



## Original Research

# The Results of Core Decompression Treatment in Avascular Necrosis of the Femoral Head

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### Abstract

**Objective:** Avascular necrosis of the femoral head (AVNFB) is a progressive disease seen in young, active patients, leaving significant disability in the joint when untreated. We retrospectively examined the results of patients with early stage AVNFB who had been operated in our clinic.

**Methods:** In our study, 65 hips of 46 patients were evaluated retrospectively. These patients were evaluated clinically by the Merle d'Aubigné–Postel Score and Harris Hip Score. The patients were radiologically staged according to the criteria by Ficat and Arlet with hip anterior-posterior and lateral graphs and magnetic resonance imaging.

**Results:** The mean follow-up period of the patient group was 73 months, and the mean age of the patients was 35 years. Of these patients, 59% were female and 41% were male; 41% had bilateral and 40% had right hip involvement. One of the patients developed AVNFB while she was pregnant, 7 were idiopathic, and 38 (81%) developed AVNFB due to steroid use. According to the Ficat and Arlet classification, 18 hips were found to be stage 1, 37 hips stage 2, and 9 hips stage 3 during admission. From the etiological point of view, 81% of the patients developed AVNFB while using steroid and 19% had idiopathic AVNFB. As for clinical improvement of the patients, the Harris Hip Score increased from 58 to 90 in idiopathic patients and 55 to 83 among steroid users. The Merle d'Aubigné–Postel classification scores increased from 6 to 15 in the idiopathic group and from 6 to 13 among steroid users. Radiologically, according to the Ficat and Arlet stage, progression was seen in all stages. Of the patients, 38.8% in stage 1, 70.2% in stage 2, and 88.8% in stage 3 showed progression, whereas 20% demonstrated rapid progression and needed total hip prosthesis. All patients who demonstrated progression were on chronic steroid therapy. The mean time to conversion to total hip replacement was 27 months.

**Conclusion:** Osteonecrosis is a disease associated with high morbidity. Early diagnosis can reduce morbidity and improve a patient's quality of life. Core decompression has the effect of stopping the progression of AVNFB in the early (stage 1) stages, although it has a significant and long-term palliative effect in all stages. Most of the young and active patients with AVNFB still do not have any ideal method for treatment today, but core decompression in the early stages has been seen to reduce morbidity. It is a time-saving attempt before the final treatment, which is hip arthroplasty, is performed.

**Keywords:** Avascular necrosis; core decompression; femoral head.

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**A**vascular necrosis of the femoral head (AVNFB) is a progressive disease that causes severe disability as a result of collapse of the joint surface due to the weakening of the subchondral bone, bone fracture, and apoptosis caused by a decrease or discontinuation of the blood supply to the femoral head. Although its etiopathogenesis is not clearly known, it is thought to be multifactorial.<sup>[1, 2]</sup> According to US data, risk factors for AVNFB are estimated to be associated with alcohol use in 20%–40%, steroid treatment in 35%–40%, and idiopathic etiologies in 35%–40% of the cases.<sup>[3]</sup> The disease mostly affects young active individuals between the ages of 30 and 50 years and poses serious socioeconomic problems for this population in their active business life.<sup>[4]</sup> AVNFB is bilateral in 30%–70% of the cases. As reported in literature, its incidence in German-speaking countries is thought to be 0.01%.<sup>[5]</sup> In the US, 20,000–30,000 new patients are diagnosed with avascular necrosis annually. Of the 250,000 total hip arthroplasties performed in 1 year, 10% are composed of coxarthrosis on the background of AVNFB. The disease rarely regresses spontaneously, and it progresses in 67% of untreated asymptomatic patients and 85% of symptomatic patients.<sup>[6]</sup> Although most investigators have planned the treatment methods according to the patient's age, symptoms, stage of disease, and concomitant systemic disease, no algorithm has been established yet.<sup>[4, 7]</sup> In the early stages, core decompression surgery is thought to slow the progression of the disease and decrease the symptoms. Therefore, establishment of the diagnosis at an early stage has a critical importance.

With detailed anamnesis, physical examination appropriate radiological examination diagnosis can be made.<sup>[6]</sup> AVNFB progressively causes coxarthrosis, and in these patients due to long-term problems of total hip arthroplasty. In the early stages of the disease, core decompression, which is one of the treatment methods used to protect the hip joint, can be applied.<sup>[8]</sup> In our study, we evaluated the effectiveness of core decompression surgery in severely disabled young patients with early stage AVNFB.

## Methods

In our clinic, 46 out of the 79 patients who underwent core decompression due to AVNFB between 1998 and 2009 were evaluated. Sixty-five hips of 46 patients were included in the study. Patients with Ficat–Arlet stage 4, with a history of total hip arthroplasty, or who had osteonecrosis developed on the background of trauma and children were excluded from the study. Patients were classified according to age, gender, laterality, bilaterality, and etiological factors. The patients were evaluated using the Ficat–Arlet staging based on preoperatively and postoperatively obtained anteroposterior radiograms and magnetic resonance imaging of the hips (Table 1).<sup>[9]</sup> Functionally, patients were followed up with preoperative and postoperative Harris Hip Scores<sup>[10]</sup> and Merle d'Aubigné–Postel staging<sup>[11]</sup> (Table 2).

## Statistical Analysis

Data were evaluated using SPSS Windows 10.0 statistical package program (SPSS Inc., Chicago, IL, USA). Wilcoxon rank, Mann–Whitney U, Paired Student's t and chi-square tests were used. Pearson correlation analysis was used for correlation of data. A p value <0.05 was considered significant. The study was conducted with the approval of the Ethics Committee (decision no. 11555).

**Table 1.** Ficat–Arlet staging system

Stage	Radiological findings
I	Plain radiograph, magnetic resonance imaging, and scintigraphy: normal
IIA	Sclerotic and cystic lesion (absence of subchondral cystic formation)
IIB	Subchondral collapse (crescent sign) and/or subchondral aliasing
III	Irregular femoral contour
IV	Collapse of the femoral head, acetabular involvement, and articular destruction (osteoarthritis)

**Table 2.** Merle d'Aubigné–Postel Score

Score	Pain	Range of motion of the joint	Walking ability
6	None	Flexion >90°, abduction: normal	Normal
5	Occasionally	Flexion =80°–90°, abduction >15°	Slight limping
4	Resolves during rest	Flexion =60°–80°, patient can touch his/her feet	The patient can walk short distance without a cane
3	Restricts activity	Flexion =40°–60°	Continuous use of a single cane
2	Prevents activity	Flexion <40°	Use of double cane
1	Night pain	Ankylosing hip in good condition	Use of double crutches
0	Persistent tenderness	Ankylosing hip in bad condition	Inability to walk

15–18 points, good; 12–14 points, moderate; <12 points, bad.

## Results

The mean age of the patients was 35 (20–58) years. Of the operated patients, 27 (59%) were female, and 19 (41%) were male. The mean follow-up period was 73 months. When the cases were evaluated according to the affected side, AVNFHs were right (n=18; 39.1%) and left (n=9; 19.6%) sided or bilateral (n=19; 41.3%). AVNFH was due to chronic steroid use in 38 (n=53 hips; 81.38%), pregnancy-related complications in 1 (3.07%), and idiopathic etiologies in 7 (18.46%) patients (Table 3). Since the majority of the patients included in our study were referred from the rheumatology clinic of our university, steroid was the common etiologic agent. The lesions on the femoral head were radiologically classified according to the Ficat–Arlet criteria. According to the Ficat–Arlet staging, at admission, 18 hips were in stage 1, 37 hips in stage 2, and 9 hips in stage 3.

All patients underwent core decompression surgery. Forty-six patients (65 hips) were placed in supine position on the radiolucent table and underwent forage under the guidance of the scopy. These procedures were performed in the same session, except five patients with bilateral involvement. All patients underwent antibiotherapy for 24 h postoperatively. The patients were mobilized on day 2 with the help of crutches. Patients undergoing bilateral forages were followed up with bed exercises and pool therapy until week 6 when the load-bearing period began. The patients who were mobilized with crutches for 6 weeks without weight-bearing had an average hospital stay of 2 days.

Any additional treatments, such as antiresorptive medication and hyperbaric oxygen administration, were not given during the postoperative period. In general, during outpatient follow-ups, all patients were allowed to complete week 6 with partial weight-bearing, and then full weight-bearing was permitted starting from month 3. One patient developed subtrochanteric fracture following full weight-bearing on postoperative month 3 (Fig. 1). None of the patients had deep infection, deep vein thrombosis, and bleeding. The mean follow-up period was 73.35 months. Patients were evaluated clinically and radiologically. Clinically, the

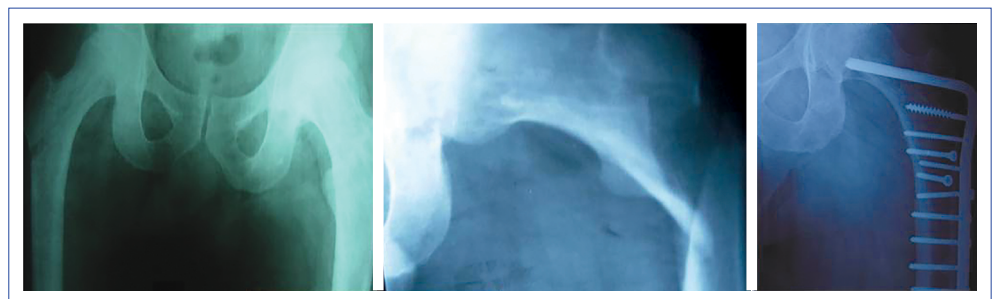
**Table 3.** Etiology

1. Idiopathic	7	15.2
2. Pregnancy-related		
Related to steroid use;	1	2.2
3. SLE	11	23.9
4. ITP	5	10.9
5. Kidney transplantation	4	8.7
6. Pemphigus vulgaris	2	4.3
7. Temporal arteritis	2	4.3
8. NHL	2	4.3
9. Asthma	2	4.3
10. Hodgkin's Lymphoma	1	2.2
11. Wegener's granulomatosis	1	2.2
12. Blepharitis	1	2.2
13. Myositis	1	2.2
14. Evans syndrome	1	2.2
15. Chronic bronchitis	1	2.2
16. Chronic pleurisy	1	2.2
17. Pseudotumor of orbita	1	2.2
18. ALL	1	2.2
19. Henoch–Schönlein purpura	1	2.2

**Table 4.** Pre and postoperative distributions of the Harris Hip classification scores

Etiology	Idiopathic		Steroid		P
	Mean	SD	Mean	SD	
Preop	58.71	6.85	55.24	5.04	.136
Postop	89.86	10.99	83.11	13.14	.220
Difference	31.14	5.46	28.04	12.06	.514

Harris Hip and Merle d'Aubigné–Postel Scores were rated. After clinical examination, magnetic resonance imaging was performed in all patients in addition to plain radiograms (pelvis anterior-posterior [AP] and hip AP/lateral) and staged according to the postoperative Ficat–Arlet criteria.



**Figure 1.** Proximal femur subtrochanteric fracture due to core decompression.

**Table 5.** Pre and postoperative distributions of the Merle d'Aubigné–Postel classification scores

Etyoloji	Idiopathic		Steroid		p
	Mean	SD	Mean	SD	
Preop	5.86	.90	5.62	1.08	.597
Postop	15.43	2.44	13.79	3.68	.274
Difference	9.57	1.72	8.17	3.55	.321

**Table 6.** Pre and postoperative disease progression in three stages according to the Ficat–Arlet classification

Preop Ficat	Postop Ficat-Arlet				Total
	Stage 1	Stage 2	Stage 3	Stage 4	
Stage 1	11	5	1	1	18
Stage 2		11	8	18	37
Stage 3			1	8	9
Total	11	16	10	27	64

The surgical outcomes of the patients who had been subjected to total hip arthroplasty were evaluated at the final follow-up visit according to the Harris Hip Scores as excellent in 24, good in 11, moderate in 5, and poor in 4 hips and as good in 28, moderate in 15, and poor in 3 hips based on the Merle d'Aubigné–Postel Scores. In our cases, the Harris Hip Score and Merle d'Aubigné–Postel Scores were found to be statistically significantly correlated with each other, and clinical findings and improvements were also statistically significant. However, any statistically significant difference was not seen between patients using and not using steroid therapy (Table 4, 5). However, AVNFB in 64% of the patients in the steroid-treated and systemic lupus erythematosus (SLE) groups progressed rapidly so total hip prosthesis was applied.

According to the Ficat–Arlet staging system based on radiological and clinical findings, progression was seen in 38.8%, 70.2%, and 88.8% of the patients in stages 1, 2, and 3, respectively (Table 6).

In the present study, there are no correlation between the clinical and radiological stages of the disease. In our study, clinical improvement was observed in patients who showed radiologically progressive disease.

Thirteen out of the 65 hips (20%) subjected to core decompression because of AVNFB showed rapid deterioration that required total hip prosthesis. The mean time to total hip replacement was 27.6 (15–41) months.

## Discussion

A consensus on the treatment of AVNFB has not yet been established.<sup>[12, 13]</sup> The treatment is planned according to the

stage of the disease, its etiology, duration of symptoms, pain, and systemic disease. Patients with AVNFB develop subchondral fracture within 2–3 years if not treated, and joint-conserving surgery cannot be performed.<sup>[5]</sup> In AVNFB, core decompression is thought to decrease blood pressure in the femoral head by decreasing the pressure in the early stage and conversion to implantation of total hip prosthesis and pain.<sup>[4, 14]</sup>

Ficat<sup>[9]</sup> presented core decompression for the first time in 1962. This procedure is intended to increase the blood supply to the necrotic area by means of a drill hole made from the distal end of the trochanter. In addition to core decompression therapy, there are also graft (vein–veinless fibula), mesenchymal stem cell, and tantalum rod applications.<sup>[15, 16]</sup> Core decompression is still the preferred procedure because it is simpler than other methods, and the complication is low. The most common complication of this method is proximal femur fracture, which is reported to range between 0% and 18%<sup>[17]</sup> (Fig. 1). In our series, 1 (3%) patient had subtrochanteric fracture. We think that the complication rate is due to the development of the technique and the progression of postoperative rehabilitation.<sup>[18]</sup> AVNFB shows higher rates of bilateral joint involvement in 30%–70% of the cases.<sup>[5]</sup> In our series, bilateral joint involvement was observed in 40% of these cases. For this reason, both hips of the patients should be examined. Mont et al.<sup>[19]</sup> compiled the outcomes of 1206 cases with AVNFB reported in the literature up to now and revealed that forage exerts a significant positive effect on the course of the disease and increases survival rates in stages 1 and 2 from 35% to 85% and from 31.4% to 65%, respectively, compared with conservative treatment. As shown in our study, forage cannot prevent radiological progression, and progression rates reached 38.8%, 70.2%, and 88.8% in stages 1, 2, and 3, respectively. Fairbank et al.<sup>[8]</sup> reported these rates as 62% and 93%, respectively.

Disease progression was also seen in our stage 1 patients. AVNFB induced by steroid use seen in 80% of the patients was associated with different follow-up periods of the patients.

The effect of forage on stopping the progression of AVNFB is evident only in the early stage (stage 1/2) lesions but has a marked and long-lasting analgesic effect in all stages.<sup>[20]</sup> Similarly, in a meta-analysis performed by Castro and Barrack,<sup>[17]</sup> 22 relevant publications on core decompression were compared with 8 publications on conservatively treated patients. As a result, it was shown that core decompression was superior to conservative treatment only when applied to stage 1 lesions.

When we evaluated our results, a significant progression



was observed between stage 1 and stage 2–3 cases. Our study was consistent with the study by Castro and Barrack. In contrast to the literature, the progression of stage 1 disease was attributed to SLE and steroid use in the patient group. When the femoral head collapses and the acetabulum is affected, the treatment option is joint reconstruction. The most common method performed is total hip arthroplasty and surface replacement. The preference of these methods depends on the stage and extent of the disease.<sup>[21]</sup> Thirteen out of the 65 hips of our cases showed progression after core decompression, so total hip replacement was performed.

The effect of core decompression on the progression of AVNFH is evident in radiological and clinical early stage (stage 1) lesions, whereas it has a marked and long-lasting analgesic effect at all stages. Since an ideal method for the treatment of most of the young and active patients with AVNFH has not been found, core decompression is a time-saving intervention prior to total arthroplasty with important analgesic effects. Considering that the aim of the treatment of AVNFH is to obtain a painless and functional hip, this treatment method can be said to be clinically successful at an early stage.

## Disclosures

**Ethics Committee Approval:** The study was conducted with the approval of the Ethics Committee (decision no. 11555).

**Peer-review:** Externally peer-reviewed.

**Conflict of Interest:** The authors declare no conflict of interest.

**Authorship contributions:** Concept – M.A.T.; Design – Y.T.; Supervision – M.K.; Materials – M.A.T.; Data collection &/or processing – M.A.T.; Analysis and/or interpretation – M.M.S.; Literature search – F.D.; Writing – M.A.T.; Critical review – H.M.Ö.

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