



FUNCTIONAL OUTCOME OF TARPOS APPROACH IN DISTAL FEMUR FRACTURES

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ABSTRACT Distal femur fractures are complex injuries with potential to cause long term disabilities. These are fractures involving distal 15 cm including metaphysis and/or articular surface. Distal femur fractures can result from high energy trauma in young or middle-aged patients and low energy trauma in elderly patients. Previously, the treatment of these fractures leaned towards closed conservative management with plaster cast and skeletal traction due to non-availability of proper techniques and implants to provide stable fixation. Current generation of distal femoral locking compression plate has the advantage of combination of conventional compression plating and locked plating technique which enhances plate osteosynthesis. TARPOS approach was developed by Krettek for the osteosynthesis of distal femur intra-articular fractures. The study was conducted to evaluate the functional and clinical outcome of fracture distal femur in patients treated by open reduction and internal fixation via TARPOS approach (Trans-Articular Retrograde Plate Osteosynthesis). A prospective study was done in 18 patients who underwent Open reduction and internal fixation with LISS plates via TARPOS approach in the Department of Orthopaedics, Govt. Medical College, Thrissur. The functional and radiological outcomes were assessed in these patients 6 months after surgery using Thoresen's scoring system. The post operative outcomes- intermediate and final, were assessed and analysed for statistical significance using Microsoft Word, Microsoft Excel and statistical software IBM – SPSS (International Business Machines – Statistical Product and Service Solutions), using appropriate statistical tests. A series of 18 patients with supracondylar femur fractures were studied. The largest contribution came from the age group of 40 to 70 years. Fall was the commonest mode of injury (77.77%). 1 case was found to develop post-operative infection and 1 case was found to have mild degree of restriction of knee movements. Post-operatively, excellent scores were achieved in 14 cases and good results in 2 cases. Average time of union of fracture was 10.5 weeks. The study shows that this approach has various benefits in terms of better fixation and healing rates and as such makes it an attractive treatment option for distal femur fractures.

KEYWORDS :

INTRODUCTION

Supracondylar femur fractures are severe injuries that can be technically challenging to operatively treat. Although they account for less than 1 % of all fractures and 3 to 6 % of femur fractures, their incidence is likely to increase with rising geriatric populations and the increasing number of peri-prosthetic injuries. Injuries to distal femur follow a bimodal distribution between geriatric low energy fractures and high energy trauma in young individuals. As with all fractures involving periarticular metaphyseal bone, treatment invariably includes understanding the fracture characteristics, careful operative planning, assessment of patient goals and health, bone quality, surgeon experience and implant selection.

In the early 1960s, most distal femur fractures were managed conservatively with fracture bracing and traction, achieving acceptable results in 67% to 90% of patients. However, with the advent of new surgical techniques and implants, the pendulum shifted from conservative management to surgical stabilization of these injuries.

Through historical review, Henderson and colleagues chronicled the increasing success rates with operative fixation from 52% to 54% in the 1960s, 73.5% to 75% in 1970s, to 74% to 80% in 1980s. Steady advances in our understanding of distal femoral anatomy and fracture biology have heralded various implant designs that further optimized successful treatment of these injuries. These modalities, each with their own merits and drawbacks, range broadly from external fixation (locked and unlocked), intramedullary nailing, arthroplasty, distal femoral replacement and plate fixation (locked and unlocked). Different surgical approaches have been devised for plate fixation of distal femur fractures and one such method is called TARPOS approach (Trans-Articular Retrograde Plate Osteosynthesis). In this study, we will be focusing on the functional outcome of this approach using a prospective study of several patients in a series of follow-ups and we will be scoring the outcome of the study using appropriate scoring methods and clinical analysis of patients and patient outcome. We will also be analysing the efficiency of this method in identifying fractures missed in X rays, and the convenience of surgery using this method. A sample of 18 patients were analyzed for this study.

MATERIALS AND METHODS

Patients presenting to Government Medical College, Thrissur, with history of trauma and diagnosed as distal femur fractures or supracondylar femur fractures are admitted and a detailed history is taken and complete physical examination done. Diagnosis is

confirmed by X ray. Following confirmation of diagnosis, patients are planned for emergency surgery with Open reduction and internal fixation with plates via TARPOS approach. Routine investigations are done.

Patient was placed supine on the operating table with a sterile pillow under the knee and the knee is placed on the radiolucent side of the table. Under sterile aseptic precautions and general anaesthesia / spinal anaesthesia, tourniquet was applied to the fractured limb at the level of thigh with adequate padding, parts painted and draped. Incision of size 8 cm was made over the anterolateral aspect of thigh, a lateral parapatellar arthrotomy was performed and continued proximally (among the fibres of rectus femoris and vastus lateralis) and distally up to the tibial tuberosity. By this procedure, the patella was medially retracted, allowing perfect visualization of the femoral condyles.¹ Following direct reduction of the articular surface using Schantz pins as joysticks, Weber clamps or a colinear reduction clamps and its stabilization by provisional Kirschner wires, fixation was performed by 1 or 2 cannulated cancellous screws.¹

Following articular reconstruction and indirect reduction of the metadiaphyseal region, LISS and LCP plates were inserted beneath the vastus lateralis. The alignment and positioning of the plate on the diaphysis was provisionally fixed using proximal and distal Kirschner wires. Screws applied using an aiming device and following its removal, a distal locked screw was applied in the remaining hole.

Post operatively, radiographs were taken to confirm the implant placement and fracture reduction.

Active knee exercises were started at the earliest possible. Parenteral antibiotics and analgesics were given during the first 3 postoperative days, which were later converted to oral route. Suture removal was done on the 10th day.

The cases were reviewed after 3 weeks. Active exercises of knee and hip, weight bearing exercises and gait training were started. The patients were followed up for a minimum period of 6 months. The subjective, objective and radiographic findings were quantified.

RESULTS

Table 1: Mode of Injury

Study	No. of patients	Commonest mode of injury

TARPOS approach functional outcome study by P. D. Sirbu et. al	17	Road Traffic Accident
Transarticular joint reconstruction and plate osteosynthesis by C. Krettek et. al	8	Road Traffic Accident
My study	18	Road Traffic Accident

Table 2: Gender Distribution

Study	No. of patients	Male : Female	Percentage of male
TARPOS approach functional outcome study by P. D. Sirbu et. al	17	10:7	58.8
Transarticular joint reconstruction and plate osteosynthesis by C. Krettek et. al	8	5:3	62.5
My study	18	12:6	66.6

Table 3: Radiological Outcome

Study	No. of patients	Mean time of union
TARPOS approach functional outcome study by P. D. Sirbu et. al	17	12.6 weeks
Transarticular joint reconstruction and plate osteosynthesis by C. Krettek et. al	8	13.3 weeks
My study	18	12.94

Table 4: Clinical Outcomes In Various Studies

Study	Excellent	Good	Fair	Poor
TARPOS approach functional outcome study by P. D. Sirbu et. al	15	1	1	0
Transarticular joint reconstruction and plate osteosynthesis by C. Krettek et. al	6	1	1	0
My study	14	3	1	0

DISCUSSION

Initially, most of the distal femur fractures were treated conservatively with splints and traction, but now, there is a change in the management of these fractures, because of higher complications following conservative management. These fractures have a higher tendency to go for non-union, malunion and knee stiffness due to improper reduction and re-displacement.

Distal femoral fractures are a serious and potentially life-changing injury in the elderly due to the associated increased complication rates. Complications such as, infection and the need for secondary surgical procedures, to address cases of non-union or implant failure, may be increased by the presence of underlying osteoporosis and the poor physiological reserves of this group of patients. Other issues associated with individuals suffering from this injury include; a prolonged length of hospital stay and impaired ambulation. Both have a sizeable impact on the independence and the perceived quality of life of affected individuals.

In order to address the issue of fixation failures in osteoporotic bone due to screw cut-out, locked osteosynthesis fixation techniques were developed to overtake the use of non-locked osteosynthesis implants, in which the stability of the construct and the transfer of load from the bone to the implant, is dependent on the frictional force generated by the contact of the osteosynthesis plate against the underlying bone. With locked osteosynthesis devices, an angular stable, fixed-angle construct is created by the individual locking of screws onto the osteosynthesis plate.

Locked osteosynthesis devices can also be described as 'internal external fixators' as the need for a tight pressed fit against the underlying bone is unnecessary, allowing for less disruption of the periosteal blood flow, optimising the chances of fracture healing (¹¹⁶). Biomechanical studies using paired cadaveric femurs comparing locked with unlocked fixations have demonstrated that fixation with locked plate osteosynthesis devices are superior to conventional, unlocked implants (^{117,118}). The LISS implant, a first generation locking osteosynthesis device, possesses only a mono-angle of screw insertion, which is at 90 degrees to the plane of the implant.

The complication rates following distal femoral fractures vary somewhat with the patient population studied. As previously

mentioned distal femoral fractures have a bimodal incidence, occurring in young individuals, as a result of high energy trauma and also predominantly in the elderly female population, as a result of low energy falls in the presence of underlying osteoporosis. These two groups vary significantly in terms of their injury patterns, physiology and co-morbidities, thus an expected difference in clinical outcome is not unreasonable.

Because of these critical challenges like comminution, medial cortical loss, intra articular extension, muscle force on fractured fragments makes instability and all these difficulty are encountered in unstable distal femur fractures. 5-10 % of open injuries added the complexity more.

Among the Classification by the Muller, Weight defines type A2, A3, C2&C3 are unstable fractures. Of which particularly type A3, C2 and C3 are highly unstable; which are considered in our study, need adequate reduction, proper alignment and careful selection of implant which withstand these forces and correct method of fixation in midst of careful soft tissue handling. Without this knowledge and skill these fractures mostly end up in failure and complications provide the headache for the surgeons and importantly, discomfort, frustration, depression for the patients.

The goal of locking plate is to provide better stability in fragile bone. Primary stability of the plate is obtained by locking the screw into the plate not by pressing the plate by screw to the bone. Plate design is anatomical which allows it to be used as reduction mold to molding the bone to the plate. When we considered biomechanical aspect locking plate are superior than conventional plate. Though strength under axial compression is more than other implants, but strength under torsion was reduced. The locking plates do not have direct contact with bone which allows preservation of the periosteal blood supply. Thus, locking compression plates are biomechanically superior and biologically compatible.

All patients were evaluated properly taken for surgery within a week of period. All were operated under spinal anaesthesia with TARPOS approach. Strict standard reduction techniques and meticulous soft tissue handling followed in all cases. All patients received lateral locking compression plate laterally. Medially in 75% of cases we used large fragment T buttress plate, which has advantage of distal transverse limb with two cancellous screws in condylar portion at anterior and posterior part. One female patient had screw loosening in follow up due to osteoporotic bone. So medially, Locking plates are preferred over non locking especially in old osteoporotic individuals.

We also used locking reconstruction plate (3.5mm) in one patient, non locking reconstruction plate in two patients, narrow DCP in one patient which were easy to slide sub muscularly by minimal incision when long fracture segment to be spanned.

Because of small sample size there is no significant statistical difference can be elicited between choice of medial plate with time to union and outcome and rate of complications. Mean intra operative blood loss was 615 ml (range 400 to 800 ml). Most surgeries had blood loss between 600 to 900 ml. Mean duration of surgery was 117 minutes (range 90 to 180 minutes). 80% surgeries were finished within 120 minutes. Mean duration of surgery not extended compared to single plate fixation by other studies.

Duration of surgery not related to whether injuries were open or closed. When considered type of fracture blood loss was more in type C3 compared to type A3, no significant relationship with duration of surgery. There is no statistical significance between operative duration and post operative complication and outcome.

There is significant relation between type of fracture and Sander's score and outcome ($p = 0.007$). Type A3 had better score than type C2 and type C3. Type C2 had better score than type C3. There is better outcome in above 40 years of age. There is no significant relation of sex, mode of injury, duration of surgery and bone grafting compared with functional outcome ($p > 0.05$). The final knee flexion between minimum 30 degrees to maximum 135 degree with mean flexion of 102.25 degrees. Three patients had extension lag, of which two were having lag of 5 degrees and below and one had lag of 10 degrees.

In my study, the mean age of the patients was found to be 73.3 and most supracondylar fractures were sustained by elderly people with

osteoporotic bone. Male gender was found to be more common to sustain supracondylar fracture and the most common cause was found to be road traffic accident. Radiologically, good callus formation was found within 6 weeks and most of the fractures united well within 12 weeks.

The study conducted by Sirbu showed excellent outcome in 15 patients out of 17 total patients, whereas the study conducted by Krettek showed excellent outcome in 6 patients out of a total 8 patients. In my study, excellent outcome was obtained in 14 patients out of 18 patients. None of the patients presented with postoperative infection and the scar was minimal and complete healing of the scar took place in almost 2-3 weeks in all the patients. Patients were able to flex the knee to 90 degrees in 6 weeks and maximum 135 degrees was obtained in 12 weeks time with adequate physiotherapy. Patients were able to partially weight bear with walker support within 2 weeks and fully weight bear after 6-10 weeks.

In my study, 14 patients had good union of fractures with a mean union period of 12.8 weeks, while 3 patients had delayed union of 15-16 weeks and one patient had malunion without any significant functional limitation.

CONCLUSION

This single centre small to medium population series demonstrated good to excellent results in the majority of patients after open reduction and internal fixation of distal femur fractures via TARPOS approach with outcomes comparable to other studies in literature.

This study corroborates the finding of other well-designed studies showing association between radiographic and clinical outcomes in patient population with distal femur fractures as an improved outcome was noted in those cases where good anatomical reduction could be achieved.

This study also led to the conclusion that TARPOS approach in distal femur fractures could guarantee high chance of union with decreased complication rate. Rehabilitation and wound healing is quick because immobilization of the joint is for relatively short period and the incision is minimal, respectively.

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