



Research Article

Results of Copeland Shoulder Resurfacing Arthroplasty in Sickle Cell Patients with Humeral Head Avascular Necrosis

Ayman Al-Amri*, Ahmed Al-Hadeethi, Sultan Al-Maskari

Department of Surgery, Sultan Qaboos University Hospital, Muscat, Oman

*Corresponding author: Ayman Al-Amri, Department of Surgery, Sultan Qaboos University Hospital, Muscat, Oman

Citation: Al-Amri A, Al-Hadeethi A, Al-Maskari S (2022) Results of Copeland Shoulder Resurfacing Arthroplasty in Sickle Cell Patients with Humeral Head Avascular Necrosis. J Orthop Res Ther 7: 1254. DOI: 10.29011/2575-8241.001254

Received Date: 05 September, 2022; **Accepted Date:** 12 September, 2022; **Published Date:** 15 September, 2022

Abstract

Introduction: Avascular Necrosis (AVN) of the humeral head is a debilitating complication of Sickle Cell Disease (SCD) estimated to occur in about 5% of patients for which the optimal therapy is not well defined. Although Copeland is often used for AVN in other settings, little information is available about the outcome of Copeland resurfacing in this population. The aim of this study was to evaluate the results of Copeland Shoulder Resurfacing Arthroplasty (CSRA) in sickle cell patients with humeral avascular necrosis.

Methods: Eleven CSRA were performed in eight patients with sickle cell disease from 2010 to 2014 in Sultan Qaboos University Hospital, Oman. Medical recorded, radiograph, operative note, clinical outcome, and complications were reviewed retrospectively with a mean follow-up of 4 years.

Results: Seven CSRA (63.6%) have improved in their pain and range of movement post-operatively. One patient developed stiffness that required arthroscopic capsular release. Three CSRA (27.3%) underwent revision to a total anatomical shoulder arthroplasty due to aseptic loosening (one patient) and glenoid arthrosis (two patients). Patients with high-grade AVN (stage 4 and 5) showed inferior results and satisfaction following CSRA. **Conclusion:** Treatment of humeral head AVN in SCD patients is challenging. Copeland shoulder resurfacing arthroplasty may improve pain and function in selected SCD patients with early stages of humeral head AVN.

Keywords: Copeland resurfacing; Humeral head avascular necrosis; Shoulder resurfacing arthroplasty; Sickle cell disease

Introduction

Sickle Cell Disease (SCD) is a commonest inherited blood disorder in Oman (3.5-4.7/1,000) [1]. It is an autosomal recessive disease resulting from a point mutation in the 13-globin gene. Patients with SCD have a variety of clinical manifestations, and the most common are chronic haemolytic anaemia and vaso-occlusive disease. Avascular Necrosis (AVN) of the humeral head is reported to have a prevalence of around 5% in SCD patients [2]. The Co-

peland Shoulder Resurfacing Arthroplasty (CSRA) was developed in the early 1980s by Copeland and his colleagues. It is a cementless, pegged Humeral Head (HH) surface replacement [3]. There are several advantages of CSRA: shorter operation time, preservation of humeral bone stock, and lower risk of periprosthetic fractures [4]. However, very little is known about the results of shoulder resurfacing arthroplasty in sickle cell patients with humeral head avascular necrosis. Therefore, this study aims to evaluate the outcome of Copeland Shoulder Resurfacing Arthroplasty (CSRA) in Sickle Cell Disease (SCD) patients with humeral Avascular Necrosis (AVN).

Methods

Patient Population

This study is a retrospective observational study that includes all patients with Copeland shoulder resurfacing arthroplasty for Humeral avascular necrosis due to SCD from 2010 to 2014 at Sultan Qaboos University Hospital (SQUH), Oman.

Surgical Technique

All surgical procedures were performed by a single experience shoulder surgeon under general anesthesia with an interscalene block on a beach chair position. Surgical approach was a standard Deltopectoral approach with Subscapularis tenotomy approximately 1 cm from its insertion. Tenodesis of long head of biceps below the groove. Special attention was given to the humeral preparation to carefully expose the anatomical neck of the humerus and ensure correct positioning of the prosthesis. circumferential removal of all osteophytes. A humeral drill guide of the correct size as determined by its fit to the native HH was placed with its free edge parallel to the anatomic neck. No procedure was performed on the glenoid and there was no posterior capsular release. Trans-osseous repair of the subscapularis was performed using nonabsorbable sutures. The Copeland Mark IV (Biomet Orthopaedic Ltd) hydroxyapatite coated prosthesis was used for all cases.

Clinical and Radiological Assessment

Functional outcome assessment using the **Oxford shoul-**

der score (OSS) (scale 1–48, 48 = optimal functioning shoulder) was used only in post-operatively. Six patients completed the OSS scores post-operatively. **Pain** (no pain, mild, moderate and severe) and **satisfaction** level (Satisfied, somehow satisfied, unsatisfied) were assessed in the follow-up. **Complications** (infection, peri-prosthetic fracture, stiffness, glenoid erosion, instability, aseptic loosening) were evaluated. Follow-up radiographs including anterolateral and axillary views were taken preoperatively, immediate postoperatively, 3 months, 6 months then annually. AVN of humeral head was staged based on the Ficat and Arlet classification, modified by Cruess for the shoulder [5].

Results

Eleven CSRA were performed in eight patients from 2010 to 2014 at SQUH. There were 2 males (%) and 6 females (%). The mean age was 31.6 years (range 21–51 years) and the mean follow-up was 4.1 years (range 3.1–8.3). There were five shoulders in Humeral head AVN stage III (Figure1), three shoulders are stage IV, and three shoulders in stage V. Table 1 demonstrated the clinical and complications result according to AVN humeral head stage. During follow-up, three CSRA (27.3%) underwent revision to a total anatomical shoulder arthroplasty due to significant progressive glenoid erosion (Figure 2) and One shoulder developed stiffness that required arthroscopic capsular release (after 18 months). One patient with proximal migration and rotator cuff tear, reluctant to go to further surgery.

AVN stage (n=11)	Oxford Shoulder Score (mean)	Post-op Pain n (%)	Satisfaction n (%)	Complication n (%)
Stage III (n=5)	31	3 Mild 2 moderate	3 satisfied 2 somehow satisfied	No complications
Stage IV (n=3)	20	1 moderate 2 severe	1 somehow satisfied 2 unsatisfied	1 stiffness 1 Glenoid erosion
Stage V (n=3)	11	3 severe	3 unsatisfied	2 Glenoid erosion 1 Proximal migration (RCT)

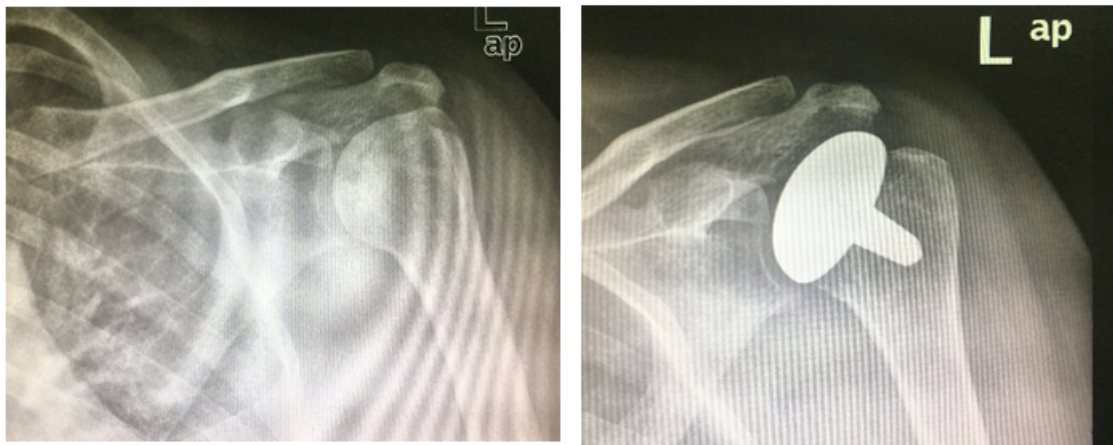


Figure 1: SCD patient with stage III humeral head AVN of left shoulder underwent Copeland shoulder resurfacing arthroplasty.

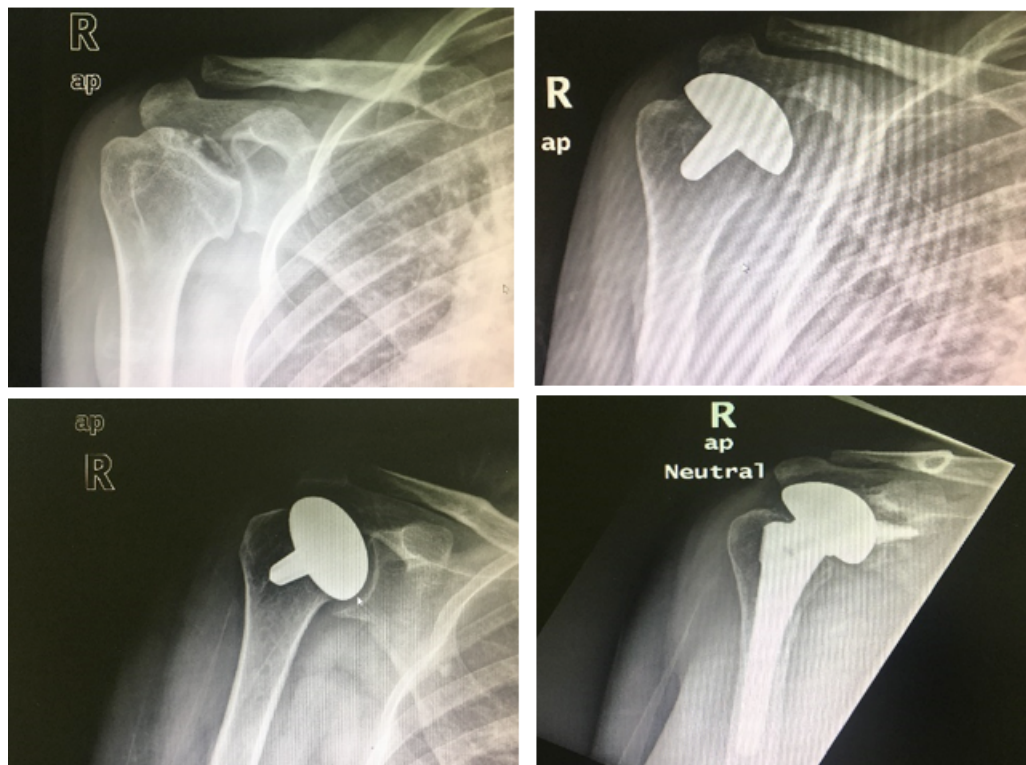


Figure 2: SCD patient with stage IV humeral head AVN of the right shoulder underwent Copeland shoulder resurfacing arthroplasty and underwent revision to a total anatomical shoulder arthroplasty due to significant progressive glenoid erosion.

Discussion

There are few published data currently on the outcomes from shoulder arthroplasty in sickle cell patients. Lau et al [6] reported the outcome of 8 shoulder arthroplasties (7 hemiarthroplasty and one TSA) in sickle cell patients with a mean of 51 months follow-up. Results are variable for both function and pain relief. Three patients had complications (intraoperative rotator cuff tear, stiffness and infection) and One patient with a hemiarthroplasty underwent revision to TSA.

In the largest **HHAVN arthroplasty** studies Schoch et al [7] performed retrospective study comparing the outcome between HA & TSA in **(141)** patients with atraumatic AVN with **9.3-year** mean follow-up. Results reported significant improvements in pain, ROM and satisfaction in all patients (HA & TSA). However, eleven percent of HA had moderate to severe glenoid erosion at follow-up, and 25% of glenoid components of TSA were radiographically at risk. Although the Copeland prosthesis has been used since 1986, very few case series have been published. Alizadehkhayat et al [8], reported a result of series of 102 consecutive CRSA in OA (47.1%), RA (40.2%), RCA (8.8%) and AVN (3.9%). The best results were obtained in OA patients, then RA group and AVN. RCA patients having the poorest outcome. 12.9% revision rate. In another study, Rai et al reported a long-term follow up (12.0 years) outcome of 46 CRSA in mixed patient groups. OA (40 shoulder), 2 with RA, one with instability and one with AVN. The OSS and SF-12 scores were good for all pathologies except rotator cuff disease. 3.6 % revision rate.

Our series showed that the best results of CRSA in SCD patients were in patient with early stage of AVN (stage 3). However, pain was persistence after arthroplasty in almost all patients This is can be explained due to ongoing vascular occlusion events from SCD and Other joints involvement. In our study, the main complication and reason of revision were glenoid erosion. One major limitation of our study is the small number of patients.

Conclusion

Treatment of humeral head AVN in SCD patients is challenging. CSRA may provide improvement in pain and function in selected SCD patients with early stages of humeral head AVN. However, further studies with larger number of patients and longer follow-up are required

References

1. Wali Y, AlBalushi H, Nazir NH (2017) Sickle cell disease in Oman and HBS Oman: a brief review. Hematol Transfus Int. J 4: 142-143.
2. David HG, Bridgman SA, Davies SC, Hine AL, Emery RJH (1993) The shoulder in sickle-cell disease. J Bone Joint Surg Br 75: 538-545.
3. Copeland S (2006) The continuing development of shoulder replacement: "reaching the surface". J Bone Joint Surg 88: 900-905.
4. Burgess DL, McGrath MS, Bonutti PM, Marker DR, Delanois RE, et al. (2009) Shoulder resurfacing. J Bone Joint Surg 91: 1228-1238.
5. Cruess RL (1976) Steroid-induced avascular necrosis of the head of the humerus: natural history and management. J Bone Joint Surg Br 58-B: 313-317.
6. Lau MW, Blinder MA, Williams K, Galatz LM (2007) Shoulder arthroplasty in sickle cell patients with humeral head avascular necrosis. J Shoulder Elbow Surg 16: 129-134.
7. Schoch BS, Barlow JD, Schleck C, Cofield RH, Sperling JW (2016) Shoulder arthroplasty for atraumatic osteonecrosis of the humeral head. J Shoulder Elbow Surg 25: 238-245.
8. Alizadehkhayat O, Kyriakos A, Singer MS, Frostick SP (2013) Outcome of Copeland shoulder resurfacing arthroplasty with a 4-year mean follow-up. J Shoulder Elbow Surg 22: 1352-1358.