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Evaluation of surgical management of distal femoral fractures treated surgically with Plating.

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Introduction

In the modern world with the increasing density of automobile traffic on roads and ever increasing number of road accidents, there is great increase in number and severity of fractures.Advance in mechanization and increase in the speed of motor vehicles have been accompanied by an increase in the number and severity of fractures; those in distal part of femur are no extension and Fractures around knee joint have assumed an importance and frequency. In the precarious plight of city pedestrian, the knee seems to be most vulnerable point. A hinge joint at the exact level of automobile bumper is most commonly struck on its lateral side. For two wheeler occupants knee joint is frequently injured both by direct collision or getting struck to ground on falling on ground. For car occupants knee joint is in front of dash board and takes major blow in head on collisions.Increase in road traffic accidents and associated high velocity trauma has increased the incidence of distal femoral fractures, which has always been a therapeutic challenge for the treating surgeon, right from the past.

Watson Jones (1955)^[1] and Charnley (1963)^[2] pointed out that closed treatment of supracondylar fracture of femur often results in stiffness of the knee joint, angular deformity and shortening. **Neer** (1967)^[3] concluded that close reduction using skeletal traction on Bohler-Braun splint for three weeks followed by early knee mobilization on Pearson's attachment provided both the relative safety of non operative treatment and advantage of early mobilization.

Supra-condylar and inter-condylar fractures of the distal femur historically have been difficult to treat. These fractures often are unstable and comminuted and tend to occur in elderly or multiply injured patients. The incidence is highest in females over age of 65 years and in males between the ages of 15 and 45 years.^[4] Because of the proximity of these fractures to the knee joint, regaining full knee motion and function may be difficult. Adverse events include infection, decreased range of motion, need for bone grafting, mal-union, and non-union.^[5] These fractures require anatomical reduction and stabilization with least disturbance of vascular supply of surrounding soft tissue.

Once diagnosed, treatment decisions are based on both the characteristics of the fracture and patient factors. Treatment challenges are presented by patients with osteoporotic bone, with significant bone loss, and fractures with short articular segments.^[6]

In general, however, nonoperative treatment does not work well for displaced fractures. **Butt et al**^[7] performed a randomized control trial evaluating operative versus nonoperative treatment for displaced distal femur fractures in elderly patients and recommended operative treatment for displaced distal femur fractures in elderly patients.

Initial management of distal femur fractures typically includes a well padded long leg splint to improve patient comfort and prevent further soft tissue injury. In highenergy closed and open distal femur fractures, particularly in polytraumatized patients, some surgeons may temporarily stabilize the fracture with a knee-spanning external fixator until definitive management is possible.^[8-10] Other options for temporary stabilization include a skeletal traction pin through the proximal/distal tibia or calcaneus.

Multiple options exist for the definitive treatment of distal femur fractures and include external fixation, intramedullary nailing, and plate osteosynthesis with either open reduction and internal fixation or minimally invasive plate osteosynthesis. Likewise, multiple different plating options are available and include conventional buttress plates, fixed angle devices, and locking plates.

External fixation is typically reserved for those patients with open fractures with bone loss, vascular injury, associated significant soft tissue injuries, or extensive comminution.^[11-15] Reported benefits of external fixation include decreased surgical time and blood loss, and less disruption of the blood supply to fracture fragments.^[12-14] Monolateral external fixation^[13,14] and circular or ring fixators have been most commonly used.^[11-13,15]

Complications related to the use of external fixation for definitive treatment of distal femur fractures include septic arthritis, osteomyelitis, pin tract infectrion (thought to be due to the large soft tissue envelope of the femur), loss of reduction, delayed union or nonunion requiring bone grafting, and limited knee motion.^[11-15] Most series have reported $<10^{\circ}$ of angular deformity and <3 cm of shortening in most fractures.^[11,12,14]

Timing of external fixator removal may be difficult to determine in complex fractures. Time to bony union has been reported to require upto an average of 25 weeks.^[11-13] Furthermore, external fixator removal may require anesthesia and may lead to a risk of refracture. In a systematic review of actual distal femur fracture treatment with external fixation, Zlowodzki et al^[16] reported an average 7.2% nonunion rate, a 1.5% rate of fixation failure, a 4.3% rate of deep infection, and a 30.6% rate of secondary surgical procedures.^[16]

Internal Fixation

Traditional devices for internal fixation have included the 95 degree condylar blade-plate, the dynamic condylar screw with a 95 degree side-plate, and intramedullary nails. However, coronal fractures or extensive distal comminution may preclude the use of these devices. In such cases, a lateral buttress or neutralization plate may be used.

Intramedullary nail fixation is reserved for fractures with enough intact distal femur to allow for interlock fixation. The main indication for using an intramedullary nail is an AO/OTA type A fracture. However, both antegrade and retrograde nailing has been used successfully in the management of high energy AO/OTA type C 1 and 2 fractures.^[6,17-20]

Open reduction and internal fixation techniques using various implants like angle blade plate, intramedullary supracondylar interlocking nails, dynamic condylar screw and blade plate, spoon or cobra buttress plates and recently locking plates have been advocated with their merits and demerits. Because of many complication of direct reduction technique like devascularization of fracture fragment,Increased risk of delayed union, nonunion, infection.

Minimally invasive plate osteosynthesis causes Indirect reduction of metaphyseal & diaphyseal fracture

component, limited lateral surgical dissection, passage of plate submuscularly under the vastuslateralis and proximal screw insertion through incision through the muscle. This biological plating technique lowered the incidence of infection & implant failure, decreased the need for secondary bone grafting procedure and led to earlier fracture callus formation duo to improved of periosteal blood supply.^[21]

Continued development of locking plates led to implant that allow for bicortical locking screws as well as the ability to place compression and locking screws in the same plate. This capability led to the development of "hybrid fixation". This technique uses non-locked screws to either aid in coronal plane fracture reduction using the plate's anatomic contour, compress the fracture site in simple fracture patterns, or for diaphyseal fixation that theoretically increases screw pullout strength. In LCP the next evaluation is Hybrid plating technique studied by **Ricci WM et al (2006)**^[22] utilize nonlocked screws to compress the plate against the bone. The plate contour is used as a reduction aid and then locked screw to improve biomechanics.

Locking compression plate also give an extra advantage to achieve an stability in complex metaphyseal fracture & osteoporotic fracture because osteoporotic bone often cannot achieve the torque necessary to maintain such construct stability. Some author have demonstrated the ability of locked plates to absorb more energy before failure compared with angled blade plates or intramedullary nailings, thereby having a lower incidence of loss of fixation.

In this study we report the result of surgical management of distal femoral fractures using various Plate designs.

Materials And Method

A prospective study of 25 patients with distal femoral fractures including supra condylar fractures with

intercondylar extension with 12 Type A, and 13 Type C fractures were treated surgically was carried out during the period from March 2017 to May 2018, at Pt. B.D.Sharma PGIMS, Rohtak ,Haryana

Total 42 cases of supracondylar were reported to us out of whom 17 were not included in our study because they were not satisfying our inclusion criteria. 6 cases had compound fractures, 3 cases had pathological fractures, 5 cases had type B supracondylar fractures and 2 case lost to follow-up and one had follow-up of less than six months. These 17 cases were excluded from the study hence effectively it is a study of 25 cases.

In all cases detailed history was taken and thorough clinical and radiological examination done preoperatively. All clinical and radiological data were recorded from the beginning of the study period in a specifically built database. All patients gave their informed consent for surgery .The study was authorized by the local ethical committee.

study design

Prospective, observational study.

Inclusion Criteria

- Fresh cases of Distal femoral fractures which are of closed type.
- Cases will include all supracondylar and intercondylar extensions of distal femoral fractures.
- Both the Genders
- Muller type A1,A2,A3 and type C1,C2,C3 Fractures.
- Patient willing to provide their voluntary written informed consent.

Exclusion Criteria

- Age below 18 years
- Compound Fractures
- Patients not willing for surgery
- Patients not medically fit for surgery
- Pathological fracture secondary to neoplasm

• Muller type B Distal femoral fractures

Method of Treatment

Most of the patients were brought to casualty. A careful history was elicited from the patient and/or attendants to reveal the mechanism of injury and the severity of trauma. Clinical assessment of skeletal and soft tissue injuries and general condition was done.

The patients who had supracondylar and intercondylar fractures of distal 9 cm of femur were selected for the study.

Vital signs were recorded. Systemic examination was done. Local examination of the fractured limb in majority of the cases revealed lateral rotation of the limb, swelling at the fracture site, tenderness, abnormal mobility, crepitus and shortening from 1 cm to 2 cm. Distal neurovascular status was assessed by palpating dorsalis pedis and posterior tibial artery and asking the patient to dorsiflex and evert the foot. Out of 25 patients all were fresh fractures, and they presented to hospital within 0 to 4 days of trauma.

X-ray of lower half of thigh including knee joint AP and lateral views was taken. **Muller's** classification was used. There were 3 type A1, 4 type A2, 5 type A3, 4 type C1, 7 type C2 and 2 type C3.

The injured limb of all the patients were immobilized by skin traction and injectable analgesics were given to relieve pain.

There were 16 men and 9 women with an average age of 47.61 years, ranging from 18 years to 85 years. The mode of injury was traffic accident in 19 patients, fall in 6 patients, with fall from height in 2 patient and simple fall in 4 patient.

Associated injuries were present in 9 patients. All these injuries were managed according to standard treatment protocol followed in our institution. Patients who had head injury or had a loss of consciousness after injury were taken for surgery only after getting opinion regarding fitness for surgery from neurosurgeon.

The interval between injury and definitive treatment ranged from 1 days to 5 days. Average is 1.98 days.

Lateral Femoral Plating Instruments And Implants

Condylar buttress plate, spoon plate and locking compression plate of two design has been used these two plates are available in size of 4 hole to 18 holes. In Locking plate threaded holes present in plate head which accepting 5.00 mm & 6.5 mm locking head screws in different direction. In shaft there is a LCP combination hole is present accepting 5.00 mm locking cortical & 4.5 mm simple cortical screw so provided dynamic compression and angular stability in one implant. The lower end having tapered, rounded plate tip for easier application of MIPPO.

Post-Operative Management

All patients were given post-operative antibiotics for 3 days. Post- Operative radiographs were taken on the following day. Static Quadriceps exercises was started on the following day. The patients were encouraged to do active hip, knee and ankle movements as soon as the pain and inflammation subsided. Suture removal was done on the $12^{\text{th}} - 14^{\text{th}}$ day.

After suture removal active mobilization of the hip and knee was started with non-weight bearing with crutches or a walker until 6 weeks. If the fractures was very unstable and communited and in the geriatric Patients we have applied high groin cast for 3 weeks. Patients were mobilized non-weight bearing as soon as the pain or general condition permitted. Weight bearing was commenced depending upon the stability of the fracture and adequacy of fixation and radiological union in x-rays, delaying it for patients with unstable fractures.

Functional Results

The results were evaluated according to the **Schatzker** and Lambert^[23] criteria which is as follows:

Excellent:

- Full extension
- Flexion loss less than 10⁰
- No varus, valgus or rotator deformity
- No pain
- Perfect joint congruity

Good: Not more than one of the following:-

- Loss of length not more than 1.2cm
- Less than 10° varus or valgus
- Flexion loss not more than 20°
- Minimal pain

Moderate

- Any 2 of the criteria in good category **Poor:** Any of the following:
- Flexion to 90° or less
- Varus or Valgus deformity exceeding 15
- Joint incongruity
- Disabling pain, no matter how perfect the X-Ray.

A union was defined as less than 5 degree of varus-vulgus or procurvatum-recurvatum angulation, malrotation of less than 10 degree and not more than 0.5 cm of limb length discrepancy.

Complication

Intra-operative

No major intra- operative complication was faced while doing these surgeries.

Post Operative Complications

Deep Infection: There was 1 case of Deep infection, which persisted even after appropriate antibiotic treatment after culture and sensitivity. Infection subsided after

removal of stitches and thorough lavage of the operative site. This patient also went into delayed union.

Delayed Complications

- a) Implant Failure: In one patient 85 year old who is operated for comminution with intercondylar extension supracondylar fracture coming after 1 month with stress fracture ipsilateral femur just above the implant duo to sudden slip in home which was treated with ORIF with 8 hole broad DCP.
- **b)** Non union: No patient in our series had non union.

Result and Discussion

- In this study 25 cases of distal femoral fractures of distal 9 cm of the femur with average age of 47.64 years, treated surgically through direct or indirect reduction technique with LCP or conventional plate.
- 2. Our aim was to treat these fractures by minimal soft tissue stripping, rigid internal fixation, early mobilization and to know the outcome of these fractures.
- 3. The mean age group of patients was 47.64(±13.741) years and maximum patients were in the age group of 41 to 58 years. Males were predominating in our study. 16(64%) patient were men with average age of 43.31 yrs and 9 (36%)patients were women with average age of 55.33 years.
- 4. Road traffic accident was the main cause of fractures. In young patients high energy trauma such as RTA 19 (76%) and fall from height 2(8%) and in elderly low energy trauma such as simple fall 4(16%) was the main cause of fractures in patients.

- 5. 13 cases were of right side(52%) and 12 cases were left side(48%) with slight preponderance of right side was found in our series.
- 6. Many fractures were comminuted.
- Among 25 fractures 12% were type A1, 16% were type A2,20% were type A3 and 16% were type C1,28% were type C2 and 8% were type C3.
- Associated other injuries were common, constituting 9(36%) of total patients in the series. There were no ligamentous or vascular injuries.
- 9. Surgery was performed within 1-5 days, after injury, an average of 1.98 days.
- 10. Radiological union was seen at an average of 14.72 weeks range from 12 to 24 weeks.
- 11. Average range of knee motion was 112.8°. In type A it was 112.56°(±10.55°) and in type C it was 111.66°(±10.316°). Average knee motion in patient treated with LCP was 113.32° and patient treated with conventional plate was 110.01°
- 12. Clinical and radiological evaluation done at regular follow-up, at an interval of every 4 weeks. With a minimum follow-up of six months, final fuctional outcome was evaluated as per Schatzker and Lambert criteria.
- 13. End results were excellent in 17cases(68%), good in 3cases(12%), moderate in 3cases(12%) and poor in 2 patients(8%). 2 poor result was found in our series 1(4%) duo to deep infection and 1(4%) duo to stress fracture in geriatric patient after one month just above the plate.
- 14. Bad result was more often associated with comminuted fractures associated with infection and poytrauma patients.
- 15. Average Duration of hospital stay in our series was 6.24 days range from 2 to 11 days. Patients was discharged within 5 to 7 postoprative day

only 3 patient remain for longer duration one was having deep infection, one was having medical problems and 3rd one was having polytrauma.

- 16. Commonest complications encountered in this study were varus angulation seen in 3 cases(12%).Deep infection was found in 1(4%) cases.One cases of stress fracture found in our series and no any case of nonunion implant failure was found in our series.
- 17. Although our study period is short and our sample size was limited so that the assessment of long term follow-up of patient was difficult but within the limited time period we followed-up and we have a encouraging results.
- 18. functional outcomes is poor in geriatric patient and in polytrauma patient but with the help of locking compression plate coincide with minimally invasive technique achieved a very good result in type A and communited type C in both in younge and geriatric age group help in early mobilization of knee joint and stiffness can be prevented.
- 19. Hence it is concluded that supracondylar/distal femoral fractures can also effectively treated by Locking compression plate . It leads to rapid bone healing despite of severe comminution, avoiding the need for bone grafting is because of less soft tissue dissection and periosteal stripping. Conventional plate be used in type A fracture with a good bone stock.

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Example Case Age: 35 Years Sex: Male



Preoperative X-Ray (A-P & Lateral View)



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