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ORIGINAL STUDY

Walking quality after surgical treatment of developmental dysplasia of the hip in children

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We assessed the quality of life of children with developmental dysplasia of the hip (DDH) treated surgically, through analysis of leg length discrepancy, quality of walking and presence of pain in 39 children with DDH between 1991 and 2011 at the University Children's Hospital in Belgrade. Salter's innominate osteotomy combined with derotation and femoral bone shortening was performed. Patients were divided into 3 groups based on their age at operation : the first group included participants operated at age up to 24 months, the second group between 24 and 48 months and the third group above 48 months of life. In the first group, leg length discrepancy was present in 30.76% and mean leg shortening was 0.63cm, versus 27.77% and 1.30 cm in the second group and 37.50% and 1.50 cm in the third group. Children with DDH that were operated earlier in life had less leg shortening and did not display any significant asymmetry of walking.

Keywords : walking quality ; developmental hip dysplasia ; children.

INTRODUCTION

Developmental dysplasia of the hip (DDH) refers to abnormality in size, shape, orientation and organization of femoral head, acetabulum or both anatomical structures. Incidence of DDH varies around 1 in 1000 newborns (*1,16*). Although the aetiology is mainly unknown, various risk factors can predispose to the anomaly (*3,6*). In children with DDH age up to 10 years of age, Salter's innominative osteotomy is widely used to redirect the dysplastic acetabulum, allowing normal development (*7,17*).

Through improvement in diagnosis and prompt and adequate treatment of DDH, the number of children requiring a surgical approach significantly decreased (*2,9,12,18*). Serbia is a country where the incidence of DDH is still high with a significant proportion of operated hips.

In order to obtain normal function and development of the hip, an anatomical reduction is necessary. It should be stated that a certain proportion of patients with a good reduction still do not achieve

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normal function, with possibility of osteoarthrosis development in later life (*19*).

There are several operative techniques, however most frequently, Salter's innominate osteotomy combined with femoral derotation and shortening is used (*14*). In children with DDH, beside surgical treatment, it is important to consider quality of life. The parameters to measure quality of life are those that parents find most important in evaluating treatment results : leg length inequality, limping and pain.

The aim of our study was to determine the quality of life of children operated for DDH through analysis of these parameters.

MATERIALS AND METHODS

At the Paediatric orthopedic department of the University Children's Hospital in Belgrade, 39 children with DDH were operated, between 1991 and 2011, using Salter's innominate osteotomy combined with femoral derotation and shortening. The study was prospective and included clinical, orthopaedic and radiographic follow-up of treated patients. Leg length was measured and evaluation of walking quality was done by observing pelvic oscillation, presence of Trendelenburg sign and walking symmetry. Prior to inclusion in the study, parents or legal guardians were informed about the study protocol and informed consent was obtained. The study was conducted in accordance with the Helsinki declaration and followed the principles of good clinical practice.

All patients were divided into 3 groups : the first group included patients, operated up to the age of 24 months, the second group between the age of 24 and 48 months and the third group above the age of 48 months.

For statistical analysis of leg length discrepancy in all ages the Kruskal-Wallis test was used. For analysis of postoperative shortening between two age groups, the Mann-Whitney test was used. Statistical significance was set at $p<0.05$.

RESULTS

In the first group there were 13 children (33.3% of the overall population of 39) with a median follow-up time of 11.25 years, in the second group 18 (46.15%) children with a median follow-up time of 12.33 years and in the third group 8 (20.52%) children with a median follow-up time of 14.88 years.

Table I. — Distribution of proportions of patients with leg length discrepancy and actual shortening in operated children

Operated patients	Discrepancy proportion (%)	Shortening (cm)
Group I	30.8	0.63
Group II	27.8	1.30
Group III	37.5	1.50

The frequency of leg length discrepancy after surgical correction and the actual shortening in centimeters are shown in Table I. With respect to limb shortening, a statistically significant difference was found between the first and the second and between the first and the third group, but not between the second and third group (Table II).

All hips were concentrically reduced at the end of follow-up. In 97.44% of operated patients walking was within physiological range. Only one child (2.56%) from the third group presented with a Trendelenburg gait due to the weakness of hip abductor muscles. There was pain during walking in 2/39 patients (5.1%). These patients were from the third age group and they represented 25% of the population of the third group.

DISCUSSION

Developmental dysplasia of the hip is the most frequent congenital defect in newborns (*10*). Therefore quality of life is an important aspect of treatment, with great impact in modern society .

Several surgical techniques are used in children with DDH up to 10 years of age and some studies suggest a better outcome with Salter's innominate osteotomy versus Chiari's iliac osteotomy (*15*) due to the expected improvement in acetabular angles and remodeling during follow-up in patients treated with Salter's technique.

The importance of screening for DDH should be emphasized (*13*). Studies have shown that early treatment, more specifically before the age of seven, can postpone the onset of osteoarthrosis (*4,5*).

Our study over a period of 20 years aimed to evaluate the success of treatment protocols especially in younger patients by evaluating quality of life parameters. Our results pointed out that the

Table II. — Statistical analysis of leg shortening between different age groups

	Kruskal-Wallis test	Mann-Whitney test
All age groups	H = 6.448*	–
First and second group	–	U = 1.5 Z = 2.215*
Second and third group	–	U = 5.5 Z = 0.644
First and third group	–	U = 0.5 Z = 2.038*

*p < 0.05.

degree of leg shortening is in direct correlation with the timing of surgical intervention.

As can be seen in table I, leg shortening was more than twice less in the first age group compared with the second and third group. When the second and third age groups were compared for leg shortening, no significant difference was noted. Results of our survey are in line with other studies concerning the influence of surgical timing on outcome in patients with DDH (*11*). One aspect that is important to address is that as children are younger, less surgical shortening is necessary for safe reposition and hip position maintenance. Those children have a larger biological potential of accelerated growth after surgery with better and greater catch-up of the shortening (*8*). Better outcome in children especially those up to 18 months of life lies in the fact that the surgeon can use the remodeling capacity of the developing skeleton more effectively. If uncorrected, secondary changes become more evident and hard to repair, as there are pelvic obliquity and postural scoliosis.

In the first and second group of patients there were no postoperative alterations in walking quality. In the third group, one patient presented with a Trendelenburg gait pointing to a less satisfactory result in the older age group. Pain also, was only found in the older age group. Although a specific cause for pain is hard to identify, more leg shortening and Trendelenburg gait in children that were operated later in life could be an explanation.

The strength of this study is its long time of follow-up. This gives us the possibility to monitor changes and progression of all parameters during growth in order to assess functional outcome more reliably.

Given the findings reported, correction of DDH in early childhood is clearly associated with a better quality of life in later years.

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