



Complications of uncemented total hip replacement in avascular necrosis head of femur, encountered intra and post-operative period

Dwivedi VM^{1*}, Singh V², Agrawal A³

DOI: Total hip replacement

^{1*} Dwivedi VM, Resident, Department of Orthopaedics, RD Gardi Medical College, Ujjain, MP, India.

² Singh V, Department of Orthopaedics, RD Gardi Medical College, Ujjain, MP, India.

³ Agrawal A, Department of Orthopaedics, RD Gardi Medical College, Ujjain, MP, India.

Introduction: Avascular Necrosis Head of Femur is a progressive disorder in which lack of sufficient blood supply leads to cell death, fracture and collapse of the affected area. In stage 3 and 4 patients of AVN of hip, uncemented total hip replacement is the treatment of Choice. The complications in uncemented THR can be intraoperative, postoperative and anaesthetic and also according to time duration can be immediate, early and late.

Material and Method: Fifty-one patients of Avascular necrosis of femoral head of stage III and IV, are operated in last two years by uncemented total hip arthroplasty and their results were assessed by Harris hip score. There are few complications which we encountered in intraoperative and post operative period. The assessment and corresponding solutions of the complications are provided in this study.

Results: The pre-operative modified harris hip score had a mean of 48.51 with a standard deviation of 3.114. The post-operative modified harris hip score increased significantly to a mean of 90.96 with a standard deviation of 3.268. Intraoperative complication like periprosthetic fracture was seen in 3.9% cases only. The majority (92.2%) did not experience any anesthetic complications. Among those who did, 3.9% encountered hypotension and tachycardia, while 2% experienced postoperative nausea and vomiting. Additionally, one patient (2%) suffered from a spinal headache (PDPH). Post-operative complications were present i.e. 5.9% of the patients experienced sciatic nerve injury, and another 5.9% had superficial infections. Additionally, anterior thigh pain, deep infection, and limb length discrepancy each affected 3.9% of the patients, while 2% experienced dislocation.

Conclusion: Uncemented THR is one of the most successful operative procedure done across the globe. The best possible outcome in uncemented total hip replacement surgery can be achieved by appropriate patient selection, appropriate implant size and design, and above all maintaining sterility intra-operatively and during regular dressings and during suture removal.

Keywords: Uncemented THR, AVN Hip, Complications

Corresponding Author	How to Cite this Article	To Browse
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Introduction

Avascular Necrosis Head of Femur is a progressive disorder in which lack of sufficient blood supply leads to cell death, fracture and collapse of the affected area.¹

Etiologic factors associated with osteonecrosis are such as idiopathic, corticosteroid administration, alcohol use, SLE, Cushing disease, chronic renal failure/hemodialysis, pancreatitis, pregnancy, hyperlipidemia, organ transplantation, intravascular coagulation, thrombophlebitis, cigarette smoking, hyperuricemia/gout, AIDS, femoral neck fracture, dislocation or fracture-dislocation, sickle cell disease, hemoglobinopathies, caisson disease (dysbarism), gaucher disease and radiation.²

Avascular Necrosis of Head of Femur is classified into stages by Ficat and Arlet Classification into 5 stages – Stage 0,1,2,3,4 on basis of symptoms, radiological changes, bone scan, pathologic findings, biopsy. For stage 0,1,2 patient is advised for non-operative management with avoidance of associated etiologic factor if any and core decompression and/or bone grafting. In case Stage 3,4 patient is advised for operative management i.e. uncemented total hip replacement is the treatment of choice.

Materials and method

The study was carried out on 51 Patients of AVN Head of Femur operated by uncemented total hip replacement in the department of orthopedics, R. D. Gardi Medical College, Ujjain. This study is done from August 2022 to June 2024. Information on the patients was compiled from clinical details, case files and operation theatre records. Study type was observational study. Objective of this study was to assess the complications occurred during or after uncemented THR.

Inclusion Criteria was, all the patients of Stage 3,4 avascular necrosis of femoral head, patients of age group more than 18 years and less than 70 years, willing to give informed consent, with minimum follow-up period of 6 months Exclusion Criteria was patients with deformities or pathologies in other lower limb joints that could negatively affect the functional outcome of the surgery, patients younger than 18 years or older than 70 years, who were lost to follow-up or uncooperative, who refused to consent to the study.

Case 1:



Figure 1 and 2: pre-operative x-ray and post-operative xray



Figure 3: A, B, C, D -Post-op follow up images after 1 month

Results

In the current study 51 patients were studied. Mean age of the patients studied were 40.88 ± 14.20 years. Median age 38 years, minimum age 22 and maximum age 70 years. Majority of patients were in the <40 years age group, accounting for 62.7% of the participants. There were more male patients (72.5%) than female patients (27.5%). In causes of AVN head of femur, the most common cause was idiopathic in 74.5% cases, steroid induced in 23.5% and traumatic only in 2% cases only.

Housewives had the highest complication rate (66.7%), significantly more than laborers (18.9%) and students (0.0%), with a p-value of 0.005, indicating a statistically significant difference. A vast majority (94%) had no limb length discrepancy before the operation, while only 1.96% (1 patient) had a discrepancy (shortening) of 1 cm and 1.96 (1 patient) had a discrepancy (shortening) of 1.5 cm and 1.96 (1 patient) had a discrepancy (lengthening) of 1.5 cm. After the operation, 96.1% of the patients had no limb length discrepancy, similar to the preoperative status.

However, 2% of the patients had a discrepancy (shortening) of 1.5 cm, and another 2% had a discrepancy (lengthening) of 1.5 cm. This indicates that postoperative limb length discrepancy remained minimal, with only a small number of patients experiencing a noticeable difference.

The vast majority (96.1%) did not experience any intraoperative complications, while only 3.9% encountered periprosthetic fractures during surgery. This suggests that intraoperative complications were relatively rare in this patient population undergoing hip surgery.

The majority (92.2%) did not experience any anesthetic complications. Among those who did, 3.9% encountered hypotension and tachycardia, while 2% experienced postoperative nausea and vomiting. Additionally, one patient (2%) suffered from a spinal headache (PDPH). This indicates that while most patients did not face anesthetic complications, a small percentage experienced various issues related to anesthesia administration. The majority of patients (74.5%) did not experience any complications after surgery. However, 5.9% of the patients experienced sciatic nerve injury, and another 5.9% had superficial infections.

Additionally, anterior thigh pain, deep infection, and limb length discrepancy each affected 3.9% of the patients, while 2% experienced dislocation. The pre-operative Modified Harris Hip Score had a mean of 48.51 with a standard deviation of 3.114, while the post-operative score increased significantly to a mean of 90.96 with a standard deviation of 3.268. The paired t-test for the difference between pre-operative and post-operative scores showed a mean difference of 42.451, with a 95% confidence interval ranging from 41.316 to 43.586, and a p-value less than 0.0001, indicating a highly significant improvement in hip function post-surgery.

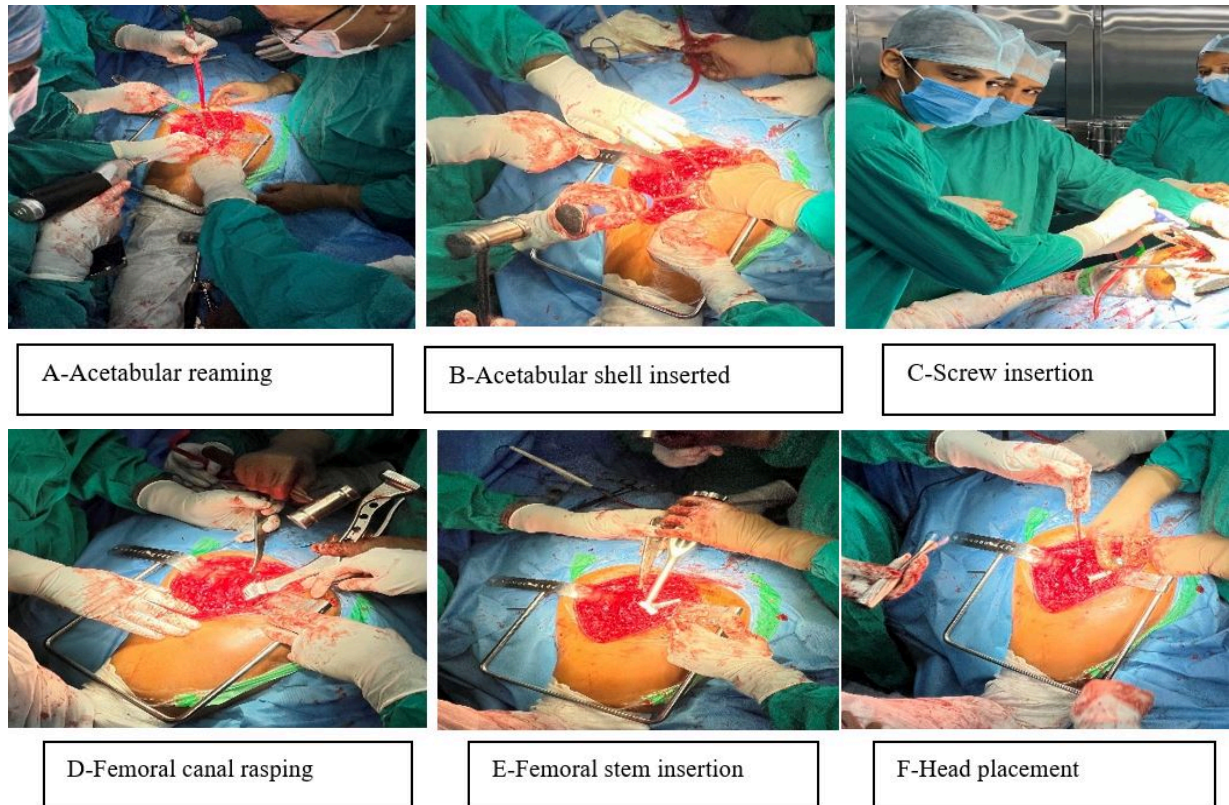


Figure 4: A, B, C, D, E and F: Intraoperative images

Complications apart from being anaesthetic, intra-operative, post-operative, are also divided into immediate, early, and late as per the time duration. Immediate complications occur within hours to days after surgery.

Early complications occur within weeks to months after surgery. Complications that arise months to years after surgery are considered late complications. Immediate / perioperative complications are anaesthetic complications which include hypotension & tachycardia, post-op nausea & vomiting, Spinal headache (PDPH).

Nerve Injury includes sciatic nerve injury chiefly, which gives rise to foot drop. Also includes femoral and obturator nerve injury as well. In vascular injury, the external iliac and femoral arteries are the vessels most commonly at risk during this procedure. The risk of direct laceration or rupture increases with drill or screw penetration during acetabular implant fixation.

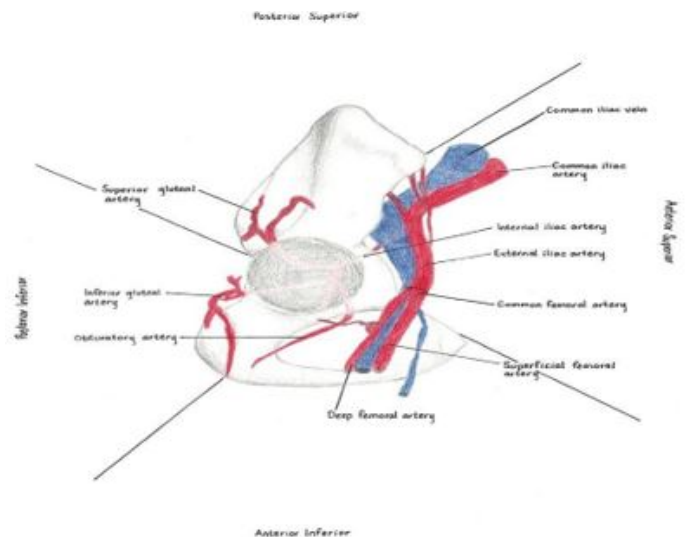


Figure 5: Hip Vasculature and Corresponding quadrants of acetabulum, postero-superior quadrant is the safest 4

Periprosthetic fractures are fractures that occur around orthopedic implants. 5

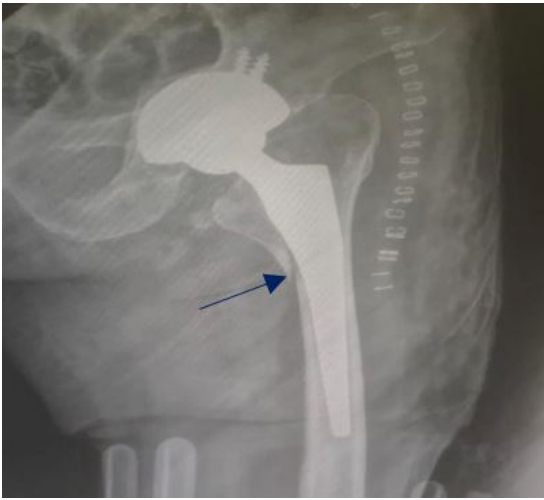


Figure 6: Intra operative Periprosthetic fracture

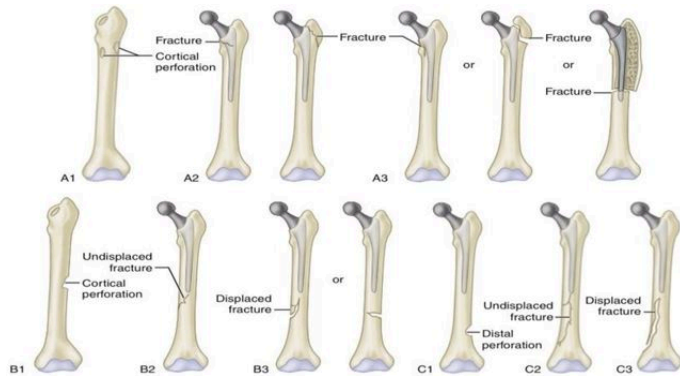


Figure 7: Vancouver classification for Periprosthetic Hip Fractures 6

Venous thromboembolism (VTE), encompassing both deep venous thrombosis (DVT) and pulmonary embolism (PE), is a significant complication following total hip arthroplasty (THA). Deep vein thrombosis (DVT) commonly manifests with symptoms such as pain, swelling, warmth, or erythema in affected limb, usually in lower extremities, although it can also occur in upper extremities. 7 Early complications are infection, dislocation and limb length discrepancy. The standard management of infected THA involves removal of implant, thorough debridement, and administration of antibiotics both systemically and locally through impregnated spacers.



Figure 8: Infected THR

Dislocations can be classified based on the direction of dislocation, each associated with specific mechanical causes. First is cranial dislocation that can result from excessive cup inclination, abductor insufficiency, or polyethylene wear, causing dislocation with the hip joint adducted and extended. Second is posterior dislocation arises due to insufficient anteversion or retroversion of the cup, joint hyperlaxity, or primary or secondary impingement can cause posterior dislocation, characterized by dislocation with internal rotation and adduction of the flexed hip joint or deep flexion. Third is anterior dislocation it results from excessive combined antetorsion of the stem and cup, joint hyperlaxity, or primary or secondary impingement, leading to external rotation and adduction of the extended hip.



Figure 9: Radiological Picture of Posterior Dislocation in Uncemented THR

Limb length discrepancy (LLD) is a common complication post-THA, with reported incidence rates varying widely from 1% to 50%.⁹ Lengthening of the operated limb is more frequently observed than shortening.¹⁰ LLD can be measured by comparing the distance from the antero- superior iliac spine to the medial malleolus on both sides. ¹¹



Figure 10: Pre And Post-Operative Clinical Image Of Uncemented THR Showing Limb Length Discrepancy

Late complications are chronic thigh pain, heterotopic ossification, osteolysis and loosening of implant.

Anterior thigh pain is a recognized complication following uncemented primary total hip replacement, with reported incidence rates varying from 1.9% to 40.4%. The predominant cause of pain in most cases is loosening of the implant, typically localized to the anterolateral aspect of the mid-thigh at the level of the stem tip.

Heterotopic ossification (HO) presents a spectrum from faint, indistinct formations around the hip to complete ankylosis,¹² impacting postoperative outcomes in total hip arthroplasty (THA). Prophylaxis typically includes low-dose radiation and non-steroidal anti-inflammatory drugs (NSAIDs). Surgical excision is seldom necessary due to mild associated pain and the complexity of extensive exposure required for excision.

Osteolysis is characterized by progressive periprosthetic bone destruction, evident on serial radiographs by developing radiolucent lines or cavities at the implant-bone interface.¹³ The primary mechanism involves an immunological response to particulate debris, triggering macrophage-mediated bone resorption and subsequent implant loosening.¹⁴

Aseptic loosening, defined as the failure of prosthetic component fixation without infection, is a significant concern in total hip arthroplasty (THA). This condition may arise from inadequate initial fixation, mechanical loss of fixation over time, or biologic loss of fixation due to particulate-induced osteolysis surrounding the implant.¹⁵

Discussion

This study was conducted to assess the complications of uncemented total hip replacement (THR) performed at our institution, specifically in patients with avascular necrosis (AVN) of the femoral head. The 20th Annual Report of the National Joint Registry 16 of England and Wales, Northern Ireland, the Isle of Man, and Guernsey reveals that uncemented and hybrid total hip replacements currently represent the predominant methods, accounting for 76.5% of all primary hip replacements performed in 2022. The proportion of cemented hip replacements has decreased by half to 19.1% between 2006 and 2022.

The New Zealand Joint Registry¹⁷ analysis shows that out of 42,665 primary total hip replacements (THR) documented, 920 cases (2.16%) required revision involving replacement of at least one component. Fully-cemented THRs exhibited a lower overall revision rate ($p < 0.001$), whereas uncemented THRs had a lower rate among patients under 65 years of age ($p < 0.01$).

Swedish Hip Arthroplasty Register 2023¹⁸ conducted in a total of 20,568 primary total hip replacements were reported., states that uncemented fixation has been on the rise in the past two decades. In 2003, uncemented replacements constituted only 5 % of all reported operations, but in 2022, this figure exceeded 33%. The current study found that mean age of patients was 40.88 ± 14.201 years, with majority (62.7%) in under 40 years age group, followed by 27.5% in 40-60 years group, and 9.8% in over 60 years group.

This age distribution highlights a significant prevalence of hip issues in younger to middle-aged adults. In comparison, studies conducted by Kakaria HL et al.¹⁹ and Karimi S et al.²⁰ also noted a higher incidence of hip joint issues among middle-aged individuals.

The study revealed that 62.7% of the patients did not report any addictions, while 43.1% were smokers, 31.3% consumed alcohol, and 7.8% chewed tobacco. Karimi S et al. emphasized the harmful effects of smoking and alcohol consumption on bone health and vascular integrity, which can worsen conditions such as AVN. Smoking is known to reduce bone mineral density and restrict blood flow to the femoral head, thereby increasing susceptibility to AVN and other degenerative joint disorders.

In our study several complications were reported associated with hip procedures, including infection (5 cases, 9.8%), dislocation (1 case, 2%), sciatic nerve injury (3 cases, 5.9%), and heterotopic ossification (not specifically mentioned but inferred from related literature). These complications were in line with findings from previous studies, although the rates varied.

In our study, the most common postoperative complications included superficial infection (3 cases, 5.9%), deep infection (2 cases, 3.9%), and anterior thigh pain (2 cases, 3.9%). Limb length discrepancy was observed in 2 cases (3.9%). These findings emphasize the importance of meticulous surgical technique and vigilant postoperative care to minimize these adverse outcomes.

Schmalzried et al.²¹ conducted a study involving 3,126 consecutive total hip replacements, identifying postoperative neuropathy in the ipsilateral lower extremity in fifty-three cases (1.7%). The prevalence was 1.3% after primary arthroplasties but rose to 5.2% for those performed due to congenital dislocation or dysplasia of the hip and 3.2% after revision surgeries, indicating these operations were significant risk factors ($p < 0.01$).

A study conducted by Patsiogiannis et al.²², concluded that certain B1 fractures will benefit from revision surgery, whilst some B2 fractures can be effectively managed with osteosynthesis, especially in frail patients.

A meta-analysis by Peng et al.²³ examined the use of topical vancomycin powder to prevent surgical site infections in primary total hip and knee arthroplasty. The study found that the local application of vancomycin powder significantly reduced the rates of surgical site infections (SSIs) and periprosthetic joint infections (PJI) in primary total joint arthroplasty (TJA) without altering the bacterial spectrum involved.

A Study conducted by Rao et al.²⁴, in 98 patients who underwent arthroplasty using the posterior approach wore a knee immobilizer postoperatively. When the posterior approach is used in hip replacement procedures, we have found that postoperative use of a knee immobilizer helps prevent dislocation.

A Study done by Gordon et al. 25 reported that approximately 90% of the population has a limb length discrepancy of less than 1.0 cm. Hip pathology is more often associated with the longer leg, while knee issues have been observed in both the longer and shorter legs in various studies. Low back problems are more common on the short side in individuals with limb length discrepancies.

The average preoperative HHS improved from 48.51 ± 3.114 to 90.96 ± 3.268 postoperatively, highlighting a significant enhancement in patient quality of life. Initially, all patients had poor HHS scores, but after surgery, 29.4% achieved a "Good" score, and 70.6% attained an "Excellent" score. Similar improvements in HHS have been documented in studies by Kakaria HL et al. and Karimi S et al. Kakaria HL et al. reported an increase in HHS from an average preoperative score of 43 to 89 postoperatively, while Karimi S et al. noted that 90% of their patients achieved a perfect HHS of 100%, with 97% showing excellent results on a modified HHS. These findings are in line with the outcomes observed in the present study, underscoring the efficacy of hip procedures in enhancing patient outcomes.

Morshed et al.26, in their systematic review and meta-analysis of 20 articles comparing cemented versus uncemented fixation in 112,094 total hip arthroplasty (THA) cases across 24 studies, did not find a clear advantage for either procedure when defining failure as the need for revision of one or both components or revision of a specific component.

In a meta-analysis conducted by Fei et al. 27, which investigated the relationship between the use of screws and acetabular cup stability in total hip arthroplasty, seven trials involving 1402 patients (1469 THAs) were included: 767 patients (809 THAs) with screws and 635 patients (660 THAs) without screws. The findings indicated that uncemented acetabular component fixation with the use of additional screws was not associated with cup migration, migration on roentgen stereophotogrammetry, or reoperation rates after THA.

A systematic review and meta-analysis of randomized controlled trials comparing cemented versus uncemented total hip replacement (THR), conducted by Abdulkarim et al. 28, analyzed a total of 930 THRs performed in 778 patients. The study revealed that cemented and uncemented THRs showed comparable implant survival rates based on revision rates. Nevertheless, cemented fixation demonstrated superior short-term clinical outcomes, notably in terms of pain relief.

According to Tian et al. (29) meta-analysis on partial versus early full weight bearing following uncemented total hip arthroplasty (THA), early full weight bearing appears to be safe and does not lead to an increased incidence of postoperative complications.

Conclusion

Uncemented THR is one of the most successful operative procedure done across the globe. Still, it is has got complications associated with it.

Any sort of complication occurring to patient of uncemented total hip replacement is worst and dreaded outcome, orthopaedic surgeon tries his best to avoid it. The best possible outcome in uncemented total hip replacement surgery can be achieved by appropriate patient selection, appropriate implant size and design, and above all maintaining sterility intra-operatively and during regular dressings and during suture removal. Current scenario indicates that due to increased steroid medication and addiction avascular necrosis of head of femur cases will increase causing increase in uncemented total hip replacements as an operative procedure.

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