ORIGINAL ARTICLE

Functional Outcomes of Uncemented Total Hip Arthroplasty for Osteonecrosis of the Femoral Head due to Sickle Cell Disease in Nepal: A Retrospective Study

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Abstract

Introduction: Sickle cell disease is particularly prevalent among the Tharu population of western Nepal. Osteonecrosis of the femoral head is a common and debilitating complication of sickle cell disease, resulting from recurrent vaso-occlusive episodes. The study aimed to determine the functional outcomes and complications following total hip arthroplasty in patients with sickle cell disease-associated osteonecrosis of the femoral head.

Methods: A retrospective study was conducted at a tertiary care hospital after ethical clearance (Reference No: 1137/26-01-2026) between January 2019 and June 2025. Medical records of 16 patients who underwent total hip arthroplasty for advanced osteonecrosis of femoral head secondary to sickle cell disease were reviewed. Demographic characteristics, sickle cell genotype, functional outcome and complications were recorded. Functional outcomes were assessed using the Harris Hip Score preoperatively and at 6-month follow-up and were compared using a paired t-test.

Results: Among 16 patients (17 hips), the mean Harris Hip Score improved from 46.29±11.92 preoperatively to 86.47±5.96 at 6-month follow-up. The mean age was 40.88±10.31 years. There were 9 (56.25%) females and 7 (43.75%) males. Fourteen patients had homozygous genotype and two had sickle-beta thalassemia. Bilateral hip involvement was observed in 6 (37.50%) patients. Postoperative outcomes were excellent in 6 (35.29%) hips, good in 8 (47.06%), and fair in 3 (17.65%) hips. One superficial wound infection and three acute vaso-occlusive or acute anemic episodes requiring intensive care and transfusion were recorded.

Conclusions: Total hip arthroplasty provides significant functional improvement and pain relief in patients with sickle cell disease-associated osteonecrosis of the femoral head, with acceptable complication rates when appropriate perioperative management is provided.

Keywords: *arthroplasty; hip; osteonecrosis; replacement; sickle cell disease.*

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Introduction

Osteonecrosis of the femoral head (ONFH) is a common and disabling musculoskeletal complication of sickle cell disease (SCD).[1,2] Repeated vaso-occlusive episodes impair the blood supply to the femoral head, leading to bone infarction, collapse of the articular surface, and secondary degenerative arthritis.[3,4] Advanced ONFH causes severe pain, limitation of mobility, and reduced quality of life.[5-9] Total hip arthroplasty (THA) is considered the most effective treatment for advanced disease, providing pain relief and restoration of hip function.[5-9]

Sickle cell disease and other hemoglobinopathies are prevalent among the Tharu population and other communities in western Nepal.[5] Despite the regional burden of the disease and the increasing use of THA, there is limited evidence from Nepal regarding the functional outcomes and complications of THA in patients with SCD-related ONFH.[8-11]

The aim of the study was to evaluate the functional outcomes and complications of total hip arthroplasty in patients with osteonecrosis of the femoral head secondary to sickle cell disease.

Methods

A retrospective study was conducted among patients with sickle cell disease who underwent total hip arthroplasty for osteonecrosis of the femoral head at a tertiary care hospital in Nepal between January 2019 and June 2025. Ethical clearance was obtained from the Nepal Health Research Council (Reference number: 1137/26-01-2026). Convenience sampling was used. All eligible patients treated during the study period were included in the study. Patients aged 18 years or older with clinically and radiologically confirmed osteonecrosis of the femoral head secondary to sickle cell disease, classified as Ficat and Arlet stage III or IV, who underwent primary unilateral or bilateral total hip arthroplasty and had complete clinical, radiographic, and functional outcome records with a minimum follow-up of 6 months were included. The diagnosis of sickle cell disease was confirmed by hemoglobin electrophoresis or documented medical records. Patients who underwent total hip arthroplasty for osteonecrosis unrelated to sickle cell disease, revision arthroplasty, previous hip surgery, incomplete medical records, or inadequate follow-up were excluded.

No formal sample size calculation was performed because of the rarity of the condition and the limited number of eligible cases available during the study period. All eligible patients meeting the selection criteria were included to maximize case ascertainment.

The primary outcome was postoperative functional status measured using the Harris Hip Score, a validated instrument that assesses pain, function, absence of deformity, and range of motion. Harris Hip Score results were categorized as excellent (90–100), good (80–89), fair (70–79), and poor (<70). Secondary outcomes included postoperative complications, including wound infection, vaso-occlusive crisis, and acute anemic episodes. Independent variables included age, sex, sickle cell genotype, laterality of disease, and preoperative osteonecrosis stage according to the Ficat and Arlet classification.

All patients underwent preoperative hematologic evaluation. A target preoperative hemoglobin concentration of at least 10g/dl was maintained. Packed red blood cell transfusions were administered when required to correct anemia. All procedures were performed through a posterior surgical approach using uncemented acetabular and femoral components with metal-on-polyethylene bearing surfaces. To reduce the risk of thromboembolic complications, low-molecular-weight heparin was administered subcutaneously from second post operative day and continued for one week, followed by aspirin thromboprophylaxis for one month.

Data were collected from hospital records using a structured data extraction form. Information regarding demographic characteristics, sickle cell genotype, laterality of hip involvement, osteonecrosis stage, perioperative complications, and functional outcomes was recorded. Functional outcomes were assessed using the Harris Hip Score before surgery and at 6 months postoperatively.

Data were entered into Microsoft Excel 2016 (Microsoft Corporation, Redmond, WA, USA) and analyzed using Statistical Package for the Social Sciences (SPSS) version 24 (IBM Corp., Armonk, NY, USA). Point estimate at 95% Confidence Interval was calculated along with frequency and percentages for binary data, and mean and standard deviation for continuous data.

Results

A total of 16 patients involving 17 hips were included in the study. The mean age of the patients was 40.88±10.31 years. There were 9 (56.25%) female patients and 7 (43.75 %) male patients. One patient underwent bilateral total hip arthroplasty, accounting for the total of 17 operated hips. The representative cases are shown in figure 1 and 2.

Regarding sickle cell genotype, 14 (87.50%) had HbSS disease, while 2 (12.50%) had sickle beta-thalassemia. Bilateral hip involvement was observed in 6 (37.50%) patients, although only one patient underwent bilateral total hip arthroplasty during the

study period. Of the 17 operated hips, 9 (52.90%) were left hips and 8 (47.10%) were right hips.

Functional outcomes improved substantially following surgery. The mean preoperative Harris Hip Score (HHS) was 46.29±11.92, which increased to 86.47±5.96 at the six-month postoperative follow-up. The mean improvement was 40.18±10.14 points (95% CI 34.99 – 45.36). Paired t-test analysis demonstrated that this improvement was statistically significant ($t= 16.35$, $df = 16$, $p < 0.0001$).

Based on postoperative Harris Hip Score grading, excellent outcomes were achieved in 6 (35.29%) hips, good outcomes in 8 (47.06%) hips, and fair outcomes in 3 (17.60%) hips. No hips were classified as having a poor outcome. Overall, 14 (82.40%) hips achieved good-to-excellent functional results at six months postoperatively.

Postoperative complications were observed in 4 (25%) patients. One patient developed a superficial wound infection, that was managed with antibiotics and local wound care. Three patients experienced acute vaso-occlusive crises accompanied by acute anaemic episodes during the postoperative period, requiring intensive care management and blood transfusion support. The hemoglobin levels of all three patients were ≥ 9 g/dL on first postoperative day but declined within the first postoperative week to 6 g/dL, 4 g/dL, and 4 g/dL, respectively. All three patients recovered well with multiple packed red blood cell transfusions and supportive intensive care measures. No deep infection, prosthetic dislocation, periprosthetic fracture, or implant loosening were observed during the follow-up period.

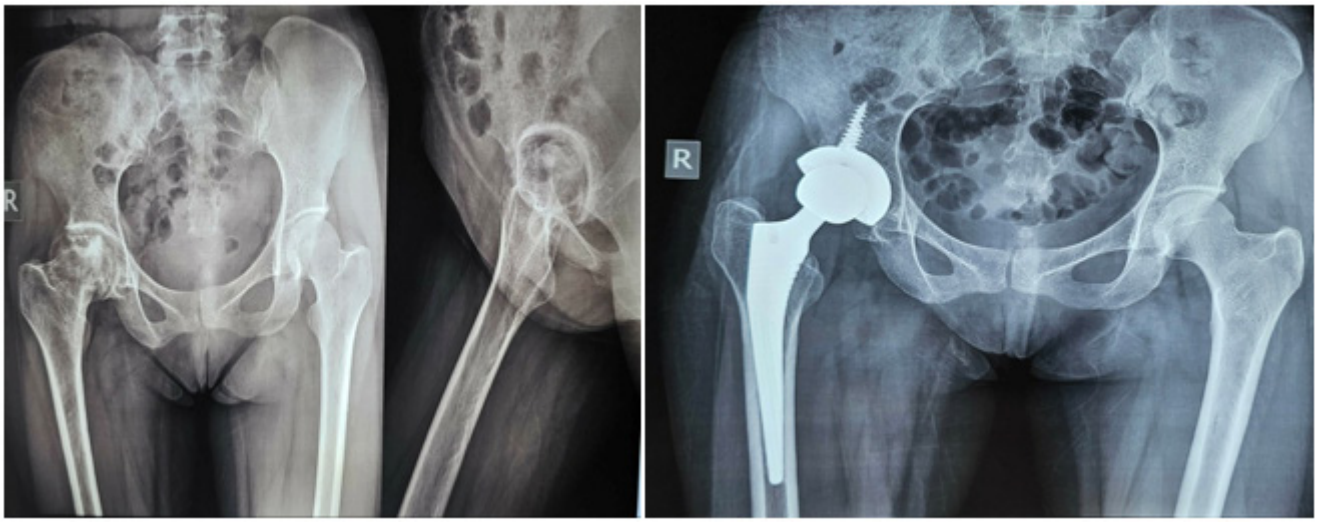

Figure 1: Xray of osteonecrosis right femoral head & total hip arthroplasty of the same hip

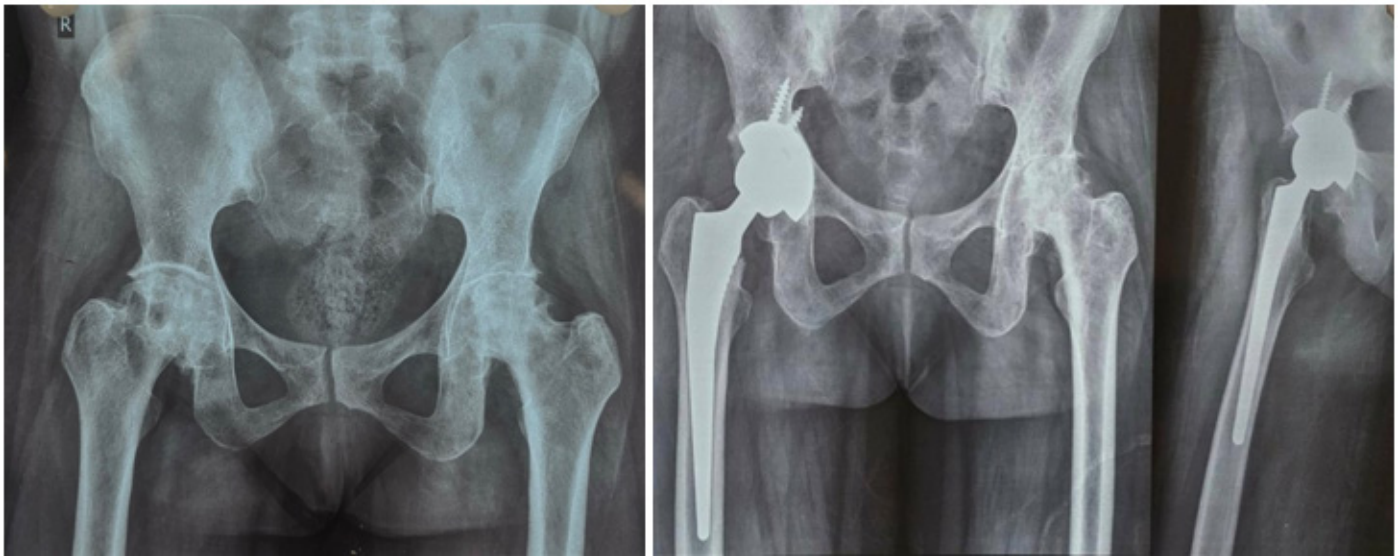

Figure 2: Xray of osteonecrosis of both femoral heads & total hip arthroplasty of right hip

Discussion

Osteonecrosis of the femoral head is a well-recognized complication of SCD and is primarily caused by repeated vaso-occlusive episodes that impair the blood supply to the femoral head.[4,12] Progressive ischemia leads to bone infarction, collapse of the articular surface, and eventually secondary osteoarthritis of the hip joint.[13] In advanced stages, joint-preserving procedures are no longer effective & total hip arthroplasty remains the most reliable treatment for pain relief and functional restoration.[14-16]

In the present study, the mean age of patients undergoing total hip arthroplasty was 40.88±10.31 years, which is comparable to the findings of Smith et al. (mean age 37 years in patients with SCD undergoing total hip arthroplasty).[8] Patients with SCD typically require hip replacement at a younger age than those with primary osteoarthritis due to the early onset of osteonecrosis.[17] Hernigou et al. reported a mean age of 28 years in patients undergoing hip arthroplasty for sickle cell–related osteonecrosis.[18] Adesina O et al, in a population-based cohort study (1991-2013) studied 6237 patients with SCD & observed that 22% developed femoral head osteonecrosis at a median age of 27 years.[19]

The majority of patients in this study had the HbSS genotype, which is known to be associated with a higher risk of osteonecrosis in many series.[18,20,21] In a large study with 2590 patients over 5 years, Milner PF et al found that patients with HbSS had significantly higher incidence of osteonecrosis compared to other genotypes.[21] In our series, bilateral hip involvement was present in six patients, although only one patient underwent bilateral total hip replacement. Bilateral disease has been frequently reported in SCD due to the systemic nature of vaso-occlusive episodes.[3] Previous studies have demonstrated that up to half of patients with sickle cell-related osteonecrosis eventually develop bilateral hip involvement.[22]

The functional outcomes in our study showed marked improvement following surgery. The mean Harris Hip Score improved from 46.29±11.92 preoperatively to 86.47±5.96 at 6 months postoperatively, indicating substantial improvement in pain and functional mobility. Outcome grading in our study demonstrated excellent results in six hips, good results in eight hips, and fair results in three hips, indicating that the majority of patients achieved favorable outcomes. These findings are consistent with recent studies demonstrating significant postoperative improvement in functional outcomes, including Harris Hip Score, following total hip arthroplasty in patients with SCD.[23-25] However, some variation exists across the literature, as a few studies have reported comparatively lower functional gains following total hip arthroplasty in patients with SCD.[26,27] These discrepancies may be attributed to differences in patient demographics, baseline disease severity, implant selection, perioperative transfusion protocols, and as well as heterogeneity in follow-up duration and reporting of outcomes.

Despite the favorable functional outcomes, patients with SCD remain at risk for postoperative complications.[9] In the present study, one patient developed superficial wound infection, which was managed successfully with antibiotics and wound care. Additionally, three patients developed postoperative acute vaco-occlusive crisis & acute anemic episodes, requiring intensive care management and repeated blood transfusions. The importance of multidisciplinary perioperative management in patients with SCD is well established, with guidelines from the National Heart, Lung, and Blood Institute recommending strategies such as adequate hydration, oxygenation, effective pain control, and appropriate transfusion support to reduce the risk of vaso-occlusive crises and other postoperative complications.[28]

Other studies have highlighted complications such as intraoperative fractures, implant loosening, and increased transfusion requirements, which are attributed to poor bone quality and altered marrow physiology in SCD. Furthermore, the hypercoagulable state and endothelial dysfunction contribute to increased perioperative risk.[29]

Overall, the findings of the present study reinforce that total hip arthroplasty is an effective treatment option for osteonecrosis of the femoral head in patients with SCD. It provides significant pain relief, substantial functional improvement, and acceptable complication rates when performed with appropriate perioperative care. Continued advances in surgical techniques, implant design, and multidisciplinary management are expected to further improve outcomes in this challenging patient population.

The major strength of this study is that it represents the first reported series of total hip arthroplasty in patients with SCD from Nepal. Although this study was conducted at a single centre, the hospital serves as the major referral centre for SCD in western Nepal. Therefore, the findings may be relevant to similar resource-limited settings where specialized sickle cell services are available, yet a single centre study may limit its generalisability. The study had a relatively small sample size, involving only 16 patients and 17 hips, with one patient contributing bilateral hips to the analysis. As outcomes from both hips of the same patient may not be entirely independent, this could have influenced the statistical estimates. Despite achieving statistical significance, the findings should

be interpreted cautiously because of its relatively small sample size. The follow-up period was limited to 6 months and may not adequately reflect long-term outcomes. Implant survival and postoperative complications following THA require longer-term follow-up. Additionally, the retrospective design of the study may introduce potential selection and information bias. Future multi-center studies with larger sample sizes and longer follow-up durations are recommended to better evaluate the long-term outcomes of total hip arthroplasty in patients with sickle cell disease.

Conclusions

Total hip arthroplasty is an effective surgical intervention for osteonecrosis of the femoral head in patients with SCD. The procedure provides notable improvement in early hip function and substantial pain relief. Although complications such as sickle cell crisis may occur in the postoperative period, careful perioperative management can lead to favorable outcomes.

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