

Impact of physiotherapy on a female child with bilateral genu valgum managed with hemiepiphysiodesis: A case report

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Abstract

Genu valgum is also known as knock knee. It is most commonly seen in children, but this condition gets ignored in most cases until the child presents with an altered cosmetic appearance with irregular gait, pain, altered patellar tracking, difficulty in walking, and discomfort in performing activities of daily living. Determining whether the deformity is primary at the femur or tibia is important. Hemiepiphysiodesis, a guided growth plate of the femur or tibia, is a surgical procedure to correct the altered alignment at the knee joint. In this study, the assessment of a 9-year-old child with genu valgum was done pre-operatively as well as post-operatively. Physiotherapy is crucial in the post-operative management of genu valgum, focusing on pain reduction, improving muscle strength, and enhancing range of motion. This rehabilitation protocol was successfully implemented in a 9-year-old child post-hemiepiphysiodesis, leading to significant improvements in lower extremity function and quality of life. The child showed enhanced confidence, reduced social stigma, and actively participated in daily and recreational activities.

Keywords: Genu valgum; Orthopedic Procedures; Physiotherapy; Quality of life

1. Introduction

Genu valgum, commonly referred to as knock knees, is a prevalent condition in children, with a prevalence of 11.27% in South India. ^[1] The condition can be either unilateral or bilateral and is influenced by various etiological factors. Early diagnosis is crucial for determining whether the valgus is physiological or pathological for understanding the progression of deformity and which treatment protocol to follow. ^[2]

The natural history of the development of knee joint and knowledge of the tibiofemoral angle is a key factor for distinguishing between pathological and physiological knee valgus. It is important to determine whether deformity is primary at the femur or tibia, this is done by measuring two angles: Lateral Distal Femoral Angle (LDFA) and Medial Proximal Tibial Angle (MPTA). ^[3]

The first line of treatment for angular deformities with metabolic disorders is treating underlying disease & then surgical correction. Surgical correction is recommended for cases with significant angular deformity, typically managed

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with hemiepiphysiodesis in children under 10 years of age with genu valgus greater than 15-20 degrees whose mechanical axis falls on the lateral quadrant of the tibia. Osteotomy is another surgical correction usually done in children more than 10 years of age with skeletally mature growth. [4]

Skeletal age & physeal width are an important factor in predicting the timing of epiphysiodesis for angular deformity correction with growth charts. The younger the patient, the more rapid correction is obtained. Removal of hardware is needed to avoid overcorrection & close monitoring is done. Post-operative rehabilitation is a must for improving long-term outcomes in genu valgus patients. Early rehabilitation is necessary as physiotherapy has a significant effect on the rehabilitation of genu valgus for improving Quality of life (QOL). [5]

1.1. Case presentation

A 9-year-old female child was experiencing bilateral knee joint pain. Parents noticed her altered gait while walking and staircase climbing in May 2023. She was then brought to a tertiary care hospital and radiological investigations (Fig.1 and Fig. 4) were done with a diagnosis of bilateral genu valgum. Vitamin D3 and Calcium investigations also indicated a deficiency of Vitamin D3 (9.51 ng/mL) and calcium (8.7 mg/dL) therefore the patient was advised a 1-month course of Vit. D3 (800 IU/day) and Tab. Calcium (500 Mg TDS). After a month Injection Arachitol (60k IU) was given once in 15 days with a total of 4 dosages. She was observed for a couple of months and Vit D3 levels got back to 38.47 ng/mL with no significant correction in deformity hence surgical correction of B/L genu valgum deformity was indicated. B/L hemiepiphysiodesis was done on 2nd Aug 2023 for the distal femur (Fig.2 and Fig.3).

After that child was referred to physiotherapy on postoperative day 2. The physiotherapy protocol describing therapeutic intervention is given in Table 1.

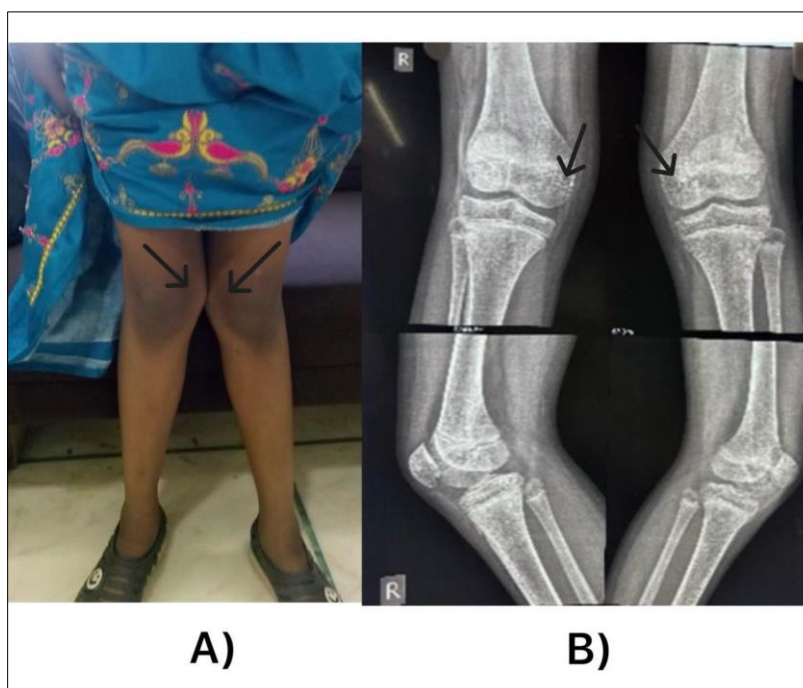


Figure 1 Pre-operative assessment of a child with bilateral genu valgus deformity. (a) The pre-operative posture of the child. (b) Pre-operative X-ray showing bilateral genu valgus deformity, with growth arrest lines visible in the visualized portion of the shaft of both femur bones



Figure 2 Post-operative assessment on day 5. The posture of the child on post-operative day 5, showed improved alignment and mobility following the procedure

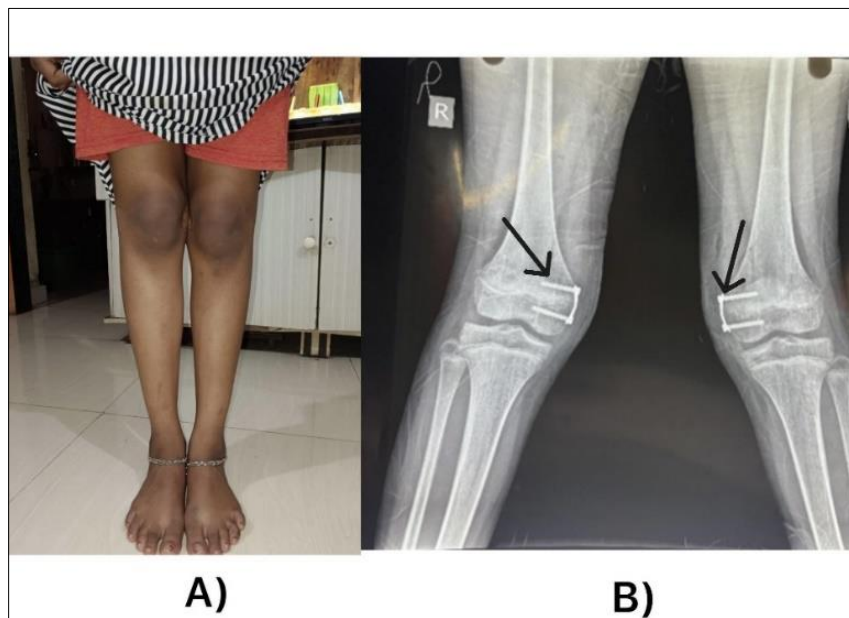


Figure 3 Post-operative assessment at 3 weeks following hemiepiphysiodesis. (a) Post-operative posture of the child. (b) Post-operative X-ray at 3 weeks showing the presence of 8-plate and screws bilaterally on the medial side of the femur, indicating successful hemiepiphysiodesis.

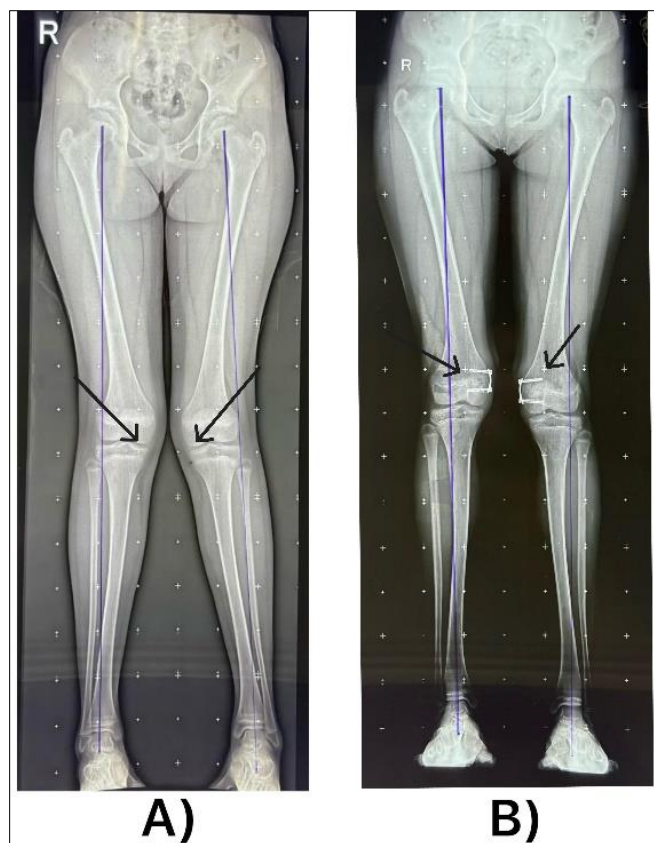


Figure 4 Pre-operative and post-operative scanograms. (a) Pre-operative scanogram at 6 weeks showing a Lateral Distal Femoral Angle (LDFA) of 78° on the right and 79° on the left. (b) Post-operative scanogram showing improved alignment with a Lateral Distal Femoral Angle (LDFA) of 83° on both the right and left femur

1.2. Clinical findings

1.2.1. On observation

A thorough clinical examination was performed with patient and parent consent. The scar was visible on the medial side bilaterally. Calcaneal valgus was seen bilaterally with an increase degree of toe out on right side. The right knee was 20 degrees flexed. While walking hip flexion decreased and circumduction was present on the left side with decreased bilaterally swing time and direct foot contact. Weakness of hamstrings, gluteus medius, and dorsiflexors indicated an imbalance in musculature around hip and knee joints.

1.2.2. On palpation

Pain was present bilaterally while bending the knee post-operatively at the end range which was graded 7/10 on VAS on Post-operative day 2. Reduced ROM for knee joint flexion left > right was documented. Angle dorsiflexion is reduced left > right this is confirmed through assessment of tightness of plantar flexors. Manual muscle testing examination revealed weakness of the hamstring, gluteus medius, gluteus maximus, and core muscles.

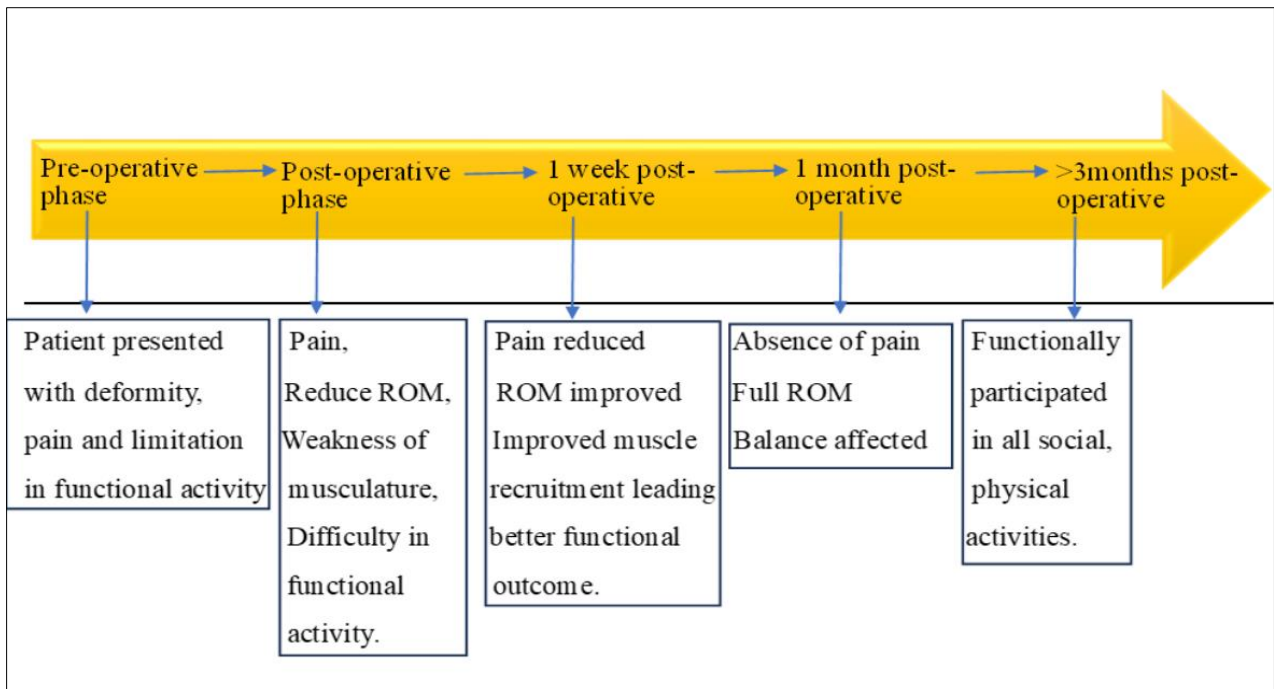


Figure 5 Timeline of patient’s clinical course. A representation of the patient’s key milestones, including pre-operative assessment, surgical intervention, and post-operative recovery stages

Table 1 Therapeutic interventions for genu valgum rehabilitation

Phase	Aim	Physiotherapy Intervention	Outcome measures
Pre-Operative Period:	Patient Education and parent counseling	Educating parents and child regarding health status, surgery, recovery, and the importance of rehabilitation.	Lower extremity function scale: Pre-operative score: 42/80
Maximum protection Period: (Immediate post-operative 0-7days)	Patient Education and counseling	Above patient and parent education continued in post operative period too.	VAS at post-operative Day 1: 7/10
	Reduce pain and swelling.	1. To reduce inflammation: cryotherapy with elevation. 2. Relaxation – Jacobson's technique and deep breathing exercises. [6] 3. Electrotherapy: NMES for Quadriceps stimulation to gain pumping effect for reducing inflammatory exudate and indirectly reducing swelling and pain.	
	Recruiting muscles for improving stability at the knee joint.	For improving reflex inhibition of quadriceps, isometric exercises of quadriceps as well as setting exercises of hamstrings are done with holds.	
	Improve ROM	1. Heel slides within pain-free range for improving hip and knee ROM.	

		2. Bedside sitting 3. Dynamic quadriceps exercise 4. Continuous passive motion.	
Moderate protection period: Phase 1: (2-4 Weeks Post-operative)	Strengthening of hip and knee musculature.	Progressive resisted exercise (PRE) is based on principles of strengthening hip and knee muscles using theraband, and weight cuffs.[7] 2. Cycling against resistance.	VAS at 1 week post-operative: 5/10.
	Gait training.	Full weight bearing initially with walker then progressed to independent walking.	
	Stretching of tight musculature	Stretching protocol of tendoachilies and hip flexors.	
Moderate protection period phase - 2: (4-6 Weeks Post-operative)	Improve balance and proprioception.	Exercise protocol involving weight transfers, one leg stance, tandem standing and walking, and bosu ball training.	VAS at 1-month post-operative: 3/10
	Functional training.	Side walking, backward walking, sit-to-stand training, staircase climbing.	
	Progression of previous exercises.	Wall squats, Lunges.	
Minimum protection period: Return to activity (>6 weeks)	Improve functional activity and training for endurance.	Agility training Spot running, marching Step-up and down exercises Cycling progression, Gradual return to recreational exercises.	VAS at 3 months post-operative: 0/10 Post score of Lower extremity functional scale: 75/80 Indicates improved lower extremity function post-operative with rehabilitation.

2. Discussion

In genu valgum child presents with irregular gait, pain, patellar malalignment difficulty in walking, and discomfort in performing activities of daily living.^[8] In this study assessment of a 9-year-old child with genu valgum was done pre-operatively and then the child was reassessed post-operatively. The surgical approach depends on the age of the child and the maturity of the bone. In this case, Hemiepiphyodesis i.e. guided growth plate of the femur is performed according to measurement of the Lateral Distal Femoral Angle and Medial Proximal Tibial Angle in non- skeletally mature child. Removal of hardware may need to be performed to avoid over-correction of varus. Since there is a tendency for rebound growth, it is recommended to allow over-correction before hardware removal. Therefore, keen follow-up of the patient is important. The distal femur or proximal tibial osteotomies are also been done for correction of genu valgum in late adolescents and young adults but guided growth modulation is a first-line treatment widely adopted to correct lower limb angulations.

Studies, such as Maleki et al., have demonstrated the effectiveness of hemiepiphyodesis in correcting angular deformities with minimal complications.^[9] Another study also stated that patient age has a considerable effect on hemiepiphyodesis outcome but not the gender of the child concluding that if surgery is performed earlier that is before the skeletal maturity of a child, then a better outcome can be achieved. ^[10]

Post-operative rehabilitation is essential in optimizing the outcomes of hemiepiphysiodesis, with a primary focus on restoring range of motion, strengthening muscles, and alleviating pain. The limitation of this study is subjective measures such as patient-reported pain levels or functional outcomes were used. These measures can be influenced by psychological factors, such as the patient's expectations or perception of improvement.

Physiotherapy rehabilitation includes treating patients from the maximum protection phase to return to sports activity. This makes the patient more confident and functionally independent. The child participates more socially. Rehabilitation of children with genu valgum has a lot of evidence but there is a paucity of literature regarding rehabilitation of genu valgum post hemiepiphysiodesis. If patients are not undergoing rehabilitation post-operatively, patient may end up with muscular imbalance leading to further aches and altered posture.

3. Conclusion

Early diagnosis and timely surgical intervention, followed by structured physiotherapy, are critical for children with genu valgum. Skeletal growth maturity should be taken into consideration for appropriate surgical intervention. Physiotherapy rehabilitation should include early mobilization in the maximum protection phase and the child should be rehabilitated till returns to recreational activity. This comprehensive approach significantly enhances muscle strength, balance, and functional independence, leading to improved quality of life and social participation, as demonstrated in this case.

Patient perspective

The patient experienced improved QOL and her confidence was boosted regarding the cosmetic appearance of knee valgus due to surgical correction and physiotherapy rehabilitation. The patient's social participation has improved and she does not experience any social stigma which was previously present. Parents were happy regarding her improved involvement in academic as well as recreational activities. The child felt more confident. Pain was absent with no difficulties in performing ADLs.

Abbreviations

- LDFA: Lateral Distal Femoral Angle
- MPTA: Medial Proximal Tibial Angle
- QOL: Quality of life
- B/L: Bilateral
- ng/mL: nanogram/millimeter
- mg/dL: milligram/deciliter
- VAS: Visual Analogue Scale
- ROM: Range of motion
- NMES: Neuromuscular Electrical Stimulation
- ADL: Activities of daily living.
- PRE: Progressive Resisted Exercises

Compliance with ethical standards

Acknowledgments

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Disclosure of conflict of interest

The authors hereby declare that they have no conflicts of interest to disclose regarding the publication of this manuscript.

Statement of ethical approval

Ethical approval is not required, an informed consent document was obtained.

Statement of informed consent

Written informed consent was obtained from both the patient and, the patient's parents for participation in this study and for the publication of any identifying information or images in this manuscript.

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