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Treatment of Severe Genu Valgum Deformity Secondary to Renal Osteodystrophy by Medial Close Wedge Osteotomy using an Innovative Trigonometric Technique of Wedge Calculation

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Abstract

Genu valgum is one of the most common deformity of the knee in which the knee bend toward the midline with increase in the intermalleolar distance. It is often treated surgically with the osteotomy or by growth modulation techniques such as hemiepiphysiodesis using bone staplers. We, hereby, present a case of 16-year-old female with severe genu valgum deformity of bilateral lower limbs secondary to renal osteodystrophy causing pain in her bilateral lower limbs and inability to walk. She was treated by McEwan's close wedge osteotomy using an innovative trigonometric-based technique for calculation of wedge size which resulted in accurate correction of deformity.

Keywords: Genu valgum, renal osteodystrophy, medial close wedge osteotomy, trigonometric method of wedge calculation.

Introduction

Genu valgum is the uniplanar angular deformity of the knee in which both the knee bend toward midline. Mostly, it is a physiologic process that subsides itself by the age of 6 years. Pathological genu valgum may be idiopathic or associated with congenital syndromes like tyrosinemia, metabolic disorders like rickets, or chronic kidney disease (CKD). Unilateral deformity is seen in post-traumatic or post-infective cases. Up to 7–10°of valgus is considered normal but when it exceeds 10°, it becomes symptomatic with pain and limp, which leads to permanent deformity and causes early knee osteoarthritis.

The correction of uniplanar deformity was first described by McEwan [1] in 1878 for correction of rachitic genu valgum by medial close wedge osteotomy.

Genu valgum can be corrected surgically by osteotomy or by growth modulation technique (hemiepiphysiodesis) depending on the age of patient.

The most common complication associated with osteotomy by the empirical method is over/under correction. Hence, it is important to calculate the wedge size correctly to avoid this complication. However, the available methods are either unreliable or too expensive (computer-based). We, hereby, present a case of severe genu valgum deformity secondary to renal osteodystrophy corrected by trigonometric method of wedge calculation which is easy, simple, and accurate.

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Case Report

A 16-year-old girl presented with complaints of severe bilateral genu valgum deformity and difficulty in walking with pain in bilateral knees. The deformity in the right and left side was 38° and 50°, respectively. The intermalleolar distance was 44 cm (Fig. 1).

The patient was a known case of chronic kidney disease (CKD) and her urea and creatinine were 120 mg/dL and 1.7 mEq/L, respectively. Her Hb level was 9 g/dL with TLC 6600/cumm, S. calcium 8.2 mg/dL, S. phosphate 5.2 mg/dL, and S. ALP levels were 333 IU/L.

A knee flexion test was done and the deformity was found to be in the femur as the deformity disappeared on flexion of the knee.

A plain radiograph of her bilateral knees was obtained along with a CT scanogram of bilateral lower limbs (Fig. 2).

After getting clearance for surgery from the nephrology department, McEwan's medial wedge close osteotomy for the left

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Figure 1: Bilateral Genu Valgum deformity with an intermalleolar distance of 44 cm.

Figure 2: CT scanogram of bilateral lower limbs showing severe bilateral genu valgum.

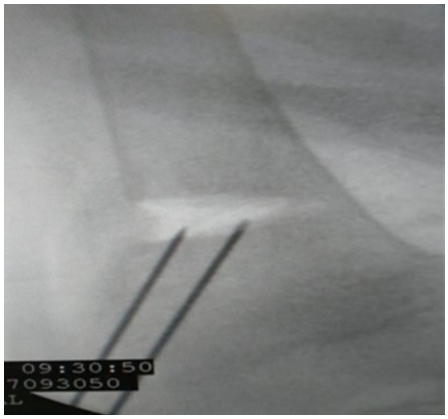

Figure 3: Intraoperative C-arm imaging.

Side	Deformity	O	Canal size	Wedge by trigonometric method	Wedge by empirical method
Right	38^0	31^0	4 cm	2.4 cm	3.1 cm
Left	50^0	43^0	3.8 cm	3.4 cm	4.3 cm

Table 1: Wedge size calculation by trigonometric method and comparison with the empirical method.

femur was done followed by the right femur.

The wedge was calculated by trigonometric method (tanΘ= perpendicular/base) where perpendicular = wedge to be removed, base = canal of the femur, and tanΘ = degree of deformity after 7° of physiologic valgum correction (Table 1).

The osteotomy was stabilized by 2 K-wires (Fig. 3), and postoperatively, an above knee cast was applied (Fig. 4 and 5). Her post-operative recovery was uneventful and weight-wearing was advised after 3 months. At 3 months follow-up, the patient was walking with assistance, and at 6 months follow-up, she was walking without assistance with significant improvement in gait (Fig. 6).

Discussion

CKD is a metabolic cause of genu valgum deformity. The mineral and endocrine functions got disturbed in CKD which is important in the regulation of both initial bone formation during growth and bone structure and function during adulthood. Renal osteodystrophy causes various osteoarticular complications [2]. These complications include growth disturbance (short stature), genu valgum and varum, slipped capital femoral epiphysis, and pathological fracture [3]. Genu valgum, in particular, occurs most often in children with CKD.

Figure 4: Post-operative radiographs of the left side.

Figure 5: Post-operative radiograph of the right side.

Figure 6: Post-operative picture after 6 months follow-up.

According to Oppenheim [4], surgery for children with renal osteodystrophy and knee deformities is quite feasible and requires surgical planning and pre-operative metabolic stabilization. According to the literature [4, 5], serum alkaline phosphatase levels more than 500 IU for more than 10 months preoperatively are associated with the recurrence or failure of the surgical management. In this case, the preoperatively S. ALP was 333 IU/ML.

The valgus deformity of bilateral knees in this patient was very severe which was easily treated by this novel trigonometric method of wedge calculation. The advantage of this method over the empirical method [6] of wedge calculation, in which 1 mm of wedge cut for every 1° of deformity is that it does not lead to limb length discrepancy (LLD) which is a common complication after empirical method which leads to a very significant amount of bone resection causing LLD and instability of osteotomy site.

Many methods have been advised to fix this osteotomy site such as by staples, K-wires, cross K-wires, and plating. However, we choose to fix the osteotomy site by two K-wires which are an easy and efficient method and based on our experience of good recovery in many other cases.

Conclusion

Renal osteodystrophy is associated with several skeletal abnormalities. Many of these angular deformities can be treated with osteotomy of that particular affected part after the cessation of normal growth in the child. As these deformities are prone to relapse, a longer follow-up is required but since the age of the patient was 16 years; further, skeletal growth was not expected after the surgery as relapse of the deformity is mostly seen in the growing age.

On account of the severity, if we had used the conventional empirical method of wedge calculation it would have led to a large size of wedge resection, leading to instability of osteotomy site not amenable to fix by simple fixation methods.

Our case study is significant due to the fact that we have not found any source in the literature treating this amount of severe genu valgum deformity with trigonometric method of wedge calculation in a patient of renal osteodystrophy. Moreover, we suggest the use of the trigonometric method of wedge calculation to be used in every case of genu valgum as it is an easy, accurate, and fast method of correcting the deformity with less complication of LLD [7-9].

Declaration of patient consent: The authors certify that they have obtained all appropriate patient consent forms. In the form, the patient has given his consent for his images and other clinical information to be reported in the Journal. The patient understands that his name and initials will not be published, and due efforts will be made to conceal his identity, but anonymity cannot be guaranteed.

Conflict of Interest: NIL; **Source of Support:** NIL

References

1. McEwan W. Lecture on antiseptic osteotomy for genu valgum, genu varum, and other osseous deformities. Lancet 1878;112:911-4.
2. Wesseling-Perry K, Salusky IB. Chronic kidney disease: Mineral and bone disorder in children. Semin Nephrol 2013;33:169-79.
3. Niki H, Aoki H, Hirano T, Beppu M. Severe genu valgum deformity and slipped capital femoral epiphysis with renal osteodystrophy: A report of two cases. J Orthop Sci 2012;17:500-6.
4. Oppenheim WL, Fischer SR, Salusky IB. Surgical correction of angular deformity of the knee in children with renal osteodystrophy. J Pediatr Orthop 1997;17:41-9.
5. Davids JR, Fisher R, Lum G, Von Glinski S. Angular deformity of the lower extremity in children with renal osteodystrophy. J Pediatr Orthop 1992;12:291-9.
6. Bauer GC, Insall J, Koshino T. Tibial osteotomy in gonarthrosis (osteo arthritis of the knee). J Bone Joint Surg Am 1969;51:1545-63.
7. Filho EL, Torres MR, Silva MR, Lima FR, Anguir JL. Simplified calculation for corrective osteotomies of long bones. Acta Orthop Bras 2016;24:253-8.
8. Warnock KM, Johnson BD, Wright JB, Ambrose CG, Clanton TO, McGarvey WC. Calculation of the opening wedge for a low tibial osteotomy. Foot Ankle Int 2004;25:778-82.
9. Wylie JD, Maak TG. Medial closing-wedge distal femoral osteotomy for genu valgum with lateral compartment disease. Arthrosc Tech 2016;5:e1357-66.

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