Chapter 6.
Hip fracture in elderly patients: complications after hospital discharge.

Abstract

OBJECTIVES:. To investigate the effect of an early discharge program on mortality and complications of elderly hip fracture patients.
STUDY DESIGN: Follow-up until 4 months after hospital admission or death.
POPULATION: Two hundred and eight consecutively admitted patients, 65 years and older. First, a group of 102 patients remained in hospital for the conventional length of time (average stay 26 days); second, 106 patients were enrolled in an early discharge program (average stay 13 days).
OUTCOME MEASURES: All medical events that required therapeutic intervention were recorded as complications.
RESULTS: Hospital mortality was 3% and mortality at 4 months was 19%. There were no substantial differences between conventionally discharged and early discharged patients. Patients experienced on average 3 complications in the four-month period. Conventionally discharged patients experienced 334 complications and early discharged patients experienced 298 complications. Of the conventionally discharged patients, 64% of complications occurred during hospital stay, 24% in the nursing home and 12% at home. Of the early discharged patients, 45% of complications occurred during hospital stay, 45% in the nursing home and 10% at home. Complications were local in 22%, circulatory in 49%, cardiovascular in 29%, respiratory in 15%, urinary tract in 52%, psychiatric in 20%, gastrointestinal in 14%, and other in 27% of patients. Main predictive factors for complications and mortality were age, institutional residence before fracture, and number of comorbidities.
CONCLUSION: Elderly hip fracture patients experience many medical complications before and after discharge from the acute hospital. An early discharge policy did not affect the number or nature of complications but shifted the location of occurrence to outside the hospital.

6.1 Introduction

The length of stay in hospital of patients being treated for hip fracture has been reduced by new surgical and anaesthetic techniques with early mobilisation[1], joint

orthopedic-geriatric rehabilitation[2] and rehabilitation at home or in geriatric rehabilitation centers.[3]

In most follow-up studies, the description of hip fracture complications is limited to the direct postoperative period in hospital. For longer follow-up periods, complications are usually only reported when they lead to re-admission to hospital, and the exact time period between discharge and the occurrence of complications is often not mentioned [4-7]. More complications occurring outside hospital are anticipated as numbers of frail hip fracture patients increases and the length of their hospitalization is reduced. We describe all the complications experienced by consecutive elderly hip fracture patients during a follow-up period of four months. We also assess the influence of an early discharge program on the location of occurrence.

6.2 Methods

Between October 1996 and October 1998, we recruited consecutive patients, aged 65 years and older, who were admitted with a fresh hip fracture to a university hospital and a general hospital in Rotterdam, the Netherlands. Patients with a hip fracture because of metastatic cancer or multitrauma were excluded. Eighteen percent of the patients refused to participate. There were no clear differences in age and sex between participants (208 patients) and non-participants (46 patients). More non-participants lived at home before admission (85% versus 60%) but residence at 4 months or mortality did not differ from participants. Two groups of patients were consecutively included: first, a group of 102 patients who remained in hospital for the conventional length of time (average stay 26 days); second, 106 patients who were enrolled in an early discharge program (average stay 13 days). Patients underwent surgery within 1 to 2 days after hospital admission. Patient mobility was encouraged as soon as possible (1 to 2 days after surgery). All patients received thromboembolic prophylaxis unless contraindications were present.

The same investigator interviewed and evaluated all patients using a standard protocol at 1 week, 1 month and 4 months after admission to the hospital. After 4 months, no further recovery can be expected [5,8,9]. Furthermore, the mortality rate for the survivors becomes the same as the expected mortality rate for the population approximately three to eight months after injury.[10,11]

Information about comorbidity, type of fracture, surgery and length of stay was obtained from medical charts and health professionals. Function was assessed by the Rehabilitation Activities Profile.[12] All medical events that required nurse-physician

monitoring or therapeutic intervention were recorded as complications. During their stay in hospital and in the nursing home, medical and nursing charts were examined for the occurrence of complications. If necessary, health professionals were asked for clarification. In case of discharge either to home or home for the elderly, general practitioners were approached by phone or letter. Also, patients and relatives were asked about the occurrence of complications. A 100% complete follow-up was thus accomplished. All complications were recorded using a predefined classification list. Complications were classified using a severity rating scale[13] that divides complications into 4 classes:

Class A: complication requiring < 1 day of Nurse-Physician Monitoring (N-PM), without Therapeutic Intervention (TI), without evident Residual Functional Impairment (RFI);

Class B: complication requiring TI and 1-7 days of N-PM, without RFI;

Class C: complications requiring TI and 8-21 days of N-PM, without RFI;

Class D: complication associated with RFI and requiring TI, regardless of duration of N-PM.

Comorbid conditions were only registered if patients had complaints, had used medication, or experienced a functional limitation as a consequence of these comorbidities at hospital admission. Univariable and multivariable Cox regression analyses were carried out using the following variables to determine potential risk factors for the occurrence of first complications and mortality: age, gender, early discharge versus conventional discharge, general hospital versus university hospital, residence in home for the elderly and nursing home before admission, number of comorbidities, diagnosis of dementia before admission, and functioning before admission (as assessed using the Rehabilitation Activities Profile). Potential risk factors were entered together in a multivariable model with subsequent stepwise deletion of factors with $p > 0.20$. Factors with $p < 0.05$ were considered statistically significant. The calculated percentages of patients with complications were corrected for mortality. Statistical analysis was performed using SPSS (Chicago, IL).

6.3 Results

Patient Characteristics

Patients were of high mean age (83 years), predominantly female (79%), and a substantial proportion (41%) already lived in an institution before their hip fracture

Table 1.
Patient characteristics and outcome. 208 patients admitted to hospital with hip fracture.

Variable	Conventional Discharge N = 102	Early Discharge n = 106	Total n = 208
Mean age years	83	84	83
median (25th-75th percentile)	83 (77-88)	84 (79-90)	84
Percentage women	84%	74%	79%
Admitted from(%)			
own home	58%	61%	60%
home for the elderly	27%	25%	26%
nursing home	16%	14%	15%
Fracture type (%)			
cervical	43%	51%	47%
trochanteric	49%	47%	48%
subtrochanteric	8%	2%	5%
Operation type (%)			
hemiarthroplasty	25%	29%	27%
dynamic hip screw	19%	23%	21%
hansson pins	13%	12%	13%
Gamma-nail	37%	20%	28%
other	4%	11%	8%
not operated	3%	5%	4%
Comorbidity (% of patients)			
cardiovascular	45%	44%	45%
musculoskeletal	42%	41%	41%
neuropsychiatric	38%	30%	34%
neurologic	26%	30%	28%
respiratory	16%	8%	12%
metabolic and endocrine	16%	17%	16%
gastrointestinal	9%	8%	8%
urogenital	8%	6%	7%
Number of comorbidities			
mean	2,4	2,2	2,3
Days in hospital			
mean	26	13	
median (25th-75th percentile)	18 (13-29)	11 (9-15)	
Discharged from hospital to (%)			
died in hospital	6%	0%	
own home	25%	14%	
home for the elderly	17%	9%	
nursing home	53%	76%	
Residence at 4 months (%)			
died	20%	19%	
own home	36%	41%	
home for the elderly	17%	14%	
nursing home	28%	26%	

(Table 1). The group of patients who were discharged conventionally (n=102), stayed on average 26 days (median 18 days) in hospital while the group of patients whose discharge was accelerated (n=106), stayed on average 13 days (median 11 days) in hospital. There were no differences in age, sex, pre-fracture residence, comorbidity, type of fracture, and type of surgery between the two groups. Fifty-three percent of conventionally discharged patients and 76% of early discharged patients were discharged to a nursing and rehabilitation center from hospital. At 4 months after hospital admission, 19% of patients were dead and 27% were in a nursing home. There were no differences between the 2 groups. Of the patients who came from home, 63% were back at home at 4 months after fracture. Patients had on average 2.3 comorbid conditions at hospital admission and only 6% had no comorbid condition. The diagnosis of dementia was established before hospital admission for 20% of all patients.

Mortality

Forty patients died (19%) within 4 months. Of these, 7 patients died within 1 month. Seven patients died in the hospital, 26 in the nursing and rehabilitation center, 4 after discharge back to their home for the elderly and 4 at home. The average survival time of all deceased patients was 56 days after hospital admission. Cox regression analysis revealed 3 important predictive factors: higher age ($p < 0.01$), living in a nursing home before hospital admission ($p = 0.04$) and number of comorbid conditions ($p < 0.01$). Mortality was not associated with conventional discharge or early discharge. Causes of death were: pneumonia (8 patients with an average survival of 68 days), dehydration and cachexia (7 patients, 51 days), heart failure (6 patients, 45 days), myocardial infarction (4 patients, 41 days), stroke (3 patients, 65 days), sepsis (3 patients, 59 days), shock (2 patients, 71 days), pulmonary embolism (2 patients,12 days), and mamma carcinoma, epilepsy, COPD, intestinal obstruction, sudden death (each 1 patient).

All complications

Patients developed a total of 632 complications up to 4 months after hospital admission. Of these, 24% were severe (Table 2). Most frequently occurring complications were post-operative anemia (16% of total) and urinary tract infection (20%). Of all patients, 92% developed at least one complication. The average was 3.0 complications per patient. More than 1/3 of all complications occurred within 6 days after

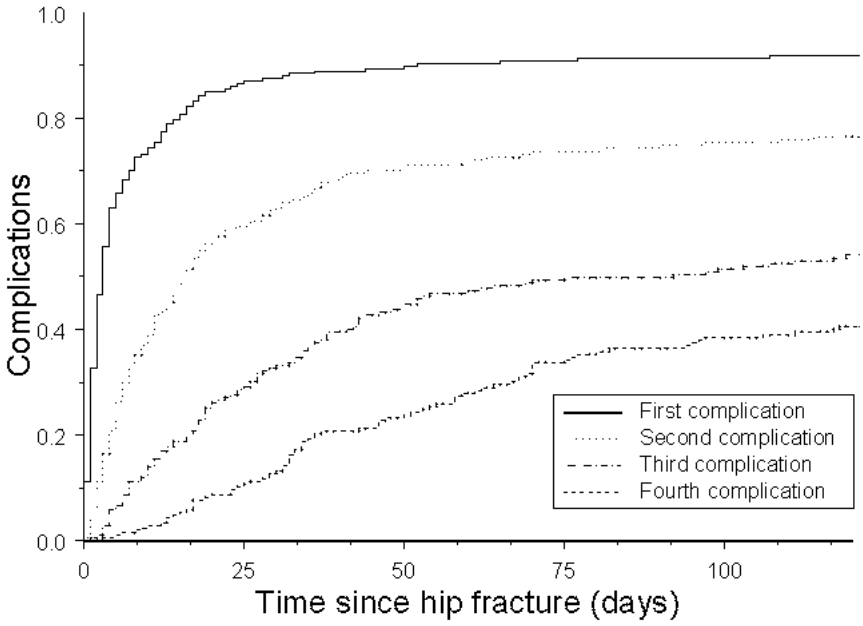
Table 2.
Number of complications. Four-month follow-up in 208 patients with hip fracture.

Complications	Number	% of Class D complications
Local		
Wound infection	19	
Wound haematoma	7	
Loosening and luxation	22	
Other	10	
Total of local complications	58	41%
Circulatory		
Sepsis	2	
Anemia	99	
Electrolyte imbalance	15	
Other	3	
Total of circulatory complications	119	5%
Cardiovascular		
Myocardial ischaemia ,infarction	8	
Cardiac arrhythmia	13	
Heart failure	25	
Pulmonary embolization	2	
Deep vein trombosis	5	
Cerebro vascular accident	10	
Other	8	
Total of cardiovascular complications	71	41%
Respiratory		
Pneumonia	24	
Exacerbation COPD	6	
Other	4	
Total of respiratory complications	34	32%
Pressure ulcers		
Heels	21	
Buttocks	36	
Other	1	
Total pressure ulcers	58	33%
Urinary tract		
Infection	124	
Retention	15	
Renal failure	2	
Other	7	
Total urinary tract complications	148	2%
Psychiatric		
Acute confusion, delirium	23	
Depression	9	
Other	15	
Total psychiatric complications	47	57%
Gastrointestinal		
Bleeding	7	
Other	26	
Total of gastrointestinal complications	33	28%
Other complications	64	25%
Total complications	632	24%

Class D: Complication associated with residual functional impairment and requiring therapeutic intervention.

hospital admission. On day 7 only 31% of patients had no complication, while 30% had 2 or more (Table 3). Within 4 months, 41% of patients had 4 or more complications (Figure 1).

Figure 1.
Occurrence of First, and Fourth Complication After Hip Fracture,



Early discharge versus conventional discharge

There were no clear differences in the occurrence of complications up to 4 months between early discharged patients and those discharged conventionally (298 versus 334, p = 0.11, Table 4). However, a shift occurred from hospital to nursing and rehabilitation center. Patients in the conventional discharge group experienced 64% of all complications during their hospital stay and 24% in the nursing home. The figures for early discharged patients were 45% and 45% respectively. The majority (87%) of all complications occurred when the patients stayed in an institution (hospital or nursing home) and only 11% after discharge to home or home for the elderly. In the conventional discharge group, 57 patients were discharged from hospital or nursing home to home or home for the elderly with a mean stay in these institutions of 38

days. Forty-two complications occurred at home or home for the elderly of which 10 were severe (Table 5). In the early discharge group, 64 patients were discharged from hospital or nursing home with a total average stay of 34 days. Twenty-nine complications occurred at home or home for the elderly of which 8 were severe.

Table 3.
Proportion of hip fracture patients (n= 208) with complications 7, 30, and 120 days after hip fracture.

	Days since hip fracture			
Complications	Day 7	Day 30	Day 120	t-50%*
First	69%	88%	92%	3
Second	30%	63%	76%	10
Third	9%	33%	54%	21
Fourth	1%	13%	41%	37
Local	9%	15%	22%	12
Circulatory	40%	46%	49%	3
Cardiovascular	13%	17%	29%	10
Respiratory	5%	10%	15%	17
Pressure ulcers	10%	22%	27%	9
Urinary tract	15%	39%	52%	16
Psychiatric	8%	15%	20%	11
Gastrointestinal	3%	9%	14%	19
Other	8%	14%	27%	23

* Number of days within which 50% of patients experienced a complication.

Subdivision of complications

A total of 58 local complications occurred in 44 patients (22% of total number of patients, Table 3). Twenty-two (38 %) were severe such as breakout of osteosynthesis material. These led in all cases to re-operation.
The severity of local complications was also reflected in the percentage (41%) which led to functional limitation (Table 2). Although most were diagnosed within 1 month, 18 local complications occurred between 1 month and 4 months (Figure 2),

50% within 12 days after hospital admission. Severe local complications (with residual functional impairment) were scarce in patients after discharge to home or home for the elderly. Patients treated with Hansson pins developed more local complications than patients treated with other osteosynthesis material (15 local complications in 26 patients versus 43 local complications in 174 patients, p = 0.009).
A total of 119 circulatory complications occurred in 102 patients (49%). The most frequent circulatory complication was postoperative anemia (83%) (treated in 90% of cases with a blood transfusion). Circulatory complications occurred predominantly in the first 7 days after surgery with few consequences for functioning of patients.
Seventy-one cardiovascular complications were diagnosed in 58 patients (29%). Cardiac complications (myocardial infarction, heart failure and arrhythmia) were the most important in this group. They occurred both in and outside the hospital

Table 4.
Number of complications that occurred in 208 patients until 4 months after hospital admission for hip fracture by diagnosis, residence, and group (conventional versus accelerated discharge).

Complications	Hospital Up to 5 days after admission		Hospital from Day 6 until discharge		Nursing home		Home for the elderly		Home		Readmisson		Total	
	Conv.	Early	Conv.	Early	Conv.	Early	Conv	Early	Conv.	Early	Conv.	Early	Conv.	Early
Local	9	10	8	2	6	11	1	2	5	3	-	1	29	29
Circulatory	47	40	7	2	6	13	2	1	-	-	-	1	62	57
Cardiovascular	15	12	6	2	7	14	5	2	3	2	3	-	39	32
Respiratory	3	7	6	1	4	7	3	1	0	1	1	-	1	17
Pressure ulcers	5	9	13	4	6	15	1	1	4	-	-	-	29	29
Urinary tract	13	15	25	8	28	46	5	2	2	1	-		73	75
Psychiatric	7	8	10	-	8	9	-	1	1	3	-	-	26	21
Gastrointestinal	5	2	8	-	6	6	1	1	3	-	-	1	23	10
Other	12	7	10	-	8	13	2	0	4	8	-	-	36	28
Total	116	110	93	19	79	134	20	11	22	18	4	6	334	298
Total All	226		112		213		31		40		10		632	

producing a high percentage (41%) of functional impairment. Although 50% of patients with cardiovascular complications experienced their first complication within 10 days after hospital admission, half of the total number of complications occurred outside the hospital. Pulmonary embolism (2 patients) and deep venous thrombosis (5 patients) were rare, as well as cerebrovascular accidents (10 patients).

A total of 34 respiratory complications occurred in 29 patients (15%). Pneumonia (24 times in 23 patients) was an important diagnosis in this group both in and outside the hospital but mostly occurring within 1 month after hospital admission. Forty-eight percent of patients with pneumonia died (11 patients).

Fifty-eight pressure ulcers were diagnosed in 56 patients (27%). One quarter of the pressure ulcers developed within 5 days post-operatively but a substantial portion of these ulcers (36%) was diagnosed during the stay in the nursing and rehabilitation center. Half of the pressure ulcers developed within 8 days after hospital admission and 81% within 1 month.

A total of 148 urinary tract complications occurred in 106 patients (52%). Within this group, urinary tract infection was most frequently found (124 treated infections in 94 patients). Urinary tract complications occurred especially in the first 30 days after hospital admission. Although women had more urinary tract infections than men, gender was not predictive for the occurrence of urinary tract complications as a whole because other complications, such as retention, occurred more frequently in men.

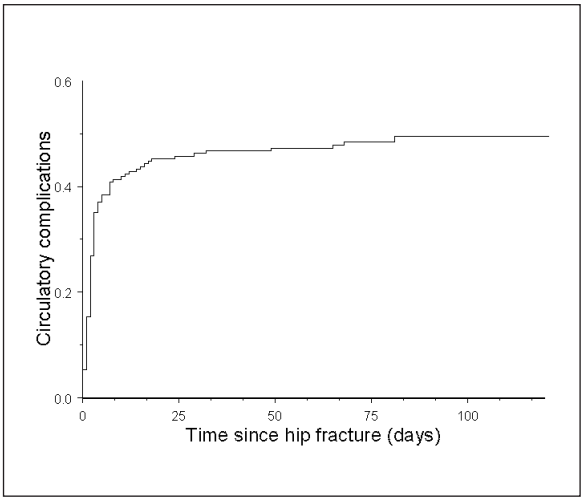
Forty-seven psychiatric complications were diagnosed in 42 patients (20%). Acute confusion (delirium) postoperatively comprised half of the psychiatric complications. Depression and other psychiatric illnesses occurred later especially in the nursing and rehabilitation center. After 1 month, patients had few new psychiatric problems. In regard to the consequences for functional impairment, these complications were the most severe.

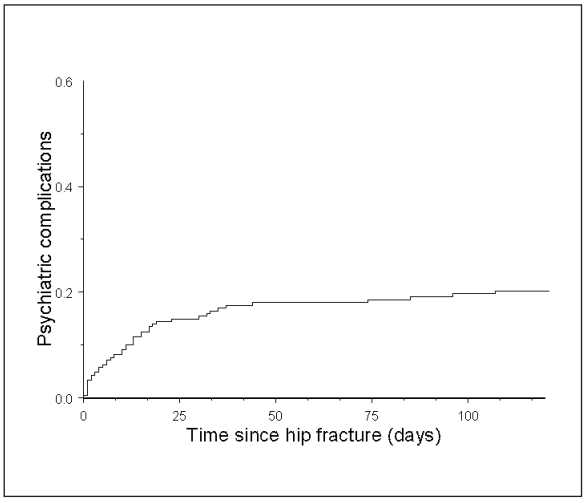
A total of 33 gastrointestinal complications occurred in 31 patients (14%), both inside and outside the hospital. One fifth of the gastrointestinal complications concerned bleeding (7 times in 6 patients). Four patients with bleeding died (causes of death 2 x shock, 1 x heart failure and 1 x pneumonia).

Other complications (not classified) occurred 64 times in 54 patients evenly divided over the total study period. A large proportion of these other complications consisted of muskuloskeletal disorders (19 x contusions, arthritis, and other), endocrine

Table 5.
Number of complications at home or home for the elderly in conventionally and early discharged patients by severity.

	Conventional discharge N = 57		Early discharge N = 64	
	Class B/C	Class D	Class B/C	Class D
Local				
Wound infection	3		1	
Wound haematoma			1	
Breakout/ luxation		2	1	1
Other		1	1	
Circulatory				
Anemia	1			
Electrolyte imbalance	1			1
Cardiovascular				
Myocardial ischaemia	1	1		
Heart failure	4		2	1
Deep vein thrombosis			1	
Other	2			
Respiratory				
Pneumonia	2			
Exacerbation COPD			1	
Other	1		1	
Pressure ulcers				
Heels	1	1	1	
Buttocks	2	1		
Urinary tract				
Infection	7		3	
Psychiatric				
Acute confusion				2
Other		1	1	1
Gastrointestinal				
Other than bleeding	1	3	1	
Other	6		6	2





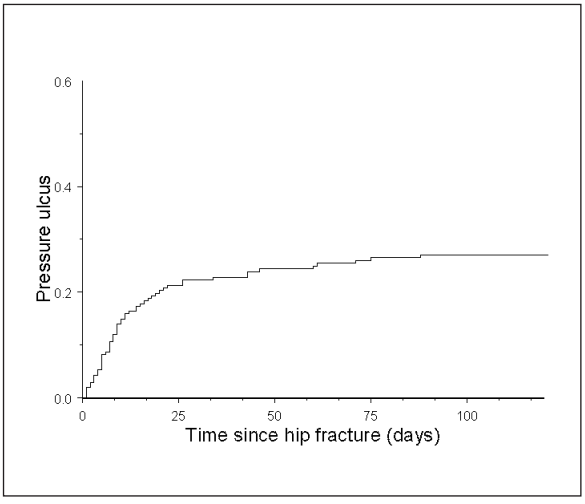


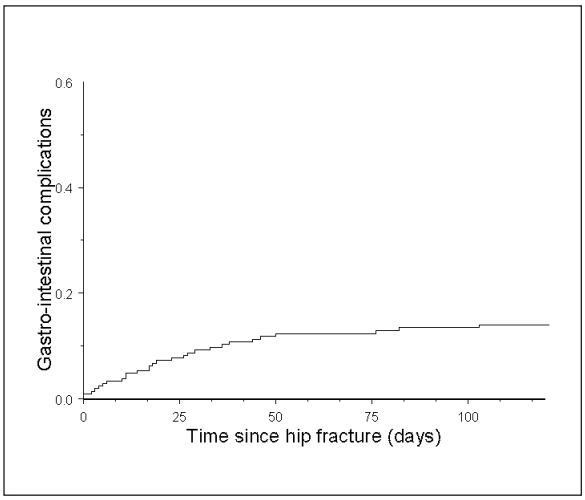
Figure 2: Occurrence of Complications by Diagnosis After Hip fracature

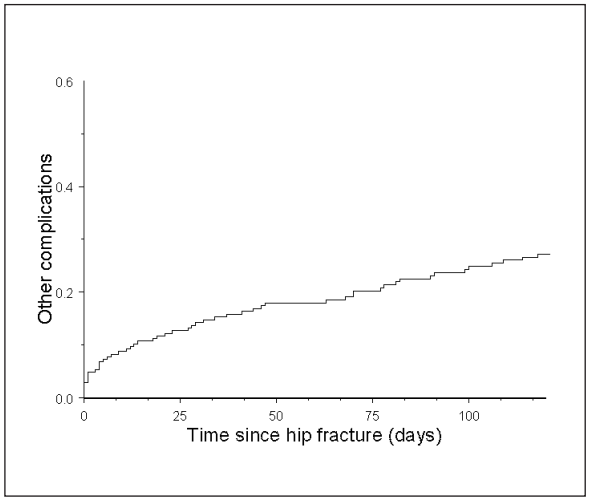
disorders (9 x derangement of diabetes or thyroid disorder), other infections (12 x skin), and side effects of medication (5x).

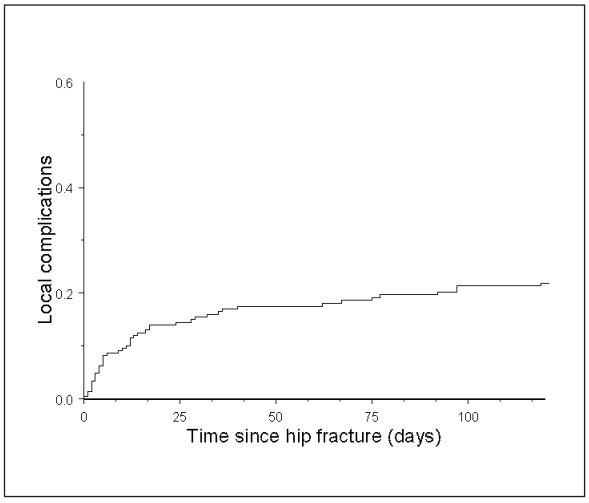
Predictors

Patients admitted to the general hospital (n = 90) experienced 311 complications and patients admitted to the university hospital (n = 118) 321 complications up to 4 months. The difference in occurrence of any first complication and a circulatory complication was significant (Table 6); patients who were admitted to the general hospital experienced more complications. This difference occurred mainly because more patients admitted to the general hospital (50%) were treated for anaemia (with a blood transfusion) than patients admitted to the university hospital (30%) in the direct postoperative period. Another predictor for the occurrence of all complications was the number of comorbidities at hospital admission. Comorbidity was also an important predictor of cardiovascular, respira-

tory, and gastro-intestinal complications. Higher age was associated with urinary tract problems and males were more likely to suffer from circulatory and respiratory complications. Pre-fracture institutional residence predicted the occurrence of respiratory complications and pressure ulcers. The presence of the diagnosis of dementia at hospital admission, and function before fracture, were not associated with the occurrence of complications between those patients in the conventionally discharged group or the accelerated discharge group.

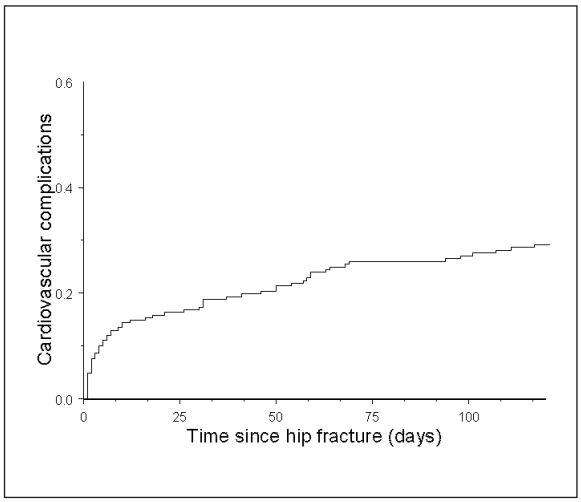


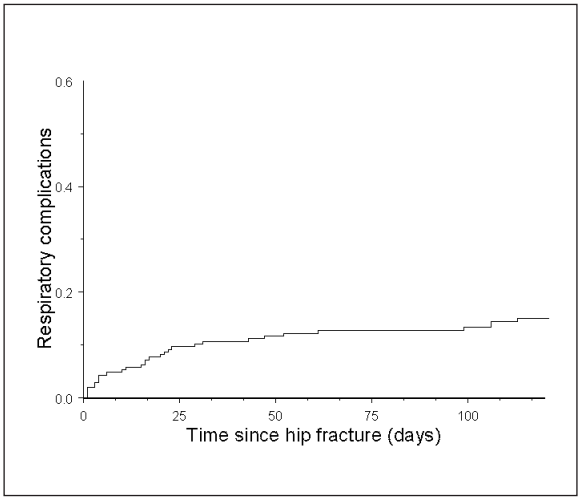


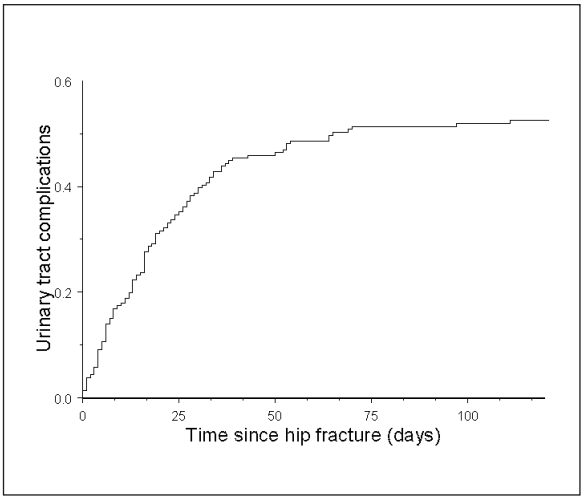


6.4 Discussion

This study included 208 patients with a high average age (83 years). In addition, many patients were included who already lived in a long-term care facility (41%) before their fracture and the number of patients with one or more comorbid conditions was high (94%, an average 2.3 comorbid conditions). These patient characteristics influence the occurrence of complications [4,14,15] and mortality [11,15-17] after hip fracture. Our results confirmed the importance of these predictive factors and the high number of







complications identified in this study should be considered in that light.

Occurrence of complications in relation to time and residence

The average length of hospital stay of hip fracture patients differs from approximately 13 days in Sweden[18] and the United States[19,20] to approximately 23 days in the Netherlands [18]. The present study includes both lengths of stay in the same country. Our results show that the occurrence of complications was by no means limited to the stay in hospital. This applied for serious and less serious complications.

Early discharge from hospital by 13 days did not clearly influence the total number of complications or mortality up to 4 months after fracture. The average number of complications that occurred in patients discharged conventionally was 3.3 and in early discharged patients 2.8. Mortality was 19% for both groups. However, accelerated discharge changed the location where these complications were diagnosed and treated. Thirty-six percent of the complications in the conventionally discharged group and 55% of the complications in the early

Table 6.
Relationship of patient characteristics with the occurrence of complications: Multiple regression analysis.*

Variable	Complications									
	Local p =	Circulatory p =	Cardiovascular p =	Respiratory p =	Pressure ulcers p =	Urinary tract p =	Psychiatric p =	Gastro-intestinal p =	Other p =	Any p =
(Higher) age	--	0.26	0.28	0.22	--	0.03	0.10	--	--	0.36
Male gender	--	0.009	0.11	0.001	--	0.29	0.96	--	--	0.18
Conventional discharge	--	0.15	--	--	0.74	--	--	0.10	--	0.30
General hospital	--	0.0001	--	--	0.08	--	--	0.82	--	0.001
Prefracture living Elderly home	0.26	--	--	0.012	0.009	--	--	--	--	0.11
	0.15	--	--	0.024	0.05	--	--	--	--	0.44
(Higher) number comorbidities	--	--	0.001	0.022	--	--	--	<0.0001	0.0006	0.06
Dementia	--	--	--	--	--	0.22	--	--	--	--
Function (decreased) before fracture	--	--	--	--	0.07	--	--	--	--	--

* Characteristics were only included if $p < 0.20$. If age and gender had $p < 0.20$, both were included.
If early versus conventional discharge or hospital had $p < 0.20$, both were included

discharge group developed outside the hospital. The location, where serious (i.e., associated with
impaired function) complications occurred, shifted even more: 44% outside the hospital in the conventionally discharged group and 80% outside the hospital in the early discharge group. The more serious complications (24% of total complications) were predominantly local, cardiovascular, psychiatric, or pressure ulcers. The treatment and care of patients who died within 4 months after hip fracture also took place mostly outside hospital: 13 of the 20 deceased patients in the conventionally managed group and all (20) deceased patients in the early discharged group.
In the Netherlands, patients are rehabilitated in nursing homes with skilled nursing and rehabilitation facilities (employing doctors trained in geriatric medicine). Accelerated discharge from the hospital will therefore result in more patients being discharged to nursing homes. Because, in the early discharge group, 70% of all patients coming from home were discharged to these skilled nursing and rehabilitation facilities and all patients coming from long-term care facilities in nursing homes were discharged back to the nursing home, 45% of complications and 67% of the deaths were recorded during the nursing home stay. Therefore, most complications were already diagnosed and treated in the hospital and nursing home before patients were discharged home, which limits the burden on general practitioners. However, a different health care system with earlier discharge to home (Sweden[1], United Kingdom[27]) than in the Netherlands will probably be accompanied by more and possibly more serious complications that will require diagnosis and treatment by general practitioners. Furthermore, in cases where general practitioners provide medical care in nursing homes to hip fracture patients discharged from hospital (United States[19]), it should be ensured that these practitioners have enough time and skills to prevent and treat complications.

Nature and number of complications

Nearly all patients (92%) developed complications within 4 months after the hip fracture. Such a large number (632 complications in 208 patients) of (especially general medical) complications has not been reported previously. However, the results of the present study do not differ from other studies in regard to the occurrence of serious medical in-hospital complications or surgical complications up to 4 months.
Serious medical in-hospital complications such as deep venous thrombosis (2

patients, 1%), pulmonary embolism (2 patients, 1%), myocardial infarction (2 patients, 1%) and cerebro vascular accident (5 patients, 2%) occurred with the same frequency as reported by other authors (1- 2% for each of the above-named complications).[7,16,21,22] The number of surgical complications in hospital (29 in 23 patients) and the total number of surgical complications within 4 months after admission (58 in 46 patients) were in agreement with numbers found in other studies.[4,5,7,14,23,24] We found no predictive factors for the occurrence of surgical complications. In contrast with the clear relationship between a high pre-operative risk score with mortality and medical complication rate, Miller et al could also find no relationship with surgical complications.[14] Pre-fracture living in an institute however, was found in France to be related to surgical complications after fracture.[4]
Most studies reporting surgical and medical complications after hip fracture only include the in-hospital period or register complications that lead to re-admission to hospital. In comparison with these studies, we found higher hospital incidences of medical complications such as urinary tract infections and pressure ulcers. Urinary tract complications were related to age and pressure ulcers were related to institutionalization before fracture. This is in agreement with other studies.[4,25]
Few researchers have compared studies with a follow-up that also included the period after hospital discharge (Broos et al [3] months[6], Baudoin et al 2 years[4] and Koot et al 1 month[5]). In comparison with these studies we found higher incidences of medical complications.
The high average age, many comorbid conditions and high proportion of already institutionalized patients present in our study population, could partly explain this finding. A second explanation for the high number of recorded general complications could be the careful, prospective method of registration. Patients were followed for 4 months with 3 interviews at 1 week, 1 month and 4 months. At these time points, patients or their relatives were asked about the occurrence of complications. In addition, medical and nursing records were investigated for recorded complications and, if necessary, health professionals were asked for clarification. We registered medical events as complications only when they were followed by treatment or reduced function. Despite this restriction, many complications were found (probably because our registration method allowed for very few complications to be missed). Findings from health outcomes research relying on administrative databases or solely on hospital facesheets have a tendency to be inaccurate. Fox et al.[26] showed that in 17% of charts, a complication after hip fracture identified in medical records,

was not coded in the hospital facesheet and that complications with low severity in particular were omitted.

Limitation of study design

In order to address the study questions, a " before and after" study design was developed that corresponded to an organisational change from conventional to early discharge arrangements. Randomisation of patients was not considered feasible since the change from conventional to accelerated discharge arrangements required organisational adjustments that made a simutaneous offer of both service models not possible.
We found high incidences of medical complications within 4 months after hospital admission. Because we did not compare the occurrence of complications in the studied population with the occurrence of medical ailments in a group of elderly patients with the same characteristics but without a hip fracture, we could not determine whether these complications were directly related to the hip fracture. However, the inclusion of elderly patients with a hip fracture in the current study was unselected. Consequently, all surgical and medical ailments that can be expected until four months after hip fracture were recorded.

6.5 Conclusion

Elderly hip fracture patients experience many medical complications after hip surgery. A substantial proportion of these complications occurs after discharge from hospital. An earlier discharge of two weeks shifted the location where these complications occurred, making them more likely to take place outside the hospital. With the increasing trend of reducing the hospitalization of these patients, it becomes more important to arrange adequate geriatric care after discharge from hospital. The number of comorbid conditions at hospital admission is the most important prognostic factor in identifying patients who are expected to develop complications. On the whole, the occurrence of medical complications does not depend strongly on type of fracture, surgery, or anaesthesia but on the pre-operative characteristics of patients such as age and comorbidity. The frequent occurrence of medical complications makes the treatment and care of these frail patients a challenge not only for surgeons but also for the geriatrician and general practitioner.

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