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Surgical Correction of Dysplastic Coxarthrosis and Endoprosthesis Replacement by TiNi-based Implants

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Abstract

Dysplastic coxarthrosis is predominating among children orthopedic cases and its surgical correction continues to be an urgent issue. Despite the application of advanced therapies and medical treatment, such patients constitute a significant percentage of the total patient number, i. e. from 19 to 35%. In this article a detailed literature review of surgical correction methods for missing acetabular roof by applying different implants has been described. The authors have proposed applying titanium nickelide materials in surgical correction method, as such materials possess the following properties: high corrosion stability, full compatibility with the body tissues, as well as, high porosity to provide radial border structure regeneration of the acetabular roof, which in its turn, improves the support ability of extermity. In the event of coxarthrosis progression iliac segment is reserved for the replacement.

1 Introduction

Early incidence and rapid progression of advanced dysplastic coxarthrosis has become an emerging trend in modern orthopedics. High bilateral pathology frequency results in life expectancy degeneration and impairments, disabilities and handicaps and further social and psychological adaptation difficulties.

Increasing children dysplastic disease frequency of supporting-motor apparatus induces new challenging problems in children surgery- development of both critical pathways and therapeutic approaches for dysplastic hip joint diseases. This article

presents the results of early arthroplasty of progressive coxarthrosis by endoprosthesis replacement of hip joint (acetabulofemoral joint), which previously were surgically operated by applying titanium nickelide implants [1-3].

2 Experimental

Progressive and advanced coxarthrosis course with degenerated- dystrophic manifestations in the hip component and further in femoral head are described in the following clinical case.

Clinical case: 12-year-old patient B was hospitalized in Orthopedics Department, Tomsk University Clinic, 15.12.2008. In-patient history case №4123. On admittance: diagnosis – left dysplastic coxarthrosis 2 degree. Patient examination: limb shortening up to 2 cm., rapid fatigability when supporting on left lower limb and gait disorder – limbing on left leg. Positive Trendelenburg symptom. According to past medical history at 6 Legg-Calve-Perthes disease (LCP) with adverse outcome as hip joint (acetabulofemoral joint) deformation and further dysplastic deformation as dysplastic coxarthrosis. During child growth and development, secondary deformation in hip joint roof and hip head bone dislocation. No established care in Children Out-patient Department and only now the above-mentioned complaints are present in the patient. Patient B. X-ray of dysplastic coxarthrosis on admittance (Fig. 1).

Fig. 1. Patient B. X-ray of dysplastic coxarthrosis on admittance

X-ray examination results: dysplastic coxarthrosis 2 degree with hip head bone subluxation, underdeveloped left external acetabular roof edge. АИ – 55°, neck-shaft-angle 130°, left angle of antetorsion - 55°, Wiberg angle 5°, left coating ratio – 0.5, coating index - 4. Pain and discomfort in the left hip joint region occurred 4 months ago when the patient put on weight.

First stage involved operation: overacetabular osteotomy of iliac bone with modeled acetabular implant component of porous titanium nickelide. Body cast for 6 weeks. After removing plaster bandage- standard remedial treatment, including electrotherapy, massage, physiotherapy and Kinesio Taping. Four months after operation – graduated weight bearing on crutches; in five months – walking with cane; and in six months—full weight bearing on operated limb. Examination of patient in a year. Functional capacity of limb- complete rehabilitation, no complaints. Patient B. X-ray of hip joint (acetabulofemoral joint)- one year after operation (Fig. 2).

Fig. 2. Patient B. X-ray of hip joint (acetabulofemoral joint)- one year after operation

X-ray examination showed formed biocomposite porous bone implant. Complete roof coating. No mobility symptoms of the implant.

Patient examination in 5 years after first applying in hospital and 4 years after first operation at the age of 17- symptoms of advanced dysplastic coxarthrosis from proximal femoral bone. Patient complained of pronounced pain in hip under axial and static load. After planned hospitalization endoprosthesis replacement of operated joint was performed. In forming socket "bed" the surgical exploration of joint titanium nickelide implant and acetabulum companion revealed complete biointegration (bone tissue ingrowth) without signs of metallosis (which could be observed in most surgical exploration cases of other implants) (Fig. 3).

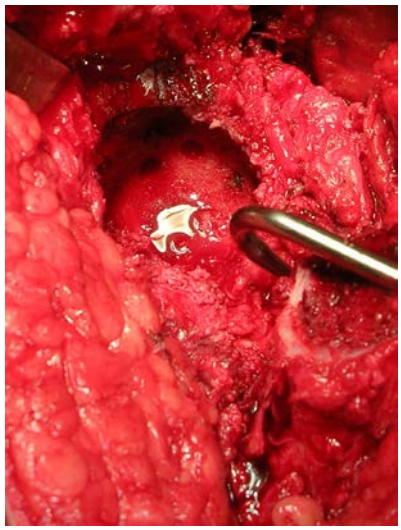

Fig. 3. Surgical exploration of titanium nickelide implant and acetabulum companion when inserting prosthethic cup implant

After inserting implant cup and subtrochanteric osteotomy, prosthetic implant was fixed. It should be noted that hip stem component of prosthethic implant, supporting the main load, is from poroustitanium nickelide, as a result of biointegration, prevents micromobility and periprosthetic fracture. Appearance of operative wound after complete prosthethic implant insertion (Fig. 4).

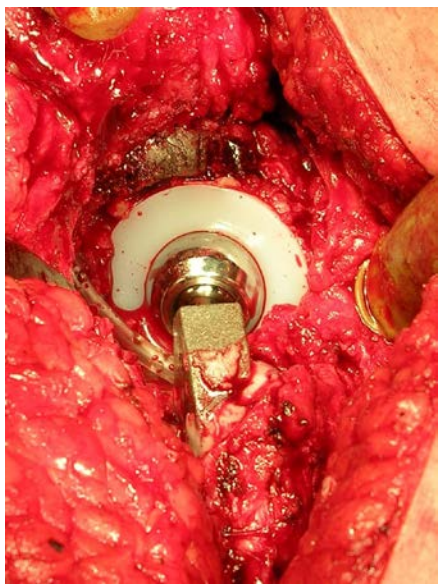

Fig. 4. Appearance of operative wound after complete prosthethic implant insertion

Surgical wound is stitched layer-by-layer 10 days after operative treatment. After remedial treatment (electrotherapy, massage, physiotherapy and Kinesio Taping) the patient was allowed graduated weight bearing on crutches; in two months – walking with cane; and in three months—full weight bearing on operated limb.

Examination of patient in a year. Functional capacity of limb- complete rehabilitation, no complaints. Patient B. X-ray of hip joint (acetabulofemoral joint)- one year after operation (Fig. 5).

Fig. 5. Patient B. X-ray of hip joint (acetabulofemoral joint)- one year after

3 Results and discussion

X-ray examination showed formed biocomposite porous bone implant. This is good plastic and support material to form the socket "bed" for prosthethic implant. The endosteal response to porous hip component of prosthethic implant exhibits its biointegration.

According to Harris Hip Scope the results are 61 and 90 scores before and after the operations. According to Luboshyce – Mattis-Schwarzberg clinical scale the treatment outcome is 4.3 out 5, which could be considered to be a good result. Dynamic factor is more than 1, which corresponds to the parameter "improvement." Recommendation- case follow-up at orthopedist.

4 Summary

Significant and successful treatment results of dysplastic coxarthrosis only in the case if the surgical correction of advanced disease is in-time and even, to some extent, upstream surgery. This could be based more on patient complaints than on X-ray patterns, as soft tissue component of hip joint (acetabulofemoral joint) retains its elastic properties to the end of the first adolescence period. In the case

of advance malignant current coxarthrosis and formed iliac dislocation without adequate load on the joint surfaces, mineral metabolism in joint components progressively decreases under osteodystrophy aggravation, which, in its turn, completes the progressive coxarthrosis pathway [3, 4].

Rotating transposition of acetabulum is useless as this would not provide the congruence of hip joint (acetabulofemoral joint) components, especially under advanced dysplastic coxarthrosis. According to reference review data it has been noted that to the end of the first adolescence period the formation of he acetabulum is close to normal [3]. Patients, in the second adolescence period under severe acute dysplastic coxarthrosis, would probably show unacceptable results.

It is considered that the most appropriate method of modeling missing acetabular roof is osteotomy of iliac bone with acetabular implant component of porous titanium nickelide, which, in its turn, provides complete coating of hip head bone without affecting the epiphysial plate, reliable fixation of left external acetabular roof edge and improve bone regeneration within osteotomy region.

Graduated axial load during post-operation period improves osteointegration from the bone bed in the porous implant. Applying the above-mentioned correction method for children coxarthrosis the anatomical relationships of the hip joint (acetabulofemoral joint) are persistent This enhances possible further endoprosthesis replacement of hip joint (acetabulofemoral joint) after closing the epiphysial plate under favorable conditions, only if there are no severe formed deformations of the hips and lumbar-sacral vertebral region.

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