Volume : 2 | Issue : 6 | June 2013 • ISSN No 2277 - 8160

Research Paper | Medical Science

Outcomes in Patients of Fractures of Distal End of Femur (Supracondylar and Intercondylar Fractures of Femur) Treated with Less Invasive Stabilization System (Liss) Plate And Screw Fixation – A Prospective Study.

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ABSTRACT

Fractures in the distal femur have posed considerable therapeutic challenges throughout the history of fracture treatment because they are usually compound, comminuted, readily deformed because of muscle forces acting on the distal fragment. The objective of our study is to evaluate outcomes in patients of fractures of distal end of femur treated with Less Invasive Stabilization System (LISS) plate and screw fixation. Outcome was assessed by functional activity score, modified knee rating system and knee range of motion. In our study, average knee range of motion was 106 degrees. 94% of our patients were able to walk normally without limp and support. LISS plating is useful in treating complex distal femoral fractures, resulting in reduced blood loss and low infection rates, while achieving early mobility due to primary stability of the construct.

KEYWORDS: LISS plate, distal femur fracture, supra-condylar and inter-condylar femur fracture

- **Introduction:**

Watson Jones said in 1955, "Few injuries present more difficult problems than distal fractures of the femur and few have resulted in as much disability".

Advances in mechanization and acceleration of travel have been accompanied by an increase in the number and severity of fractures and the distal region of the femur is no exception. Fractures in the distal femur have posed considerable therapeutic challenges throughout the history of fracture treatment because they are usually compound, comminuted, readily deformed because of muscle forces acting on the distal fragment, prone to result in functional impairment of the knee joint and ankle joint because of injury to quadriceps system and often occur in elderly patients with osteoporosis. Whether it is transverse, oblique, comminuted or intercondylar in "T" or "Y" fashion its management still evokes much controversy because of the poor results obtained. Various modes of treatment have been advocated by a number of authors. They vary from closed treatment with traction, application of cast brace following preliminary traction, to open reduction and internal fixation with a variety of devices. Closed treatment results in significant morbidity with common complications of malunion, shortening, slow recovery of knee motion and prolonged recumbency with its own complications. All these complications have led to widespread attempts at open reduction and internal fixation. The modified knee rating system used for analysis of results includes parameters affecting the daily functional activities like squatting and sitting cross-legged which are essential for Indian population.

- **Objective:**

Evaluate the results of Less Invasive Stabilization System (LISS) plating in different types of distal femoral fractures (open and closed) both clinically as well as radiologically.

- **Materials and methods:**

In this study, we have analysed the results of LISS plating in various types of fractures of distal femur.

- Men and women both included in study.
- Different mode of injuries i.e. by road traffic accident, assault, direct injury, fall from height are included.
- Both open and closed fractures are included.
- All types of fracture pattern involving distal femur included.
- Patients who have completed minimum of 3 months after surgery included.
- Patients having other associated injuries or medical illness like jaundice, tuberculosis, diabetes included.

- **Assessment standards:**

- Time required for union according to pattern of fracture in average built person.
- Infection rate.
- How many patients developed nonunion and malunion.
- ROM (range of motion) at knee and ankle.
- Time required to reach the level of fitness for performing routine daily activities.

- **Observation and discussion:**

30 patients with distal femur fractures were treated with LISS plate fixation.We have compared the data, analysis and results in our study with various series done for LISS plating in distal femur fractures.

1. Age:

- We had patients of age ranging between 21-70 years. Majority of our patients (73%) were in 21-50 years age group. Mean age in our study was 37 yrs.
- Mean age in Fan Liu et al study was 49 years (range 18-82 years).
- Mean age in Ru J et al study was 55 years (range 32-72 years).
- Mean age in P. Schandelmaier study was 54 years (range 20-92 years).
- Mean age was 49 years (17-90 years) in Kolb W et al study.

2. Sex:

- In our study ratio between male to female was 5:1
- The dominance of male because –

1) Male are more involved in outdoor activities hence more vulnerable to vehicular accidents.
2) Due to social customs, certain tasks which involve more risk are done by males eg. working at heights, driving, labour work and travelling.

In Kanabar et al study, M:F ratio was 1:1.83
In Ru J et al study, there were 15 men and 11 women.

3. Occupation:

- In our study out of 30 patients, 16 patients (53%) were labourers, 5 (17%) were housewives and 9 (30%) patients had other occupations.
- Labourers sustained maximum injury to distal end of femur.

4. Mode of injury versus acceptable results:

- In our study among patients who sustained vehicular accident, 81.8% patients had acceptable results. Among the patients who

had history of fall, 75% had acceptable results. In our study, 2 fair and 2 poor results were seen in patients with vehicular accidents and 1 fair and 1 poor result was seen in patients with fall from height.
- In Kanabar et al study there were 14 patients with fall as mode of injury and 3 patients with vehicular accidents as mode of injury and all patients with satisfactory results.
- In Srinivas et al study there were 13 patients with fall as mode of injury and 10 patients with vehicular accidents as mode of injury and all patients with satisfactory results.

5. Side of injury:
- In our study, left side was involved in 10 patients (33%) and right side was involved in 20 patients (67%).
- In Kanabar study, left side was involved in 7(41%) patient and right side was involved in 10 patients (59%).
- In Ru J et al study, left side was involved in 16(62%) patient and right side was involved in 10 patients (38%).

6. Associated injuries:
- In our study, 9 patients (30%) were having associated injuries. 2 patients (7%) were having ipsilateral lower limb injuries and 3 patients (10%) were having ipsilateral upper limb injuries, 1 patient was having injury in contralateral upper extremity and 3 patients (10%) were having head injuries.
- Associated injuries in ipsilateral extremity alters the outcomes of LISS plating in distal femur by delaying weight bearing(partial or full) when compared to other patients with no associated injuries.

7. Type of fracture:
In our study, we had 54% of patients with extraarticular fractures and 46% of patients with intraarticular fractures.

8. Type of fracture versus results:
- Presence of comminution and intraarticular extension are important factors in determining the final results.
- In our study 16 (54%) patients had extra articular fractures and 14 (46%) had intraarticular fractures. All patients with extraarticular fractures had excellent results at final follow up.
- Out of 14 intraarticular fractures (46%) we had 3 patients (10%) with type C-I and 7 patients (23%) with type C-2 and 3 patients (10%) with type C-3 fractures and one patient (3%) with type B-1 partial articular fractures. Out of those 14 patients, 11 patients (36%) had acceptable results and 3 (10%) patients had poor results at final follow up. Poor results in such patients were due to associated soft tissue injuries which later on led to adhesions; intraarticular comminution and open injuries.
- In Kanabar series, 9 patients out of 17 (53%) were having intra articular extension with 7 cases (41%) of type C3 fracture and 6 cases having satisfactory results.
- In Srinivas series, (21%) were having intra articular extension with all cases having satisfactory results.

9. Open and close injury versus results:
- In our study, 17(57%) patients had close fractures and 13 (43%) had open fractures – Gustillo Anderson grade–I 1(3%) and grade-II 4(13%) and grade-III 8(27%).
- Of the 17 close fractures, all patients had acceptable results.
- Of the 13 open fractures, 10(33%) patients had acceptable results.
- In Kanabar series, 17% patients had open injury out of which 11% had acceptable results.

10.Fracture union:
- The average time of union in our series is 17.5 weeks. Majority of fractures united within 15 to 20 weeks. 5 cases united at >20 weeks.
- There were two nonunion in our study.
- Union rate was 93.3% in our study
- In Kanabar et al study, average union time was 17 weeks with union rate of 100%.

11. Complications:
- The most common complications occurring after LISS plating were joint stiffness, infection, implant failure, nonunion and malunion.
- No intra-operative or early post-operative complications were encountered in any of the patients.
- 27% of patients had knee joint stiffness at long term follow up possibly due to type C-3 comminuted fractures and delayed mobilization.
- The incidence of infection in our study is 3% while the incidence of infection in Weight and Wong study was 2%.
- Two non-union (7%) occurred in our study while the incidence of nonunion or malunion in Weight and Wong study was 0%
- Majority of fractures healed and united uneventfully in our study.

12.Knee range of motion, squatting, sitting cross-legged:

	>120	90-120	80-90	<80
Kanabar study	18%	65%	6%	11%
Kolb W et al study	48%	39%	7%	6%
Our study	20%	49%	17%	14%

13. Functional activities:

a) Walking without limp and support
- All patients were discharged with active quadriceps exercise.
- 94% of our patients were able to walk normally without limp and support.
- 74% of our patients were able to walk for unlimited distance and 23% patients were able to walk a distance of 1 km and 3% patients were able to walk < 0.5 km possibly due to intraarticular comminution and adhesions and preexisting osteoarthritis.

b) Climbing Stairs
- 70% of our patients were able to climb stairs without discomfort. 30% patients had to climb stair either by holding rails or by climbing one stair at a time due to restricted knee range of motion and pain.

c) Shortening
- 73% patients had no shortening, remaining 24% had shortening of less than 1.5cm and 3% had shortening of > 1.5 cm.

d) Pain
- 50% of patient had no pain at final follow up and 47% had occasional pain. Pain may be due to associated injuries or preexisting osteoarthritis.

e) Return to work
- 80% of the patients could resume their pre-injury job / lifestyle
- 13% patients either had difficulty in their job / lifestyles due to difficulty in sitting cross-legged, squatting and restricted knee movements.
- 7% patients had to leave their pre-injury job due to severe restriction of knee movements.

14. Results:
- Using 'Modified knee rating system' which included more stringent criteria like squatting and sitting cross-legged important for Indian life style, we have 90% acceptable result, out of which 20 cases (67%) with excellent result, 4 cases (13%) with good results and 3 cases (10%) with fair results. There were 3 (10%) cases with poor result.
- The average score in our study is 83.7 (out of 100).
- Methods for measuring functional status after LISS varied widely between studies.
- In Kolb W et al study, the function according to the Neer score was excellent in 15 (48%), good in 10 patients (32%), and fair in 6 patients (20%). The mean Neer score was 80 (60-100).
- Ru J et al study evaluated by the Merchant score system for the knee joint, of the 26 patients 13 achieved an excellent result, 11 achieved a good result, and 2 achieved a fair result, with 92.3% excellent and good results. Based on the Rasmussen criteria for the fracture reduction, the 26 patients had standard scores of 12-19 with an average of 17.6; of the 26 patients, 16 had an excellent result, 9 had a good result, and 1 had a fair result.

- **Conclusion:**
- LISS plating is useful in treating complex distal femoral fractures, resulting in reduced blood loss and low infection rates, while achieving early mobility due to primary stability of the construct.

The LISS technique offers the advantages of a stable construct with minimal soft tissue disruption. However the procedure requires careful surgical planning and experience in the operative technique is of paramount importance.

- Thus, from our study it is concluded that with early post-injury intervention, good surgical technique, anatomical reduction, stable and rigid internal fixation and early post-operative mobilization, one can achieve acceptable results with Less Invasive Stabilization System (LISS) plate and screw fixation in fractures of distal end of the femur.

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