

Long Term Sequels Of Intramedullary Nailing In Childhood Femoral Shaft Fractures.

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Citation

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Abstract

Objective. To evaluate the impact on bone growth of intramedullary nailing of femur using Küntscher technique in childhood. **Methods:** 18 patients who had undergone Küntscher technique intramedullary nailing were analyzed as they have grown to adulthood. Growth of each lower limb was compared using predefined clinical and radiological parameters. **Results:** Patient ages at the time of evaluation, ranged from 21 to 30 years and the follow up length 12 to 16 years. Clinical examination noted 10 normal patients and 8 patients with anomalies, among them 6 were less than 12 years old at the time of intervention. Six patients had lengthening of the operated limb; 4 patients had atrophy of the thigh of the operated limb and 7 patients had coxa valga of operated limb. All patients with coxa valga had undergone the intervention before the age of 12 years. **Conclusion:** intramedullary nailing using Küntscher technique to treat femoral fractures in children of feoo may have some long terms sequels. Therefore it is advisable not to use this technique in children less than 12 years old.

INTRODUCTION

Treatment option with intramedullary nailing of femur fractures in children is still debated. Injury of growth cartilage is the major risk of surgery and protection of growth plate and periosteum which respectively ensure the bone growth in length and thickness should be the main concern.

Proximal femoral chondroepiphyses comprises of 4 growth cartilages: 3 spherical (greater trochanter, lesser trochanter, head nucleus) and 1 rectangular (neck cartilage). The growth of the femur proximal epiphyseal is the result of a balanced developmental interactions between the cartilage of the neck and the three spherical cartilages¹.

The femur proximal epiphyseal determines an inclination angle (neck-shaft angle) by a synergy action which allows the growth plates of the femoral epiphysis to provide a twice quantity of growth (2x) in direction of femoral neck while the greater trochanter provides (x) quantity of growth, in the same direction. When the growth plate of the trochanteric apophysis is injured, the neck-shaft angle increases (coxa valga), whereas when the epiphysis growth plate is injured, the neck-shaft angle decreases (coxa vara)².

Taking into account these facts, treatment varies according

to age. In our pediatric surgical ward, surgical treatment of femur fracture in children, was open reduction and intramedullary nailing using Rocher or Küntscher nails, with very good short term results. These patients were followed-up until adulthood, to evaluate long term consequence of this treatment on their bone growth.

PATIENTS

18 patients (11 males, 7 females) who had had femur fracture on a non pathological bone were included into the study. They were aged 7 to 15 years at the time of treatment and 21 to 30 years at the time of evaluation with follow-up ranged 12 to 16 years.

METHODS

PROCEDURE

The intramedullary nailing using Rocher or Küntscher nails was applied without fracture table, because of the limited facilities.

This procedure consists of opening the site of fracture, introduction into the medullar canal of a tailored nail by retrograde way to cross the greater trochanter, reduction of the fracture, followed by gentle forward movements to push the nail of which the eyelet was left at 2-3 centimeters above the greater trochanter to permit the removal of the material

after 6 to 18 months.

PARAMETERS OF EVALUATION

Evaluation consisted of clinical examination and radiography of pelvis: face incidence in dorsal position.

- Clinical examination included: measurement of the length of the lower limb and circumference of the thigh at 15 cm to the patella basis.

- Radiographic evaluation included: measurement of neck-shaft angle, the length and the width of femoral neck.

DEFINITIONS OF SEQUELS

CLINICAL DEFINITION:

Lengthening of operated limb was defined as a difference between the two limbs was 2cm at last.

Atrophy of the thigh was defined as a reduction in its circumference of 2 cm at least compared to the other thigh.

RADIOGRAPHIC DEFINITION:

Coxa valga was defined as the neck-shaft angle, higher than 135° .

The femoral neck was lengthened or shortened when the measurement of its length shown a difference of 2 mm on one side compared to the other.

The femoral neck was thinned or thickened when the measurement of its widths shown a difference of 2 mm on one side compared to the other.

CLASSIFICATION OF SEQUELS

Sequels were classified as minors and majors.

Minor sequels included atrophy of the thighs, lengthening of lower member and also lengthening and thinning of femoral neck.

Major sequels included coxa valga with or without minor's sequels.

RESULTS

6 patients were without any sequels. 12 patients presented with clinical and/or radiological sequels.

CLINICAL FINDINGS

8 patients had minors sequels on operated members included: 6 cases of lengthening and 4 cases of atrophy of the thigh. Lengthening of the lower members and atrophy of thigh were associated in 2 cases. The lengthening of the limb

were within 2-3 cm and associated with a limping.

RADIOLOGICAL FINDINGS

5 patients had minor's sequels as lengthening and thinning of femoral neck.

7 patients had majors sequels included: 4 coxa valga with lengthening and thinning of femoral neck (figure 1), 3 coxa valga associated with shortening and thickening of femoral neck (figure 2).

INFLUENCE OF IMPLANT REMOVAL

10 patients declined removal material because of reluctance to a second intervention.

8 patients have had implant removal, 4 at 16 months, 2 at 7 months, 1 at 11 months and 1 at 64 months. In these patients, the neck-shaft angle was increasingly higher than the healthy side. Among them there are 3 cases of coxa valga.

Among the 10 patients who still had their implant in place, there are 4 coxa valga. Their nail eyelet was tucked away with the bone growth or at surface level of greater trochanter (figures 2).

RADIO-CLINICS CORRELATIONS

The table 1 shows relationship between age of intervention and occurrence of coxa valga

The 7 patients with coxa valga were 9 years old on average with age ranged from 7 to 11 years at the time of nailing.

The 11 patients without coxa valga were 12 years old on average with age ranged from 8 to 15 years at the time of nailing.

The 7 cases of coxa valga compared to the length of the lower member were divided into 3 coxa valga out of 6 cases of lengthening of the operated member.

No patients with atrophy presented with coxa valga.

Figure 1

Pelvic radiograph showing , lengthening and thinning of femoral neck

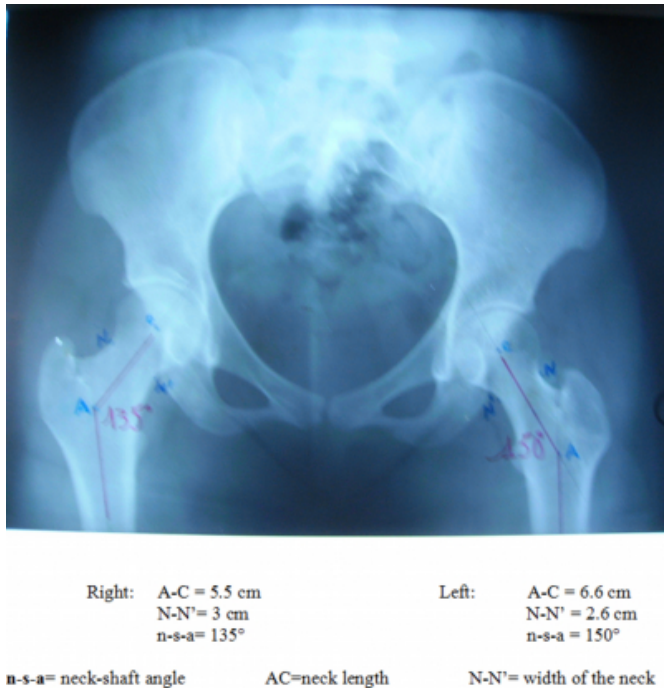


Figure 2

Pelvic radiograph, with femoral neck shortened and squat. Rocher's nail was hidden in the greater trochanter.

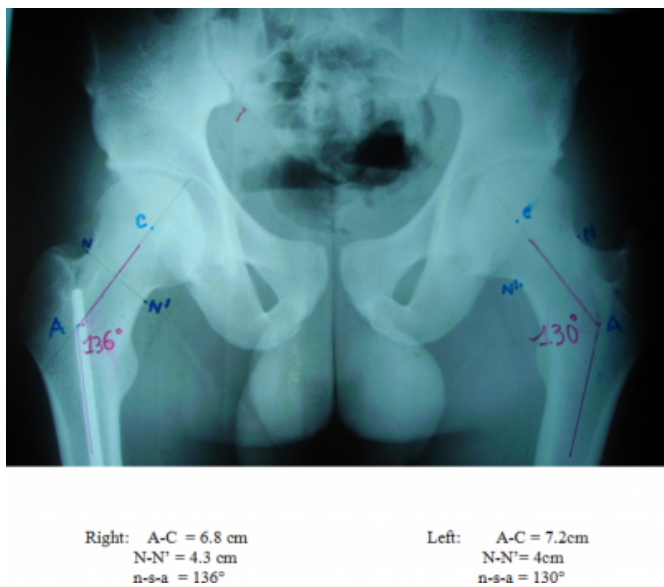


Figure 3

Relationship between age of intervention and occurrence of coxa valga

	Coxa valga	yes	no	Total
Age<12 years old				
yes		7	6	13
no		0	5	5
Total		7	11	18

DISCUSSION

Intramedullary nailing of femur fractures in children using Rocher or Küntscher nails is now abandoned because of growth plate injury, but our limited facilities obliged us to continue with this option. Our evaluation showed sequels that were analyzed.

CLINICAL ASPECTS

The examination of gait and measurement of the lowers members noted 6 cases of lengthening with limping. This inequality was often observed after long bone fracture, and is not results from proximal growth plate destruction. Her genesis results from vicarious lengthening due to periosteum removing during osteosynthesis. Limping was done because of the lengthening who's become evident at 2cm. We noted, that it's rarely a shortening of the fractured member, but rather its lengthening. This observation was also reported by Stock⁴.

RADIOLOGICAL ASPECTS

After analysis of pelvis radiographies we noted 12 abnormal femur proximal epiphysis. These anomalies might result from the destruction of growth cartilage of the greater trochanter which causes the coxa valga, whereas the lesion of the rectangular cartilage of the neck would be responsible for occurrence of thinning and the lengthening, according to Jouve et al.². Gonzalez-Herranz et al.⁵ reported sequels as coxa valga, the stop growthing of the greater trochanter and the thinning of the femoral neck because of the destruction of the trochantero-cervical growth plate. Merki⁶ and Stock⁴ announced the frequency of coxa valga after femoral intramedullary nailing. Orlor et al.⁷, evoked that the femoral intramedullary nailing by antegrade way before the closure of growth plate can lead to ischemic necrosis of femoral head and a coxa-valga. In order to avoid these complications, they suggest that the nail entry point may be

dorso-lateral below the trochanteric physis.

Lechevalier et al.⁸ identified 3 great complications: femoral head necrosis (3 to 5 %), coxa valga with narrowing of femoral neck and neurological complications (5 to 10%). In the same way, Templeton et al.⁹ reported that the intramedullary nailing determines a femoral head necrosis and stop the growth of the greater trochanter.

Besides Darren et al.¹⁰, about a polytraumatized adolescent evoked that apart from the damage due to the nailing, other factors like hypovolemic shock would influence the determinism of osteonecrosis of the femoral head.

THERAPEUTIC ASPECTS

Many options according to age were proposed to treat femoral fracture. Conservative treatment necessitates a long stay in hospital for traction and subsequent immobilization in cast. Among surgical methods, were described plate fixation (submuscular or open), external fixator, flexible intramedullary nails, interlocked intramedullary nails. The safeguard of the growth plates in children lead surgeon a testing of a technique of internal fixation named ‘‘stable elastic intramedullary nailing’’ of Metaizeau¹¹. This technique uses two flexible nails which are introduced percutaneously either through the lower metaphysis or the subtrochanteric area. This technique provided adequate reduction and stabilization, with very low operative risk.

Analyze of the sequels occurring after intramedullary nailing of femur according to Küntscher, confirmed that the crossing of greater trochanter by the nail might be responsible of occurrence of coxa valga. We suggest that this technique must be avoided before 12 years old. In the case of the femur avoid the nailing as long as the growth plates of proximal epiphysis of femoral bone is not closed, particularly the growth plates of the greater trochanter.

Gordon et al.¹², Keeler et al.¹³ with the intramedullary nailing by the antegrade with latero-trochanteric access in children did not observe any proximal deformity as coxa valga or cervical shortening or osteonecrosis.

Before 12 years old we recommend that it is necessary to make as well as possible conservative treatment or a stable elastic intramedullary nailing (ECMES), an alternative to osteosynthesis of shaft fracture or proximal femoral fracture. Indeed ECMES, a method which takes care of the integrity of the growth plates presents very low operative risk^{14,15}.

RADIO-CLINICAL CORRELATION

Coxa valga, majors sequels create an asymmetry of the pelvis, source of the hip instability, responsible of her progressive wear which leads later to coxarthrosis¹. After analyzed of this survey, we observed that coxa valga more affected the younger children under 12 years old. Gonzalez-Herranz et al.⁵ in their series frequently observed this sequel in children under 13 years old. The neck-shaft angle was higher among patients who had implant removal than others. This fact explained that the implant removal constitutes a new aggression of the growth plate which was not yet closed.

Coxa valga could be associated or not with a lengthening or atrophy of thigh on the operated member. This differentiates the genesis from vicarious lengthening due to periosteum removing during osteosynthesis, implant removal and coxa valga due to epiphysiodesis of greater trochanter’s growth plate⁸.

CONCLUSION

Intramedullary nailing of femoral shaft fracture determines in long terms: lengthening of operated member, the coxa valga, the lengthening and the thinning of the femoral neck. These sequels create an asymmetry of pelvis, which may be responsible of a limping. The absence of these sequels among patients operated after 12 years old, authorizes us to continue this procedure in the older patients, while waiting for a favorable conditions. We propose conservative treatment for smallest.

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