

MINIMALLY INVASIVE PLATE OSTEOSYNTHESIS OF PAEDIATRIC PROXIMAL LATERAL FEMORAL FRACTURES WITH LOCKED COMPRESSION PLATE

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ABSTRACT

Objective To evaluate the effectiveness of internal fixation with locked compression plate (LCP) applied with minimally invasive plate osteosynthesis (MIPO) technique in proximal lateral femur fractures in children.

Study design Descriptive case series.

Place & Duration of study Department of Orthopaedics Combined Military Hospital Lahore, from April 2009 to April 2010.

Methodology Children, who presented with Colonna type IV fractures in the proximal region of femur were treated with 3.5 mm LCP fixation by MIPO technique. The locking head screw (LHS) was introduced through the LCP into the neck of femur. In cases where the fracture was too proximal or comminuted, an attempt was made to apply a cancellous de-rotation screw into the neck of the femur through proximal most hole of the LCP. In patients where the neck size allowed passage of only one LH screw, a supporting hip spica was applied to avoid rotation. Patients were evaluated to determine complications, clinical and radiological outcome. All the patients were followed up at two weekly intervals for first month and then four weekly for 2 months and six monthly for one year. The implant in all patients were planned to be removed after one year.

Results Eighteen children (males 16, females 2) between ages of 7 to 12 years were managed. At a mean postoperative follow up of 3 months, good callus union was achieved in all cases. One female patient had mild coxa valga (due to plate over bend) and one male developed superficial wound infection. In one male patient there was posterior displacement of a fracture fragment in comminuted fracture. No avascular necrosis of the head of femur or premature physeal closure was noted. Fifteen patients had excellent results while three patients had good results in term of weight bearing and gait.

Conclusions The method of early stable internal fixation of paediatric lateral proximal femur fractures, utilizing contoured 3.5 mm LCP bend to measurements, coupled with MIPO, was safe with gratifying results.

Key words Paediatric lateral proximal fracture femur, Locked compression plates, Minimally invasive plate osteosynthesis.

INTRODUCTION:

Children are the most active individuals with high

reserves of energies making them highly prone to injuries. Child abuse and neglect too add to their share of causes of injuries in children. Among the array of various injuries which are sustained in childhood, fractures form a considerable part. The fractures of proximal femur in a paediatric patient present a challenging situation. These fractures have been well classified by Delbet and Colonna.¹

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Of these the lateral proximal femur fractures or Colonna type IV, are very challenging due to the attached musculature which predisposes the fracture fragments to deformity. Moreover the quality of bone in children is fairly diverse from adults, being more inclined towards the dense bone especially in the proximal femoral area and is well enveloped by a strong periosteal sheath. This makes it necessary that high energy forces are imparted on such bones before breaking it.

Paediatric lateral proximal femoral fractures not only confront the treating orthopaedic surgeons with a taxing situation but also in face of the damaged thin, under developed and fragile soft tissues and musculature surrounding the fragments, the picture gets further complex. The need in such a scenario is to adopt a method of treatment that not only addresses these facts but also minimizes the chances of infection which is catastrophic once it develops in a paediatric bone. Similarly due to high and rapid healing potentials these cases are more prone to develop complications like malunion, nonunion, coxa vara/valga, avascular necrosis (AVN) and premature epiphyseal closure etc. A diligent and prompt treatment of such potentially perilous fractures is the key to a successful outcome, a fact which has been illustrated in many studies.²

Traditionally type IV, intertrochanteric fractures were treated with skin or skeletal traction, and abduction spica cast. Internal fixation was considered in those cases only if the fracture could not be reduced and held in a spica cast. However with the advent of good implants and ancillary aids like image intensifier, new and novel techniques are emerging. LCP applied to these fractures with MIPO technique is also one of them. This study describes experience of this technique in children.

METHODOLOGY:

This study was conducted at Orthopaedic Department of CMH Lahore, from April 2009 to April 2010. Patients with Colonna type IV closed fractures of lateral proximal femoral region were included in the study. They were treated by fracture fixation with 3.5 mm and 4.5 mm narrow LCP plate applied with MIPO method.

Patients were not allowed weight bearing for 6 weeks postoperatively. Partial weight bearing was then started. All the patients were followed up at two weekly intervals for first month and then four weekly for next two months and six monthly for one year. Plate removal was planned after completion of 12 months post operatively.

RESULTS:

Eighteen patients with Colonna type IV closed fractures of lateral proximal femoral region were included in the study. Their ages ranged between 7-12 years. Sixteen patients were males (M) and 2 females (F). Ten children had transverse pattern and six had oblique fracture. Two patients had comminuted pattern of fracture.

Fracture was the result of fall from height in 13 children (M=12, F=1), automobile accidents in 4 (M=4) and assault with a bamboo stick (F=1). Fifteen (M=14, F=1) patients were operated upon within 24-72 hours of injury. In three (M=2, F=1) patients the operative intervention was delayed by 6 days, the main reason of delay being the non availability of funds for implant (cost factor). Other associated injuries if any were managed on their own merit.

Postoperative evaluation in these patients revealed early callus in 12 children (M=11, F=1) at 4 weeks and appreciable early union at 10 weeks. Six children displayed appearance of callus at 6 weeks and early union at 16 weeks (M=5, F=1). Good union was seen at 16 weeks follow-up. One of the patients developed superficial wound infection which proved to be a stitch abscess and treated successfully at a very early stage. One patient with comminuted fracture developed a mild coxa valga deformity mainly due to slight over angulation of the plate, but the difference did not merit any further treatment as it did not exceed 10 degrees. No shortening of limb length was seen. There was no incidence of loosening or breakage of the plate or screw pull out. No premature epiphyseal fusion occurred in any of the cases. Full weight bearing was achieved in 14 children by 10th week and in 4 children by 12th weeks. Good union was seen in all by the 16th week.

The final assessment was done according to the Harris hip scores.³ According to it 15 patients had an excellent result (90-100 points) while 2 patients had a good result (80-89 points) and in one patient the results were fair (70-80). None of the patients had a poor result (less than 70).

DISCUSSION:

In most of the children the fractures of lateral proximal femur or Colonna type IV fractures are sustained due to fall from a height like roof or trees or blunt trauma sustained due to hit by a vehicle, domestic trauma or assault.⁴ Traditionally such fractures were treated by skin or skeletal traction or abduction spica cast which sometimes resulted in avoidable proximal femoral deformities like coxa vara or valga with limb length discrepancies. Internal fixation was considered necessary if the fracture

could not be reduced satisfactorily and held in a spica cast. With the development of latest implants, advancements in understanding of fracture managements and invention of ancillary aids like image intensifier etc, novel methods like MIPO with implants like LCP, are commonly used.^{5,6} Moreover the comminuted variety of fractures when opened up may result in complications like infection, delayed union or non union which can be effectively avoided by more "biologic" methods of reduction like MIPO, involving the use of indirect techniques and new plate designs. Such methods preserve the blood supply to the injured bone, improve the rate of fracture healing, decrease the need for bone grafting and lower the incidence of infection and other complications. Percutaneous plating appears to be the next step in the evolution of biologic plating. With these techniques, the fracture is reduced indirectly, and plates are placed into sub muscular tunnels through limited skin incisions. This may result in less surgical trauma to tissues and further improvements in clinical results compared with current methods of plate insertion.⁷

The concept of LCP has revolutionized the orthopaedic fixations and its use in fragile and osteoporotic bones is remarkable in terms of its success.⁸ Paediatric diaphyseal femur fractures have been fixed at some centers with 4.5 mm narrow low-contact dynamic compression plate plates by MIPO i.e. minimal exposure for plate entry and percutaneous screw placement, which has greatly facilitated the treatment of these fractures.⁹ Use of such plates is not very common in managing lateral proximal femoral fractures in children and a few have been reported in literature so far.¹⁰ These plates provide an early, stable internal fixation in the form of a 3.5 mm LCP which can be contoured as per the dictates of the neck shaft angle. Minimally invasive plate osteosynthesis too has revolutionized the fracture fixation especially in comminuted fractures.¹¹ This technique not only helps in retaining the soft tissue envelope around the fragments, but also prevents the loss of fracture haematoma which in turn dramatically reduces the chance of infection, delayed union or non union.¹² Careful and meticulous reduction also goes a long way in prevention of malunion, though one should remember that LCP application with minimally invasive plate osteosynthesis is not a simple procedure and it requires a learning curve.^{13,14} Adequate preoperative planning is mandatory, as well as surgical timing.

It has been seen that in early postoperative period the children should preferably kept on restricted

mobility for at least 04 weeks, as movements can seriously jeopardize the entire exercise of fracture fixation. Some people recommend that they should be kept on traction even after stable fixation.⁶ Infection is a dreaded complication of this fracture. Overall reported incidence in various series has been from 2% to as high as 21%, if overzealous dissection or fragment exposure carried out.¹⁵ It has been proposed that infection in these cases results from the fragmentary interruption of blood supply during dissection or infection of fractures haematoma which can seep deep into the tissues during manipulations.¹⁵ Moreover attempts to perfectly reduce and fix such fractures can further lead to infection by devascularizing the fracture fragments.

Nonunion is another devastating complication of these fractures. Various series particularly early ones, have reported an incidence of 6.7% of AVN.¹⁵ Our study however does not report a single case of nonunion possibly because all the cases were treated with proper reduction and stable early fixation with MIPO/LCP fixation. Delayed union, coxa vara/valga and premature epiphyseal closure are other complications which can occur. Our series had only one case of a mild coxa valga because of iatrogenic over bending of the LCP due to miscalculation, though the valgus exaggeration did not exceed 10 degrees.

CONCLUSION:

This method of early, stable internal fixation of lateral proximal femur fractures, utilizing contoured 3.5 mm LCP bend to measurements, coupled with MIPO was found technically demanding but a safe and gratifying in terms of results.

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