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Effect of comorbidities and postoperative complications on mortality after hip fracture in elderly people: prospective observational cohort study

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Abstract

Objectives To evaluate postoperative medical complications and the association between these complications and mortality at 30 days and one year after surgery for hip fracture and to examine the association between preoperative comorbidity and the risk of postoperative complications and mortality.
Design Prospective observational cohort study.
Setting University teaching hospital.
Participants 2448 consecutive patients admitted with an acute hip fracture over a four year period. We excluded 358 patients: all those aged <60; those with periprosthetic fractures, pathological fractures, and fractures treated without surgery; and patients who died before surgery.
Interventions Routine care for hip fractures.
Main outcome measures Postoperative complications and mortality at 30 days and one year.
Results Mortality was 9.6% at 30 days and 33% at one year. The most common postoperative complications were chest infection (9%) and heart failure (5%). In patients who developed postoperative heart failure mortality was 65% at 30 days (hazard ratio 16.1, 95% confidence interval 12.2 to 21.3). Of these patients, 92% were dead by one year (11.3, 9.1 to 14.0). In patients who developed a postoperative chest infection mortality at 30 days was 43% (8.5, 6.6 to 11.1). Significant preoperative variables for increased mortality at 30 days included the presence of three or more comorbidities (2.5, 1.6 to 3.9), respiratory disease (1.8, 1.3 to 2.5), and malignancy (1.5, 1.01 to 2.3).
Conclusions In elderly people with hip fracture, the presence of three or more comorbidities is the strongest preoperative risk factor. Chest infection and heart failure are the most common postoperative complications and lead to increased mortality. These groups offer a clear target for specialist medical assessment.

Introduction

Hip fractures related to osteoporosis constitute a major clinical and financial burden to the NHS. Excess mortality after hip fracture is 20% in the first year and is higher in older men.[1 2] The high mortality, particularly in the first three months, is probably due to the combination of trauma, major surgery in elderly people with concurrent medical problems,[1] and a low physiological reserve. We investigated how demographic factors and important medical conditions influence postoperative outcomes following hip replacement.

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Table 1 Age and sex distribution (% in age group)

Age (years)	Total (%)	Women (%)	Men (%)
60-69	196 (8)	118 (64)	66 (36)
70-79	661 (27)	510 (76)	160 (24)
80-89	1126 (46)	910 (81)	208 (19)
≥90	465 (19)	417 (88)	59 (12)
Total	2448	1955 (80)	493 (20)

Patients and methods

We prospectively evaluated all patients admitted to the university hospital with a hip fracture from 8 May 1999 to 7 May 2003. Follow-up ended on 7 June 2003.

We diagnosed complications clinically or after investigations and recorded them prospectively until the time of hospital discharge. We excluded patients with simultaneous bilateral fractures (n=6), periprosthetic fractures (n=25), and pathological fractures (n=63), and patients <60 years (n=165), those dying before a decision to treat was made (n=20), and those treated without an operation (n=79) (see bmj.com for details).

Statistical methods

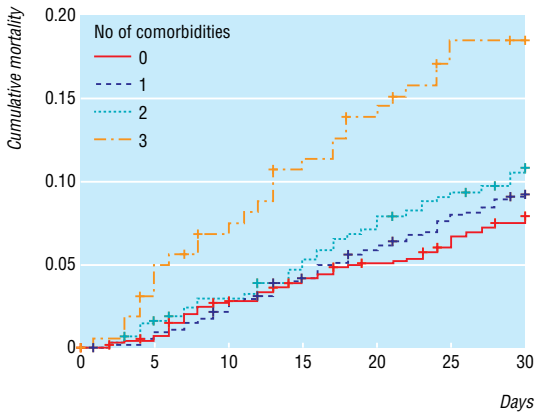
We analysed postoperative complications and mortality at 30 days and one year. We used univariate Cox regression analysis to evaluate the crude effect of comorbidities and complications on mortality. Multivariate Cox regression analysis allowed adjustment for age, sex, and confounding variables (for details of statistical analysis see bmj.com).

Results

Demographics

Over the four year period 2806 patients were admitted with a hip fracture. We excluded 358, leaving 2448 patients within the study. The mean age was 82 years (range 60-103 years), and 80% (1955) were women (table 1).

Comorbidities—Forty one per cent (1011) had no comorbidity; 35% had one, 17% had two, and 7% had three or more comorbidities. The most common were cardiovascular disease (24%), chronic obstructive airways disease (14%), and cerebrovascular disease (13%).



Survival analysis based on number of preoperative comorbidities

Postoperative complications—Twenty per cent of patients (498/2448) had a postoperative complication. The complication rate was 14% (147/1011) for patients with no comorbidity on admission. The most common complications were chest infection (9%, 215/2448), heart failure (5%, 119/2448), and urinary tract infection (4%, 98/2448). There were 35 cerebrovascular events and 25 myocardial infarctions.

Mortality—Mortality was 9.6% at 30 days (n=231) and 33% at one year (n=747). Mortality at 30 days was 8.2% (n=158) in women and 15% (n=73) in men, a significant difference (log rank test 20.91, P<0.01). In patients with postoperative heart failure the mortality was 65% at 30 days (n=77/119) (hazard ratio 8.0, 95% confidence interval 5.5 to 11.6). At one year the mortality was 92% (n=109/119) (5.0, 3.9 to 6.5). In patients who developed a postoperative chest infection the mortality was 43% (n=92/215) (3.0, 2.1 to 4.2) at 30 days and 71% (n=153/215) (2.4, 1.9 to 3.0) at one year. Forty two patients (1.7%) developed deep vein thrombosis or pulmonary embolus despite receiving prophylactic low molecular weight heparin. In these patients the hazard ratio was 4.5 (2.7 to 7.6) for mortality at 30 days.

Preoperative risk factors for mortality

After adjustment for age and sex, patients with three or more comorbidities had a hazard ratio for death at 30 days of 2.5 (1.6 to 3.9) (figure). Significant factors for increased mortality at 30 days include number of comorbidities present on admission, patients with three or more comorbidities being at increased risk compared with those with none (hazard ratio 2.5, 1.6 to 3.9), male sex (1.2, 1.5 to 2.6), respiratory disease (1.8, 1.3 to 2.5), and renal disease (2.0, 1.2 to 3.5). Increasing age was also a significant factor.

Preoperative risk factors for postoperative complications

Chest infection—Respiratory disease (odds ratio 2.7, 1.9 to 3.8), male sex (2.0, 1.5 to 2.8), enteral steroids (2.5, 1.2 to 5.2), and greater age were all important risk factors for developing a chest infection after surgery for hip fracture. Interestingly, in our patients smoking was not a significant risk factor (P=0.098, table 2).

Cardiac failure—Age ≥90 years compared with younger (4.1, 1.5 to 10.9), male sex (1.8, 1.2 to 2.8), and a history of cardiovascular disease (2.3, 1.6 to 3.4) were all significant risks for developing postoperative heart failure. Patients with two or three or more comorbidities on admission had an increased risk of developing postoperative heart failure compared with those with no comorbidity (2.0, 1.2 to 3.5, and 4.6, 2.5 to 8.3, respectively). Patients with previous stroke were at increased risk of a second stroke in the postoperative period (4.7, 2.3 to 9.5).

Discussion

Our study confirms that heart failure and chest infection are major postoperative complications in elderly patients undergoing surgery for hip fracture.[3,4] Postoperative mortality was high in patients who developed acute heart failure or chest infection. In the 30 days after surgery, 13% (334) of our patients

Table 2 Multivariate logistic regression analysis of effect of all preoperative variables on incidence of postoperative chest infection and cardiac failure. Figures are odds ratios (95% confidence intervals)

	Chest infection	Cardiac failure
Male sex	2.0 (1.5 to 2.8)**	1.8 (1.2 to 2.8)*
Age (years)†:		
60-69	1	1
70-79	1.5 (0.7 to 3.0)	1.2 (0.4 to 3.2)
80-89	2.1 (1.1 to 4.3)	2.2 (0.8 to 5.6)
≥90	4.0 (1.9 to 8.3)	4.1 (1.5 to 10.9)
Comorbidities		
Cardiovascular disease	1.3 (0.9 to 1.7)	2.3 (1.6 to 3.4)**
Respiratory disease	2.7 (1.9 to 3.8)**	1.3 (0.8 to 2.2)
Stroke	1.5 (1.0 to 2.2)*	1.6 (1.0 to 2.6)
Rheumatoid disease	0.8 (0.3 to 2.0)	2.0 (0.9 to 4.6)
Malignancy	1.1 (0.6 to 1.8)	0.8 (0.4 to 1.8)
Renal disease	2.3 (1.2 to 4.3)*	1.6 (0.7 to 3.6)
Diabetes	1.3 (0.8 to 2.0)	1.7 (1.0 to 2.9)
Parkinson's disease	1.9 (1.0 to 3.6)*	1.2 (0.5 to 3.1)
Paget's disease	1.8 (0.4 to 8.4)	0 (0 to ∞)
Enteral steroids	2.5 (1.2 to 5.2)*	1.5 (0.5 to 4.4)
Current smokers	1.5 (0.9 to 2.3)	1.2 (0.6 to 2.4)

*P<0.05; **P<0.01.
†P<0.01 for chest infection and cardiac failure.

developed one of these complications yet they accounted for 73% (169) of the deaths. Cardiovascular disease and chronic lung disease predispose patients to the most common and serious postoperative complications.

Management of high risk patients

To reduce mortality, attention must focus on optimising health status preoperatively, preventing postoperative complications, and, when these complications develop, providing optimal specialist medical care. No study has specifically examined high risk patients who may have most to gain from more specialised medical care. Interventions by physicians related to rehabilitation, rather than acute medical assessment, have not shown a significant difference in early mortality. The Royal College of Physicians recommended medical assessment of patients with hip fracture to reduce their operative risk,[5] but specialist medical assessment and management of elderly patients with hip fracture before and after surgery remains uncommon in the United Kingdom.

Persistent hypoxia may be present in all patients with hip fracture from the time of admission until up to five days postoperatively,[6] and episodes of myocardial ischaemia occur in postoperative patients with known ischaemic heart disease.[7] Measures such as higher triggers for transfusion and monitoring oxygen saturation and arterial blood gases before and after surgery may help reduce complications.

Invasive physiological monitoring with oesophageal Doppler ultrasonography or pulmonary artery catheters in the perioperative period may be of benefit[8] by optimising cardiac output and reducing postoperative cardiac failure in vulnerable patients.

Limitations of the study

It was not possible to have diagnostic criteria driven by protocol, and treatment for each comorbidity and more accurate premorbid data would have been useful—for example, echocardiography to assess the degree of heart failure or lung function tests to define the severity of lung disease. The study was observational and did not look at different systems of care for these patients.

What is already known on this topic

Mortality is high after surgery for hip fracture in elderly patients

Postoperative complications are associated with a poor outcome

What this study adds

Patients with multiple comorbidities, especially respiratory disease and malignancy, before surgery for hip fracture are at higher risk of mortality

Postoperative complications, such as chest infection and heart failure, are also associated with increased mortality

Conclusions

Nine out of 100 elderly patients with hip fracture in our series died within one month of the event. A fifth of patients had a postoperative complication, the most common being chest infection and heart failure. Age, male sex, and the presence of three or more comorbidities on admission all predicted a high risk of complications. Further studies are required to evaluate different systems of medical care to establish whether these can reduce the incidence and severity of these complications.

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