoid component with a finned peg. In 1990, this was superseded by the mark II prosthesis, which had a metal backed glenoid component, with both components having a

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fluted taper fit peg. The implant investigated in this report is the mark III, which was introduced in 1993. This most recent design features a cruciform tapered peg with porous titanium and hydroxyapatite coating.[14]

The majority of existing outcome studies[14,16,17] have been reported by the group who developed the Copeland prosthesis. The purpose of this study is to evaluate the long-term outcome of the Copeland mark III humeral resurfacing replacement in a District General Hospital, and previous studies have included patients with total shoulder resurfacing; however, we provide the largest study group and the longest follow-up till date of shoulder resurfacing hemi-arthroplasty.

2. Materials and methods

There were 95 Copeland hemi-arthroplasty operations performed in 85 patients at our institution over a ten-year period (1994–2003). We obtained details of these patients from the hospital theatre register. Case-notes of the cohort were examined and details of each operation, complications and re-operations noted. The surviving patients were sent an Oxford Shoulder Score (OSS) questionnaire, a Short Form 12 (SF-12) questionnaire and a short questionnaire asking about satisfaction and any further surgery. Ethics committee approval was obtained prior to the commencement of the study.

The OSS was devised in 1996 as a patient-reported outcome measure.[8] It comprises two sections, the first assessing pain and the second assessing function. The original scoring has been revised recently[21] and now ranges from 0 to 48, with 48 being the best outcome. The functional score ranges from 0 to 32, and the pain score from 0 to 16. The OSS has the advantages of being short, with low respondent burden and is specific to shoulder pathology. It is also highly responsive to detecting change.[3] The SF-12 score is an abbreviated version of the SF-36 score, which is used to assess physical and mental function. It is scored with the norm-based method, where the population mean is always 50 and a standard deviation 10. Using this system, an individual's score of less than 45 or a group score of less than 47 is considered below the average range.[24]

Statistics were performed in Microsoft Excel version 2007 (Microsoft, New York, NY, USA) and Statistical Package for the Social Sciences (SPSS) version 19.0 (SPSS Inc., Chicago, IL, USA). Data are given as means with standard deviations (SD) unless stated otherwise.

3. Surgical technique

The deltopectoral approach was used in order to preserve deltoid function. The patients were positioned in a "deck chair" position. A vertical incision was used, one centimetre lateral to the coracoid process. The Cephalic vein was identified in the deltopectoral interval. The conjoint tendon was partially divided to improve exposure. Subscapularis was then divided with capsule just medial to the insertion to the lesser tuberosity. The capsule was entered and the humeral head was dislocated and marginal osteophytes removed. The entry point was found by identifying the margins of the humeral articular surface, inserting a guide-wire and selecting the implant size.

After reaming, a trial prosthesis was reduced. The final prosthesis was inserted without cement, unless the bone stock was poor, in which case, Palacos cement (Heraeus, Hanau, Germany) was used. During closure, subscapularis and the partially divided conjoint tendon were repaired and the deltopectoral groove reconstructed.

4. Results

Of the 85 patients (95 shoulders), 36 patients (38 shoulders) had died and 40 patients (46 shoulders) responded with functional outcome information. 9 patients (11 shoulders) were still alive but were lost to follow-up. Therefore, there was an 80.7% response rate.

Of the deceased patients, 36 shoulders had osteoarthritis (OA) and 2 shoulders had rheumatoid arthritis. None of the deaths were directly related to shoulder surgery. The deceased patients accounted for 42.4% (36 shoulders) of the cohort. 10 were male and 26 were female. They had a mean age of 73 years (8) at operation and a mean age of 81 years (9.3) at death. Of those lost to follow-up, 8 were female, 1 was male and none had any complications reported in the case-notes.

Of the 40 patients that responded, 6 had bilateral operations resulting in 46 shoulders. In this group, there were 40 shoulders with osteoarthritis, 2 with rheumatoid arthritis, 1 with instability, 2 with rotator cuff disease and 1 with avascular necrosis. There were 9 male respondents and 31 female respondents. The mean age was 67 years (SD: 11; range: 35–82). Mean follow-up length was 12 years (SD: 3; range: 8.7–18.0).

4.1. *Satisfaction*

The mean overall satisfaction score from our questionnaire was 1.5 (SD: 0.81), where 1 is very satisfied and 4 is very dissatisfied.

4.2. *Oxford Shoulder Score*

The mean OSS was 35.2 (SD: 8.54; range: 17–48). The mean functional score was 24.3 (6.0) and the mean pain score was 11.3 (3.8). The scores were good for all pathologies except for rotator cuff disease, which had a mean OSS of 23.0 (0). The OA group had a mean score of 35.8 (9) (Table 1). The numbers in the individual groups were too small to provide statistical comparison; however, there was no significant difference between OA and non-OA groups ($p = 0.4$). The male sub-group had a mean OSS of 38.9 (5.56) and the female sub-group had a mean OSS of 33.5 (9.01). The difference was not statistically significant ($p = 0.11$).

4.3. *General health and satisfaction*

The mean SF-12 score was 83 (15.5). The mean physical score was 33.2 (11.8) and the mean mental score was 49.8 (10.1). Overall, 88% were very satisfied with their shoulder outcome, with 88% able to do housework or gardening and 85% able to do recreational activities.