

Ipsilateral femoral neck and shaft fractures

Retrospective study of 33 cases

Chi-Chuan Wu and Chun-Hsiung Shih

Forty-two consecutive adult patients with a concomitant ipsilateral femoral neck and shaft fracture were treated. The neck fracture was initially missed in 7 patients. Surgery was delayed for a median of 7 days because of the patients' poor general conditions. Thirty-three patients were followed up for 2 (1-6) years. All 33 necks healed, with a union period of 3.3 ± 1.7 months; and 28 shafts healed after 7.9 ± 1.8

months. Thus, the femoral shaft determined the total union rate and union period. All the complications, (eight out of 33) occurred in the open procedure group. Our series reveals that ipsilateral femoral neck and shaft fractures have a relatively satisfactory outcome. Closed Küntscher's nailing or interlocking nailing with supplementary Knowles' pinning is the preferable technique.

Chang Gung Medical College, Department of Orthopedics, Chang Gung Memorial Hospital, No. 5, Fu-Hsin St. 33333, Kweishan, Taoyuan, Taiwan, R.O.C.

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Ipsilateral femoral neck and shaft fractures are uncommon, and are caused by a severe force (Casey and Chapman 1979, Bucholz and Rathjen 1985, Friedman and Wyman 1986). Swiontkowski (1987) suggested that there had been nearly 60 recommended methods of managing this fracture combination in his 176 cases collected from 20 series. He had also reported that 19 percent of the neck fractures were initially missed.

We report a retrospective study of 42 cases of this uncommon fracture combination.

Materials and methods

From January 1984 to April 1989, 42 consecutive adult patients with a concomitant ipsilateral femoral neck and shaft fracture were treated at our hospital. During the same period, 1,425 femoral shaft fractures in adults were treated there. The incidence of femoral shaft fractures was thus 3 percent (42/1425). There were no bilateral cases. The median age was 36 (16-59) years, and 38 were men. Thirty-seven cases were caused by a motorcycle accident, 3 by an automobile accident, and 2 by a fall from a height. Nineteen femoral neck fractures (13 displaced and six non-displaced) were intracapsular. Seven fractures (one intracapsular and six basal) were initially missed, and they were all nondisplaced. All 42 neck fractures were closed, and nine shaft fractures were open (three Type I, three Type II, two Type IIIa, and one Type IIIc; Gustilo and Anderson 1976). Thirty-four fractures were located in the midthird, and 20 were unstable

(Winquist's Type III, IV, segmental, and spiral) (Winquist and Hansen 1980). Most of the patients had multiple injuries (Table 1); only 12 had no other injuries.

Patients were resuscitated at the emergency service for systemic stabilization. Severe open femoral shaft fractures were debrided in the operating room, and intravenous antibiotics were given. Only 4 cases had immediate femoral neck and shaft definitive internal fixation. Others were temporarily immobilized with upper tibial skeletal traction. An early regular operation was arranged as soon as possible if the general condition of the patient became stable. Of the 38 delayed cases, 7 were missed neck fractures, which had been delayed for 16 (5-75) days; and the other 31 cases were delayed for 8 (1-50) days.

Before the introduction of interlocking nails in December 1986, there was no single, favored technique for internal fixation. The method of treatment

Table 1. Associated injuries (n 42)

Craniofacial	8
Chest	4
Abdominal	5
Musculoskeletal	
Tibial fracture	15
Radioulnar fracture	5
Foot fracture	5
Patellar fracture	4
Wrist fracture	4
Clavicular fracture	4
Others	17

Table 2. Clinical data in 42 patients with an ipsilateral femoral neck and shaft fracture

A	B	C	D	E	F	G	H	I	J	K	L	M	N
1	34	1	1	2	2	1	2	2	3	3	10	6	75
2	38	1	1	5	2	1	2	4	5	T	T	T	T
3	39	1	1	6	3	1	2	3	1	T	T	T	T
4	42	1	1	2	2	1	2	7	5	2	5	6	58
5	46	2	1	6	2	2, IIIa	2	11	1	3	11	5	45
6	24	1	1	6	2	1	2	2	3	4.5	8	6	44
7	36	1	1	5	2	1	2	9	4	6	10	6	43
8	49	1	1	3	4	2	2	8	3	4	10	6	42
9	27	1	1	5	2	1, II	1	10	3	2.5	8	6	42
10	45	1	1	3	3	2	2	18	2	2	10	6	40
11	44	1	1	6	3	1, I	2	7	2	3	7	6	40
12	26	1	1	3	3	1	2	0	1	2	W	1	40
13	50	1	1	6	2	2	2	7	2	T	T	T	T
14	26	2	1	2	2	1	2	3	2	1.5	W	2	38
15	25	1	1	5	2	1	1	75	3+8	4	10	3	38
16	17	1	1	3	2	2	2	10	1	T	T	T	T
17	35	1	2	3	2	2	2	8	6	2	6	6	33
18	34	1	1	3	2	1, I	2	9	5	T	T	T	T
19	17	1	1	5	2	2	2	7	7	6	8	6	30
20	27	2	1	3	2	1	2	8	3	2	6	6	28
21	31	1	1	5	2	2	1	5	3	1.5	10	6	26
22	49	1	1	5	2	1	2	0	1	1.5	5	6	26
23	43	1	1	6	4	2	2	14	1	2	8	6	24
24	18	1	2	3	1	2	2	2	4	6	8	6	24
25	21	1	1	5	2	2	1	24	3	6	8	6	24
26	16	1	1	6	2	2, I	2	12	1	4.5	8	6	24
27	57	1	1	3	2	1	2	10	2	2	8	6	23
28	39	1	1	5	2	1, IIIa	2	4	2	3.5	10	6	23
29	59	1	2	6	2	2	2	20	2+8	4	8	6	21
30	40	1	1	3	2	2	2	8	2	8	W	2	20
31	50	1	1	6	2	2	2	10	2	5	W	1	20
32	46	1	1	2	2	2	1	18	3	T	T	T	T
33	23	1	1	2	2	1	2	0	7	T	T	T	T
34	41	1	1	2	4	2	2	0	1	4	W	1	17
35	52	2	1	6	3	1, II	2	9	1	1.5	8	6	16
36	17	1	1	5	2	1	1	15	3	5	6	6	16
37	47	1	3	6	1	2	2	7	4	T	T	T	T
38	40	1	1	3	2	2	2	1	1	4	7	6	15
39	26	1	1	6	2	2, II	2	4	1	1.5	7	6	14
40	45	1	1	3	3	1	2	3	1	3	5	6	13
41	17	1	3	3	2	1	2	50	1+8	T	T	T	T
42	26	1	1	5	2	1, IIIc	1	16	2	5	8	4	12

A Case

B Age

C Sex

- 1 man
- 2 woman

D Traumatic mechanism

- 1 motorcycle
- 2 automobile
- 3 fall

E Fracture types: neck

- 1 intracapsular Garden's Stage I
- 2 II
- 3 III
- 4 IV
- 5 basal nondisplaced
- 6 basal displaced

F Fracture types: shaft (level)

- 1 proximal third
- 2 mid
- 3 distal
- 4 segmental

G Fracture types: shaft (stability) and type according to Gustilo and Andersen 1976

- 1 stable
- 2 unstable (Winquist's Type III, IV, segmental, spiral)

H Missed neck fracture

- 1 yes
- 2 no

I Delay of neck fracture treatment, days

J Treatment

- 1 plate + Knowles' pin
- 2 Huckstep's nailing + Knowles' pin
- 3 open Küntscher's nailing + Knowles' pin
- 4 sliding screw plate + Knowles' pin
- 5 closed Küntscher's nailing + Knowles' pin
- 6 closed locking nail + Knowles' pin
- 7 others
- 8 Meyers' muscle pedicle bone graft

K Results: neck, months of union

T lost for follow-up

L Results: shaft, months of union

W nonunion

M Complications

- 1 nonunion of shaft with implant failure
- 2 nonunion of shaft without implant failure
- 3 necrosis of femoral head
- 4 deep infection
- 5 refracture of shaft
- 6 none

N Follow-up, months

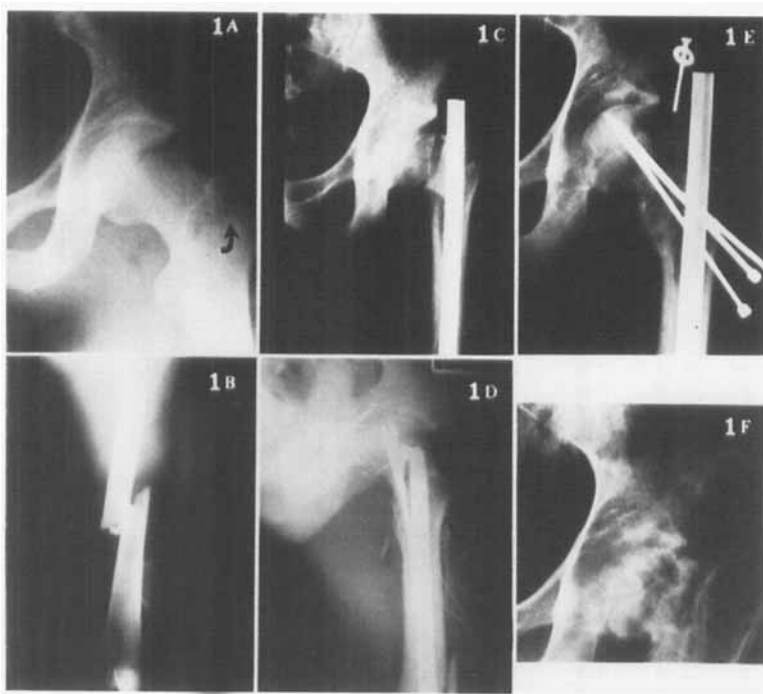


Figure 1. Case 15. A 25-year-old man sustained a head injury, a mandibular fracture, and left ipsilateral femoral neck (arrow) and shaft fractures. The nondisplaced basilar neck fracture was missed for 75 days. Initially, open Küntscher's nailing was performed for a shaft fracture. Although open reduction with Knowles' pin fixation, as well as Meyers' muscle pedicle bone grafting, was performed, aseptic necrosis still appeared after 1 year. Neck and shaft unions occurred without complications.

was chosen according to the surgeon's skill, fracture severity, and fracture level (Table 2). After the training in interlocking nailing, closed nailing with a Küntscher nail or an interlocking nail became the method of choice. The neck fracture was stabilized with three or four Knowles' pins.

Meyers' (1973) muscle pedicle bone grafting was performed in 3 cases. One was a missed femoral neck fracture case that had been delayed for 75 days (Figure 1), and the other 2 had been delayed for 20 and 50 days because of the patients' poor general conditions.

The Type IIIc open femoral shaft fracture (Case 42) sustained popliteal artery rupture and accepted the emergency venous grafting. Upper tibial traction was in place for 16 days, then Huckstep's nailing with Knowles' pinning was done.

Case 33 had an above-the-knee amputation due to failure of an associated Type IIIc open tibial fracture.

Postoperatively, patients were permitted early ambulation with crutches. Protected weight bearing was advised until bony union. Quadriceps strengthening, as well as knee-motion exercise, was encouraged. Patients were followed up at 4-6 week intervals. Fracture healing, wound condition, and the rehabilitation program were recorded.

We defined union as follows: clinically no pain, no tenderness, ambulation without aids, and a radiograph showing both recanalization of trabeculae in the

femoral neck and solid bridging callus in the femoral shaft (Delee et al. 1981, Chan et al. 1984). Nonunion was defined as when the fracture was still ununited after 1-year (Seinscheimer 1978).

Results

Of the 42 patients, 33 patients were followed up for 26 (12-75) months. In 28 patients both fractures had healed during the follow-up period. All 33 necks healed in 3 ± 2 months, and 28 shafts healed in 8 ± 2 months (Figures 2 and 3).

The range of knee motion was 120° (90° - 140°). There was no difference between the closed and the open procedure ($P > 0.05$, chi-square test with Yates' correction).

All eight complications occurred in the open procedure group ($P > 0.05$, chi-square test with Yates' correction): a) five nonunions occurred in femoral shaft fractures with two plate failure after 5 months and 1.5 years, and one Huckstep nail failure after 1 year (Figure 4). b) Necrosis of the femoral head developed in the femoral neck fracture with delayed treatment for 75 days (Figure 1). c) One deep infection occurred in the Type IIIc femoral shaft open fracture

Figure 2. Case 17. A 35-year-old man sustained a right femoral shaft transverse fracture and left femoral neck (arrow) and comminuted shaft (arrow) fractures. Closed Küntscher's nailing was done for the right shaft, and closed interlocking nailing with Knowles' pinning for the left neck and shaft. The surgery was delayed for 8 days. Neck and shaft unions ensued, and there was no aseptic necrosis after a 3-year follow-up.



(Case 42). Although popliteal artery repair succeeded, a deep infection with chronic osteomyelitis of the femoral shaft was noted later. d) Refracture occurred without trauma 3 weeks after the plate had been removed in Case 5. Open Küntscher's nailing was performed and bony union ensued.

Besides, there was neither significant malalignment ($> 10^\circ$ angulation or rotation) nor leg discrepancy (> 2 cm).

Discussion

The femoral neck fracture is often initially missed because of masking by a femoral shaft deformity (Friedman and Wyman 1986) and nondisplacement (Swiontkowski 1987). The present series shows 7 out of 42 cases, and 19 to 30 percent is reported in the

literature (Swiontkowski et al 1984, Bucholz and Rathjen 1985, Swiontkowski 1987). Therefore, pre-operative and postoperative proximal femoral radiographs must be examined carefully.

The basic treatment of intracapsular neck fracture is early anatomic reduction with stable internal fixation (Garden 1971, Barnes et al. 1976, Bucholz and Rathjen 1985, Rehnberg and Olerud 1989). The complications of aseptic necrosis and nonunion are related to delayed surgery and fixation stability (Brown and Abrami 1964). Although Graham (1968) and Barnes et al. (1976) found no relation, Massie (1973) reported 100 percent aseptic necrosis after 1 week of delayed surgery. The present series revealed only one aseptic necrosis from 33 cases with delayed surgery of 7 days (0 to 5 percent in combined fracture cases in the literature; Friedman and Wyman 1986, Swiontkowski 1987). The low incidence of aseptic necrosis may be due to the fact that the majority of

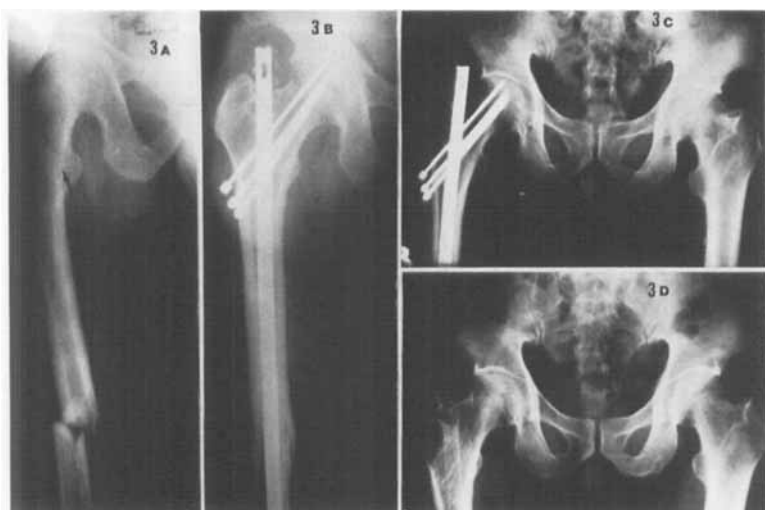


Figure 3. Case 4. A 42-year-old man sustained right femoral neck (arrow) and shaft transverse fractures. Closed Küntscher's nailing with Knowles' pinning was performed with a 7-day delay. Neck and shaft unions ensued, and there was no aseptic necrosis after a 5-year follow-up.



Figure 4. Case 12. A 26-year-old man sustained intraabdominal bleeding, a right clavicular fracture, a left humeral shaft fracture, a right wrist fracture, and left femoral neck (arrow) and shaft fractures. Emergency laparotomy was performed. Plating and Knowles' pinning were performed immediately for the neck and shaft fractures. The neck had healed at 2 months, but the plate failed at 6 months. Revision with a new plate and cancellous-bone grafting were performed. Shaft union ensued, and there was no aseptic necrosis after a 3-year follow-up.

energy had dissipated at the midshaft level (Swiontkowski 1987). Consequently, the time factor seems to be less important; all of these combined fractures can tolerate delayed surgery.

The insertion of Knowles' pins combined with a Küntscher nail to stabilize femoral neck fracture is technically demanding. Inserting Knowles' pins around an interlocking nail is more difficult. There is less bony stock for the pin insertion due to the bulged proximal contour. Bucholz and Rathjen (1985) advocated backward insertion to the femoral head in front of the nail as the key to success. The present series also proves this technique (Figure 2). We believe that the technique will be easier if the shaft is fixed first (Eieskjer et al. 1989).

We conclude that an ipsilateral femoral neck and shaft fracture have a relatively satisfactory outcome (Casey and Chapman 1979). The shaft fracture should be treated with closed intramedullary nailing and the neck fracture with pinning. Emergency femoral neck fixation is unnecessary.

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