Bahrain Medical Bulletin, Vol. 26, No. 4, December 2004

Complications and Failures of Hip Replacement in Sickle Cell Disease

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Objective: Progressive osteonecrosis of the femoral head is a common musculo-skeletal problem in sickle cell disease. In advanced hip changes, replacement arthroplasty may be the more acceptable option. Total hip arthroplasty in osteoarthritic patients is an operation with good success rate. But in sickle cell disease, the operation carries high incidences of complications and failures. In some reports the failure rate may exceed 50%, in less than 10 years follow-up. The aim of this paper is to evaluate and report on the complications and failures in 41 hips replaced in sickle cell disease patients.

Setting: Orthopaedic Department at Salmaniya Medical Complex.

Design: Prospective Study.

Methods: Forty-one replaced hips in 32 patients operated upon between 1984 to 1997 were followed-up. The mean follow-up was 9.7 (4.5–17) years. All complications and failures were recorded.

Results: Forty-three early and intermediate complications were recoded: 6 excessive bleeding, 7 perforation of the acetabulum, 5 fracture or perforation of the femoral shaft, 6 sickle cell crisis, 5 wound haematoma, 5 clinical deep venous thrombosis, 2 dislocation and 7 heterotopic ossification. One hip failed due to deep infection. Nine hips failed due to aseptic loosening at 6, 7, 9, 9.5, 11, 13, 14, 15 and 17 years.

Conclusion: The incidence of complication in this study is comparable to others. Failure on this study is much lower than any other studies. In Sickle cell disease, the incidence of early and post-operative complications are high. On long term follow up, many replaced hips will fail. Treating doctors and patients should be aware of the difficulties of the operation and the challenge of revision. Every possible improvement methods should be implemented to reduce the incidence of complications and failures.

Bahrain Med Bull 2004;26(4):

Sickle cell disease (SCD) is a genetically transmitted multi-system disease. The disease is relatively common in Bahrain[1]. Although the disease has been clinically described at the beginning of the last century, the laboratory demonstration of red cell sickling was reported in 1940's. The substitution of valine for glutamic acid at the sixth position in beta chain of haemoglobin was demonstrated at a later stage. In the last few decades, the

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diagnostic and therapeutic methods for management of SCD had improved. Therefore, many patients will survive to adulthood and middle age.

Skeletal manifestations of the SCD may affect all age groups. Bone changes occur because of both hyperplasia of bone marrow and thrombosis that causes vascular insufficiency and infarction.

Osteonecrosis of the femoral head is one of the common skeletal problems in SCD[2,3]. It is frequently seen in young adults. Many patients suffer from bilateral femoral head affliction. The disease may progress to fragmentation and collapse of the femoral head followed by secondary oseoarthritic changes. Once the disease reach such advanced stage, head-preserving treatment is not beneficial. Until 1960's, the surgical options for advanced hip changes were osteotomy, arthrodesis or excision arthroplasty, these have many functional disabilities and limitations in advanced stages of the disease. Hip replacement arthroplasties were offered to SCD patients in the last few decades. Early replacement surgery in sickle cell disease showed high incidence of complications and failure rate[4-6].

The outcome of hip replacement surgery on our first 28 patients with SCD was reported with the pre- and post-operative scoring[7]. The modified Harris scoring system was used for evaluating our patients before surgery and on follow up[8].

The aim of this paper is to evaluate and report on the complications and failures in 41 hips replaced in sickle cell disease patients.

METHODS

Between 1984 to 1997, forty-five total hip replacement (THR) arthroplasties were performed on 35 SCD patients at Salmanyia Medical Centre of Bahrain. Two patients (3 hips) were lost to follow-up and one died three years after hip replacement from acute respiratory failure. Therefore, forty-one replaced hips in 32 patients were followed-up.

The decision for surgery was based on severity of pain, functional disability and radiological changes. Patients with low HB were transfused to raise their level of HB to above 9 gm. Prophylactic antibiotics and subcutaneous heparin started on the day of surgery and continued for three to five days. All complications were recorded.
The replaced hip was considered failure when revision or excision arthroplasy is indicated.

RESULTS

Forty-one replaced hips in 32 SCD patients were followed-up. There were 17 women and 15 men. The mean age at the time of surgery was 28 (18-42) years. Nine patients had bilateral THR, six of them were women. The mean follow up was 9.7 (4.5 – 17) years. Thirteen patients required transfusion before surgery. Forty-three complications (Table 1) and ten failures were encountered.

Complications: Mean intra-operative blood loss was 1280 (700 - 2400) ml and loss from the drain was 440 (190 - 810) ml. In six patients the blood loss during operation exceeded two liters.

Table 1. **Early and intermediate complications in 41 replaced hips**

Complication	Number
Excessive bleeding	6
Acetabular perforation	7
Femoral shaft injury	5
Sickle cell crisis	6
Wound haematoma	5
Clinical DVT	5
Dislocation	2
Heterotopic ossification	7
Aseptic loosening	1
Septic loosening	8
Total	43

In two patients, it was decided to discontinue the operation due to excessive blood loss (2300 and 2400 ml). In those two patients, in the first stage the hip was dislocated and the femoral neck resected. In the second stage the prosthesis was implanted.

Small perforations occurred during preparation of the acetabulum in seven hips. Four femoral shafts were accidentally perforated and one was fractured. Cerclage wires stabilized the femoral shaft fracture.

Six patients required post-operative special care for 1 to 3 days (ICU) for treatment of sickle cell crisis.

Five hips developed wound haematoma. Three of them required drainage. Delayed wound healing occurred in four hips.

Five patients were diagnosed as clinical deep venous thrombosis. Anti-coagulant therapy was continued with coagulation profile monitoring.

One patient developed dislocation six months after surgery. He had no further dislocation after reduction. Another patient developed dislocation two months after surgery. Subsequently, she had eight recurrent dislocations over a period of one and half year. It was discovered that she was dislocating herself purposeful to stay in the hospital.

Follow up radiographs showed heterotopic ossifications in seven hips. Five were asymptomatic and two experienced occasional ache. One had restricted movement (Fig 1).

One patient developed deep infection 10 years after replacement of the left hip. This was treated by aspiration under ultrasound and antibiotic for six week. Twice aspiration and twice aggressive treatment failed to cure the infection. Therefore, resection arthroplasty was performed (Fig 2).

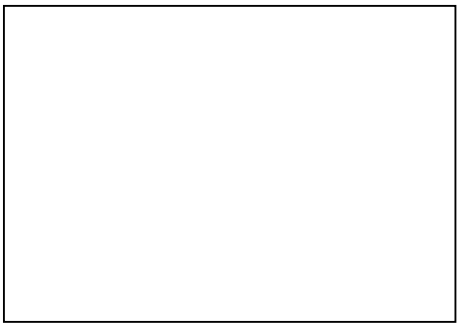

Figure 1.Heterotopic ossification of the right hip that caused pain and restriction of movement

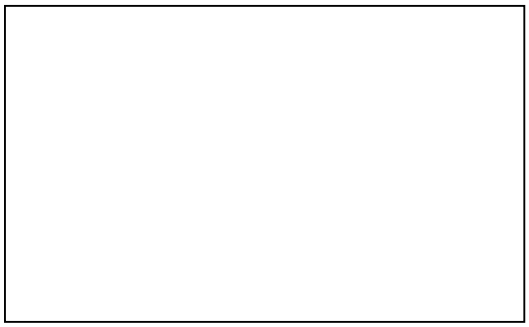

Figure 2. Excision arthroplasty of the left hip following deep infection

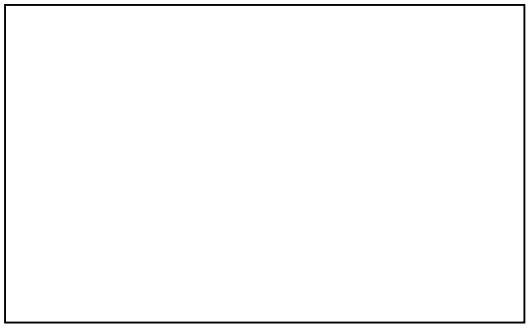

Figure 3. Loosening of the replaced hip. The acetabulum is displaced.

Nine hips in seven patients failed due to aseptic loosening at 6, 7, 9, 9.5, 11, 13, 14, 15 and 17 years. Four hips required revision of the cup (Fig 3).

Both components (acetabula and femoral) required revision in four of the other five hips. It was noticed that three of the four revisions required before completing 10 years follow up were for the cup, while four of the five revisions after more than 10 years were for both components.

DISCUSSION

Due to the many advances in the management, the life expectancy of SCD patients has increased. Subsequently, sickle cell patients develop skeletal problems due to the multi-system nature of the disease. Osteonecrosis of the femoral head is common in SCD patients[9,10]. Necrosis occurs due to stasis and lack of oxygenation following hyperplasia of the bone marrow, sickling of the red cells, increased blood viscosity, arterial occlusions and venous obstruction causing ischaemia. In a later stage the femoral head may collapse and secondary osteoarthritis develop.

In the early phase the patient presents with intermittent pain. The pain may increase in frequency, duration and severity. At a later stage, persistent painful restriction of movements, shortening, deformity and limping dominate the manifestations of the disease.

Femoral head preserving treatment would delay the need for replacement of the hip in the relatively young patients if performed before collapse occurs. The treatment consist of: rest, non-weight bearing mobilization, core decompression, vascular graft, osteotomy and cement injection[11-15]. However, once changes occurs in the femoral head, it is a matter of time before the inevitable deterioration takes place specially if the affected area of the head is more than 30%[16,17]. While treating the affected femoral head, the other side should be observed as bilateral changes may occur in more than 30% of patients[18,19].

In advanced stages, changes in the hip are disabling. Replacement surgery may be more acceptable procedure with better functional outcome than arthrodesis or excision arthroplasty. Hip replacement arthroplasty showed high incidence of reported complications and failures in SCD patients[4,5,20]. Appropriate pre-operative care and early preventive measures would help in reducing the incidence of complications and failures. It is with hope that when treating team is more aware of the different aspects of the problems, and take the necessary percussions that will reduce the incidence of complications and failures.

It is important to improve the level of haemoglobin and reduce the level of HBS before surgery to facilitate oxygenation of the tissues and reduce the incidence of sickle cell crisis. In this study 13 patients required blood transfusion or exchange before surgery. Pre-operative transfusion has been a common practice. Other studies proposed transfusion protocol only intra-operatively as it reduces the incidence of haemolysis[21]. Reducing the level of HBS can be achieved by both exchange transfusion and dilution of the patient's blood.

Replacement procedures were performed under general anaesthesia, but in the last ten years, spinal or epidural anaesthesia are preferred. It is early to assert from this study that the incidence of sickle cell crises is less with spinal anaesthesia. Operating room temperature, cardiopulmonary functions, blood gases, oxygenation, hydration and blood loss should be monitored to evade sickle cell crisis following surgery[22,23]. Despite all precautions six patients had the crisis. If crisis are suspected, the patient should be continuously monitored. Due to our concern with the nature of organisms in ICU, we preferred continuous monitoring in the ward, and if necessary the shortest possible period in ICU.

Despite all precautionary measures against infection including prophylactic antibiotic, five hips in this study developed wound haematoma. None developed early deep infection. However, one of them suffered from deep infections ten years after surgery that required excision arthroplasy. In this study cultures was encountered[24, 25].

The incidence of intra-operative femoral shaft fracture in total hip replacement for non-sickler patients is less than 1%. In sickle cell disease patients the incidence is higher[4,24,25]. SCD patient suffer from adhesions, protrusio-acetabuli, weakness or sclerosis of the bone and small diameter of the medullary canal[27,28]. In this study, four perforations and one femoral shaft fracture occurred. It was possible to stabilize the fracture by circlage wires

Fracture may occur while applying torsion force during dislocation of the hip at the early phase of the operation or while preparing the narrow medullary canal and during difficult reduction at the end of the operation.

In this study, two patients with heterotopic ossifications were given indomethacin 75 mg daily for one month after replacing the second hip. The two patients did not develop ossification following the second operation. Preparation of sclerosed bone in SCD patients would spread bone debris in the operative field. This may add to the development of heterotopic ossification. Effort should be made to minimize tissue damage and spread of bone debris by gentle handling and irrigation of the exposed tissue. It has been reported that indomethacin could reduce the incidence of the ossification from 63 to 17%[29].

In this study of 41 hips, one patient (2.4%) developed deep infection and 9 (22%) failed due to aseptic loosening. Aseptic loosening is a serious and major late complication following THR. It is the most common indication for revision surgery. In the early phase of THR in the 1960's, follow-up showed a very high incidence of loosening. This was followed by certain changes that improved the results[31-33]. In osteoarthritic hip, improved components designs, material and fixation techniques have brought down the incidence of loosening of the femoral components even in active patients younger than 50 years to less than 5% at 10 to 15 years follow-up[34-37]. The incidence of loosening of the acetabulum component has improved, though it is still higher than the incidence of femoral stem loosening specially after 10 years follow-up. The incidence of deep infection and septic loosening came down to less than ½%.

In SCD patients the problem is greater. The incidence of complications is higher than those for osteoarthritic patients. Aseptic loosening and deep infection reported to be relatively more frequently seen at a shorter follow-up period and the failure rate might exceed 50%[3,5, 20,38-40]. Uncontrolled deep infection has a dramatic effect on the patient. Presence of foreign implants adds to the incidence of infection and to the difficulties of treatment. Presence of SCD makes the patients more vulnerable. Therefore, no effort should be spared in the prevention of infection. Heterotopic ossification may act as a fulcrum that produce abnormal load on the implant adding to the risk of loosening[30]. The more the younger and active is the patient the more is the incidence of loosening.

CONCLUSION

The incidence of complication in this study is comparable to others. Failure on this study is much lower than any other studies. Improvement in the medical care of SCD increased the life expectancy of the patients. Many SCD patients develop progressive avascular necrosis of the femoral head. The pain and functional disabilities are very distressing. At some stage of the disease, THR may be the only acceptable method of treatment. Beside the general and local complications, many of the hips will fail, sooner or later, because of aseptic loosening and or deep infection. Dealing with failed joint replacement especially in SCD patient is extremely challenging problem.

Efforts should be made to make the replaced joint last longer without aseptic or septic loosening. Patient and the surgeon may select to take the risk of revision surgery for aseptic loosening. In presence of deep infection, the risk is too high to be taken and excision arthroplasy would be safer.

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