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## Medial tibial plateau elevation by double osteotomy in severe Blount's disease in low-income country: Short-term outcomes

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### Abstract

**Introduction:** Blount disease is a growth affection characterized by disordered endochondral ossification of the medial part of the proximal tibial physis resulting in multiplanar deformities of the lower limb. Their management is complex and must consider the deformations associated in all the plans. Several therapeutic options can be used. We report a series of 31 patients treated by osteotomy in single step operative procedure.

**Patients and Methods:** It was a retrospective study relating a series continues prospective of 39 knees (31 patients) treated in three different centers in the same period between January 2012 and September 2020. All the patients had an advanced genu varum in the setting of Blount's disease. All the patients had a preoperative pangenometry. The procedure began with a closing-wedge distal femoral osteotomy fixed by plate, when the femoral valgus was associated. The operative procedure comprised four stages. a fibular osteotomy, double tibial osteotomy, osteotomy of the medial tibial plateau and hemiepiphysiodesis of the lateral proximal tibial epiphysis. All the patients were followed clinically and by radiographs in 45<sup>th</sup>, 60<sup>th</sup> and 180<sup>th</sup> day. The clinical assessment and functional calculus were based on the criteria of Schoenecker.

**Results:** At the last 7.4 months follow-up (3 - 13), no complications were observed. Bone consolidation was acquired in 100% of cases. The Schoenecker score was considered good in 10/23 patients (43.47%) and average in 12/23 patients (52.21%). In three (3) patients, the results were considered poor. Two (2) of them were repeated for better restoration of the joint space and the last one was lost to follow-up

**Conclusion:** Blount disease is rare but can be severe. Double ostectomy of medial tibial plateau remains a therapeutic option in the context of developing countries.

**Keywords:** Severe Blount's disease, knee varum, double osteotomy, medial tibial plateau elevation

### 1. Introduction

Blount disease is a growth affection characterized by disordered endochondral ossification of the medial part of the proximal tibial physis resulting in multiplanar deformities of the lower limb [1]. It is initially a proximal tibia vara which in the absence of treatment, evolves under the influence of multiple repeated stress on the medial slope of the tibial plateau gradually to the procurvatum, medial torsion, compensatory valgus of distal femur and shortening of the limb in unilateral case [2,3,4].

The management of these evolved forms then becomes complex because it must consider the deformations associated in all the plans [5,6].

Several therapeutic options can be used. Among them, the raising of the medial tibial plateau accompanied by associated gestures necessary according to the case [7, 8, 9]. The literature proposes a single-time operative strategy to solve all the problems [7]. However, all these works are confined mainly to northern countries and no consensus seems to emerge.

In developing countries like ours, the management of these advanced forms remains a real therapeutic challenge in an environment with a weak technical platform and insufficient resources. In the present study, the authors report the results of patients with advanced Blount disease who were treated in a single operation with dual valgization, derotation and medial tibial plateau osteotomy.

## 2. Patients and Methods

### 2.1 Patients

This retrospective study related to a series continues prospective of 39 knees (31 patients) treated in three different centers in the same period between January 2012 and September 2020. All the patients had an advanced genu varum in the setting of Blount's disease (Fig1): stage I (21 knees),



**Fig 1:** Severe Blount's disease



**Fig 2:** Pangonogram in charge showing deformities in an 11 year-old girl

Stage II (8 knees) according to the classification of Laville [10]. They were 20 girls and 11 boys with a mean age of 9.43 years (range 6-13 years). The average variation inter condylar was of 21 cm (range 12-35). The inequality length of the extremity was 1.06 (range 0.5-2.5). The patients had a frontal ligamentous laxity of the knee. All the patients had a preoperative pangonometry (Fig 2) and with the last retreat. Initial mechanical tibio-femoral angle average was  $149.68^\circ$  (range 135-165); the femoral valgus of  $96.96^\circ$  (range 90-110); the depression of the medial tibial plateau angle was  $40.24^\circ$  (Range 32-50).

### 2.2 Surgical procedure

The procedure began with a closing-wedge distal femoral osteotomy fixed by plate, when the femoral distal valgus was associated. The objective was to have a normal mechanical

tibio-femoral angle of  $90^\circ$ . In many of the cases, the operative procedure comprised four step:

1. A fibular osteotomy has been performed to allow rotational correction and a segment of 2-3 cm was taken and use as graft to support the opening wedge. This osteotomy sat at the higher third part of the fibula.
2. A double tibial osteotomy: a first osteotomy below the level of the tuberosity of derotation and lateral valgisation was carried out by initially anterolateral approach. It was fixed by a plate,
3. A hemiepiphysiodesis of the lateral proximal tibial epiphysis by fastening, using the same approach,
4. An osteotomy of the medial tibial plateau: one realizes by A medial approach with a disinsertion partial of the muscles of the goose leg by exposing under periosteum the slope postero-medial tibial plateau. Against bent is positioned in front of the patellar tendon. A second against bent is placed behind to protect the package vasculo-highly-strung person. A pin of Kirschner 18/10 is placed to metaphyseal range parallel to the depression and moving towards the spines tibiales. The osteotomy is carried out with the scissors struck under the metaphyseal pin while moving towards the spines tibiales without fluoroscopy control. The raising is done gradually using the osteotomes various thicknesses to obtain a sufficient correction. The elevating is maintained by a grip of Meary (Fig 3) and is fixed by a staple of Blount or plate in some case (Fig. 4). A complementary stabilization by a groin to toe plaster cast was carried out during six weeks (Figure 4). The resumption of the support was authorized in two months with use of crushes.



**Fig 3:** Medial tibia plateau elevation



**Fig 4:** Stabilization by plate and staple of blunt

### 2.3 Follow-up method

All the patients were followed clinically and by radiographs

in 45<sup>th</sup>, 60<sup>th</sup> and 180<sup>th</sup> day. The clinical assessment and functional calculus were based on the criteria of Schoenecker [11]. The inequality length of lower extremity was measured from umbilicus to internal malleolus. The amplitude of flexion of the knee was measured using a goniometer. The radiological evaluation related to radiological measurements in preoperative and last retreat, of mechanical axes and depression medial plateau angle.

### 3. Result

At the last 7.4 months follow-up (3-13), no complications were observed. Bone consolidation was acquired in 100% of cases (Fig 5). The average HKA angle was reduced from 149.68 ° to 187.3 ° and the depression angle of the medial plateau (DPMA) from 40.24 ° to 6.62 °. The Schoenecker score was considered good (Fig 6) in 10/23 patients (43.47%) and average in 12/23 patients (52.21%). A bad case was observed, it was a hypocorrection which was corrected by lateral tibial epiphysiodesis. The wildebeest's mean arc of motion was 125 ° (100 - 135) with no flexum or recurvatum. The mean unequal length of the lower limb was 0.6 cm (0 - 1.3). The fixation materials were implanted in eight patients.



Fig 5: Consolidation at last follow-up



Fig 6: Knees centered at last follow-up in a 14-year-old girl

In three (3) patients, the results were considered poor; in those cases, it was insufficient correction. Two (2) of them were reoperated for better restoration of the joint space and the last one was lost to follow-up.

### 4. Discussion

Because of the relative rarity of Blount's disease and the length of the follow-up required for the validity of the results of its treatment by osteotomy, the publications relating to this subject are limited to date mainly to clinical cases, short series and retrospective studies for the most part [8]. Thus, this work suffers not only from its retrospective nature but also from local constraints characterized by the weakness of the technical platform. In addition to the unavailability of the image intensifier for intraoperative fluoroscopic control, the evaluation of the correction angle, which is normally done on CT slices [9], was carried out freehand using the goniometer and the modification of the tibial slope visualized on a few lateral X-rays.

The same is true for the MRI, which was not performed in any of our patients; However, Janoyer [12] indicates the very valuable contribution of the MRI by the information on the cartilage, the menisci and the ligaments, as well as on the blood supply to the growth plates and particularly in the severe forms like ours, it could have made it possible to measure the tibial cartilaginous slope, a more precise parameter than the bone tibial slope measured on X-rays.

In osteotomy options, progressive correction of the distortion of the proximal tibia using the circular external fixator is currently emerging as the technique of choice; in addition to its precision, it is recognized to give early support, early bone consolidation and a short treatment time [13, 14, 15, 12].

However, single-step correction, although it is criticized for the high postoperative morbidities due to several correction gestures in a single step and its imprecision [16], is also practiced especially in advanced forms in children aged more than 4 years like ours with encouraging results.

Of all the studies published on single-step correction, although our average follow-up is costly, but our sample seems to have the largest number. Thus, Fitoussi reported that out of eight children treated, the results were good in six cases, average in one case and poor in one case with recurrence of the varus due to incomplete external epiphysiodesis at 48 months of mean follow-up [7].

#### 4.1 Medial tibial plateau elevation

As Schoenecker *et al.* [9] pointed out, this correction is essential from a slope of 30° as it restores the height of the plateau, joint congruence and improves frontal laxity of the tibial skeleton.

This uplift osteotomy allowed to obtain a correction of the slope, reducing the APDM from 40.26° to 6.62°.

This uplift has been supported in our experience by the lateral subtraction graft. Van Huyssteen [17] used the iliac crest while for Fitoussi [7] it was not necessary to provide support for the medial plateau tibial with a bone graft. The external fixation system used being strong enough to maintain the bone bearing.

The stabilization of the correction was achieved by a plate or by staples which was the fixing material available in our country. The downside to our method is the bulky and uncomfortable plaster requirement, the support delayed for more than 2 months. The use of the Ilizarov external fixator [7, 15, 18] gives solid correction in all planes, gradual readjustments of member's length.

In our series, the distal femoral valgus was corrected in first intention by a femoral varization osteotomy at the same time of operation to obtain a horizontal femorotibial space (Fig 4). This correction of the femoral valgus was necessary according to most of the authors.

In our surgical approach, we did not use a distal osteotomy of the tibial tubercle like Gordon JE [15], because clinically, we did not observe any inferior metaphyseal deformity in the valgus of the tibia.

Raising the medial tibial plateau and correcting the distal femoral valgus contributed to the restoration of the femoral-tibial joint space, thus improving frontal laxity.

Indeed, the absence of frontal laxity during and after surgery was a predictor of relative articular congruence in our series due to the reduced technical platform. We did not use ligament retentive procedures.

#### 4.2 Overall Results

Even if for Sabharwal S [19], the definition of "success" in the treatment of a child with childhood Blount's disease remains subjective and requires consensus. In the short term, we believe that our results are satisfactory in our context of practice (Fig 5). Indeed, many patients presented severe deformities marked by significant collapse of the medial tibial plateau, torsion of the tibial skeleton and joint incongruence. Three (3) bad cases were observed; they have all been linked to an overcorrection of the deformity. Blount once said that incomplete correction tends to cause progressive recurrence [20].

By systematically combining the fixation of all our osteotomies by a screw-retained plate and the lateral epiphysiodesis by a staple, our hidden objective was to reduce the recurrences which are not rare [9, 21, 22] and which the parents of the children should be well informed.

There is really no consensus on the best osteotomy option; each method shows its own advantages and disadvantages [13, 8] especially in severe forms in children over 4 years of age.

In these forms, it can be considered from the literature, given the extent and complexity of angular deformations that progressive correction using an external fixator seems to be a more precise and safer technique.

However, one-step treatment correcting all the factors involved in the deformation remains a current method in an environment marked by a weak technical platform, limited financial resources and unavailability of external fixators.

#### 5. Conclusion

Despite the difficulties of its realization in the absence of radiography image intensifier, double osteotomy of medial tibial plateau remains a therapeutic option in the severe forms of Blount's disease especially in the context of developing countries. It can allow the restitution of the mechanical axes and knee articular congruence.

#### 6. Conflicts of interest: None

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