

Orthogeriatric Service Reduces Mortality in Patients With Hip Fracture

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Charlotte Stenqvist, MD¹, Christian Medom Madsen, MD¹,
Troels Riis, RN¹, Henrik Løvendahl Jørgensen, MD²,
Benn Rønnow Duus, MD¹, Jes Bruun Lauritzen, DMSc, MD¹,
and Susanne van der Mark, MD¹

Abstract

Introduction: Orthogeriatric service has been shown to improve outcomes in patients with hip fracture. The purpose of this study is to evaluate the effect of orthogeriatrics at Bispebjerg University Hospital, Denmark. The primary outcome is mortality in-hospital and after 1, 3, and 12 months for patients with hip fracture. The secondary outcome is mortality for home dwellers and nursing home inhabitants. **Materials and Methods:** This is a retrospective clinical cohort study with an historic control group including all patients with hip fracture admitted from 2007 to 2011. Patients with hip fracture are registered in a local database, and data are retrieved retrospectively using the Danish Civil Registration Number. **Results:** We included 993 patients in the intervention group and 989 patients in the control group. A univariate analysis showed only significantly decreased mortality in-hospital 6.3% vs 3.1% ($P = .009$) after orthogeriatrics. However, when adjusting for age, gender, and American Society of Anaesthesiologists (ASA) score in a multivariate analysis, including all patients with hip fracture, we find significantly reduced mortality in-hospital (odds ratio [OR] 0.35), after 30 [OR 0.66] and 90 days [OR 0.72] and 1 year [OR 0.79]). When using a univariate analysis for home-dwelling patients, we found significantly reduced mortality in-hospital (8.3-2.0%, $P < .0001$), after 30 days (12.2-6.8%, $P = .004$) and 90 days (20.5-13.0%, $P = .002$). One-year mortality was not significant. Patients from nursing homes had no significant decreasing mortality at any point of time in the univariate analysis. **Conclusion:** We have shown significant decreases for in-hospital, 30 day, 90 day, and 1-year mortality after implementation of orthogeriatric service at Bispebjerg Hospital when adjusting for age, gender, and ASA score. Future trials should include frail patients with other fracture types who can benefit from orthogeriatrics.

Keywords

orthogeriatrics, hip fracture, mortality, Denmark

Background

Orthogeriatrics is a multidisciplinary collaboration between orthopedic surgeons and geriatricians. They cooperate in the treatment of the frail, elderly patient with comorbidities, chronic diseases, and reduced level of function, often due to low-energy trauma resulting in a fracture requiring orthopedic hospitalization and intervention.

The pioneers in the field of orthogeriatrics were Devas and his colleagues in Hastings, England, in the late 1950s.¹ Orthogeriatrics has developed internationally within the last decades primarily encompassing patients with hip fracture, though any other frail patient with a fracture could benefit from multidisciplinary treatment. The frailty phenotype is defined by deterioration of multiple organ systems including the neurological, musculoskeletal, cardiovascular, metabolic, or immunological systems.² Frailty has been shown to be associated with falls resulting in injuries.³

The patient with hip fracture is known to be older with chronic comorbid disorders, frailty, and functional impairment

before the fracture. Male gender, high age, and multimorbidity are well-known factors related to an increased risk of dying within the first year after a hip fracture.^{4,5} Admittance from a nursing home, a high-ASA score, and frailty have also been shown to be independent predictors of mortality.⁶ After fracture, patients may experience severe disability, reduced quality of life, and admittance to nursing homes.⁷

The presence of geriatricians in orthopedic surgery departments has been shown to improve outcomes including burden of medical complications, length of stay, readmissions,

¹ Department of Orthopedic Surgery, Bispebjerg Hospital, University of Copenhagen, Copenhagen, Denmark

² Department of Clinical Biochemistry, Bispebjerg Hospital, University of Copenhagen, Copenhagen, Denmark

Corresponding Author:

Charlotte Stenqvist, Department of Orthopedic Surgery, Bispebjerg Hospital, University of Copenhagen, Bispebjerg Bakke 23, 2400 København NV, Denmark.
Email: charlotte_stenqvist@hotmail.com

short-term mortality, discharges to nursing homes, and result of long-term rehabilitation.⁷⁻¹⁴ There are no prospective randomized trials providing evidence of which model of orthogeriatrics provides the most beneficial results, but there is a trend suggesting that the effect is most significant when the geriatrician performs comprehensive geriatric assessment and intervention at admittance.^{9,15,16}

Internationally, several other improvements in treatment of the patient with hip fracture have been introduced. They have focused on preoperative antibiotics, early assessment by an anesthesiologist, minimal invasive surgery, fast track treatment, optimized pain treatment, and early mobilization as well as a systematic approach to nutrition, fluid, and oxygen therapy.^{7,17,18}

The purpose of this study is to illuminate and evaluate the effect of orthogeriatrics at Bispebjerg University Hospital, Denmark. The primary outcome is inhospital mortality and mortality after 1, 3, and 12 months for patients with hip fracture. The secondary outcome is mortality for the subpopulation of home dwellers and nursing home inhabitants.

Methods

Study Design and Data Collection

This is a retrospective clinical cohort study with an historic control group including all 1982 patients with hip fracture admitted to Bispebjerg University Hospital from 2007 to 2011. We analyze data from 2 groups of patients treated by the same orthopedic trauma team at the Department of Orthopaedics Bispebjerg University Hospital, which admits 400 to 600 patients with hip fracture every year.

The hospital is situated in a part of Copenhagen with a large population of elderly patients, with a high comorbidity, a relatively low standard of living, and a large number of substance abusers, especially alcoholics and smokers.

At Bispebjerg University Hospital, all patients with hip fracture are registered in a local database. The data are retrieved retrospectively from different sources using the Danish Civil Registration Number (CRN), which is unique to each individual and used for all contacts with the public health care system. From the CRN, age and gender can be extracted. Additional data such as ASA score, body mass index (BMI), length of stay, time to surgery, type of fracture, and type of operation were collected from hospital charts and operation notes. For a subset of the patients, data on residence on admission were also available.

On September 1, 2009, an orthogeriatric ward was established at the Bispebjerg University Hospital. The intervention group consists of all patients admitted with a hip fracture in a 2-year period from December 1, 2009 to December 1, 2011. Similarly, a historic control group from before the implementation of orthogeriatrics was retrieved from the database. The patients in the control group were admitted from June 1, 2007 to June 1, 2009. Patients admitted 3 months before and after the implementation of the orthogeriatric service were excluded to

allow a run-in period and to avoid the intervention affecting the control group. If patients were admitted twice during the study period due to bilateral fractures, their second admission was not included in the study, there were no other exclusion criteria or any randomization.

Implementation of the orthogeriatric service was part of the quality improvement at Bispebjerg Orthopaedic Department and thus not requiring approval by the Ethical Committee of the Capital Region of Denmark.

Before Orthogeriatrics

The standard hip fracture treatment before orthogeriatrics was admission via the emergency department (ED). In the ED, most of the patients admitted with suspected hip fracture were given femoral nerve catheter blockade by the anesthesiologist, who also assessed whether patients older than 65 years needed a chest X-ray. Blood samples were taken, 1 g of paracetamol was given and, when needed, intravenous morphine. Patients had a hip X-ray obtained, and if the radiographer found a fracture, the patient went directly to the orthopedic department. The junior doctor wrote a report and prescribed thrombosis prophylaxis, laxatives, multivitamins, and paracetamol. Nurses identified patients with nutritional risk. Surgery was performed as quickly as possible, and spinal anesthesia was one of the anesthetics used.

The aim was to operate within 24 hours. Patients received antibiotics perioperatively as well as after 8 and 16 hours postoperatively. Patients received a urinary catheter if they presented more than 1 occasion of urinary retention. The nurses focused on mobilization into at least sitting position the first day. There was generally focus on early mobilization, and patients were expected to be mobilized and discharged within 5 days, a goal that was not consistently achieved. Blood samples were taken on the first, second, and third days after surgery. Patients were discharged with a rehabilitation plan and relevant pain treatment.

After Orthogeriatrics

In 2009, the geriatricians were responsible for the implementation of a new clinical pathway described below. This pathway was used for all patients with hip fracture regardless of age. At the orthopedic department, patients were admitted either to the orthogeriatric unit or the neighboring unit where they received the same basic treatment.

In the ED, patients with an obvious hip fracture were seen by a specially educated nurse. The nurse added an intravenous access, took an electrocardiogram and preoperative blood samples, and started fluid therapy, oxygen, and bladder scan. They also ensured that patients were positioned on special mattresses in order to prevent pressure ulcers.

Pain was treated with 1 g paracetamol and IV morphine. Initially during the intervention period, the anesthesiologist added a femoral nerve catheter blockade. Later during the intervention period, this was replaced by a "single shot"

femoral nerve catheter blockade with Ropivacaine. Patients had a hip X-ray taken. If the patient had a hip fracture, was older than 60, or had a known pulmonary or cardiac disease, the radiographer took a chest X-ray. Confirmed hip fractures went directly to the orthopedic department after X-ray.

Patients were routinely prescribed proton pump inhibitors, vitamin D, and calcium supplements together with thrombosis prophylaxis, laxatives, multivitamins, and paracetamol. Preoperative standard screening included creatinine, hemoglobin, white blood cell (WBC) counts, vitamin D status, coagulation status, thyroid blood tests, and hepatic parameters.

The orthogeriatric unit consisted of 21 beds and was managed by 2 full-time geriatricians. This is the first time geriatricians have been employed directly in an orthopedic department in Denmark.^{10,19} The unit admitted patients with fracture primarily older than 65 years, suffering from severe medical comorbidity, and exposed to polypharmacy. They admitted primarily patients with hip fracture, but still half of the patients with hip fracture, not presenting a geriatric profile, were admitted to a neighboring unit. If any of these patients had medical perioperative complications, they could be transferred to the orthogeriatric unit.

Comprehensive geriatric assessment and intervention were possible 5 days a week. The geriatricians optimized patients for surgery and improved care preoperatively. Geriatricians saw every patient during their daily rounds in the orthogeriatric ward, and orthopedic surgeons went rounds as needed.

Nurses systematically measured vital parameters and were taught the importance of fast and proper reactions. Nursing was systematized including delirium care plan, bladder scans at least 4 times a day and sterile disposable catheterization when needed, early fluid therapy, and focus on nutrition with complementary supplements from admission. Premorbid functional status was assessed. Focus was on thrombosis prophylaxis [low molecular weight heparin (LMWH)], prevention of pressure ulcers, and constipation. All patients with hip fracture had a urine sample sent for cultivation.

After surgery, nurses focused on nutrition, constipation, urination, wound care, discharge planning, and contact with family and social coordinator/multidisciplinary rehabilitation coordinator. Adequate staffing was mandatory for all these activities.

Besides systematic education and training of nurses, junior surgeons were educated in order to optimize monitoring and treatment during night shifts with no geriatrician on hand.

The geriatrician focused on individualized pain management, medical review, and management of medication. The multidisciplinary team of doctors, nurses, nutritionists, occupational therapists, and physiotherapists discussed and individualized rehabilitation and discharge on an ongoing basis and in a large forum once a week. See Table 1 for improvements in the hip fracture treatment program before and after orthogeriatrics.

Statistics

Differences in mean values were analyzed using the student *t* test for normally distributed variables and the Mann-Whitney

U test for data with non-normal distribution. Categorical variables are shown as proportions, and the differences between the groups were analyzed using the Pearson χ^2 test. For multivariate survival analysis, hazard ratios were calculated using Cox regression analysis. For multivariate categorical analysis, odds ratios (ORs) were calculated using logistic regression.

Statistical significance level was chosen to $P < .05$, and all analyses were two sided. Database management and all statistical analyses were performed using SAS statistical software version 9.2 (SAS Institute Inc., Cary, North Carolina).

Results

We included 1982 patients, 993 patients in the intervention group and 989 patients in the control group. In Denmark, we have a tradition of performing surgery on all patients with hip fracture despite functional status. In total, 71.9% ($n = 711$) were female in the control group and 70.9% ($n = 704$) were female in the intervention group ($P = .6$).

In the control group, the mean age was 80.9 years (95% confidence interval [CI] = 80.1-81.6) and 80.2 years (95% CI = 79.4-80.9, $P = .2$) in the intervention group. The length of stay was 12.8 days before orthogeriatrics and 12.1 after orthogeriatrics ($P = .07$).

In our databases, time to surgery was defined by date of admission related to date of surgery. We found marginal but significant increase in surgery delay after orthogeriatrics. The BMIs for patients in the control group were 22.7 (95% CI = 22.4-22.9) and 22.7 (95% CI = 22.4-22.9, $P = 1.0$) in the intervention group. See Table 2 for baseline characteristics.

The ASA score in the control group was significantly lower than that in the intervention group ($P < .0001$). In the intervention group, 43.9% of the patients had ASA ≥ 3 while only 33.1% had ASA ≥ 3 in the control group. There were more intertrochanteric and subtrochanteric fractures in the intervention group than in the control group, where most of the fractures were intracapsular. We did not find any significant change in the type of surgery for the specific fracture types over time (Table 2).

A univariate analysis including all patients showed that inhospital mortality was 6.3% in the control group and 3.1% in the intervention group ($P = .0009$). Mortality 1 month after fracture was 12.5% in the control group and 10.5% in the intervention group ($P = .1$). Ninety-day mortality was 21.8% before orthogeriatrics and 18.8% after orthogeriatrics ($P = .1$). One-year mortality before orthogeriatrics was 31.6% and 29.3% after the implementation of orthogeriatrics ($P = .3$), see Table 3.

A multivariate analysis correcting for age, gender, and ASA score shows significantly reduced mortality as well inhospital (OR 0.35), as after 30 (OR 0.66) and 90 days (OR 0.72) and 1-year (OR 0.79; Table 4).

Our secondary outcome is mortality for nursing home inhabitants and home-dwelling patients. For home-dwelling patients, using a univariate analysis, we found significantly reduced mortality inhospital (8.3-2.0%, $P < .0001$), after 30

Table I. Differences in Interventions Before and After Orthogeriatrics at Bispebjerg Hospital, Denmark.

	Before Orthogeriatrics	After orthogeriatrics
ED		
Healthcare Provider	Junior Doctor	Specially Educated Nurse
Pain treatment	Femoral nerve catheter block with a bolus injection of 20 mL bupivacaine 5 mg/mL by the anesthesiologist. Maintenance dose 20 mL bupivacaine 2.5 mg/mL 4 times a day. One gram paracetamol \times 4/day and eventually 400 mg ibuprofen \times 3/day. When necessary intravenous morphine.	The femoral nerve catheter block changed to a "single shot" femoral nerve catheter block with 15 mL robivacain 7.5 mg/mL later on in the intervention period. One gram paracetamol \times 4/day and intravenous morphine. Later on epidural catheter by anesthesiologist.
Preoperative blood samples	Were taken	Including creatinine, hemoglobin, WBC counts, vitamin D status, coagulation status, thyroid counts, and hepatic parameters.
Fluid therapy	Planned by anesthesiologist	Patients had an intravenous access routinely. One liter of NaCl IV were initiated by treating nurse.
Oxygen therapy	Two liters per minute through a nasal catheter when resting and during the first 4 nights.	Routinely by nurse.
Electrocardiogram	Were taken if necessary	Routinely by nurse.
Chest X-ray	Decided by the anesthesiologist, only if patients were >65 years.	All patients >60 years and patients with known pulmonary or cardiac disease.
Bladder scan	–	Routinely by nurse and eventually intermittent catheterization. Urine sample sent to cultivation if the urine dipstick was positive.
Pressure ulcers	–	Nurses positioned patients preventing ulcers at special mattresses.
Orthogeriatric unit/orthopedic ward		
Unit	Patients were admitted to standard orthopedic unit	Half of the patients were admitted to orthogeriatric unit where they received CGS. The rest of the patients admitted to a conventional orthopedic unit.
Geriatrician	No geriatric service	Employed directly in the orthogeriatric unit.
Primary prescriptions	LMWH, laxatives, multivitamins, and paracetamol	PPI, vitamin D and calcium supplements, LMWH, laxatives, multivitamins, and paracetamol.
Nursing	–	Systematized observations and predefined algorithms for interventions, delirium care plan, and assessment of premonitory functional status. Focused intervention on nutrition, constipation, urination, blood sample results, mobilization, wound care, discharge planning, contact to family, and social coordinator.
Nutrition	Assessment of nutritional status	Early fluid therapy and focus on nutrition with complementary supplements.
Urinary retention	The first urinary retention resulted in a single catheterization and the second in continuous catheterization.	Fixed bladder scans minimum 4 times a day and sterile disposable catheterization when needed (>200 mL).
Discharge	With a rehabilitation plan and relevant pain treatment, hopefully within 5 days.	Discharge planning in a multidisciplinary team after CGS after weekly conferences, individualized medical adjustments, and diet plan.

Abbreviations: ED, emergency department; WBC, white blood cell; NaCl, sodium chloride; CGS, comprehensive geriatric service.

(12.2-6.8%, $P = .004$), and 90 days (20.5-13.0%, $P = .002$; Table 5). One-year mortality was not significant. Patients from nursing homes had no significant decreasing mortality at any point of time in the univariate analysis (Table 6).

Discussion

The differences in organization of orthogeriatrics are caused by discrepancies in national health care systems and the local

facilities. In the United Kingdom, orthogeriatrics is a prerequisite for achieving maximum reimbursement from the public health system.²⁰

Kammerlander et al have compared 4 different models of orthogeriatric service: (1) orthopedic ward and geriatric consultant service on request, (2) orthopedic ward and daily geriatric consultative service, (3) geriatric and rehabilitation ward and orthopedic consultant service, and (4) orthopedic ward and integrated care. Model 4 is the most sophisticated model where

Table 2. Baseline Characteristics Before and After Orthogeriatrics at Bispebjerg Hospital, Denmark.

n	Before Orthogeriatrics 989	After Orthogeriatrics 993	P Value na
Gender (n, [%], female)]	711 (71.9%)	704 (70.9%)	.6
Age (years, mean [95% CI])	80.9 [80.1-81.6]	80.2 [79.4-80.9]	.2
ASA (n [%])			<.0001
1	71 (7.2%)	74 (7.5%)	
2	540 (54.6%)	445 (44.8%)	
3	310 (31.3%)	404 (40.7%)	
≥4	18 (1.8%)	32 (3.2%)	
Missing data	50 (5.1%)	38 (3.8%)	
BMI (mean [95% CI])	22.7 [22.4-22.9]	22.7 [22.4-22.9]	1.0
LOS (days, mean [95% CI])	12.8 [12.1-13.5]	12.1 [11.6-12.6]	.07
Time to surgery (% [n])			.01
Surgery at the same day as admission	17.5% (173)	18.6% (183)	
Surgery at the day after admission	55.6% (549)	49.3% (486)	
Surgery 2 days after admission or later	26.9% (265)	32.1% (316)	
Missing data	(2)	(8)	
Fracture type (n [%])			.005
Intracapsular	537 (54.3%)	470 (47.3%)	
Intertrochanteric	349 (35.3%)	396 (39.9%)	
Subtrochanteric	52 (5.3%)	78 (7.9%)	
Missing data	51 (5.2%)	49 (4.9%)	
Type of surgery (n, %)			.3
Screws	170 (17.2%)	163 (16.4%)	
Hemiarthroplasty	275 (27.8%)	255 (25.7%)	
Dynamic hip screw	136 (13.8%)	166 (16.7%)	
Intramedullary nail	343 (34.7%)	341 (34.3%)	
Total hip arthroplasty	12 (1.2%)	19 (1.9%)	
Girdle stone	2 (0.2%)	0 (0.0%)	
Missing data	51 (5.2%)	49 (4.9%)	

Abbreviation: CI: confidence interval.

Table 3. Mortality Inhospital, After 30 Days, 90 Days, and 1-year.^{a,b}

	Before	After	P Value
Inhospital	62/989 (6.3%)	31/993 (3.1%)	.0009
30 day	124/989 (12.5%)	101/993 (10.2%)	.1
90 day	216/989 (21.8%)	187/993 (18.8%)	.1
1 year	312/989 (31.6%)	291/993 (29.3%)	.3

^aIncluding all patients.

^bDifferences were tested using Pearson χ^2 statistics.

the orthopedic surgeon and the geriatrician manage the patient together from admission until discharge. This model with coordinated multidisciplinary care has demonstrated a great influence on improving outcome in fragile patients with fracture.⁹

Table 4. Multivariate Analysis (Logistic Regression for Inhospital Mortality and Cox Regression for 30 Days, 90 Days, and 1-Year Mortality of All Patients Correcting for Age, Gender, and ASA Score After Orthogeriatrics.

Mortality	OR/HR	Lower 95% CI	Higher 95% CI	P Value
Inhospital (OR)	0.35	0.22	0.58	<.0001
30 day (HR)	0.66	0.50	0.87	.003
90 day (HR)	0.72	0.59	0.89	.002
1 year (HR)	0.79	0.67	0.94	.006

Abbreviation: OR, odds ratio; CI, confidence interval; HR, hazard ratio.

Table 5. Mortality of Home-Dwelling Patients Before and After Orthogeriatrics.^a

	Before	After	P Value
Inhospital	25/303 (8.3%)	14/710 (2.0%)	<.0001
30 day	37/303 (12.2%)	48/710 (6.8%)	.004
90 day	62/303 (20.5%)	92/710 (13.0%)	.002
1 year	82/303 (27.1%)	157/710 (22.1%)	.09

^aDifferences were tested using Pearson χ^2 statistics.

Table 6. Mortality Before and After Orthogeriatrics for Patients Admitted From Nursing Homes or Rehabilitation.^a

	Before	After	P Value
Inhospital	7/78 (9.0%)	15/218 (6.9%)	.5
30 day	20/78 (25.6%)	47/218 (21.6%)	.5
90 day	27/78 (34.6%)	85/218 (39.0%)	.5
1 year	38/78 (48.7%)	114/218 (52.3%)	.6

^aDifferences were tested using Pearson χ^2 statistics.

Earlier studies have shown that none of the geriatric interventions can reduce mortality on their own; the interdisciplinary teamwork is very important.²¹

Furthermore, a randomized controlled trial in Trondheim, Norway, has compared physical behavior and functional outcome during the first postoperative days for home-dwelling patients with hip fracture older than 70 years managed with comprehensive geriatric care (CGC) and for those managed with orthopedic care (OC). The authors found that patients treated with CGC compared to OC spent more time upright and had better lower limb function shortly after surgery, despite no difference in need for assistance during ambulation.^{18,22}

In Denmark, there is no option of receiving intermediate care for rehabilitation. The length of stay includes waiting time for rehabilitation, which is the municipalities' responsibility. The individual municipalities participating in this program faced varying budgets over time, thus complicating comparative statistics based on the length of stay.

Applying univariate analysis in our study, in-hospital mortality decreased significantly for all patients despite only 50% of the total group being directly admitted to the orthogeriatric ward. For all home-dwelling patients, 30- and 90-day mortality also decreased significantly.

Our data show significantly increasing ASA scores over time reflecting increasing frailty and comorbidity among the patients with hip fracture. We have noticed that the anesthesiologists during the last years prefer daytime surgery for the most frail and comorbid patients. We have shown that despite higher ASA score and a higher rate of inter- and subtrochanteric fracture types after orthogeriatrics, mortality decreased in our population. When adjusting for age, gender, and ASA score in a multivariate analysis, we find significant reduction in mortality for all patients at 30 days, 90 days, and 1 year.

Especially home-dwelling patients benefit from comprehensive geriatric assessment and intervention, and it appears that chronic disease has a greater reversibility when patients are home dwelling. This is in concordance with earlier published data.

In Denmark, nursing home residents have an increasingly high comorbidity, high age, and increasing mortality. Severe dementia is present among 50% to 80% of the population, mean age when admitted is 84 years (Statistics Denmark and Ministry of Health). During the last 10 years, resources for skilled care have decreased in nursing homes and rehabilitation facilities and increased skilled staffing is needed due to increasing comorbidity.

Our population after orthogeriatrics consists of 23% (218/928) nursing home residents. In our study, we were not able to show significantly improved survival rates for nursing home residents. Recent publications have shown increased acute mortality for nursing home residents admitted with hip fracture,^{23,24} both studies with a lower proportion of nursing home residents than in our study.

There has been a tradition to discharge nursing home residents early, but the increasing comorbidity among these patients and decreasing skills at the step down facilities call for a change in management for these weak patients.

The geriatricians were responsible for implementing the new pathway for all patients with hip fracture. Orthogeriatric intervention has systematized care for the most ill patients and has had an effect on our entire population although the geriatricians personally only saw about half of the patients. This might indicate an underestimation of the possible effects of orthogeriatric care given that we analyze data on the whole population with hip fracture.

Nurses now found themselves with both medical and orthopedic competencies and were trained to intervene in the treatment of the fragile geriatric patient. In this manner, there were more regular and better observations of patients' conditions and, as a consequence, a more rapid reaction when patients' conditions declined. Furthermore, there is always a medically competent doctor on hand during the day. As mentioned earlier, systematic training of young surgical doctors resulted in an increase of medical competencies during night time. The geriatricians participate in the orthopedic conferences and take part in decisions about the patients, thus providing an opportunity for all orthopedic surgeons to seek medical advice.

It is our experience that CGC resulted in increased referral of patients to other departments and specialities because of the patients' comorbidities. Other positive trends are improved interdisciplinary teamwork, general guidelines for observations, and better treatment of patients with delirium.

The strength of our study is that we present data based on all 1982 patients with hip fracture admitted from 2007 to 2011. Our control group is drawn from the same population, the same hospital, and the same surgical community as the intervention group; this homogeneity likely minimizes bias and confounding. Early surgery was already implemented in the control group, thus early surgery was not responsible for our improved outcome (Table 2). We have a high rate of retrieved data due to the Danish CRN. We have mortality data for all included patients. Our population is characterized by a lot of elderly patients with a high comorbidity, relatively low standard of living, and a large number of substance abusers.

To our knowledge, it is the first time that significantly increased 1-year survival rates after hip fracture has been shown when correcting for age, gender, and ASA score as a result of orthogeriatric comanagement.²⁵

The weakness of our study is that we present a retrospective study in which we compare with a historical cohort. This increases the risk of bias in terms of time trends. We also use ASA score to represent comorbidity.

Recently, a definition of a standard set of outcome parameters for orthogeriatric intervention has been proposed. They might be used for evaluation and comparison research studies of different models of orthogeriatric comanagement used for treatment of patients with hip fracture. These parameters include length of hospital stay, mortality, time to surgery, complications both medical and surgical, 30-day readmission rate, mobility, quality of life, pain levels, adverse drug reactions, activities of daily living, place of discharge postoperatively, and cost of care.^{26,19} New studies in the field of orthogeriatrics should use these parameters to compare outcome for frail patients.

Conclusion

In our population with hip fracture, we have shown significant decrease in inhospital, 30-day, 90-day, and 1-year mortality after implementation of orthogeriatric service when correcting for age, gender, and ASA score despite only 50% of the population receiving geriatric assessment.

Our results reflect incremental improvement due to the addition of a geriatric assessment since our department had implemented early surgery years ago.

We have good experience in upgrading surgical staff with medical competencies and consider this very important in the future of orthopedics with increasing comorbidity among the patients.

Future trials should include frail patients with other fracture types who can benefit from orthogeriatrics and should include the above-mentioned parameters as recommended by Liem et al.²⁶

Declaration of Conflicting Interests

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