Treatment of ipsilateral femoral neck and shaft fractures

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**Objective:** To investigate the clinical characteristics, treatment options and causes of misdiagnosis of ipsilateral femoral neck and shaft fractures.

**Methods:** Among 20 patients with ipsilateral femoral neck and shaft fractures, 19 were treated operatively and 1 was treated conservatively. Sixteen cases of femoral shaft fractures were treated by open reduction and internal fixation with compressive plate, and 2 cases were treated with interlocking intramedullary nailing. Eighteen femoral neck fractures were treated with cannulated screws. Another patient was treated with proximal femoral nail to fix both the neck and shaft. Delayed diagnosis for femoral neck fractures occurred in 2 cases preoperatively.

**Results:** A total of 19 patients were followed up. The follow up period ranged from 5 to 48 months with an average of 15 months. All the fractures were healed.

**Conclusion:** For case of femoral shaft fracture caused by high energy injury, an AP pelvic film should be routinely taken. Once the femoral neck fracture is recognized, operative reduction and fixation should be performed in time. Femoral neck and shaft fractures should be fixed separately.

**Key words:** Femoral neck fractures; Femoral shaft fractures; Fracture fixation

**METHODS**

**Patterns of injury**

Twenty patients with ipsilateral femoral neck and shaft fractures were treated in the Institute of Orthopaedics in Xijing Hospital of Fourth Military Medical University in the period from January 2000 to August 2005. This study was a nonrandomized retrospective analysis of 20 adult patients including 12 males and 8 females, an average age of 45 years ranging from 19 to 76 years. Two patients were elicited by fall injury and the other 18 patients belonged to high energy injury including road traffic accidents and falling from a height. The femoral shaft fractures included 16 middle-proximal fractures and 4 middle-distal fractures. The femoral neck fractures were classified according to Garden classification: grade II in 10 cases, grade III in 5 cases and grade IV in 5 cases. Associated injuries were found in 17 cases including brain injuries (4 patients), rib fractures and hemopneumothorax (12 patients), pelvic fractures (6 patients), ipsilateral clavicle fractures (2 patients); ipsilateral patella or knee fractures and ligament injury (4 patients).

**Diagnosis**

Eighteen cases of ipsilateral femoral neck and shaft fractures were correctly diagnosed before operation. Two patients were miss-diagnosed, in which femoral neck fracture was found by radiograph after operations of femoral shaft fracture. The delayed time was 5 days and 9 days respectively.

**Surgical protocols**

Nineteen cases were treated operatively. Primary management aimed at resuscitation of the patients. After initial resuscitation and their general condition permitted, the patients were placed supine on a fracture table and...
closed reduction of the femoral neck and shaft fracture was performed. Femoral shaft fractures were fixed with antegrade interlocking intramedullary nailing in 2 cases and with compression plate in 16 cases. Femoral neck fractures were fixed with cannulated screws in 18 cases. Femoral neck and shaft of the remained 1 case were fixed with proximal femoral nail.

Postoperative management

After operation the patients were allowed to walk with crutches till a trace of callus was found. Then the patients were permitted to gradually bear weight on the affected limb aided with crutches. Patients discarded crutches only after appearance of bridging callus or clinical union. After suture removal, the patients were assessed by clinical and radiological methods every 1 month during the first 6 months, every 2 month during the second 6 months, and every 3 months thereafter. Radiological follow-up for avascular necrosis was continued till a minimum of 1 year. The status of fracture healing and progress in recovery were recorded.

RESULTS

The operation time ranged from 2 to 10 hours, with a mean time of 4 hours. Blood transfusion during surgery ranged from 600 to 3 900 ml, with a mean volume of 1 470 ml. Hospital stay ranged from 14 to 49 days, with a mean duration of 24 days. Among all the curative patients, only 1 case was found infective. The patient was associated with pelvic fracture and urethral rupture. The wound was infected after pelvic fixation. The postoperative radiography showed that reductions were satisfactory in all cases. During an average of 15 months of follow-up (range from 5 months to 4 years), the fractures were healed in all the patients treated surgically. The average union time was 4.5 months (range from 3 to 7 months). Functional outcome was graded by analyzing clinical records based on daily living ability. All the patients’ functions were unlimited, thus the grade was recognized as good.

Two patients having missed diagnosis of femoral neck fractures were treated operatively. The ipsilateral leg of 1 patient was amputated and the wound was infected. Debridement and plate fixation of the femoral shaft were performed. Femoral neck fracture was neglected until 5 days after operation and it was fixed with cannulated screws after close reduction and union of the fracture was obtained finally. The other patient was in an unconsciousness condition on admission. The diagnosis was femoral shaft fracture associated with severe head injury (including epidural hematoma, subarachnoid hemorrhage, and frontal bone fracture) and hemopneumothorax. Emergent closed reduction and intramedullary interlocking nailing were performed together with neurosurgeries. Femoral neck fracture was identified 9 days after operation. Open reduction and cannulated screw fixation were performed in addition to neurosurgical management at the same time. Fracture union was obtained finally (Fig. 1A-Fig. 1F).

Fig. 1A. Right femoral shaft fracture associated with brain injury. Fig. 1B. X-ray after femoral interlocking intramedullary nailing. Fig. 1C. Ipsilateral femoral neck fracture identified 9 days after trauma.
DISCUSSION

Ipsilateral fractures of the femoral neck and shaft are rare and usually encountered in high-energy injuries. It is reported that the incidence of this injury ranged from 2.5% to 6% in all femoral shaft fractures and has a tendency to rise.\textsuperscript{3-5} The reasons for explaining the rise include improved recognition of the fracture pattern, ameliorated resuscitation capabilities leading to increased survival rate in these patients, and more use of minitype motor vehicles in which dashboards located at knee level, resulting in a directional force to produce this fracture pattern.\textsuperscript{6-8} These patients are relatively young, usually are the victim of high-energy trauma, and frequently have sustained multisystem injuries. It is often caused by motor vehicle accidents, motorcycle accidents, and falls from a height.\textsuperscript{9} In our series, 18 patients were caused by high-energy trauma. 85% patients have multisystem injuries. It is suggested that general examination should be performed to avoid neglecting life-threatening injuries.

Reasons for missed diagnosis of femoral neck fracture

It is not difficult to diagnose an ipsilateral femoral neck and shaft fracture. Missed diagnosis of femoral neck fractures may happen for it is often neglected when femoral shaft fractures coexisted. The missed diagnosis rate of femoral neck fracture is from 13% to 31%.\textsuperscript{6,10} or even 19%-50%.\textsuperscript{11} In this study there were 2 neglected femoral neck fractures, leading to a delay of the operation for 7 days. The reasons for high rate of missed diagnosis are considered as follows. (1) The incidence of this kind of injury is low and the symptoms of femoral neck fractures are sometimes covered by those of shaft fractures. Orthopedic surgeons overlook physical examination on the injured hip. (2) Femoral neck and shaft fractures frequently sustain multisystem injuries. Systematic physical examination is often neglected while saving patients’ lives. (3) In most cases, the femoral neck fracture line is almost vertical and not displaced or minimally displaced\textsuperscript{6,12} and thus tends to be missed. Yang et al\textsuperscript{11} found 8 of 14 neck fractures not visible on the initial pelvic radiographs, but 6 of the 8 undisplaced fractures were clearly revealed before operation by CT scans and the other two were iatrogenic. Preoperative CT scan for high suggestive patients is helpful to reduce the missed diagnosis rate.

Treatment options and prognosis

Ipsilateral femoral neck and shaft fracture is unstable one.\textsuperscript{12} It should be treated operatively by internal fixation. Early fixation allows an early functional exercise, reduces the complications of traction and recumbence and lowers medical costs.\textsuperscript{13} More than 60 methods have been reported for managing these concomitant fractures, but there is no consensus regarding their optimal treatment. The three major issues related to treatment of these fractures are: the optimal time of surgery, an appropriate sequence of the management to these fractures and the choice of internal fixation.\textsuperscript{2}

The prognosis of ipsilateral femoral neck and shaft fracture is generally good after early treatment. The incidence of osteonecrosis in the ipsilateral femoral neck and shaft fractures (3%) is lower than that in the solitary femoral neck fractures (10%). This is probably due...
to three reasons. First, the energy of trauma is dissipated in the shaft fracture. Second, most of the femoral neck fractures are basal neck fractures and non-displaced neck fractures that affect the blood supply to a less extent. Third, there exists a different pattern of the neck fracture, an almost vertical fracture.\(^2\) It is doubtful that a delay in diagnosis and treatment will increase the risk of osteonecrosis.\(^3\) In our two cases the delayed time from injuries to internal fixation was 10 days and 15 days respectively. The fractures were healed finally and no osteonecrosis was found. It is no doubt that early diagnosis and treatment are beneficial for these patients.\(^10\)

Controversy exists about which fracture should be treated first. Some authors suggest that femoral neck fracture should be fixed first to avoid displacement of the neck and also femoral head osteonecrosis.\(^6\) \(^11\) Others insist that femoral shaft fracture be fixed first\(^2\)\(^5\)\(^14\) because they believe that the shaft fracture is the main determining factor for patients’ overall outcome. Though there is no obvious evidence showing that femoral neck displacement would result in an increased incidence of femoral head osteonecrosis, we prefer a temporary neck fixation before shaft fixation.\(^13\)

Treatment options include: (1) antegrade femoral shaft nailing with cancellous screws placed anteriorly to the nail for fixation of the neck; (2) reconstructive intramedullary nailing using proximal interlocking screws that passes through the proximal nail segment, across the femoral neck fracture and into the femoral head; (3) various plate combinations (including a hip screw and long side plate configuration, a hip screw with short side plate for the neck and separate plate for the shaft, or cancellous screws for femoral neck and a plate for the shaft); and (4) retrograde intramedullary nailing for shaft fixation with cancellous lag screws placed superiorly to the tip of the nail for neck stabilization. In our series 16 patients were fixed using various plate combinations (cancellous screws for femoral neck and a plate for the shaft). Two patients were fixed by antegrade femoral shaft nailing with cancellous screws placed anterior to the nail for fixation of the neck. One patient was fixed by proximal femoral nailing. All of the neck and shaft fractures were healed. Evidence suggests that separate femoral neck and shaft fixation may result in less possibility of re-operations.\(^15\) The results of our series support the viewpoint. We preferably postulate that femoral shaft and neck fractures should be fixed separately.

REFERENCES