Algorithm for choosing a method of surgical correction of proximal femur deformity in aseptic necrosis of the femoral head after conservative reduction of congenital hip dislocation in children

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ABSTRACT

To study the immediate results of surgical correction of proximal femur deformity in children with ANFH after bloodless reduction of congenital hip dislocation. Materials and methods of the study. We observed 72 children aged 7 to 12 years with multiplanar deformities of the proximal femur in ANFH after bloodless reduction of congenital hip dislocation

Keywords: Tazodrennyy Sustav, Vrozhdennyy Vyvix Fedra, Asepticheskу Necro Golovki Bedrennoy Kosti.

Relevance. Aseptic necrosis of the femoral head (ANFH) is a frequent and severe complication that occurs after reduction of congenital hip dislocation in children, leading to the early development of dysplastic coxarthrosis, significantly prolonging the period of follow-up treatment in children and largely determining the functional and anatomical outcome [1,3,5,8]. According to the literature, the frequency of this complication in closed reduction of hip dislocation varies from 10 to 60% [13,18,20]. In 60-80% of patients, the disease progresses torpidly, which leads to the development of gross anatomical deformations of the proximal femur. Undoubtedly, multiple attempts at reduction, ending in vain regardless of the cause, in combination with long-term immobilization in a plaster cast in the antephysiological position of the lower limbs lead to iatrogenic damage to the joint structure, cause vascular disorders, which ultimately initiates the occurrence of

various deformations of the femoral head [2,3,4,6,9,15,19]. Surgical treatment of proximal femur deformation in children after ANFH is a complex and multi-stage process that requires an individual approach to each patient. Depending on the degree of deformation, the patient's age, the presence of complications and other factors, various surgical methods can be used. Deformations of the proximal femur (PFF) in children after ANFH are not uncommon and often require complex surgical interventions [11,17,21]. The severity of residual deformations, according to Luhmann S.J. et al, Herold H.Z. depends on the severity of the lesion of the ossification center of the epiphysis of the femoral head, at the beginning of the pathological process. [16,20]. It is believed that type II deformation according to Kalamchi is the most common and makes up from 25 to 61% [17,19]. Often, with this type of pathology, in addition to the listed problems, multiplanar deformation of the proximal femur develops [4]. Treatment of type II deformation of the proximal femur according to Kalamchi-MacEwen: is extremely complex, and the most difficult is considered to be the correction of multiplanar deformations, in which the main task of the intervention is to normalize all deviations, "as far as possible" [22], and the works devoted to it are isolated [19]. The problem of treating ANFH and the consequences of impaired growth of the lateral part of the proximal growth plate of the femur does not always lead to satisfactory results [7,11,12,17,22]. Surgical method is the only one for normalization of ratios in the joint, and N. Clarke [14] saw the main task of treatment of deformations after AN in their "minimization by surgical means", and Yu. I. Pozdnikin [9] considered restoration of the shape and function of the joint to be the "ideal treatment". Methods of surgical correction of PJ deformations should be applied differentially in different age groups, taking into account the results of a comprehensive assessment of the hip joint condition and the biomechanical prognosis of its development after the planned reconstruction. Surgical intervention in childhood should be carried out not only taking into account existing deformations, but also those deviations that will inevitably arise as a result of the continued functioning of the damaged growth zones of the proximal femur. Surgical interventions are carried out on patients with pronounced residual PJ deformations in ANFH after conservative treatment of congenital hip dislocation, at the outcome stage, when there are clear signs of decentrations and violation of the congruence of the articular surfaces.

The aim of the study: to study the immediate results of surgical correction of proximal femur deformity in children with ANFH after bloodless reduction of congenital hip dislocation. Materials and methods of the study. We observed 72 children aged 7 to 12 years with multiplanar deformities of the proximal femur in ANFH after bloodless reduction of congenital hip dislocation. All patients underwent surgical correction of proximal femur deformity according to the treatment and diagnostic algorithm developed by us. All patients had multiplanar proximal femur deformity: hip subluxation, varus or valgus deformity and shortening of the femoral neck, valgus deviation of the epiphysis, high position of the greater trochanter and negative value of the articulotrochanteric distance. During the radiographic examination of children, radiography of the hip joints was performed in the anteroposterior projection with the hips in the middle position, with internal rotation and abduction of the lower limb. The radiographs were used to measure the parameters characterizing the angular values of the hip joint and the proximal femur: the angle of vertical inclination of the acetabulum, the angle of vertical conformity, the acetabular angle, the neck-diaphyseal angle, the angle of anteversion, the Alsberg angle, the bone coverage coefficient, and the parameters characterizing the ratio of the femoral head and the greater trochanter in the frontal plane: articulo-trochanteric distance, trochanteric-trochanteric distance, articulo-minorovertebral distation. The diagnostic and treatment algorithm for proximal femur deformities in aseptic necrosis of the femoral head after bloodless reduction of congenital hip dislocation allows for the reasonable use of

surgical correction methods in children, taking into account the type, degree of deformity, patient's age, and the results of a comprehensive assessment of the hip joint condition and biomechanical prognosis of its development after the planned reconstruction.

Type I deformity of the PFB: isolated lesion of the ossification center of the epiphysis of the femoral head. There are no abnormalities in the femoral neck, the growth zone is not involved in the pathological process, and the development of the acetabulum corresponds to age norms. This type is characterized by the phenomenon of "head in head", which is manifested by compaction of the primary ossification center with an increase in the head due to the appearance of an external band of bone tissue after months. The most common consequences of type I are "minor forms" or "minor manifestations", which include a decrease in the height of the head and the formation of "coxa magna". "Minor manifestations" are indisputable evidence of aseptic necrosis, do not have a negative impact on the immediate treatment outcome, existing deviations constantly pose a threat of compensation failure: - an increase in antetorsion by 10-150, which is 45-600, while the projection SDU is 145-1550. This requires surgical correction in patients over 7-8 years old.

Clinical manifestation of pathology: is the occurrence of pain by the end of the day or after a long stay on the legs.

Radiography of the hip joints in the anteroposterior projection with the average position of the hips and internal rotation.

Radiological signs of deformation of the POBB type I:

- lateroposition and subluxation of the femoral head;
- an increase in the angle of antetorsion 45-600;
-increase in the SDU, it is equal to 145-1550
- "coxa magna", which leads to joint destabilization.

Surgical treatment of type I PFB deformity

In children aged 8-9 years and above, extra-articular or open centering of the femoral head with detorsion-devalgizing osteotomy of the femur.

Type II occurs due to damage to the lateral segment of the head growth zone, in combination with the lateral part of the metaphysis, with subsequent slowing down and then cessation of growth of the lateral part of the femoral neck due to premature closure of the compromised area of the physis. The medial part of the head and neck of the femur continues to develop normally, which leads to slow lateral sliding and transverse orientation of the epiphysis, with the occurrence of valgus deformity of the proximal "coxa valga" and a deficiency in the coverage of the head by the acetabulum.

The clinical manifestations of the pathology are:

- walking with the feet positioned internally, caused by excessive pathological antetorsion of the proximal femur;
- frequent falls of the child, when walking the socks "touch" each other;
- rapid fatigue and tiredness in the legs;
- the appearance of pain in the hip joint, which bothers patients by the end of the day or after intense physical activity;
- shortening of the lower limb by 1.0 cm.

Its main radiological manifestations are: lateral tilt of the epiphysis of the head of the femur with the formation of "coxa valga", shortening of the lateral part of the neck compared to the medial, the femoral head is aspherical due to the egg-shaped flattening of the internal parts of the epiphysis, in the external part the epiphysis hangs over the neck of the femur - the "cornice" symptom, closure of the lateral part of the physis of the head of the femur and counter growth of the bone formation from the side of the growth zone of the greater trochanter with the formation of an "external bone bridge" between the epiphysis and the metaphysis and the formation of a significant depth of depression along the upper contour of the neck - a "noose". Radiography of the hip joints in the anteroposterior projection with the hips in the middle position and internal rotation for more complete information in the growth zone of the femoral neck: the outer,

inner and central sections of the epiphysis of the head of the femur:
X-ray of the hip joints in the Lauenstein position and in the axial projection for information on the anterior and posterior sections of the epiphysis of the head of the femur.

X-ray signs of type II PFB deformity:
- decentration and deficiency of coverage of the femoral head by the acetabulum;
- the vault of the acetabulum roof is shortened;
- AI-140;
- Sharp angle -450;
- Wiberg angle -130;
- Shenton line rupture;
- multiplanar deformity of the proximal femur often develops.
MRI: - a characteristic MRI sign is a hypointense signal from the femoral head on T1b images and possibly also on T2b images depending on the degree of osteosclerosis.
MSCT: - subluxation of the femoral head;
- in older children, decentration and torsion;
- cystic and dystrophic changes in the structures of the hip joint.
Surgical treatment of type II PFB deformity:
A) In children under 8-9 years old - open or extra-articular centration of the femoral head with posterior-rotational osteotomy of the femur, apophysiodesis of the greater trochanter of the femur and plastic surgery of the acetabulum roof or without it. It allows changing the spatial position of the femoral head and neck in three planes, achieving femoral head centering with simultaneous removal of the necrotic epiphysis focus from under the load, improving the congruence of the articular surfaces and stopping the pathological process in the POBB, which subsequently contributed to the favorable development of the hip joint with the restoration of its function and normalization of the biomechanical conditions of the functioning of the hip joint muscles.
B) In children aged 9 years and above - open or extra-articular femoral head centering with posterior-rotational osteotomy of the femur, "transposition" (lowering) of the greater trochanter of the femur in the caudal direction and plastic surgery of the acetabulum roof or without it. It allows changing the spatial position of the femoral head and neck in three planes, achieving centering of the femoral head with simultaneous removal of the necrotic epiphysis focus from under the load, improving the congruence of the articular surfaces and the position of the greater trochanter and normalizing the biomechanical conditions of the functioning of the hip joint muscles. Result of the operation. These operations allow changing the spatial position of the femoral head and neck in three planes and normalizing the position of the greater trochanter, as a result, the clinical and radiometric parameters of the hip joint are improved and thereby normal relationships in the hip joint are restored and the biomechanical conditions of the functioning of the hip joint muscles are normalized.
III-type: damage to the central part of the physis of the femoral head. A characteristic component of the pathology is a significant total shortening of the femoral neck with almost no change in the SDU. The greater trochanter of the femur maintains normal growth, which leads to its gradual proximal migration and high standing. In combination with a short femoral neck, extremely unfavorable biomechanical conditions for the function of the gluteal muscles arise and the functional "coxa vara", shortening of the neck "coxa breva" and pronounced hypertrophy of the greater trochanter "relative overgrowth of the greater trochanter" develop. Already at an early age, the proximal part of the neck expands and by 4-5 years takes the form of a "bell-shaped" or "funnel". The femoral head gradually descends into this "funnel" and ends up placed in it. In this case, a total shortening of the femoral neck with a slight varus tilt is noted. Clinical signs of type III PFB deformation:
- pain in the knee joint, which is explained by the common segmental innervation of these areas.
- pain in the hip joint, which occurs episodically at first, has a weak intensity, with time the frequency and intensity of the pain syndrome increases;
- later, lameness joins the pain syndrome, the cause of which is the pain syndrome.

- shortening of the lower limb with unilateral localization of the pathological process.

Radiography of the hip joints in the anteroposterior projection with the average position of the hips and internal rotation for more complete information in the growth zone of the femoral neck: the outer, inner and central parts of the epiphysis of the femoral head:

X-ray signs of type III PFB deformation:

- the height of the femoral head is reduced, it is flattened and "sits" on the base of the neck, as if it is a continuation of the femoral diaphysis;

- the EDU is 108-1190;

- high position of the greater trochanter, the apex of which is located at the height of the joint space or proximal to it;

- the vault of the acetabulum roof is short, the entrance to the acetabulum is elongated;

- Sharp angle - 450;

- Wiberg angle 11-150;

- Shenton line gap by 0.3-1.0 cm.;

- the epiphyseal-neck coefficient is reduced to 450.

-- the symptom of a "sagging rope"

Surgical treatment of type III PTFE deformity:

In children under 8-9 years old - open or extra-articular centering of the femoral head with intertrochanteric valgus and neck-lengthening osteotomy of the femur, apophysiodesis of the greater trochanter of the femur.

In children over 9 years old - extra-articular centering of the femoral head with intertrochanteric valgus and neck-lengthening osteotomy of the femur.

Type IV - total lesion of the epiphysis - severe vascular disorders involving the ossification center of the epiphysis, the central part of the growth plate and the middle of the metaphysis of the proximal femur, characterized by the gradual formation of severe deviations and multiplanar deformation of the femoral head. The characteristic and defining feature of this group is varus deformity "coxa vara", as a result of braking mainly in the inner part of the growth zone of the head and a sharp shortening of the femoral neck "coxa breva". Lesion of the anterior-inner part of the growth zone is characterized by the development of varus deformity in combination with the anterior formation of the epiphysis "epiphyseal anteversion", lesions of the postero-inner - also varus deformity with the posterior formation of the epiphysis "epiphyseal retroversion". By 12-14 years, the lower pole of the head is pulled downwards and "wrapped" inward in the form of a "comma". The greater trochanter of the femur is located significantly above the joint space and as a result of its contact with the pelvic wing, which occurs during movement, "neoarthrosis" is formed, as evidenced by the "depression" on the ilium and porosis of this area.

Clinical signs of type IV PFB deformity:

- with a significant difference in limb length, pelvic tilt and compensatory scoliosis may occur.

Radiography of the hip joints in the anteroposterior projection with the hips in the middle position and internal rotation: for more complete information in the growth zone of the femoral neck: the outer, inner and central sections of the epiphysis of the head of the femur:

Radiography of the hip joints in the Lauenstein position and in the axial projection: for information on the anterior and posterior sections of the epiphysis of the head of the femur.

Radiological signs of type IV PFB deformity:

- varus deformity "coxa vara" and a sharp shortening of the femoral neck "coxa breva";
- "epiphyseal anteversion" or "epiphyseal retroversion";
- "sagging rope" symptom;
- Wiberg angle - decreases to 15-50:
- epiphyseal angle - increases to 114-1150;

Surgical treatment of type IV PFB deformity:

In children under 8-9 years old - extra-articular centering of the femoral head with intertrochanteric detorsion-valgus osteotomy of the femur, apophysiodesis of the greater trochanter of the femur and acetabular roof plasty or without it.

In children over 9 years old - extra-articular centering of the femoral head with intertrochanteric detorsion-valgus osteotomy of the femur.

In children over 9 years old with shortening of the lower limb - extra-articular centering of the

femoral head with intertrochanteric detorsion-valgus and lengthening osteotomy of the femur. Detorsion-lengthening osteotomy with resection of the base and bringing down the greater trochanter. After cutting off the apex of the greater trochanter with the attached muscles, its base is resected in the form of a cylinder or trapezium, which is inserted between the femur fragments osteotomized in the subtrochanteric region. The height of the base and apex of the trapezium depended on the correction of the neck-diaphyseal angle.

The proposed intertrochanteric detorsion-valgus and lengthening osteotomy of the femur allows not only to restore the length of the limb, but also to simultaneously remove the necrotic focus of the epiphysis from under the load and normalize the biomechanical conditions of the functioning of the hip joint muscles.

Result of the operation. All patients experience disappearance of pain and lameness, internal rotation of the lower limbs when walking, improved range of motion in the hip joint. X-ray parameters characterizing: the ratio of the acetabulum and head of the femur; the ratio of the head and neck of the femur and the greater trochanter; improved centering of the head in the acetabulum; the continuity of the Shenton line is restored; the position of the greater trochanter of the femur is normalized.

Thus, the algorithm we proposed for choosing a method for surgical correction of POBB deformities in ANFH after conservative reduction of congenital hip dislocation allows for a reasoned approach to the treatment of pathological changes in the proximal femur, acetabulum and their relationships. It simplifies the task of choosing and choosing a method for surgical correction of POBB deformities in ANFH, taking into account its type, degree of subluxation, age-related anatomical features for restoring correct relationships in the hip joint, including centering the head and neck of the femur and the position of the greater trochanter, congruence of the articular surfaces and normalization of the biomechanical conditions of the functioning of the hip joint muscles.

Literature

1.Абакаров А.А., Гусейнов А.Г. Новый метод комплексной профилактики асептического некроза при лечении врождённого вывиха бедра у детей.//Актуальные вопросы детской травматол. и ортоп.-С.П., 2000.-С.314-315.

2. Алпысбаев Х.Ш. Ранняя диагностика, профилактика и лечение асептического некроза головки бедренной кости после консервативного вправления врождённого вывиха бедра у детей: Автореф. дис. канд. мед. наук -Ташкент, 2009.-22с.

3. Ахтямов И.Ф. Дегенеративно-дистрофические заболевания тазобедренного сустава у детей и подростков. Казань, 2003. С.6-13.

4. Белецкий А., Ахтямов И., Богосьян А., Герасименко М. Асептический некроз головки бедренной кости у детей.-Казань 2010. -255с.

5. Винокуров В.А., Бахтеева Н.Х., Бирюкова Л.И., Саидов Р.М. // Актуальные вопросы детской травматологии и ортопедии: Матер. науч.-практ. конф. детских травматологов-ортопедовРоссии.-СПб,2004.-С.218.

6. Куценок Я.Б., Рулла Э.А., Мельник В.В. Врожденная дисплазия тазобедренного сустава. Врожденный подвывих и вывих бедра. Киев: Здоровья, 1992, 182с.

7. Малахов О.А., Кожевников О.В., Иванов А.В. Лечение болезни Легг-Кальве-Пертеса методам демпферной динамической разгрузки с применением биосовместимых полимеров нового поколения. //Патол. крупных суставов и др. актуальные вопр. дет.травматол. и ортоп.- С.-Петербург.-1998.-С.149-151.

8. Малахов О.А., Цыганкова Е.Е. //Актуальные вопросы детской травматологии и ортопедии: Матер. науч.-практ. конф. детских травматологов-ортопедов России. - СПб, 2005.-С.229-230.

9.Поздникин Ю.А. Ацетабулопластика-остеотомия таза как метод реконструкции диспластической вертлужной впадины / Ю. А.Поздникин //Ортопедия, травматология и протезирование.–1983.–No3.–с.35–36.

10.Соколовский А.М., Крисюк А.С. Хирургическое лечение заболеваний

тазобедренного сустава. Минск: Навукаітэхніка, 1993.248с.
11.Соколовский А.М., Соколовский О.А., Ковальчук О.В., Лихачевский Ю.В.Оперативная коррекция деформаций II типа по Kalamchi после перенесенного аваскулярного некроза проксимального отдела бедра у детей: Материалы научно-практической конференции детских травматологов-ортопедов России. - Сыктывкар, 2008. -С.249-250.
12. Bar-On E., Huo M.H., DeLuca P.A. // J. Pediatr. Orthop. B. - 1997. - Vol.6. - P.138-145.
13. Brougham D.I., Broughton N.S., Cole W.G., Menelaus M.B. Avascular necrosis following closed reduction of congenital dislocation of the hip // J. Bone Joint Surg. 1990. Vol. 72-B, No. 4.P.557-562.
14. Clarke N. M. The surgical treatment of established congenital dislocation of the hip: results of surgery after planned delayed intervention following the appearance of the capital femoral ossific nucleus / N. M. Clarke, A. J. Jowett, L. Parker // J Pediatr Orthop. – 2005. – Vol. 25, N 4. – P. 434–39
15. Connolly., Connolly P., Weinstein S. L. The course and treatment of avascular necrosis of the femoral head in developmental dysplasia of the hip //Acta Orthop Traumatol Turc. 2007. Vol.41,No.l.P.54-59.
16. Herold H.Z. Unilateral congenital hip dislocation with contralateral avascular necrosis. //Clin.Orthop.-1980-Vol.148.-p.196-202.
17. Kim HW., Morcuende J.A., Dolan L.A., et al. // J. Bone Joint Surg. Am. - 2000. - Vol.82. - P.1692-1700.
18. Kruczynski J. Avascular necrosis of the proximal femur in developmental dislocation of the hip incidence, risk factors, sequelae and mr imaging for diagnosis and prognosis // Acta Orthop Scand.1996.Vol.67,No.268.P.4-12.
19. Luedtke L.M., Flynn J.M., Pill S. G. A Review of avascular necrosis in developmental dysplasia of the hip and contemporary efforts at prevention // Univ. Pennsylv. Orth. - 2000. - Vol.13.P.22-28.
20.Luhmann S.J., Schoenecker P.L., Anderson A.M., Basselt G.S. The prognostic importance of the ossific nucleus in the treatment of congenital dysplastic of the hip. //J. Bone and Joint Surg.-1998.-Dec:80(12):1719-27.
21.Maquet P. //Acta Orthop. Belg. - 1999. - Vol.65, N3. - P.302-314.
22. Millis, M.B., Murphy S.B., Poss R. //Instr. Caurse Lect. -1996. - Vol.45. - P.209-226.

Резюме