

Case Report

## Late Onset Deformity in a Healed Fracture: A Case of Paediatric Post Traumatic Tibia Valga

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**Abstract**— Post traumatic tibial valga, also known as Cozen's phenomenon, is a condition of a pathologic knee valgus with variable limb shortening in the affected limb. It is a late-onset complication following a previously healed fracture of the proximal tibial metaphases. The deforming nature of the condition raises much concern for patients and their carers. Despite the appearance of deformity, the child is frequently asymptomatic. It can be treated successfully with watchful waiting and supervised neglect that can potentially span over a few years. In this case report, we emphasise the early recognition of patients at risk of this unique complication. As illustrated in this case report, not all deformity needs surgery.

**Keywords**— fracture, metaphyseal, tibia, genu valgum, Cozens phenomenon

### I. INTRODUCTION

Paediatric proximal tibia fractures comprise only 2.4% of total fractures in this age group. It occurs mainly between 3-6 years old, with a male predominance [1]. Post traumatic tibial valga (PTTV) is an uncommon potential late complication that is unique, particularly to fractures of the proximal tibia metaphases [2]-[4]. It was first reported by Dr Cozen in 1953, commonly referred to as 'Cozen's phenomenon'[4].

Multiple mechanisms have been proposed to explain the development of this condition, including an overgrowth process in which the proximal tibia fracture stimulates the physis to grow [4 - 6]. With the intact fibula acting as a tether,

valgus angulation develops. The late deformity in the wake of successful fracture healing is a cause of distress for caretakers and has been reported to lead to mitigation of the treating surgeon [4, 6].

This case report follows the injury, treatment of the initial fracture and management of complications of a young paediatric patient who developed post traumatic tibia valga after uncomplicated fracture healing that was successfully managed without surgical intervention. We wish to highlight this unique complication of an uncommon injury, the unpredictable nature of the deformity progression, and the treatment options for subsequent management.

## II. CASE REPORT

A 2-year-old boy sustained left leg pain following an injury at a water park where his left leg was traumatically rotated as the child descended down a slippery slide. After the incident, the child could not bear full weight and was very fretful on attempts to palpate the proximal left leg. Clinically, there was effusion of the proximal leg and knee region with no open wounds. The initial radiographs show an undisplaced fracture of the left proximal tibial metaphysis. The patient was treated with an above-knee cast with a medial mold that was removed after 8 weeks. Serial radiographs on follow-ups showed unremarkable fracture healing as physiologically expected.

At 12 months following the trauma, knee deformity was reported by his parents, in which the onset was gradual and insidious onset. Apart from the apparent deformity, the parents did not notice any difficulty in ambulation, clumsiness in gait, or any marked activity limitation, and the child was active as would any 3-year-old. On our examination, a left genu valgum was observed. The boy had no functional limitations and could carry out tests such as standing on toes, standing on his heel and squatting. Mechanical axis deviation of the long leg radiographs was noted, and proximal tibial and tibio femoral angles indicate a genu valgum.

We discussed the cause and possibility of outcomes for the child with the parents and commenced non-surgical management with continued close observation and follow-up for this child. At 24 months post-injury, plain radiographs demonstrated an improved lower limb alignment with correction of the mechanical axis. Thirty-six months after injury, a left-sided genu valgum is still seen despite radiologically improving angulation. The genu valgum is comparable to the right knee and within physiological values for age. The deformity did not disturb the child's daily activities and did not cause significant discomfort to the child.

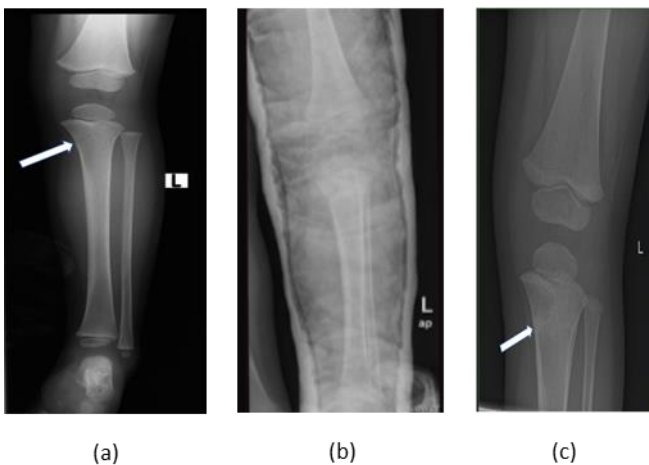


Figure 1. (a) Radiographic image of the left tibia and fibula showing incomplete fracture on the medial cortex of the metaphysis of the proximal left tibia metaphyseal. (b) The fracture was treated with a long leg cast with the knee in extension and medial moulding. (c) On removal of the cast at 8 weeks, evidence of a uniting fracture is seen.



Figure 2 (a) and (b) Radiographs at 12 months and 24 months post injury, respectively. An increased tibio femoral angle of the left leg in (a) indicates a pathologic genu valgum that underwent subsequent correction 1 year later in (b).

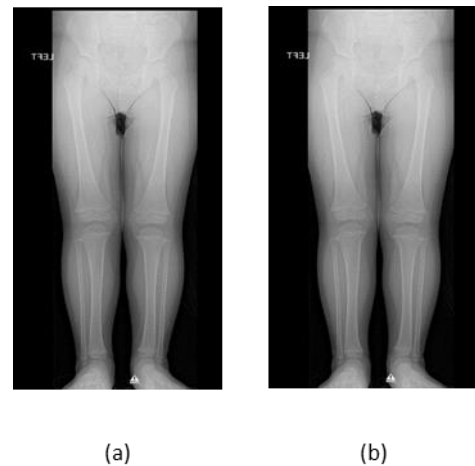


Figure 3. (a) and (b) There is residual valgus of the leg comparable to the right lower limb but clinically more pronounced.

## III. DISCUSSION

In addition to falls and motor vehicle accidents, PTTV has been reported to occur during sports activities, such as trampoline injuries and medial collateral ligament avulsion injuries in paediatric athletes [2, 3]. In the original article, Cozen described this condition as specifically occurring in low-energy trauma and undisplaced and non-angulated fractures [4].

The mechanism of fracture of the proximal tibial metaphysis is by a valgus mechanism via a laterally applied force to an extended knee that results in failure of the medial metaphysis in tension [7]. This can occur in rotary situations, as demonstrated in our patient in which the injury was inflicted in the event of coming down a slide. By adding a varus mold to the extension above the knee cast to close the medial fracture gap, Burton et al. observed the deformity can be minimised but not fully prevented, as experienced in our patient [5].

The deformity can be apparent as early as 6 weeks to 5 months after injury [2, 7]. The deformity in our patient was reported by the parents approximately 1 year after the injury.

At the time of initial injury, a degree of valgus deformity is commonly present [2, 5, 8]. The progression of the deformity peaks at approximately 1-year post injury, and progresses at a mean of two and a half years post injury. Higher degrees of angulation are associated with more complex fracture patterns, such as completely displaced fractures.

When PTTV is reported, the practice of close observation is an appropriate first-line approach. Gradual correction of the long axis of the bone in line with physiologic longitudinal growth has been found to lead to spontaneous improvement of the deformity in patients [2,8-10]. Interestingly, the valgus deformity was not necessarily corrected to physiological values. Nenopoulos et al. reported that full remodelling was seen in a patient 14 years post injury, with over 50% of 38 patients achieving partial remodelling at an average of 7.8 years post injury [10]. In a case series of seven patients, the mechanical axis remained 15mm lateral to the centre of the centre of the knee despite spontaneous, full remodelling in patients who were followed up to an average age of fifteen years and 8 months [9]. The residual clinical valgus does not significantly affect daily activity; most importantly, the child remains asymptomatic [8]-[10]. Similarly, in our case, the patient did have residual clinical valgus that did not interfere with his activities and ambulation. Hence, we advocate aiming for adequate clinical correction via non-surgical methods.

Surgical removal methods of soft tissue, hemiephysiodesis and guided growth have been practised to treat PTTV. Surgeons take advantage of the open physes in children and aim to modulate growth to prevent the long-term effects of mechanical axis deviation, which ultimately leads to secondary degenerative changes [11]-[14]. To the best of our knowledge, no reports directly compare non-surgical and surgical treatment outcomes. However, surgery risks such as surgical site infection, hardware migration and secondary surgical procedures for implant removal are inevitable. We, therefore, suggest that surgery be reserved for select patients with conditions such as persistent severe deformity that affects gait and activities of daily living.

#### IV. CONCLUSIONS

PTTV in the asymptomatic paediatric patient can be managed non-surgically with close supervision. Watchful waiting and expectant management are acceptable approaches, with the highest regard for the child's daily activity and functional condition. Surgical intervention should be reserved for patients who have symptoms secondary to malalignment. The parents must be well informed of the possible complications of this entity and the ensuing management lines.

#### CONSENT

Written informed consent was obtained from the patient for the anonymised information to be published in this article.

#### CONFLICT OF INTEREST

The authors declare that there is no conflict of interest regarding the publication of this paper.

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