

## Avascular Necrosis of The Femur Head Caused by Trauma: Case Report

Taruna Andang\*, Ichsantyaridha Mahardhika, and Fatria Y Jaka

Islamic Hospital Pondok Kopi, Jakarta, Indonesia

\*Corresponding author details: [andangtaruna14@gmail.com](mailto:andangtaruna14@gmail.com); Taruna Andang

### ABSTRACT

Avascular necrosis of the femoral head can be caused by several conditions, one of which is trauma to the hip joint. In this case we report a patient with symptom of pain in the left hip making it difficult to walk. The patient has a history of trauma to his left hip. Apart from the clinical manifestation, a radiological examination is also needed to support the diagnosis and determine the level of severity. This report aims to determine the diagnosis and treatment of cases of avascular necrosis of the femoral head caused by trauma.

**Keywords:** avascular necrosis; femoral head; hip replacement

### BACKGROUND

Avascular Necrosis or commonly called osteonecrosis is the death of bone cells due to disruption of blood flow to the proximal part of the bone caused by trauma or non-trauma. This disease very often affects the hip joints, but apart from that it can also occur in the shoulder, ankle or knee joints <sup>(1,2)</sup>.

Some common causes of this case are bone fractures, dislocation of the hip joint, use of corticosteroid drugs, and alcohol abuse <sup>(4)</sup>.

Making a diagnosis as early as possible will provide a better prognosis for the patient, but on the contrary, cases of avascular necrosis that are not treated will develop into secondary hip arthritis <sup>(4)</sup>. If secondary hip arthritis has occurred then joint replacement surgery is very necessary <sup>(5,6)</sup>.

### CASE REPORT

A 55-year-old man came to the emergency room with symptom of pain in his left hip for the past 1 month. The hip pain radiating to the left groin, apart from that, complaints of pain getting worse, especially when the patient climbs stairs. The pain disappeared when the patient sitting or resting. The patient did not complain of numbness.

Previously, the patient had a history of falling from a height of around 3 meters at home 1 year ago. However, because the patient felt he could still walk, the patient decided not to seek treatment. Until finally the patient complained that the pain was getting worse, making it difficult for the patient to walk.

On physical examination, there was difficulty in all physiological movements of the left hip joint due to pain. Most of the pain is felt during abduction and internal rotation movements. There were no open wounds or edema found in the patient's left hip joint area.



**FIGURE 1:** Anteroposterior view of the pelvic before the surgery.

Then, supporting examinations are carried out in the form of laboratory and radiological examinations. The results of an X-ray radiological examination of the left hip joint showed a deformation of the femoral head and the presence of bone sequestrum or the appearance of dead bone.

### MANAGEMENT

The patient underwent surgery in the form of bipolar hip arthroplasty. After surgery, patient was monitored regularly by undergoing a medical rehabilitation program. Radiographic examination after the patient's left hip replacement surgery showed that there was a prosthesis on the patient's left hip in a good position.

Several rehabilitation procedures were carried out, starting with passive stretching of the left hip joint, then gradually carrying out active movement exercises on the patient's left hip joint.

After the patient was able to bear weight, the patient was trained to restore normal gait and practice balance. The patient follows a post-operative medical rehabilitation program for several months until the patient can carry out daily activities independently.

**DISCUSSION**

Avascular necrosis is characterized by the death of osteocytes due to vascular disruption (7). The most common location of avascular necrosis is the femoral head. Usually patients come with complaints of pain in the hip (7,8). Most of the blood supply to the femoral head comes from the medial and lateral circumflex branches of the profunda femoral artery, which originates from the femoral artery.

In cases of avascular necrosis, there is a decrease in blood supply to the femoral head, causing necrosis of bone cells which ultimately increases the risk of secondary osteoarthritis (9,10).

The etiology of avascular necrosis of the femoral head is as follows (1, 11):

Traumatic	Non-Traumatic
1. Fracture	1. Corticosteroids
2. Dislocation	2. Alcohol abuse
	3. Lupus erythematosus
	4. Gaucher's disease
	5. Sickle cell anemia
	6. Bone marrow transplant
	7. Antiretroviral treatment
	8. LCPD in children

Avascular necrosis of the femoral head is divided into several classifications according to Ficat, namely (12):

Stadiums	Radiographic picture	Clinical picture
0	Inconspicuous/normal findings	0 (silent hips)
I	Inconspicuous findings or minor changes (slight patchy osteoporosis, blurring of trabecular pattern, subtle loss of clarity)	+
II A	Diffuse/focal radiological changes (osteoporosis, sclerosis, cysts)	+
II B	Subchondral fracture ("crescent sign") segmental flattening of femur head ("out-of-round appearance")	+
III	Broken contour of femoral head, bone sequestrum, joint space normal or increased	++
IV	Flattened contour of femoral head, decreased joint space collapse of femoral head, acetabular osteoarthrotic changes	+++

In this case, the patient experienced avascular necrosis of the left hip with Ficat III grade which was caused by trauma and delay in initial treatment.

The radiological features of osteonecrosis generally include collapse of the articular cortex, fragmentation, mottled trabecular patterns, sclerosis, subchondral cysts, and/or subchondral fractures (7). The radiological findings in this case shows deformation of the femoral head as well as the presence of a bone sequestrum or the appearance of dead bone.

The diagnosis of avascular necrosis is based primarily on clinical and radiographic findings. The typical clinical manifestations including increasing pain, stiffness, as well as crepitation, usually starting with a period of minimal symptoms. On physical examination, patients usually complain of limited movement in the hip joint and pain, especially with internal rotation movements (3). Many imaging techniques have proven helpful in detecting signs of bone necrosis, including X-rays, magnetic resonance imaging (MRI), computerized tomography (CT), and radionuclide examination. Imaging evaluation of avascular necrosis should begin with inexpensive and widely available radiographic examinations. Classic radiographs may show a subchondral radiolucency, the so-called "crescent sign," indicating subchondral collapse (11). While the gold standard for early diagnosis of avascular necrosis is MRI examination.

MRI allows for early diagnosis of avascular necrosis and can help identify patients at risk of femoral head fracture (1, 4, 11).

Management of avascular necrosis patients is divided into 2, namely non-surgical and surgical management. Conservative treatment of avascular necrosis aims to improve hip function, prevent collapse of the femoral head, relieve pain, and prevent bone necrosis. This non-surgical management is mainly carried out in the early stages of the disease (4, 13).

Using a cane, crutches, or walking aids is one way to reduce the load on a patient's joints, thereby preventing the disease from becoming more severe (14). In addition, the use of several pharmacological agents has been proposed as a treatment for avascular necrosis, some of which are anticoagulants, statins, vasodilators, bisphosphonates, and other agents that are currently under investigation (13). This type of treatment is widely used in the early stages of the disease. However, its effectiveness is limited, and there are no clear recommendations for its use in avascular necrosis due to lack of evidence. Many patients, after pharmacological treatment, ultimately undergo surgery (14).

Surgical treatment in cases of avascular necrosis is usually carried out in stage of before bone collapsing happened.

Core decompression is the most common procedure performed in the early stages of avascular necrosis. The principle of this method is to reduce intraosseous pressure and restore circulation in the femoral head<sup>(15)</sup>.

Nonvascularized bone grafts derived from other parts of the body (e.g., tibial autograft, fibular autograft, or allograft) are used to fill necrotic areas of the femoral head. This procedure is most often used in the early stages of the disease after core decompression has failed<sup>(16)</sup>.

A vascularized graft will improve the subchondral architecture and also restore circulation in the damaged femoral head area. This technique uses part of the fibular bone with a nutrient artery. This technique is usually used for patients with avascular necrosis with articular collapse <3mm and femoral head <50%<sup>(1)</sup>.

Cellular therapy primarily uses mesenchymal stem cells (Mesenchymal Stem Cells) derived from bone marrow, adipose tissue, or the umbilical cord. MSCs initiate the process of revascularization and regenerate bone tissue<sup>(17,18)</sup>.

Bipolar hip arthroplasty is recommended for patients with grade 3 avascular necrosis of the femoral head<sup>(19)</sup>. Meanwhile, total hip arthroplasty should be performed in patients with significant femoral head collapse, loss of hip function, and severe pain. This procedure involves removing the ball and socket of the hip and replacing it with an artificial implant<sup>(3)</sup>. Most patients with Total Hip Arthroplasty have a good outcome, particularly pain relief and restoring hip function<sup>(20)</sup>.

In this patient's case, surgical treatment was carried out in the form of Bipolar Arthroplasty because in the clinical condition the patient experienced limited movement, pain, and radiological images showed that there was deformation of the femoral head and the presence of bone sequestrum or the appearance of dead bone. After the patient is allowed to go home, the patient is still evaluated under control at the orthopedic clinic and is advised to follow the stages of rehabilitation therapy in order to speed up the patient's healing process and speed up the return of function to the patient's hip joint.

## CONCLUSION

Whenever a patient presents with hip pain due to trauma, the doctor should suspect avascular necrosis. Untreated avascular necrosis will cause secondary hip arthritis which ultimately requires treatment in the form of hip arthroplasty. Establishing an early diagnosis of avascular necrosis will help doctors determine relevant management steps for maximum results for the patient's recovery rate. MRI examination is the gold standard to help diagnose osteonecrosis. Nevertheless, from a practical point of view, imaging evaluation of avascular necrosis should begin with traditional radiography because this technique is inexpensive and widely available. Management of avascular

necrosis can be done non-operatively for early stages and operative treatment, especially at advanced stages.

The aim of this review is to provide a brief and practical overview of cases of avascular necrosis of the femoral head and its management. As authors, we hope that this review will help provide readers with information to better understand the clinical aspects of avascular necrosis of the femoral head and its management.

## REFERENCES

- [1] Petek, D.; Hannouche, D.; Suva, D. Osteonecrosis of the femoral head: Pathophysiology and current concepts of treatment. *EFORT Open Rev.* 2019,4, 85–97. [CrossRef]
- [2] Mankin, HJ Nontraumatic necrosis of bone (osteonecrosis). *N. Engl. J. Med.* 1992,326, 1473–1479.
- [3] Moya-Angeler, J.; Gianakos, AL; Villa, J.C.; Ni, A.; Lane, J.M. Current concepts on osteonecrosis of the femoral head. *World J. Orthop.* 2015,6, 590–601. [CrossRef] [PubMed]
- [4] Tripathy, S.K.; Goyal, T.; Sen, RK Management of femoral head osteonecrosis: Current concepts. *Indian J. Orthop.* 2015,49, 28–45. [CrossRef]
- [5] Lamb, JN; Holton, C.; O'Connor, P.; Giannoudis, PV Avascular necrosis of the hip. *BMJ* 2019,365, l2178. [CrossRef] [PubMed]
- [6] Mont, MA; Zywiell, MG; Marker, DR; McGrath, MS; Delanois, RE Natural history of asymptomatic osteonecrosis of the femoral head treated: A systematic literature review. *J. Bone Jt. Surgery.* 1.2010,92, 2165–2170. [CrossRef] [PubMed]
- [7] Yochum T, Rowe L. Essentials of skeletal radiology. 2nd ed. Baltimore: Williams & Wilkins 1996; 1260–1263.
- [8] Tierney Jr. LM, McPhee SJ, Papadakis MA. Current Medical diagnosis and treatment. 36th ed. Stamford: Appleton & Lange 1997; 798–799.
- [9] Mankin, HJ Nontraumatic necrosis of bone (osteonecrosis). *N. Engl. J. Med.* 1992,326, 1473–1479.
- [10] Gautier, E.; Ganz, K.; Krugel, N.; Gill, T.; Ganz, R. Anatomy of the medial femoral circumflex artery and its surgical implications. *J. Bone Jt. Surg. Br.* 2000,82, 679–683. [CrossRef]
- [11] Barney, J.; Piuze, N.S.; Akhondi, H. *Femoral Head Avascular Necrosis*; StatPearls: Treasure Island, FL, USA, 2022.

- [12] Ficat RP (1985) Idiopathic bone necrosis of the femoral head. Early diagnosis and treatment. *J Bone Joint Surg Br* 67:3-9
- [13] Sen, RK Management of avascular necrosis of femoral head at pre-collapse stage. *Indian J. Orthop.* 2009,43, 6-16. [CrossRef]
- [14] Mont, MA; Carbone, J.J.; Fairbank, AC Core decompression versus nonoperative management for osteonecrosis of the hip. *Clin. Orthop. Relat. Res.* 1996,324, 169-178. [CrossRef]
- [15] Salas, AP; Mazek, J.; O'Donnell, J.; Mendez-Perez, E.; Brizuela-Ventura, M.; Velasco-Vazquez, H.A.; Meza, F. Hip Arthroscopy and Core Decompression for Avascular Necrosis of the Femoral Head Using a Specific Aiming Guide: A Step-by-Step Surgical Technique. *Arthrosc. Tech.* 2021,10, e2775-e2782. [CrossRef]
- [16] Lespasio, M]; Sodhi, N.; Mont, MA Osteonecrosis of the Hip: A Primer. *Perm J.* 2019,23. [CrossRef] [PubMed]
- [17] Murab, S.; Hawk, T.; Snyder, A.; Herold, S.; Totalally, M.; Whitlock, PW Tissue Engineering Strategies for Treating Avascular Necrosis of the Femoral Head. *Bioengineering* 2021,8, 200. [CrossRef]
- [18] Wang, C.; Wang, Y.; Meng, H.Y.; Yuan, XL; Xu, XL; Wang, AY; Guo, Q.; Peng, J.; Lu, S. Application of bone marrow mesenchymal stem cells to the treatment of osteonecrosis of the femoral head. *Int. J. Clin. Exp. Med.* 2015,8, 3127-3135.
- [19] Dudani, Baldev.; Shyam, Ashok.; Arora, Pankush.; Veigus, Arjun. Bipolar hip arthroplasty for avascular necrosis of femoral head in young adults. 2015, 48, 329.
- [20] Pierce, T.P.; Elmallah, R.K.; Jauregui, J.J.; Verna, D.F.; Mont, M.A. Outcomes of total hip arthroplasty in patients with osteonecrosis of the femoral head-a current review. *Curr. Rev. Musculoskelet. Med.* 2015, 8, 246-251. [CrossRef] [PubMed]