Treatment of Blount's disease by temporary hemiepiphysiodesis using eight plate

Systematic review

Submitted by

Mohammad Hassan Abbas Abdullah
M.B.B.CH

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Supervised by

Prof.DR. Ahmed Hassan Yousry

Professor of Orthopedic surgery
Faculty of medicine , Ain-shams university

Assist.Prof.DR. Shady Samir Elbeshry

Assistant Professor of Orthopedic surgery
Faculty of medicine , Ain-shams university

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Mohammad Hassan Abbas
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List of abbreviations

Abbreviation	Description
BMI	Body mass index
EBM	Evidence based medicine
KAFO	Knee ankle foot orthosis
LDF	lateral distal femur
LPT	lateral proximal tibia
MAA	Mechanical axis angle
MAD	Mechanical axis deviation
MD angle	Metaphyseal-diaphyseal angle
MPTA	medial proximal tibial angle
NM	Not mentioned
Pt	Patient
RCT	Randomized controlled trials
ROC	Rate of correction
TMDA	tibial metaphyseal-diaphyseal angle

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ABSTRACT

Background: Tibia vara (Blount's disease) is an orthopedic condition that affects young children causing varus deformity of the knee. Blount described tibia vara as "an osteochondrosis located at the medial side of the proximal tibial epiphysis." Currently, tibia vara is considered an acquired disease of the proximal tibial metaphysis, However, rather than an epiphyseal dysplasia or osteochondrosis. The exact cause is unknown, but enchondral ossification seems to be altered. Suggested causative factors include infection, trauma, osteonecrosis and a latent form of rickets, although none of these has been proved. Combination of hereditary and developmental factors is the most likely cause. Weight bearing must be necessary for its development because it does not occur in non-ambulatory patients and the relationship of early walking and obesity to Blount disease has been clearly documented.

Purpose: to establish, through the literatures, what is the effectiveness of temporary hemiepiphysiodesis by eight plate in treating Blount's disease.

Methodology: A systematic review was carried out on several studies which met the inclusion criteria. In this Study we conducted an up-to-date review of the studies discussing results of use of eight plates in temporary hemiepiphysiodesis in Blount disease and published between June 2008 and June 2018.

Results: in our study, success rate is 67.1% with a considerable rate of correction of mechanical axis deviation ranging between 0.58 mm\month to 1.5mm\month. Success rate in infantile age group was 95%, while in adolescent age group was 48%.

Conclusion: it is evident that results of 8-plate in Blount disease is much better in infantile group of age than adolescent group. So, 8-plate can be used in treatment of Blount's disease up to stage IV . The results are better in low BMI and younger age group .

Keywords: *Blount's Disease - Temporary Hemiepiphysiodesis - Eight Plate*

INTRODUCTION

Tibia vara (Blount's disease) is an orthopedic condition that affects young children causing varus deformity of the knee. Blount described tibia vara as "an osteochondrosis located at the medial side of the proximal tibial epiphysis." Currently, tibia vara is considered an acquired disease of the proximal tibial metaphysis, However, rather than an epiphyseal dysplasia or osteochondrosis. The exact cause is unknown, but enchondral ossification seems to be altered. Suggested causative factors include infection, trauma, osteonecrosis and a latent form of rickets, although none of these has been proved. Combination of hereditary and developmental factors is the most likely cause.[(1)] Weight bearing must be necessary for its development because it does not occur in nonambulatory patients and the relationship of early walking and obesity to Blount disease has been clearly documented. [(2)]

Frequency worldwide is less than 1 % of all children born. The condition equally affects boys and girls. African and West Indian Blacks are more affected than Whites but there is a significant increase of the white population affected (reasons unknown). [(2)]

Although the exact cause of tibia vara is controversial, the clinical and radiographic findings are consistent. The abnormality is characterized by varus and internal torsion of the tibia and genu recurvatum. Blount distinguished, according to age at onset, two types of tibia vara : infantile, which begins before 8 years of age, and adolescent which begins after 8 years of age but before skeletal maturity.[(3)]

In tibia vara, characteristically the medial half of the epiphysis as seen on radiographs is short, thin and wedged ; the physis is irregular in contour and slopes medially. The proximal metaphysis forms a projection

medially that is often palpable, but this projection is not diagnostic for tibia vara . However, medial metaphyseal fragmentation is pathognomonic for the development of a progressive tibia vara. The angular deformity occurs just distal to the projection. [4]

The treatment of Blount's disease depends on the age of the child and the severity of the varus deformity. Generally, observation or a trial of bracing is indicated for children below the age of three years but progressive deformity usually requires other options of treatment. Multiple treatment options had been described for this condition. These included corrective osteotomy (acute or gradual correction), elevation of the medial tibial plateau, resection of a physeal bar, lateral hemiepiphysiodesis and guided growth of the proximal tibial physis.[5]

There has been increasing interest in treating Blount's disease by guided growth modulation. The principle of guided growth modulation depends on inhibiting the growth on the lateral aspect of the proximal tibial physis while allowing the medial part of the physis to continue growing resulting in correction of the genu varum deformity. [5]

For decades, the Blount's staples have been used to perform temporary hemiepiphysiodesis for angular deformity correction in children with open growth plates. Recently, the eight-plate guided growth system has gained popularity for use in this procedure. The eight-plate is said to be superior to the Blount's staples, as it is less likely to break or migrate out of the bone. [6]

The eight plate is one of the most recent development in implants used for temporary hemiepiphysiodesis. The eight-plate guided growth system is attached to the bone with two screws, making it more stable. The eight Plate may correct the deformity more quickly than the Blount

staples. Rebound is less likely with the eight-Plate. It has gained acceptance as the preferred primary treatment in treating pediatric lower limb deformities as it is minimally invasive with a lesser morbidity than the traditional osteotomy. Our aim was to determine its safety and efficacy in correcting tibia vara in children younger than 14 years.[6]

OBJECTIVES

This review seeks to establish, through the literatures, what is the effectiveness of temporary hemiepiphysiodesis by eight plate on treating Blount's disease .

The specific review objectives to be addressed are:

- Identification of the success rate of temporary hemiepiphysiodesis by eight plate on treatment of Blount's disease .
- Identification of the possible complications and incidence of those complications resulting from temporary hemiepiphysiodesis using eight plate on treatment of Blount's disease .

RELEVANT SURGICAL ANATOMY, BIOMECHNICS & PATHOMECHANICS

Normal development of tibio-femoral axis

Throughout childhood, the knee joint compensates for the rapid growth and varying stresses placed on it. At birth, a tibio-femoral angle of 15° varus is common. This angle is formed by the intersection of the long axis of the femur and the tibia (see **Figure 1.1**). As a child grows, the varus angle decreases, reaching a neutral point at 14-22 months of age. From there, the knee becomes increasingly valgus, peaking at an angle of 10° at the age of 3-4 years before it stabilizes to an adult level of approximately 6° valgus at the age of 6 or 7 years (see **figure 1.2**). Since young children normally have some degree of physiological varus bowing, it can be difficult to differentiate normal tibia vara from early Blount's disease.[2,3]

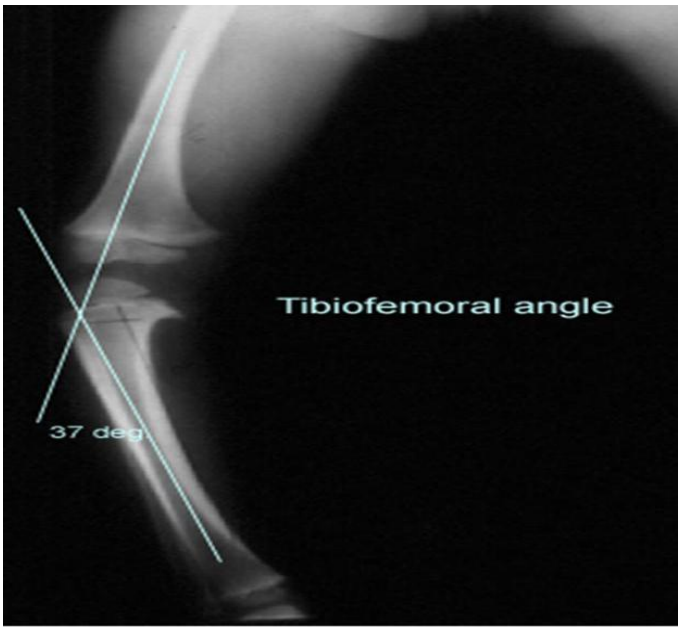

Figure 1.1 Radiograph demonstrating the method of measuring the tibio-femoral angle used in diagnosing Blount's disease.[3]

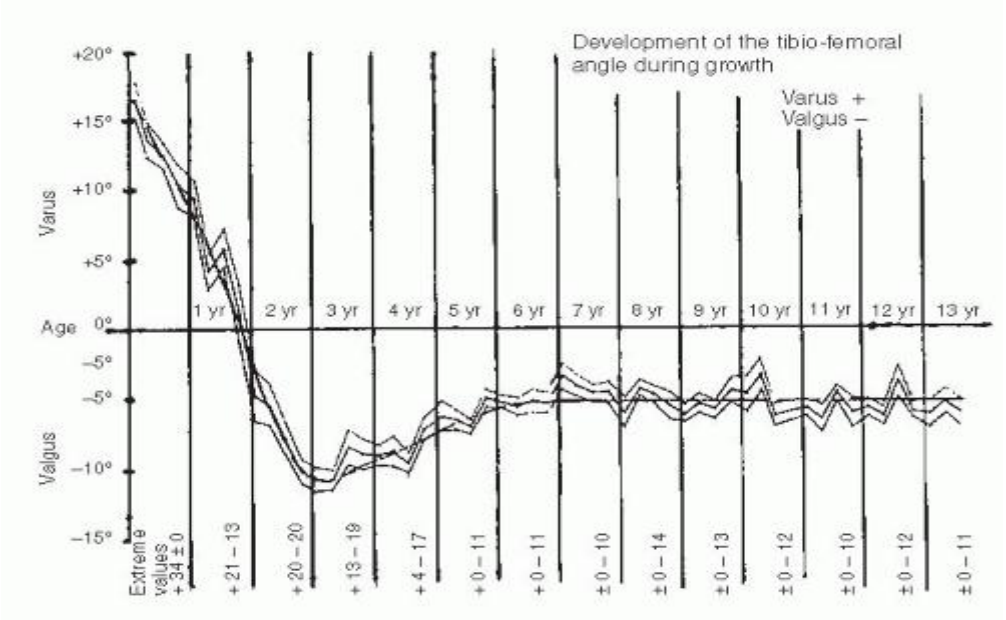

Figure 1.2 : development of tibio-femoral angle with age[7]

Pathomechanics of Blount disease :

Blount's disease is a pathology in the form of disruption of ossification and chondrocyte function of the proximal tibial epiphysis causing outward tibial bowing in children. This outward tibial bowing is called tibia vara . One method of determining the presence and severity of tibia vara is to measure the angle formed between the long axis of the femur and tibia, the tibio-femoral angle (see **Figure 1.1**), on a radiograph. Another angle shown to help distinguish between normal tibial bowing and Blount's disease is the tibial metaphyseal-diaphyseal angle, TMDA (see **Figure 1.3**). "This is calculated by the angle subtended by a line perpendicular to the long axis of the tibia and a line connecting the most prominent beaking on the medial and lateral sides of the proximal metaphysis.".This measurement has been found to play an important role in diagnosing Blount's disease: if the TMDA is less than 11°, there is a 95% chance that the tibial bowing is physiological, but if the angle is greater than 16°, Blount's disease is more likely. [2]

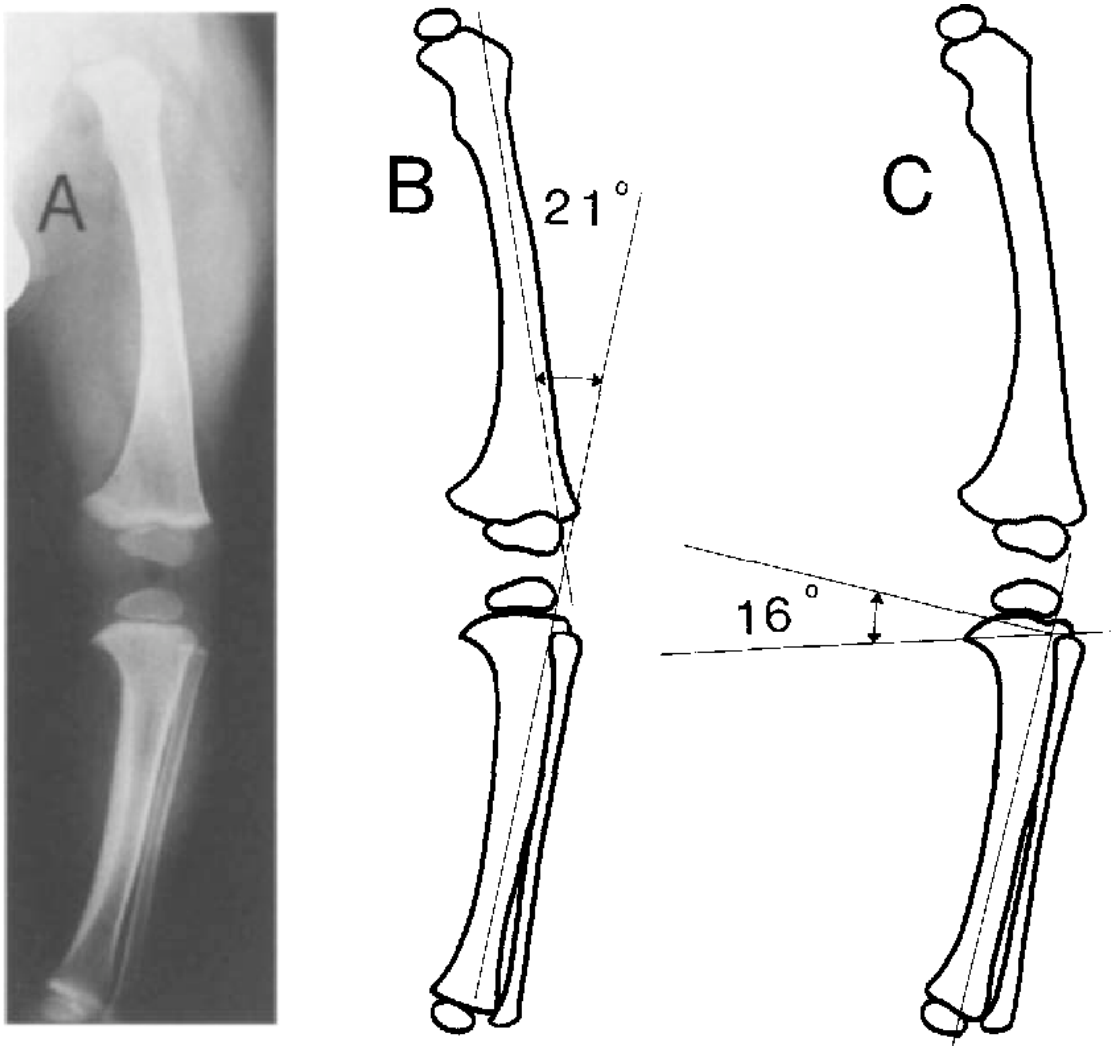

Figure 1.3 Various angles used in diagnosing Blount's disease. A. An AP radiograph demonstrating tibial bowing deformity. B. The tibio-femoral angle measured between the intersection of the tibial and femoral axis. C. The tibial metaphyseal-diaphyseal angle, TDMA, subtended by a line perpendicular to the axis of the tibia and a line connecting the most prominent beaking on the medial side of the proximal metaphysis.[31]