

Efficacy of Core Decompression alone in Early-Stage Avascular Necrosis of the Femoral Head

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ABSTRACT

Background: Avascular necrosis of the femoral head (AVNHF) is a progressive musculoskeletal disorder that can cause substantial disability due to collapse of the articular surface, primarily affecting young, active adults and posing significant socioeconomic challenges. The purpose of the study was to evaluate the efficacy of core decompression alone in patients with early-stage avascular necrosis of the femoral head. **Methods & Materials:** This prospective observational study at the Department of Orthopedics, Rangpur Medical College Hospital, Rangpur, and Sadar Hospital, Lalmonirhat, Bangladesh (July 2021–June 2025), included 30 patients with early-stage AVN (Ficat–Arlet I–II) undergoing core decompression. Demographics, HHS, radiological outcomes, and complications were recorded; data were analyzed using SPSS 26.0, with mean \pm SD, frequencies (%), and paired *t*-tests for HHS changes ($p < 0.05$). **Results:** Among 30 patients (mean age 24.8 ± 4.0 years; 23 males), 14 had bilateral hip involvement. Etiology included steroid-induced AVN in 14, idiopathic in 10, and alcohol-related in 6 cases. Mean Harris Hip Score improved significantly from 58.4 preoperatively to 84.6 at 12 months ($p < 0.001$), with 22 patients achieving good-to-excellent outcomes. Radiologically, 24 hips remained stable or improved, while 6 progressed. Postoperative complications were minimal: mild pain in 8 patients, early femoral head collapse in 2, and no femoral neck fractures. **Conclusion:** Core decompression alone is a safe and effective treatment for early-stage avascular necrosis of the femoral head, providing significant functional improvement and radiological stability.

Keywords: Core Decompression, Avascular Necrosis, Femoral Head

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INTRODUCTION

Avascular necrosis of the femoral head (AVNHF) is a progressive musculoskeletal disorder that can result in considerable disability due to collapse of the articular surface. This collapse occurs because of weakening of the subchondral bone, fractures, and programmed cell death (apoptosis) triggered by a reduction or cessation of blood supply to the femoral head [1,2]. The condition predominantly affects young, active adults, generally between 30 and 50 years of age, creating significant socioeconomic implications for individuals during their productive working years [3].

Data from the United States suggest that the risk factors for AVNHF include alcohol consumption in 20%–40% of cases, corticosteroid therapy in 35%–40%, and idiopathic causes in 35%–40% [4]. Etiologically, AVNHF can be categorized into traumatic and non-traumatic forms. Contributing factors for non-traumatic AVN of the femoral head include prolonged use of oral corticosteroids, excessive alcohol intake, coagulation

disorders, hyperlipidemia, smoking, storage disorders, autoimmune conditions, and hematologic diseases [5]. Given the progressive nature of the disease, timely recognition and management are essential to preserve hip joint function and prevent further deterioration [6].

Typically, patients affected by AVNHF are in their third or fourth decade of life. The pathology arises when the blood supply to the femoral head is interrupted, leading to death of bone tissue components. This disruption causes structural collapse of the femoral head and a consequent loss of hip function accompanied by pain [7]. Among the various staging systems available, the Ficat classification has been considered the most accurate for categorizing disease severity and guiding treatment decisions. This classification system was initially described by Ficat and Arlet in 1964 [8].

For patients in the early stages of the disease, core decompression is a widely utilized surgical intervention

aimed at slowing disease progression and alleviating symptoms. The procedure involves decompressing the subchondral region of the femoral head, which reduces intraosseous pressure, encourages neovascularization around the decompression channel, and facilitates new bone formation [9]. According to the Ficat classification, core decompression is most effective during precollapse stages of AVN of the femoral head (Ficat–Arlet Stage I or II), as it may delay or prevent the need for reconstructive procedures such as total hip arthroplasty (THA) and mitigate the associated consequences of joint deterioration. This intervention is primarily intended to preserve the structural integrity and function of the hip joint while relieving AVN-associated pain [10].

Despite the widespread use of core decompression for early-stage AVN of the femoral head, there remains variability in reported outcomes, and long-term functional and radiological results are not consistently documented. Many studies combine core decompression with adjunctive therapies such as bone grafting, stem cell injections, or platelet-rich plasma, making it difficult to isolate the effectiveness of core decompression alone. Additionally, there is limited evidence from population-specific studies, particularly in South Asian cohorts, regarding the efficacy, safety, and complication profile of this procedure when performed as a standalone intervention. These gaps underscore the need for focused research to evaluate the outcomes of core decompression without adjuncts.

METHODS & MATERIALS

This prospective observational study was conducted at the Department of Orthopedics, Rangpur Medical College Hospital, Rangpur, and Sadar Hospital, Lalmonirhat, Bangladesh, from July 2021 to June 2025. A total of 30 patients diagnosed with early-stage avascular necrosis of the femoral head (Ficat–Arlet Stage I or II) were included, selected based on specific inclusion and exclusion criteria. Data were collected to evaluate the clinical and radiological outcomes following core decompression alone in these patients.

Inclusion Criteria:

- Patients aged 18–35 years diagnosed with early-stage AVN of the femoral head (Ficat–Arlet Stage I or II)
- Both males and females
- Patients with unilateral or bilateral hip involvement
- Patients willing to undergo core decompression and follow-up for at least 12 months

Exclusion Criteria:

- AVN of the femoral head at advanced stages (Ficat–Arlet Stage III or IV)
- Previous surgical intervention on the affected hip
- Associated hip pathology (e.g., osteoarthritis, inflammatory arthritis)
- Coagulopathy or medical contraindications to surgery
- Patients unwilling or unable to comply with follow-up

Demographic and clinical data, including age, gender, etiology, side involvement, stage of AVN, and duration of symptoms, were recorded. Preoperative functional status was assessed using the Harris Hip Score (HHS). All patients underwent core decompression of the femoral head under standardized aseptic conditions, involving percutaneous drilling of the necrotic area to reduce intraosseous pressure and promote revascularization. Postoperative care included pain management, limited weight-bearing, and physiotherapy.

Functional outcomes were evaluated using HHS preoperatively and at 3, 6, and 12 months postoperatively, with 12-month results categorized as excellent (HHS ≥ 90), good (80–89), fair (70–79), or poor (<70). Radiological outcomes were assessed at 12 months using X-rays and the Ficat–Arlet classification, categorized as improved/stable or progressed to Stage III. Postoperative complications, including pain, wound infection, femoral neck fracture, and early collapse (<3 months), were recorded.

Data were analyzed using SPSS version 26.0. Continuous variables are presented as mean \pm standard deviation (SD), and categorical variables as frequency and percentage. Changes in HHS over time were analyzed using paired t-tests, with a significance level of $p < 0.05$.

RESULTS

Table – I: Baseline Characteristics of the Study Patients (n = 30)

Variable	Frequency (n)	Percentage (%)
Age Group (years)	18–22	30.0
	23–27	50.0
	>28	20.0
	Mean \pm SD	24.8 \pm 4.0
	Range	18–35
Gender	Male	76.7
	Female	23.3
Side Involved (hips)	Right only	33.3
	Left only	20.0
	Bilateral	46.7
Etiology	Steroid-induced	46.7
	Idiopathic	33.3
	Alcohol-related	20.0
Stage (Ficat–Arlet, hips)	Stage I	46.7
	Stage II	53.3
Duration of Symptoms (months)	Mean \pm SD	5.2 \pm 2.1
	Range	2–10

Most patients were aged 23–27 years ($n = 15$, 50.0%), followed by 18–22 years ($n = 9$, 30.0%) and >28 years ($n = 6$, 20.0%), with a mean age of 24.8 ± 4.0 years (range 18–35). The majority were male ($n = 23$, 76.7%), while 7 patients (23.3%) were female. Side involvement included 10 right hips (33.3%), 6 left hips (20.0%), and 14 bilateral cases (46.7%).

Steroid-induced AVN was the most common etiology ($n = 14$, 46.7%), followed by idiopathic ($n = 10$, 33.3%) and alcohol-related ($n = 6$, 20.0%). Based on Ficat–Arlet classification, 14 hips (46.7%) were Stage I and 16 hips (53.3%) were Stage II. The mean duration of symptoms was 5.2 ± 2.1 months (range 2–10).

Table – II: Comparison of Harris Hip Score (HHS) Before and After Core Decompression ($n = 30$)

Time of Assessment	Mean HHS \pm SD	p-value
Preoperative	58.4 ± 6.2	(Reference)
3 months postoperative	74.1 ± 8.5	< 0.001
6 months postoperative	80.3 ± 9.1	< 0.001
12 months postoperative	84.6 ± 10.3	< 0.001

The mean preoperative Harris Hip Score (HHS) was 58.4 ± 6.2 , which improved significantly to 74.1 ± 8.5 at 3 months, 80.3 ± 9.1 at 6 months, and 84.6 ± 10.3 at 12 months following core

decompression. The improvement at each postoperative interval was statistically significant ($p < 0.001$).

Table – III: Functional Outcome at Final Follow-Up (12 Months) According to Harris Hip Score ($n = 30$)

Outcome Category	HHS Range	Frequency (n)	Percentage (%)
Excellent	≥ 90	10	33.3
Good	80–89	12	40.0
Fair	70–79	5	16.7
Poor	< 70	3	10.0

At the 12-month follow-up, 10 patients (33.3%) achieved excellent outcomes and 12 patients (40.0%) had good outcomes, giving a combined good-to-excellent rate of 73.3%.

Five patients (16.7%) demonstrated fair results, while 3 patients (10.0%) showed poor outcomes.

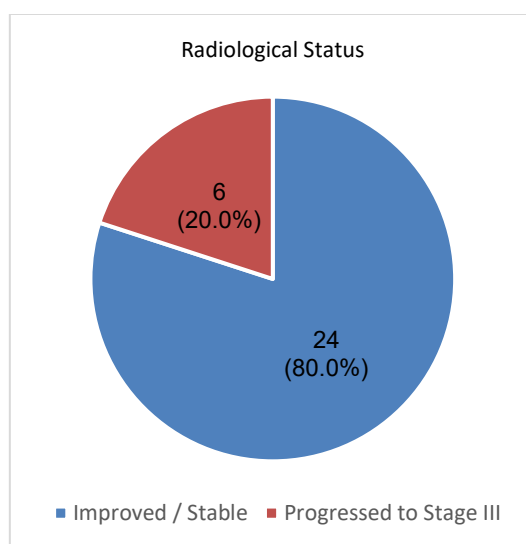


Figure – 1: Radiological Outcome (Based on Ficat–Arlet Classification) After 12 Months ($n = 30$)

At the 12-month follow-up, radiological evaluation based on the Ficat–Arlet classification demonstrated that 24 patients (80.0%) showed improvement or remained radiologically

stable, while 6 patients (20.0%) progressed to Stage III disease.

Table – IV: Postoperative Complications Following Core Decompression ($n = 30$)

Complication	Frequency (n)	Percentage (%)
Mild postoperative pain	8	26.7
Femoral neck fracture	0	0.0
Early collapse (<3 months)	2	6.7

Following core decompression, mild postoperative pain was the most commonly observed complication, occurring in 8 patients (26.7%). No femoral neck fractures were reported,

and early collapse of the femoral head within 3 months was noted in 2 patients (6.7%).

DISCUSSION

Clinical and radiological outcomes following core decompression alone in early-stage avascular necrosis of the femoral head were evaluated at two tertiary care hospitals in Bangladesh. AVNFD, a condition characterized by progressive femoral head collapse due to impaired blood supply, poses significant functional challenges, particularly in young, active adults. The findings highlight the influence of etiological factors such as steroid use, trauma, and idiopathic causes on disease progression. The observed improvements in hip function and radiological stability underscore the importance of early diagnosis and timely intervention to preserve joint integrity and delay the need for more invasive procedures such as total hip arthroplasty.

In the present study, most patients were young adults, with a mean age of 24.8 ± 4.0 years (range 18–35), reflecting the tendency of AVN to affect individuals in their productive years, similar to findings by Ansari et al.^[11]. Male predominance (76.7%) aligns with previous reports by Ansari et al. and Etemadifar et al.^[12], possibly due to greater exposure to risk factors such as corticosteroid use, alcohol consumption, and trauma. Bilateral hip involvement was observed in 46.7% of patients, slightly higher than the 31.8% reported by Etemadifar et al.^[12] and 38% by Ansari et al.^[11], highlighting variability in disease laterality. Steroid-induced AVN remained the most frequent etiology (46.7%), followed by idiopathic (33.3%) and alcohol-related causes (20.0%), consistent with global trends. Stage II hips slightly outnumbered Stage I hips (53.3% vs. 46.7%), emphasizing the importance of early diagnosis and timely intervention with core decompression to preserve femoral head integrity and delay progression. The demographic and clinical characteristics of this cohort are comparable with previously reported studies, supporting the generalizability of the findings.

A statistically significant improvement in Harris Hip Score (HHS) was observed following core decompression. The mean preoperative HHS of 58.4 ± 6.2 increased to 74.1 ± 8.5 at 3 months, 80.3 ± 9.1 at 6 months, and 84.6 ± 10.3 at 12 months ($p < 0.001$), indicating progressive recovery in hip function and pain relief. These results are in line with Shehata et al.^[8], who reported an increase in mean HHS from 67.2 ± 11.5 preoperatively to 87.7 ± 7.8 postoperatively ($p = 0.001$), and with Grassi et al.^[14], who observed a rise in mean HHS from approximately 64 to 84 over two years. The comparable outcomes emphasize the effectiveness of core decompression in early-stage AVN for symptom relief, functional improvement, and delaying femoral head collapse.

Functional outcomes at 12 months showed that 33.3% of patients achieved excellent results (HHS ≥ 90), 40.0% had good outcomes (HHS 80–89), 16.7% showed fair improvement (HHS 70–79), and 10.0% remained poor (HHS < 70), indicating that 73.3% of patients attained good-to-excellent recovery. These findings are comparable to Aigner et al.^[15], who reported excellent outcomes in 27 of 45 hips with a mean postoperative HHS of ~ 91.9 . Ansari et al.^[11] reported improvement from 60.18 preoperatively to 80.81 postoperatively ($p = 0.012$), and Mei et al.^[16] found HHS increased from 52.49 ± 6.50 to 81.14 ± 8.55 at two years ($p < 0.05$). Collectively, these results reinforce that core decompression alone produces substantial functional improvement in most patients with early-stage AVN.

Radiological assessment based on Ficat–Arlet classification showed that 24 patients (80.0%) improved or remained stable, while 6 patients (20.0%) progressed to Stage III at 12 months. These findings are consistent with Shehata et al.^[8], who observed 80% of patients with radiological stability and 20% progression, and Shah et al.^[7], who reported 92.3% stability or improvement with only 7.7% progression after core decompression with bone grafting. Talmaç et al.^[17] also reported a significant proportion of patients achieving radiological improvement or stabilization, supporting the efficacy of core decompression in halting disease progression and maintaining hip joint integrity in early-stage AVN.

In the present study, postoperative complications following core decompression were infrequent and generally minor. Mild postoperative pain was observed in 8 patients (26.7%), no femoral neck fractures occurred, and early femoral head collapse within 3 months was noted in 2 patients (6.7%). These findings indicate that core decompression is a relatively safe procedure for patients with early-stage avascular necrosis of the femoral head. Comparable results were reported by Steinberg et al.^[18], who evaluated 406 hips in 285 patients treated with core decompression and bone grafting, observing complications in only 5 cases, including 2 fractures during the first postoperative month. The low incidence of significant adverse events in both studies reinforces the favorable safety profile of core decompression as a hip-preserving intervention in early-stage AVN.

Limitations of the study

This study had some limitations:

- The study population was relatively small, limiting generalizability.
- The sample was not randomly selected.
- The study's limited geographic scope may introduce sample bias, potentially affecting the broader applicability of the findings.

Conclusion and recommendations

Core decompression alone in early-stage avascular necrosis of the femoral head resulted in significant functional improvement and favorable radiological outcomes. The majority of patients achieved good-to-excellent hip function, most hips remained stable or improved, and postoperative complications were infrequent and minor, indicating that core decompression is a safe and effective hip-preserving intervention. Given the predominance of young adults, steroid-induced AVN, and bilateral involvement in this cohort, timely intervention in early-stage AVN, along with regular clinical and radiological follow-up, risk factor management, and adherence to physiotherapy protocols, may further enhance patient outcomes and reduce the risk of disease progression.

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Conflicts of interest

There are no conflicts of interest.

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