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FEATURES OF TOTAL HIP ARTHROPLASTY IN THE TREATMENT OF SECONDARY COXARTHROSIS OF DIFFERENT GENESIS IN OLDER CHILDREN

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Total hip arthoplasty (THA) in school children with secondary hip arthritis is the least studied treatment in orthopedic surgery. The need for THA arises much less often in children than in adults, but is a pressing problem. Indications for joint replacement at the age of 12–17 years include secondary hip arthritis of various etiologies such as dysplastic (congenital and paralytic), posttraumatic, infectious allergic (juvenile rheumatoid arthritis and Bechterew's disease), postinfectious (osteomyelitis and tuberculosis of the joints hip joint) associated with severe pain, joint contractures, and decreases in motor activity. The aim of this study was to evaluate the effectiveness of THA in adolescents with stage 3 hip arthritis. A two-stage method of surgical treatment in cases of limb shortening of >4 cm is proposed. We present the results of the treatment in 45 patients. The proposed surgical technique achieved satisfactory results in 68% of the cases. The method allowed the restoration of hip joint function and limb length in all patients. Based on these results, we recommend the use of this method in the treatment of severe forms of secondary coxarthrosis as a result of dysplastic, paralytic, postinfection, systemic autoimmune, and posttraumatic processes.

Keywords: children; hip dislocation; cerebral palsy; coxarthrosis; limb shortening; Ilizarov apparatus; endoprosthesis.

ОСОБЕННОСТИ ТОТАЛЬНОГО ЭНДОПРОТЕЗИРОВАНИЯ ПРИ ЛЕЧЕНИИ ВТОРИЧНОГО КОКСАРТРОЗА РАЗЛИЧНОГО ГЕНЕЗА У ДЕТЕЙ СТАРШЕГО ВОЗРАСТА

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Эндопротезирования детей старшего возраста с вторичным коксартрозом наименее изученная часть ортопедии и травматологии. Необходимость проведения эндопротезирования в детской практике возникает значительно реже, чем у взрослых, но является актуальной проблемой. Показанием к эндопротезированию суставов служит наличие вторичного остеоартроза тазобедренного сустава различной этиологии — диспластический (врожденный и паралитический), посттравматический, инфекционно-аллергический (ювенильный ревматоидный артрит, болезнь Бехтерева), постинфекционный (остеомиелит и туберкулез костей, формирующих тазобедренный сустав), сопровождающийся выраженным болевым синдромом, наличием контрактур, уменьшением двигательной активности, в возрасте 12–17 лет. Цель исследования — оценить эффективность метода эндопротезирования у больных подросткового возраста с коксартрозом 3-й стадии. Предложен двухэтапный метод хирургического лечения в случаях наличия укорочения конечности более 4 см. Авторы приводят результаты лечения 45 пациентов. Предложенная тактика позволила получить хорошие результаты в 68 %. Метод позволил восстановить функцию тазобедренного сустава, длину конечностей у всех пациентов. Достигнутые результаты позволяют рекомендовать применение данного метода в комплексе восстановительного лечения при тяжелых формах вторичного коксартроза в результате диспластических, паралитических, постинфекционных, системных аутоиммунных и посттравматических процессов.

Ключевые слова: дети; вывих бедра; ДЦП; коксартроз; укорочение конечности; аппарат Илизарова; эндопротез.

INTRODUCTION

Total hip replacement in adolescents with secondary coxarthrosis is one of the most challenging surgical procedures in orthopedics and traumatology [2, 6, 9, 13]. Although the requirement of arthroplasty is significantly less often in adolescents than in adults, the problems associated with the surgery should be urgently addressed [4, 7, 9].

In the present case, the decision in favor of surgery was difficult [1, 3, 12]. These children usually had pronounced radiological and clinical changes in the joint that were associated with movement limitations and stiffness, and ankylosis was observed in a vicious position. However, multiple ethical issues further complicated the problem. A special place was occupied by coxarthrosis developed due to dysplastic, paralytic, post-infectious, systemic autoimmune, and post-traumatic processes.

Many patients naturally prefer to preserve their tissues and often postpone surgery. However, in some patients, existing anatomical and functional abnormalities (such as changes in the joint and limb shortening and violation of the biomechanics in the musculoskeletal system) are extremely critical to be restored or compensated without surgical intervention [2, 8, 10].

AIM

The aim of the present study was to assess the efficacy of total hip replacement in adolescents with secondary coxarthrosis as well as hip dysplasia, cerebral palsy, and conditions related to traumatic, systemic, autoimmune, or infectious lesions in the hip joint.

MATERIALS AND METHODS

The study included 45 patients with stage 3 secondary coxarthrosis aged 13.5–18 years who underwent 51 total hip replacement surgeries during 2009–2016. In all patients, coxarthrosis was accompanied by a contracture of the affected hip (from stiffness to fibrous ankylosis). All patients were divided into four groups according to etiology. Group 1 included 12 patients with congenital hip dislocation (grade 3–4) and limb shortening (2.5–10.5 cm). In Group 1, two patients received no surgical treatment prior to hip replacement, whereas the remaining previously received up to nine surgical interventions. This group also included eight adolescents with cerebral palsy and paralytic hip dislocation. Group 2 comprised three patients who had severe infectious/inflammatory processes (acute hematogenous osteomyelitis of the hip and pelvis and tuberculosis of the hip and pelvis). Group 3 comprised two patients with traumatic hip dislocation that was not timely diagnosed. Group 4 comprised 20 patients with systemic autoimmune disorders (juvenile rheumatoid arthritis and Bekhterev's disease).

In addition to conventional radiography of the pelvis and spine, all patients underwent 3D computed tomography scanning to assess the size and details of the pelvic and proximal femur deformation for preoperative planning and select an appropriate prosthesis. All patients also underwent standard clinical and laboratory examination, assessments of immune status, and testing for chronic infections. Patients diagnosed with any immunological disorders or infections received a course of preoperative therapy. All adolescents were diagnosed with grade 2 thoracolumbar compensatory scoliosis due to a severe hip contracture and pelvic tilt.

Due to severe joint contracture and deformation, all patients underwent endoprosthetic reconstruction of the hip. During the surgery, all patients developed cicatricial transformation of the capsule and muscles of the hip joint. Patients with hip dislocation were observed to have acetabular deficiency (hypoplasia of the edges, flattening, and size reduction to a critical value) and proximal femoral deficiency (hypoplasia, necrosis of the femoral head, cervico-diaphyseal angle over 150°, and femoral neck anteversion angle of 40°–80°).

Patients with limb shortening >4 cm underwent a two-stage surgery that included shortening of the femur using the Ilizarov apparatus (first stage) and hip replacement (second stage).

We used the following two models of femoral components for hip arthroplasty that were most suitable for patients with dysplastic hip deformation: Wagner conical stems (Zimmer, Warsaw, IN, USA) for non-cement-augmented fixation and dysplastic Biomet CDH stems. In eight patients with hip dislocation and an extremely small acetabulum, we used the pelvic component of the minimum possible size (40–42 mm) and additional fixation with screws. In this case, we had to use the metal/polyethylene contact pair (cross link). In the remaining 43 patients with an acetabulum of size ≥44 mm, we applied ceramic/ceramic contact pairs. In three patients, we used porous metal augments to restore the volume of the ilium body and repaired the roof of the acetabulum. In another five patients, we used massive structural autografts from the removed femoral heads for the same purpose.

One of the most important characteristics of adolescent patients in our study (particularly of those with cerebral palsy or autoimmune disorders) was pelvic and proximal femur osteoporosis. Extreme caution was required during surgery in the tissues, and some corrections were performed during postoperative patient management. Patients with cerebral palsy compulsory underwent open adductor myotomy and immobilization of the lower extremities using a plaster bandage [11].

Postoperative patient management depended on surgery characteristics. Patients implanted with a massive structural graft as well as patients with severe osteoporosis stayed in bed for 4 weeks to ensure adaptation of the graft components. Patients with cerebral palsy had their limbs immobilized with an abduction frame during 3 weeks. All patients received antibacterial therapy and massage and practiced therapeutic exercises. Load bearing on the operated limb was limited during 3–4 months postoperatively. Radiological control examinations were conducted during the intervention and at 3 and 12 months postoperatively. All patients with autoimmune disorders were supervised by a rheumatologist pre- and postoperatively and received basic therapy.

RESULTS AND DISCUSSION

The outcomes of surgical treatment were evaluated via radiological, anthropometric, and clinical examination of 32 patients who were followed up for up to 6.5 years postoperatively. All grafts were observed to be radiographically and clinically stable without pain syndrome. Further, patients with grade 3–4 cerebral palsy according to the Gross Motor Function Classification System (GMFCS) additionally used orthopedic assistive devices. No signs of inflammation in the surgical site were observed.

In eight patients with initial limb shortening of 6.5–8 cm, the relative length of the lower extremities was fully restored. One adolescent with congenital hip dislocation and initial limb shortening of 10.5 cm, who underwent nine surgeries prior to hip replacement, finally had a limb length discrepancy of 1 cm. Thus, the limb extended by 9.5 cm.

One patient with a history of acute hematogenous osteomyelitis and initial limb shortening of 12.5 cm achieved an 8-cm lengthening with the remaining limb length discrepancy of 4.5 cm due to a tibial shortening developed during the disease. We further plan tibial lengthening to equalize leg length when the patient stops to grow.

Thirty-two patients achieved normal or close to normal movement amplitudes. The remaining patients had some motion limitations in the operated joint due to severe initial scarring and spasticity associated with cerebral palsy. Twenty-seven patients developed no lameness; the rest developed lameness due to cicatricial transformation of the muscle tissue. Patients with systemic autoimmune disorders and multiple lesions in the joints of the upper and lower extremities had difficult a postoperative period with slow motion restoration and residual contractures in the operated joints. Recovery of motor function was particularly difficult in adolescents with cerebral palsy. However, we managed to assign lower GMFCS levels to several patients during treatment.

Several patients had surgical complications. Four patients developed traction neuritis of the femoral and sciatic nerves after two-stage hip replacement. In the case of complication, the distraction was stopped and resumed only after a course of appropriate therapy and disappearance of symptoms. All neurological disorders were reversible. During the implementation of a two-stage hip replacement technique, one patient had a needle displacement in the wing of the ilium, which required apparatus removal and an urgent reiteration of the second stage.

One patient with an iliac dislocation of the hip, who underwent five surgeries prior to hip replacement, fell down the stairs 2 months postoperatively leading to the luxation of the graft head. This was followed by a visit to a doctor after 4.5 months. Therefore, the patient required application of the Ilizarov apparatus along with an inspection and replacement of some graft components. The patient had no more luxations afterwards. A physician should first of all ensure correct attachment of the Ilizarov apparatus in order to achieve success and avoid complications. Second, patients at risk of immunological disorders (with infectious lesions of joints or those who underwent multiple surgeries) should undergo additional immunological testing with subsequent correction of any abnormalities detected.

We observed no neurological and vascular complications during the late postoperative period.

CONCLUSION

Total hip replacement using our two-stage method helped to restore hip function, achieve pain relief, correct limb length discrepancy, and eliminate lameness in adolescents with stage 3 secondary coxarthrosis.

Hip replacement in patients with cerebral palsy and paralytic hip dislocation facilitated significant progress during rehabilitation.

From our results, we recommend this method as a part of rehabilitative treatment for patients with severe secondary coxarthrosis developed as a result of dysplastic, paralytic, post-infectious, systemic autoimmune, and post-traumatic processes.

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