

# Outcome of Management of Pediatric Subtrochanteric Femoral Fracture with Broad Dynamic Compression Plate and Proximal Cancellous Screw through the Femoral Neck

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## ABSTRACT

**Introduction:** Pediatric subtrochanteric femoral fracture can be managed with traction followed by spica, intramedullary elastic nailing, plating or external fixators. The prognosis largely depends on adequate reduction and stable fixation. **Aims:** The aim of this study was to evaluate functional outcome of pediatric subtrochanteric femoral fracture treated with broad dynamic compression plate. **Methods:** This prospective observational study consisted of 32 children between the age 7 to 15 years, with an average of 10.06 years  $\pm$  2.29, with subtrochanteric femoral fracture. Fractures were reduced by an open reduction through lateral approach and stabilized with a broad dynamic compression plate along with a proximal cancellous screw through the femoral neck. All patients were followed for 15 months and the results were evaluated on the basis of Flynn scoring system. **Results:** All fractures united with a mean duration of 12.6 weeks  $\pm$  0.91. Average hospital stay was 8.43 days (5 to 14 days). Functional outcome was excellent in 84.38% (27 patients) and satisfactory in 15.62% (5 patients). Full weight bearing was started after mean duration of 16.62 weeks  $\pm$  0.91. Implants were removed at an average of 11.21 months  $\pm$  1.06. There were no significant limb length discrepancies, deep infections, re-fracture, osteomyelitis and avascular necrosis. **Conclusion:** This prospective study showed good functional outcome in pediatric patients having subtrochanteric femoral fractures who were treated with a broad dynamic compression plate and a proximal cancellous screw through neck.

**Keywords:** Pediatrics, Plating, Subtrochanteric femoral fracture

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## INTRODUCTION

Subtrochanteric femur fractures in children are rare injury, accounting almost 4% to 10% of pediatric femur fractures.<sup>1,2</sup> Sub trochanteric fracture in children can be described as fractures within 10% of the total femur length below the lesser trochanter.<sup>3,4</sup> Pediatric subtrochanteric fracture is usually associated with high velocity trauma. Proximal fragment is flexed, abducted and externally rotated secondary to forces from the iliopsoas, hip abductors and short external rotator muscles.<sup>5</sup> It is difficult to reduce this short and rotated proximal fragment which even if reduced may not have adequate bone to accommodate sufficient screw purchase for a stable fixation.

Traditionally, pediatric subtrochanteric fractures were coupled with pediatric femoral shaft fractures and were managed conservatively with a hip spica cast.<sup>6,7</sup> Small children tolerated

the hip spica cast better than older children and adolescent. Difficult nursing care and less remodeling time in near mature skeleton discourages the conservative management while intramedullary nails were also not able to reduce and stabilize the fracture satisfactorily. External fixators remained another option but the cumbersome assembly around the hip region led to difficulty in dressing and grooming of the patient. Also, there is risk of pin tract infection with external fixators.<sup>5, 8, 9</sup> Pediatric dynamic hip screw plates are always a valid option in management of these types of injuries, but the implants are not easily available. In our study we used a broad dynamic compression plate for fixation of fracture and evaluated functional outcome according to Flynn scoring system.

## METHODS

32 children with subtrochanteric femoral fractures, treated with a broad dynamic compression plate with proximal cancellous

screw towards the neck at Nepalgunj Medical College Teaching Hospital, Kohalpur from July 2017 to June 2021 were included in this prospective observational study. Pathological fractures, open fractures and patients more than 15 years were excluded from this study. Informed written consent was taken from the patient's guardian and only those willing to take part in this study were included.

Under general anesthesia patient was placed supine on a radiolucent fracture table. After an open reduction through lateral approach to thigh, a pre-bent broad dynamic compression plate was placed and a 5.5mm cancellous screw was passed through most proximal hole into femoral neck without violating the physis under C-arm guidance (figure 1). The plates were contoured by plate bender. Plates were selected based on the fracture length with at least six cortices purchased at distal fragment.

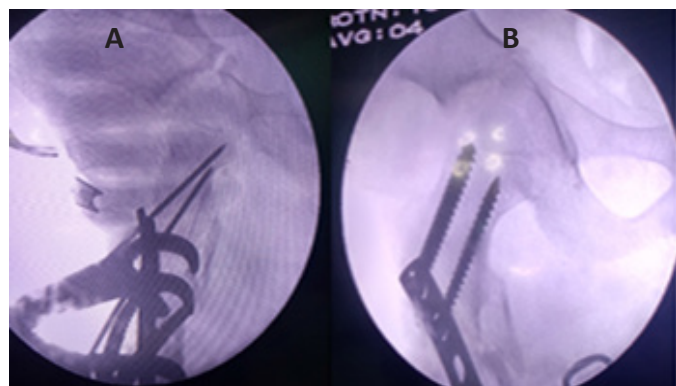


Figure 1: A: Placement of guide wire avoiding physis. B: final position of screws

Hip and knee movements were started soon after operation, within the limits of pain, followed by toe touch weight bearing and ambulation with crutches. Increased weight bearing was allowed as the fracture was judged to be healing. Full weight bearing was allowed once clinical and radiological union was achieved. Age and sex of the patients were recorded. Fracture pattern was documented as length stable or length unstable. Length-stable fractures were transverse and short oblique whereas length-unstable fractures were comminuted, spiral and long oblique, where the length of the obliquity was twice the diameter of the femoral shaft at that level. Time to radiological union was defined as duration when there was evidence of callus across the fracture site seen on at least 3 of 4 cortices seen on an antero-posterior and lateral X-rays.

Functional outcome was evaluated at final follow-up using Flynn scoring system (table I) as excellent, satisfactory or poor based on leg length discrepancy, fracture malalignment, pain and complications.<sup>10</sup>

Criteria	Excellent	Satisfactory	Poor
Leg length discrepancy	< 1.0 cm	< 2.0 cm	>2.0 cm
Malalignment	5 degrees	10 degrees	>10degrees
Pain	-	-	Present
Complications	-	Minor and resolved	Major complication and/ or lasting morbidity

Table I: Flynn scoring system<sup>10</sup>

**Statistical methods:** SPSS version 21 was used for statistical analysis. For descriptive data analysis percentage, mean and standard deviation was calculated.

## RESULTS

The study consisted 32 patients, of them 22(68.75%) were male and 10(31.25%) females with an average age of 10.06 years  $\pm$  2.29 (mean  $\pm$  SD). 26(81.25%) sustained trauma due to fall from height and six had road traffic accident.

The radiological observation showed that 18(56.25%) had length stable fractures and 14(43.75%) had length unstable fractures. Two patients sustained ipsilateral forearm bone fracture, one had ipsilateral clavicle fracture, one had head injury and one had blunt trauma abdomen. The average hospital stay was 8.4 days (range 5 to 14 days), as those patients who had associated injuries stayed for longer duration. The surgery was uneventful for all, while three (9.4%) had superficial wound infection which healed with oral antibiotics and regular change of dressing and two (6.25%) had limb length discrepancy, where the involved limb was longer 1 cm and 1.5 cm respectively. The functional outcome was excellent in 84.38% (27 patients) and satisfactory in 15.62% (5 patients) as shown in figure 2 and 3.

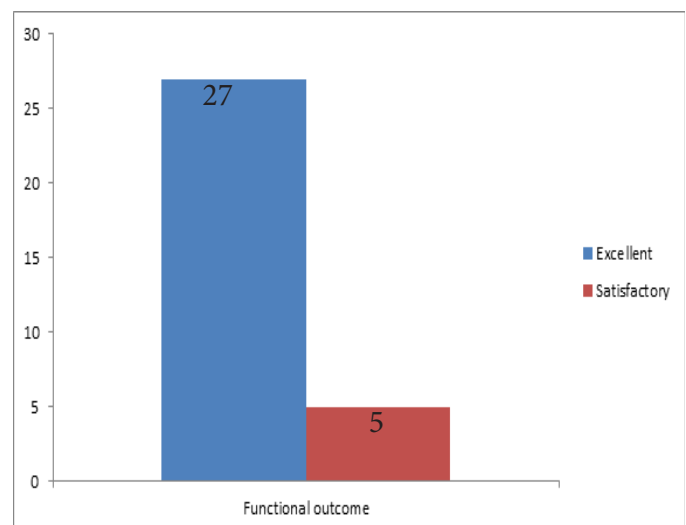
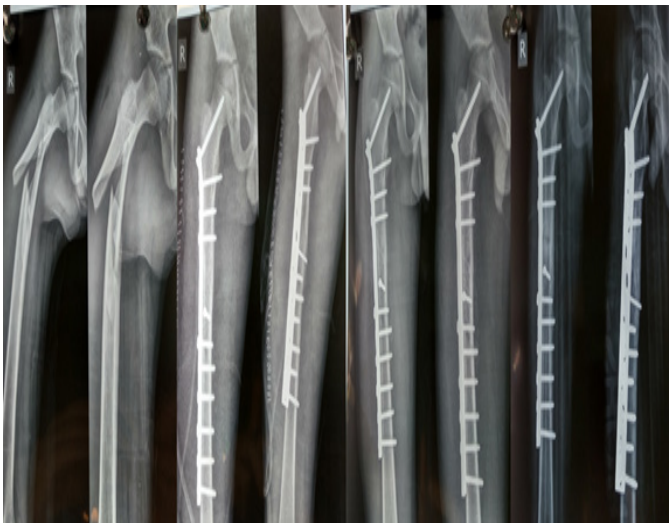


Figure 2 : Functional outcome at final follow up



**Figure 3 : Hip range of motion in postoperative period**

All the fractures united at an average of 12.6 weeks  $\pm$  0.91 (mean  $\pm$  SD) as shown in figure 4. The implants were removed at an average of 11.21 months  $\pm$  1.06 (mean  $\pm$  SD).



**At the time of injury      Immediate Post-Operative X-ray      X-ray at 12 weeks      X-ray at 8 months**

**Figure 4: Sequential x-rays till full union**

## DISCUSSION

Pediatric subtrochanteric fractures are rare injuries and are complex in terms of management. There are literatures where several authors have tried their hands-on variety of treatment options like traction followed by hip spica casting, immediate spica casting, cast bracing and internal as well as external fixation devices.<sup>6, 8, 11</sup>

There is no clear consensus in management of these injuries. Ireland and Fischer in their study managed older children, initially with a 90-90 degree traction followed by hip spica cast. They noticed maximum of 5 cm of overriding of affected extremity with maximum sagittal plain angulation of about 50 degrees and coronal plane angulation of about 45 degrees.<sup>4</sup> Aronson et al<sup>12</sup> also concluded that children older than 10 years and more than 45 kg weight, when managed with hip spica cast after a 90/90 traction had higher incidence of shortening

and malunion. Besides, prolonged immobilization of patients is another drawback with hip spica cast leading to loss in school hours as well.

Several studies have documented surgical management of pediatric subtrochanteric to be more superior to conservative treatment with plaster. External fixators though yielded satisfactory results, are occasionally associated with risk of pin tract infection, loss of reduction and refracture.<sup>5,9</sup> The assembly makes dressing and grooming difficult as well. Sayed et al<sup>1</sup> in their study also discouraged the use of external fixators owing to the insufficient space for adequate pin placement in proximal fragment. While intramedullary elastic nails being a popular fixation device for pediatric shaft of femur fracture; seems inadequate in subtrochanteric fracture. Flynn et al<sup>10,13</sup> and Luhmann et al<sup>14</sup> in their several studies have mentioned malunion, leg length discrepancies, painful nail prominence and nail exposure with an intramedullary elastic nails. An appropriate implant selection is always a dilemma in management of these fractures because of short and rotated proximal fragment that does not have adequate space for sufficient purchase of screws to provide a stable fixation. The proximal screw aimed towards the femoral neck, gives space to accommodate an extra screw in the small proximal fragment that increased the stability.

The mean union duration of all fractures was 12.6 weeks  $\pm$  0.91 (mean  $\pm$  SD). These results were similar to that of Sayed et al<sup>1</sup> and Gogna et al.<sup>15</sup> The functional outcome was excellent in 84.38% (27 patients) and satisfactory in 15.62% (5 patients). Our result was consistent to that of Li et al.<sup>11</sup>

The study performed by Sayed et al<sup>1</sup> mentioned that 11.1% patients had superficial infections which were managed with antibiotics and regular wound cleaning. Likewise in our study, three patients (9.4%) developed superficial wound infection. This healed eventually with antibiotics and regular dressing of wound. There was no case of osteomyelitis and compromising leg length discrepancy.

## LIMITATIONS

The major limitation of this study is smaller sample size, so that total numbers of patients were not enough to make more accurate conclusion but considering rarity of these fractures it is still a case series with adequate number. Another limitation is lack of control group to compare this technique with conservative management or nailing to make a more meaningful conclusion.

## CONCLUSION

This prospective study showed good functional outcome in pediatric patients with subtrochanteric femoral fracture who were treated with a broad dynamic compression plate and a proximal cancellous screw through neck. We believe the addition of this technique in the armamentarium of existing methods could be valuable, because of ease of availability of implants, less technically demanding surgery, good outcome and an early mobility which also prevented loss of school hours

in children.

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