

Epidemiological Study of Femoral Head Osteonecrosis

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In recent years, there has been an increase in the number of studies on the etiology of femoral head necrosis. We retrospectively reviewed all patients diagnosed with aseptic necrosis of the femoral in the period of 2010-2015. We recorded a total of 230 cases diagnosed with aseptic necrosis of the femoral head, group was composed of 65.7% men and 34.3% women, risk factors identified was 19.13% (post-traumatic), 13.91% (glucocorticoids), 26.52% (alcohol), 3.47% (another cause) and in 36 95% of the cases no risk factors were found. The results of the study based on the type of surgery performed on the basis of stages of disease progression, 8 patients (3.48%) benefited from osteotomy, 28 patients (12.17%) benefited of bipolar hemiarthroplasty prosthesis and 188 patients (81.74%) benefited of total hip arthroplasty. Osteonecrosis of the femoral head is characteristic to young patients between the age of 30-50 years old. Predisposing factors, alcohol and corticosteroid therapy remains an important cause of the disease. Total hip arthroplasty remains the best option for the patients with osteonecrosis of the femoral head.

Keywords: femoral head necrosis, osteotomy, bipolar hemiarthroplasty prosthesis

Osteonecrosis of the femoral head is an entity characterized by dying bone leading to joint pain, bone destruction and loss of mobility. In nontraumatic osteonecrosis, the etiology and pathogenesis have not been fully elucidated.

In recent years, there has been an increase in the number of studies on the etiology of femoral head necrosis. Although, studies have pointed out that systematic steroids administration and alcohol consumption are important factors to cause necrosis [1-5], various studies have found certain genetic abnormalities in patients with osteonecrosis, contributing to the development of the disease [6-9]. Some anomalies directly affect the clotting mechanisms that predispose to hypercoagulation, especially when we have other associated factors as well, such as corticosteroids, alcohol consumption and increased blood lipids. Other etiological factors recently found include cryofibrinogen, P-glycoprotein [9], as well as certain metabolic effects of adipocytes, osteoblasts and osteoclasts.

Today, there are used different conservative methods of treatment for the necrosis of the femoral head. These are used either isolated or associated with surgical procedures. Not all patients have the same promising results, and now these methods are rarely used, because the surgical treatment and especially the hip arthroplasty provides superior comfort to conservative treatment.

Experimental part

We retrospectively reviewed all patients diagnosed with aseptic necrosis of the femoral head hospitalized in the Clinic of Orthopedics and Traumatology Rehabilitation Hospital in Iasi, Romania, in the period of 2010-2015.

To analyze the cases, we used the inclusion criteria: diagnosis of aseptic necrosis of the femoral head.

We evaluated data on age, sex, origin, risk factors, clinical outcomes, biological and imaging data, disease stage and type of intervention used that were obtained from the medical records of the patients from the hospital records and compared with the hospital's database. The

information obtained was stored in Microsoft Excel files and was statistically analyzed afterwards in order to investigate the relationship between clinical data of the patients diagnosed with avascular necrosis of the femoral head and the treatment performed.

We used Microsoft Excel XL for graphical representation and the calculation of regression coefficients was made with Excel tables using controls and data analysis functions.

For the descriptive data of statistical analysis we used MD SPSS 18.0. I analyzed the t-Student test and Test 2. The frequency distribution were analyzed using the Kruskal-Wallis test. To determine the relationship between variables I used linear and multiple regression. We considered the level of statistical significance at $p < 0.005$.

Results and discussions

We recorded a total of 230 cases diagnosed with aseptic necrosis of the femoral head hospitalized during 2010-2015 in the Clinic of Orthopedics and Traumatology Rehabilitation Hospital in Iasi, Romania.

After analyzing the gender of patients we found that the study group was composed of 65.7% men and 34.3% women, of which 151 men and 79 women, a male/female ratio of about 2:1 (fig. 1). The structure of the residence is made of: 130 patients (56.52%) from the rural areas, while 100 patients (43.47%) from the urban environment (fig. 1).

The patients included in the study were aged between 20 and 67 years, with an average age of 45.64 years. The

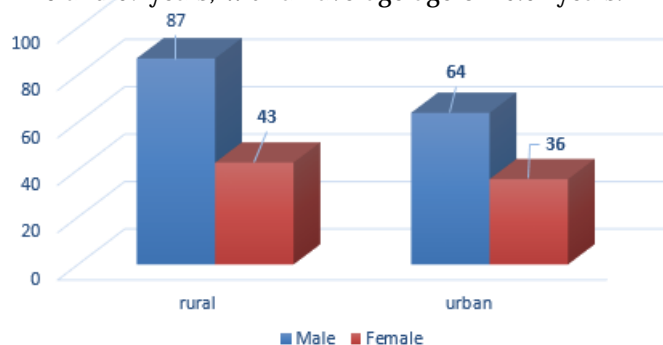


Fig. 1. Distribution of patients by gender and origin

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age distribution of the patients was as follows – 3.47% of the patients were aged 20-29, 29.13% were between 30-39 years old, 35.65% were between 40 and 49 years old,

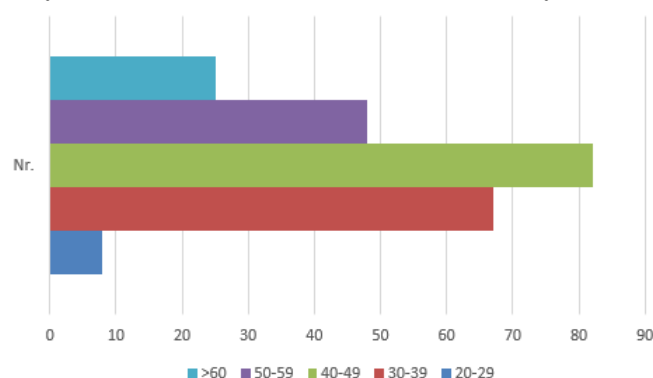


Fig.2. Distribution by age group

20.86% were between 50 and 59 years old and 10.86% were older than 60 years old (fig. 2)

From the point of view of the risk factors identified in patients investigated it was observed that 19.13% (post-traumatic), 13.91% (glucocorticoids), 26.52% (alcohol), 3.47% (another cause) and in 36.95% of the cases no risk factors were found (fig. 3).

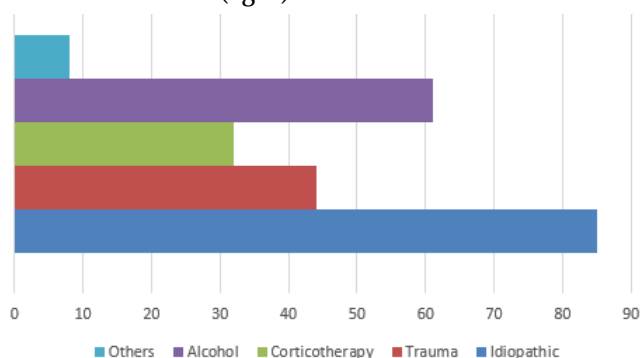


Fig.3. Distribution of patients based on the frequency of risk factors

It was found that the damage of one hip is at a rate of 59.56% and 40.43% of both hips, of which 7.39% bilateral and 6.52% unilateral of cortisone cause, 15.21% bilateral and 21.73% unilateral of idiopathic cause, 17.39% bilateral and 9.13% unilateral of alcohol cause (fig. 4).

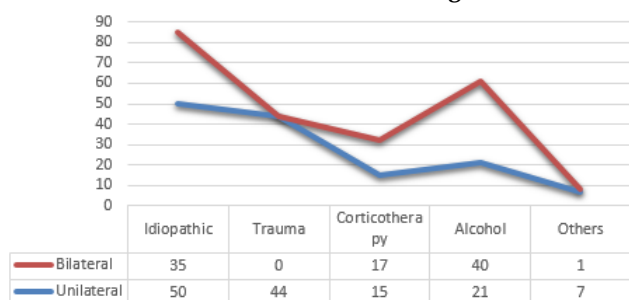


Fig. 4. Etiological distribution according to hip localization

Following the clinical and imaging examination, the patients were divided into two groups. For this distribution, a staging system for aseptic necrosis of the femoral head was used: Ficat-Arlet [10].

The distribution of patients depending on the stage of the disease has been diagnosed in 3.47% of diagnosed patients in stages I-II and 96.53% diagnosed in stages III-IV (fig. 5). The results of the study based on the type of surgery performed on the basis of stages of disease progression, 8 patients (3.48%) benefited from osteotomy, 28 patients (12.17%) benefited of bipolar hemiarthroplasty

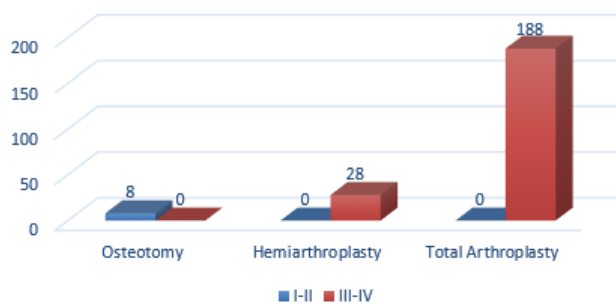


Fig. 5. Distribution depending on the stage of disease and surgical treatment

prosthesis and 188 patients (81.74%) benefited of total hip arthroplasty (fig. 5).

Early diagnosis of patients with aseptic necrosis of the femoral head is difficult, because of the asymptomatic character of the early stages. Pain in the hip is usually neglected or related to other cause. Long-term monitoring of these patients is therefore very important, as subchondral collapse can occur in two years after such injury [11, 12]. As observed in the study, the results show that most of the patients addressed in the final stages of the disease (fig. 5).

We used for the disease staging, radiographs of first intention, some studies saying that it takes 1-3 years for the disease to progress and radiological changes to occur [12-16] and that the radiological diagnostic sensitivity of traumatic necrosis in the early stages is about 41% [17] and Glickstein et al. [18] reported that the specification and the sensitivity of MRI is 97%.

After the statistical study of risk factors, we observed that alcohol consumption is associated with a rate of 26.52% of cases, result objectified by other authors such as Hirota et al. [19], the study conducted by Matsuo and others [20]. Later, other studies have confirmed the positive association between alcohol consumption and necrosis of the femoral head [21, 22], although the pathogenesis caused by alcohol is not well established.

In terms of corticotherapy, Chandler and Wright have disclosed the side effects that occurred through intra-articular injection [23] and then Freiburger and Heimann published similar results to the administration of corticosteroids orally in high doses [24]. Numerous studies have shown that there is a direct correlation between the use of high-dose corticosteroids and increased risk of osteonecrosis [25].

In our study, we obtained a frequency of 19.13% of traumatic necrosis compared to other studies, Hougaard [26] observed a frequency of 4.8% when anatomic reduction is made in the first 6 hours from the hip dislocation and 52.9 % when the reduction is made after 6 hours and necrosis of the femoral head is often 15-20% following the dislocation of the hip [27-29]. Studies show that the frequency of the femoral head necrosis due to fracture of the neck is greater than trochanteric fractures [30, 31].

Due to the small number of patients diagnosed in stage I-II, we practiced only in 3.48% of the cases osteotomy, although Sugioka et al. reported a 88% success rate in stage III and 68% in stage III-IV [32].

Although hemiarthroplasty has its advantages, shorter time of surgery, lower bleeding rate [33], our study reported that the patients diagnosed in stage III-IV was performed 12.17% hemiarthroplasty with bipolar prosthesis and 81.74% total arthroplasty of the hip. Yoon et al. [34] reported the same efficacy in patients with total arthroplasty of the femoral head necrosis.

Conclusions

Osteonecrosis of the femoral head is characteristic for young patients between the age of 30-50 years old.

Clinical examination correlated with the imaging tests remains essential in the early diagnosis of patients with osteonecrosis of the femoral head.

Predisposing factors, alcohol and corticosteroid therapy remains an important cause of the disease.

Total hip arthroplasty remains the best option for the patients with osteonecrosis of the femoral head.

References

1. LUCK JV. Bone and joint diseases. Springfield: Charles C Thomas; 1950;
2. RUSSELL J. An essay on necrosis. Section I. General remarks and description of appearances. ClinOrthop. 1978; 130:5;
3. DUBOIS EL, COZEN L. Avascular (aseptic) bone necrosis associated with systemic lupus erythematosus. JAMA. 1960;174:108;
4. JONES JR JP, Engleman EP. Osseous avascular necrosis associated with systemic abnormalities. Arthritis Rheum. 1966; 9:728;
5. KONIG F. Ueberfreie Körper in der Gelenke. Beiträge zur Ätiologie der Cordar Mobilia. Entstehung derselben durch Osteochondritis Dissecans. Dtsch Z Chir. 1988; 27:99;
6. KOO K-H, LEE J-A, LEE Y-S, ET AL. Endothelial nitric oxide synthase gene polymorphisms in patients with non-traumatic femoral head osteonecrosis. J Orthop Res. 2006; 24(8):1722-8;
7. KIM T-H, HONG J-M, LEE J-Y, ET AL. Promoter polymorphisms of the vascular endothelial growth factor gene is associated with osteonecrosis of the femoral head in the Korean population. Osteoarthritis Cartilage. 2008; 16(3):287-91;
8. CHANG JD, HUR M, LEE SS, ET AL. Genetic background of nontraumatic osteonecrosis of the femoral head in the Korean population. ClinOrthopRelat Res. 2008; 466(5):1041-6;
9. HE W, LI K. Incidence of genetic polymorphisms involved in lipid metabolism among Chinese patients with osteonecrosis of the femoral head. Acta Orthop. 2009;80(3):325-9;
10. FICAT RP. Idiopathic bone necrosis of the femoral head. Early diagnosis and treatment. J Bone Joint Surg Br. 1985; 67(1):3-9;
11. BACHILLER FG, CABALLER AP, PORTAL LF. Avascular necrosis of the femoral head after femoral neck fracture. ClinOrthopRelat Res. 2002; 399:87-109;
12. BARNES R, BROWN JT, GARDEN RS, NICOLL EA. Subcapital fractures of the femur. A prospective review. J Bone Joint Surg Br. 1976; 58:2-24;
13. JACOBS B. Epidemiology of traumatic and nontraumatic osteonecrosis. ClinOrthopRelat Res. 1978; 130:51-67;
14. GARDEN RS. Malreduction and avascular necrosis in subcapital fractures of the femur. J Bone Joint Surg Br. 1971; 53:183-97;
15. SEVITT S. Avascular necrosis and revascularisation of the femoral head after intracapsular fractures: a combined arteriographic and histological necropsy study. J Bone Joint Surg Br. 1964; 46:270-96;
16. KAWASAKI M, HASEGAWA Y, SAKANO S, SUGIYAMA H, TAJIMA T, IWASADA S, IWATA H. Prediction of osteonecrosis by magnetic resonance imaging after femoral neck fractures. ClinOrthopRelat Res. 2001; 385:157-64;
17. RESNICK D, NIWAYAMA G. Osteonecrosis: diagnostic techniques, special situations and complications. Philadelphia: WB Saunders; 1995;
18. GLICKSTEIN MF, LAWRENCE BD, SCHEIBLER ML, ET AL. Avascular necrosis versus other diseases of the hip. Radiology. 1988; 169: 213-215;
19. HIROTA Y, HIROHATA T, FUKUDA K, MORI M, YANAGAWA H, OHNO Y, SUGIOKA Y. Association of alcohol intake, cigarette smoking, and occupational status with the risk of idiopathic osteonecrosis of the femoral head. Am J Epidemiol. 1993; 137(5):530-8;
20. MATSUO K, HIROHATA T, SUGIOKA Y, IKEDA M, FUKUDA A. Influence of alcohol intake, cigarette smoking, and occupational status on idiopathic osteonecrosis of the femoral head. ClinOrthopRelat Res. 1988; 234:115-23;
21. SHIBATA A, FUKUDA K, INOUE A, HIGUCHI F, MIYAKE H, NISHI M, MORI M, ISHII S, NAGAO M, YANAGAWA H. Flushing pattern and idiopathic avascular necrosis of the femoral head. J Epidemiol. 1996; 6(1):37-43;
22. SAKATA R. A case-control study of association between life-style, alcohol dehydrogenase 2 and aldehyde dehydrogenase 2 genotype and idiopathic osteonecrosis of the femoral head. Kurume Med J. 2003; 50(3-4):121-30;
23. CHANDLER GN, WRIGHT V. Deleterious effect of intra-articular hydrocortisone. Lancet. 1958;2(7048): 661-3;
24. HEIMANN WG, FREIBERGER RH. Avascular necrosis of the femoral and humeral heads after high-dosage corticosteroid therapy. New Engl J Med. 1960; 263:672-5;
25. MONT MA, JONES LC, HUNGERFORD DS. Nontraumatic osteonecrosis of the femoral head: ten years later. J Bone Joint Surg Am. 2006; 88(5):1117-32;
26. HOUGAARD K, THOMSEN PB. Traumatic posterior dislocation of the hip—prognostic factors influencing the incidence of avascular necrosis of the femoral head. Arch Orthop Trauma Surg. 1986; 106(1):32-5;
27. WATANABE Y, TERASHIMA Y, TAKENAKA N, KOBAYASHI M, MATSUSHITA T. Prediction of avascular necrosis of the femoral head by measuring intramedullary oxygen tension after femoral neck fracture. J Orthop Trauma. 2007;21(7):456-61;
28. GIANNOUDIS PV, KONTAKIS G, CHRISTOFORAKIS Z, AKULA M, TOSOUNDIS T, KOUTRAS C. Management, complications and clinical results of femoral head fractures. Injury. 2009;40(12):1245-51;
29. GUO JJ, TANG N, YANG HL, QIN L, LEUNG KS. Impact of surgical approach on postoperative heterotopic ossification and avascular necrosis in femoral head fractures: a systematic review. IntOrthop. 2010; 34(3):319-22;
30. MOON ES, MEHLMAN CT. Risk factors for avascular necrosis after femoral neck fractures in children: 25 Cincinnati cases and metaanalysis of 360 cases. J Orthop Trauma. 2006; 20(5):323-9;
31. YERANOSIAN M, HORNEFF JG, BALDWIN K, HOSALKAR HS. Factors affecting the outcome of fractures of the femoral neck in children and adolescents: a systematic review. J Bone Joint Surg Am. 2013; 95(1):135-42;
32. SUGIOKA Y. Transtrochanteric anterior rotational osteotomy of the femoral head in the treatment of osteonecrosis affecting the hip: a new osteotomy operation. ClinOrthopRelat Res. 1978; 130:191-201;
33. PATRASCU A., LUPESCU O., SAVIN L., MIHAILESCU D., GRIEROSU C., MIHAI N. D., GRIGORESCU V., BOTEZ P. Tranexamic Acid vs Autologous Reinfusion Drain in Primary HIP Arthroplasty: A retrospective cohort study. Rev. Chim. (Bucharest), 67, no.11, 2016;
34. BYUN JW, YOON TR, PARK KS, SEON JK. Third-generation ceramicon- ceramic total hip arthroplasty in patients younger than 30 years with osteonecrosis of femoral head. J Arthroplasty. 2012; 27: 1337-43

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