Percutaneous upper tibial osteotomy for management of Genu Varum in pediatrics

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ABSTRACT:
Introduction A large proportion of referral from primary care to pediatric orthopedic clinic involve bowed legs (Genu varum). It is important for treating surgeon to understand the normal developmental pattern of a child’s lower limbs in order to ascertain what is physiologic and what is pathologic. A common pathologic causes of genu varum includes Blount’s disease, Rickets, Epiphyseal dysplasia and post-traumatic genu varum.

Different types of surgical procedures have been described for correction of genu varum in pediatrics.

Methods: In this study the authors have used a minimal invasive technique of percutaneous upper tibial osteotomy, we have operated twenty case of bilateral genu varum (40 tibiae), with a mean follow up of six months, correction was maintained by using cast only without any internal fixation.

Results: the final clinical outcome was favorable in the 40 tibiae with no major complications encountered.

Conclusion: the minimal invasive percutaneous technique for upper tibial osteotomy is an effective method in correction of genu varum with the advantage of short operative time, morecosmetic scar and no implant removal is required.

Keywords: percutaneous, tibial, osteotomy, genu varum.

Introduction
Genu varum (bow legs) is an extremely common pediatric deformity, and parents uniformly seek evaluation even though it is rarely symptomatic in the age group (younger than 2 years) in which it is most common. Determining whether the condition represents physiologic genu varum or a pathologic process, such as infantile tibia vara, is critical because the prognosis and treatment differ profoundly. (1) The legs of most newborns are typically bowed, with 10 to 15 degrees of varus angulation. When the infant begins to stand and walk, the bowing may appear more prominent and often seems to involve both the tibia and the distal part of the femur. Concomitant internal tibial torsion may exacerbate the deformity. Clinical measurements of the tibiofemoral angle and intercondylar distance in normal children show maximal varus at 6 to 12 months of age, neutral alignment by 18 to 24 months, maximal genu valgum at 4 years (12 to 14 degrees of tibiofemoral valgus), and a gradual decrease in genu valgum to a mean of 6 degrees by the age of 7 to 8 years.(1) The presence of genu varum after 2 years of age can be considered abnormal, but this “expected” pattern of change over time from genu varum to genu valgum is a generalized standard, and variations may be observed. A distinct subset of patients with more severe varus angulation at initial evaluation, slower resolution to neutral alignment by the age of 3 to 4 years, and radiographic femora vara have been described. (1,2) The differential diagnosis of persistent genu varum still includes physiologic genu varum, which remains the most common etiology, even in a deformity that is slow to resolve and appears to be pathologic. One must also consider infantile tibia vara, physial disturbance secondary to trauma or infection, metabolic bone disease, generalized skeletal dysplasia, and focal fibrocartilaginous dysplasia. All these conditions are diagnosed radiographically. (1,2)

Many methods have been described for correction of genu varum the most common of which is the proximal tibial osteotomy.(3,4) Opening- and closing-wedge osteotomies are generally used, together with dome and chevron-type osteotomies.(5,6) The preferred timing for tibial osteotomies is as soon as it is clear that the deformity is not correcting spontaneously and before the age of four years, thus minimizing the rate of recurrence and of late complication.(6,7) Different type of proximal tibial osteotomy and different fixation methods were described. In 1937 Blount described the use of a high tibial osteotomy for correction of the deformity and refers to
Langensiold's curved osteotomy initially described in 1932 as he used plaster to hold the reduction and does not clarify whether a fibular osteotomy was done in all cases. Some of his postopradiographs demonstrate a fibular osteotomy and not others. He did describe problems with recurrence of the deformity and difficulty retaining the corrected position in plaster. The objectives of this study are to evaluate the minimal invasive percutaneous upper tibial osteotomy regarding stability of the osteotomy after correction and complications risk. Patients and methods: This study was conducted at Qaser Alainy pediatric hospital (Cairo University) in the period from May 2015 to May 2016. With mean follow-up period of 6 months for each patient. A prospective interventional study including 20 children (10 boys and 10 girls) with mean age of 3 years and 8 months with bilateral genu varum deformity, most of the cases were caused by rickets (15 cases) (75%) in whom the metabolic status were corrected by medical treatment before they underwent operative correction, and (5 cases) (25%) were caused by infantile tibia vara (Blount's disease). All patients were treated with percutaneous upper tibial opening wedge osteotomy and stabilized with a knee cast without any internal fixation method. Written consent was obtained from patient's parents for all cases. Inclusion criteria: All cases of genu varum in children more than 3 years old caused by rickets, Blount's disease with no previous surgical treatment. Exclusion criteria: In post-traumatic cases and genu varum caused by epiphyseal dysplasia. Standing AP and lateral views were obtained to determine if the deformity has tibial or femoral component or both, to detect if the patient has active rickets or not, and also for measurement of the tibiofemoral angle and the metaphyseal-diaphyseal angle. Surgical technique: Under general anaesthesia and aseptic condition, a small snip is made one finger breadth below the tuberosity through which 4 or 5

![Figure 1: Demonstration of steps of the percutaneous technique (A).](image1)

![Figure 1: Relationship of Gender to Profession in the Epileptic Patients (B).](image2)
Figure 1 demonstrates steps of the percutaneous technique (C).

Figure 1 demonstrates steps of the percutaneous technique (D).

Figure 1 demonstrates steps of the percutaneous technique (E).

Figure 1 demonstrates steps of the percutaneous technique (F).
Shanz pin is inserted to make a hole in the near cortex, then the pin is directed toward the posterior, postertemidal, medial, and posterolateral cortices then the osteotomy is completed manually by applying a valgus directed force distal to the osteotomy site with one hand while the other hand is holding the part of tibia proximal to the osteotomy site in place, then the deformity is corrected under immage intensifier and above the following figure 1 from A to F demonstratste steps of the closed technique. Postoperatively patients were kept in hospital for 24 hours after the operation under observation and patient’s mothers are instructed to keep their child’s lower limb elevated above the heart level to prevent development of compartment syndrome and also for early detection and intervention if compartment syndrome has developed, the patient discharged from the hospital on the on the second day. Intravenous antibiotic according to child weight is given for before the operation and for 24 hour post operativ, no antibiotic is prescribed after discharge only analgesics and anti-pyretics which are continued for one week post operativa. Post operative X ray is performed after the operation then follow up X rays are performed after 3 weeks and 6 weeks and if required 9 weeks, the correction is assessed by measuring tibofemoral shaft (TFS) angle before and after the operation.

Results: 20 child (40 tibiae) were treated by surgical correction for genu varus deformity using percutaneous upper tibial osteotomy to correct angular and torsional deformity, no cases were missed during follow up, the mean time for radiographic consolidation at osteotomy site were 6 weeks, the mean tibiofemoral angle (TFS angle) preoperatively were 14.65 degrees in varus, and the meanTFSangle after correction were 6 degrees in valgus, and no major complications observed.

Discussion: for correction of genu varum deformity in pediatrics. Regardless the cause of deformity, we used transverse osteotomy which allow correctin of different aspect of the deformity with preservation of the length and restoration of joint alignment, we did not use any form of internal fixation and the correction was maintained by using cast, there were no major complications no neurological problems and no reoperations required for removal of any fixation device. The Natural history of untreated Infantile blount’s disease is not well documented, but spontaneous resolution of the varus deformity is rare.(6). Ingvarsson et al satatated that only one third of all untreated patient with infantile Blount’s disease will have a straight leg without arthritis at the age of 40 years. (9) Zayer concluded that the predisposition to osteoarthritis was not in direct relation to the degree of varus deformity.(6) Hofmann, Jones and Herring found that 37% of the knees in their study were asymptomatic although most had early degenerative arthritis (10), but Doyle, Volk and Smith noted that 68% of their patients were asymptomatic. (11)

There are few reports on the long-term follow -up of patient with infantile Blount’s disease treated by operation. Hofmann et al (9) and Doyle et al (11) followed such patients for over 20 years. Doyle’s group concluded that those with a single osteotomy had a significantly better result than patients who needed reoperation.(11) Recurrence of deformity correlated with the development of late symptoms. No correlation was found between the degree of correction after operation and the final result at follow-up. The preferred timing for tibial osteotomies is as soon as it is clear that the deformity is not correcting spontaneously and before the age of four years, this minimizing the rate of recurrence and of late complication.(6,7) In a retrospective study of 37 children with infantile tibia vara, Ferrier and Shapiro found a rate of recurrence of 57% and complication of 13% in proximal tibial osteotomies performed in the metaphyseal region, including closing- or opening-wedge and dome osteotomies with internal fixation.(7) Laurencin et al described the result of an oblique incomplete, closing-wedge, proximal tibial osteotomy using fixation by lateral tension plate on 18 tibia. The advantage of this method is that no immobilization in a cast is required, but over correction may occur due to fracture of the medial cortex, there is shortening of the limb and the removal of the internal fixation is necessary.(12) Opening-wedge osteotomy, as described by Martin et al , has the advantage of stable fixation and predictive alignment, but need more extensive dissection and a second operation. However, two of their patient required further operation to correct deformity and another with infantile Blount’s disease needed distal tibial rotational osteotomy because of under correction of internal tibial torsion. (13) The use of external fixation for stabilising osteotomies for tibia vara was described by Price et al. This procedure has the advantage of adjustability, early weight-bearing and the ability to lengthen the limb in case of LLD. It’s disadvantages are a longer consolidation time, unsightly scars, and the need for expensive, complex devices. Complications of this method include pin-track infection and post-operative neuropraxia. This technique appears to be more suitable for the adolescent patients with Blount’s disease, in which 82% had good result compared with only 69% in the group of infantile tibia vara.(14)

Conclusion We concluded that, the percutaneous technique of upper tibial medially opening wedge osteotomy with casting is a useful technique for correction of genu varum deformity in pediatrics, and it provides a comparable results to those techniques using internal fixation or external fixation, but without their complications, with the advantage of being cost effective, more cosmetic scar and shorter operative time than the other techniques.

Case presentation: 4 years old child with bilateral genu varum.
References:
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