EARLY RESULTS OF CONTRALATERAL REVERSE DISTAL FEMORAL LOCKING COMPRESSION PLATES IN THE TREATMENT OF UNSTABLE INTERTROCHANTERIC FRACTURES OF FEMUR

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ABSTRACT

BACKGROUND

There is no consensus about the best option of internal fixation for unstable intertrochanteric fractures of femur. This study aimed to evaluate the treatment effects of contra-lateral reverse distal femoral locking compression plates in unstable femoral intertrochanteric fractures as a viable alternative to intramedullary devices.

MATERIALS AND METHODS

A total of 30 cases with unstable femoral intertrochanteric fractures were treated with contra-lateral reverse distal femoral locking compression plates. The period from injury to operation was 3-10 days.

RESULTS

The intra-operative blood loss was 160.5 ± 80 ml and the operation time was 55 ± 20 mins. The fractures united within 12-24 weeks (average 16.4 weeks). According to the Modified Harris Hip Score, the results were excellent in 15, good in 12, fair in 2 and poor in 1 case. Excellent and good rate of clinical results were 90%. 2 cases developed trochanteric bursitis due to irritation by hardware. 1 case had plate collapse who was offered surgical option but sought no treatment for malunion. None of the cases had any implant failure, non-union and any surgical site infection.

CONCLUSION

Contra-lateral reverse distal femoral locking compression plate is an effective way for treating unstable femoral intertrochanteric fractures. However, early weight bearing should be avoided and judicious use of bone grafting wherever it is needed is recommended to achieve early union.

KEYWORDS

Unstable Femoral Inter-Trochanteric Fractures, Contra-lateral Reverse Distal Femoral Locking Compression Plates.

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BACKGROUND

Intertrochanteric Fracture of Femur (IF) is one of the leading causes of disability in elderly people accounting for almost 50% of all hip fractures. Even though, there are numerous techniques and implants for internal fixation of these fractures, still there is no consensus, which is the best. There is still debate over the superiority of extra-medullary fixation over the intramedullary fixation and vice versa.[1-6] In recent years, the trend is more towards minimally invasive techniques for treating such fractures with Proximal Femoral Nail Anti-Rotation (PFNA).[7] Simmermacher et al. in their long term study complications rate of 6.5%,in cases of PFNA fixation of intertrochanteric fracture.[8] The studies have also reported that the geometry between proximal femoral nails and the femora of Asian population does not always match appropriately thus making the surgery even more difficult and complicated.[9,10] The angular stable devices like Proximal femoral locking compression plates (PFLCP) were designed to provide rigid fixation of comminuted proximal femoral fractures.[6] Even though early results were very promising, but long term follow up have shown significantly higher failure rates.[11,12] In search for a better alternative, some studies recommended the use of reverse distal femoral locking compression plate (reverse-DFLCP) of the contralateral side for unstable intertrochanteric fractures. It was postulated that it would be a more stable construct owing to the added number of screw options for proximal femoral fracture fragments. It would provide angular stability and greater pull out strength preventing fracture displacement till union occurs. However, its use was limited to selective cases and as a salvage option in non-union of proximal femoral fractures.[13-16]

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So, we carried out a study to find out if contra-lateral reverse DFLCP is a viable alternative option for treating unstable intertrochanteric fractures of femur.

MATERIALS AND METHODS

Total 30 cases with IF were treated with reverse DFLCP (Sharma Surgicals, India) in a tertiary care hospital from January 2012 to January 2014. Patients with age more than 18 years, single fracture; and fresh (less than 2 weeks old) closed unstable intertrochanteric fractures with follow-ups were included in the study. Those excluded from the study had 1) multiple fractures; 2) co existing hip disease; and 3) not cooperating with treatments. There were 12 males and 18 females in the study. They had age ranging from 44 to 86 years old with an average of 68.4 years. 9 cases had left side fractures and 21 had right side fractures. For the traumatic causes 22 had a fall, 7 had a traffic accident and 1 had a fall from height. Patient had a plain radiograph anteroposterior (AP) view of the pelvis with both hips with 15 degrees of internal rotation and lateral view of hip with thigh done at the time on admission, and all fractures were categorized according to Evans-Jensen classification.[17] According to Evans-Jensen classification, there were 19 type III fractures and 11 type IV fractures. Out of 30 patients, 24 cases had coexisting medical conditions including 14 cases with high blood pressure, 2 cases with coronary heart disease, 5 cases with diabetes, 3 hypothyroid cases and 7 cases with multiple coexisting medical conditions. All these cases were evaluated thoroughly by Internal Medicine prior to surgery and co existing medical conditions were treated. So, there was delay of 3-10 days from injury to operation, with an average of 5.3 days.

Figure 1. DFLCP over Distal femur

Figure 2. Contra-Lateral Reverse DFLCP over Proximal Femur

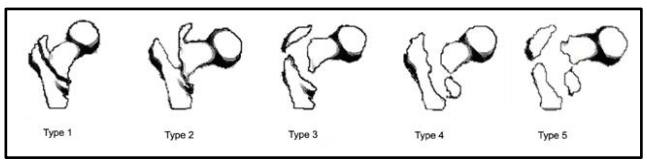

Figure 3. Jensen Modification of Evans Classification of Intertrochanteric Fracture Femur

After admission temporary skin traction was applied with Thomas Splint, a detailed history was taken, relating to the age, sex, and occupation, mode of injury, past and associated medical illness. Routine pre-operative investigations were done. Patients received active treatment for associated co morbidities from concerned departments. After taking informed consent, a pre-operative anaesthetic evaluation and pre-operative planning, patients were taken up for operative treatment.

Operative Procedures

All the patients received prophylactic antibiotics by intravenous route to avoid infection. After Spinal anaesthesia or combined spinal epidural anaesthesia was administered, the patient was placed in supine position on a radiolucent table, traction was applied on fracture table and closed reductions were performed. Under C-arm X-ray device, after satisfactory reduction was achieved, and the traction was maintained. A 4-6 cm long incision was made over the greater trochanter. In all cases anatomical reduction was preferred specially for fractures with greater displacement. In the fractures involving medial and posteromedial lesser trochanter of femur, every attempt was made to regain continuity of medial and posteromedial bone cortex as much as possible by minimally invasive technique. After the incision, a sub-muscular tunnel was made on the femoral surface. A contra-lateral reverse DFLCP of appropriate length was sub-muscularly inserted to the femur, without stripping the periosteum. The correct placement of the plate over bone was checked under C-arm in both lateral and anterior-posterior view. A small incision was made on the distal end to expose the plate. After ensuring, the plate is matching the anterior bowing of femur, it was temporarily held in the center of lateral femur using bone forceps. A Kirschner wire was used for temporary fixation of the plate to bone. A guidewire was inserted into femoral neck under C arm imaging in such a way that it lies 1/3 below the femoral neck on the anterior-posterior view and in the center of the femoral neck on the lateral view. 4-5 locking screws were placed at proximal end of the fracture under C arm imaging. 3-4 bicortical locking head screws were inserted at the distal end of the fracture. Final position of plate and screws were checked under C arm imaging before closure. The wound was closed over drain after haemostasis and saline wash. Intra-operative variables that were recorded were: duration of surgery, blood loss during surgery. Plain AP and lateral radiographs were obtained on the first post-operative day, and analysed for reduction of the fracture and position of the implant.

On day 1 of postoperative period, patients were encouraged to sit in bed and do static quadriceps exercises. Day 2 drains were removed, and patients were advised to move within the bed and sit in semi-Fowler's position. The sutures were removed 10-14 days following surgery after wound inspection. 6 weeks after surgery, the patients were asked to exercise with weights which were increased in step wise manner as permissible. Early aggressive weight bearing was not pursued as most patients were elderly with advanced osteoporosis and poor physical fitness. 3-6 months later, the patients were allowed full weight after looking at callus response seen in radiographs. Patients were advised to come for follow up and clinico-radiological assessment at two weeks, six weeks, three months, six months and one year. Patients with a minimum follow up of one year were included in the final analysis.

Patient were assessed functionally with the Modified Harris Hip score. The results were excellent for a score of ≥ 90, good for 80-89, fair for 70-79 as fair and poor for <70, respectively.[18] For radiological assessment, serial radiographs of the hip were taken at 6 weeks, 3 months, 6 months and 1 year. Union was defined as full painless weight bearing with bridging callus across atleast three cortices on AP and lateral views of the femur.[19] It was not always possible to know exactly when union occurred in each individual patient with these criteria.

RESULTS

The period from injury to operation was 3-10 days, with an average delay of 5.3 days as most of the cases were elderly patients with co-existing morbidities. They had to be evaluated by Internal medicine team prior to surgery. The intra-operative blood loss was 160.5 ± 80 ml (100-340 ml). The operative time was 55 ± 20 min. (40-110 min). 30 cases were followed up for 12-26 (average 14.8) months. The fracture united by 12-24 weeks (average 16.4 weeks). According to the Modified Harris Hip Score, the results were excellent in 15, good in 12, fair in 2 and poor in 1 case. 90% cases had good to excellent results. 2 of our cases developed pain and discomfort over greater trochanter after fracture union which was later on diagnosed as due to trochanteric bursitis. This resolved nicely by conservative treatment with oral anti-inflammatory drugs and local steroid infiltration. 1 case had plate collapse due to backing out or loosening of the locking screws. This occurred during beginning of our study, after that we took extra care to ensure that all the locking screws were properly seated and locked to the plate. This patient was offered surgical option but sought no treatment for malunion. None of the cases had any implant failure and non-union, or any surgical site infection.

Figure 4. Preoperative X-ray

Figure 5(a). Immediate Post-Operative X-Ray

Figure 5(b). Immediate Post-Operative X-Ray

Figure 6(a). Follow Up X-Ray at 1 Year

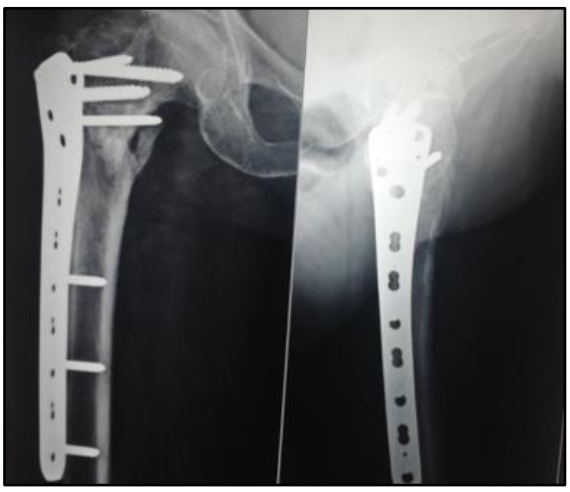

Figure 6(b). Follow Up X-Ray at 1 Year

Figure 7. Clinical Pictures

DISCUSSION

Intertrochanteric Fractures of Femur (IF) is a common clinical injury, accounting for 50% of proximal femoral fractures, out of which 60% are unstable fractures.[13] As these fractures mostly occur in elderly population, there is osteoporosis of bone along with medical co-morbidities. Early internal fixation is preferred to reduce both mortality and morbidity by allowing early mobilization. Even with the recent advances in fracture fixation and evolution of new generation of intramedullary nails and extramedullary fixed angle implants, failure of fixation is still a challenging problem. Which ones are the best remains controversial.[20] Intramedullary nail device is biomechanically more stable and has shorter lever arm under load.[21] Simmermacher et al. recommended Proximal Femoral Nail Antirotation (PFNA) as optimal implant for unstable intertrochanteric fractures in osteoporotic bone.[8] However, use of intramedullary nail in unstable inter trochanteric fractures requires a long learning curve, hence is associated with high failure rates. Proper training of surgeons in reducing complex fractures and inserting PFNs is recommended.[22] The evidence-based studies have not been able to establish conclusively, the superiority of intramedullary devices over plates.[3,4] The application of DHS to fix unstable IF, leads to uncontrolled collapse and failure.[23] Unstable IF with osteoporosis had failure rates of more than 50%. In such cases DHS should not be the first choice for treatment.[24] Haidukewych et al. reported that fixed angle devices resulted in better outcomes and less complications when compared with DHS in such fractures.[25] Proximal femoral locking plates (PFLCP) were introduced in the last decade as angular stable devices to provide rigid fixation of comminuted proximal femur fractures.[6] Though their initial results were promising but due to higher failure rates of proximal femoral locking compression plate (PFLCP), they fell out of favour and are now no longer recommended as 1st choice.[11,12] The Distal femoral locking compression plate (DFLCP)/ "LISS" (Less Invasive Stabilisation System) was developed by the Arbeitsgemeinschaft für Osteosynthesefragen (German for "Association for the Study of Internal Fixation") or AO group for treatment of distal femoral fracture .It matches the anatomy of distal femoral condyle and is a fixed angle device. Few studies have demonstrated the feasibility of reverse LISS in the treatment of proximal femoral fracture.[13-15] Yao et al. advocated reverse LISS as a modality of treatment for rapid fixation and damage control in polytrauma patients ORIF of subtrochanteric and reverse oblique intertrochanteric fractures, thereby keeping reverse LISS as a optional method for treating unstable IF in elderly patients.[13] Intramedullary nailing is technically demanding with a stiff learning curve, in treating femoral subtrochanteric fractures extending to pyriform fossa or trochanteric fractures with comminution or split in coronal plane, obese patients, patients with previous fracture in femur ,excessive anterior bowing of femur, narrow femoral canal. Contra-lateral reverse DFLCP is a viable choice in such situations.[26] The shape of lateral femoral condyle is almost similar to that of greater trochanter of femur, so DFLCP plate can be used in reverse manner that is upside down for placement over lateral cortex of greater trochanter. Thus one has to use right side DFLCP in reverse for left side fracture and vice versa. There are some technical difficulties in using contra-lateral reverse DFLCP in proximal femur. Though the contra-lateral reverse DFLCP has seven holes in plate head but maximum 5 locking crews can be placed into the femoral neck at a time. There was also mismatch in the width of the plate head and greater trochanter in some

cases, which was troublesome especially in thin women. This can cause prominence of hardware, pain and then cause trochanteric bursitis. In this present study too, there were 2 cases who developed trochanteric bursitis following surgery. However, they resolved with conservative treatment with anti-inflammatory drugs and local steroid infiltration. Another issue was bowing of femur, which could cause offsetting of the distal portion of the plate from femur surface specially if one is using a longer plate. Contralateral reverse DFLCP is a fixed angle device which acts as a internal external fixator, it does not provide gradual controlled collapse and compression on fracture fragments with weight bearing. So early weight bearing may lead to varus union or rupture of implant, especially when calcar femorale is not reduced properly. This is another major issue specially in case of osteoporotic unstable fractures. Acklin et al. reported complications rate of 16%, including 1 case with screw rupture.[27] In this study too, 1 case had plate rupture and varus malunion of fracture, caused due to backing out or loosening of the locking screws and poor adherence after surgery to weight bearing protocol.

Limitation and Recommendations

The are many limitations of this study including small sample size, shorter duration of follow up, lack of any statistical verification. Large, double-blind, and randomized prospective trials are needed to verify the long-term results. The contra-lateral reverse DFLCP was not made specifically, to anatomically match the contour of proximal femur and also there is nonavailability of a range of plates with different width in plate head, so as to choose as per patient built and bone morphology. We recommend that new implants with the same advantages of reverse DFLCP but with better contouring to match with proximal femur should be designed to overcome this mismatch. In our study, we had to delay full weight bearing for 3-6 months till plain radiographs fulfilled the radiological criteria of union of fracture. As per protocol, the patients were followed up at two weeks, six weeks, three months, six months and one year, thus making it difficult to know exactly when union occurred in each individual patient. So, we suggest the patients should be followed up at more frequent and at uniform interval of 1 month till fracture union. This will help to detect more precisely at what time the union has occurred and allow weight bearing after that. We also recommend judicious use of cancellous bone grafting so as to achieve early union, to allow early weight bearing and to prevent varus collapse, as and when needed.

CONCLUSION

We conclude that contra-lateral reverse DFLCP is an effective modality of treatment for unstable intertrochanteric fractures of femur despite few flaws in its design. To improve the clinical outcomes, additional bone grafting may be done to achieve early union and weight bearing to be delayed till fracture consolidation.

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