SciMedCentral

JSM Arthritis

Original Research

Surgical Treatment of the Avascular Necrosis of the Hip Development Disorder

Amel Hadžimehmedagić[1], Ismet Gavrankapetanović[2]*, Adnan Papović[2], Mehmed Jamakosmanović[2], and Elvir Baždar[2]

[1]*Clinic for Vascular Surgery, University Clinical Center Sarajevo, Bosnia and Herzegovina*

[2]*Clinic for Orthopedics and Traumatology, University Clinical Center Sarajevo, Bosnia and Herzegovina*

***Corresponding author**

Ismet Gavrankapetanović, Clinic for Orthopedics and Traumatology, University Clinical Center Sarajevo, Bolnička 25, 71000 Sarajevo, Bosnia and Herzegovina, Tel: 387-33-297-600. Email: ismetcap@ortotrauma.com.ba

Submitted: 11 November 2016

Accepted: 03 January 2017

Published: 05 January 2017

Keywords

- Avascular necrosis
- Hip development disorder
- Treatment
- Surgery

Abstract

The purpose of this research is to evaluate the consequences of an operative treatment of hip developmental disorder in children and to analyze the research results and make a recommendation for the following treatment dilemma: when is the optimal time for an operative treatment of a hip development disorder?

The research is a retrospective and observational analysis based on the classification of indirect radiological signs of local vascular disorder by the Buacholz-Ogden's scale. Materials used for this research are medical records of treated patients at the Clinic for Orthopedics and Traumatology of the Sarajevo University Clinical Center. Using a random selection, two groups of 30 patients with hip development disorder have been formed. The first group is comprised of patients aged between 6 to 18 months and the second group of patients aged between 18 and 60 months. The medical records used for this research included all necessary anamnestic details and postoperative state treatments with clinical findings and regular radiological check-up findings that include the presence or absence of the ossification nucleus as well as its position.

The results of this study show that the performance of a surgical treatment during the age between 12 and 20 months is burdened by the highest percentage of avascular necrosis. Even though AVN can be noticed in other age groups, according to the results of our research, it seems that vascular supply of the hip is the most vulnerable in the period between 12 and 20 months.

ABBREVIATIONS

AVN: Avascular Necrosis

INTRODUCTION

Branching of the blood vessels of the proximal femur is different than any other joint. This scheme changes during the individual's development, dynamically depending on age. Namely, the caliber, blood flow rate and dominance of certain arteries from the entire network of vessels that participate in hip blood supply are not equally expressed in all stages of development. In each successive stage, blood supply is dominated by a different artery that, after a certain period of time, shifts its major role to another artery [1]. Anastomoses between individual arteries are not constant in all stages of development and they represent a great importance for compensatory mechanisms.

The disturbance of local arterial blood vessels, at a time when they dominate the blood supply and affect the quality of hip development and maturation, leads to reduced perfusion, and consequently, to the lack of development, ossification and possible osteonecrosis [2].

Knowing the nature of luxation and the hip development disorder, as well as knowing the importance of vascularization of the proximal femoral part for vitality of the specific region and its successful development through childhood and adolescence, is a task in which the main problem remains to preserve vitality and functionality of cartilaginous and bone tissue [3,4]. In addition, there are clear indications defined by orthopedic standards on which patients to select for surgical treatment of developmental hip dysplasia. At the same time, there is increasing debate on which age group surgery should be performed on and whether it should be done in one or two acts [5]. Hips that were supposed to be treated in early childhood, as well as hips treated with ignorance of this problem, often because of vulnerable vascular

supply, after completion of growth are subject to the degenerative changes that are being compensated in youth, but in the further evolution represent a disabling factor.

MATERIALS AND METHODS

This research is a retrospective and observational analysis based on the classification of indirect radiological signs of a local vascular disorder based on the Bucholz-Ogden's scale.

Materials used for this research are medical records of patients treated at the Clinic for Orthopedics and Traumatology of the Sarajevo University Clinical Center. Using a random selection, two groups of 30 patients with hip development disorder have been made. The first group is comprised of patients aged between 6 and 18 months and the second group of patients aged between 18 and 60 months. The study sample is made up of children with a basic disorder – a hip luxation without any comorbidity that could affect eventual changes in bone structure of the femoral head. Medical records used for this research included all necessary anamnestic details and postoperative state treatments with clinical findings and regular radiological check-up findings that include the presence or absence of the ossification nucleus and its position. All patients underwent surgeries with the same operative technique that was performed by the same surgeon. Operative treatment included bloody reposition and anterior approach to the hip (Smith-Petersen approach). For all patients in the age group between 18 and 60 months operative technique included bloody reposition, osteotomy of the proximal femoral part with abbreviation, varus correction and derotation and for all of these patients Salter's pelvis osteotomy was performed.

RESULTS AND DISCUSSION

In total, there were 60 patients who underwent surgery for developmental dysplasia of one or both hips between the ages of 6 and 60 months. Out of 60 patients, only 10 (16.6%) were male while 50 (83.3%) were female (a ratio of 5:1). Research showed that dislocation is predominantly a disease affecting female children, 4-10 times more often than male children [6,7]. Patients were divided into two groups - the first group classified children that underwent surgery between the ages of 6 and 18 months, while the other group included children that underwent surgery between the ages 1.5 and 5 years.

Family history refers to the occurrence of a similar or the same disease only among the closest relatives (a sister, brother, father or mother). From the total sample, there was a history in 15% of the cases; or by groups it was positive in 16.6% of cases in group 1 and 13.3 % of cases in the group 2.

The type of birth and the intrauterine position were correlated with congenital luxation or the existence of a less valuable hip. According to research by Clausen and Nielsen, the breech position carries the risk of dislocation and dysplasia with a rate of 13.3% [8]. This study addressed the time of delivery, but with incidence of 86.6% in the first and 93.3% in the second group on-time delivery dates, there was no statistical significance for further relation of date of birth and eventual development of avascular necrosis.

The previous treatment refers to the period between setting up the diagnosis and starting the surgical treatment. Senaran had a hypothesis in his study that the optimal treatment of developmental hip dysplasia can be achieved using Pavlick's belts during the first two months of life, and then, if conservative treatment fails to produce a good result, bloody reposition should be performed no later than 3 months of age.

All studies that have researched events on hips have registered the importance of the presence of an ossification nucleus which indirectly indicates the existence of high-quality vascular supply or guaranteed conditions for progress in the development and maturation of the entire hip [9-11]. In the group of patients aged between 18 and 60 months, in which an ossification nucleus has been present at all stages of the follow-up (100%), the group that includes patients of up to 18 months of age, showed presence of the same in 62.2%. To evaluate the success of a surgical treatment of developmental hip dysplasia by Salter, there should be at least one year of postoperative follow-up for indirect signs of the vascular supply disorder of proximal femur to register signs of avascular necrosis (AVN). All patients in this study had a long enough follow-up period up to 72 months on average. Given that follow-up period, the first group of patients enjoyed longer and thus higher-quality follow-up period. From the total sample, there were 24 (32 %) cases with no signs of AVN or only mild and reversible signs of AVN (type 0 and type 1). However, 51 of them (68 %) had manifested signs of AVN at the end of the follow-up period.

By observing the distribution of AVN in relation to age and time of the surgical procedure, in the first group, the concentration of the worst form of AVN (type IV) for patients who underwent surgery in a period between 12 and 18 months of age is evident. Patients in the second group, we do not form a significant concentration due to a wider range of variables.

CONCLUSION

Avascular necrosis of varying degrees can also be a complication of the treatment of developmental dysplasia of the hip, which in many cases is characterized by the subsequent development of premature osteoarthritis.

Avascular necrosis is a common complication of surgical procedures that aim to permanently regulate the position of related elements of the hip. Current literature records the frequency of these complications ranging from 0% to 73%, compared to the variability of diagnosis. This variability has not changed since 1990 when the incidence ranged from 3-60%, which directly depends on the authors, their protocols and the length of the follow-up period [12]. In this study, postoperative complications of AVN, were mostly found in children operated for developmental hip dysplasia in the age group between 6 and 18 months and as contrasted to the group aged between 18 and 60 months. In group 1, the presence of AVN expressed a significance of 1.1813 E - 09, while in the second group it was expressed with a significance of 7.0745 E – 10, a finding which answers our initial research dilemma: the optimal time for an operative treatment would be in the second group of patients because of their lower incidence of AVN, which is directly connected to the anatomic distribution of the hip vascular scheme. The degree of morphological changes in further development of proximal femur and the subsequent disability are proportional to the

degree of vascular damage. The results of this study show that the performance of a surgical treatment during the age between 12 and 20 months is burdened by the highest percentage of a vascular necrosis. Even though AVN can be noticed in other age groups, according to the results of our research, it seems that vascular supply of the hip is the most vulnerable in the period between 12 and 20 months.

REFERENCES

1. Kalhor M, Horowitz K, Gharehdaghi J, Beck M, Ganz R. Anatomic variations in femoral head circulation. Hip Int. 2012; 22: 307-312.
2. Zlotorowicz M, Szczodry M, Czubak J, Ciszek B. Anatomy of the medial femoral circumflex artery with respect to the vascularity of the femoral head. J Bone Joint Surg Br. 2011; 93: 1471-1474.
3. Hernigou P, Habibi A, Bachir D, Galacteros F. The natural history of asymptomatic osteonecrosis of the femoral head in adults with sickle cell disease. J Bone Joint Surg Am. 2006; 88: 2565-2572.
4. Drescher W, Li H, Lundgaard A, Bunger C, Hansen E.S. Endothelin-1-Induced Femoral Head Epiphyseal Artery Constriction Is Enhanced by Long-Term Corticosteroid Treatment. J Bone Joint Surg Am. 2006; 88: 173-179.
5. Remmel E, Schraml A, Stauner K, Schuh A. Long-term results after two-stage operative treatment of late developmental displacement of the hip. Int Orthop. 2009; 33: 1095-1100.
6. Lynn T. Staheli. Developmental hip dysplasia in Fundamentals of the pediatric orthopedics. Williams & Wilkins. 2007; 208-219.
7. Williams H, Johnson KJ. Developmental Dysplasia of the Hip. In imaging of the hip and bony pelvis. Birkhauser. 2005; 107-141.
8. Clausen I, Nielsen KT. Breech position, delivery route and congenital hip dislocation. Acta Obstet Gynecol Scand. 1988; 67: 595-597.
9. Aaron RK, Dyke JP, Ciombor DM, Ballon D, Lee J, Jung E, et al. Perfusion abnormalities in subchondral bone associated with marrow edema, osteoarthritis, and avascular necrosis. Ann N Y Acad Sci. 2007; 1117: 124-137.
10. Connolly P, Weinstein SL. The course and treatment of avascular necrosis of the femoral head in developmental dysplasia of the hip. Acta Orthop Traumatol Turc. 2007; 41: 54-59.
11. Lafforgue P. Pathophysiology and natural history of avascular necrosis of bone. Joint Bone Spine. 2006; 73: 500-507.
12. Compion J, Benson M. Developmental dysplasia of the hip: Surgery. 2007; 25: 176-180.

Cite this article

Hadžimehmedagić A, Gavrankapetanović I, Papović A, Jamakosmanović M, Baždar E (2017) Surgical Treatment of the Avascular Necrosis of the Hip Development Disorder. JSM Arthritis 2(1): 1019.