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Nailing of femoral neck fracture

Clinical and sociologic 5-year follow-up of 510 consecutive hips

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In a retrospective population-based study, 510 consecutive cervical hip fractures treated by internal fixation with a spring-loaded four-flanged nail, early weight bearing, and social rehabilitation were examined at 5 years after primary nailing. Six (1.6 percent) deep infections occurred. After a new trauma, seven fractures through the nail entrance were seen. Mortality at 2 years was 32 percent and at 5 years 53 percent. With a program for active rehabilitation, 80 percent of the survivors coming from independent living returned to this and remained there.

The frequency of reoperations in patients below age 70 years was twice as high as in those over 70. Secondary arthroplasty was performed in 6 percent of the 129 undisplaced fractures and in 25 percent of the 381 displaced fractures. Totally, 67 percent of the fractures had no secondary procedure, not even nail extraction.

In Scandinavia, femoral neck fracture is generally treated by primary nailing in order not to discard living femoral heads; even in displaced fractures the majority heal without complications (Arnold 1984, Boyd and Salvatore 1964, Strömqvist et al. 1983). We report the long-term results in a consecutive series of patients treated with a spring-loaded four-flanged nail, immediate postoperative weight bearing, and optimized social rehabilitation.

Patients and methods

From 1977 through 1980, a total of 602 patients with 616 femoral neck fractures were admitted from the 230,000 primary catchment population of our department. Four patients died while being prepared for operation. Five were treated conservatively; another 2 were not operated on because of severe cardiac disease or a pressure ulcer. Primary arthroplasty was performed because of severe coxarthrosis in 2 patients, fracture luxation in 1 patient, and failure of fracture reduction in 1 patient. Twenty patients from other parts of the country primarily treated at our department were excluded, as were 25 patients mainly treated with other types of osteosynthesis at other centers not using the four-flanged Rydell (1964) nail. Forty-three patients from a regional mental hospital, treated as outpatients, were also excluded. In 3 cases, data were missing. Thus, 510 hips in 498 patients operated on with the Rydell nail were studied (Figure 1). The mean patient age was 78 (28–99) years and the female to male ratio 3:1.

On admission, pin traction was applied through the tibial tuberosity in displaced fractures, and the operation was performed on the day after admission if no contraindications were present. Perioperative procedures included general or spinal anesthesia, usually biplane fluoroscopy, and an extension table. No prophylactic antibiotics were used. All the staff surgeons performed the operations. Full weight bearing was encouraged from the first postoperative day. On returning home after mobilization in the ward, active rehabilitation was monitored by a nurse or physiotherapist (Ceder 1980).

The preoperative radiographs were classified according to Garden (1961) as Stages I and II

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Figure 1. The spring-loaded four-flanged nail.

(undisplaced) or III and IV (displaced). Radiographic healing complications were recorded either as redisplacement and/or nonunion or segmental collapse of the femoral head (Brown and Abrami 1964).

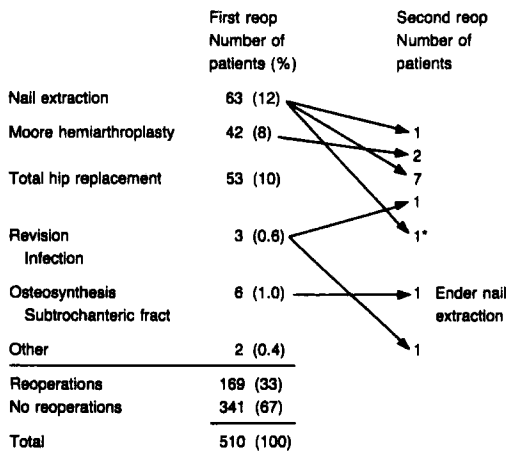
Five years postoperatively, the files on the patients were checked, and the surviving patients were interviewed on the telephone. All the patients with suspected hip pain were offered a clinical examination. Twenty-seven of 178 patients living without a prosthesis had symptoms and were all examined. Four segmental collapses and three nonunions were discovered, but none of the 7 patients had symptoms justifying total hip replacement.

Results

Total patient material (Table 6)

Superficial infection developed in 11 hips and deep infection in six (1.2 percent); and of these, only three were diagnosed before reoperation, whereas the remaining three infections were detected during reoperation or from bacteriologic samples taken at the time of the operation. Seven subtrochanteric fractures through the nail entrance were caused by new trauma. One of these fractures was undisplaced and was treated conservatively; the other fractures were nailed according to Ender or with nail and plate. All of these fractures healed subsequently. Thirteen nails slipped, one penetrated the acetabulum, and one fractured the medial femoral cortex. One patient had a large postoperative bleeding.

In 67 percent of the fractures, no secondary procedure was performed; and 79 percent retained the femoral head. Nonunion had been diagnosed on radiographs in 23 percent of the fractures and segmental collapse in 11 percent. Totally, 21 percent of the patients had an arthroplasty owing to complications from the fracture, and 1 additional patient owing to coxarthrosis not related to the fracture (Figure 2). The time lag between primary nailing and arthroplasty was, in the majority of cases, less than 4 months for redisplacement/nonunion, whereas half of those with segmental collapse were reoperated on between 1 and 2 years after the fracture (Table 1). The frequency of reoperations irrespective of indication was lower in the older age-groups, and the mortality considerably higher as compared with younger patients (Table 2). After secondary arthroplasty, 16 percent of the patients had died within 1 year, 20 percent after 2 years, and 41



*Case 200 who had an infection had surgery another four times (Insertion and extraction of gentamicin beads, Girdlestone resection and THR).

Figure 2. Reoperations during 5 years in 510 cervical hip fractures.

Table 1. Time lag between primary nailing (510 fractures) and arthroplasty for different indications

Time (yr)	Redisplace-ment/ nonunion	Segmental collapse	Total
0.1	12	0	12
0.3	30	1	31
1	18	10	28
2	13	7	20
3	4	4	8
4	0	5	5
5	0	0	0
Total	77	27	104

Table 2. Percentage reoperations and mortality in relation to age. For patients operated on more than once, the last reoperation was recorded

Age (yr)	n	Nail extrac-tion	Other reop	Prosth	Any reop	Dead (years) 1	2	3	4	5
< 70	105	16	5	30	50	8	10	13	15	16
⩾ 70	405	9	6	18	28	24	37	46	54	61
⩾ 80	248	9	4	16	27	29	46	55	63	70

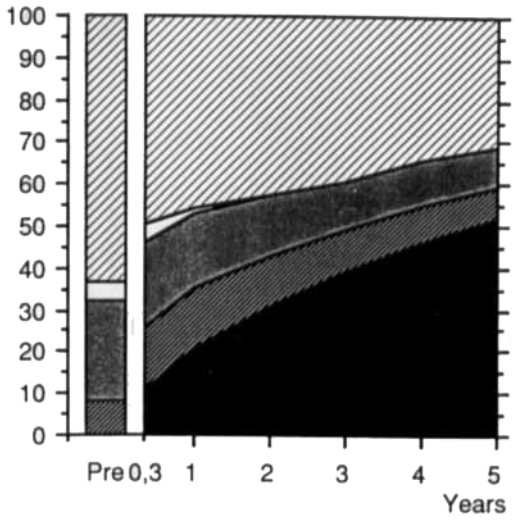
Table 3. Mortality (percent) at different time intervals after femoral neck fractures

Years	Total material 510 cases	Own home 324 cases
0.3	11	6
1	21	12
2	31	21
3	39	26
4	46	32
5	52	38

Table 4. Complications and performed arthroplasties in displaced and undisplaced femoral neck fractures at 5 years after primary osteosynthesis

	n	Redispl/nonunion Total	Redispl/nonunion Arthro-plasty (percent)	Segmental collapse Total	Segmental collapse Arthro-plasty (percent)
Undis-placed	129	8	4 (3)	10	4 (3)
Displaced	381	109	73 (19)	46	23 (6)
Total	510	117	77	56	27

percent at 5 years. The overall mortality of the patients that had an osteosynthesis and any secondary procedure was 21 percent after 1 year, whereas patients admitted from their own homes had a 12 percent mortality (Table 3). After 5 years, 52 percent of the patients had succumbed.



■ Mortality, ▩ Geriatric hospital, ■ Old peoples home, □ Acute hospital, // Own home.

Figure 3. Environment (percent) with increasing time after femoral neck fracture for the total material.

Undisplaced fractures

Of 129 undisplaced fractures, 8 patients had (re)displacement/nonunion and 10 patients had a segmental collapse. Four patients in each group had a secondary arthroplasty (Table 4).

Displaced fractures

Of 381 displaced fractures, 109 patients had redisplacement/nonunion, 73 of whom had an arthroplasty; 46 patients had a segmental collapse, of whom 23 had an arthroplasty (Table 4).

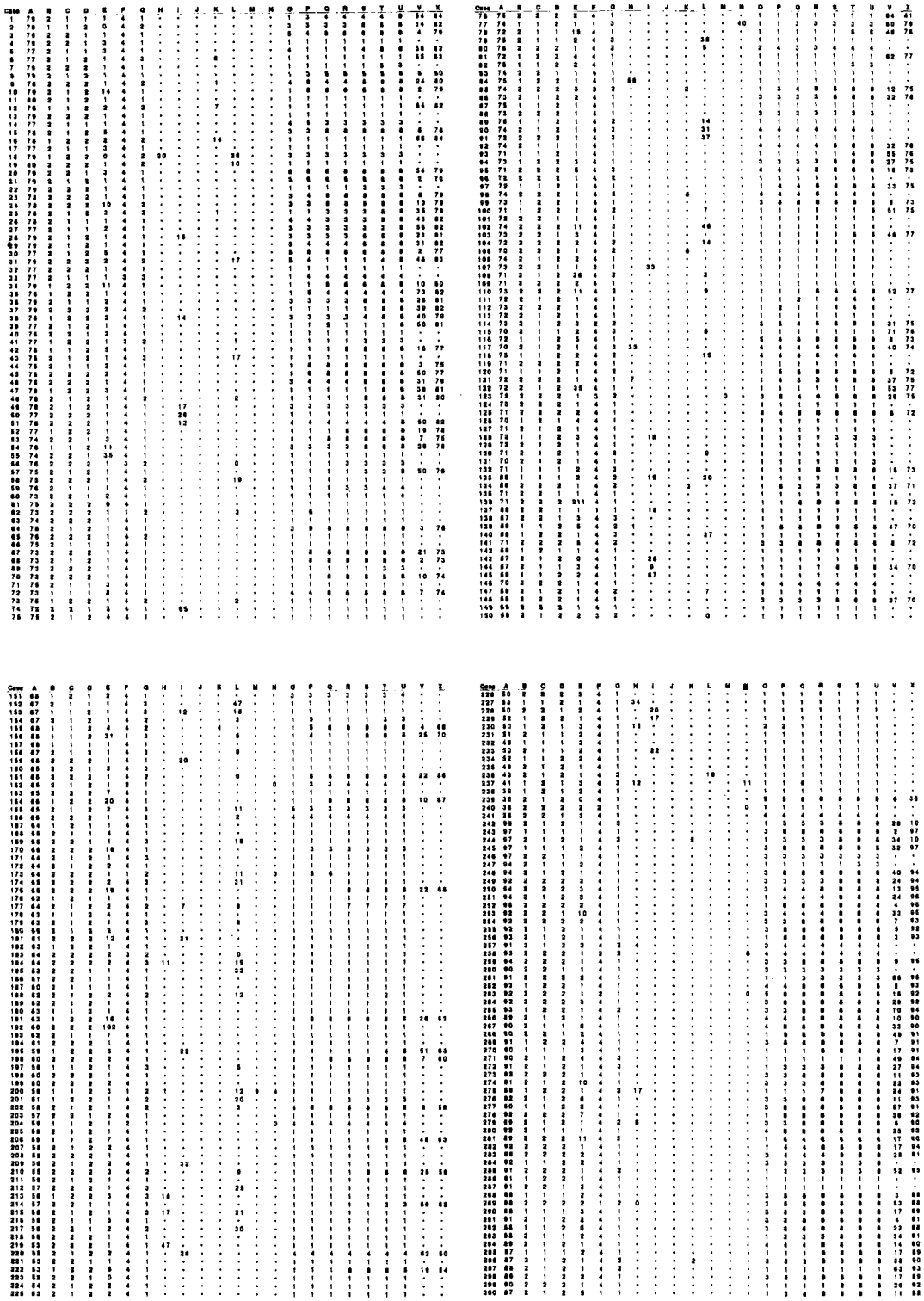
Habitat (Figure 3)

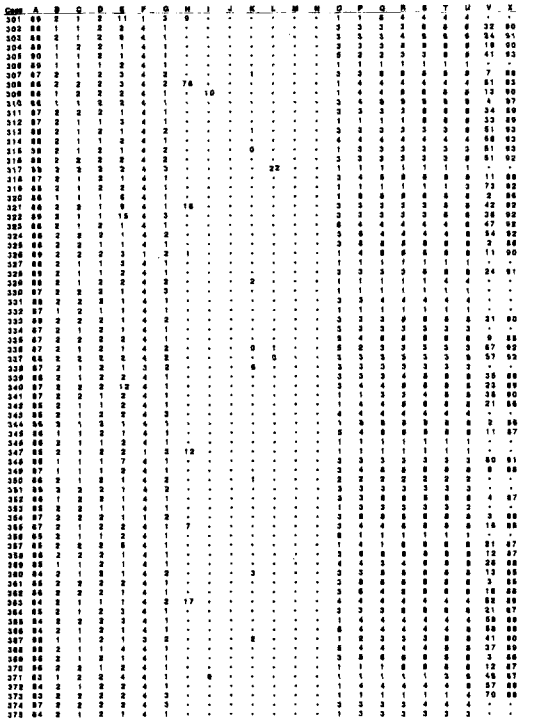
Sixty-four percent of the patients were living independently in their own homes prior to their fracture. Of these, 80 percent of the survivors returned home within 4 months. This fraction was constant during the 5 years of the investigation.

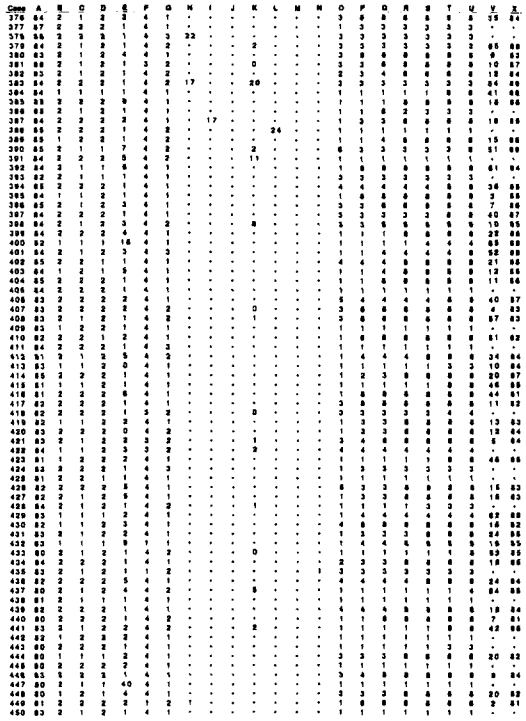
Discussion

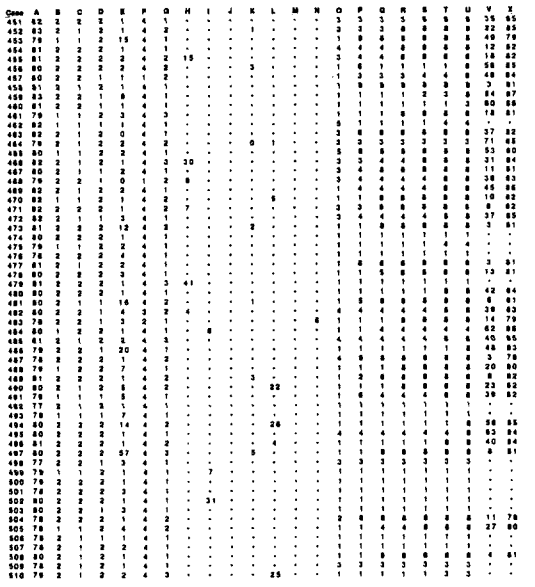
Our study sufferes from being retrospective and partly from being based on telephone interviews. On the other hand, it included every femoral neck fracture admitted to our department during a 5-year period; all the fractures treated by a

Table 1. Data for 510 patients with femoral neck fracture









Key to data

A Age	Years
B Sex	1 Male, 2 Female
C Side	1 Right, 2 Left
D Dislocation	1 Undisplaced, 2 Displaced
E Operative delay	Days
F Complications	1 Infection, 2 Refracture, 3 Other, 4 None
G Final radiograph	1 Unchanged/union, 2 Redisplacement/Non-union 3 Segmental collapse

Reoperations (months postoperatively)

H Nail extr. for complications
I Nail extr. for local symptoms
J Re-nailing
K Hemiarthroplasty
L Total hip replacement
M Girdlestone
N Other

Habitat	1 Own home
O Pre fracture	2 Convalescent
P 4 months	3 Old peoples home
Q 1 year	4 Geriatric hospital
R 2 years	5 Other clinic
S 3 years	6 Orthop clinic
T 4 years	7 Unknown
U 5 years	8 Dead
V Time fracture to death	Months
X Age at death	Years

spring-loaded four-flanged nail were analyzed. Our material corresponds well with other reports concerning age, sex, fracture displacement, and mortality. Our hospital is the only one in the catchment area, and the distance to the hospital is short from all parts of the area. Patients with problems were likely to have contacted us; and at 5 years postoperatively, the symptomatic patients were offered a clinical examination. Strömqvist et al. (1984), in a prospective randomized series, reported complications 2 years after osteosynthesis with the four-flanged nail. Radiographic healing complications in undisplaced/displaced fractures were 28/42 percent and arthroplasty 16/27 percent. The arthroplasty frequency agrees with this series, and this supports the opinion that the rate of complications reported here is accurate.

Independence must be the ultimate indicator of the treatment in this group of patients (Devas 1974). Many suffer from other diseases, and some have had marginal function in their home before the fracture. Today, we must accept that 20 percent cannot return to independent living after a hip fracture; their previous marginal existence has become unbearable.

Our incidence of complications is comparable to other patient materials treated with nailing (Frandsen and Andersen 1981, Høgh et al. 1982, Holmberg et al. 1987). When compared with the less traumatizing hook-pin osteosynthesis (Hansson 1982), the need for prosthetic replacement was more frequent in our study. In a prospective study, Strömqvist et al. (1987) at 2 years showed a total hip-replacement frequency for fractures treated with hook-pins of 11 percent. i.e. only half of the frequency in the present material and in that of Holmberg et al. (1987) (Table 5). A similar difference was shown in a prospective randomized trial by Strömqvist et al. (1984). This difference may be explained by fractures of the femoral head caused by the osteosynthesis, but undetected by conventional radiographs (Kalén 1968, Scott et al. 1985) or by distraction in the fracture causing additional vascular damage during insertion of the nail (Strömqvist and Hansson 1983, Strömqvist et al. 1983). The results of osteosynthesis in undisplaced fractures may be further improved by aspiration of a hemarthrosis tamponading capsular vessels (Wingstrand et al. 1986, Strömqvist et al. 1988).

The use of primary prosthetic replacement selectively in older age-groups is questioned by our investigation because the frequency of reoperations was considerably lower than for younger age-groups (Table 2). The mortality in our series was considerably lower than that reported for primary prosthetic replacement (Hunter 1980, Arnold et al. 1974). Hägglund et al. (1984) showed a low mortality and morbidity rate when prosthetic replacement was done as a planned secondary procedure after healing complications rather than as an emergency operation for femoral neck fractures. Healing complications can be accurately predicted by scintimetry 1–2 weeks postoperatively (Strömqvist et al. 1987); if these patients become symptomatic, they should have a secondary arthroplasty performed early to avoid physical and mental deterioration.

Two-thirds of our patients had no secondary procedure, and 79 percent retained their own femoral head. Thus, this investigation supports primary osteosynthesis for the treatment of femoral neck fractures. This is even more apparent when less traumatic fixation methods are used. For example, the complications and reoperation rates can be reduced by 50 percent when using hook-pins (Strömqvist et al. 1983, 1987). It also pays to have the operations performed by better trained surgeons (Holmberg et al. 1987, own unpublished data).

Table 5. Failures and reoperations following nailing of cervical hip fracture.
Comparison (percentage) of patients from own home in the present material with Holmberg et al. (1987) (patients from own home) and Strömqvist et al. (1987) (patients from all habitats).

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