IOSR Journal of Dental and Medical Sciences (IOSR-JDMS)
e-ISSN: 2279-0853, p-ISSN: 2279-0861.Volume 14, Issue 5 Ver. III (May. 2015), PP 27-31
www.iosrjournals.org

Fixation of Shaft and Ipsilateral Neck Fracture of Femur Using Locking Compression Plate and Cannulated Cancellous Screws: A Case Series

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Abstract: *fracture of shaft and ipsilateral neck of femur is a challenging problem to Orthopaedics surgeons. Most of the cases seen in young adults and most of the times it follows severe road traffic accident. Here we are presenting 5 cases of ipsilateral fracture shaft of femur with neck fracture, in young adults attending Regional Institute of Medical Sciences, Imphal OPD and emergency. All cases were of closed fractures. Mean age of the patients were 41.8 years. All the cases were diagnosed initially by X-rays and then CT scan with 3D reconstruction was done for neck fractures. Cannulated cancellous screw fixation was done for neck fractures with 3 screws and locking compression plating was done for shaft fractures. Clinically mean union time for neck fracture was 3.4 months and clinical and radiological union time for shaft was 4.5 months. No case was diagnosed with avascular necrosis or nonunion. Our study suggests that cannulated cancellous screw fixation and compression locking plating for ipsilateral neck and shaft fractures of femur in carefully selected patients, of younger age group gives good result. Though other better modalities of treatment are available, this method also gives comparable result.*

Keywords: *Ipsilateral fracture shaft and neck cannulated cancellous screw, locking compression plating, young adult, clinical union, CT scan.*

I. Introduction

Young patients with high-energy fractures of both the femoral neck and the ipsilateral femoral shaft present a special problem. Both fractures must be fixed and there are several ways of doing this. The femoral neck fractures take priority, as complications following this fracture are generally more difficult to address than those of the shaft fracture. Anatomic reduction and stable fixation of the femoral neck fracture must not be compromised in order to accommodate fixation of the shaft fracture (1). This injury combination is usually found in young adults with high-energy femoral shaft fractures. Between 2% and 6% of femoral neck fractures in young adults have an ipsilateral shaft fracture. The injury is easily missed, particularly if the fracture is not displaced or the radiographs of the proximal femur are inadequate or of poor quality (2). Timing of the diagnosis of the femoral neck fracture has a dramatic impact on the outcome and late diagnosis of concomitant femoral neck fractures can have disastrous complications. Radiographs must be carefully scrutinized to avoid missing an associated femoral neck fracture. The evaluation of fractures includes antero-posterior and lateral views of the femur, as well as an antero-posterior view of the pelvis and lateral view of the affected hip. Because a high quality lateral image of the affected hip can be difficult to obtain in a patient with a femoral fracture, a pelvic CT scan is obtained on every patient who has a femoral shaft fracture. The pelvic CT scan should include coronal and sagittal reconstructed images in addition to the standard axial images (3). Classification of shaft of femur is based on Winquist and Hansen system. It is based on fracture comminution. This classification divided fracture shaft of femur into 4 groups,

Type I: Minimal or no comminution
Type II: Cortices of both fragments at least 50% intact
Type III: 50% to 100% cortical comminution
Type VI: Circumferential comminution with no cortical contact.

Fracture neck of femur, classified by Garden is based on the degree of valgus displacement. It has 4 types

Type I: Incomplete/valgus impacted
TypeII: Complete and nondisplaced on AP and lateral views
TypeIII: Complete with partial displacement; trabecular pattern of the femoral head does not line up with that of the acetabulum
TypeIV: Completely displaced; trabecular pattern of the head assumes a parallel orientation with that of the acetabulum (4).

Four methods for fixation of femoral neck and shaft fractures have received attention in the literature: (1) Initial prompt fixation with multiple cancellous screws for the femoral neck and an extra-articular retrograde intramedullary nail for the femoral shaft; (2) A cephalomedullary nail; (3) Antegrade intramedullary nailing with cancellous lag screws, and; (4) Plate fixation of the femoral shaft with lag screw fixation of the femoral neck. Due to the lack of randomized trials, it is unclear which method of fixation leads to fewer complications (5). Numerous implants have been recommended for the fixation of these injuries, but no consensus has been reached as to the optimal treatment strategy. The selected implant should facilitate anatomic fracture reduction and stable fixation, both of which have been shown to favour early mobilization, high union rates and reduced complication rates (6).

II. Method

Between June 2013 and February 2015, 5 male patients with an average age of 41.8 years were diagnosed with ipsilateral femoral neck and shaft fractures and treated according to our study design. In our study this particular method of treatment was given in young adults, age ranging from 35 to 50 years. No patient was included in this particular system of treatment beyond this age group. Only Gardens type 1 and type II for neck fracture cases and mid shaft fractures of femur of ipsilateral side was included. 3 patients had mid cervical fractures and 2 patients had basicervical fractures. Shaft of femur cases were all diaphyseal fractures. None of the patients had pathological fractures. One patient had associated volar barton fracture, was treated accordingly. All cases were closed fractures. Patients had no significant co-morbidities. Initially all the patients were kept in Thomas splint with skin traction.

Choice of implant: partially threaded cannulated cancellous screws for neck and locking compression plate for shaft of femur using locking screws.

Initial radiography was done in all the patients. X-ray pelvis with both the hips, antero-posterior and lateral view (across the table) of neck and X-ray of thigh with knees in both antero-posterior and lateral views were done. In two cases diagnosis of fracture neck of femur was not obvious, but clinical finding was indicative of fracture. So CT scanning with 3 D reconstructions for neck was done on emergency basis. It showed fracture neck of femur. Remaining 3 cases also underwent CT scan for proper fracture definition. Routine investigations were done for anesthetic safety. Average operating time was 6.8 days later the fracture.

First we fixed shaft of femur. Antero-lateral approach was made between anterior superior iliac spine and the lateral margin of the patella. After incising the superficial and deep fascia, the rectus femoris and vastus lateralis muscles were separated along their intermuscular septum. The vastus intermedius muscle was brought into view. Then vastus intermedius muscle was divided in the line of its fibers down to the femur. Femur was exposed by subperiosteal reflection of the incised vastus intermedius muscle. Fracture site was exposed and curetted for any hematoma and soft tissues and after freshening the ends reduction was attempted. After proper reduction, plate of desired size and hole was put and held with reduction forceps. Then plate was fixed with locking screws leaving the fracture site. Bicortical purchase was achieved for all the screws. Then wound closed in layers with a negative suction drain. Sterile dressing was done.

Now we approached for neck fracture. Fracture table was not used as patients had fracture of shaft. Position of fracture was confirmed by IITV. Out of 5 cases one fracture was displaced and reduction done with abduction and internal rotation. Skin incision extending 2 to 3 cm proximally was given. Fascia in line with the skin incision was split and a Cobb elevator was used to gently split the fibers of the vastus lateralis muscle longitudinally. Now infero-central wire was placed in perfect position on both views. A guide wire was used along the anterior femoral neck helped in determining appropriate anteversion. Once the first guide pin was in place, we used a parallel guide wire to place the postero-superior and antero-superior pins to obtain posterior and anterior cortical support in the femoral neck. Then we advanced the threaded guide pins just short of the articular surface without violating the articular surface. To determine appropriate screw length, we measured the length of the guide pin and subtracted 5mm. Self-drilling, self-tapping screws were used. Washers were used where space permitted. Position of the screws was finalized by IITV. After confirming the position wound was closed in layers.

Intra-operative and post-operatively 3rd generation cephalosporine was given for 48 hours and changed to oral formulation. Oral anti inflammatory drugs was given with oral calcium and vitamin C. Early mobilization was encouraged post-operatively but weight-bearing restricted for the first 8 weeks. Partial weight bearing was then allowed based on radiographic signs of callus formation. Passive knee range of motion and isometric quadriceps-strengthening exercises were started from the second post-operative day. Radiographs at injury, post-surgery and during follow-up were reviewed to assess the quality of fracture reduction and time to union. The follow-up radiographs were repeated on a monthly basis until union of both fractures was certain. Fracture union was defined using clinical (absence of pain during weight bearing) and radiographic (bridging callus across 3 out of 4 cortices of the fracture) criteria for shaft.

III. Result

Mean follow-up period was of 18 months and none of the patients left follow up. Patients operated with in a mean of 6.8 days post trauma. Mean operating time was 3 hours. 3 cannulated cancellous screws were put in neck in inverted triangle fashion and locking compression plating done for shaft fractures. All patients were followed up in OPD every 4 weeks for first 6 months and then every 12 weeks for next 1 year. Serial radiographic monitoring was done in every visit with clinical examination to evaluate bony union. Clinical union of neck fracture was achieved in a mean of 3.4 months and clinical and radiological union of shaft fracture was achieved by a mean time of 4.5 months. Range of motion of all the patients were monitored in every visit and proper guidance was given to do exercises at home. After 6 months all the patients had full range of motion in both the hip and knee.

Complication: In 4 cases union took place in proper position. In one patient minimal posterior angulation (<5°) of shaft was seen. But union was complete. No intervention done for that angulation. One patient had superficial infection in shaft incision, but controlled with oral antibiotic only.

IV. Discussion

In our study we did cannulated cancellous screw fixation with 3 screws for neck fracture and locking compression plating for shaft fracture. Our result indicated that this modality of treatment can be done in selective patients with undisplaced fracture of neck and diaphyseal fracture of shaft of femur, especially if the fracture is grossly comminuted, where nailing is not indicated. This method gives good result with good union and good range of movement achieved. No cases of avascular necrosis or implant failure were seen. Ipsilateral fracture of neck is missed many a times in initial examination. If neck fracture diagnosed late it may lead to catastrophic outcome, so proper radiographic evaluation has to be done in all the suspected cases. A standard guideline can be followed in young patients with high energy trauma with shaft fracture, routine CT scan can be done in all the cases to rule out neck fractures. Once the diagnosis is certain, no further delay should be made in operating, as non operative treatment is not appropriate in such young patients and in operated cases early mobilization can be done. Variety of options are available such as antegrade femoral nailing with a cephalomedullary nail, fixation of the femoral neck fracture with cannulated screws and retrograde intramedullary nailing of the femoral shaft fracture and fixation of the femoral neck fracture with cannulated screws and plating of the femoral shaft fracture. Various studies has shown the advantages of reconstruction nailing in the management of these fractures include minimal surgical trauma and blood loss, reduced operative time, single device positioning, biological fixation of the shaft fracture and a better aesthetic result. But overall the ideal method for this kind of fracture is still controversial. Nailing is more skill demanding technique with all the nailing related complications and problems associated with alternative fixation methods, such as knee pain and stiffness from retrograde nailing or extensive dissection and stress shielding for plate fixation. Nail itself can displace the shaft fractures. Moreover nailing result is not satisfactory in severely comminuted fractures of shaft. Moreover infection in cases of nailing has disastrous outcome. But these are rare complications to condemn nailing as a principle method. In cases of plating overall hardware failure is more than nailing and removal of plate also puts bone at risk in immediate post-operative period. The use of one or two femoral neck screws for the stabilization of femoral neck fractures during reconstruction nailing is debated also. But some studies have shown that two screws may be as effective as 3 screws. The optimum position of the screws has also been a source of debate, particularly whether they should be parallel or divergent. But conclusive evidence is still lacking. Use of plating for shaft fracture is still controversial, but plating needs less surgical skill than nailing, easy to perform and is routinely done in comminuted fractures of shaft also. With plating we can achieve exact anatomical reduction under direct vision unlike nailing and rigid fixation can be achieved. But plating demands longer duration of non-weight bearing unlike nailing where early mobilization is done.

A limitation of our study was including less number of patients and no comparison was done with other modalities of treatment. Only closed fracture of garden type I and II were included for neck fractures and for shaft only diaphyseal fractures were included. However result of our study is promising but further studies are required with large sample size and comparative randomized studies necessary to evaluate the outcome of other modalities in comparison to plating. Finally based on our study we found that plating with cannulated cancellous screw fixation with locking compression plate for ipsilateral fracture shaft and neck of femur is a good treatment option for shaft fracture with neck fracture of femur, though widely recommended reconstruction nailing (Antegrade femoral nailing with cephalomedullary nail) is superior modality in current scenario.

Fig. 1 pre-operative X ray

Fig.2 femoral plating

Fig.3 guide wire passing

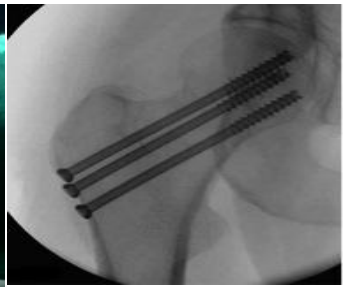

Fig.4 IITV image of CCS

Fig.5 review X-ray after 4 months

fig.6 cannulated cancellous screw

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