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Dome-Shaped Proximal Tibial Osteotomy For Infantile Genu Varum: Assessment Of Outcomes

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ABSTRACT
Background: The most common deformity of the knee in children is infantile genovarum. We aimed to evaluate the outcome of children with genu varum after proximal tibial dome shaped osteotomy.
Patients and methods: a prospective case study was conducted on 12 patients with Persistent physiological infantile genu varum and underwent Dome-Shaped Proximal Tibial Osteotomy. During follow up period, the angle formed by the femoral condyle and the tibial shaft determined by a line drawn parallel to the inferior surface of the femoral condyle intersecting the anatomical axis of the tibia (femoral condyle-tibial shaft angle), normally about 90°, used for assessment of correction in plain X ray to the knee and tibia to avoid need for full length radiograph. All cases were evaluated pre and post-operatively according to Modified Hospital for Special Surgery Knee Scoring System
Results: 10 (83.3%) knees had full correction of deformity while 1 knee (8.3%) had under correction and 1 knee (8.3%) showed over-correction of deformity. The mean pre-operative HSSKS scores were 70.16±11.3 while the mean post-operative HSSKS scores were 91.4±2.1. The subjects HSSKS results were improved from pre to post-operatively with a statistically significant difference between them.
Conclusion: Dome-Shaped Proximal Tibial Osteotomy is associated with good outcome and the reasonable stability arising from the anteroposterior orientation of the osteotomy and greater surface area for early union, and early weight bearing and active knee exercise indicate a good safety profile and it should be recommended to correct Infantile Genu Varum

Keywords: Infantile Genu Varum; Dome-Shaped Proximal Tibial Osteotomy; Modified Hospital for Special Surgery Knee Scoring System

1. INTRODUCTION:

Proximal tibial osteotomy has been the most frequently used form of surgical management in pediatric genu varum deformity .Many types of valgus osteotomies have been described for correction of genu varum, such as lateral closing wedge osteotomy, medial opening wedge, dome shaped osteotomy, oblique tibial osteotomy, and the intraepiphyseal or transepiphyseal tibial osteotomy for severe deformity. **(1)**
The aims of the proximal tibial osteotomy are correcting the Hip- knee-ankle angle and

stopping the progress of the destruction of the knee joint's medial part. It may be performed by a wide range of techniques including opening wedge, closing wedge and dome shaped surgery methods **(2).**

Dome-shaped osteotomy is the operation for choice when a large degree of correction is needed (18-20 mm open or closed, or more than 20o of angular correction). Although there are different treatment methods for the correction of genu varum, detailed assessments before surgery play an important role in the selection of the appropriate treatment. In addition, the treatment outcomes of these patients are also of particular importance **(3).**

The aim of the present study was to evaluate the outcome of children with genu varum after proximal tibial dome shaped osteotomy.

2. PATIENTS AND METHOD:

This study was a prospective case study and was conducted in Orthopedic Department of Zagazig University Hospitals between March 2019 and May 2020 on 12 patients with bilateral infantile genu varum deformity was recruited from the outpatient clinic of Zagazig University Hospitals.

The study was approved by the ethical committee of Zagazig faculty of medicine. After approval from ethical committee, an informed consent was obtained from all patients in this research. Every patient received an explanation for the purpose of the study. All given data were used for the current medical research only.

Patients presenting with Persistent physiological infantile genu varum -aged 3 years and above - were included in this study. Patients with Blount disease and Adolescent genu varum were excluded from this study

Sheet was taken for every case including: name, age, sex, address, complaint (pain, deformity, metabolic diseases and genetic abnormalities), and side of the deformity, onset of deformity, physiological or pathological, and progression of the deformity. General examination was done to exclude other metabolic,

congenital or developmental causes of infantile genu varum.

Local examination which include: range of knee movement, the stability of the knees, lateral thrust when walking and rotational deformity. Full-length weight-bearing antero-posterior (with both patella facing forward) radiographic views of both lower extremities (teleradiographs) and Lateral radiographs of affected limb segments had been done for all cases.

Deformity was assessed based on principles outlined by **Paley et al. (4).** Cases had frontal plane analysis suggested mechanical axis deviation (MAD), tibial–femoral angle (TFA), CORA, medial proximal tibial angle (MPTA), and sagittal plane analysis for posterior proximal tibial angle (PPTA) assessment as shown in figure (38)

During follow up period, the angle formed by the femoral condyle and the tibial shaft determined by a line drawn parallel to the inferior surface of the femoral condyle intersecting the anatomical axis of the tibia (femoral condyle-tibial shaft angle), normally about 90°, used for assessment of correction in plain X ray to the knee and tibia to avoid need for full length radiograph

All cases were evaluated pre and post-operatively according to Modified Hospital for Special Surgery Knee Scoring System (HSSKS) **(5).**

3. RESULTS:

In the present study, age and sex distribution among studied group of patients, the mean age

was 5.91±1.62, ranged (4-9) years. 8 (66.7%) of them were males and the rest 4 (33.3%) were females.
Pre-operative ligamentous laxity among the studied legs, 4 (33.3%) of the patients had positive testing for pre-operative ligamentous laxity.

Tibiofemoral angle: preoperative was 21.75±5.65, while postoperative was 3.18±1.97 (P< 0.00**). Femoral condyle-tibial shaft (FTA): preoperative was 16.37±2.89, while postoperative was 3.25±1.12, Paired t 16.842 (p<0.00**). Metaphyseal diaphyseal angle (MDA): Preoperative was 15.875±2.6, versus 3.62±1.23 postoperatively, Paired t 16.409 (P<0.00**). All angles decreased from pre to post-operatively among the studied legs with a statistically significant difference. In the present study, outcome distribution among the studied legs, 10 legs (83.3%) legs had full correction while 1 legs (8.3%) had under correction with 1 leg has been (8.3%) overcorrected.
In the present study, post-operative complications among the studied legs, 2 cases (16.6%) had post-operative swelling and superficial infection was founded among 3 (25%) cases. All complications were addressed and managed conservatively during early post-operative follow up.
Regarding pre and post-operative Modified Hospital for Special Surgery Knee Scoring System (HSSKS) scores in which the pre- operative mean score was 70.16±11.3 versus 91.4±2.1 post-operatively with a statistically significant difference in between (p<0.05).
Superficial infection was reported in 3 cases (25%) and treated by local and systemic antibiotics. Anti-edematous drugs and limb elevation were used in two patient developed moderate to severe edema.

Table 1: Pre-operative ligamentous laxity distribution among studied knees (N=12).

		N	**%**
Pre-operative ligamentous laxity	-VE	8	66.7
	+VE	4	33.3
	Total	12	100.0

Table 2: Radiological assessment for Femoral condyle-tibial shaft angle, Metaphyseal-diaphyseal angle and tibio-femoral angle pre and post-operatively

Angle	**Pre**	**Post**	**Paired t**	**P**
Femoral condyle-tibial shaft angle	16.37±2.89	3.25±1.12	16.842	0.00**
Metaphyseal- diaphyseal angle	15.875±2.6	3.62±1.23	16.409	0.00**
Tibio-femoral	21.75±5.65	3.18±1.97	14.871	0.00**

Table 3: Outcome distribution regarding under, full and over-correction of deformity among studied legs (N=12).

		N	**%**
Outcome	Full	10	83.4
	Under	1	8.3
	Over	1	8.3
	Total	12	100.0

4. DISCUSSION:

Dome shaped tibial osteotomy corrects accurately both the angular and rotational malalignment that occurs in patients with moderate to severe degrees of tibial deformity whilst maintaining bone length. Good bony apposition occurred **(6).**

In the present study, age and sex distribution among studied group of patients, the mean age was 5.91±1.62, ranged (4-9) years. 8 (66.7%) of them were males and the rest 4 (33.3%) were females.

In a study of **Nadeem et al. (7),** the mean age at surgery 10.25 years (range 4.0–15.25 years), and from 31 patients included in that study 18 patients were males and the rest 13 patients were females.

However, in a study presented by **Ahmed and Abdullah (8),** the mean age was 4.02 ± 0.84 and ranged (3–6) years. 58.3 % of them were males and the rest 41.7% were females which is comparable to our patient's characters.

Pre-operative ligamentous laxity among the studied legs in the present study, 4 (33.3%) of the patients had positive testing for pre- operative ligamentous laxity.

In the study of **Ahmed and Abdullah (8),** they reported that 41% of children included in that study had pre-operative ligamentous laxity which was agreed with our results.

In the present study, radiological angles assessment and distribution pre and post intervention. Tibiofemoral angle: preoperative was 21.75±5.65, while postoperative was 3.18±1.97 (P< 0.00**). Femoral condyle-tibial shaft (FTA): preoperative was 16.37±2.89, while postoperative was 3.25±1.12, Paired t 16.842 (p<0.00**). Metaphyseal diaphyseal angle (MDA): Preoperative was 15.875±2.6, versus 3.62±1.23 postoperatively, Paired t 16.409 (P<0.00**). All angles decreased from pre to post-operatively among the studied legs with a statistically significant difference. In the present study, outcome distribution among the studied legs, 10 legs (83.3%) legs had full correction while 1 legs (8.3%) had under correction with 1 leg has been (8.3%) overcorrected. In the study of **Tabatabaei et al. (9)**, they concluded that the mean tibiofemoral angle was significantly reduced after the surgery compared with before the surgery (P < 0.001), which is consistent with our results.

There are contradictions in various studies on the amount of the correction of the valgus angle. In a study of **Insall et al. (10)**, they reported that an amount of post-operative valgus correction between 5° and 14° is acceptable.

However, in a study presented by **Pourfeiz et al. (11)**, they concluded that the tibiofemoral angle in dome-shaped osteotomy reduced significantly and reached from 12.7 ± 3.7 before surgery to 4.2 ±

0.8 after surgery, which is also comparable to our study results.

In the study of **Rezaeizadeh et al. (12**), the average varus angle changes from 17.5 to 5.5 valgus degrees after proximal tibial osteotomy using dome-shaped method.

In a study of **Geith and El. Naggar (6),** they showed that the mean tibiofemoral angle reached from 19° (between 19 and 26 varus degrees) before proximal tibial osteotomy to a mean of 2° (5° valgus-15° varus) after dome-shaped osteotomy

The results of all studies mentioned were agreed to our current study results, indicating that the effectiveness of this technique is in the correction of the tibiofemoral angle.

In the study of **Ahmed and Abdullah (8),** the mean thigh-foot angle was much improved from −7.83±2.84° (5–15 in internal rotation) preoperatively to a postoperative value of 2.08±1.74° (0–5 in external rotation).

The radiological parameters (tibiofemoral angle, mechanical axis deviation, and metaphyseal-diaphyseal angle) showed a significant improvement in the postoperative mean values when compared with the preoperative mean values.

In the present study, post-operative complications among the studied legs, 2 cases (16.6%) had post-operative swelling and superficial infection was founded among 3 (25%) cases. All complications were addressed and managed conservatively during early post-operative follow up. In the study of **Tabatabaei et al. (9),** they reported that, in none of the patients, post-operative complications such as peroneal nerve damage, infection, compartment syndrome, venous thrombosis, fractures, lack of complete correction, and over-correction were observed.

In the study of **Ahmed and Abdullah (8),** they reported that, the findings showed absence of skin necrosis, wound dehiscence, vascular insufficiency, peroneal nerve palsy, and compartment syndrome. There was no evidence of recurrence of the deformity in the studied patients in the early follow-up period, but longer follow-up till skeletal maturity is recommended to confirm this evidence.

Regarding pre and post-operative Modified Hospital for Special Surgery Knee Scoring System (HSSKS) scores in the present study in which the pre-operative mean score was 70.16±11.3 versus 91.4±2.1 post-operatively with a statistically significant difference in between ($p<0.05$). These results were comparable to results of a study presented by **Tabatabaei et al. (9),** in which a significant improvement in post- operative knee function score (HSSKS) was obtained. Furthermore, the amount of this index in all patients was between 80 and 85, which is indicative of good knee performance.

In the study of **Chiang et al. (13),** they reported excellent or good performance in 94.73% of the knees, which underwent dome-shaped proximal osteotomy surgery for correction of geno-varum, which is consistent with our results.

In the study of **Geith and El. Naggar AM (6)**, they reported that, at a mean time of 30-months of follow-up, all patients had a good clinical and radiological correction of deformity with improvement of preoperative symptoms, which comes in agreement of our results.

We can conclude that Dome-Shaped Proximal Tibial Osteotomy is associated with good outcome and the reasonable stability arising from the anteroposterior orientation of the osteotomy and greater surface area for early union, and early weight bearing and active knee exercise indicate a good safety profile and it should be recommended to correct Infantile Genu Varum

Conflict of Interest: No conflict of interest.

5. REFERENCES:

[1] **Sabzevari S, Adel Ebrahimpour A, Roudi MK, Kachooei AR. (2016)** High tibial osteotomy: a systematic review and current concept. Arch Bone Jt Surg; 4:204–212.

[2] **Canale ST, Beaty JH. (2008)** Campbell's Operative Orthopaedics. 11th ed.

[3] Philadelphia, PA: Mosby Elsevier.

[4] **Paccola C. A. (2015).** Pre-operative planning and surgical technique of the open wedge supracondylar osteotomy for correction of valgus knee and fixation with a fixed-angle implant. revista brasileira de ortopedia, 45(6), 627–635.

[5] **Paley D. (2002).** Principles of deformity correction. Verlag Berlin Heidelberg: Springer.

[6] **(5).Hofmann AA, Tkach TK, Evanich CJ (1997)** patellar component medialization in total knee arthroplasty. J Arthroplasty 1997; 12:155-160.

[7] **Geith MA, Naggar AM. (2016)** Modified dome shaped proximal tibial osteotomy for treatment of infantile tibia vara. Int J Res Orthop; 2:394-9.

[8] **Nadeem R.D, Quick T J, & Eastwood D. M (2005).** Focal dome osteotomy for the correction of tibial deformity in children. Journal of Pediatric Orthopaedics B; 14(5): 340-346.

[9] **Ahmed A.A. Y, & Abdullah E.A (2018)** Anteroposterior inverted-U proximal tibial osteotomy without internal fixation for correction of angular and torsional deformities in children with infantile tibia vara. The Egyptian Orthopaedic Journal; 53(4): 373.

[10] **Tabatabaei S Narimani A & Mehramiri S. (2017)**. Assessment of the Treatment Outcomes of Dome-shaped Proximal Tibial Osteotomy in Patients with Genu Varum Referred to Razi Hospital. Asian Journal of Pharmaceutics; 11(3): S667-S671.

[11] **Insall JN, Joseph DM, Msika C (1995)** High tibial osteotomy for varus gonarthrosis. A long-term follow-up study. J Bone Joint Surg Am; 66: 1040-8.

[12] **Pourfeiz HH, Soleimanpour J, Sales JG, Taleb H, Tabrizi (2014).** Comparison of the short time outcomes of geno varum correcting surgery between the open wedge and dome shape high tibial osteotomies. Med J Tabriz Univ Med Sci Health Serv; 35:32-7.

[13] **Rezaeizadeh A (2006).** High tibial dome shape osteotomy for symptomatic geno-varum in young adults. Res J Math Stat; 12:77-84.

[14] **Chiang H, Hsu HC, Jiang CC (2006)** Dome-shaped high tibial osteotomy: A long-term follow-up study. J Formos Med Assoc; 105:214-9.