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Complications and Patient-Reported Outcome after Hip Fracture. A Consecutive Annual Cohort Study of 664 Patients.

Susanne Hansson[1], Ola Rolfson[2,3,4], Kristina Åkesson[1], Szilard Nemes[2],

Olof Leonardsson[5], Cecilia Rogmark[1, 2]

[1] Department of Orthopaedics, Lund University, Skåne University Hospital, Malmö, Sweden

[2] Swedish Hip Arthroplasty Register, Registercentrum VGR, Gothenburg, Sweden

[3] Department of Orthopaedics, Institute of Clinical Sciences, Sahlgrenska Academy, University of Gothenburg, Gothenburg, Sweden

[4] Harris Orthopaedic Laboratory, Massachusetts General Hospital, Boston, MA, USA

[5] Department of Orthopaedics, Blekinge Hospital, Karlskrona, Sweden

Corresponding author:

Susanne Hansson, Department of Orthopaedics, Skåne University Hospital, SE-205 02

Malmö, Sweden. Phone: +46 40 332666. E-mail: susanne.hansson@med.lu.se.

ABSTRACT

Introduction

The aim for every patient with hip fracture is to regain previous function but we know little about the outcome, especially patient-reported outcome. We wanted to investigate what factors influence the result one year after hip fracture, including fast-track for hip fracture patients, as well as investigating the patients' satisfaction with their rehabilitation and to what degree they regained their pre-fracture function.

Methods

All patients (>20 years, non-pathological fracture, residents in the catchment area, n=664) having surgery for hip fracture at our hospital during 2011 were included in a retrospective cohort study. From medical records information was gathered about pre-fracture condition as well as fracture type, surgical details, length of stay and whether the patient entered the hospital through the fast-track system. Medical records were scrutinised for general complications up to six months and for local complications up to one year after surgery. A postal questionnaire was sent one year after surgery inquiring about health status, pain and satisfaction along with multiple-choice questions regarding mobility and rehabilitation. Variables were analysed with linear regression or the proportional odds model.

Results

The most common general complications were new falls, pneumonia and new fractures. Deep infection was the most frequent local complication. The only significant effect of the fast-track system was shorter time to surgery (78% vs. 62% had surgery within 24 hours, $p < 0.001$). 29% reported to have regained their previous mobility and 30% considered the rehabilitation to be adequate. Mean value for pain VAS was 24 (SD 22) and for satisfaction 28 (SD 25). Absence of general and local complications correlated to satisfaction and hip pain. General complications correlated to loss of function. Higher age correlated to inadequate rehabilitation.

Conclusion

General complications seem to be the major risk factor, being the only factor affecting functional outcome and together with local complications affecting pain and satisfaction. To avoid general complications co-operation between orthopaedic surgeons and internists may be crucial in the aftercare of hip fracture patients. A majority did not receive adequate rehabilitation and efforts need to be made to improve the rehabilitation process.

Introduction

Guidelines commonly state that the aim for every individual with a hip fracture is to regain previous function [1, 2]. However, this is not the belief of the patients [3] and perhaps not even of health care professionals. In fact, previous studies [4, 5] indicate that this aim is not reached for most patients. Follow-up after hip fracture treatment vary substantially nationally and internationally, and may be cut to a minimum due to economic austerity. We therefore know little about the outcome of patients today.

The evidence base for optimum treatment of hip fractures is increasing. The initial treatment of hip fractures has changed in the last decade, for example surgical methods of intracapsular fractures where the use of monoblock hemiarthroplasty has declined in favour of modular hemiarthroplasty or total hip arthroplasty [6-8]. Many hospitals have implemented a fast-track system [9, 10] for hip fracture patients, by-passing the accident & emergency department (A&E) and transporting patients with a suspected hip fracture straight to radiology. However, the effect of these changes on the long-term results is so far not fully investigated, especially concerning patient-reported outcome. Ideally particularly challenging patient groups could be identified in order to improve the outcome for these patients, by increased efforts and resources.

The aims of this study was threefold; 1) to investigate how surgical and patient-related factors influence complication rates and patient-reported outcomes up to one year after hip fracture surgery, 2) to explore patients' perceptions on rehabilitation and to what degree they regained their pre-fracture function, and 3) to analyse if complications, patient-reported outcomes and

process measures differed depending on whether the patient was admitted via the fast-track system or not.

Materials and methods

Subjects

All patients (697 patients, 709 hip fractures) who underwent surgery for hip fracture at Skåne University Hospital in Malmö during 2011 were considered for inclusion in a retrospective cohort study. Exclusion criteria were age below 20 years, pathologic fracture (except osteoporotic fracture) and patients living outside of the catchment area of the hospital. In cases of bilateral hip fractures within this year only the first fracture was included. 664 patients were included in the study. Patients lost to follow-up were assumed to be very few or none as only one hospital serves the area. Each individual was traced via the unique identity number given to all Swedish residents. The researchers had access to all medical records within the hospital.

At the time of the study, the guidelines at our clinic recommended internal fixation for all non-displaced intracapsular fractures and for displaced intracapsular fractures in patients below 70 years, whilst healthy individuals aged 70-80 years normally received total arthroplasty and frail elderly hemiarthroplasty. For trochanteric fractures sliding hip screw and plate is recommended, if needed with a biaxial sliding plate and/or trochanteric support plate.

Data collection

From the medical records, information was gathered about the patients' pre-fracture conditions (place of residence, dependency in activities of daily living, walking ability, cognitive impairment or previous hip fracture) as well as fracture type, surgical details, length of stay and whether the patient entered the hospital through the fast-track system. The fast-track system for hip fracture patients was introduced in Skåne University Hospital in Malmö in 2009 and was well implemented at the time of the study. The decision to include a patient in the fast-track system is made by the ambulance nurse/paramedic when arriving to a patient with a suspected hip fracture. The patient can be excluded from the fast-track system based on predefined exclusion criteria or after consulting a physician. The fast-track system entails a direct transport to radiology and if a hip fracture is confirmed an immediate transport to a bed in a hospital ward, by-passing the A&E.

Medical records were scrutinised for general complications during the first six months and for local complications during the first year after surgery. The shorter time frame for general complications was chosen to identify events with a plausible relation to the hip fracture, in combination with the known increased risk of death during the first six months post fracture [11]. Only complications leading to contact with the hospital were registered; i.e., simple falls or complications treated by general practitioners were not included.

The patients received a postal questionnaire one year after surgery regarding health-related quality of life (the EQ-5D) [12], visual analogue scales (VAS) 0-100 for pain in the injured hip and for satisfaction with the surgery result (0 = no pain, 100 = unbearable pain; 0 = very

satisfied, 100 = dissatisfied). In addition, the questionnaire included multiple-choice questions regarding mobility and rehabilitation (Table 1).

Statistical analyses

For statistical analyses, some factors were grouped in order to describe patient and fracture characteristics. Patients with medical records indicating impaired mobility prior to the fracture, diagnosed with dementia or receiving daily assistance were defined as non-autonomous, whereas all other patients were defined as autonomous. The severity of the fracture was estimated on a combination of fracture type and surgical method, regarding known clinical results in terms of reoperation and severity of postoperative pain [13]. Non-displaced intracapsular fractures and stable trochanteric fractures [14] together with arthroplasty-treated displaced intracapsular fractures were regarded as simple fractures, whereas unstable trochanteric fractures [14], subtrochanteric fractures and displaced intracapsular fractures treated with internal fixation were classified as severe fractures. The rationale for this grouping was the severity of pain reported at 4 months after different fracture types in Rikshöft, the Swedish National Registry of hip fracture patient care [13].

Mean values of VAS for pain and satisfaction and EQ-5D-index was compared by T-test between different groups of patients. Continuous outcome variables were analysed with linear regression, ordinal outcome variables with the proportional odds model. The proportionality of the odds was assessed by graphical means. The odds ratios from the proportional odds model with the EQ-5D dimensions as outcome denote the factor increase (or decrease) in odds of moving from "No Problems" to "Moderate Problems/Severe Problems" (or from "No

Problems/Moderate Problems" to "Severe Problems") as the exposure increases with one unit.

The statistical calculations were performed using IBM SPSS Statistics version 20 and R version 3.0.2. Significance was set at $p \leq 0.05$.

Results

Patients

482 (73%) of the patients were female. Median age was 84 (28-104) years. 527 patients (80%) lived in their own home prior to the fracture. 173 (26%) patients had a diagnosed or clinically suspected dementia. According to the medical records, 269 (41%) had impaired walking ability before the fracture and 82 (12%) had suffered a previous hip fracture.

161 patients (24%) died within one year. The most common general complications were new falls, pneumonia and new fractures. Wound infection was the most frequent local complication (Table 2). The distribution of fracture types is shown in Table 3.

Fast-track system

A majority of the patients (441, 66%) entered the hospital via the fast-track system. 163 (25%) were correctly excluded according to exclusion criteria, usually serious illness or head trauma. 60 patients (9%) were never included in the fast-track system.

The only significant effect of the fast-track system was shorter time to surgery. 78% (342 of 441) of the patients included in the fast-track had surgery within 24 hours, compared to 62% (138 of 223) among the others ($p < 0.001$). There was no difference in length of stay or

incidence of major complications between patients included in the fast-track system and those not included.

Patient-reported outcome

Excluding diseased individuals, 384 of 503 (76%) responded to the follow-up questionnaire. 111 (29%) reported to have regained their previous mobility and 114 (30%) considered the rehabilitation to be adequate (Table 1). Mean value for pain VAS was 24 (SD 22) which represents moderate pain and for satisfaction 28 (SD 25) representing satisfaction (Table 4).

We found significantly higher mean values of pain VAS for patients >80 years compared to those <70 years, for patients with intracapsular fracture treated with internal fixation compared to arthroplasty, for patients with severe fracture and for patients with local or general complications. Also mean values for satisfaction VAS was significantly higher in patients with local or general complications. When comparing EQ-5D-index male patients, non-autonomous patients, patients with cognitive impairment and patients with general complications had significantly higher scores (Table 4).

Linear regression and the proportional odds model were used to identify factors correlated to outcome one year after fracture (Table 5). The factors analysed were age, gender, severity of fracture, autonomy, cognitive impairment, fast-track, time to surgery, general complications and local complications. The analysis showed absence of general complications and local complications to correlate to satisfaction. The incidence of complications also correlated to hip pain. The only correlation to loss of function was with the occurrence of general complications. Higher age correlated to inadequate rehabilitation.

Non-autonomous patients and those diagnosed with dementia reported lower on EQ-5D-index when analysed by linear regression. General complications and local complications had a borderline significant ($p < 0.1$) negative effect. Non-autonomous patients reported lower on all questions of EQ-5D except for pain (Table 6).

Discussion

In order to use our resources wisely, our ambition was to identify patient groups who suffer poor outcomes in terms of patient-reported variables and subsequently allocate more rehabilitation efforts to them. We found that complications, general as well as local, were the only factors that correlated with a poor outcome in terms of satisfaction. There was no association between pre-surgery data such as gender, age, pre-fracture function, cognition and fracture severity and satisfaction after one year. This might be a question of statistical power, but moreover highlighting the complex nature of recovery after trauma in the elderly. Besides the variation in pre-fracture status, psychological factors, such as expectations and personality, might influence individuals' perception of whether the end result was satisfactory or not.

Interestingly, general complications negatively affected outcome to the same extent as hip related complications. The orthopaedic matter of heart, well-performed surgery, will be outflanked by a medical complication. Therefore, co-operation between orthopaedic surgeons and internists may be crucial in the aftercare of hip fracture patients, as concluded in previous studies [15, 16]. Patients with general complications postoperatively have a substantially higher mortality, especially for those with multiple complications [17]. Hence, these events

must be prevented, not only to improve functional outcome but also to decrease mortality and avoid morbidity after hip fracture.

Even if we had foreboded a mediocre result regarding the ability to regain pre-fracture function, we were discouraged to find that in this cohort, in which 40% already had impairment before the fracture, less than one-third of the patients still alive after one year reached this goal. Different studies report different numbers of return to pre-fracture mobility. A Greek study [18] showed results similar to ours, 35% of the patients who walked independently before fracture regained their pre-fracture mobility. On the other hand, both a Spanish [19] and a Taiwanese study [20] report much higher recovery rates, 80 and 74% respectively. Although the mean age of the study populations did not differ much, the latter studies had a larger amount of patients walking independently before the fracture, which could explain the different outcomes. The small amount of patients regaining pre-fracture function in our study could also be explained by the equally low number of patients receiving enough rehabilitation. Ariza-Vega et al. [19] showed that patients receiving rehabilitation during the first three months after discharge had a better functional recovery compared to those who did not receive any outpatient rehabilitation. Functional recovery may take up to one year [4], which makes continuous training important.

Obviously, there is room for improvement of the rehabilitation process. In Sweden the community care is responsible for the patients' rehabilitation after dismissal. The study cohort was routinely offered basic rehabilitation, commonly in their homes during the first weeks. Thereafter a third care-giver, the primary health care, takes over the responsibility. The orthopaedic department therefore has little influence on the duration and the intensity of the

efforts. On group level, patients were satisfied with the outcome of surgery even though mean pain was moderate. This implies that this is a group with low demands, not anticipating much after their hip fracture. It is not likely that patients themselves will demand proper rehabilitation if not prompted and encouraged. As a result of the study, we are now trying to eliminate the gaps between the different caregivers.

The increased use of patient-reported outcome measures (PROMs) in orthopaedic research during the last decade has put an important focus on the patient's perspective. Still, as our study shows, other factors than fracture severity and surgical methods influence patient-reported outcomes and limit the interpretation of it. We saw little use of the EQ-5D-instrument at one year, without any pre-fracture data to compare with. Obtaining pre-fracture EQ-5D result by recall technique has been done in several studies [21-23] but may be obscured by cognitive limitations in the elderly, often aggravated by pain, medication and surgery during the period when the interview would be performed. Comparing EQ-5D to age-matched tariffs may also be misleading, as hip fracture patients usually are more frail than their peers. Working with one-year data only we inevitably see closed circle relationships, such as patients who were help dependent before fracture reported worse results in all separate dimensions of the EQ-5D–instrument at one year, except for pain. The EQ-5D-index, quite predictably, only showed significant correlation with non-autonomy and dementia.

The questions regarding present pain in the hip and satisfaction with treatment turned out to be more useful for outcome analysis than the EQ-5D-instrument. Both general and hip-related complications led to less satisfaction, and general complications also correlated to the

subjective loss of mobility after one year. Individuals with severe fractures, local complications or general complications had more pain, and those with dementia less, but the predictive value of the analysis was low. It was more common for patients with dementia to have the questionnaire answered by a relative or care-giver, suggesting that the patients' pain might be underestimated. As comparative studies on orthopaedic implants often include PROMs, the pronounced influence of general complications on mobility, pain and satisfaction is startling, factors we intuitively connect with the orthopaedic procedure only. In a comparative study, any uneven distribution of general complications may falsely result in inferior outcome for one of the implants. Still, we believe that inclusion of PROMs, in addition to reoperations and complications as outcome measures, is of outmost value. Our study shows that patient perspective covers much more than the traditional orthopaedic definition of failure.

The fast-track system seems to be well-functioning in our hospital since only a small amount of patients are admitted in other ways. However, the only effect seen was a reduced time to surgery, consistent with results by Eriksson et al. [10]. This is important since a shorter time to surgery reduces mortality and complications [6, 24]. Other studies have reported fewer complications in patients treated in facilitated pathways [10, 25]. A limitation of the present study is the absence of records on urinary tract infections and pressure ulcers, which are both clinical problems related to the quality of nursing. In clinical practice, our personal experience is that patients and proxies express content when the A&E is by-passed. After one year, though, none of the PROMs were influenced by whether the patient was admitted via fast-track or not. Supposedly, a survey in close connection to the hospital stay might have provided a different outcome.

Conclusions

We found disappointing results in regaining pre-fracture function and efforts need to be made to improve the rehabilitation process. Patient-reported outcomes as evaluation of hip fracture treatment are difficult to interpret due to the influence of several other factors besides the fracture and its treatment. Occurrence of general complications seems to be the major risk factor, being the only factor to affect functional outcome and together with local complications affecting pain and satisfaction. The severity of the fracture did only correlate with pain. Still the patient's perspective should be taken into account, and future studies will preferably focus on suitable PROM instruments for this particular patient group.

Conflict of interest

The authors report no conflicts of interest. We received no funding for this study.

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Table 1. Questions in questionnaire about mobility and rehabilitation.

		Freq.[a]
Compared to before the injury, my mobility and walking ability today is…	- better	27 (7)
	- the same	84 (22)
	- a little worse	150 (39)
	- much worse	116 (30)
	no answer	7 (2)
I have received help with rehabilitation after the injury.	- Yes, enough	114 (30)
	- Yes, but in a limited amount	120 (31)
	- No, not enough rehabilitation	59 (15)
	- No, no rehabilitation at all	83 (22)
	no answer	8 (2)

[a] frequency, % of total, n (%)

Table 2. Frequency of general and local complications.

General complications	Freq.[a]	Local complications	Freq.[a]
additional fall	97 (15)	wound infection	27 (4)
pneumonia	76 (11)	deep infection	14 (2)
additional fracture	41 (6)	nonunion	13 (2)
dementia[b]	24 (4)	periprosthetic fracture	5 (1)
myocardial infarction	13 (2)	dislocation	3 (0.5)
stroke	11 (2)	other hip related complications (e.g. persistent pain, avascular necrosis)	37 (6)
pulmonary embolism	12 (2)		
deep vein thrombosis	8 (1)		
death (within 1 year)	161 (24)	reoperation	47 (7)

[a] frequency, n (%), one patient could have several complications [b] diagnosed post-fracture

Table 3. Distribution of fracture types and reoperation rates.

Fracture type	Freq.[a]	Reop.[b]
intracapsular, non-displaced	65 (10)	4 (6)
intracapsular, displaced	245 (37)	29 (12)
- treated with internal fixation	28 (11)	12 (43)
- treated with arthroplasty	217 (89)	17 (8)
basicervical	34 (5)	1 (3)
trochanteric, stable	147 (22)	5 (3)
trochanteric, unstable	126 (19)	5 (4)
subtrochanteric	47 (7)	3 (6)
Total	664	47 (7) [c]

[a] frequency, % of total, n (%)
[b] reoperations, % of fracture type, n (%)
[c] % of total

Table 4.
Mean values of pain and satisfaction VAS and EQ-5D-index divided by patient characteristics.

	Pain (VAS)			Satisfaction (VAS)			EQ-5D index		
	Mean	(SD)	p-value	Mean	(SD)	p-value	Mean	(SD)	p-value
age									
<70 yrs.[a]	29	(24)		31	(28)		0.55	(0.39)	
70-80 yrs.[a]	25	(23)	0.4[b]	29	(26)	0.6[b]	0.46	(0.41)	0.2[b]
>80 yrs.[a]	22	(22)	0.04[b]	27	(24)	0.3[b]	0.45	(0.36)	0.09[b]
gender									
female	24	(23)		28	(25)		0.44	(0.38)	
male	22	(22)	0.5	27	(25)	0.7	0.54	(0.36)	0.03
type of surgery[c]									
internal fixation	25	(22)		28	(25)		0.47	(0.38)	
arthroplasty	20	(22)	0.02	27	(26)	0.6	0.46	(0.36)	0.7
severe fracture[d]									
yes	27	(23)		29	(25)		0.48	(0.39)	
no	21	(21)	0.05	27	(25)	0.3	0.46	(0.36)	0.5
non-autonomous[e]									
no	24	(22)		29	(24)		0.39	(0.37)	
yes	23	(23)	0.5	26	(27)	0.4	0.62	(0.33)	<0.001
cognitive impairment									
yes	20	(20)		26	(22)		0.33	(0.36)	
no	24	(23)	0.15	28	(26)	0.5	0.50	(0.37)	<0.001
fast-track									
yes	25	(22)		28	(25)		0.48	(0.37)	
no	21	(23)	0.2	28	(26)	1.0	0.44	(0.38)	0.4
time to surgery > 24 h									
yes	24	(23)		29	(26)		0.45	(0.37)	
no	24	(22)	0.9	27	(25)	0.6	0.48	(0.38)	0.5

general complication									
yes	30	(22)		43	(35)		0.38	(0.39)	
no	22	(22)	0.01	26	(24)	0.01	0.49	(0.37)	0.03
local complication									
yes	35	(27)		35	(26)		0.40	(0.42)	
no	23	(22)	0.02	26	(25)	0.02	0.48	(0.37)	0.3
All patients	24	(22)		28	(25)		0.47	(0.38)	

[a] years
[b] compared to <70 years
[c] intracapsular fractures only
[d] displaced intracapsular with internal fixation, unstable trochanteric, subtrochanteric
[e] patients with impaired mobility, dementia or daily assistance

Table 5.
Patient characteristics correlated to satisfaction and pain VAS by linear regression and to function and rehabilitation by proportional odds model.

				$R^{2\,c}$
Satisfaction (VAS)	General complications	10.061	(2.968-17.154) [a]	4.2 %
	Local complications	15.005	(5.581-24.430) [a]	
Pain (VAS)	General complications	9.521	(3.336-15.707) [a]	6.1 %
	Local complications	8.863	(0.6444-17.081) [a]	
	Severe fracture[e]	6.346	(1.565-11.127) [a]	
	Dementia	-7.950	(-15.876 --0.0250) [a]	
Loss of function	General complications	2.129	(1.064-4.613) [b]	0.54[d]
Inadequate rehabilitation	Age	1.022	(1.001-1.043) [b]	6.0 %

[a] beta coefficient (95% CI)
[b] odds ratio (95% CI)
[c] predictive power
[d] area under the cure, c-statistic
[e] displaced intracapsular with internal fixation, unstable trochanteric, subtrochanteric
CI = confidence interval

Table 6. Patient characteristics correlated to EQ-5D-index by linear regression and to each separate question by proportional odds model.

				$R^{2\,d}$
EQ-5D-index	Non-autonomous[e]	-0.192	(-0.279--0.105) [b]	8.6 %
	Dementia	-0.144	(-0.275--0.013) [b]	
#1 Mobility[a]	Non-autonomous[e]	3.443	(1.966-6.154) [c]	14.6 %
	General complications	2.494	(1.298-4.869) [c]	
#2 Self-care	Non-autonomous[e]	3.628	(2.139-6.281) [c]	21.2 %
	Dementia	3.860	(1.912-7.946) [c]	
	Women	1.763	(1.045-3.027) [c]	
#3 Usual activity	Non-autonomous[e]	2.965	(1.848-4.798) [c]	20.6 %
	Dementia	3.987	(1.905-8.709) [c]	
#4 Pain	Severe fracture[f]	1.646	(1.048-2.688) [c]	7.2 %
	Dementia	0.251	(0.104-0.609) [c]	
#5 Anxiety and depression	Non-autonomous[e]	1.736	(1.075-2.819) [c]	5.8 %
	General complications	2.173	(1.244-3.823) [c]	

[a] answered 2 or 3, compared to the autonomous
[b] beta coefficient (95% CI)
[c] odds ratio (95% CI)
[d] predictive power
[e] patients with impaired mobility, dementia or daily assistance
[f] displaced intracapsular with internal fixation, unstable trochanteric, subtrochanteric
CI = confidence interval

Compared to before the injury, my mobility and walking ability today is...	a) better. b) the same. c) a little worse. d) much worse.
I have received help with rehabilitation after the injury.	a) Yes, enough. b) Yes, but in a limited amount. c) No, not enough rehabilitation. d) No, no rehabilitation at all.

Figure 1. Questions in questionnaire about mobility and rehabilitation.