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Management of distal femur fractures with distal femur locking plate by MIPPO technique

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Abstract
Introduction: Distal femur fractures are a challenge to orthopaedic surgeons as full restoration of function is problematic and demands technical expertise. Rigid fixation, maintaining the alignment and length of the femur and early mobilisation is required to achieve good results. The study was conducted to know the outcome after fixation by distal femur locking plate by MIPPO technique.
Materials and methods: A prospective study of 20 cases of distal femur fracture operated with distal femur locking plate using MIPPO technique was conducted at MVJMC & RH from June 2012 to June 2016. Patient followed up at 2, 4, 6 weeks and 3, 6, 9 months and has evaluated for fracture union, knee ROM and Knee Society Score at 6 months.
Results: Total number of 20 patients with distal femur fracture was managed with distal femur locking compression plate by MIPPO technique. In all 20 patients fracture united with mean duration of 14.5 weeks. There were no cases of non-union. Mean Knee Range of Movements at 6 months was 110^0 flexion and extension limitation of 10^0.Mean Knee Score was 87.6 and Mean Functional Score was 78. There were no cases of implant loosening or breakage. 1 case of superficial infection, no deep infection noted.
Conclusion: With MIPPO technique using distal femur locking plate for distal femur fractures gives good results with rigid fixation, excellent union rates, good functional outcome and minimal complications

Keywords: Distal femur, MIPPO, LCP

Introduction
Distal femur fractures constitute about 4-6% of all fractures of the femur [1]. These fractures are almost 10 times less common than fractures of the proximal femur [2], yet they are the second most common fracture of the femur in geriatrics patients [3]. These fractures are seen as a result of high velocity trauma in young patients and low velocity trauma in older patients with osteoporotic bones. These fractures are compounded by factors such as osteoporosis, extensive fracture communition and intra-articular extension.
Operative procedures are useful in permitting early rehabilitation and mobilisation. Operative management include supracondylar nail, condylar blade plate, dynamic condylar screw and distal femur locking plate. Open reduction and internal fixation of these are associated with requirement of a wide surgical procedure, risks of non-union, excessive bleeding, and tissue healing complications.
The above mentioned complications can be avoided by MIPPO technique [4]. MIPPO technique is fixation of the fracture with minimal opening, preserving the soft tissue attachment and blood supply to the bone, which has the advantage of small incision, minimal tissue dissection, less blood loss, less chance of infection than open technique [5, 6]. Distal femur plate is anatomically contoured plate for the distal femur fractures with locking holes for screws which gives better angulation stability and prevents screw back out which preserves the periosteal blood supply beneath the plate by acting as an internal fixator [5, 6].

Materials and methods
This is a prospective study conducted at MVJ MC & RH from June 2012 to June 2015.

Inclusion criteria

1. Patients above 20 years with distal femur fractures.
2. Fracture type A $_{1, 2, 3}$, B $_{1}$, C$_{1, 2}$.
3. Grade I, II open fractures

Exclusion criteria

1. Type B $_{2, 3,}$ C$_{3}$
2. Open fractures III and above
3. Patients with severe co-morbidities or not fit for surgery.
4. Ipsilateral limb associated fractures

Protocol followed

All our patients received initial management as per the ATLS protocol.

The fracture was temporarily stabilised with a Thomas Splint. Appropriate X-rays of the femur with knee were obtained. Pre-operatively all the systems evaluated, all blood parameters reviewed, Physician clearance for Surgery was obtained and pre-anaesthetic check up was done. 1 unit whole blood was kept on standby. All patients underwent preoperative counselling and appropriate written consent was obtained for the surgical procedure. Patients were placed on a fracture table with the limb in longitudinal traction by traction boot. This helped in achieving appropriate limb length and also helped in achieving reasonable alignment in grossly communited fractures.

In open fracture management thorough wound wash was given at arrival and in Type I fractures wound debridement and fixation was done. In open Type II fractures wound management and debridement was done immediately and fixation was planned after 5 days of I/V antibiotics.

Small incision placed 2 cm posterior to the patella, laterally extending distally as required only in cases with intra-articular extension. The operative incision deepened until sub-muscular plane was reached. Locking plate of appropriate length was selected and passed through the sub-muscular plane along the lateral border of Shaft of Femur. Proximally another small incision was placed to centre the plate on the lateral cortex. Alignment of the plate, fracture fragments were assessed intra-operatively using the C-arm. Fracture fragments were reduced and held in plane with multiple K-wires or by bone spikes placed percutaneously. Locking screws were fixed proximally and distally and final alignment achieved under C-arm. Thorough wash was given and wound closed in layers, sterile dressing applied.

Primary iliac crest grafting was done with minimal access in 2 cases, where there was gap and fibular graft in 1 case were there was extensive communition and graft. Antibiotic prophylaxis given with Inj. Ceftriaxone 1gm, 3 doses for closed cases and 5 days for open fractures.

Post operatively patient wound reviewed on 2nd day and knee ROM exercises commenced on 5th day. Patient mobilised strictly non-weight bearing until full radiological union was evident.

Patients were followed up clinically and radiologically at 6 weeks, 3 months, 6 months, 9 months and 1 year.

Parameters assessed were Time for radiological union, Knee Range of Movements, Knee Society Score at 6 months any related complications were recorded.

Results

Total numbers of 20 patients with distal femur fractures were managed by MIPPO. 13 males and 7 females were studied. Age group studied ranged between 38-70. Mean age was 54. Mean time to surgery 3 days (1-6 days).There were 2 cases of Open Type I injury and 1 case of Open Type II compound fracture which healed without any complications. Mean time for union was 14.5(9-22 weeks). There were 2 cases of malunion within acceptable range and no cases of shortening more than 1 cm. Functional range of movement at 6 months, Minimum flexion 90^0(90^0-120^0), mean 110^0. Extensor lag maximum was 30^0(0^0-30^0, mean 10^0). Mean knee score was 87 (75-95), mean functional score was 78(65-95). Less than 10% of patients had poor results [because of stiffness]. No cases of implant loosening, cut out or failure. No wound healing complications. 1 case of superficial wound infection. No mortalities.

Discussion

Fracture of the distal femur is quite common. The quality of bone, fracture pattern, condition of the soft tissue envelope, healing potential, articular extension all influence in the outcome of surgical management and achieving good functional outcome are quite challenging. Traditionally conservative treatment with different techniques has been shown to be ineffective because of difficulty in reduction of fracture and maintenance of the reduction. This results in deformity and restriction of movement at the knee joint [5]. The advent of AO angled blade plate in 1970 started changing the outcome and more and more people started opting for ORIF [7].

Over the past 40 years, many implants have been used with both advantages and disadvantages. Now, it is recognised that supracondylar fractures are better treated with anatomic reduction, stable fixation and early mobilisation.

Locking plates are now the preferred choice of implants for metaphyseal and diaphyseal fractures in severely communited and osteoporotic bones [2]. Biological fixation improves early and long term outcome [3]. Locking system provides better fixation/stability and maintains fracture reduction [4].

The distal femur locking plates are designed in such a way that they can be placed along the lateral aspect of the femur with adequate locking screws for secure fixation. These plating systems achieve fracture unions with bridging callus through relative stability, which allow micro motion at the fracture site [8]. Hence the fracture site heals by secondary intention [9].

MIPPO technique further compliments locking plate fixation. There is minimal soft tissue dissection, periosteum is not stripped. This facilitates early healing and better clinical results, decreases chance of infection, decreases need for bone grafting [10, 11]. Various other studies show that the use of long plates increase the plate working length and thereby improves its capacities to withstand loading [12].

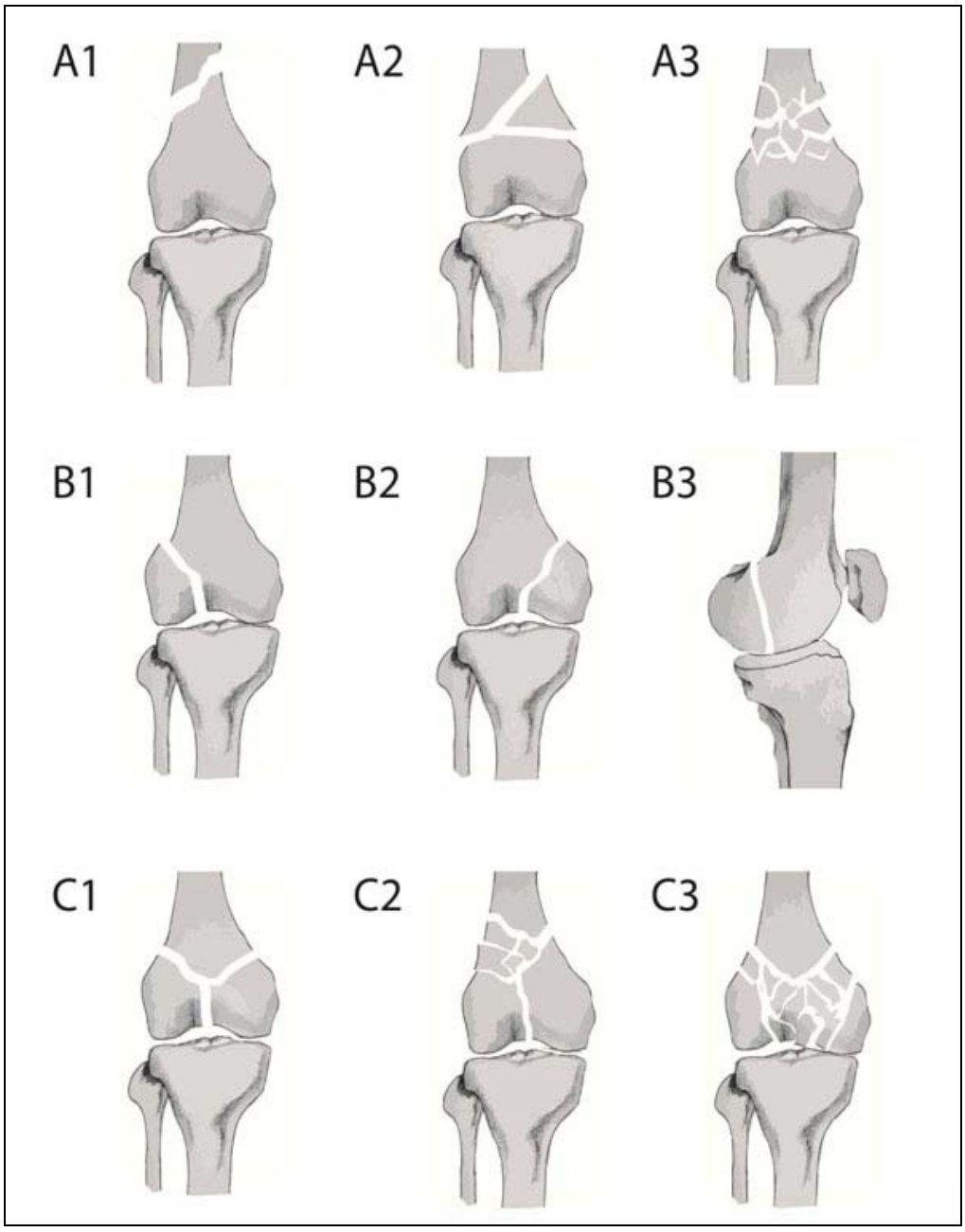
Results of our study were comparable to other studies. The fracture union in our study was 100% and no non union as compared to 90.9% in Yeap EJ *et al* [13].

Average fracture union time in our study was 14.5 weeks as compared to 14.4 weeks [14].

Mean Knee score at 6 months was 87 and functional score was 78.

In our study, shortening and malalignment was not significant as reduction and fixation was confirmed in C-ARM, there were no cases of implant failure.

AO classification of Distal Femur Fractures



Pre-op X-ray | Post-op X-ray | X-ray After complete fracture union

Case example 1

Pre-op x-ray Post-op x-ray

Case example 2

Conclusion

Locking compression plating by MIPPO technique is one of the good methods of fixation for fracture of the distal femur. The locking plate provides good angular stability due to its inherent triangular reconstruct principle and further helps in early mobilization even in comminuted fractures. The use of MIPPO technique minimized intra-operative blood loss, decreased the incidence of post-operative infection, and protected the integrity of the soft tissue envelope, helped in early rehabilitation and restoration of function.

LCP with MIPPO technique gives good results with rigid fixation, excellent union rates, good functional outcome and minimal complications in distal femur fracture management.

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