Upsala J Med Sci 94: 209–221, 1989

Influence of Treatment Factors on the Outcome After Hip Fractures

Thomas Dolk

Department of Orthopaedics, Regionsjukhuset, Örebro, Sweden

ABSTRACT

To investigate the influence of different treatment factors in the outcome and rehabilitation after hip fractures, a series of 282 consecutive patients with femoral neck or trochanteric fractures were followed up prospectively for two years postoperatively. The long-term results were analysed by a review of the patients' records after 10 years.

The hospital stay and aftercare in the total material were shorter when the operation was not delayed. In patients from their own homes, the hospital stay was influenced by the day of operation in relation to admission, the duration of operation and the operative result (the possibility of achieving stable internal fixation). Social rehabilitation was affected by day of operation, duration of operation and postoperative complications in the femoral neck group and by postoperative complications in the trochanteric group. The walking capacity was reduced after the fracture in most patients and only about one-half of the patients became independent walkers. Reoperations led to a greatly increased length of hospital stay in patients with trochanteric fractures and to a moderate increase in those with cervical fractures. Fracture healing was influenced by treatment factors both in the femoral neck group (poor reduction and postoperative infection) and in the trochanteric group (postoperative infection and unstable internal fixation). Mortality was related to preoperative factors and was not influenced by the treatment.

The frequency of the occurrence of another hip fracture up to 10 years postoperatively was 17.4 %, with an equal distribution of fracture types.

INTRODUCTION

The incidence of hip fractures in Sweden is reported to be increasing. The Swedish Planning and Rationalization Institute of the Health and Social Services (SPRI) initiated a project in 1973 on "production control", and hip fractures were considered to be of particular interest (25).

The aim of this study was to consider the results of treatment of hip fractures and to examine their relationship to preoperative, peroperative and postoperative factors. To

investigate the long-term outcome, the patients' hospital records were reviewed after 10 years.

PATIENTS AND METHODS

The study comprised 282 patients with hip fractures (femoral neck or trochanteric) who were treated consecutively during the one-year period 1973 - 1974 at the departments of Surgery and Orthopaedics of the Regional Hospital, Örebro. A description of the patient material has been given in a previous investigation (7).

All data concerning the patient and the treatment were collected and recorded by a specially appointed nurse, who also interviewed the patients and made regular visits to the ward to follow their progress. She also attended at the special follow-up examinations 4 months, 1 year and 2 years postoperatively together with the author. Preconstructed data sheets were used and subsequently analysed (25, 26).

Hospital stay, social rehabilitation, fracture healing and mortality were analysed in three steps by multiple discriminant analysis (MDA) with respect to preoperative, peroperative and postoperative factors that might influence the outcome (Table 1). These variables were selected by the author among all recorded variables and were supplemented by other variables for specific questions, as specified later. Age was analysed first in the preoperative step. If any variable did significantly ($p = 0.1$) influence the outcome it was kept constant in the discriminant equation when the following variables were tested.

Table 1. Basic explanatory variables used in the multiple discriminant analysis (MDA)

PREOPERATIVE	
Age (years)	Preoperative walking capacity (scale 1-4)
Sex (male/female)	Cause of fracture(accident/medical)
State of general	Place of accident (outdoor/indoor)
health(healthy/non-healthy)	Number of previous fractures (n)
Time accident - admission (h)	Time admission - operation (days)
Type of fracture (fem neck/troch.)	
PEROPERATIVE	
Surgeon's experience	Duration of operation (min)
Fracture reduction(good/bad)	Nailing quality(good/bad)
POSTOPERATIVE	
Wound infection (yes/no)	Nursing score 1 week (scale 1-5)
Fracture complications (yes/no)	Mobility score at discharge (scale 1-4)
Confusion (yes/no)	Walking with quadruped
Number of postoperative	within 14 days
complications (n)	postop (yes/no)
Mobility score	
at discharge(scale 1-4)	

Other statistical tests were Student's t test and one-way analysis of variance (1). In the long-term follow-up, official death registrations were used (Swedish Death Register, Stockholm) and all hospital records were reviewed.

RESULTS

HOSPITAL STAY. Hospital stay was analysed in various ways and always calculated for living patients on discharge. In Table 2 the hospital stay in the acute department is given for different groups of patients and for the total material.

The lengths of hospital stay and total care - including aftercare - for patients from their own homes were 28 +/- 21 days and 46 +/- 37 days respectively.

Table 2. Hospital stay in different groups of patients (living on discharge).

		M (SD)	Median	Range
WOMEN	Trochanteric	32 (25)	26	3 - 102
	Femoral neck	22 (17)	17	3 - 97
	Total	27 (21)	20	3 - 102
MEN	Trochanteric	27 (19)	25	3 - 90
	Femoral neck	22 (23)	14	3 - 111
	Total	24 (22)	17	3 - 111
Femoral neck Total		21 (19)	16	3 - 111
Trochanteric Total		30 (23)	26	3 - 102
Troch + fem. neck. Total		26 (22)	20	3 - 111

Patients who fractured their hips on Sunday to Wednesday usually underwent operation on day 1 - 2 (Table 3), whereas many patients with fractures that occurred on Friday to Saturday were operated upon after the weekend (day 2-4). No patients were operated upon on the day of arrival (day 0).

Table 3. Fracture day/day of operation. Percentage of patients for every fracture day and the total number of patients operated on (n= 275).

	Day of operation					
Fracture day	1	2	3	4	5	Total number of patients
Monday	63	21	5	9	2	43
Tuesday	47	29	16	2	6	49
Wednesday	51	29	3	5	12	41
Thursday	51	3	3	30	13	37
Friday	5	8	51	26	10	39
Saturday	6	34	41	16	3	32
Sunday	38	41	6	9	6	34

There was a marked difference between the ordinary and the "delayed" group in regard to hospital stay and aftercare (Table 4). There was a non-significant tendency towards more

complications in the Thursday - Saturday group, but this group showed no significant difference in hospital mortality or mortality at 4 months.

Table 4. Hospital stay and aftercare (in days) of patients with fractures sustained on days Thursday - Saturday and Sunday - Wednesday (living patients on discharge). P values according to t test, independent samples. Mean values, standard deviation and median values.

	Fracture day	
	Sunday-Wednesday (n = 148)	Thursday-Saturday (n = 99)
Hospital stay	23.4 (19.9) (median 16.8)	30.1 (23.5) (p = 0.021) (median 21.9)
Hospital stay + aftercare	33.9 (28.9) (median 24.9)	45.4 (41.9) (p = 0.019) (median 32.0)

When the material was analysed regarding the first four days of operation (Table 5), it was found that the postoperative hospital stay and aftercare were significantly longer the later the patients were operated on. There was no difference between these groups in the variables age, sex, type of fracture and preoperative habitation. (Twenty-six patients operated upon on day 5 or later were not included in this table - in 14 of these the operation was postponed for medical reasons).

Table 5. Postoperative stay in patients operated on on different days after admission (day of arrival = 0). Mean values in days. P values in test for linear trend, one-way analysis of variance.

	Day of operation			
	1	2	3	4
Postoperative hospital stay	20.5	24.2	26.0	31.2 (p = 0.013)
Postoperative hospital stay + aftercare	30.3	37.7	40.2	48.2 (p = 0.008)

There was a tendency towards more complications (p = 0.087) in the later groups, but no significant increase in mortality.

Patients with unstable internal fixation (surgeons' judgement) had a longer stay in the acute department than those with stable internal fixation. This difference was significant in patients from their own homes (mean 40 and 27 days, p = 0.04). No difference was found regarding the whole length of care, including aftercare (p = 0.72). Patients from old people's homes had a longer mean hospital stay and patients from the mental hospital or

geriatric departments had a shorter stay than patients from their own homes (Fig.1). In these groups, also, an unstable internal fixation prolonged the hospital stay.

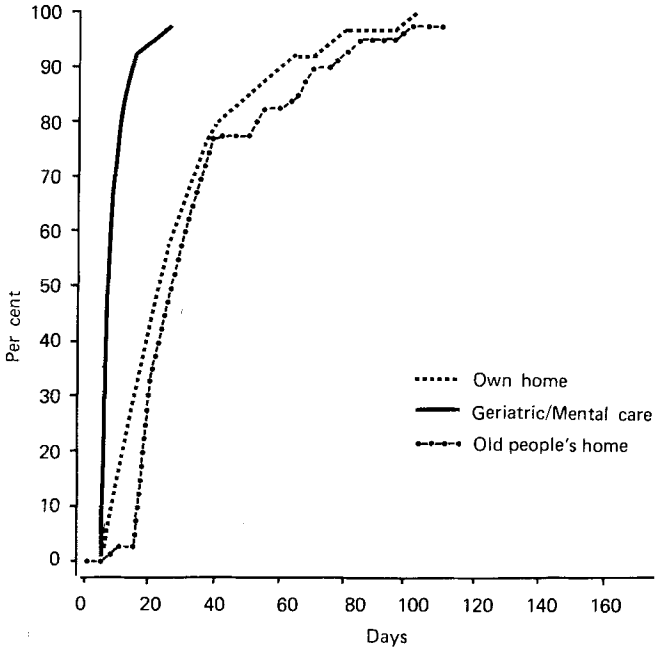

Fig.1.Cumulative proportion of living patients with different preoperative forms of habitation discharged from hospital.

MDA was used for a further study of the hospital stay of patients from their own homes. The quartiles with the shortest and longest stay in the femoral neck group and in the trochanteric group were chosen for study. Basic variables (Table 1) plus marital status (married or not), help at home (yes/no), living alone(yes/no), need for stair climbing ability(yes/no) were included in the analysis. Preoperative factors of importance were found to be age (negative), day (delay) of operation (negative) and "medical" factors (e.g. fainting) as the cause of the accident (negative). An important peroperative factor was the length of operation (negative) and an important postoperative factor the occurrence of fracture complications (negative).

MDA was also used to study of the total length of hospital stay, including aftercare, in the same group of patients. The variables age (negative), day (delay) of operation (negative), non-specialist surgeon (positive!) and nursing score at one week (negative) were found to be of importance. Neither the type of fracture nor the occurrence of dislocation differed significantly between the specialist and non-specialist groups.

SOCIAL AND WALKING REHABILITATION. Social rehabilitation was analysed only in terms of destination on discharge and habitation at the later follow-ups (Table 6). Nearly all patients from geriatric departments or the mental hospital returned there for rehabilitation

and are not included in the table. More than half of the patients from old people's homes returned there on discharge from the acute hospital and few changes occurred later.

Only 34 % of the surviving patients from their own homes returned home directly. At the 4-month follow-up 60 % of the original patients had returned home (71 % of living patients). Most patients spent some time in the aftercare unit (52 % of living patients discharged). After 4 months there were no great changes in habitation.

Table 6. Destination on discharge and habitation at different times in patients from their own homes and old people's homes (OPH).

		On discharge	4 months	1 year	2 years
Own homes (n = 182)	Own home	57	110	108	99
	Aftercare	89	10	0	0
	Geriatric	22	24	22	25
	Mental	1	2	3	2
	OPH	1	9	13	14
	Missing	0	3	1	0
	Dead	12	24	35	42
Old people's homes (n = 54)	OPH	30	25	22	16
	Aftercare	3	0	0	0
	Geriatric	7	5	6	5
	Mental	0	1	1	1
	Missing	0	1	0	2
	Dead	14	22	25	30

Geriatric care was needed after discharge by 12 % of the patients from their own homes and 13 % from old people's homes.

Applications for geriatric care were made for 74 patients from their own homes or old people's homes by the doctor in charge. Twenty-seven of them were transferred directly to a geriatric clinic on discharge and another 5 within the first 4 months (47 % correctly). Of 162 patients who were not considered to need geriatric care, 9 were transferred during the first year (94 % correctly).

MDA was performed to study the chances of returning to their own home at the 4-month follow-up among patients originally living there. Basic factors (Table 1) plus the same additional factors as for hospital stay were considered.

For patients with fractures of the femoral neck, preoperative discriminating factors were help at home before the fracture, high age and day (delay) of operation (all negative). Among the peroperative factors, duration of operation showed a positive correlation, and postoperatively the numbers of postoperative complications (negative) and fracture complications (positive correlation) were of importance.

For patients with trochanteric fractures the preoperative discriminating factors were high age (negative), subtrochanteric fracture (negative) and outdoor accident (positive).

Peroperatively no factor showed a relationship and postoperatively the number of postoperative complications was of importance (negative).

The walking capacity was studied on different occasions postoperatively. Before the fracture 64 % of all patients were able to walk without walking aids, 30 % with such aids and the rest with the help of someone else or could not walk at all. Most patients used a walking aid on discharge, but patients from geriatric clinics or the mental hospital were discharged practically without walking training. Not until one year postoperatively did the walking capacity reach its peak value and scarcely half of the patients became good walkers (without walking aids) after the fracture. Generally speaking men walked better than women after the fracture and patients with fractures of the femoral neck walked better than those with trochanteric fractures. The extremes were men with femoral neck fractures (61 % good) and women with trochanteric fractures (38 % good). Patients from old people's homes did not walk very well at one year (21 % good).

The walking capacity could be affected by new fractures or diseases occurring during the follow-up. In the trochanteric group 4 further femoral neck, 4 trochanteric, one femoral and one ulnar fracture were noted. In the group with fractures of the femoral neck 3 further femoral neck, 2 trochanteric, 2 femoral and one patellar fracture were diagnosed. Cancer was also diagnosed in 2 patients. For these reasons MDA was not performed regarding walking rehabilitation.

REOPERATIONS AND FRACTURE HEALING. In the trochanteric group 5 reoperations were performed with new internal fixation material (4 %) and in 10 patients the internal fixation material was removed (8 %), making a total reoperation frequency within 2 years of 12 %. One patient succumbed 2 months after reoperation and 3 patients showed a pseudarthrosis at the 2-year follow-up; otherwise the healing was uneventful. The mean total length of stay in hospital for operation and reoperation (5 patients with simple removal of a nail not included) was 151 days.

In the group with fractures of the femoral neck no new internal fixation operations were undertaken. Within 2 years 12 secondary arthroplasties had been performed (10 simple and 2 total arthroplasties). In one patient the hip prosthesis was removed and a Girldestone procedure was carried out.

Primary arthroplasty was performed in 4 % of those operated on, and secondary arthroplasty in 8 %, making a total arthroplasty rate in the first 2 years of 12 %. Within 3 years this figure had risen to 15 %.

The frequency of reoperation within 2 years in the femoral neck fracture group was 18 %, including nail removals. Not including the 10 patients with nail removals for healed fractures, the mean total length of hospital stay for operation and reoperation was 46 days.

The 2-year results in the group with reoperated femoral neck fractures were as follow: 3 patients had died, one had a Girldestone operation, one had a pseudarthrosis, and 11 had a prosthesis, which in most cases was functioning well.

Fracture healing was studied on X-ray films by the author. The healing was sometimes difficult to judge and the classification was not reliable until one year postoperatively.

In the group with fractures of the femoral neck, at the one-year follow-up the fractures in 61 % of the 120 surviving patients were healed and in 12 % were "healing"; 25 % of the patients had some form of problem and 2 % were not X-rayed.

The corresponding figures for the original material were: 46 % healed, 9 % "healing", 20 % with healing problems, 21 % dead and 2 % not X-rayed.

The healing in the femoral neck fracture group at one year was studied by MDA and preoperative factors that were found to be of importance were Garden staging (high Garden groups negative) and age (high age negative). A peroperative factor of importance was poor reduction (negative) and a postoperative factor infection (negative). Poor reduction was the strongest negative indication of healing. All factors in Table 1 were considered, and in addition X-ray findings including location, Pauwels' and Garden grading, and habitation.

When MDA was applied to the data at the 2-year follow-up the same factors were discriminating, but among the preoperative variables the number of previous fractures also showed a relationship (negative).

In the trochanteric group most fractures healed, except for some infected cases. Among patients alive at the one-year follow-up, the fracture was healed in 87 % and "healing" in 3 %. Healing complications had occurred in 5 % and 5 % were not X-rayed.

For the original patient material the corresponding figures at the one-year examination were: 55 % healed, 2 % "healing", 3 % with complicated healing, 3 % missing and 37 % of the patients had died.

At MDA at 4 months (with reference to the one-year follow-up in uncertain cases), no preoperative or peroperative factors were discriminating. Postoperative wound infection (negative) and weight-bearing within 2 weeks (positive) were related to the outcome. All basic factors (Table 1) were considered, plus X-ray findings (type and dislocation) and habitation.

MORTALITY AND LONG-TERM FOLLOW-UP. The mortality in different patient groups is shown in Table 7. The hospital mortality (11 %) did not differ between the sexes and fracture groups but was higher among patients from geriatric and old people's homes (22 and 26 % respectively) than among those from their own homes and the mental hospital (7 and 4 % respectively).

The later mortality noted at the 4-month and one-year follow-ups was higher among men, among patients with trochanteric fractures and among all institutionalised patients.

The higher mortality in these patients and the difference between femoral neck and trochanteric fractures can be seen in Fig.2, where the survival curves are drawn in comparison with the normal age-related population.

In the group with femoral neck fractures the mortality increased during the first 6 months postoperatively and was subsequently slightly lower than in the normal population. Among

the patients with trochanteric fractures the mortality was increased during the first 8 months postoperatively, after which it equalled that in the normal population.

The mortality in the total material was studied 8 months postoperatively by MDA and the above results were confirmed. All factors in Table 1 were considered, and in addition marital status, cause and place of accident and habitation.

Among the preoperative factors age (negative), trochanteric fracture (negative) and institutional habitation (negative) were discriminating, as were female sex (positive) and preoperative walking capacity (positive). No peroperative factors appeared to be of influence. Postoperatively the nursing score at one week (negative) was a discriminant factor.

Table 7. Mortality in % in different patient groups during follow-up.

		Hosp	4 m	1 year	2 yrs	5 yrs	10 yrs
TROCHANTERIC							
Men	(n = 34)	9	27	45	53	68	74
Women	(n = 97)	11	22	34	39	63	77
Total	(n = 131)	11	23	37	43	64	76
FEMORAL NECK							
Men	(n = 46)	13	24	28	35	59	83
Women	(n = 105)	11	14	17	22	49	66
Total	(n = 151)	11	17	21	26	52	71
Own homes	(n = 182)	7	13	19	23	45	64
Geriatric departments	(n = 18)	22	28	44	44	72	94
Mental hospital	(n = 26)	4	19	35	50	73	81
Old people's homes	(n=54)	26	41	46	56	89	94
Fem neck. + trochanteric	(n = 282)	11	20	28	34	57	73

The patient's records were analysed after 10 years and the mortality rates were calculated (Table 7), using data from the Swedish Death Register.

Patients originally living in their own homes had a 10-year survival of 36 %, the mental hospital patients 19 % and the others 6 %. Among women with femoral neck fractures the survival at 10 years was 34 %, and among men with such fractures 17 %.

No major reoperations were performed after 3 years, but 9 more nails were extracted, 5 patients underwent amputation and 3 had a knee arthroplasty.

New hip fractures occurred, as well as some other fractures (3 distal end of femur, 2 tibial condyle, 4 radius, 2 pelvis, 3 ankle, 2 humerus).

In the original femoral neck group there were 7 further fractures of the femoral neck and 5 more trochanteric fractures, and in the trochanteric group there were 4 more femoral neck fractures and one more trochanteric. Ten years postoperatively, with 75 patients still alive, the frequency of two hip fractures was 49/282 (17.4 %). There was no striking difference in

the distribution of new fractures between the original femoral neck and trochanteric fracture groups (Table 8).

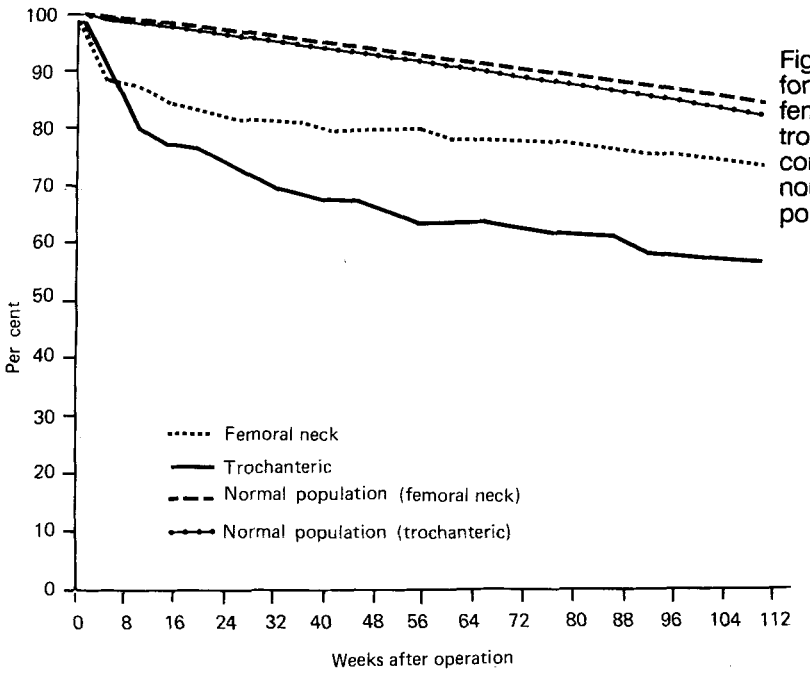

Fig.2.Survival curves for patients with femoral neck and trochanteric fractures compared with normal age-matched populations.

Table 8. Occurrence of an additional hip fracture before the current fracture and up to 10 years postoperatively.

	Before current fracture	0-2 years postop.	3 - 10 yrs postop.	Total
Femoral neck fracture group (n = 151)	2 F. neck 4 Troch.	3 F. neck 2 Troch.	7 F. neck 5 Troch.	12 F.neck 11 Tr.
Trochanteric fracture group n = 131)	8 F. neck 5 Troch.	4 F. neck 4 Troch.	4 F. neck 1 Troch.	16 F.neck 9 Tr.

DISCUSSION

The length of hospital stay in patients with hip fractures has diminished, probably mostly on account of a re-evaluation of the non-weight-bearing period postoperatively and almost total operative treatment of trochanteric fractures (3, 5).

In Gothenburg the length of hospital care in the beginning of the sixties was 50 days (21) and the current figure is 20 days, but aftercare is not included (27, 28). Jensen & Töndevold noted the same tendency in their material from 1971 to 1976, when there was a reduction from 28 to 22 days (15).

At our hospital in Örebro the length of hospital stay in 1957 for "medial and lateral fractures of the femoral neck" was 19 days (22) and in comparison with this figure no important change has taken place. Our hospital stay figures are also in good accordance with those reported by Ceder (3). In an investigation by the Swedish National Board of Health and Welfare in 1979 the acute hospital stay in Sweden ranged between 19 - 32 days (24).

Jensen & Bagger (16) have discussed the influence of aftercare on the length of acute and total hospital stay and have found figures well in accordance with ours regarding the total stay. They consider that the resources should be concentrated on rehabilitation in the patient's own home in order to diminish the risk of institutionalization and also the total cost of care. A postoperative training unit makes it possible to save expensive acute care beds, but can reduce the possibility of rehabilitation in the patients' own homes. Ceder estimated that up to 75 % of patients from their own homes could return there directly (3). We succeeded in this in only one-third of our patients and this figure compares well with those from the hospitals in Stockholm (11). It would seem realistic to aim at a hospital care period of three weeks for patients from their own homes, but probably most of them could be sent home within two weeks (13). A more active contribution from primary health care is necessary and on its way. In the present study the need for geriatric long-term care was less than half of what the treating doctor thought at the beginning. The social situation was fairly stable after 4 months.

In the present study it was found that unstable internal fixation (according to the operating surgeon) resulted in approximately two weeks' longer hospital stay than in cases where the internal fixation was considered stable. Jensen & Töndevold (15) also reported that stable internal fixation without secondary complications was associated with the shortest period of hospital care.

Reoperations in the trochanteric group were relatively few but were associated with long total hospital care. Reoperation with an endoprosthesis seemed to be a favourable procedure, with shorter hospital care. We have calculated previously that one-fourth of the patients with a fracture of the femoral neck require a primary or secondary hip arthroplasty (6). Many authors have suggested primary arthroplasty for femoral neck fractures (15, 18, 23), but we consider that this is not indicated and the total need for hip arthroplasty in this material was only 15 %.

Holmberg (10) found that in Stockholm the costs of a primary uncomplicated internal fixation and a primary arthroplasty in an orthopaedic clinic were the same. A secondary arthroplasty cost twice as much. In spite of this he found it unnecessary to perform arthroplasty on all patients as a primary measure.

The time (day) of arrival at the hospital was of importance for the patients in this series, as the hospital policy at that time did not favour on-duty operations. It appeared that the postoperative hospital stay and aftercare were shorter in patients with "early" operations in the total material and this was supported by the findings at multiple discriminant analysis for patients from their own homes.

The mortality was increased in our material immediately after the hip fracture. Gallagher et al noted increased mortality during the period up to 4 months after the fracture (8). Hansen and Neidhardt (9) and Colbert & O'Muircheartaigh (4) found that the mortality was increased up to 6 months postoperatively. Miller (20) has suggested a corresponding time of 8 months and Karlsen (17) one year. In a study by Jensen & Töndevold (14) the mortality was increased for up to 1.6 years after the fracture. In our material there was a difference between femoral neck and trochanteric fractures and 8 months was considered to be a suitable end-point to study the increased mortality in the total material.

Social factors affected the mortality. It was highest in the group from the geriatric departments (patients were more ill) and from old people's homes (patients were older). The hospital mortality was low among patients from the mental hospital and from their own homes, but increased later. The mortality in patients from their own homes was about half of that in patients from institutions, but the hospital mortality was about the same and this should be borne in mind in comparison with other materials.

In the long-term follow-up the differences that were found from the beginning seemed to remain and the number of surviving patients from geriatric departments and old people's homes was very small at the 10-year follow-up. Long-term follow-up studies of hip fracture patients were made by Holmberg et al (11), Jensen (14) and Gallagher et al (8) and compared with their figures our results are about the same.

The distribution of new hip fractures was even and it was not found that patients sustained a new fracture of the same kind, as was claimed by Boston (2). However, 75 of the patients are still alive and the frequency of two hip fractures will probably rise a little before their deaths. In conclusion, it is estimated that the total rate of an additional hip fracture could reach about one-fifth. This is in accordance with the findings of Melton et al (19). Four patients underwent total hip arthroplasty between 2 and 3 years postoperatively, but later no patient had such an operation, and therefore the results are probably fairly constant after 3 years.

ACKNOWLEDGEMENTS

This study was supported by grants from the Örebro County Council. The author wishes to thank Lennart Bodin, Institute of Data Analysis, Örebro University, Örebro, for statistical advice and Maud Marsden, Uppsala, for linguistic revision.

REFERENCES

1. Armitage, P., Berry, G. Statistical Methods in Medical Research. Second Edition. Blackwell Scientific Publications, Oxford 1987.
2. Boston, D.A. Bilateral fractures of the femoral neck. Injury 14:207-10, 1983.
3. Ceder, L. Hip fracture in the elderly. Prognosis and rehabilitation. University of Lund, Department of Orthopaedic Surgery. Thesis, 1980.
4. Colbert, D.S. & O'Muircheartaigh, I. Mortality after Hip fracture and Assessment of some Contributory Factors. Ir J Med Sci 145:44-50, 1976.

5. Dolk, T. & Westerborn, O. Complications and mortality in a hip fracture material.(Swe) Läkartidningen 74:3654-8, 1977.
6. Dolk, T. Treatment programme for hip fractures in the elderly, editor Bauer, G. Other complications. (Swe) SPRI S 73 30-33, 45, 1977.
7. Dolk, T. Hip fractures - treatment and early complications. Upsal J Med Sci. This issue, 1989.
8. Gallagher, J.C., Melton, L.J., Riggs, B.L. & Bergstrath, E. Epidemiology of Fractures of the Proximal femur in Rochester, Minnesota. Clin Orthop 150:163-76, 1980.
9. Hansen, N, & Neidhardt, F.O. Mortality in femoral neck fractures. (Dan) Ugeskr Laeger 132:1709-14, 1970.
10. Holmberg, S. Femoral Neck Fracture. Quality of Treatment and Costs. Department of Orthopaedics Danderyd Hopsital. University of Stockholm. Thesis, 1985.
11. Holmberg, S., Conradi, P., Karlén, R. & Thorngren, K.G. Mortality after cervical hip fracture. Acta Orthop Scand 57-8-11, 1986.
12. Høivik, B. Femoral neck fractures in the elderly. (Nor) Norwegian Institute for Hospital Research, Trondheim. Rapport 4, 1981.
13. Jensen, J.S. Determining factors for the mortality following hip fractures. Injury 15:411-14, 1984.
14. Jensen, J.S. & Töndevold, E. Mortality after hip fractures. Acta Orthop Scand 50:161-67, 1979.
15. Jensen, J.S. & Töndevold, E. A prognostic evaluation of the hospital resources required for the treatment of hip fractures. Acta Orthop Scand 51:515-22, 1980.
16. Jensen, J.S. & Bagger, J. Long-term social prognosis after hip fractures. Acta Orthop Scand 53:97-101, 1982.
17. Karlsen, S. Femoral neck fractures in the elderly - factors for rehabilitation and costs. (Nor) Norwegian Institute for Hospital Research, Trondheim, 1981.
18. Kwasny, O., Sharf, W., Hertz, H. & Trojan, E. Versorgung der Schenkelhalsfrakturen mit Hüftkopfprotesen. Unfallchir 89:369-74, 1986.
19. Melton, L.J., Ilstrup, D.M. & Beckenbaugh, R.D. Hip fracture recurrence. Clin Orthop 167:131-38, 1982.
20. Miller, C.W. Survival and ambulation following hip fracture. J Bone Joint Surg 60-A:930-34, 1978.
21. Mårtensson, L. Does Swedish hospital planning fulfil its purpose? (Swe) Läkartidningen 59:3185-3200, 1962.
22. Norbäck, B. Treatment problem in femoral neck fractures. (Swe) Opusc Med 3-7, 1960.
23. Sikorski, J.M. & Barrington, R. Internal fixation versus hemiarthroplasty for the displaced subcapital fracture of the femur. J Bone Joint Surg 63-B:357-61, 1981.
24. Socialstyrelsen (National Board of Helath and Welfare). A study of general, orthopaedic and urological surgery. (Swe) PM 52, 1983.
25. SPRI. Design of clinical production control studies. (Swe) SPRI rapport S 4, 1974.
26. SPRI. Evaluation of medical methods. (Swe) SPRI rapport 19, 1979.
27. Zetterberg, C. & Andersson, G.B.J. Fractures of the proximal end of the femur in Göteborg, Sweden. 1940 - 1979. Acta Orthop Scand 53:419-26, 1982.
28. Zetterberg, C., Andersson, G.B.J. & Nachemson, A. Hip fractures in the elderly - epidemiology. (Swe) Läkartidningen 80:2040-43, 1983.

Address for reprints:

Dr Thomas Dolk

Department of Orthopaedics

Regionsjukhuset

S-70185 Örebro, Sweden.