More postoperative femoral fractures with the Gamma nail than the sliding screw plate in the treatment of trochanteric fractures

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ABSTRACT – Despite several studies showing a higher incidence of peri-implant femoral fractures with the Gamma nail than with a sliding screw plate (SSP), the Gamma nail has remained the standard implant for trochanteric fractures in many hospitals.

We recorded 921 trochanteric fractures in the city of Oslo during 2 years and compared the reoperation frequency in patients treated with the Gamma nail (n 379) and SSP (n 542). The distribution of age and gender in the two treatment groups was the same. 65 patients were reoperated on, several of them more than once. The only significant difference between the two surgical methods in complications leading to a reoperation was the frequency of femoral shaft fractures. 17 of the patients treated with the Gamma nail had a new femoral fracture postoperatively, compared to 3 of those with a SSP. The relative risk of another femoral fracture after surgery was 12 (95% CI: 2.7–52) if the surgical device was a Gamma nail compared to a SSP. The Gamma nail therefore can not be recommended as the standard implant for trochanteric fractures.

The sliding screw plate (SSP) and the Gamma nail have been used for fixation of trochanteric femoral fractures in many hospitals. Several studies have found a higher incidence of implant-related postoperative femoral fractures with the Gamma nail (Bridle et al. 1991, Radford et al. 1993, Aune et al. 1994, Butt et al. 1995, Parker and Pryor 1996). However, some have recommended use of the Gamma nail (Leung et al. 1992, Boriani et al. 1996, Park et al. 1998). Since the Gamma nail is still in use and recommended (Leung et al. 1992, Boriani et al. 1996, Park et al. 1998), we wanted to study whether the complication rate has declined.

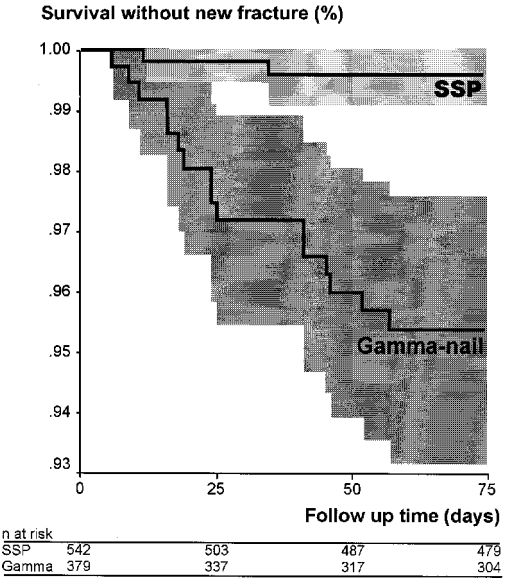
Patients and methods

Patients aged 50 years or older with an ICD9 code 820.X (hip fracture) were identified during two 1-year periods. During the first period (May 1994 through April 1995), patients hospitalized in the two somatic hospitals serving most of the Oslo population were identified by using their electronic diagnosis registers. During the second period (May 1996 through April 1997), patients hospitalized in any of the four somatic hospitals in Oslo were identified. Medical records of all patients were retrieved and the diagnosis confirmed. The study included 935 patients of whom 921 patients had been treated with a SSP or a Gamma nail. The other patients were treated with a hemiprosthesis (1), total prosthesis (n 1), other osteosynthesis (1), or conservatively (11). The mean ages were 83 (51–100) years in the Gamma group, 81 (51–102) years in the SSP group, and 82 years in the whole group. 80% were women in the Gamma group and 79% in the SSP group. Subtrochanteric fractures, fractures due to cancer metastases and high-energy traumas (defined as a fall from higher than ground level or a traffic accident) were excluded.

Table 1. Postoperative complications leading to reoperations after treatment of trochanteric fractures with Gamma nail or sliding screw plate (SSP). 87 reoperations were done on 65 patients during the follow-up (2.5–50 months)

	SSP	Gamma nail	Total
Number of primary operations	542	379	921
Reoperations			
Wound complication	12	10	22
Removal of osteosynthesis material	14	11	25
Hemiprosthesis	6	0	6
Total prosthesis	6	3	9
Femoral shaft fracture	3	19 [a]	21
Reposition of prosthesis	3	0	3
Pseudarthrosis operation	0	1	1
Total	44	44	87

[a] 2 patients whose primary fractures were treated with a Gamma nail underwent 2 reoperations for 1 postoperative femoral fracture.



Kaplan Meier curve with 95% confidence intervals of survival with no postoperative femoral fracture during 75 days after operation for trochanteric fracture in 921 patients treated with a sliding screw plate (SSP) (n 542) or a Gamma nail (n 379) in Oslo during the period May 1994 through April 1995 and May 1996 through April 1997.

Gender, dates of birth, of hip fracture, and of admission to hospital, surgical device, and complications resulting in a reoperation were retrieved from the medical records. Intraoperative and postoperative complications not resulting in a reoperation were not recorded. In all patients with postoperative femoral fractures, we examined the radiographs of the primary and postoperative fractures. The stability of the primary fracture was classified with Evans' method (1949), as modified by Jensen (1980). Postoperative fractures were classified according to the localization in relation to the implant. The follow-up of the patients in this study ranged between 2 1/2 and 50 months.

To compare the surgical methods, survival curves (showing refracture free survival) were constructed with the Kaplan-Meier method, relative risk calculated with Cox proportional hazard regression, and the frequency of complications was compared with the chi-squared test. The survival of the devices was calculated from the day of admission to hospital, since the date of primary surgery was not recorded. The statistical calculations were performed in SPSS 8.0 for Windows. The level of statistical significance was set at 0.05.

Results

65 of the 921 patients treated with SSP or Gamma nail underwent a reoperation (Table 1). 13 patients had more than one reoperation. The only significant difference between the 2 surgical methods in complications resulting in a reoperation was the frequency of femoral shaft fractures. The mean age was 85 years in the group who sustained a postoperative new peri-implant fracture. 17 of the 379 (4.5%) patients treated with a Gamma nail sustained a femoral shaft fracture postoperatively, compared to 3 of the 542 (0.6%) patients treated with SSP. During the first 75 days, there were 16 femoral shaft fractures in patients treated with the Gamma nail and 2 in patients treated with SSP ($p < 0.001$). The relative risk of a postoperative femoral fracture was 12 (95% CI: 2.7–52) if the surgical device was a Gamma nail compared to a SSP (Figure).

The reoperation rate for postoperative femoral fractures with the Gamma nail was the same in both periods, 7 of 159 (4.4%) in 1994–1995 versus 10 of 220 patients (4.5%) during 1996–1997.

Table 2. Radiographic findings in 20 patients with a postoperative femoral fracture after fixation of a trochanteric fracture with a sliding screw plate (SSP) or a Gamma nail during 2.5–50 months follow-up. All longer Gamma nails in the reoperations included a locking screw

No.	Period	Age	EJC	Device primary fracture	D	Location of fracture	Treatment
1	9495	80	4	Gamma nail, short	87	Peri-implant	Longer Gamma nail
2	9495	81	2	Gamma nail, short	11	Peri-implant	Locking screw
3	9495	78	5	Gamma nail, short	16	Peri-implant	Longer Gamma nail
4	9495	82	4	Gamma nail, short	16	Peri-implant	Two locking screws inserted and one removed peroperatively
5	9495	79	1	Gamma nail, short	24	Peri-implant	Longer Gamma nail
6	9495	92	4	SSP (with cerclage)	304	Sub-implant	Long intramedullary nail
7	9495	85	2	SSP	11	Peri-implant	Long SSP, 12 holes with cerclage
8	9495	88	2	SSP	34	Peri-implant	Long SSP, 12 holes
9	9495	93	2	Gamma nail, short	25	Peri-implant	Longer Gamma nail
10	9495	88	2	Gamma nail, short	52	Peri- to Sub-implant	Longer Gamma nail with cerclage
11	9697	71	5	Gamma nail, short	41	Peri-implant	Longer Gamma nail
12	9697	94	5	Gamma nail, short	18	Sub-implant	Longer Gamma nail
13	9697	86	2	Gamma nail, short	40	Peri-implant	Longer Gamma nail
14	9697	92	5	Gamma nail, short	17	Peri-implant	Longer Gamma nail
15	9697	74	2	Gamma nail, short	56	Peri-implant	Longer Gamma nail
16	9697	87	5	Gamma nail, short; one locking screw	45	Peri-implant	Longer Gamma nail
17	9697	78	3	Gamma nail, short	5	Peri-implant	Longer Gamma nail
18	9697	87	4	Gamma nail, short	3	Peri-implant	Longer Gamma nail with cerclage
19	9697	87	4	Gamma nail, long; two locking screws	9	Peri-implant, supracondylar	Short unlocked Gamma nail and retrograde nail from the knee
20	9697	93	5	Gamma nail, short	18	Peri-implant	Longer Gamma nail

No. case number, Age age at time of primary fracture, EJC Evans-Jensen classification of pertrochanteric fractures, D days from primary fracture until postoperative femoral fracture occurred.

12 of the 20 postoperative femoral shaft fractures occurred in unstable trochanteric fractures (Table 2). 2 of the 3 fractures initially treated with SSP were stable while 6 of the 17 initially treated with a Gamma nail were stable. The 3 patients with SSP who sustained a postoperative femoral fracture were initially operated on with four-hole Dynamic Hip Screws (DHS-Synthes). All but 1 of the Gamma nails used in the 17 patients who sustained a postoperative femoral fracture were short and had 11 mm distal diameter. Only 2 Gamma nails were locked; 1 by one screw and 1 by two. 1 patient (case 19) was initially operated on with a long Gamma nail and sustained a supracondylar peri-implant fracture postoperatively. 1 patient primary operated with a Gamma nail (case 18) had a second peri-implant fracture after being reoperated on with a long Gamma nail with locking screw. All long Gamma nails inserted during reoperation were locked distally. 1 patient initially operated on with an SSP (case 6) sustained a postoperative supracondylar fracture 15 cm from the implant 10 months postoperatively. The fracture seemed to have no relation to the previous implant and the trochanteric fracture, which had healed.

Discussion

We found a higher incidence of postoperative femoral shaft fractures in the treatment of trochanteric fractures with the Gamma nail than the SSP. No change in incidence occurred from the first to the second period of registration. Almost all postoperative femoral shaft fractures were noted during the first 75 days after the fracture.

Our retrospective study included four hospitals. Two used both devices, while two used only the SSP. The choice of method in the two hospitals using both devices were surgeon-dependent, and there may have been a bias in the choice of device. Other reasons may also account for the differences in complication rates than the implants and their method of insertion. Some of these postoperative fractures could have been created during the operation since they occurred early (Aune et al. 1994),

but the postoperative radiographs did not clearly show this.

Our study represents the largest reported single comparison of the Gamma nail and SSP in the treatment of trochanteric fractures. However, a meta-analysis of 10 randomized trials includes more trochanteric fractures (n 1,794) (Parker and Pryor 1996). In accordance with our study, they reported a higher incidence of postoperative femoral fractures with use of the Gamma nail in trochanteric fractures. No advantage has been reported for the Gamma nail in randomized studies compared to a SSP (Parker and Pryor 1996).

We observed a 5% incidence of new femoral shaft fractures after Gamma nailing. This is in accordance with previous studies (8% (Bridle et al. 1991), 2% (Halder 1992), 2% (Leung et al. 1992), 11% (Radford et al. 1993), 6% (Aune et al. 1994), 17% (Butt et al. 1995), 6% (O'Brien et al. 1995), 10% (Hoffman and Lynskey 1996), 3% (Schrøder et al. 1996), 3% (Bjørgul et al. 1998)). The Gamma nail is still used frequently in fixation of trochanteric fractures. This may be due to the theoretical advantages, which are the percutaneous technique with less blood loss, reduced frequency of infection, minimal tissue damage and a shorter operating time. In addition, the mechanical advantage of the Gamma nail is a reduced distance between the hip joint and the nail compared to the SSP, diminishing the deforming forces across the implant (Parker and Pryor 1996). According to Haynes et al. (1997), the Gamma nail has a higher failure load than the Dynamic Hip Screw (DHS). It has been suggested that postoperative femoral fractures occur due to the drilling of holes for distal locking screws, too forceful insertion of the nail into the femoral shaft, the use of too large a nail, or insufficient or excessive reaming of the femoral canal before insertion of the nail (Lacroix et al. 1995, Boriani et al. 1996). However, in our study, only 2 of the 17 postoperative femoral shaft fractures after fixation with Gamma nail were related to locking screws. In an evaluation of surgical practice (Schrøder et al. 1996), one of the hospitals in Oslo which used the Gamma nail noted that the surgical technique for operations with the Gamma nail has been modified. They avoided the use of a hammer in insertion of the Gamma nail, and used a small distal diameter of the nail. However, our study does not show that the incidence of postoperative femoral shaft fractures has declined from 1994/95 to 1996/97, and our results are similar to those reported in the earliest studies (Bridle et al. 1991, Aune et al. 1994). The modified nail and technique therefore does not seem to have reduced the problem with new peri-implant fractures.

In conclusion we cannot recommend the use of a Gamma nail in the treatment of trochanteric fractures because of the higher incidence of postoperative femoral fractures related to this treatment.

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