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Stimulation Of The Acetabular Roof For Residual Hip Dysplasia In Children

Buriev M.N.

Tashkent State Medical University, Faculty of Medicine of Jizzakh State Pedagogical University, Uzbekistan

Sangilov U.B.

Tashkent State Medical University, Faculty of Medicine of Jizzakh State Pedagogical University, Uzbekistan

Shukurov X.D.

Tashkent State Medical University, Faculty of Medicine of Jizzakh State Pedagogical University, Uzbekistan

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Abstract: The effects of periacetabular and combined wire tunneling on the development of the bones of the hip joint in young children with residual hip dysplasia were studied. If treatment is started before the age of 2 years, then 41% of children achieve good results. As the child ages, these results decrease.

Keywords: Children, residual hip dysplasia, treatment methods.

Introduction: Hip instability is the most common pathology causing disability among children and adolescents. Among all congenital malformations of the musculoskeletal system, residual hip dysplasia, congenital dislocation, and aseptic necrosis of the femoral head are common causes of this condition. The incidence of residual dysplasia and congenital subluxation of the hip is 25-30 cases per 1,000 newborns, and in ecologically unfavorable areas, it is 5-7 times higher, making this problem a pressing issue for orthopedists [1.3]. Hip dysplasia is defined as a developmental disorder of all elements that form the hip joint: the osteochondral base and surrounding soft tissue structures—ligaments, capsule, muscles, joints, and nerves [2.4]. Therefore, when treating this pathology, problems remain in some elements of the hip joint, manifesting as residual dysplasia. Most often, primary dysplasia of the vessels of this basin causes microcirculation impairment and venous stasis, which subsequently leads to delayed development of bone structures, particularly the acetabular roof. Therefore, the concept of the tropho-stimulating effect of tunneling and osteoperforation and reparative neoangiogenesis after the use of these techniques in ischemic diseases of the extremities has attracted the attention of many researchers.

Objective

To evaluate the stimulating effect of periacetabular and combined pin tunneling of the acetabular roof on the development of the hip joint in young children with residual hip dysplasia.

METHODS

The Children's Clinic at TSMU uses a low-trauma method of pin tunneling near the growth plates to stimulate reparative tissue regeneration in congenital hip dysplasia. The study included 22 children with congenital residual hip dysplasia (42 joints) treated at the clinic between 2012 and 2016. The children's ages ranged from 8 months to 3 years. There were 14 girls and 8 boys. All 20 children had bilateral dysplasia, while 2 had unilateral dysplasia. Decentration of the femoral head within the acetabulum was present in 12 of the 22 joints in the group of children with residual dysplasia. Local clinical symptoms were assessed in all children according to established procedures; gait disturbance and instability were common symptoms. Of the 10 children who walked independently, 6 limped and 4 had a clubfoot. Twelve children were unable to walk due to their young age. Soft tissue atrophy of the

hip within one or two segments (compared to the symmetrical sections of the contralateral hip) was observed in 14 children. Limited hip abduction was observed in 16 children, 8 of whom had mild adduction contracture. Shortening of the lower limb on the affected side by 0.5-1 cm was observed in 4 patients.

Hip ultrasound and radiometric parameters, determined from anteroposterior radiographs, were used to geometrically characterize the anatomical changes in the hip joint

RESULTS

As shown in Table 1, flattening of the acetabulum was noted in all groups of children before treatment. The least pronounced change in acetabular shape was observed in children with residual dysplasia without femoral head decentration. Flattening of the acetabulum was also indicated by an increase in its floor thickness. A decrease in acetabular volume (CV and ACC) was detected in all children. The femoral head was flattened in all patient groups. The greatest flattening of the epiphysis was found in the joints of children with congenital residual dysplasia, indicating a traumatic nature of its injury as a result of previous treatment.

Table 1. Radiographic indices in children with residual hip dysplasia before treatment

Average radiographic parameters	Residual dysplasia	
	without decentration	with decentration
Acetobular index (AI)	27	29
Foam thickness index (FTI)	2.1	1.8
Acetobular ratio (ACR)	82	89
Epiphyseal index (EI)	0.4	0.5
Epiphyseal ratio (ER)	75	74

Table 2. Diameter of the femoral head (in mm) in the norm and with residual joint dysplasia in ultrasound examination.

Age (months)	0	1	2	3	4	5	6	8	9	10	11	12
Normal	14.8	14.8	15,8	16,2	17,2	17,1	18,3	19	19.3	19.9	20.3	21
subluxation	13,8	14.7	15,2	16,1	16,4	16,8	17,4	18,2	18,2	18,3	18,3	18,4
n	42	11	15	13	19	13	19	19	20	21	21	21

Table 2 shows the femoral head diameter in children under 1 year of age. All children had hypoplastic femoral heads.

We used two treatment methods for congenital hip dysplasia in children: closed periacetabular pin tunneling and transfemoral neck pin tunneling (Beck). Indications for closed periacetabular pin tunneling were:

1) residual hip dysplasia in children aged 8 months to 3 years, provided that the head is centered in the acetabulum with a hip flexion angle of no more than 70° (Lorenz-I position);

2) radiographic signs of acetabular dysplasia: AI no more than 35° in children in the first year of life, no more than 25-30° in children over 1 year of age; The ossification index in children of the first year of life is not less than 1.6, in children over 1 year of age not less than 2.0; ACC not less than 81%;

3) absence of delayed ossification, dystrophic changes in the proximal femoral epiphysis.

The closed periacetabular pin tunneling technique was used in 7 patients with congenital hip dysplasia, including 3 patients with bilateral tunneling. Pins were inserted into the periacetabular region of the hip joint under fluoroscopic guidance, creating 6 tunnels. The tunnels were formed in a staggered pattern around the

perimeter of the acetabular roof to the medial cortical plate of the ilium. In cases of delayed ossification of the proximal femoral epiphysis and the presence of dystrophic changes (aseptic necrosis), closed pin tunneling through the femoral neck was indicated. This technique was used in 16 patients, including 16. Closed periacetabular tunneling was initially performed. Kirschner wires were then inserted into the femoral neck to the subepiphyseal zone, creating six channels around the perimeter of the neck. Tunneling was performed only once in all patients.

The anatomical and functional results of the treatment were assessed as follows:

1) a good result – no complaints, no shortening of the lower limb, full range of motion in the hip joint, AI less than 25°, TIDV greater than 2.2, CR greater than 0.24, ACC 91-100%, EI at least 0.6, EC 91-100%;

2) satisfactory result — lower limb shortening of no more than 0.5 cm, slight limitation of hip joint motion (within 15-20°), AI 25-30°, ITDV 1.8-2.2, KGV 0.21-0.24, ACC 81-90%, EI at least 0.5, EC 81-90%. In these cases, continued fixation of the lower limbs with a splint was necessary

3) unsatisfactory result — pronounced limping, limb shortening of more than 0.5 cm, limitation of hip joint motion of more than 20°, AI more than 30°, ITDV less than 1.8, KGV less than 0.21, ACC less than 81%, EI less than 0.5, EC less than 81%. Lower limb immobilization was necessary in these cases.

Good results were found in 9 children under 2 years of age (40.1%), satisfactory results were found in 12 children (54.5%), and unsatisfactory results were found in 3 children (13%), who were diagnosed with disabilities.

CONCLUSION

This study examined the effects of periacetabular and combined pin tunneling on hip development in young children with residual hip dysplasia. When treatment is initiated before the age of 2, good results are achieved in 41% of children. These results decline with age. Treatment of residual hip dysplasia should be early, systematic, differentiated, and comprehensive. Adherence to all treatment and preventive measures is essential to achieve the desired results. It is also important to be aware that delayed treatment can lead to permanent disability.

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