

Clinical Studies on Epiphyseal Ischemic Necrosis of Femoral Head in Children Treated with Femoral Head Epiphyses and Neck Decompression

Hongxing Zhao¹, Xiaodan Pang¹, Linjing Li², Yuzhen Dong¹, Kunzheng Wang³

¹Department of Orthopedics, the First Affiliated Hospital, Xinxiang Medical University, Weihui, Henan 453100, China

²Department of Pneumology, the First Affiliated Hospital, Xinxiang Medical University, Weihui, Henan 453100, China

³Department of Orthopedics, the Second Affiliated Hospital, Xian Jiaotong University, Xian, Shaanxi 710049, China
Email: zhangpingsjnk@163.com

ABSTRACT: [Purpose] By following up the LCPD cases treated with femoral head epiphyses and neck decompression operation, to analyze the effect of typing and age to the clinical curative effect and the image indexes, **[Methods]** We collected the Patients who were diagnosed LCPD and treated by femoral head epiphyses and neck decompression operation. 49 patients(54 hips) were followed up and received overall data. to analyze the radiological characteristics of pre-operation and post-operation. **[Results]:** The patients were followed up 12~110 months, with an average of 72 months. The sick hip showed slight pain or claudication or shortening of lower extremity preoperatively, the symptoms were ameliorated strikingly postoperatively. highdensity necrosis shadow became smaller, the femoral head epiphyses became full, height of the femoral head epiphysis increased after 3 months of postoperation. **[Conclusion]** This operation can improved the clinical symptoms such as pain, claudication or Shortening of lower extremity preoperatively, It has a better short-term curative effect. The prognosis has relations with the ages of onset and the lesion severity of the femoral head epiphysis. The younger patient, the better outcome. The operation has a distinct effect on recovering of height of the femoral head epiphysis, however there is no effect on the shape of acetabulum in short term.

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Children femoral epiphysis ischemic necrosis (Legg-Calve-Perthes Disease / LCPD), also known as the femoral head aseptic necrosis of the femoral head osteochondrosis, flat hip femoral epiphysis part due to the femoral head blood supply due to an impediment or all of necrosis occurred in the children's self-healing, self-limiting systemic disease [1], advanced disease high morbidity, is one of the orthopedic difficult disease. Ischemia due to various reasons, the femoral head blood circulation disorders and bone pressure increased [2,3], and after clinical and experimental confirmed most scholars in recent years is the opinion of the study, and LCPD throughout the course of the disease are present to venous disorders, bone the repair is carried out in a low-oxygen, high-acid environment, natural repair delay, prolonged course [4]. Through the epiphyseal our hospital, neck decompression treatment LCPD patients were studied retrospectively grouped according to Herring typing and different ages, efficacy evaluation after a follow-up to the patients, analysis of different age, stage surgical treatment ; by measuring the height of the femoral head epiphysis, acetabular index, CE angle, acetabular coverage percentage, acetabular depth, neck-shaft angle indicators, changes

in the application of statistical methods to compare these indicators before and after surgery, analysis of surgery on the risk of hip epiphysis and hip reference the mortar impact of treatment for LCPD.

1. Materials and Methods

1.1 Generally August 2000 to 2010 line epiphyseal cervical decompression surgery for the treatment of 60 cases were followed up, 49 cases of complete data cases. Among them, 42 males and 7 females. The double hip incidence of five cases, a total of 54 hips, which left 34 hips, 20 hips right side. Surgery age 2 to 12 years old, with an average of 7.5 years; Herring typing: B-29 hips, C 25 hips; according to age at surgery: 19 hips, 6-year-old, 6 to 9 years of age in 20 hips, 9 years old (15 hips).

1.2 Methods

1.2.1 surgical methods using general anesthesia or continuous epidural anesthesia. Hip anterolateral approach (Smith-Peterson incision) layers and cut the skin, subcutaneous tissue, revealed lateral femoral cutaneous nerve and be protected,

cut open the fascia from the rectus femoris and tensor fascia lata gap enter, revealing, and "T" shaped incision of the joint capsule, revealing the head and neck of the hip. Before the lateral part of the femoral head head and neck at the junction of the arc Zaozao into bone window, its depth close to the epiphyseal plate, but you can not destroy the epiphyseal plate. Cystic lesions of the femoral neck with curettage, bone defects filled with cancellous bone taken from the amount of the greater trochanter. Other below the non-weight-bearing area knife cut articular cartilage to form a triangular cartilage flap flips cartilage flap underwent femoral epiphysis the epiphysis of fine Kirschner drilling decompression, can not damage the epiphyseal plate decompression reset cartilage flap. The suture joint capsule, close the incision.

1.2.2 Postoperative management of postoperative bed rest, avoid weight-bearing limb skin traction, given the anti-inflammatory symptomatic treatment. The incision regularly dressing, 10 to 12 days after the sutures. Postoperative patients were asked to bed rest for 3 to 4 months, from 2 months in bed activities hip, non-weight-bearing activities within six months. Patients discharged from hospital outpatient review March line physical and radiographic examination, to understand the clinical symptoms and ipsilateral epiphyseal changes

1.3 The follow-up observed capital femoral epiphysis height of epiphysis density, epiphyseal plate, femoral neck, acetabulum, joint space. The same period in the same indicators ipsilateral and contralateral ratio (for patients with bilateral left and right on both sides of the measure with the same set of segments of the indicators of the contralateral ratio of the average), so that, respectively, produced the same patients before and after epiphyseal height ratio, acetabular index than CE angle than the the acetabular coverage percentage than acetabular depth ratio, neck-shaft angle than 6 ratio indicators. Application of domestic easy Shende [5] ten twentieth evaluation standard postoperative effects of the different stages of evaluation, greater than or equal to 18 excellent, 15 to 17 as good, 12 to 14 for less than 12 persons for the poor.

1.4 Statistical Methods SPSS13.0 statistical software for statistical analysis, preoperative and postoperative X-ray measurement

indicators ratio data using paired T test, efficacy evaluation in excellent rate compared using the chi-square test. $P < 0.05$ was significant difference.

2. Result

2.1 Clinical observation of the results of preoperative hip knee mild to moderate pain and 41 cases, 35 patients were in remission, four cases of activities for a long time after the acid storm discomfort, two cases pain relief is not obvious; associated with varying degrees of claudication in 39 patients before surgery, 35 patients had to be eased, more than four cases of long-standing limb shortening and limp, 3 cases of very obvious limp, Herring C type and patients greater than 10 years old; preoperative limb shortening more about 1cm 33cases (three cases shortened more than 2.5cm), after 29 patients were in remission; varying degrees of hip activity limitation in 40 patients after 34 patients were in remission. Postoperative hip mild adhesions and 7 patients a sense of discomfort, remission after functional exercise. 3 cases of coxa vara, are older than the nine-year-old Herring C patients. This group no early epiphyseal closure, the window at the fracture phenomenon.

2.2 Imaging observations by the cases of X-ray observation, postoperative X-ray findings of the following aspects: 1) the epiphysis change: capital femoral epiphysis cystic degeneration, collapse and fragmentation, higher density and uneven (Figure 1). 2) metaphyseal changes: metaphyseal cystic changes, cystic degeneration around irregular sclerosis (Figure 1). 3) changes in joint space: the femoral head and the acetabulum bottom distance increases compared with the contralateral 4) changes in the acetabulum: acetabular increases, shallow (Figure 1). 5) after epiphyseal repair performance: postoperative the epiphysis high density shadow narrow the capital femoral epiphysis the shadow gradually become full (Figure 2, 3, 4).



Figure 1. Male patients 8 years of age, the right side of preoperative epiphysis seemed flat.



Figure 2 One year after surgery, the epiphysis recovered well, uniform density.

Density was significantly increased, metaphyseal involvement, cystic degeneration.



Figure 3. femoral head epiphyseal recovery round, well-developed femoral neck (2 years after)



Figure 4. Epiphyseal good recovery (after 5 years)

X-ray indicators results according to different the Herring staging and age groups, can be divided into six groups: B1, B2, B3 (respectively B period of less than 6 years of age, 6 to 9 years old, more than 9 years old) C1, C2, C3(respectively C period of less than 6 years of age, 6 to 9 years old, more than 9 years old) group. Measured preoperative and postoperative X-ray indicators ratio, expressed as mean ± standard deviation (± s) for normality test using the the SPSS13.0 software on the ratio of the difference between the preoperative and postoperative same determined in line with the normal distribution, preoperative and postoperative indicators paired T-test analysis. The results are shown in Table 1, Table 2.

Table 1. The different surgery before and after X-ray indicators (suffering / Kin) ratio measurement results ($\bar{X} \pm s$)

	B1		B2		B3	
	Preoperative	Postoperative	Preoperative	Postoperative	Preoperative	Postoperative
Epiphyseal height	0.7059±0.08 16	0.7820±0.0583 ▲	0.7242±0.074 4	0.7751±0.0873 ▲	0.7438±0.046 6	0.7925±0.0605 ▲
Acetabular index	1.0483±0.06 74	1.0447±0.0583	1.0392±0.060 1	1.0250±0.0540	1.0650±0.07 89	1.0538±0.0620
CEAngle	0.9136±0.04 61	0.9672±0.0429 ▲	0.9308±0.054 0	0.9742±0.0526 ▲	0.8975±0.056 5	0.9325±0.0459 ▲
Acetabular coverage	0.9327±0.03 38	0.9771±0.0550 Δ	0.9475±0.032 5	0.9775±0.0449 Δ	0.8750±0.032 9	0.9450±0.0719 ▲
Acetabular depth	0.9441±0.04 52	0.9557±0.0513	0.9082±0.038 5	0.9158±0.0398	0.8788±0.050 8	0.8750±0.0466
Neck shaft angle	0.9768±0.05 37	1.0090±0.0490	0.9683±0.050 2	0.9733±0.0357	0.9225±0.056 2	0.9337±0.0441

Δ: P<0.05 ▲: P<0.01

It can be seen from Table 1 that different age groups HerringB type before and after surgery epiphyseal height ratio CE angle than acetabular coverage percentage were higher than preoperative than

postoperative, there is a significant difference (P <0.05); neck shaft angle than, the acetabular index ratio, acetabular depth than change before and after surgery, there was no significant difference (P > 0.05).

Table 2. surgery before and after X-ray indicators (suffering / Kin) ratio of the measurement results

groups Index	C1		C2		C3	
	Preoperative	postoperative	Preoperative	postoperative	Preoperative	postoperativ e
Epiphyseal height	0.5333±0.1045	0.7111±0.1595▲	0.5788±0.0682	0.6951±0.0969▲	0.4957±0.0547	0.5729±0.1368
Acetabular index	1.1001±0.0708	1.0891±0.0587	1.0325±0.9161	1.0438±0.0793	1.1254±0.08182	1.0942±0.0787
CE Angle	0.8991±0.0536	0.9361±0.0718Δ	0.8875±0.0449	0.8987±0.0485	0.9329±0.0665	0.9371±0.0629
Acetabular coverage	0.8910±0.0723	0.9110±0.7203Δ	0.9425±0.0627	0.9101±0.0691	0.8801±0.0496	0.8957±0.0621
Acetabular depth	0.8941±0.0587	0.9081±0.0541	0.8551±0.0374	0.8512±0.0334	0.8514±0.0521	0.8614±0.0595
Neck shaft angle	0.8811±0.0420	0.8930±0.0745	0.8788±0.0502	0.8712±0.0445	0.8757±0.0812	0.8686±0.0917

Δ: P<0.05 ▲: P<0.01

As seen from Table 2: Herring type C younger than 6-year-old group of epiphyseal height ratio CE angle than acetabular coverage percentage were higher than preoperative than postoperative significant difference (P <0.05); to 9-year-old group only epiphyseal height postoperative greater than before the surgery, there is a significant difference (P <0.05); older than 9-year-old group the observation points ratio changes had no significant difference (P > 0.05).

Type B in B1, B2, B3 excellent rate of 2.4 clinical efficacy results were 100%, 83.3%, 62.5%; C-type C1, C2, C3 excellent rate were 80%, 62.5%,

42.8%, B-type excellent and good rate 82.75% C excellent and good rate was 68%, excellent rate of B-type and C-type statistical difference (P <0.05). 6-year-old group, the total fine was less than 89.4%; 6 to 9-year-old group was 75% excellent and good; excellent and good rate was 60% greater than the 9-year-old group, excellent rate of each age group (P <0.05). Efficacy for poor patients, coxa vara severe femoral neck was significantly shorter, the greater trochanter high, the hip limited functionality, limb shortening 2.5cm. The results are shown in Table 3.

Table 3. The different group postoperative efficacy comparison

group s	excellent Case (%)	good Case (%)	fair Case (%)	Poor Case (%)	Total Case	Excellence rate (%)
B1	8 (88.9)	1 (11.1)	0 (0.0)	0 (0.0)	9	100.0
B2	6 (50.0)	4 (33.3)	2 (16.7)	0 (0.0)	12	83.3
B3	2 (25.0)	3 (37.5)	3 (37.5)	0 (0.0)	8	62.5
C1	4 (40.0)	4 (40.0)	2 (20.0)	0 (0.0)	10	80.0
C2	1 (12.5)	4 (50.0)	3 (37.5)	0 (0.0)	8	62.5
C3	0 (0.0)	4 (57.1)	0 (0.0)	3 (42.9)	7	42.8

Discussion

Since 1910, is recognized as the independence of the disease, LCPD etiology, pathology studies a lot. Consider trauma, metabolic disorders and endocrine dysfunction, synovitis caused by hip pressure, excess glucocorticoids, bone age delay and mechanical stress factors, genetic factors, passive smoking [6,7]. However, the true etiology of LCPD none has been clear. In recent years, most scholars study ischemia and different reasons femoral head blood circulation disorders and bone increased pressure on [8,9]. This disease early intra-articular pressure was significantly higher than the drainage capital femoral epiphysis ossification center of the small venous pressure, but lower than the pressure of the small arteries, thus

inevitably lead to venous disorders, venous stagnation caused by the tube, mainly bone marrow microcirculation stasis, caused by the sinusoids and collection sinus expansion, oozing, bone marrow tissue ischemia and hypoxia, cell edema, and thus increased bone contents and expansion, caused by increased pressure within the bone. Epiphyseal, neck decompression play the following role 1) cut the joint capsule, reduces the pressure is increased due to the joint capsule femoral head femoral neck vein reflux disorder, reduce the mechanical pressure, conducive to reconstruction; 2) line the epiphyseal neck decompression to relieve the pressure, scraping necrosis epiphyseal bone, and reduced pressure at implantation of fresh cancellous bone stimulate epiphyseal repair and

reconstruction. Kun-Zheng [10] that the femoral head by relieving pressure, improve structural femoral epiphysis, peripheral vascular hyperplasia, while columnar cells of the bone to stimulate distal epiphysis, metaphysis proliferation Lee necrosis epiphyseal repair. Play a benign stimulation of longitudinal growth of the epiphyseal plate, is conducive to the growth of limbs, improve claudication; 3) to increase blood flow, improve the blood supply of the femoral epiphysis.

Through the X-ray measurement of indicators before and after surgery, we found that: in the different age HerringB group, the surgery can improve the epiphyseal height ratio CE angle than the acetabular coverage percentage conducive femoral head epiphyseal height restoration, increased femoral head match the extent of the stability of the acetabulum, the femoral head and the acetabulum increase the contact area of the femoral head within the acetabulum, the decrease in epiphyseal relocation of the degree. However, the results show that the surgery to improve the role of the acetabular morphology. For HerringC patients with surgery can improve the indicators than HerringB patients with significantly reduced. Improvement in the recovery of the surgery only HerringC younger femoral epiphysis; those who are older, especially > 9 years of age effect is not obvious. Age of onset of therapeutic effect significant correlation, the younger the recovery better, but it does not mean that all the younger patients have better prognosis and severity should combine, we observed that the issue in the follow-up bone epiphyseal necrosis partially involving the epiphyseal plate small, even if the age of onset is often poor prognosis. Therefore, early detection and early treatment is particularly important, Li Zhiyong, etc. [11] that the radionuclide bone imaging in the early diagnosis of Perthes disease was significantly better than the X-ray, and can sensitively reflect the course of the development process, and found limp, continued the hip pain and hip outreach and internal rotation is limited clinical manifestations children, radionuclide bone scan can help early diagnosis. Studies have shown that the epiphyseal, neck decompression surgery can improve the early the LCPD patients with epiphyseal height ratio CE angle than, acetabular coverage percentage conducive to the femoral head epiphyseal repair, restoration of joint function. As the follow-up, relatively few cases, the time is relatively short, for the surgical treatment of the LCPD patients with long-term efficacy need to continue to follow-up observation.

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Corresponding author:

Yuzhen Dong,

Department of Orthopedics,

The First Affiliated Hospital, Xinxiang Medical University,

Weihui, Henan 453100, China

Email: dongyuzhen1998@163.com**References:**

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