

Minimally Invasive Plate Osteosynthesis an Option in the Management of Complex Proximal Femoral Diaphyseal Fractures: A Case Series

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ABSTRACT

A complex proximal femoral diaphyseal fracture (32 C) poses a serious management challenge due to distracting muscle forces and a lack of medial buttressing. Many treatment options were tried with varying degrees of success. Hence, in this study, we employed the use of minimally invasive plate osteosynthesis (MIPO) using a proximal femoral locking plate (PF-LP) and screws for managing this fracture. We are looking at the outcome of the management of proximal femoral diaphyseal fractures using PF-LP. Three patients with a comminuted AOT 32C fracture following a high energy motor vehicular accident (MVA), aged 24–42 years, had bridge plating with PF-LP using the MIPO technique. Radiographic Union Score for Tibia (RUST) and Parker and Palmer Mobility Score were used to assess outcome. Result revealed all three patients fractures had united at 12 weeks, and all the patients were able to walk outside their homes comfortably using crutches and go shopping at 12 weeks (score of 6). They walk with no difficulty at 6 months (score of 9). Therefore, bridge plating could be considered as an option while dealing with a complex proximal femoral diaphyseal fracture.

Keywords: Minimally invasive plate osteosynthesis, proximal femoral locking plate, complex proximal femoral fracture.

INTRODUCTION

Complex proximal femoral diaphyseal fractures (32 C) poses a serious management challenge due to it distracting muscle forces and lack of medial buttressing. Intrafragmentary compression might not be possible especially in this fracture with severe comminution. Many treatment options were tried with varying degree of success. Taylor et al described Intramedullary

nailing as the treatment of choice for the management of comminuted subtrochanteric fracture. Biological fixation using 95 degree angle blade plated or Dynamic condylar screws were also employed for the management of this fracture. MIPO of subtrochanteric fracture provides relatively stable fixation, with a high union rate and a minimal complication rate. Minimally Invasive

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Plate Osteosynthesis (MIPO) is a technique which enables indirect reduction and stable fixation with minimal biological footprint and preserving vascular supply at the fracture site. We employed the use of minimally invasive plate osteosynthesis using proximal femoral locking plate (PF-LP) and screws, this technique combined relative stability with preservation of fracture biology to achieve rapid callus formation and fracture consolidation. The implant has the required strength that neutralises the high lateral tensile force and angle stable locking screw fixation. The technique is more suitable for low resource setting because neither image intensifier nor fracture table was used to achieve fixation when compared with proximal femoral nailing and use of dynamic hip fixations.

PATIENTS AND METHODS

Three patients age 24, 36 and 42 years respectively with comminuted AOT 32C fracture following high energy Motor Vehicular Accident (MVA), were managed between June 2019 and October 2020 at Barau Dikko Teaching Hospital Kaduna, Nigeria. The patients were admitted via accident and emergency, they all had resuscitation using ATLS protocol. Plain radiograph of the femur anteroposterior and lateral views were obtained and used in selecting appropriate plate length (at least 3x the length of comminuted segment) and screws. They also had initial fracture splintage using skin traction with 5kg weight for the period of resuscitation before surgery. All the three patients were optimised for surgery within 24 hours to 5 days.

Surgical Technique

In the theatre after administration of spinal anaesthesia and prophylactic antibiotics, routine surgical site preparation was done; an incision was made using lateral approach from about 2cm above the tip of greater trochanter to just below the lesser trochanter but short of the fracture site. Vastus lateralis was lifted, greater trochanter and part of the proximal femoral diaphysis exposed. Another

lateral incision was made to expose the distal major fragment (Figure 1). A submuscular tunnel was bluntly created and the plate inserted, by means of bone holding forceps the proximal aspect of the plate positioned and the most proximal Locking cancellous screws applied. Locking plate drill sleeve was used to ensure correct screw placement. Indirect reduction by ligamentotaxis was achieved using manual traction. Slight recoil to ensure fragment contact was done and reduction maintained by holding the distal major fragment with two bone holders. Level of contralateral knee and medial malleolus were reference to ensure limb length equality. Two non-locking cortical screws were inserted into the distal major fragment closed to fracture site and most distally. The remaining locking screws were inserted both proximally and distally. One locking cortical screw was put at the proximal diaphysis below the lesser trochanter to improve fixation. Neither image intensifier nor fracture table was used throughout the procedure. Wound was copiously irrigated with normal saline and closed over a suctioned drain at the distal incision. Post operative care with IV fluid, Analgesic and prophylactic antibiotics was achieved. Ankle pump and quadriceps exercises commenced on the 1st postoperative day as tolerated. Ambulation non weight bearing under supervision of physiotherapist was commenced on 3rd day post operative using axillary crutches, partial weight bearing after 6 weeks and full weight bearing was commenced 12 weeks post operative. Radiographic union score for tibia (RUST) (Table 1) was used to assess union on post operative radiograph at 12 weeks, 6 months and 9 months. Ability to walk was also assessed using mobility score of Parker and Palmer (Table 2) at 12 weeks and 6 months. All the three patients were followed up for 9 months.

Table 1; Radiographic Union score for Tibia

Score per cortex	Callus	Fracture line
1	Absent	Visible
2	present	Visible
3	present	Invisible



Figure 1;- Showing healed MIPO incision scars

Table 2; - Parker And Palmer Mobility Score

Walking Ability	No difficulty	Alone with an assistive device	With help from another person	Not at all
Able to walk inside house	3	2	1	0
Able to walk outside house	3	2	1	0
Able to go shopping	3	2	1	0

RESULTS

Union is defined based on RUST as presence of bridging callus in at least 3 cortices with score of ≥ 7 . The average RUST at 12week was 8.7 (Table 3), fractures in all the three patients were united at 12weeks (Figure 2 and 3)

Table 3;- RUST from 6 weeks to 9months

Patients	RUST Score			
	6 weeks	12 weeks	6months	9 months
1	5	9	11	12
2	6	8	10	12
3	6	9	11	12
Average	5.7	8.7	10.6	12

The best Parker and Palmer mobility score was assessed at 6 weeks, 12 weeks and 6 months the result showed all the patients were able to walk outside home comfortably using crutches and go shopping at 12 weeks (score of 6). They walk with no difficulty at 6 months (score of 9) as shown in Table 4

Table 4;-Best Parker and Palmer Mobility Score at 6 weeks, 12 weeks and 6 months

Patients	Parker and Palmer Mobility Score		
	6 weeks	12 weeks	6 months
1	6	6	9
2	4	6	9
3	4	6	9
Average	4.7	6	9

No complication was recorded in any of the patients so far.



Figure 2. showed serial pre and post operative radiograph of the 1st patient; A- preoperative, B-Immediate post operative (Op), C- 6weeks post Op., D- 12 weeks post Op., and F 6 months post Op., showing successive callus formation and obliteration of fracture line.



Figure 3. showed serial pre and post operative radiograph of the 2nd patient; A- preoperative, B- Immediate post operative (Op), C- 12 weeks post Op., and D- 6 months post Op., showing successive callus formation and obliteration of fracture line.

DISCUSSION

Treatment of complex proximal femoral diaphyseal fracture is challenging. It is associated with high incidence of complications especially delay union, non-union and implant failure. The choice of appropriate fixation depends on the fracture pattern, fixation device and available resources. Understanding the biomechanics of proximal femur is paramount to achieve a good outcome. Intramedullary fixation may not be suitable for difficult fracture pattern with severe fracture comminution.

Our result showed union in all three patient with bridging callus in at least three cortices with RUST >7 in all the patients (Table 3) at 12 weeks post operative. Preservation of some fracture hematoma, periosteum and pluripotent stem cells lead to good biologic milieu resulting in rapid callus formation and good healing by secondary bone healing following MIPO. Similar good union was also reported^{5,6}.

The tension band mechanism is almost impossible in these patients with complex fracture due to lack of medial buttressing because of comminution, however the locking plate have the require stiffness to maintain the tensile forces on the lateral aspect of the femur and prevent varus collapse. The patients in this series were ambulated using bilateral axillary crutches non-weight bearing on the affected lower limb for the first 6 weeks this prevent implant failure and allowed for callus formation, some fracture stiffness and restoration of medial buttressing before partial weight bearing ambulation that was commenced at 6 weeks post operative.

All the patients were able to walk outside the house with their crutches having mobility score of 6 (Table 4) and were able to go shopping at 6 months. Mobility in this series was found to be good and earlier than the finding by Lee *et al* who used dynamic hip screw in their study. The cases were done without aid of neither image intensifier nor

fracture table, a situation commonly found in many centres in developing countries. This approach is easier and suitable for resource constrained settings for the treatment of this complex fracture.

CONCLUSION

Minimally invasive plate osteosynthesis was found to be suitable option in the management of complex subtrochanteric fracture from this series. Larger sample size is looked forward for to have a more robust study outcome.

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