

## **Simultaneous Bilateral Birmingham Mid Head Resection Resurface Arthroplasty (BMHR) Compared to Staged Procedure for Sickles Hip Avascular Necrosis.**

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### **Abstract**

**In July 2010 two patients were admitted for bilateral Birmingham Mid Head Resurface (BMHR) two patients for unilateral procedure and were followed for two years. The pre-operative work up, intra-operative complications, early systemic complications, the operating time, positioning of the patient in the bilateral case, positioning of components, the functional score, restoration of limb length and survival rates at two years were discussed in the two groups. All patients had clinical and radiological evaluation at one, three, six and 12 months and annually thereafter in both the groups. No significant difference was found between the two groups with respect to the operating time, 207.42 minutes in the one-stage group and 120 minutes in the single procedure group. The total estimated blood loss was slightly higher in patients undergoing a bilateral procedure than in the one who had single procedure. The postoperative hematocrit at eight hours was significantly lower in the one-stage group, 0.287 as compared with 0.321 but did not change transfusion rate in this unique group of patients. This study demonstrates safety of One-stage bilateral hip mid head resection resurfacing arthroplasty in sickle cell anemia patients with advanced avascular necrosis of femoral head when compliance with sickle cell perioperative care guidelines is exercised.**

**Keywords:** Sickle cell anemia, Total hip replacement, Single stage replacement, Birmingham mid head resurface arthroplasty

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### **Introduction**

Sickle cell anemia is widely prevalent in Africa and the Middle East (ME) and with better survival there is an increase in number of patients suffering from the musculoskeletal manifestations, most notably avascular necrosis of the femoral head, which leads to disabling arthritis in early adulthood. Although the molecular and biological understanding of sickle cell anemia dates back more than half a century, this has not led to effective treatment for patients suffering the skeletal manifestations of the disease. Sickle cell disease is common in Africa & the in Middle East (ME) and is both biologically fascinating and clinically challenging. It is one of the first diseases for which the molecular genetic basis was understood. Clinical treatment of its musculoskeletal conditions is chal

lenging because the treatments given are not perfect, particularly for entities such as avascular necrosis of the femoral head which causes considerable disability in young patients. Although there is some randomized trial evidence available to guide treatment of the disease, the level of evidence regarding the treatment is poor. There are legitimate questions whether reported results of total hip replacements from Western countries can be applied to clinical decision-making in Africa & the ME.

### **Patients and Methods**

In July 2010 two patients were admitted in Aseer Central Hospital for bilateral Birmingham Mid Head Resurface arthroplasty (BMHR) Fig. 1 and two patients for unilateral procedure Fig. 2, were followed for two years and

half. The exclusion criteria included other causes of avascular necrosis of femoral head other than sickle cell anemia, patient not fit for the procedure and an inability to obtain informed consent. Patients with extensive femoral head necrosis or cystic changes extending into the neck-head junction making BMHR difficult to do, significant disability (multiple sickling crises musculoskeletal infarcts affecting the knee or spine may have encountered difficulties in post-operative functional recovery, making comparison difficult). Patients with bilateral severe deformities were booked for the bilateral hip replacement group because we considered that a one-stage procedure gave superior functional recovery, while patients with single hip affection were booked for single procedure.

There were two groups bilateral or unilateral. A total of 2 patients had a one-stage bilateral Total Hip arthroplasty (THA) and two patients had a unilateral (single) procedure. The age, gender, the level of the hemoglobin, the hematocrit, the limb-length discrepancy, the pre and post Harris Hip Score (HHS) and hospital stay were recorded. Both groups were followed by the same hematologist and a single surgeon using a posterior approach performed all the operations eliminating potential bias related to the surgical technique. The most symptomatic hip was always treated first in the bilateral group. The procedures were carried out under general anesthesia.

Before doing the second hip in a bilateral procedure, intraoperative evaluation by the anesthesiologist to confirm that patient is fit for the same procedure in other hip. Two tables with draping equipment were set up and placed to the next hip. As soon as the dressing had been applied and the patient repositioned, the second assistant prepared the skin of the second hip.

The operating time, intra-operative blood loss, and any intra-operative complications were recorded. In the bilateral group the operating time was calculated as the time lapse between the induction of anesthesia and skin closure on the second hip, and in the single procedures as the time lapse between the induction of anesthesia and skin closure. Intra-operative blood loss was estimated by measuring the volume of blood in the suction bottles, weighing the swabs used and deducting the volume of irrigation fluid. Total blood loss was calculated as the sum of the estimated intra-operative blood loss and the blood collected in the suction drains in the first 24 hours. The length of hospital stay was calculated from the day of operation until discharge. For the patients in the single procedure group, the total blood loss and the length of hospital stay was calculated for the operation. Each patient received 1g of Ceftriaxone and 80 mg gentamycin intravenously before operation then 1g Ceftriaxone when second hip surgery was started for the bilateral single stage or by skin closure in the single procedure group followed by 1 g of Ceftriaxone twice a day and 80 mg gentamycin

three times intravenously daily for three days. Subcutaneous enoxaparin (40 mg once daily) was given to all patients starting from the day of surgery and continuing upto 4weeks. Early mobilization was used both to prevent DVT and to hasten functional recovery, commencing the mobilization in bed from the second post-operative day in all patients. Full-weight-bearing was allowed from the third day onwards. All patients received oral indomethacin, 25 mg three times daily for three weeks as prophylaxis against heterotypic ossification. Post-operatively, the hematocrit was measured at eight hours and the hemoglobin levels on the first, second and third post-operative days. Any blood transfusion was also recorded.

### Radiological evaluation

Evaluation of the post-operative radiographs were obtained and at one month after the procedure in both the groups. The parameters recorded were the angle of abduction of the cup and the alignment of the BMHR stem, measured as the angle between the stem and the long axis of the femur on antero-posterior radiographs and classified as varus, neutral or valgus. On the lateral radiograph, the stem alignment was classified as anterior, neutral or posterior. Similarly as in regular THA Limb-length discrepancy was determined by the measurement of the distance between the upper margin of the lesser trochanter and the interteardrop line on the anteroposterior radiograph of the pelvis Fig. 1, Fig. 2.

### Post-operative follow-up

All patients had clinical and radiological evaluation at one, three, six and 12 months and annually thereafter the procedure in both the groups. All were allowed to bear weight immediately after surgery. The Harris Hip Score HHS was recorded six months after operation in all patients. The use of any walking aid was also noted for longer time in the bilateral procedure group. The incidence of heterotopic ossification at any point during follow up was looked for and there was none.

### Results

There were no significant differences in age, gender, etiology, pre-operative hemoglobin, ASA status, pre-operative limb-length discrepancy and the HHS between the two patients in the simultaneous group, and the single stage group had two females with no difference apart from that. No significant difference was found between the two groups with respect to the operating time, 207.42 minutes in the one-stage group and 120 minutes in the single procedure group. The mean total blood loss was comparatively higher in the single procedure group as compared to that in the one-stage bilateral procedure

group, 998.06 ml per procedure (1996.12ml for two staged hips) and 1473.86 ml respectively. The need for blood transfusion was similar for both the groups of sickle cell disease patients. The postoperative hematocrit at eight hours was significantly lower in the one-stage group, 0.287 as compared with 0.321 in the two-stage group. No intra-operative fracture was observed. One of the bilateral group patients had subcutaneous hematoma affecting the wound of the first surgical site and the padding was found effective in preventing this complication in the second case of the simultaneous group.

### **Early post-operative complications**

No significant difference was found in the incidence of complications in the early post-operative period between the two patients, although in the bilateral case the operated first site showed subcutaneous hematoma and indurations which subsided gradually leaving no significant harming effect. Adequate padding was done before turning the patient on the operated site to do the other hip simultaneously, which was found effective in preventing this complication. The overall incidence of systemic complications was negligible in the two groups.

### **Radiological findings**

Complete sets of radiographs were available for the two patients. MRI was obtained to evaluate the femoral head necrosis.

### **Harris hip score**

The pre-operative HHS was 35 in the bilateral group and 40 in the unilateral group, which improved to 87 and 90, respectively.

### **Radiological evidence of in growth of the prosthesis**

The Radiological follow up of the two hips with plane x-rays in two, 6, 12 weeks then 6 months, one year and two years showed progression to full in growth of the prosthesis which is in keeping with in growth of cement less conventional hip prosthesis Fig. 1, Fig. 2.

### **Hospital stay**

Patients total hospital stay was seven days for simultaneous procedure and 5 days for the single procedure, during which they were able to mobilize from bed to chair and gradually walking with assistance and had full weight bearing before discharge.



*Figure 1. Pre and Post-operative X-rays in the single stage case*



*Figure 2. Pre and post-operative x-rays in the single procedure case*



**Figure 3:** Violation of obliterated femoral canal during total hip in sickler case



**Figure 4.** The need of Fluoroscopy increase radiation risk

## Discussion

No previous studies have compared simultaneous mid head resection arthroplasty in sickle cell anemia patients to unilateral similar procedure. Previous studies has shown no detrimental effects when undertaking a single-stage bilateral THA (conventional) compared with a staged procedure with an interval of at least three months between the sides. In this study a single stage BMHR is definitely less invasive with regard to femoral canal violation Fig. 3, no radiation risk Fig. 4 and optimization pre-operatively is the same as single stage. Most of sickler cases are with regular hematology follow up and this may have had a favorable effect on the lack of systemic complications and easier pre-operative work up. Previously, reported a higher incidence of peri- and post-operative complications in patients with significant co morbidities (ASA grade 3 and grade 4) whether the operation was staged or conducted as a single procedure. It showed in

this study that even patient with comorbidities as sicklers have reasonable success with single staged mid head resection (BMHR) bilateral hip replacement.

Although the total estimated blood loss was significantly lower in patients undergoing a one-stage procedure, the transfusion requirements were significantly higher in the two-stage group. The need for a transfusion was guided by the post-operative hematocrit which was significantly lower in these patients. Since the total blood loss in the two-stage group was the sum of two values during the two procedures, carried out at least three months apart, it was easy to understand why the transfusion requirements were lower in these patients. Similar observations were made by Salvati et al. [1] and Alfaro-Adrian et al. [2]. The present study had no significant difference in the operating time between the two groups. Sickler patients adopted to low haematocrit and single stage procedure had no higher risk than the two stage procedure.

Ritter and Vaughan [3] found a significant increase in the rate of formation of heterotopic bone in patients who underwent a single-stage procedure. Although in this study we had a comparable number of patients with similar etiologies, but did not encounter any difference in the rate of post-operative heterotopic ossification. Sickle cell patients had no difference in this regard.

Many earlier studies comparing the incidence of DVT in unilateral THA and single-stage bilateral THA have reported a higher incidence in the latter group. However, recent studies have compared the incidence of DVT and pulmonary thromboembolism in single-stage and two-stage bilateral THA and have found no difference between the two approaches. Ritter and Stringer [4] attributed this to the improvement in anticoagulation therapy and to early post-operative mobilization. Sickle cell anemia carries higher risk in terms of stasis and so thromboembolism.

The functional outcome in a patient with a unilateral THA who has a normal contralateral hip cannot be compared with a patient with bilateral THA. No significant difference in the functional outcome of bilateral THA, as evaluated by the Harris Hip Score (HHS) and walking capacity at six months, whether done as a single-stage or in two stages was observed. Wykman and Olsson [5] also found that in patients with bilateral hip disease, optimal function was not entirely regained until both hips were replaced.

In the present study radiological evaluation at one month after operation showed similar results with regard to the positioning of the acetabular and femoral components and restoration of limb-length in the two groups. The length of hospital stay in the single-stage group was significantly shorter than the two-stage patients. Costs involvement was not assessed, this would certainly had an impact in reducing the economic burden.

Sene et al. [6] described the outcome of total hip arthroplasty for management of aseptic osteonecrosis. Although the main complications were loosening and dislocation and their rates were high, functional outcomes in this series were good. These findings indicated that arthroplasty should be considered as the treatment of choice for aseptic osteonecrosis due to stage 3 and 4 sickle-cell disease in young patients.

Berend and Lilly [7] reported a patient presented acetabular protrusion 2 years following hemiresurfacing of the femoral head for osteonecrosis associated with sickle cell disease. Renewed interest in bone-preserving hip arthroplasty has led to increased use of hemiarthroplasty and femoral resurfacing in young patients with arthritis. In cases of osteonecrosis, especially that associated with sickle cell disease, awareness of this potential complication is important.

Vichinsky et al. [8] reported the perioperative complication rate of orthopedic surgery in sickle cell disease of the National Sickle Cell Surgery Study Group. A multicentered study was conducted in this study to determine the perioperative complications among sickle cell patients assigned to different transfusion regimens prior to orthopedic procedures. Overall, decompression coring was a safer, shorter operation. The study demonstrates a high rate of perioperative complications despite compliance with sickle cell perioperative care guidelines. Pulmonary complications and transfusion reactions were common. This study support the results previously published by the National Preoperative Transfusion in Sickle Cell Disease Group. These results stated that a conservative preoperative transfusion regimen to bring hemoglobin concentration to between 9 and 11 g/dl was as effective as an aggressive transfusion regimen in which the hemoglobin S level was lowered to 30%.

Following studies are worth reporting since their samples size, follow-up, reporting of complications were different thus no comparable to the present study

Mukisi-Mukaza et al. [9] reported the results of core decompression in the treatment of sickle-cell disease avascular necrosis of the femoral head. It may be especially recommended in under-equipped regions where drepanocytosis (sickle cell anemia) and its osteo-articular complications are frequent.

Hernigou et al. [10] retrospectively reviewed 312 arthroplasties performed in 244 patients with sickle cell disease. Although THA carries a high risk of complication in patients with sickle cell disease, the benefits for the patient are substantial, and the risk of revision for loosening or infection appeared less than described in previous literature.

Neumayr et al. [11] randomized prospective study found that physical therapy alone appeared to be as effective as hip core decompression followed by physical therapy in improving hip function and postponing the need for additional surgical intervention at a mean of three years after treatment.

Sickle Cell Anemia Study Group in multicenter randomized Controlled Trial found that although osteonecrosis of the femoral head is a frequent complication in adult patients with sickle cell disease. Untreated asymptomatic osteonecrosis of the femoral head in patients with sickle cell disease has a high likelihood of progression to pain and collapse.[12]

Buck and Davies SC [13] reported that Persons with sickle cell disease (SCD) are more likely to undergo surgery than are the general population during their lifetime. This article provides readers with information about the role of surgery in SCD and the measures that should be taken to ensure patients were well cared in the perioperative period.

Jeong et al. [14] stated that advances in medical treatment have led to improved life expectancy in patients with sickle cell hemoglobinopathies. A multidisciplinary approach to implementing effective preoperative treatment strategies increases the likelihood of a successful surgical outcome. Their results of cementless total hip arthroplasty have been encouraging.

Alonge and Shokunbi [15] stated Secondary osteoarthritis of the hip joint often complicates avascular necrosis of the femoral head in young adults suffering from sickle cell anemia. The surgical procedures carried out in these patients range from osteotomies to arthroplasties. In this series, five patients treated with secondary osteoarthritis in six hip joints (bilateral in one patient) using cement less bipolar arthroplasty with good outcome.

Ould Amar et al. [16] found that Red blood cells (RBCs) transfusion is a common practice in the treatment or for the prevention of complications of patients with sickle-cell disease. In addition, pre-operative transfusion therapy is reported to be largely responsible for an increased morbidity and mortality in patients with sickle cell anemia undergoing surgery.

Al-Mousawi et al. [17] reported on 35 total hip replacement arthroplasties in 28 patients with avascular necrosis of the femoral head secondary to sickle cell disease (SCD). Their study supports the decision to offer the procedure for patients with arthritic hips secondary to SCD. It is important that patients and surgeons should be aware of the wide varieties of complications.

Ilyas and Moreau [18] reported in simultaneous bilateral uncemented total hip arthroplasty for avascular necrosis of the femoral head resulting from sickle cell disease was performed in 18 consecutive patients (36 hips).

In conclusion, the present study compared the peri-operative safety, transfusion requirements, post-operative function, the incidence of complications, the duration of hospital stay and the survival of the implant in a short-term follow-up in the patient with simultaneous bilateral BMHR with that in patients with a single similar procedure prospectively and the short term follow up which is promising for this unique set of patients with sickle cell anemia.

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