International Journal of Orthopaedics Sciences

ISSN: 2395-1958
IJOS 2016; 2(4): 146-149

www.orthopaper.com
Received: 24-08-2016
Accepted: 25-09-2016

Dr. Pramod G
Consultant, Orthopedician,
Chikkaballapur, Karnataka
India

Dr. Vijayakumar AV
Assistant Professor,
AJ Shetty Medical College,
Mangalore, Karnataka India

Correspondence
Dr. Vijayakumar AV
Assistant Professor,
AJ Shetty Medical College,
Mangalore, Karnataka India

Study on the complications of locking compression plate used for fracture lower end of femur

Dr. Pramod G and Dr. Vijayakumar AV

DOI: http://dx.doi.org/10.22271/ortho.2016.v2.i4c.24

Abstract
The tension band & axial compression principles are used frequently while using plate and screws for fracture fixation. Müller, Allgöwer, and others of the AO group in Switzerland designed a compression plate and equipment to apply compression to fractures. These plates have been modified several times since their introduction in 1963.In our study of 20 lower end of femur fractures, 4 were of Muller's Type A2.; 5 were of Muller's Type A3; 1 was of Muller's Type C1 ; 5 were of Muller's Type C2; and remaining 5 were Muller's Type C3. Of all these fractures 4 were open and of these fractures 2 needed prior debridement and primary closure.

Keywords: Femur, locking compression plate, complications

Introduction
The knee is the largest synovial joint in the body. It consists of three distinct and partially separated compartments, which form a complex 'hinge' joint. This arrangement offers a fulcrum for propulsive muscles, and allows the limb to be folded away in confined spaces and to get closer to ground. The price of its mobility is a tendency to instability. To counter this tendency a complex ligament arrangement, vulnerable to injury, has evolved. The understanding of knee anatomy has improved considerably in recent years, driven in large measure by the advances in surgery in this region. Knee joint is composed of the tibio femoral, patella femoral and tibio patellar articulations .Femoral component comprises of medial and lateral femoral condyles articulating with the medial and lateral tibial condyles. Ligaments providing anterio-posterior stability are ACL, PCL whereas stability to valgus and varus force is provided by MCL and PCL respectively. Knee joint is lined inside by synovium containing synovial fluid. It is followed by joint capsule, fascia and skin [1, 2].

Treatment of displaced supracondylar femoral fractures by ORIF has traditionally resulted in 70% to 90% good and excellent results. However, the use of bone grafts is frequently recommended if medial comminution or bone loss is present, particularly in intercondylar type C2 and C3 fractures. Without the use of bone grafts, many series report an increased incidence of delayed union, pseudarthrosis, loss of reduction, and implant failure. The traditional surgical approach for severe intra-articular distal femoral fractures is through a lateral incision with elevation of the vastus lateralis muscle and ligation of the perforating vessels. This approach allows for good visualization and reduction of the shaft fracture. Reconstruction of complex intra-articular fractures through a lateral exposure, however, may be difficult. Medially placed retractors are often necessary to visualize the articular fragments, and soft tissue is consequently stripped from the metaphyseal bone. As a result, fracture healing may be delayed with increased rates of secondary revision and primary or secondary bone grafting. The following two approaches are suggested as alternatives [3, 4].

Plate and screw fixation of fractures has undergone continuous design modifications and improvements. Pauwels first defined and applied the tension band principle in the fixation of fractures and non-unions. This engineering principle applies to the conversion of tensile forces to compression forces on the convex side of an eccentrically loaded bone. Tension forces are counteracted by the tension band in this position and converted into compressive forces. If the plate is applied to the compression (or concave) side of the bone, it is likely to bend, fatigue, and fail. A basic principle of tension band plating is that it must be applied to the tension side

of the bone so that the bone itself would receive the compressive forces, and the tension band appliance need not be heavy and rigid [5].

The tension band & axial compression principles are used frequently while using plate and screws for fracture fixation. Müller, Allgöwer, and others of the AO group in Switzerland designed a compression plate and equipment to apply compression to fractures. These plates have been modified several times since their introduction in 1963. Specific plate designs include semi-tubular, one-third and one-quarter tubular plates, T-plates and L-plates, spoon plates, dynamic compression plates, cobra arthrodesis plates and, more recently, pre-bent periarticular plates [6].

Methodology

The following protocol was observed for patients with fracture lower end of femur

1. General and systemic examination as well as local examination of the patient.
2. Thorough examination of patient to rule out head/ chest/ abdominal/spinal or pelvic injury.
3. Evaluation of patients in terms of:
   a. Age
   b. Sex
   c. Mode of trauma
   d. Period between injury and arrival
4. Musculo-skeletal examination of patient to rule out associated fractures
5. Stabilization of patient with intravenous fluids, oxygen and blood transfusion as and when required.
6. Careful assessment of injured limb as regards to neurovascular status.
7. Primary immobilization of involved limb in Thomas splint with a Cotton pad below the distal fragment.
8. Radiological assessment: Anteroposterior and true lateral views of injured whole femur to whole leg to rule out other injuries.

Inclusion criteria

1. Patients with lower third femoral fractures aged 20 years and above.
2. Patients willing for treatment and given informed written consent.

Exclusion criteria

1. Patients with pathological fractures of lower third of femur other than osteoporosis.
2. Patients below 20yrs of age
3. Patients not willing for treatment.
4. Patients managed conservatively for other medical reasons.
5. Lower third femoral fractures with neurovascular deficit.

Results

In our study 20 femoral fractures were treated. All cases were fresh, 17 were male and 3 were female. The median age was 45 years ranging from 22yrs to 65 yrs.15 were caused by Road Traffic Accident, 5 were due to fall. 10 patients presented with fractures on the right side and 10 presented with fractures on the left side.

In our study of 20 lower end of femur fractures, 4 were of Muller's Type A2.; 5 were of Muller's Type A3; 1 was of Muller's Type C1 ; 5 were of Muller's Type C2; and remaining 5 were Muller's Type C3. Of all these fractures 4 were open and of these fractures 2 needed prior debridement and primary closure.

4 patients had associated injuries; 1 patient had fractures of proximal tibia, 1 patient had patella fracture, 1 patient superior pubic rami fracture 1patient had only tibial shaft fracture.

All patients with associated injuries have been treated accordingly. All the patients in this study were treated by closed reduction and internal fixation by MIPPO (Minimally Invasive Percutaneous Plate (Osteosynthesis). All patients were treated within 8 days of injury.

The size of the plate was selected based on type of fracture. 6 and 8 holed plates were used more commonly for lower end of femur. Of the 20 patients, 13(65%) showed radiological union within 16 weeks. Only one patient had problem of screw cut out due to premature weight bearing by the patient. Average flexion achieved in this study by >50% of patients is 110º. Out of 20 patients 2 patients have limb length discrepancy <1cm and only 2 patient had shortening of around 2 cm. The average duration of follow up was from 3 months to 18 months. In this study two patients had varus & three patients had valgus mal-alignment.

Results are summarised in charts and tables below.

Table 1: Working capacity

Working Capacity	Number Of Cases	Percentage
Same As Before Accident	12	60%
Regular But With Handicap	3	15%
Alter Work	3	15%
Light Work	1	5%
No Work	1	5%
Total	20	100%

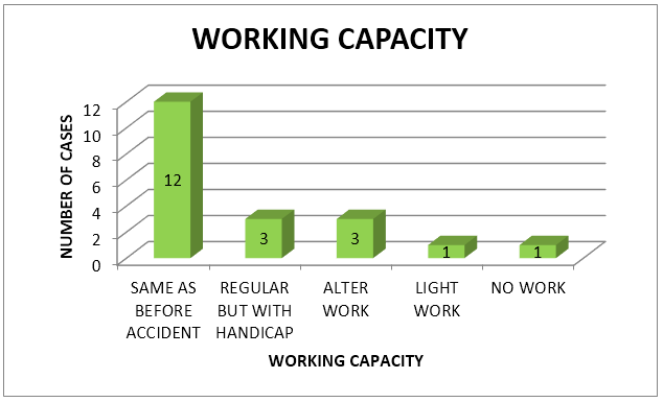

Fig 1: Working Capacity

Table 2: Complications

Complications	Number Of Cases	Percentage
Superficial Infection	2	10%
Deep Infection	0	0%
Non-Union	0	0%
Delayed Union	0	0%
Plate Backout	0	0%
Implant Failure /Screw Breakage	1	5%
Stress Fracture	0	0%
Total	3	15%

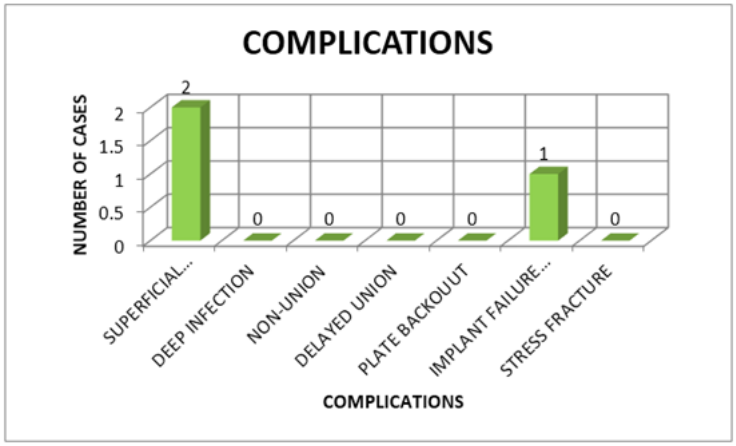

FIGURE-63

Fig 2: Complications

Discussion

In our study we had three cases of varus malalignment for distal femur of which one was AO C2 type and two cases were C3 type. Two cases had valgus malalignment Varus malalignment occurred as a result of improper reduction on day one and also non application of traction preoperatively. Other factors contributing to malalignment were comminution and usage of inadequate locking plate length due to which the fracture went into varus. In one distal femoral fracture varus malalignment occurred as a result of early weight bearing done against advice. K. Kolb *et al* [7] in their study on distal femoral fractures fixed with dcs reported malalignment in 5 cases out of 41 cases ie 12.1% cases had malunion. 2 patients developed varus and 3 developed valgus malalignment. P Kanabar *et al* [8] reported malunion in 1 case out of 17 case ie in 5.8% of cases. The 1 case reported had valgus malalignment. V. Sharma *et al* [9] reported Malalignment more than 10 degrees in AP or Lateral views in 5 patients. We would like to conclude that complete reduction of comminuted distal femoral fractures are difficult. It is advisable to assess comminuted distal femoral fractures before considering for surgery and predict varus malalignment. In case malalignment is predicted, other modalities like medial additional plating, using maximum number of screws in distal fragment, bone grafting and delayed full weight bearing are advisable.

The chances of malalignment/malunion in Distal femur locked plating in inexperienced hands is higher as the reduction of comminuted fractures is difficult. Other factors that contribute to malunion are unstable fixation, inadequate fixation and early weight bearing on part of the patients. We had infection in 1case out of 20 patients who completed the study. The patient initially had superficial infection and later it became deep and the patient had infection for 2 months which delayed bone union and full weight bearing. The infection subsided completely after debridement and course of IV antibiotics. It may be attributed to better soft tissue handling and proper antibiotic cover.

We use a combination of third generation cephalosporin (ceftriaxone 1g) and an aminoglycoside (amikacin 500 mg) one hour prior to surgery and 3 days postoperatively. Mongkon Luechoowong [10], reported one case of infection which subsided after repeated debridement and antibiotics. Kim k j *et al* [11], reported two postoperative infections

In our study, the mean flexion was 110 degrees. It was attributed to the stable and sturdy construct and the early range of motion achieved with DF-LCP. The average knee flexion in Type C fractures was 115 degrees compared to 125 degrees in Type A fractures, which shows that intra-articular fractures lead to intra-articular stiffness and decreased range of motion. Four of our patients had extension lag which persisted even after physiotherapy. Yeap and Deepak [12], reported Mean extension was 1° (range 0° to 5°), with mean flexion 107.7° (range 40° to 140°). Mean range of motion was from 1° to 107.7°. K. Kolb *et al* [7], in their series of patients with distal femoral fractures reported average range of motion of 120 degrees. P Kanabar *et al* [8], in their series of 17 patients operated with MIPO or LISS of distal femur reported average range of motion of 0-100 degrees.

We conclude ROM around the knee is better in patients treated with DF - LCP. ROM achieved post-operatively was less in Type C fractures (Avg – 115.) compared to Type A fractures (Avg – 125). At the same time strict postop physiotherapy including CPM and clinical experience plays an important role in functional out come.

Out of our 20patients in the study, twelve patients (60%) had excellent results, six (30%) good, two (10%) had fair outcomes. Younger aged patients had better results than older age. The time to union increased with increase in age. There were 11 type C fractures of which 9 (45. %) showed excellent to good results and 2 (10%) had fair results. Out of 9 type A fractures 9 (45%) showed excellent to good results. Type C fractures took longer time to unite than Type A fractures. The average knee flexion in Type C fractures was 115degrees compared to 125 degrees in Type A fractures, which shows that intra-articular fractures lead to intra-articular stiffness and decreased range of motion. Limb shortening was present in 8 of our patients. Yeap and Deepak [12], using Schatzker scoring system reported four excellent results, four good, two fair and one failure. Kim KJ *et al* [11], reported mean Neer's score of 74.2 with a range of 58 to 97 of which 3 were excellent, 5 satisfactory and 7 unsatisfactory. Yang Teng-heng et al[13], reported excellent results in 23 cases, good in 9 cases, moderate in 3 cases according to Merchan standard, which showed that the excellent and good rate was 91.4%.

Conclusion

The age group included in our study ranged from 22-65 years, with a mean age of 45 years. There were 17(85%) males and 3 (15%) females. Mode of injury included 15 (75%) road traffic accidents and 5 (25%) falls. This mode of injury confirms to the high incidence of road traffic accidents and hence high velocity injury as the major cause of this fracture. 10 (50%) were right sided and remaining 10 cases (50%) were left sided fractures. There were 11(55%) AO type C and 9 (45%) AO type A fractures. This pattern confirms to the high velocity injuries being commonly associated with AO type C.

References

1. Wilson JN. Watson Jone's: Fractures and joint injuries. 6th ed, pg. 1003-070, 1982.
2. Charnley John. The closed treatment of common fractures. 3rd ed, 197-204.
3. Hugh Owen Thomas. Quoted by Rockwood CA, Green DP. Fractures in adult, 4th ed, Vol. II, 1972-1993, 1996.
4. Fritz Steinman. Quoted by Rockwood CA, Green DP. Fractures in adult, 4thed, 1996; 2, 1972-93.
5. James E. Anderson Grant's Atlas of Anatomy. 8th Edition, Anastomosis Around Knee, 4-54, 4-55; Knee Joint, 4-56, 4-57, 4-60.
6. Weil Kuenher, Henry. Quoted by Stewart MJ, Sisk TD, Wallace SL. Fractures of distal third of femur-A compression method of treatment. JBJS, 48-A, 1966, 784-807.
7. K. Kolb *et al*, The condylar plate for treatment of distal femoral fractures: A long-term follow-up study, j. Injury, April 2009, Pages 440-448.
8. P Kanabar, V Kumar, PJ Owen, Less invasive stabilisation system plating for distal femoral fractures, Journal of Orthopaedic Surgery 2007;15(3):299-302.
9. V. Sharma; Gale; R. Mansouri; and M. Maqsood; Use of Distal Femoral LCP in fractures of Distal Femur and Periprosthetic fractures – Functional and Radiological results in 41 consecutive cases ; Journal of Bone and Joint Surgery – British Volume, 2010; 92-B:559.
10. The Locking Compression Plate (LCP) for Distal Femoral Fractures; Mongkon Luechoowong; Buddhachinaraj Medical journal, 2008, 25.
11. Kim KJ, Lee SK, Choy WS, Kwon WC, Lee DH; Surgical Treatment of AO Type C Distal Femoral Fractures Using Locking Compression Plate (LCP-DF); J Korean Fract Soc. 2010 Jan; 23(1): 20-25. Korean.
12. Yeap EJ, Deepak AS. Distal Femoral Locking Compression Plate Fixation in Distal Femoral Fractures: Early Results. Malaysian Orthopaedic Journal, 1 (1). pp. 12-17. ISSN 1985 253352. 2007.
13. YANG Teng-heng, ZHONG Zhi-nian, LAO Ji-yi, *et al*. Locking compression plate in the treatment of distal femur fractures. Jilin Medical Journal. 2011-13.