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## Case Report

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## Paediatric Subtrochanteric Femur Fracture Treated with PHILOS Plate: A Case Report

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### Abstract

Subtrochanteric femur fractures are the rarest form of hip fractures in children. Despite the different treatment options available, there is still no definite guideline regarding the ideal treatment for such injuries. We report a case of a complex subtrochanteric femur fracture in a 13 years-old girl following a fall from height. The fracture was fixed with adult Proximal Humeral Internal Locking System (PHILOS) plate (*De Puy Synthes*). Clinical and radiological union were achieved at 5 months post operation, and she was able to perform activities of daily living without any difficulties. We would like to propose the use of adult PHILOS plate as a viable implant choice for internal fixation of paediatric subtrochanteric femur fractures with satisfactory results.

**Keywords:** Paediatric, Subtrochanteric fracture, PHILOS plate.

### INTRODUCTION

Hip fractures are rare in the paediatric age group and they contribute to only about 1% of all bony injuries in children. Among all paediatric hip fractures, subtrochanteric fractures remain the least common, accounting for only 4-17% of paediatric femur fractures [1].

Paediatric subtrochanteric femur fracture is a unique injury in which the proximal fragment is flexed, abducted and externally rotated secondary to the actions of ilio-psoas, abductor group and external rotator muscles respectively. Besides that, subtrochanteric femur fractures tend to be associated with complex fracture patterns. Owing to the above reasons, it is challenging to achieve and maintain reduction in such injuries by non-operative methods

In the present case report, we described the use of adult Proximal Humeral Internal Locking System (PHILOS) plate (*De Puy Synthes*) for the fixation of paediatric subtrochanteric femur fractures. We found excellent clinical and functional outcome results on subsequent follow up; therefore, we would like to propose this as a viable treatment option for such injuries.

### CASE REPORT

A 13 years old girl with no known medical history presented to our emergency department following an attempt to jump from 2-storey height. She landed on her right lower limb and subsequently was unable to ambulate due to the great pain around the right hip. There was no associated history of loss of consciousness, blurring of vision, ENT bleeding or vomiting.

Clinically, primary survey is negative and her vital signs were stable. Secondary survey revealed marked tenderness over the right hip with limited range of movement.

Radiograph of the pelvis (Figure 1) revealed a complex subtrochanteric fracture of the right hip. It was a three-part spiral configuration with extension into the lesser trochanter. Immediate splintage was applied in Emergency Department and the patient was admitted to ward for further management. She was also

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referred to psychiatry team for mental state examination to ascertain the cause for her suicide attempt.



**Figure 1:** Radiograph of pelvis showing three-part spiral configuration with extension into the lesser trochanter

### Surgical technique and post operative assessment

Being an unusual injury, we faced difficulty in selecting the suitable implant for the above patient. None of the proximal femur anatomical locking plates for adult population are suitable size for paediatric proximal femur. After multiple discussions, we came to a consensus and chose Proximal Humeral Internal Locking System (PHILOS) plate (*De Puy Synthes*) to fix the fracture.

The patient was positioned supine on the fracture table. We attempted closed reduction with gentle traction and internal rotation done. We then proceeded with lateral approach of the hip and the fractures were temporarily secured with K-wires. Two lag screws were used to compress the distal and lesser trochanter fragments. By practicing this technique, we managed to convert the complex fracture pattern into a two-part fracture.

Pre-contoured long PHILOS plate was used to complete osteosynthesis. Multiple 3.5mm locking screws were inserted through the proximal PHILOS plate into the femoral neck. Subsequently, MIPO technique was used to insert screws along the shaft (Figure 2).



**Figure 2:** Radiograph of the right femur showing fracture fixed with PHILOS plate and two lag screws

Post-operatively, the patient was encouraged to perform crutch-assisted walking. Non-weight bearing was advised for 6 weeks, followed

by partial weight bearing. Full weight bearing was allowed after 12 weeks. The patient was on regular follow up until 5 months post surgery; at the time when radiographic assessment revealed union of fracture sites with a normal neck shaft angle (Figure 3). Clinically, the patient was already able to perform routine activities without any difficulty.



**Figure 3:** Radiograph of the right femur showing implant in situ with united fracture at 5 months post-operatively

### DISCUSSION

Paediatric subtrochanteric femoral fractures are rare and these fractures remain a challenging entity to manage. There is a lack of designated implants available on the market for paediatric subtrochanteric fractures.

The age of the patient is the most significant factor in choosing the treatment option. In general, non-operative management is the preferred option for younger paediatric patients. For those who are aged 6-10 years, traction followed by hip spica cast is an acceptable method of treatment [2]. However, this option requires a longer duration of hospital stay and frequent radiological assessment is needed for adjustment and accurate control of fracture alignment. Therefore Staheli [3] suggested immediate spica casting for children under 6 years of age with isolated femoral shaft fractures.

Generally, surgical fixation has become the preferred modality of treatment in older children and adolescents with subtrochanteric fractures as conservative management tend to result in unsatisfactory alignment and limb length discrepancy [4]. Available surgical methods of paediatric subtrochanteric fractures include flexible intramedullary nailing, external fixators, rigid intramedullary nail and compression plating.

Flexible intramedullary nailing has become the most popular flexible intramedullary nailing and they remain the option of choice for femoral shaft fractures in children. However it is not a preferred method for older children as Vivek suggested that malunion and plaster complication is more common in those age higher than five [5]. The major drawback of flexible intramedullary nailing in treating paediatric subtrochanteric fracture is that it provides less stability due to the lack of rotational control. Furthermore, it is unable to achieve compression and satisfactory reduction in multi fragmental and unstable injuries such as subtrochanteric fractures. Rigid intramedullary nailing yields satisfactory outcomes for unstable femoral shaft fracture in children [6], however subtrochanteric femoral fractures have a shorter proximal fragment, hence the standard locking techniques are more difficult in securing the shorter proximal fragment. Nail toggling is another potential complication due to the wider medullary canal in proximal

femur [1]. In addition, rigid nailing potentially carries the risk of avascular necrosis of the femoral head in those who have not reached skeletal maturity [7]. In general, external fixation is reserved for open injuries and polytrauma patients. It is a less preferred choice as the short proximal fragment allows limited working space for proximal pin fixation. Refracture after removal of the external fixators and pin site infections are possible complications [8]. Moreover compliance and cosmetic issues make this option less favorable in paediatric age group.

Some authors discussed the use of traditional plate fixation as an alternative option for such injury [9]. The disadvantages of traditional open plating include more extensive soft tissue dissection, greater blood loss and potential damage to the periosteal blood flow [1]. Theoretically these disadvantages increase the risk of infection, delayed union and non-union. Other than that, traditional plates are not anatomically precontoured and they have to be bent intraoperatively to adapt the anatomy of the proximal femur. Conversely, PHILOS plates are precontoured to proximal humerus in adults and this precontoured design was found to adequately fit to the anatomy of the the paediatric proximal femur [10]. Also, the broad proximal end of the PHILOS plate provides a stronger grip at the proximal femur.

Besides that, the proximal holes of the PHILOS plate allow locking screws at angle of 130 degrees, which is on par with the femoral neck/shaft angle. In addition, multiple locking screws options in the proximal plate allows better catch of the proximal fragment, easier screw insertion into the femoral neck, resulting in a stronger angular stability compared to compression plate. PHILOS plate also allows the use of MIPO technique which allows less soft tissue dissection and periosteal stripping, therefore reducing the damage of the vascularity and smaller surgical scars [2]. Other submuscular locking plates used for subtrochanteric femur fracture described in the literature include adult medial distal tibia locking plate in a small child and adult proximal lateral tibia locking plate in an adolescent [9].

## CONCLUSION

Paediatric subtrochanteric femur fractures are rare injuries and the management remains challenging. We report a case of paediatric subtrochanteric femur fracture with good functional outcome after being treated with internal fixation with an adult PHILOS plate. In short, PHILOS plate is a reliable implant choice for paediatric subtrochanteric femur fractures that require internal fixation.

## Conflicts of interest

There are no conflicts of interest

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## Authors' contributions

OOI and IBRAHIM involved in treatment of the patient. CHEW and PHANG involved in drafting and editing the manuscript. All authors read and approved the final manuscript.

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