

# Pyrolytic Carbon Head Hemiarthroplasty Versus Cobalt-Chromium Head for Proximal Humerus Fractures - A Short-Term Follow-Up Study

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## INTRODUCTION:

Shoulder hemiarthroplasty (HA) is a viable treatment option for complex proximal humerus fractures in younger patients (<65 years), although clinical outcomes can vary. In recent years, the pyrolytic carbon head (PCH) prosthesis has emerged as an alternative to the cobalt-chromium (CoCr) head in shoulder osteoarthritis, potentially reducing glenoid erosion.

Over the past decade, we gradually transitioned from traditional CoCr prostheses to PCH prostheses in HA procedures due to PHF in younger patients. This shift was driven by the belief that PCH prostheses would minimize future erosion and prove more advantageous in fracture cases, where the glenoid cartilage is typically intact. It is important to note that this represents an off-label use of PCH prostheses.

This study aimed to compare the outcomes of the PCH prosthesis HA with the traditional CoCr head in the treatment of complex proximal humerus fractures (PHFs), with the hypothesis that the PCH group would demonstrate superior results.

**METHODS:** Patients under 65 years old, who underwent HA using the PCH prosthesis for complex PHFs between 2019 and 2023, were compared to a control group of patients who underwent traditional CoCr HA. Postoperative assessments at minimum one-year follow-up included range of motion, Numeric Rating Scale for pain (NRS), Subjective Shoulder Value (SSV) and Radiological evaluation including greater tuberosity union and glenoid erosion.

## RESULTS:

### Baseline Characteristics

A total of 21 patients were included in the PCH group (48% male), with no exclusions. The CoCr group initially consisted of 25 patients, and after excluding five cases due to insufficient follow-up, 20 patients (50% male,  $p = 0.88$ ) were included in the final analysis. The mean follow-up duration was  $16 \pm 7$  months in the PCH group and  $17 \pm 8$  months in the CoCr group.

The mean age of patients in the PCH group was  $53 \pm 10$  years (range: 32-64), while in the CoCr group, it was  $57 \pm 7$  years (range: 42-64) ( $p = 0.14$ ). In the PCH group, an Ascend Flex stem was used in all patients, while in the CoCr group, 65% of patients received an Aequalis FX stem, while the other 35% received a Global Unite Fx stem. All stems were fixed using cement.

### Clinical Results

Forward flexion (FF) was significantly higher in the PCH group compared to the CoCr group ( $147^\circ \pm 30^\circ$  vs.  $96^\circ \pm 45^\circ$ ,  $p < 0.001$ ). Similarly, external rotation (ER) was significantly better in the PCH group ( $40^\circ \pm 19^\circ$ ) compared to the CoCr group ( $27^\circ \pm 20^\circ$ ,  $p = 0.05$ ), and the median internal rotation (IR) was significantly higher in the PCH group (T12) compared to the CoCr group (Lumbosacral,  $p = 0.02$ ). Regarding patient reported outcomes, a significant difference was observed in the Numeric Rating Scale (NRS) for pain ( $1.9 \pm 2.4$  vs.  $3.4 \pm 2.4$ ,  $p = 0.05$ ). However, no statistically significant differences were found between the groups for the Subjective Shoulder Value (SSV) scores ( $77 \pm 18$  vs.  $66 \pm 21$ ,  $p = 0.12$ ).

### Radiographic results

The proportion of patients with anatomic greater tuberosity (GT) alignment immediately postoperatively was high in both groups (84% in the PCH group and 87% in the CoCr group). However, at the one-year follow-up, better tuberosity healing was observed in the PCH group (95% Vs. 60%,  $P=0.01$ ). Grade 2 glenoid erosion was less frequent in the PCH group (1 Vs. 4 cases,  $P=0.70$ ); however, it did not reach statistical significance.

### Revision Surgery

One patient in the PCH group (5%) and one patient in the CoCr group (5%) required revision surgery to RTSA during this short-term follow-up period due to pain and significant disability resulting from greater tuberosity nonunion and migration. No other major complications were recorded.

## DISCUSSION AND CONCLUSION:

The PCH group demonstrated superior clinical outcomes in most measures compared to the CoCr group. Differences in stem designs and surgeons' experience may also influence these results, and the observed benefits cannot be attributed solely to the prosthesis head. While the main potential advantage of the PCH—reduced glenoid erosion—will require further investigation with longer follow-up, this is the first study to demonstrate the safety and short-term outcomes of the

PCH in treating proximal humerus fractures.

