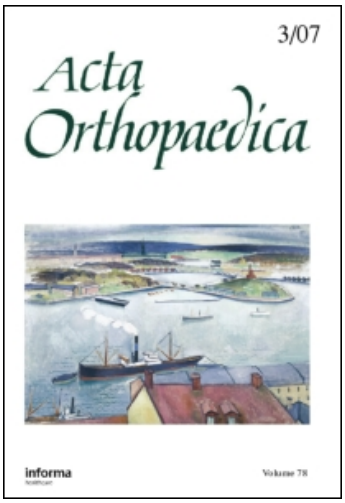

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The Norwegian Hip Fracture Register: Experiences after the first 2 years and 15,576 reported operations

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The Norwegian Hip Fracture Register

Experiences after the first 2 years and 15,576 reported operations

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Background and purpose The Norwegian Hip Fracture Register was established in January 2005 to collect nationwide information as a basis for improved management of patients with hip fractures. We now report our experience after the first 2 years.

Methods After both primary operations and reoperations, the surgeons fill in a standardized 1-page form with information about the patient, the fracture, and the operation. Fractures treated with a total hip arthroplasty are reported to the national arthroplasty register, but are added to the hip fracture register before analyses are performed. 4, 12, and 36 months postoperatively, a standardized questionnaire including health-related quality of life (EQ-5D), visual analog scales concerning pain and patient satisfaction, and Charnley class for functional assessment is sent directly from the register to the patients. To evaluate the completeness of registration, our data were compared with data from the Norwegian Patient Registry (NPR).

Results During the first year of registration, all 55 hospitals treating hip fractures in Norway started to report their hip fracture operations. During 2005, the monthly reporting increased and it stabilized in 2006. 13,251 primary-operated hips (mean age of patients: 80 years; 72% females) and 2,325 reoperations were reported during 2005 and 2006. Compared to the NPR, the completeness of registration was 64% in 2005 and 79% in 2006. 58% of the patients who were alive answered the 4-month questionnaire. The non-responders were older, were more often cognitively impaired, and had a higher degree of comorbidity than the responders. Undisplaced femoral neck fractures (19% of all fractures) were almost exclusively operated with screw osteosynthesis (95%). Dislocated femoral neck fractures (38% of all fractures) were operated with a hemiarthroplasty in 52% of the cases. Osteosynthesis with a hip compression screw was the predominant operation method for trochanteric fractures (81%).

Interpretation After only 2 years, our nationwide system for surveillance of demographics, treatment, and outcome of hip fractures is functioning well. As expected, the response rate for the 4-month questionnaires was relatively low due to the old population with high comorbidity and cognitive impairment. The different treatment methods used for patients in the same groups of fracture types show that there is still no consensus in Norway regarding the treatment of hip fractures.

Each year in Norway (with 4.7 million inhabitants), approximately 9,000 patients are hospitalized and operated due to hip fractures (femoral neck fracture, trochanteric fracture, and subtrochanteric fracture) (Directorate for Health and Social Affairs, 2005). The incidence of hip fractures in Norway is higher than in other countries (Falch et al. 1985, 1993, Lofthus et al. 2001) and increases exponentially with age (Falch et al. 1985, Lofthus et al. 2001, Mirchandani et al. 2005). Thus, the advancing age of the population has led to a higher number of hip fractures (Larsson et al. 1989), and increased demands on the health service (Engesaeter and Soreide 1985). An increase

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in the incidence of hip fractures has been shown in previous studies (Finsen and Benum 1987, Falch et al. 1985, 1993, Lonnroos et al. 2006). However, some recently published studies have suggested a reversal of this trend (Rogmark et al. 1999, Finsen et al. 2004, Nymark et al. 2006, Chevalley et al. 2007). There are several operative treatment methods available, and there is no consensus on which methods should be preferred (Jalovaara et al. 1992, Berglund-Roden et al. 1994, Cserhati et al. 2002, Bhandari et al. 2005, Figwed et al. 2006, Gjertsen et al. 2006, Frihagen et al. 2007).

With the support of the Norwegian Orthopaedic Association, the Norwegian Hip Fracture Register initiated a nationwide registration of hip fractures in January 2005. The register cooperates with—and shares facilities with—the Norwegian Arthroplasty Register. The main aims of the hip fracture register are to collect epidemiological data, to evaluate the results of different treatment methods for the different types of hip fractures in various patient populations, and to identify inferior methods early on. The register also provides data on incidence of fracture types, treatment methods, and trends over time. Finally, hospital-specific results are reported back to the participating hospitals to facilitate improvement in treatment.

Methods

Recording of data

At each of the 55 hospitals where hip fracture surgery is performed, a contact surgeon is responsible for the monthly reporting to the register. Information about the patient, the fracture, and the treatment is obtained from a form that is filled in by the surgeon immediately after surgery (Figure). To ensure that reporting is complete as possible, the form has been made as simple as possible. The same form is used both for primary operations and reoperations. Informed consent is obtained from each patient or a relative and the form is kept in the hospitals.

Hip fractures treated primarily with a total hip arthroplasty (THA) and hips reoperated with THAs due to sequelae after hip fractures are registered on separate forms from the Norwegian Arthroplasty Register. These particular THAs are added to the hip fracture register before analyses are performed. Hip fractures treated without surgery should not be reported to the register.

Using patients' national personal identification numbers, reoperations can be linked to the primary operations. All types of reoperations must be reported to the hip fracture register, including removal of implants, soft tissue revisions, and closed reduction of dislocated hemiprostheses. This is different from the reporting to the hip arthroplasty register, where only reoperations that include removal or exchange of implant components are registered. All reoperations are registered regardless of year of fracture. Consequently, for primary operations from before 2005, the reoperations would not have an index operation registered.

In order to send out 4-month questionnaires to patients at the correct time, the register encourages monthly delivery of forms to the register. Forms lacking information are returned to the hospitals for completion of the data that are missing. We receive records from the Norwegian Register of Vital Statistics with information on dates of death and emigration. To assess the completeness of the data on primary operations in the hip fracture register, data files, including all hospitalizations in 2005 and 2006 with the ICD-10 codes S72.0 (fracture of neck of femur), S72.1 (trochanteric fracture), and S72.2 (subtrochanteric fracture), and the procedure codes NFJ and NFB according to the NOMESKO Classification of Surgical Procedures (NCSP), were obtained from the obligatory administrative Norwegian Patient Registry (NPR). These data were compared to the data in the hip fracture register.

Operation form

The orthopedic surgeons in Norway are familiar with the registration form used in the Norwegian Arthroplasty Register for reporting of joint arthroplasties (Havelin 1999), and a comparable form was prepared for hip fracture operations (Figure). The form contains information about the patient, including the ASA score (American Society of Anaesthesiologists 1963) and cognitive function. To define the presence of cognitive impairment, the surgeons—if in doubt—may use the clock-draw-

ing test (Shulman 2000). Information about time of fracture, time of surgery, type of fracture, operation technique, thrombosis prophylaxis, and infection prophylaxis is also given in the form.

We use a modification of Garden's classification of femoral neck fractures (Garden 1961) where Garden 1 and 2 fractures were defined as undisplaced and Garden 3 and 4 fractures as displaced. Basocervical fractures were defined as extracapsular femoral neck fractures. Trochanteric fractures were defined as fractures involving the trochanter region, including both pertrochanteric and intertrochanteric fractures. Subtrochanteric fractures were defined as fractures with a main fracture line between the distal limit of the lesser trochanter and the proximal 5 cm of the femoral shaft.

To obtain accurate information on the implants, stickers with catalog numbers of the implants, supplied by the manufacturers, are used.

Patient questionnaire

The patients receive a questionnaire directly from the register after 4, 12, and 36 months. The questionnaire contains the EuroQol, which is a standardized non-disease-specific instrument for describing and evaluating health-related quality of life (Brooks 1996). Both the health status part (EQ-5D) and the visual analog scale (EQ-VAS) are included in the questionnaire. The EQ-5D has 5 dimensions (mobility, self-care, usual activities, pain/discomfort, and anxiety/depression). Each item has 3 different responses (no problem, some problems, major problems). The preference scores ($EQ\text{-}5D_{index}$ scores) generated from a large European population (Greiner et al. 2003) were used. The EQ-VAS is a 20-cm visual analog scale ranging from 0 (signifying worst possible health) to 100 (signifying best possible health).

In addition to the EuroQol, the questionnaire contains visual analog scales (VAS) concerning the average pain from the operated hip during the previous month (0 = no pain, 100 = unbearable pain) and patient satisfaction (0 = very satisfied, 100 = very dissatisfied). Finally, we use the Charnley class (Charnley 1979) to describe functional ability. If the questionnaire is filled in with assistance from others, this is indicated. So far, no reminders have been sent out to patients who did not return the questionnaire. Data from the patient questionnaires are not presented in this paper, but will appear in subsequent papers.

Statistics

The Pearson chi-square test was used for comparison of categorical variables in independent groups. Student's t-test and analysis of variance (ANOVA) were used for continuous variables. All data were considered to be independent, and we did not adjust for patients who were operated for hip fractures on both sides. To describe the influence of each variable on the response rate of the 4-month questionnaire, we performed a logistic regression analysis. All p-values are two-tailed, and the significance level was set to 0.01. All continuous variables are presented with 95% confidence intervals (CIs). In the hip fracture register a reoperation is defined as any surgical procedure that has been performed due to a complication after hip fracture surgery, whereas in the arthroplasty register a reoperation is defined as the removal or exchange of part of an implant, or the whole implant. The analyses were performed using SPSS 14.0 for Windows.

Reports to surgeons and hospitals

The annual reports are sent to all members of the Norwegian Orthopaedic Association, to all hospitals performing treatment of hip fractures, and to the health authorities. Each participating hospital receives specific descriptive statistics for that particular hospital on an annual basis, and also survival analyses of osteosyntheses and arthroplasties for hip fractures performed at the hospital.

Ethics

Each patient has to give written consent to be entered into the register, and consent from the patient's family is sought if the patient is not able to give or withhold consent. The consent form is entered into the patient journal at the hospital. Accordingly, the register has no information on patients who refused to give consent, and also no information on the number of patients who were not reported to the register due to the fact that they withheld their consent.

The registration is approved by the Norwegian Data Inspectorate.

Table 1. Monthly registrations of primary operations

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2005	398	434	473	398	462	428	463	494	503	517	542	703
2006	699	624	681	581	586	518	604	566	596	601	653	727

Table 2. Baseline data for all patients according to fracture types. Fractures operated with a THA, and reported to the arthroplasty register, were classified as femoral neck fractures or trochanteric fractures without further subclassification. The p-values relate to statistically significant differences between fracture types

Fracture type	n	Age mean (95% CI)	Female %	Cognitive impairment % (yes / no / uncertain)	ASA mean (95% CI)
Undisplaced femoral neck (Garden 1 + 2)	2,452	79 (78–79)	69	20 / 68 / 12	2.5 (2.4–2.5)
Displaced femoral neck (Garden 3 + 4)	5,051	81 (80–81)	73	24 / 63 / 13	2.6 (2.6–2.7)
Basocervical	612	79 (78–80)	63	21 / 69 / 10	2.6 (2.5–2.7)
Femoral neck, unspecified [d]	244	71 (70–73)	74		2.6 (2.4–2.9)
Trochanteric, 2-fragment [c]	2,292	82 (81–82)	72	24 / 63 / 13	2.6 (2.5–2.6)
Trochanteric, multifragment [c]	1,738	82 (81–82)	74	25 / 62 / 13	2.6 (2.6–2.7)
Trochanteric, unspecified [d]	27	76 (71–80)	59		2.3 (2.0–2.6)
Subtrochanteric	713	78 (77–79)	73	18 / 69 / 13	2.5 (2.5–2.6)
Others or combined fractures	103	75 (71–79)	69	18 / 70 / 12	2.6 (2.3–2.9)
Unknown	19	83 (79–88)	84	21 / 42 / 37	3.4 (2.4–4.4)
All fractures	13,251	80 (80–80)	72	24 / 63 / 12	2.6 (2.6–2.6)
p-values		< 0.001 [a]	< 0.001 [b]	< 0.001 [b]	< 0.001 [a]

[a] ANOVA.
[b] Pearson chi-square test.
[c] Including intertrochanteric fractures.
[d] Patients reported to the Norwegian Arthroplasty Register.

Results

Completeness of registration

An increase in the numbers of reported hip fractures and reporting hospitals was found during the second half of 2005, and by December 2005 all 55 hospitals operating hip fractures were reporting to the register. During 2006, the number of monthly registrations stabilized (Table 1).

When we included all data reported until October 23, 2007, 13,251 primary operations for hip fractures (2005: n = 5,815, 2006: n = 7,436) had been registered, including 271 THAs that had been reported to the hip arthroplasty register. According to the Norwegian Patient Registry (NPR), 9,150 patients had been operated due to a hip fracture in 2005, and 9,376 in 2006. Thus, comparing our data with those from the NPR, we had a completeness of registration of 64% in 2005 and 79% in 2006.

In addition to the primary operations, 2,325 reoperations were registered, including 1,084 THAs reported to the arthroplasty register. The register thus contained data on 15,576 operations.

Primary operations

The mean age of all patients was 80 years (Table 2). There were significant differences in average age between the different fracture groups ($p < 0.001$). As expected, patients operated with THAs were generally younger than the other patients, and they had the lowest ASA scores. Women constituted 72% of all patients, and there were statistically significant differences in sex distribution between the different fracture groups ($p < 0.001$). Furthermore, there was a difference in cognitive function between the fracture groups with less cognitive impairment in patients with undisplaced femoral neck fractures, basocervical fractures, and sub-

Table 3. Reporting completeness for different subgroups of the 11,038 patients who received the 4-month questionnaire

	n	Responders (%)	p-value [a]
All patients	11,038	6,399 (58)	
Age			< 0.001
< 60 years	690	436 (63)	
60–69 years	950	649 (68)	
70–79 years	2,655	1,662 (63)	
80–89 years	5,188	2,892 (56)	
> 90 years	1,555	760 (49)	
Sex			0.5
Female	8,109	4,698 (58)	
Male	2,929	1,701 (58)	
Cognitive impairment			< 0.001
yes	2,219	846 (38)	
no	7,502	4,807 (64)	
uncertain	1,090	550 (50)	
missing	227	116 (51)	
ASA score: [b]			< 0.001
1	1,308	917 (70)	
2	4,332	2,649 (61)	
3	4,794	2,520 (53)	
4	403	188(47)	
5	9	4 (44)	
Missing	192	121 (63)	
Fracture type:			0.005
femoral neck	6,449	3,833 (59)	
basocervical	511	292 (57)	
trochanteric	3,353	1,882 (56)	
subtrochanteric	618	333 (54)	
other or combined/unknown	107	59 (55)	

[a] Pearson chi-square test.
[b] ASA score
1: Healthy
2: Mild, systemic disease
3: Severe, systemic disease
4: Incapacitating disease
5: Moribund

trochanteric fractures ($p < 0.001$). However, these patient groups were younger. Finally, there were statistically significant differences in ASA class for the different fracture types ($p < 0.001$).

After 4 months (120 days), 11,494 patients were still alive. The 4-month questionnaire was sent to 11,038 patients (96% completeness). Of these questionnaires, 6,399 (58%) were returned to the register (responders). The non-responders were 2.2 years older on average (CI: 1.7–2.6), they were more cognitively impaired (30% vs. 13%), and had a higher degree of comorbidity (ASA class) compared to the responders ($p < 0.001$). There was no significant difference in response rate for the 4-month questionnaire in female and male patients ($p = 0.5$, Table 3). There were minor differences in reporting rate for the different fracture types, which were statistically significant. However, when doing a logistic regression analysis we found that age, ASA class, cognitive impairment, and hospital influenced the response rate, whereas sex, fracture type, and method of operation did not.

Femoral neck fractures constituted 57% of all fractures and 67% of the femoral neck fractures were displaced (Table 4). Trochanteric fractures represented 30% of all fractures. Screw osteosynthesis was the predominant operation method used to treat undisplaced femoral neck fractures (95%), while a bipolar hemiarthroplasty (HA) was used more often if the femoral neck fracture was displaced (52%). Basocervical fractures were operated with a hip compression screw (HCS) in 83% of cases; however, the osteosynthesis was stabilized with an additional anti-rotation screw (registered as "Other implant or combination") in 24% of these operations. Osteosynthesis with an HCS was the predominant operation method used to treat trochanteric fractures (84%). Intramedullary nails were used in 11% of all trochanteric fractures. When the fracture was multifragmented, it was more likely to be operated with an additional HCS lateral support plate (37%) or with an intramedullary nail (14%).

Most of the HAs performed were cemented, and the most commonly used implant was the Charnley-Hastings combination (Table 5). The most frequently used uncemented hemiprosthesis was the hydroxyapatite-coated Corail stem. No Austin Moore uncemented prostheses were used.

Reoperations

The commonest reason for reoperation was sequelae after femoral neck fracture (reported to the Hip Arthroplasty Register) (44%), osteosynthesis failure (25%), nonunion (10%), and local pain due to osteosynthesis material (8%) (Table 6). The most commonly performed reoperations were insertion of a THA (47%) or a bipolar HA (29%) (Table 7). In the arthroplasty register, only procedures that include removal or exchange of a prosthesis component are defined as a reoperation of a THA, and other reoperations of THAs are not registered.

Table 4. Frequencies of fracture type and operation method in the 13,251 hips primarily operated for hip fractures. Fractures operated with a THA, and reported to the NAR, were classified as femoral neck fractures or trochanteric fractures without further subclassification

A	B	C	D	E	F	G	H	I	J	K
Undisplaced femoral neck (Garden 1 + 2)	2,452 (19)	2,300	30	54	2		49	4	4	9
Displaced femoral neck (Garden 3 + 4)	5,051 (38)	2,196	79	2,622	52		53	3	10	36
Basocervical	612 (4.6)	55	2	17	7		374	11	20	126
Femoral neck, unspecified [b]	244 (1.8)					244				
Trochanteric, 2-fragment [a]	2,292 (17)	1	0	4	0		1,879	131	205	71
Trochanteric, multifragment [a]	1,738 (13)	0	1	6	0		754	642	243	92
Trochanteric, unspecified [b]	27 (0.2)					27				
Subtrochanteric	713 (5.4)	0	0	4	0		223	278	185	23
Other or combined fractures	103 (0.8)	0	0	8	0		25	28	21	21
Unknown	19 (0.1)	5	0	7	0		4	0	1	2

[a] Including intertrochanteric fractures.
[b] Hips reported to the Norwegian Arthroplasty Register.
A Fracture type
B Total n (%)
C 2 screws or pins
D 3 screws or pins
E Bipolar HA
F Unipolar HA
G THA
H Hip compression screw (HCS)
I HCS with lateral support plate
J Intramedullary nail
K Other implant or combination including HCS with additional antirotation screw

Discussion

After 2 years of registration, all hospitals operating hip fractures were reporting to the Norwegian Hip Fracture Register (NHFR). During 2005 the monthly reporting increased, and it was stable in 2006 with a completeness of registration of 79% relative to the NPR. The response rate for the 4-month questionnaires was 58%. The different treatments used among the different fracture types show that there is still no consensus in Norway about the treatment of displaced femoral neck fractures.

Completeness of registration

There was an increase in reporting during 2005 due to the fact that some of the larger hospitals started registration late that year. There was a stable reporting rate to the register throughout 2006.

The completeness of registration in the Norwegian Arthroplasty Register (NAR) has been high, both for primary operations and revisions. Espehaug et al. (2006) found a completeness of registration of 97% for all primary THAs when comparing the results in the NAR with the data from the NPR. Arthursson et al. (2005) found that only 0.4% of the THAs performed at one large local hospital had not been reported to the NAR. Elective hip arthroplasties are performed during daytime by surgeons dedicated to prosthesis surgery. Hip fracture surgery is also performed during weekends and at night by the surgeon on call—usually registrars in training and with a high turnover in their positions. This may explain some of the differences in registration completeness between the hip fracture register and the arthroplasty register. However, one might expect that it would take some time to establish good routines for reporting to a recently established register.

One Norwegian study reported that rehospitalizations due to sequelae after hip fractures might be registered in the NPR as acute hip fractures (Lofthus et al. 2005). In accordance with this, they found an overestimation of 14% in the NPR compared to local electronic databases at 3 hospitals,

Table 5. Distribution of implants used in primary operated hip fractures

Implant	n (%)	n (%)
2 screws or pins		4,669 (100)
Olmed (DePuy)	2,710 (58)	
Richards CHP (S&N) [a]	1,050 (23)	
LIH nail (Orthovita)	686 (15)	
Asnis III (Stryker)	214 (4.6)	
Unknown implant	9 (0.3)	
Hemiarthroplasty [b]		2,783 (100)
Charnley – C B (DePuy)	847 (30)	
Exeter/V40 – C B (Stryker)	560 (20)	
Corail – U B HA (DePuy)	428 (15)	
Spectron – C B (S&N) [a]	304 (11)	
Titan – C B (DePuy)	296 (11)	
Other / unknown implant	348 (13)	
Hip compression screw		4,458 (100)
CHS (S&N) [a]	2,794 (63)	
DHS (Stratec)	1,575 (35)	
Omega plus (Stryker)	87 (2.0)	
Other implant	2 (0.04)	
Intramedullary nail		689 (100)
Gamma (Stryker)	358 (52)	
Gamma 3 (Stryker)	184 (27)	
Trigen (S&N) [a]	48 (7.0)	
PFNA (Stratec)	27 (3.9)	
PFN (Stratec)	24 (3.5)	
Other / unknown implant	48 (7.0)	

[a] Smith & Nephew
[b] HA Hydroxyapatite-coated; C Cemented; U Uncemented; B Bipolar

Table 6. Reason for reoperation. All reoperations after hip fracture surgery registered in the hip fracture register in 2005 and 2006, including reoperations with THAs reported to the arthroplasty register. The numbers also include reoperations with no registered index operation. Note that each reoperation may have more than one indication. The total number of reasons (2,619) is therefore higher than the total number of reoperated hips (2,325)

Reason for reoperation	n	(%) [b]
Sequelae of femoral neck fracture (unspecified) [a]	1,028	(44)
Osteosynthesis failure	590	(25)
Nonunion	231	(9.9)
Local pain due to osteosynthesis material	174	(7.5)
Avascular necrosis (segmental collapse)	134	(5.8)
Deep wound infection	122	(5.2)
New fracture around implant	65	(2.8)
Penetration of osteosynthesis material through caput	58	(2.5)
Dislocated hemiprosthesis	55	(2.4)
Hematoma	37	(1.6)
Superficial wound infection	20	(0.9)
Fracture healed in wrong position	16	(0.7)
Sequelae of proximal femoral fracture (except femoral neck fracture)	10	(0.4)
Loosening of hemiarthroplasty	9	(0.4)
Pain after hemiarthroplasty	3	(0.1)
Other reasons	3	(0.1)
Unknown	64	(2.8)
Total number of reasons	2,619	(113)

[a] Total hip replacements reported to the Norwegian Arthroplasty Register, include avascular necrosis, nonunion, and osteosynthesis failure.
[b] Percentages of reoperated hips.

and they therefore questioned the validity of the NPR electronic database. An overestimation has also been reported for hip fractures in the English Public Health Common Data Set (McColl et al. 1998). These 2 studies may explain some of the difference between the data in the NHFR and those in the NPR.

From 2008, the NPR data will be identifiable at the level of the patient, and with such information comparisons of data from the NPR and the hip fracture register will probably be more valid. Validation studies should be performed on the registration of both primary operations and reoperations in the hip fracture register.

To date, 58% of the patients who are alive have answered the 4-month questionnaire. Two studies from the NAR have reported a response rate of 81% from patients who had undergone primary or revision hip arthroplasties (Espehaug et al. 1997, 1998). These patients did, however, have a mean age of 67 years, they had probably less comorbidity than the average hip fracture patient, and they received a reminder if they did not respond to the questionnaire. Thus, the relatively low response rate in our study group can be explained by high age, considerable comorbidity, cognitive impairment, and by many patients moving into nursing homes on a temporary or permanent basis. A better response rate might also be achieved if reminders are sent to the non-responders. One weakness in the design of the study is that the preoperative EQ-5D is assessed retrospectively, at 4 months postoperatively. The patients or the relatives may have difficulty in remembering the exact situation before fracture. Consequently, the answers in the EQ-5D may be inaccurate. The patients who responded to

Table 7. Type of reoperation. The numbers also include reoperations with no registered index operation. Note that each reoperation could consist of more than one procedure. The total number of types of reoperations (2,421) is therefore higher than the total number of reoperated hips (2,325)

	n	(%) [b]
Total hip arthroplasty [a]	1,084	(47)
Bipolar hemiarthroplasty	681	(29)
Removal of implant (when the only procedure)	202	(8.7)
Re-osteosynthesis	125	(5.4)
Drainage of hematoma or infection	115	(4.9)
Girdlestone (removal of implant/ hemiprosthesis and caput femoris)	61	(2.6)
Unipolar hemiarthroplasty	40	(1.7)
Closed reduction of dislocated hemiarthroplasty	17	(0.7)
Open reduction of dislocated hemiarthroplasty	11	(0.5)
Other	85	(3.7)
Total no. of types of reoperations	2,421	(104)

[a] Reported to the Norwegian Arthroplasty Register.
[b] Percentages of reoperated hips.

the 4-month questionnaire were generally younger, were less cognitively impaired, and had a lower ASA class compared to the non-responders. Consequently, the responders represent a selected subgroup of patients. Also, patients with an inferior clinical outcome may be more likely to respond to the questionnaire. However, the results have shown that the response rate was not influenced by fracture type or method of operation. We therefore believe that the data from the 4-month questionnaire can be relied upon.

We did not adjust for patients who were operated on both sides, as this was considered to be of little relevance to the results presented. According to an earlier study from the NAR, this adjustment will not necessarily have any effect on the results (Lie et al. 2004). However, this adjustment may be of more importance in future studies. Such adjustment will be possible whenever relevant because the primary registration is based on the patient's personal identification number.

Primary operations

We found that the mean age of patients was 80 years, and that 72% of all patients were women. These findings agree well with the results of the Swedish National Hip Fracture Register (RIKSHÖFT-SAHFE) (mean age 81 years, 71% females) (Thorngren et al. 2002) and to the results of other studies (mean age 79–80 years, 70–80% females) (Rogmark et al. 1999, Osnes et al. 2004, Moran et al. 2005, Lonnroos et al. 2006). Also, the distribution of fractures was similar to that presented for the RIKSHÖFT-SAHFE (Thorngren et al. 2002).

No national consensus on the treatment of dislocated femoral neck fractures or on the treatment of trochanteric and subtrochanteric fractures can be reached from the results of this study. Several studies from other countries have indicated that no consensus can be reached regarding the method of operative treatment for proximal femoral fractures (Jalovaara et al. 1992, Berglund-Roden et al. 1994, Cserhati et al. 2002, Bhandari et al. 2005).

Reoperations

A high number of the reoperations were prosthesis surgery. 76% of patients who underwent a reoperation were operated with a THA or an HA. Few minor complications, such as removal of an implant, were reported (9%). These operations are often performed as day surgery or in outpatient clinics. We suspect that there is a lower rate of reporting of these reoperations. The reporting rate of reoperations should be addressed in future studies.

Further research

Due to the link between the Norwegian Arthroplasty Register and the Norwegian Hip Fracture Register, the latter has a unique opportunity to perform complete analysis of all hip fracture surgery performed in an entire country. The register may also provide data on incidence of fracture types, and information on changes of treatment over time. We aim to conduct studies on pain, patient satisfaction, and quality of life in individuals who have undergone different methods of treatment, and who belong to different patient populations. We will also assess mortality after hip fractures. With further research, we hope to be able to identify inferior methods and to improve the quality of treatment in this large patient group.

Contributions of authors

This paper represents close teamwork by the orthopedic surgeons JEG, LBE, OF, LIH, TV, and JMF, and informatics specialist KS. All authors participated in the planning of the Norwegian Hip Fracture Register, the design of this study, interpretation of the results, and in preparation of the manuscript. JEG was mainly responsible for performing the statistical analyses and for writing the manuscript.

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NORWEGIAN HIP FRACTURE REGISTER
Norwegian Arthroplasty Register
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Haukeland University Hospital
Møllendalsbakken 11
5021 BERGEN
Phone: (+47)55976452

Birth number:.....

Name:.....

(Write distinct or use patient sticker – **specify hospital**.)

Hospital:.....

HIP FRACTURES

PRIMARY OPERATIONS ON PROXIMAL FEMORAL FRACTURES and ALL REVISIONS, included closed reduction of hemiprosthesis. When primary operation with total hip arthroplasty and revision with total hip arthroplasty use form to the arthroplasty register only. All stickers are to be put in marked area on back of form.

CURRENT OPERATION
☐1 Primary operation ☐ 2 Revision

SIDE (one mark) (Bilateral op.= 2 forms)
☐1 Right ☐2 Left

TIME OF OPERATION |__|__| |__|__| |__|__| hrs |__|__|

TIME OF FRACTURE |__|__| |__|__| |__|__| hrs |__|__|

If uncertainty on time of fracture, fill in next section.

TIME FROM FRACTURE TO OPERATION IN HOURS
☐1 0-6 ☐2 >6-12 ☐3 >12-24 ☐4 >24-48 ☐5 >48

COGNITIVE IMPAIRMENT
☐0 No ☐1 Yes (See text on the back of form) ☐2 Uncertain

ASA-CLASSIFICATION (see text on the back of form for definition)
☐1 Healthy
☐2 Mild systemic disease
☐3 Severe systemic disease
☐4 Incapasitating disease
☐5 Moribund

REASON FOR PRIMARY OPERATION (TYPE OF FRACTURE)
(One mark only)
☐1 Undislocated intracapsular fracture (Garden 1 og 2)
☐2 Dislocated intracapsular fracture (Garden 3 og 4)
☐3 Basocervical fracture
☐4 Trochanteric 2 fragment fracture
☐5 Trochanteric multifragment fracture
☐6 Subtrochanteric
☐7 Other .....

TYPE OF PRIMARY OPERATION (One mark only)
(Fill in only when primary operation – separate form for THAs)
(Specify product exactly or use stickers with catalogue number supplied by the manufacturers on the back of form)
☐1 Two screws or pins
☐2 Three screws or pins
☐3 Bipolar hemiarthroplasty
☐4 Unipolar hemiarthroplasty
☐5 Hip compression screw and plate
☐6 Hip compression screw with lateral support plate
☐7 AO-plate
☐8 Short intramedullary nail without distal locking
☐9 Short intramedullary nail with distal locking
☐10 Long intramedullary nail without distal locking
☐11 Long intramedullary nail with distal locking
☐12 Other, specify.....

Name / size, if possible Catalogue number.....

REASON FOR REVISION (More than one mark can be used)
☐1 Osteosynthesis failure
☐2 Nonunion
☐3 Avascular necrosis (segmental collapse)
☐4 Local pain due to osteosynthesis material
☐5 Fracture healed in wrong position
☐6 Wound infection - superficial
☐7 Wound infection - deep
☐8 Haematoma
☐9 Dislocated hemiarthroplasty
☐10 Penetration of osteosynthesis material through caput
☐11 New fracture around implant
☐12 Loosening of hemiarthroplasty
☐13 Other, specify.....

TYPE OF REOPERATION (More than one mark can be used)
(Specify product exactly or use stickers with catalogue number supplied by the manufacturers on the back of form)
☐1 Removal of implant (when only procedure)
☐2 Girdlestone
(= Removal of implant/hemiarthroplasty and caput)
☐3 Bipolar hemiarthroplasty
☐4 Unipolar hemiarthroplasty
☐5 Re-osteosynthesis
☐6 Drainage of hematoma or infection
☐7 Closed reduction of dislocated hemiarthroplasty
☐8 Open reduction of dislocated hemiarthroplasty
☐9 Other, specify.....

Name / size, if possible Catalogue number.....

FIXATION OF HEMIPROSTHESIS
(For total hip arthroplasty a separate form is sent to the arthroplasty register)
☐1 Uncemented
☐ with HA ☐ without HA
☐2 Cement with antibiotics Name.....
☐3 Cement without antibiotics Name.....

PATHOLOGICAL FRACTURE (Other pathology than osteoporosis)
☐0 No
☐1 Yes, type.....

APPROACH TO HIP JOINT WHEN HEMIARTHROPLASTY (One mark only)
☐1 Anterolateral
☐2 Lateral
☐3 Posterolateral
☐4 Other, specify.....

TYPE OF ANESTHESIA
☐1 Narcosis ☐2 Spinal ☐3 Other, specify.....

PEROPERATIVE COMPLICATIONS
☐0 No
☐1 Yes, Which.....

DURATION OF OPERATION (skin to skin).....minutes

SYSTEMIC ANTIBIOTIC PROPHYLAXIS
☐0 No ☐1 Yes, which (A).....

Dosis (A)..... Total number of dosis:.....Duration: .....hours

Ev. in combination with (B).....

Dosis (B).....Total Number of dosis:.....Duration: .....hours

THROMBOSIS PROPHYLAXIS
☐0 No ☐1 Yes, which type.....

Dosis day of surgery..... First dosis given preoperatively ☐0 No ☐1 Yes

Later dosis..... Duration.....days

Evt. in combination with .....

Dosis.....Duration.....days

Stockings ☐0 No ☐1 Leg ☐2 Thigh Duration .....days
Mechanical pump ☐0 No ☐1 Foot ☐2 Leg Duration.....days

Surgeon.....
Surgeon who has filled in form (name is not registered).

English translation of the operation form used by surgeons postoperatively.