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Evaluation of functional and radiological outcome of distal femoral fractures fixed with locking compression plate by minimally invasive plate osteosynthesis

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ABSTRACT:

Title: Evaluation of distal femoral fractures with locking compression plate using minimally invasive plate Osteosynthesis (MIPO) technique.

Aim: To prospective and retrospective analysis of clinical and radiological outcome of distal femur fractures treated with locking compression plate by minimally invasive plate osteosynthesis (MIPO) technique.

Materials and methods: This is institutional based study of 23 patients with distal femur fractures were evaluated in between may 2017 to April 2022. Distal femur was exposed using modified lateral approach. We used locking compression plate to fix the fracture. Post operative rehabilitation was started from the 1st post operative day. follow up at every 6-8 weeks interval to assess knee range of movements and functional outcome. Hammer et al grading was used to assess radiological union and the knee society scoring system was used to assess the functional outcome.

Results: 23 patients in the age group of 20 – 80 years for the period of 18 months (mean =12 months).16 patients sustained RTA and 7 had a self fall. Union was achieved in all the patients and the mean time to union was 15 weeks. Full extension was achieved in 19 of our patients. We had the several complications. The average knee society score was 153 and 75% patients had good to excellent results.

Conclusion: we conclude that the Minimally Invasive Plate Osteosynthesis (MIPO) technique results in early post-operative rehabilitation, satisfactory union and good functional outcome. The chances of infection and implant failure are less.
Keywords: MIPO, knee society score, LCP

INTRODUCTION

Distal femur fractures are defined as fractures that affect the lower nine to fifteen centimetres of the femur, down to the articular surface of the knee[1-3]. These fractures account for approximately 4% to 6% of all fractures affecting the femur[4]. A study by Martinet et al[5] found that distal femur fractures have a bimodal age distribution. The younger age group comprises mostly males in their second to third decade of life who typically sustain their injuries *via* high energy mechanisms such as motor vehicle accidents. The older age group mostly comprises females in their sixth decade of life onwards, who typically sustain their injury *via* low energy mechanisms of injury from osteoporosis[6,7]. Because of its biomechanical specifics, the treatment of distal femur fractures has historically been associated with a high incidence of complications, including non-union or delayed union, malalignment of the femur, infections of the bone and soft tissues, chronic pain and decreased range of motion and function of the knee joint[8-10]. In 1960‟s most of these fractures were treated conservatively and documented better outcome than operative treatment. But with the advent of newer implants and modern techniques, these fractures are best treated with surgical stabilization. The newer modalities of treatment include minimally invasive plate osteosynthesis (MIPO) and less invasive skeletal stabilization (LISS) [11] Hence in the Department of Orthopaedic surgery at MGM medical college INDORE and M.Y. H Hospital, INDORE; a prospective study was conducted to analyse the functional and radiological outcome of distal femoral fractures fixed with locking compression plate by minimally invasive plate osteosynthesis (MIPO) technique

AIM AND OBJECTIVE

- To evaluate 23 cases of distal femur fractures fixed with locking compression plate by minimally invasive plate osteosynthesis (MIPO) technique in the Department of Orthopaedic surgery at mgm indore medical college and Hospital, indore

- To prospectively and retrospective analyse the clinical and radiological outcome .

History & Evolution of MIPO: [12]

In 1965, AO emphasized perfect anatomical reduction & rigid internal fixation of fractures. However, they found rigid internal fixation did not always produce the desired end result.Although the use of biologic principles and LCP by MIPO technique has improved results, it does not always warranty a favourable outcome. The following complications are described in the literature.

MATERIALS AND METHODS

This is Prospective and retrospective study was conduct at department of orthopaedics at MGM Medical College Indore and M.Y.H. hospital, this study was conducted from JULY 2018 to APRIL 2020 enrolled restropectively (15 patients) and prospectively (8 Patients) may 2020 to April 2022 . Collection of data as per proforma with written & informed consent from the patients admitted in Orthopedic ward MGM Medical College Indore and M.Y.H. hospital

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Inclusion criteria

Patients in the age group of above 18 years

- Distal femoral fractures – Müllers type A ,C1 and C2
- Less then < 2 weeks of injury
- Fractures reducible by indirect methods
- Grade I and II compound injuries (Gustillo Anderson)

Exclusion criteria

- Fractures with grade III compound injuries
- Active infection
- Muller type B & C3 fractures
- > 2 weeks of injury (fracture may not reducible by indirect methods)

- Periprosthetic fractures
- Pathological fractures

Pre-operative assessment:

Investigations:

- Radiographs of affected femur with knee in AP &Lateral
- Heamogram
- Blood urea and sugar level

Plate span ratio:

The plate span ratio is the quotient of the plate length to the overall fracture length. Empirically the plate span ratio should be

- 2-3 times in multi fragmentary fractures
- 8-10 times in simple fractures

Surgery: Patient positioning: lateral

Surgical approach: Modified standard lateral approach:

Post-operative period:

Post-operative i.v antibiotics to cover both gram positive and gram negative spectrum were given for 5- 7 days.

Wound care. Sutures removed after 12-14 post-operative day.

Mobilization & weight bearing:

Mobilization was started as soon as possible even from the first post-operative day. Joints should be mobilized by active or active assisted movements. Non weight bearing ambulation was started as soon as possible and gradually partial weight bearing (10-15 kg) started within 2 weeks of surgery. Full weight bearing is allowed after radiological evidence of healing.

Post-operative X-Ray examination:

X-rays are taken in the immediate post-operative period to document the fracture reduction and fixation. There after x- rays are repeated at every 4- 6 weeks interval to monitor the fracture union and to detect any implant loosening or failure.
Follow up: The patient was discharged when the post-operative x-rays are satisfactory and there was no signs and symptoms of infection. follow up at 4-6 weeks interval and x-rays are taken during that time.
Criteria for clinical fracture union:

1. No pain/ tenderness on weight bearing
2. No pain/ tenderness on palpation / examination
3. Ability to walk /perform activities of daily living with no pain.

Criteria for radiological union:[13]

Radiological assessment of fracture healing ***Hammer et al***

Grade	Callus Formation	Fracture line	Stage of union
1	Homogeneous bone structure	Obliterated	Achieved
2	Massive .Bone trabeculae crossing fracture line	Barely discernible	Achieved
3	Apparent. Bridging of fracture line	Discernible	Uncertain
4	Trace. No bridging of fracture line	Distinct	Not achieved
5	No callus formation	Distinct	Not achieved

Knee society score:[14]

The outcome analysis done using American knee society scoring system. The total score is 200 comprises of

- knee score – 100
- function score – 100

Outcome	Knee score (100)	Function score(100)	Total score (200)
Excellent	80-100	80-100	160-200

Good	70-79	70-79	140-159
Fair	60-69	60-69	120-139
Poor	< 60	< 60	< 120

OBSERVATION AND RESULTS

The results were analysed prospectively and retrospectively both clinically and radiological. The follow up period ranged from 6 months to 18 months (mean = 12 month)

Table I – AGE DISTRIBUTION

S. no	Age (in years)	No. of patients	Percentage
1	11-40	10	43
2	41-80	13	57

Table 2 – SEX DISTRIBUTION

S. no	Sex	No. of patients	Percentage
1	Male	15	65

2	Female	8	35

Table 3 – MODE OF INJURY

S. no	Mode of injury	No. of patients	Percentage
1	RTA	14	61
2	Self-fall	9	39

Table 4 – CLOSED vs. OPEN FRACTURES

S. no	Closed/open	No. of patients	Percentage
1	Closed	14	61
2	Grade I compound	4	17
3	Grade II compound	5	22

TIME TO UNION

The time taken to achieve union ranges between minimum of 12 weeks to maximum of 20 weeks. (Mean = 15 weeks)

TABLE – 5 RADIOLOGICAL ASSESSMENT OF UNION

S. no	***Hammer et al Grade***	**No. of patients**	**Percentage**
1	I	15	65
2	II	8	35

Table 6 – KNEE SOCIETY SCORE (Total score 200)

Follow up	**Minimum score**	**Maximum score**	**Mean score**
1month	32	78	57
3 month	56	146	111

6 month	68	166	133
Final	81	188	153

TABLE – 7 OUTCOME

S. no	OUTCOME	No.of patients	Percentage
1	Excellent	9	39
2	Good	7	30
3	Fair	5	21
4	Poor	2	9

DISCUSSION

The evalution of management of distal femoral fractures has come a long way from totally conservative management in the 1960‟s to definitive surgical treatment at present. There is increasing incidence of comminuted distal femur fractures due high velocity motor vehicle accidents in younger population and increased life expectancy resulting in fractures following trivial fall due to osteoporotic bone. In both the groups our aim is to restore the function and near normal anatomy similar to the pre injury status. Due to the changing concepts

towards relative stability and biological fixation from absolute stability and rigid fixation, minimally invasive plate osteosynthesis (MIPO) technique evolved. Many studies proved better outcome with lesser morbidity than the conventional technique. In our study involving 23 patients with 15 males and 8 females with mean age of 47 and the mean follow up period ranges between 6 month to 18 month (mean - 12 month). 16 patients had type A fracture and 7 patients had type C fracture and 25% of patients had open injuries. The mean operating time was 100 minutes compared to 119 minutes by Yeap and Deepak et al [15]. The mean time to radiological fracture union was 15 weeks (range 12 -20 weeks) Which was comparable to 11 weeks by Kregor et al [16] , 14.3 weeks by Schandelmaier et al [17], 12 weeks by Fankhauser et al [18]and 18 weeks by Yeap and Deepak et al. The average knee flexion achieved was 94 degrees comparable to that of 103º by Kregor et al [16], 104º by Schandelmaier et al [17], 107º by schutz et al [19], 101º by Fankhauser et al and 93º by Kanabar et al. [20] The scoring system used was knee society scoring and the mean score was 153 compared to the score of 131 by Fankhauser et al . With this system 45 % patient is having an excellent outcome, 30 % good, 15 % fair and 10 % with poor outcome. The percentage of patients with good and excellent outcome was 75 % comparable to 87.5 % by Mark miller et al[21], 72.7 % by Yeap and Deepak .The complications encountered are deep seated infection (n=1), post-operative loss of reduction which requires a revision surgery (n=1), deep vein thrombosis (n=1), Knee stiffness (n=3), varus malalignment (n=2), reactive synovitis (n=1).The incidence of loss of reduction requiring a revision surgery was 5% comparable to 10 % by Markmiller et al, 9 % by Yeap and Deepak et al 7.9 % by Schandelmaier et al and 6 % by Schutz et al. The infection rate in our study was 5 % comparable to 7 % by Schutz et al [19] and 3 % by Kregor et al. We had two cases of varus malalignment (< 5 deg) but within acceptable limits in contrast to 15 % by Mark miller et al and 13 % by Schandelmaier et al, both having significant malalignment (> 10 deg). These patients may require a long term follow up to evaluate the development of arthritis. There was an incidence of 15 % knee stiffness (n=2) < 30º and (n=1) 70º and failed to show any improvement even after aggressive continuous motion therapy. We had a complication of post op DVT and reactive synovitis, which settled uneventfully with symptomatic therapy. Union was achieved in all cases and bone grafting was not required in any of our cases.

CONCLUSION

In our study, Minimally Invasive Plate Osteosynthesis (MIPO) technique using Locking Compression Plate (LCP) shows good to excellent results in terms of union and functional outcome.

- When operated within two weeks of injury, it was easier to achieve closed reduction. This decreases the operating time, blood loss and intra-operative morbidity.
- MIPO technique could results in satisfactory union and eliminates the need for bone grafting.
- The incidence of infection and post- operative morbidity was less compared to conventional open technique.

- LCP has a better hold in osteoporotic bone with less chances of failure.

- Inadequate fixation leads to loss of reduction, resulting in an open reduction and revision fixation.
- Long term follow up is necessary to study the development of arthritis in patients with varus/ valgus malalignment.
- From our study, we conclude that the Minimally Invasive Plate Osteosynthesis (MIPO) technique using Locking Compression Plate (LCP) will results in early post- operative rehabilitation, satisfactory union and good functional outcome. The chances of infection and implant failure are less. Proper patient selection and meticulous surgical techniques will give the best results.

DECLARATION

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