European Journal of Molecular & Clinical Medicine
ISSN 2515-8260 Volume 09, Issue 07, 2022

Original Research Article

Age and Stage as Crucial Determinant in the Treatment Strategies of Avascular Necrosis of Femoral Head

Dr. Dev Reshi Kumar Pandey[1] (Associate Professor), Dr. Ripudaman Sharma[2] (Assistant Professor) & Dr. Suhail Wani[3] (Senior Resident)

[1,2,3]Department of Orthopedics, GS Medical College & Hospital Pilkhuwa, Hapur- 245304 (U.P.) India

Corresponding Author: Dr. Dev Reshi Kumar Pandey

Abstract:

Background: Avascular necrosis of femoral head is an illness characterized by interruption of blood supply to the femoral head and mostly affects young adults. If it is not treated timely, its progression leads femoral head collapse and hip arthroplasty. Along with the idiopathic cases, some predisposing risk factors are also associated to develop avascular necrosis. Early diagnosis can preserve the hip joint. MRI imaging is considered the most effective and sensitive diagnostic tool for avascular necrosis which is helpful to detect in early stage.

Aim: The purpose of the study was to determine the stages presentation at the time of diagnosis and involved risk factors in etiology of Avascular Necrosis (AVN) of the femoral head.

Material & Method: This study conducted in orthopaedic department at GS Medical College. 50 patients of all age groups diagnosed with avascular necrosis after MRI of hip joint were included in this study. Patient information regarding age, sex, causative factors was collected from patient chart. Staging of disease was done according to Ficat and Arlet classification.

Result: It was found that most commonly males of young age group were affected. 76% cases had bilateral involvement of hip joint and 24% patients had unilateral involvement of irrespective site of hip joint. 70% patients presented with stage-III & IV at the tiem of diagnosis of disease. This study also revealed that main risk factor was idiopathic (68%).

Conclusion: Early diagnosis and treatment is the key to prevent progression of disease and can preserve hip joints. MRI evaluation and study of ethology factors can be beneficial in the management of vascular necrosis of femoral head.

Key Words: Avascular necrosis, Femoral head, Osteonecrosis

1. INTRODUCTION:

Avascular necrosis of the femoral head occurs due to due to disruption of blood supply to the proximal femur is characterized by variable areas of dead trabecular bone and bone marrow, extending to and including the subchondral plat. There are variety of causes including fractures, dislocations, chronic steroid use, chronic alcohol use, coagulopathy, congenital causes which leads to avascular necrosis [1,2]. Older patients have less chance of

revascularization. Most of the radiographically evident state that, lesions progress until the femoral head collapses. This mechanical failure represents the separation of the subchondral plate from the underlying necrotic cancellous bone which is the earliest sign known as crescent sign. Most patients have clinical progression after femoral head collapsed. As a result total hip replacement is needed [1].

The aetiology of AVN may be posttraumatic, nontraumatic or idiopathic characterized by pain felt mostly in front of the joint and restriction of movements at the affected joint with a limp [3]. Unlike, different aetiology can be responsible for this condition. One commonest traumatic cause is dislocation of the femoral head from acetabulum or femoral neck fracture. In this condition the blood supply to the head of the femur get easily disrupted leading to avascular necrosis. 15% to 50% of fractures of the neck of the femur and 10% to 25% of hip dislocations are the results of Osteonecrosis [4].

It is very important to diagnose the avascular necrosis early in the disease process since the success of the treatment is related to the stage at which the treatment starts. Use of Chronic steroid and excessive alcohol consumption represents the non-traumatic aetiologies which contribute more than 80% of them. The second most common cause of osteonecrosis after trauma is represented by Steroid-associated osteonecrosis. Many evidence indicating the correlation between steroid use and osteonecrosis, the exact pathophysiology is still not clear and probably multifactorial. In aggregation, the causative factors such as fat emboli, fat cell hypertrophy leading to increased intraosseous pressure, endothelial dysfunction, hyperlipidemia, and abnormality of the stem cell pool of the bone marrow; all of these contribute to ischemia and subsequent necrosis [5].

The incidence of avascular necrosis of the femoral head within In the United States the incidence of avascular necrosis of the femoral head is estimated to occur at a rate between 20000 to 30000 new cases every year, contributing to 10% of the approximately 250000 total hip arthroplasties performed annually [6].

According to some researcher, there is no any association with race, except regarding cases associated with sickle cell disease. Overall, this condition is more prevalent in men than women, with studies estimating ratios from 3 to 1 to 5 to 1[7]. The average age at treatment is 33 to 38 years old [8].

2. MATERIAL METHOD:

This study was carried out on 50 patients after MRI of hip joint showing signs of avascular necrosis of the femoral head and who visited in the orthopaedics department of GSMCH, Pilkhuwa, Hapur, UP, India between 2020, March to 2022 April. Institutional ethical committee approval was taken prior to conduct the study. All age groups and both Saxes were included in this study. All the patients with post-operative implants, other associated hip joint pathologies and trauma were excluded. Data regarding age, sex, etiological factors was obtained from patient charts for statistical analysis. Data analysis was done using Microsoft Excel.

The MRI scans were performed on a Model 1.5 TGE HDE Scanner using T1 Weighted spin echo (T1W) sequence in the axial and the coronal plane, the T2 weighted fast spine echo (T2W) sequence in the axial plane, the Short Tau Inversion Recovery (STIR) sequence in the coronal and the axial planes and Gradient echo sequence (GRE) in the sagittal plane. The various well-known directories of AVN like bone marrow oedema, joint effusion, flattening of femoral head, narrowing of joint space, marginal irregularity, collapse of head, subchondral fracture and double line sign were gotten by MRI sequences, especially in coronal plane. These appearances of the lesion over the various sequences of MRI were used

as the diagnostic criteria and staging of AVN. The Ficat and Arlet classification of avascular necrosis was used to stage the patients. Ficat and Arlet have developed a staging system using radiographic findings, consisting of four stages. Hungerford and Lennox modified this staging system when MRI became available, adding stage 0 to the classification and now the system currently uses a combination of plain radiographs, MRI and clinical features to stage avascular necrosis of the femoral head [9]. According to this classification there are five stages of AVN of femoral head, however, in stage zero the MRI findings were normal, hence, the cases were staged from stage I to stage IV considering the MRI findings [10].

3. RESULTS:

Total 50 patients diagnosed with avascular necrosis of femoral head in all ages group were included in this study. Out of which 39 patients (78%) were male and 11 patients (22%) were female. Highest numbers of patients were seen in age group of 41 to 60 years (50%) followed by 21 to 40 years (40%). On comparing male and female involvement in various age-groups it has been observed that males are predominantly affected in all age groups (Table 1). Bilateral involvement of hip joint was seen in 37 patients (76%) and 13 patients (24%) had unilateral involvement of irrespective site of hip joint (table 2). Out of 87 hips left hip was involved in 43 cases (49%) and right hip was involved in 44 cases (51%). This study also revealed that main risk factor was idiopathic (68%), followed by alcohol consumption (18%) (Table3). Total 50 patients that came for MRI, out of 37 patients of bilateral cases, 28 patients (75%) had stage III or IV disease at the time of diagnosis and all 13 patients of unilateral cases had stage III or IV disease at the time of diagnosis. Out of 87 hips 30 hips (34%) were found in III stage and 31 hips (35%) were in IV stage at the time of diagnosis (Table 4).

4. DISCUSSION:

The exact causative factor of avascular necrosis of femoral head is still unknown. Study reported that alcohol consumption and use of steroids are significantly involved to increase the prevalence of avascular necrosis. Its occurrence relatively in younger age results financial loss, stress and decreased social productivity of individual. Its treatment depends on the stage of disease at the time of diagnosis and degenerative consequences. An early detection of avascular necrosis has a lot of significance as it can limit the size of necrosis and corrective measures can reduce the severity of disease which can delay joint replacement and can improve the quality of life. In our study we saw the highest number of patients in the age group of 41 to 60 years (50%), followed by 21 to 40 years (40%), (Table 1). It can be said that avascular necrosis affects younger adults. Study conducted by Khaladkar MS et al., in which the age group varied from 11 to 70 years. Maximum belonged to age group 31-40 (30.5%), followed by 21-30 (25%) and 41-50 (22.2%) [11]. Another study of GEHLOT PS et.al., also revelled in his study that out of 186 patients highest number of patients (108) were in the age group of 21-40 years, followed by 62 patients in 41-60 years [12]. In our study we found male dominance as 78% patients were male and 22% patients were female. Similar result of male dominance was also found in the study of Khaladkar MS et al. and Gehlot PS et.al. [11,12]. On the basis of hip involvement we found maximum bilateral involvement of hip joint in 76% (38) patients (Table 2). Similar findings were also seen which was 61.1% patients of bilateral involvement in the study conducted by Khaladkar MS et al.,[11] and 74% patients in the study conducted by Gehlot PS et.al.[12]. Khaladkar MS et al. found out of 58 hips, left hip was involved in 33 cases (56.8%) and right hip was involved in 25 (43.1%), and

study of Gehlot PS et.al.observed twenty-six (54%) had right sided involvement and twenty-two (46%) had left sided involvement [11,12]. However, in our study results were irrespective with the sides. During our study we found maximum causative factor is idiopathic followed by alcohol consumption (Table 3). Study of Kamal D found chronic alcohol consumption in maximum cases (30.7%). Idiopathic causes and alcohol consumption are most common causative factors at global level [13].

We also found from our study that people generally elect for MRI, at the advanced stage of disease even when the symptoms were present for years, as stage III and Stage IV were observed in 70% cases(Table 4) according to ficat&Arlet staging based on clinical examination, Xray and MRI examination. Study of Kamal D included 26 patients diagnosed with avascular necrosis at the stage of III and IV [14]. It was supported by other studies also [11,12]. Treatment options that are available at higher stages are so costly and may lead to financial restraints. Early effective treatment needs timely diagnosis. This is not possible by clinical and on conventional radiographs alone. Normal radiographs do not detect avascular necrosis until and unless a considerable portion of femoral head weight bearing surface in involved. MRI is highly sensitive, being multi-planner able to detect the involvement of weightbearing area or total involvement of femoral head, which would help to predict the prognosis. The T1W and STIR sequences in coronal plane were found to be extremely helpful for quick and clear review of both the hip joints and should be incorporated in short screening protocols for the suspected patients of AVN, which will reduce the cost and time of the investigation without compromising patient care. So MR examination is so helpful to detect the avascular necrosis in early stage and also calculate percentage of involvement of femoral head weight bearing surface [15].

5. CONCLUSION:

Osteonecrosis with lesions can lead to femoral head collapse and degenerative arthritis which can eventually go for joint replacement surgery. Alertness, awareness and education regarding early diagnosis of avascular necrosis and to take preventive measure can delay the progression of disease. MRI evaluation should be encouraged as it has long term advantages in terms of health of the individual and on health care system. MRI can detect early avascular necrosis even in asymptomatic patients. Study of etiology can also be beneficial to know the development of avascular necrosis of the femoral head and management of the disease which can stop bone destruction and can prevent the collapse of the femoral head.

Table 1: Age & Sex distribution of Avascular Necrosis of femoral Head:

S N	Age Group	Male	Female	Total
1	0-20	1	nil	1
2	21-40	16	4	20
3	41-60	19	6	25
4	60 above	3	1	4
Total		39	11	50

Table 2: Side affected in patients with avascular necrosis

Side	No of patients	Percentage
Bilateral	37	76
Unilateral	13	24

Total	50	

*Since 37 patients had bilateral Avascular necrosis, total hips = 87 (left 43, right 44)

Table 3: Etiological factor of Avascular Necrosis of femoral Head:

Etilogy Factor	No of Patient	(%)
Idiopathy	34	68
Alcohol	9	18
steroid	3	6
Post pregnancy	1	2
Alcohol and steroid	1	2
Radiation	1	2
sickle cell	1	2
	50	

Table 4: Stages according to Ficet&Arlet Classification System

S N	Age Group		**Radiographic stage (Ficat&Arlet)**	
			Rt.	**Lt.**
1	0-20	Stage I	0	0
		Stage II	0	0
		Stage III	0	0
		Stage IV	1	0
		Nil	0	1
2	21-40	Stage I	4	0
		Stage II	4	7
		Stage III	4	5
		Stage IV	7	6
		Nil	1	2
3	41-60	Stage I	3	1
		Stage II	4	2
		Stage III	8	12
		Stage IV	4	7
		Nil	6	3
4	60 above	Stage I		
		Stage II	1	
		Stage III		1
		Stage IV	3	3
		Nil		
			50	50

6. REFERENCE:

1. Mont MA, Hungerford DS. Non-traumatic avascular necrosis of the femoral head. J Bone Joint Surg Am. 1995; 77:459-474
2. Petek D, Hannouche D, Suva D. Osteonecrosis of the femoral head: pathophysiology and current concepts of treatment. EFORT Open Rev. 2019 Mar;4(3):85-97

3. Saklecha AV, Wadhokar OC, Patil DS, Naqvi WM. Effect of physiotherapy rehabilitation on stage 4 avascular necrosis of femur following pyogenic arthritis: a case report. The Pan African Medical Journal. 2022;41.
4. Baig SA, Baig MN. Osteonecrosis of the Femoral Head: Etiology, Investigations, and Management. Cureus. 2018 Aug 21;10(8):e3171.
5. Xie XH, Wang XL, Yang HL, Zhao DW, Qin L. Steroid-associated osteonecrosis: Epidemiology, pathophysiology, animal model, prevention, and potential treatments (an overview). J OrthopTranslat. 2015 Apr;3(2):58-70.
6. Moya-Angeler J, Gianakos AL, Villa JC, Ni A, Lane JM. Current concepts on osteonecrosis of the femoral head. World J Orthop. 2015 Sep 18;6(8):590-601
7. Vardhan H, Tripathy SK, Sen RK, Aggarwal S, Goyal T. Epidemiological Profile of Femoral Head Osteonecrosis in the North Indian Population. Indian J Orthop. 2018 Mar-Apr;52(2):140-146.
8. Petek D, Hannouche D, Suva D. Osteonecrosis of the femoral head: pathophysiology and current concepts of treatment. EFORT Open Rev. 2019 Mar;4(3):85-97.
9. Choi HR, Steinberg ME, Y Cheng E. Osteonecrosis of the femoral head: diagnosis and classification systems. Current reviews in musculoskeletal medicine. 2015 Sep;8(3):210-20.
10. Tripathy SK, Goyal T, Sen RK. Management of femoral head osteonecrosis: Current concepts. Indian journal of orthopaedics. 2015 Feb;49(1):28-45.
11. Khaladkar MS, Randhawa S, Singh G, Aditi G, Rajesh K, Rajeshwar S. Rapid magnetic resonance imaging protocol for detecting femoral head avascular necrosis: A case series-it's utility in the general population in developing countries. Medical Journal of Dr. DY Patil University. 2015 Mar 1;8(2):189.
12. GEHLOT PS, AGRAWAL K, MANGAL R, SODANI V. Avascular Necrosis of Femoral Head: A Retrospective Study of MRI Scans. Journal of Clinical & Diagnostic Research. 2019 Oct 1;13(10).
13. Aiello MR, Chew FS, Imaging in avascular necrosis of the femoral head, available at http://emedicine.medscape.com/ article/386808; updated: May 25, 2011; accessed: May 30, 2012.
14. Kamal D, Alexandru DO, Kamal CK, Streba CT, Grecu D, Mogoantă L. Macroscopic and microscopic findings in avascular necrosis of the femoral head. Rom J MorpholEmbryol. 2012 Jan 1;53(3):557-61.
15. Lafforgue P, Dahan E, Chagnaud C, Schiano A, Kasbarian M, Acquaviva PC. Early-stage avascular necrosis of the femoral head: MR imaging for prognosis in 31 cases with at least 2 years of follow-up. Radiology 1993;187:199-204.