

Surgical Treatment of Children's Genu Varum: A Comparison between Two Methods

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Rec date: Mar 23, 2016; Acc date: Aug 10, 2016; Pub date: Aug 12, 2016

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Abstract

Introduction: The Genu Varum is physiological from birth till the age of two. It is a real consultation reason for parents who are often worried seeing this deformation that could cause gait disturbances.

Materials and methods: We conducted a retrospective study over a period of 5 years on 50 patients who went through a rickety genu varum surgery. The patients were divided into two groups: Group 1 (correction of the varus by osteotomy and fixation by Blount staples and long leg cast), Group 2 (progressive correction of the varus by the Ilizarov external fixator). The purpose of this study was to compare the results of the two surgical methods.

Results: The average age was 6.66 years, with ages ranging from 2 to 15 years. Females accounted for 65% and males 35%, a gender ratio of 1.23.

For Group 1 (osteotomy and internal fixation by stapling associated with plaster), the average hospital stay was 22 days (range: 12-50 days). Five cases of hypo-correction and two cases of hypercorrection were recorded. However, we have observed no case of infection and no compression of the plaster under member segment. The plaster was removed within an average of seven (7) weeks.

For Group 2 (Ilizarov correction) the average hospital stay was 9 days (range: 10-18 days). The correction by the external Ilizarov fixator started on postoperative D2. After the hospitalization, the parents continued the correction. There were no complication or hypo-correction recorded in the Group 2.

Discussion: The use of Ilizarov external fixator (progressive correction) did not disrupt the normal process of education of the child because of the reduction in the duration of hospitalization; the child may therefore continue to attend school with the fixative Ilizarov.

Conclusion: Surgical correction by osteotomy of genu varum of rickety origin can prevent discomfort and possibly progressive evolution towards knee osteoarthritis later in life.

Keywords: Genu varum; Children; Osteotomy; Ilizarov; Staples; Infection; Surgical correction; Vitamin D

Introduction

The Genu Varum is physiological from birth till age of 2. It is a real consultation reason for parents who are often worried seeing this deformation that could cause gait disturbances.

Salenius studied the natural evolution of the human morphotype [1]. According to him, the persistence or worsening of Genu Varum beyond 2 years should cause for concern and require for a radiological assessment, an etiological investigation in order to provide adequate treatment. The incidence of infant rickety deficiency was significantly reduced in the proportion of one to third in the early years, with the introduction of infant MILK formulas fortified with Vitamin D in France [2].

Rickets is a skeletal disease that manifests itself at the level of bony areas fast growing and whose main cause is Vitamin D deficiency. This

Vitamin D is indeed necessary in particular to the harmonious mineralization of osteoid tissue metaphysis. Thus, a Vitamin D deficiency causes rickets in growing children, especially in the first two years of life, but also in adolescence. The valgus proximal tibial osteotomy is a treatment option against a progressive deformation in case of failure of other methods. Once achieved this osteotomy can be set either by the Blount staples associated with a knee-ankle-leg cast allowing immediate correction, either by the Ilizarov external fixator that allows a progressive correction.

We conducted a retrospective study over a period of 5 years and 50 patients operated on for genu varum. It was about 29 cases (58%) who benefited from a valgus osteotomy of the proximal tibia with fixation by Blount staples and plaster, et de 21 cases (42%) with a progressive correction of the varum done with the Ilizarov external fixator. This retrospective study was conducted over a period of 5 years in orthopedics and traumatology service. The aim of this study is to compare the results of the medico-surgical management of two methods of fixation.

Patients and Methods

Patients

They were 50 children of the two genders suffering unilateral or bilateral genu varus. Eighty-four cases of genu varum were recorded out of 7550 patients seen during the study period, i.e. a frequency of 1.23%. The mean age of the 50 cases included in the study was 6.66 years, with ages ranging from 2 to 15 years.

Method

This was a retrospective study covering the period from January 1st 2007 to December 31st 2011, that is a period of 5 years.

Were included in our study, severe cases of rickets, meeting the following criteria:

- All patients aged 2-15 years, the axial deformation of the lower limbs (Genu Varum) had moved at the age of walking and who received surgical correction (Figures 1 and 2).
- Treated by valgus osteotomy of one or two pelvic members; with fixation by Blount staples and knee-ankle-pedal plaster (Figure 3).
- Treated a valgus osteotomy of one or two pelvic members with use of the Ilizarov external fixator for the gradual correction of varus; all the patients who had undergone surgery with one of these two techniques during the study period (Figures 4-6).

Were not included in our study:

- Patients aged less than 2 years and those over 15 years
- Children whose genu varum is post-traumatic, post-infectious or congenital
- Patients with inoperable or incomplete file



Figure 1: 5 years old girl with a genu varus before surgical correction.

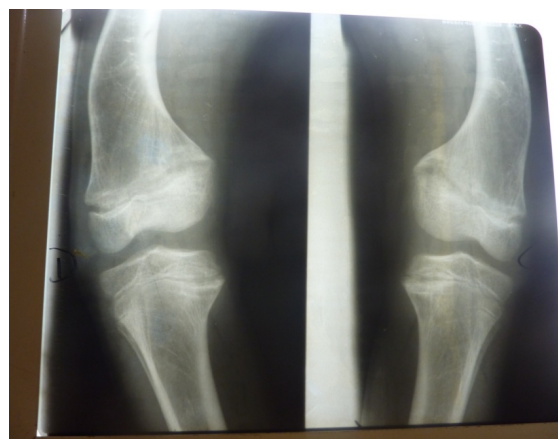


Figure 2: AP X-ray of rickets genu varum.

Angular measurements were performed on the facial radiographic incidences of the member according to the Duparc and Massare technic [3]. Thus the following angles were determined in pre and post-surgery:

- Global angular deviation (GAD)
- Corrected angular deviation (CAD)



Figure 3: X-Ray of consolidation of a valgus closing wedge osteotomy fixation with Blount staples and plaster.

The indication for surgery was decided according to the importance of the angular deviation, the functional impairment, and the desire of the parents to see their child get rid of this defect that worries them very often after the failure of the long and constraining orthopedic treatment.

These deformations being primarily of rickets origin are identified in a standard radiography by the presence of a revised growth plate cartilage, a thinned cortical, a bone demineralization, transversal striations and tibia metaphysis and flared femoral.

The patients were divided into two groups:

- Group 1: 29 cases (58%) who benefited from a valgus osteotomy of the proximal tibia with fixation by Blount staples and plaster.
- Group 2: 21 cases (42%) with a progressive correction of the varum done with the Ilizarov external fixator. This group was composed

mainly of school children of the suburban of the capital and the informed consent of the parents was obtained.

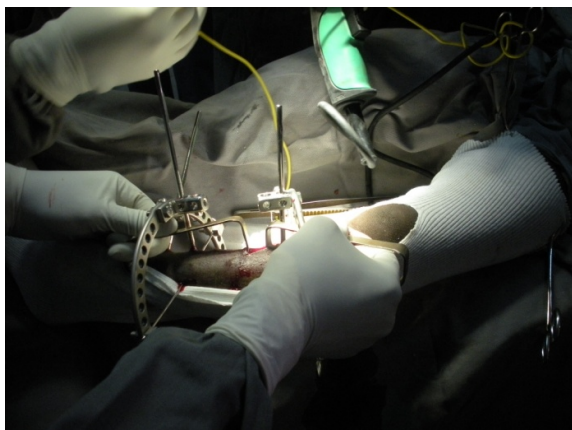


Figure 4: In intraoperative: osteotomy with installation of the Ilizarov fixator.

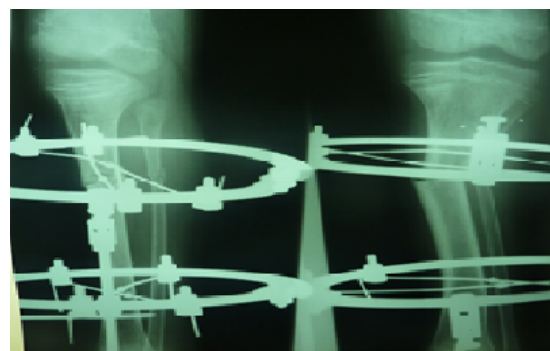


Figure 5: Postoperative X-ray of a tibial valgus osteotomy stroke progressive correction by Ilizarov fixator.

Surgical Technique

- Group 1: supine in patient position general anesthesia plus tourniquet tire of the limb. We performed an osteotomy of the fibula in the middle third, with tracking of cartilage conjugation of the proximal tibia to the amplifier of Brilliance. Then a first side of the proximal tibia to achieve tibial closing wedge osteotomy fixed by Blount staples, suction drain closing soft parts and knee-ankle-leg cast.
- Group 2: patient in supine position with pneumatic tourniquet to the limb. Locating the proximal tibial growth plate. Anterior approach the proximal tibia 0.5 centimeter from the tibial crest remote from the growth plate. Setting up of the Ilizarov fixator. Performing a corticotomy relating to transversal creating an external fixator osseuse. Le continuity solution is closed putting tibia in slight valgus. Closing soft parts.

The correction by the external Ilizarov fixator started on postoperative D2. After the hospitalization, the parents, trained on the processes of a progressive elongation, continued the correction at home. Parents are trained in cleaning with antiseptic sheets of the external fixator (twice daily) to fight against the infection cards. All the patients had received postoperative physiotherapy.

The evaluation of therapeutic results was based on the following criteria:

- Excellent result: no pain, normal flexion-extension movement, CAD less than or equal to 3°;
- Good result: no pain or minimal pain, normal extension with flexion greater or equal to 120°, CAD between 3° and 5°;
- Moderate result: minimal pain, corrected CAD lower or higher 3° to 5° from the physiological value, normal extension and flexion between 110° and 120°;
- Bad result: intense pain, stiffness in normal extension and flexion less than 110°, without correction of varus.



Figure 6: The same girl two years after the surgical correction of the genu varum with the Ilizarov fixator.

Results

Epidemiology

The females were higher in number with 65% of the cases and the males accounted for 35% of the cases, i.e. a gender ratio of 1.85. Most of our patients (34 cases, i.e. 68%) were from rural areas whereas 16 patients (32%) came from urban areas. 37 patients i.e. 90.24% of the cases had received exclusive breastfeeding; mixed feeding was reported in 4 cases i.e. 9.76%.

Clinical

All the patients had consulted for non-aesthetic deformation associated gait disturbances i.e. 100% of the cases as shown in Table 1.

Para-clinical

In 36 cases i.e. 72%, patients had anemia. The radiographic study shows: 43.9% of the patients has cartilage revamped, 65.85% had thinner cortical, 53.66% had bone demineralization, 26.83% had

transverse striations, femoral and tibial metaphyses were flared in 65.85% of the cases.

Deformations	Numbers	Percentage
Bilateral genu varum	23	46%
Gale	17	34%
Right genu varum Isolated	6	12%
Left genu varum Isolated	4	8%
Total	50	100%

Table 1: The different types of varus encountered within the patients.

Treatment

Of all the two groups, the CAD in pre and post-surgery was evaluated. In our series, the CAD in pre-surgery ranged from 6° to 55°, with an average of 19° of varus. After surgery it was an average of 6.63° of valgus i.e. an average correction gains of 12.37°.

Results	Number	Percentage
Excellent	30	60%
Good	10	20%
Average	4	8%
Poor	6	12%
Total	50	100%

Table 2: Functional results of treatment.

For Group 1 (osteotomy and internal fixation by stapling associated with plaster), the average hospital stay was 22 days (12 to 50 days). Five cases of hypo-correction and two cases of hypercorrection were registered, however no case of infection and no compression of the lower limb plaster was observed. The plaster was removed within an average of seven weeks.

For Group 2 (Ilizarov correction), the average hospital stay was 9 days (10 to 18 days). No complication, no hypo-correction or hyper-correction was recorded in the group 2. After correction, the tibial valgus was about 5° in 17 cases and 2° in 4 cases. The removal of the fixator was made after clinical and radiological consolidation which happened after an average of 80 days (Figure 5).

In both groups the surgical correction was accompanied by the administration of calcium and vitamin D in post-surgery for 2 years. The average decrease was 26.5 months (6 to 47 months). The overall results are summarized in Table 2.

Discussion

In our study, the average age is 6.66 years (2 to 15 years). Ibrahimia et al. found an average age of 6.8 years; Chatupon found an average age of 7 years and 2 months [4]. The average age of our series is very close to those found by Chatupon then by Ibrahimia et al. [5]. From these results, the genu varum is essentially found during infancy. The pre-school age is the period of predilection for the disease. Most of the patients (68%) came from rural areas. Ibrahimia et al. noted that 81.7%

of the cases are from peri-urban areas [4]. This predominance of the rural or peri-urban area is related to the poor living conditions often encountered in these environments. In their study of the etiology of the lower limbs deformities in pre-school age children, Joseph et al. found the following radiological signs that are characteristics of rickets syndrome [6]. They have thus noted with consistency diaphyseal deformities with duplication or thinning of the periosteum in 15 cases i.e. 55.55%, a diffuse demineralization, an epiphyseal expansion and a blurred metaphyseal line in 5 cases or 18.51%, a blurred part of the epiphyseal nuclei, an aspect in comb teeth and cupules, Looser-Milkman features in 7 cases (25.92%). These results are comparable to those of our study, confirming the etiology essentially rickets of the genu varum and the severity of the damage in our study. According to Mallet, the severe rickets is a result of a prolonged intake deficiency in children over 2 years of age [2]. This is the stage of bone loss and limbs deformities. There are clear diaphyseal curvatures, especially in the lower limbs. The radiological signs attribute the typical metaphyseal abnormalities in the long bones to a generalized demineralization with reduction of the cortico-diaphyseal index, broken bones being possible in the flat bones.

For most of these authors, the medical treatment consisted of calcium intake and the correction of the anemia caused by the nutritional deficit. Joseph et al. opt for a treatment which consists of either a daily intake of two vials of strong Frubiose calcium (Ergocalciferol associated to 2 calcium derivatives), or the single dose of one vial of SterogylR (Ergocalciferol) associated with the SandozR calcium (Calcium carbonate) [6].

In our study, an intake of Vitamin D associated with calcium intake was prescribed to each rickets patient for at least 2 years. This calcium and vitamin supplementation is justified as the study is done in a Sahel country exposed to regular food crises with a high prevalence of malnutrition among children.

For Group II (osteotomy with progressive re-axing by the Ilizarov external fixator), i.e. 21 patients, we obtained 100% of good results, without any complication on our 21 genu varum corrections. It is legitimate for the important forms, clinically visible, in particular for the varus, to propose a surgical treatment that will have a role of not only relieving the little patient from a painful walk, but also of preventing a development towards osteoarthritis in adulthood. In more severe cases or when the epiphysiodesis is not feasible, a re-axing osteotomy may be proposed, Mallet [2]. Our series was composed mainly of severe forms falling exclusively within surgical treatment by valgus osteotomy. The progressive re-axing is made necessary for important deformities for which the soft tissues (skin, blood vessels, nerves) do not allow a brutal re-axing at once. After the osteotomy is performed, an external fixator that allows a gradual correction is used in the osteotomy so that the skin, the blood vessels and the nerves can adapt to the anatomical modifications, Vincent [7]. We used the osteotomy with gradual correction using the Ilizarov external fixator in 21 of the 50 patients (42%), with excellent results without any hyper or hypo correction or soft tissue damage.

In the group I, out of the 29 (58%) patients who befitted from the correction osteotomy with fixation by Blount staples and plaster, five cases of hypo-correction and two hyper-corrections were recorded with an average hospital stay of 22 days (12 to 50 days) while the average hospital stay for group II was 9 days (10 to 18 days). This is important for school children. Ibrahimia et al reported on a series of 158 cases, 5 cases of external popliteal sciatic paralysis out of which 2 bilateral self-limited, 2 cases of lower limb inequality [4]. Ashfaq et al.

confirmed the excellent results obtained using the mono-lateral and the spatial fixator in the correction of the varus limbs [8]. They recommend the use of the mono-lateral fixator for the correction of varus less than 10° and the spatial fixator for the correction of varus more than 10°. Fitoussi et al. with a series of 8 genu varus, obtained 6 good results with the progressive correction of the tibial varus using the Ilizarov external fixator [9]. Clarke et al. in a series of 38 patients (54 limbs) suffering from tibial varus, used the osteotomy with progressive correction of the varus by the external fixator [10]. They conclude that the external fixator is a credible alternative for a progressive correction of the varus.

Kim et al. in their study about gradual bilateral genu varum correction in skeletal dysplasia using Ilizarov, concluded that the safety and versatility of the Ilizarov method in skeletal dysplasia patients makes it a procedure of choice [11].

The Ilizarov fixator used in a progressive correction of the genu varus hardly generates complications and allows for the participation of the parents in the process. This use of the external fixator does not interfere with the normal schooling process of the child because of the reduced length of hospitalization, the child can continue to go to school with the stably mounted Ilizarov fixator.

Initiation of parents cleaning twice daily sheets of the external fixator lute effectively against the infection plugs that cause instability assembly.

Conclusion

The majority of knee deflections in the frontal plane are physiological. A well conducted clinical examination is almost always enough. There is no non-surgical treatment for progressive deflections. These should be left to the surgeon. The surgical correction of the genu varum of rickety origin by osteotomy enables the treatment of the patients' discomforts and eventually prevent the gradual evolution

towards knee osteoarthritis at a later age. External fixation is an effective alternative for the gradual correction of these axial deviations of the limbs.

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