Internal fixation of 410 cervical hip fractures

A randomized comparison of a single nail versus two hook-pins

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Totally, 410 patients with a cervical hip fracture were randomized between two methods of osteosynthesis: a single nail (Rydell) and two hook-pins (LIH). Seventy-five percent of the patients were women. Sixty-nine percent were alive after 2 years. The patients were followed up with clinical and radiographic examinations for 2 years postoperatively. No differences between the two groups were found regarding quality of reduction, early displacement within 3 months, extraction after healing, nonunion, late segmental collapse, or reoperation with a total hip arthroplasty. Nor did we find any differences between the two groups when selecting those alive after 2 years or when dividing the fractures in displaced and nondisplaced fractures.

There is still no consensus regarding the optimal method of internal fixation of cervical hip fractures.

Many studies have found small or no significant differences when comparing methods of internal fixation (Nordkild et al. 1985, Svenningsen et al. 1985, Paus et al. 1986, Madsen et al. 1987). Others have shown that the outcome can be influenced by the choice of the internal fixation device (Frandsen and Andersen 1981, Frandsen et al. 1984, Svenningsen et al. 1984).

Elmerson et al. (1988) found no differences between the results after multiple pinning versus a single nail, nor did we in a similar study (Sernbo 1988), but Strömqvist et al. (1984) have shown better results using two hook-pins compared with a single nail.

The purpose of this report was to compare treatment with two LIH (Lars Ingvar Hansson) pins versus a single Rydell nail in patients with a cervical hip fracture.

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Patients and methods

From March 1984 to December 1985, 410 consecutive patients, residents of the city of Malmö, with cervical hip fractures were randomized between two methods of internal fixation. Excluded were fractures older than 1 week, pathologic fractures, and fractures that could not be reduced. The randomization took place in the operation theater just prior to the operation after the fracture had been reduced; the randomization was done by a random number generator. No prophylactic antibiotics were used. Thirty-three orthopedic surgeons performed the operations, and the patients were allowed and encouraged to use full weight bearing the day after the operation.

The two methods of osteosynthesis used were Group 1—a four-flanged spring-loaded single nail (Rydell 1964) and Group 2—two LIH hook-pins (Hansson 1982).

The patient material consisted of 104 men aged 76 ± 12 years and 306 women aged 77 ± 10 years. Seventy-five percent of the cervical fractures were classified as displaced, Garden (1961) Types 3 or 4. These patients were placed in tibial pin traction on admission to our hospital. The mean delay from the time of fracture to the operation was 0.8 ± 3.5 days due to the patient and 1.5 ± 1.3 days caused by the doctor.

No differences among the background factors (residence, living alone, need of aid in their daily

activities, walking aid, or concomitant diseases) were noted when comparing Groups 1 and 2.

The patients were examined clinically after 1, 3, 6, 12, and 24 months postoperatively. Radiographs were also taken at these intervals, as well as immediately postoperatively and after 1 week. In order to get reproducible projections throughout the observation period, the legs of the patient were placed in a box during the roentgen examination. Totally, 285/410 (69 percent) were alive after 2 years. In all, 8/285 patients were examined only clinically, and 1 patient was lost at follow-up. In the results after 2 years, we have included all the complications, also those among the 125 patients who were dead.

Table 1. Peroperative and postoperative results of internal fixation of cervical hip fractures (*SD*)

	Rydell nail	LIH pins
Mean time of operation (minutes)	24 *11*	25 *12*
Mean time of fluoroscopy (seconds)	255 *145*	250 *124*
Mean peroperative bleeding (mL)	40 *54*	44 *68*
Mobilized within 2 weeks (percent)	47	43
Discharged to their own homes (percent)	41	43
Mean time of hospitalization (days)	24 *25*	23 *18*

Operation technique and radiographic assessment

Spinal anesthesia was used in 96 percent of the operations. Displaced fractures were reduced by the closed method on an extension table under a biplane image intensifier. Good reduction was obtained if the Garden angle in the postoperative AP projection and the backward angle in the lateral projection, were both between 155° and 185° (Halpin and Nelson 1980) and a fracture gap—*ad latus*—in any direction was less than 5 mm.

On the postoperative AP radiograph, the fracture neck ratio and the shearing were calculated (Brown and Abrami 1964, Barnes et al. 1976). A low ratio means that the fracture is located medially on the neck of the femur. A low shearing angle means that the fracture line of the cervical hip fracture is more vertical on the AP projection.

The implant was considered to be in a good position if the nail/pins were placed in the medial third or in the center of the femoral head on the AP projection, and in the posterior third or in the center on the lateral projection. Also, the distance from the tip of the implant to the bone-cartilage border in the head of the femur had to be less than 10 mm without penetrating the border.

Early fracture displacement was considered as a complete redislocation of the fracture within 3 months and nonunion was considered if there was a redislocation later than 3 months or if bony union was not present 1 year postoperatively. Late segmental collapse (LSC) was defined as a clear impaction and changed structure of the bone/cartilage of the femoral head. The compression of the fracture was calculated by comparing the sliding of the implant on the AP projection of the radiographs postoperatively and after 1 year.

All the radiographs were evaluated by the same radiologist independently of the other authors. All the secondary operations were noted, and reoperations with hip arthroplasty (HA) included total hip arthroplasty and hemiarthroplasty.

The chi-square test with Yates' correction and the Student's *t*-test were used, as well as stepwise logistic regression.

Results

There were no differences between Groups 1 and 2 in the peroperative and postoperative results (Table 1). Neither were there any differences between the groups concerning quality of reduction or osteosynthesis. Good reduction was obtained in 90 percent and good position of the implant was found in 85 percent.

No differences were found between the two types of implants, although we had better results after LIH pinning of nondisplaced fractures (Table 2). Patients with failures (early displacement, nonunion and/or LSC) had more displaced fractures, lower mean age among the men, longer time of fluoroscopy, lower mortality, lower shearing angle, more often sliding of the implant after 1 year, and more often a previous fracture of the wrist compared with the nonfailure group. Among those alive after 2 years, we found the same differences except that there was no difference regarding the mean age of the men.

No differences between the failure and the nonfailure group were found as regards type of implant, sex, the quality of reduction, position of the implant,

Table 2 . Results after 2 years according to implant. Within brackets are the results of those alive after 2 years

	Rydell nail				LIH pins			
	Garden 1–2		Garden 1–4		Garden 1–2		Garden 3–4	
Number of fractures	60	(48)	145	(97)	58	(42)	147	(98)
Early displacement (percent)	2	(2)	10	(14)	2	(2)	13	(14)
Extraction after healing (percent)	10	(10)	3	(7)	5	(7)	6	(7)
Nonunion (percent)	13	(17)	27	(36)	9	(12)	31	(34)
Late segmental collapse (percent)	7	(6)	12	(18)	5	(7)	13	(20)
Failure (percent)	20	(23)	39	(54)	14	(19)	44	(54)
Salvage arthroplasty (percent)	15	(19)	25	(35)	9	(10)	29	(38)

mean age of the women, the rate of success in the mobilization within 2 weeks postoperatively, the time of operation, or the level of the fracture (the fracture:neck ratio).

Ninety patients had hip arthroplasty, and 83 of these were alive 2 years after their hip fracture. The patients in the arthroplasty group had more displaced fractures, greater sliding of the implant after 1 year, more often a previous wrist fracture, and a lower shearing angle as compared with the group of 320 patients who were not reoperated on with an arthroplasty.

If we select those 83 patients with an arthroplasty and who were alive after 2 years, we find the same differences (as in the total group of 90 patients) when compared with the 202 patients alive after 2 years, but without an arthroplasty.

When using a stepwise logistic regression, the most important factors leading to failure were displaced fracture, good mental status, and a previous fracture of the wrist.

The degree of initial displacement was the most important factor concerning the risk of salvage operation after internal fixation of a cervical hip fracture. A previous fracture of the wrist and home aid less than 4 hours per week at the time of the fracture were also important predictors regarding an arthroplasty.

When selecting only patients alive 2 years postoperatively, the fracture type and previous fracture of the wrist were the important factors as regards failures.

Discussion

The number of fractures in this report is high, and we have made a careful study of the patients. We think that other factors besides the type of implant determine the outcome of the fracture. This accords with earlier studies on 300 patients with a cervical hip fracture from our department (Sernbo 1988).

It is difficult to compare different results of studies of internal fixation after a cervical hip fracture. Also, it is not uncommon with good results when a new method or a new design of an implant is presented (Deyerle 1966, Strömqvist et al. 1984).

We could not confirm the findings of Strömqvist et al. (1984) that two hook-pins were better than the Rydell single nail in the treatment of a cervical hip fracture. When we compared the urban area of Malmö with a rural area only 60 km away, we found a lower incidence of hip fractures in the rural area (Sernbo et al. 1988). We now also know that the urban population has less bone mass and less muscle strength compared with the rural population (Gärdsell 1990); this is important because low bone mass is a predictor of future fragility fracture (Gärdsell et al. 1989). This increases the difficulties in comparing results.

The high proportion of failures and reoperations with a hip prosthesis can be a marker of how the elderly and the patients with hip fractures in an urban area today live longer, but have less bone mass (Sernbo 1988).

Our results confirm that the most important factor predicting the outcome of the fracture was the degree of initial displacement (Garden 1961, 1971, Barnes et al. 1976, Frandsen and Andersen 1981, Elmerson et al. 1988). Since the 1950s, the proportion of this type of fracture has increased in Malmö (Sernbo 1988). The complication rate in this study agrees with many others (Banks 1962, Garden 1971, Barnes et al. 1976, Thorling 1980, Frandsen and Andersen 1981, Holmberg et al. 1987, Elmerson et al. 1988, Sernbo 1988), but not all—for instance, the results after LIH pinning of Strömqvist et al. (1984) are better than ours. In undisplaced fractures, we had somewhat better results after LIH pinning; maybe

the single-nail method can cause damage to the head of the femur (Strömqvist 1983).

The results of this report raise the question whether a hip prosthesis, in selective types of fractures and patients, should be the alternative method to internal fixation and even the treatment of first choice as suggested by some authors (Johnson and Crothers 1975, Sikorski and Barrington 1981, Kwasny et al. 1986, Delamarter and Moreland 1987, Schwarz Lausten et al. 1987). In the present study, among patients aged over 70 years with displaced fractures, there was a high failure rate and a high rate of reoperations with a hip prosthesis within 2 years. Perhaps this group of patients can be treated better if a total hip arthroplasty is chosen primarily.

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