Psychiatric illness predicts poor outcome after surgery for hip fracture: a prospective cohort study

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ABSTRACT

Background. Hip fracture is common in the elderly. Previous studies suggest that psychiatric illness is common and predicts poor outcome, but have methodological weaknesses. Further studies are required to address this important issue.

Methods. We prospectively recruited 731 elderly participants with hip fracture in two Leeds hospitals. Psychiatric diagnosis was made within 5 days of surgery using the Geriatric Mental State schedule and other standardized instruments, and data on confounding factors was collected. Main study outcomes were length of hospital stay, and mortality over 6 months after fracture.

Results. Fifty-five per cent of participants had cognitive impairment (dementia in 40% and delirium in 15%), 13% had a depressive disorder, 2% had alcohol misuse and 2% had other psychiatric diagnoses. Participants were likely to remain in hospital longer if they suffered from dementia, delirium or depression. The relative risks of mortality over 6 months after hip fracture were increased in dementia and delirium, but not in depression.

Conclusions. Psychiatric illness is common after hip fracture, and has significant effects on important outcomes. This suggests a need for randomized, controlled trials of psychiatric interventions in the elderly hip fracture population.

INTRODUCTION

Fracture of the hip in elderly people is a significant issue. Mortality in the first year after hip fracture is 12–20% (Hempsall *et al.* 1990), and surviving patients suffer impaired quality of life and persistent physical morbidity (Laxton *et al.* 1997). Rates of institutionalization are high (Marottoli *et al.* 1994) and there is an additional burden on carers (Quine *et al.* 1994). The exponential increase in hip fracture rate with age in an ageing population (Shaw, 1993) will result in increased costs to care systems (Schroder, 1991; Cox *et al.* 1993).

In common with many other general hospital settings the elderly hip fracture population has high reported rates of psychiatric illness.

Prevalences of 9–47% for depression and 31–88% for cognitive impairment are described (Williams *et al.* 1985*a, b*; Billig *et al.* 1986; Berggren *et al.* 1987; Gustafson *et al.* 1988; Brannstrom *et al.* 1989; Lyons *et al.* 1989; Magaziner *et al.* 1990; Strain *et al.* 1991; Shamash *et al.* 1992; Parker & Palmer, 1993; de Jaeger *et al.* 1994; Withey *et al.* 1995; Holmes,1996; Shepherd & Prescott, 1996). Such wide ranges in prevalence are probably due to differing sampling techniques, timing of interviews and diagnostic instruments used. Unfortunately, not all studies have considered the prevalence of a range of psychiatric diagnoses, and none has differentiated between delirium and dementia, two conditions with differing aetiologies and prognoses.

Accurate prevalence rates for psychiatric illnesses are important, since psychiatric morbidity may account for some of the variability in outcomes (Saravay & Lavin, 1994). Unfortu-

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nately, previous outcome studies in hip fracture have not used standardized diagnostic instruments to detect the full range of psychiatric illness, have failed to deal adequately with confounding factors, have used inappropriate statistical techniques or have been too small to demonstrate important effects. For these reasons, we have undertaken the present study.

METHOD

Setting

Leeds is a city with typical hip fracture incidence rates. Hip fractures occurring in the city are brought to one of two teaching hospitals, neither of which has a dedicated hip fracture service. In one hospital there is a weekly liaison visit from a consultant geriatrician, whereas the other hospital has no formal ortho-geriatric collaboration. Psychiatric input is on a consultation basis only. Local ethical committee approval was obtained for the study.

Sample

All patients of 65 years or more were included in the study if they had been admitted to an orthopaedic ward in either of two Leeds hospitals, and had subsequently undergone surgery for hip fracture. Potential participants were excluded for the following reasons: no informed consent (from patient or relative); too physically unwell to undergo a psychiatric interview; severe deafness; severe dysphasia; no English language; and, being discharged or dying before an interview was performed.

Sample size was calculated to detect an increase in mortality from 15 % in the well population to 25 % in the depressed, assuming a power of 0·9 and a significance level of 0·05. This suggested 330 participants per group were needed, and as the depressed and well were estimated to make up approximately half the eligible population, we aimed for a sample size of at least 660.

Measures

Psychiatric illness was detected using the community version of the Geriatric Mental State/AGECAT (Dewey & Copeland, 1986; Copeland & Dewey, 1991). The Standardized Mini-Mental State Examination (Folstein *et al*. 1975; Molloy

et al. 1991) and Delirium Rating Scale (Trzepacz *et al*. 1988) were administered to differentiate between delirium and dementia, and the CAGE questionnaire (Mayfield *et al*. 1974) and a record of alcohol intake were used to detect alcohol misuse. Psychiatric diagnosis was arrived at in a hierarchical manner to produce one diagnosis for each participant.

Also recorded were age, sex, fracture type and operation, anaesthetic technique, concurrent physical illness (using a researcher-rated modified Burvill scale (Burvill *et al*. 1990)), nutritional status (using serum albumin as indicator), pre-fracture activities of daily living (using the Barthel score, a guide to physical dependence (Mahoney & Barthel, 1965; Collin *et al*. 1988)), physical and psychotropic drugs at the time of admission, and the Super Profile measure of social deprivation (Brown & Batey, 1994). Data were collected within 5 days of surgery during a research interview undertaken by a psychiatrist or a psychiatric research nurse trained in the use of the Geriatric Mental State and other measures.

Outcome measures were length of stay, mortality, change in physical dependence at discharge and change in residence at discharge for those not already in residential care. Mortality data after discharge was obtained through contact with general practitioners to reduce any potential distress to bereaved relatives.

Statistical analysis

The lengths of stay and mortality in the 6 months after hip fracture of participants in different psychiatric diagnostic groups were compared using Cox Proportional Hazards models. Socio-demographic and physical factors, changes in physical dependence on discharge and placement on discharge in different diagnostic groups were compared using chi-squared and Kruskal–Wallis tests.

RESULTS

The sample

Between mid-October 1995 and mid-May 1997, 903 patients aged ≥ 65 years were admitted to orthopaedic wards in Leeds with hip fracture. Of these, 78 (8·6 %) refused consent, 41 (4·5 %) were too ill to interview, 19 (2·1 %) were too deaf to interview, 14 (1·6 %) died before they could

Table 1. *Sociodemographic and physical factors and outcome measures for different psychiatric conditions in 731 participants*

Participants	All $N = 731$	Well $N = 208$	Dementia $N = 294$	Delirium $N = 108$	Depression $N = 93$	Other $N = 28$	
Psychiatric diagnosis							
Age							
Mean years	82·1	78·5	84·6	83·9	81·5	77·0	
95% CI	81·5 to 82·6	77·4 to 79·5	83·8 to 85·3	82·7 to 85·2	79·9 to 83·0	74·1 to 80·0	
95% CI of difference			−7·3 to −4·8	−7·1 to −3·8	−4·8 to −1·1	−1·9 to 4·5	
Sex, N (%)							$\chi^2 = 306·06$
Male	129 (17·6)	49 (23·6)	44 (15·0)	22 (20·4)	8 (8·6)	6 (21·4)	$P < 0·001$
Female	602 (82·4)	159 (76·4)	250 (85·0)	86 (79·6)	85 (91·4)	22 (78·6)	
Hospital, N (%)							$\chi^2 = 0·603$
LGI	355 (48·6)	109 (52·4)	130 (44·2)	53 (49·1)	50 (53·8)	13 (46·4)	$P = 0·44$
SJUH	376 (51·4)	99 (47·6)	164 (55·8)	55 (51·9)	43 (46·2)	15 (53·6)	
Residence, N (%)							$\chi^2 = 316·47$
Alone	339 (46·4)	117 (56·3)	103 (35·0)	57 (52·8)	48 (51·6)	14 (50·0)	$P < 0·001$
Spouse/family	210 (28·7)	81 (38·9)	64 (21·8)	25 (23·1)	27 (29·0)	13 (46·4)	
Residential	180 (24·6)	9 (4·3)	127 (43·2)	26 (24·1)	18 (19·4)	0	
Other	2 (0·3)	1 (0·5)	0	0	0	1 (3·4)	
Social deprivation, N (%)							$\chi^2 = 142·26$
Low	193 (26·4)	71 (34·1)	75 (25·5)	19 (17·6)	26 (28·0)	2 (7·1)	$P < 0·001$
Medium	202 (27·6)	47 (22·6)	87 (29·6)	35 (32·4)	22 (23·7)	11 (39·3)	
High	280 (38·3)	80 (38·5)	104 (35·4)	42 (38·9)	39 (41·9)	15 (53·6)	
Unknown	56 (7·7)	10 (4·8)	28 (9·5)	12 (11·1)	6 (5·6)	0	
Barthel score, Median (IQR)							
Admission	19 (16 to 20)	20 (20 to 20)	17 (12 to 20)	19 (15 to 19)	20 (17 to 20)	20 (20 to 20)	Kruskal–Wallis $\chi^2 = 169·21$ $P < 0·001$
Reduction on discharge	0 (0 to 2)	0 (0 to 1)	1 (0 to 2)	1 (0 to 3)	0 (0 to 2)	0 (0 to 2)	Kruskal–Wallis $\chi^2 = 33·92$ $P < 0·001$
Physical illness, N (%)							$\chi^2 = 252·78$
None	146 (20·0)	38 (18·3)	62 (21·1)	21 (19·4)	19 (20·4)	6 (21·4)	$P < 0·001$
Mild	322 (44·0)	102 (49·0)	121 (41·2)	40 (37·0)	43 (46·2)	16 (57·1)	
Moderate	232 (31·7)	61 (29·3)	101 (34·4)	39 (36·1)	26 (28·0)	5 (17·9)	
Severe	31 (4·2)	7 (3·4)	10 (4·8)	8 (7·4)	5 (5·4)	1 (3·6)	
Physical drugs							
Median	3	2	3	2	3	2	Kruskal–Wallis $\chi^2 = 6·45$ $P = 0·17$
Psychotropic drugs, N (%)							
None	488 (66·8)	175 (84·1)	172 (58·5)	65 (60·2)	56 (60·2)	20 (71·4)	
Antidepressant	117 (16·0)	13 (6·3)	53 (18·0)	20 (18·5)	24 (18·5)	5 (17·9)	
Antipsychotic	59 (8·1)	0	47 (16·0)	9 (16·0)	5 (8·3)	0	
Benzodiazepine	120 (16·4)	26 (12·5)	45 (15·3)	25 (23·1)	21 (22·6)	3 (10·7)	
Length of stay							
Median days (IQR)	23 (12 to 47)	17 (12 to 28)	27 (12 to 60)	27 (13 to 60)	28 (15 to 47·5)	19 (10 to 32)	

LGI, Leeds General Infirmary; SJUH, St James's University Hospital.
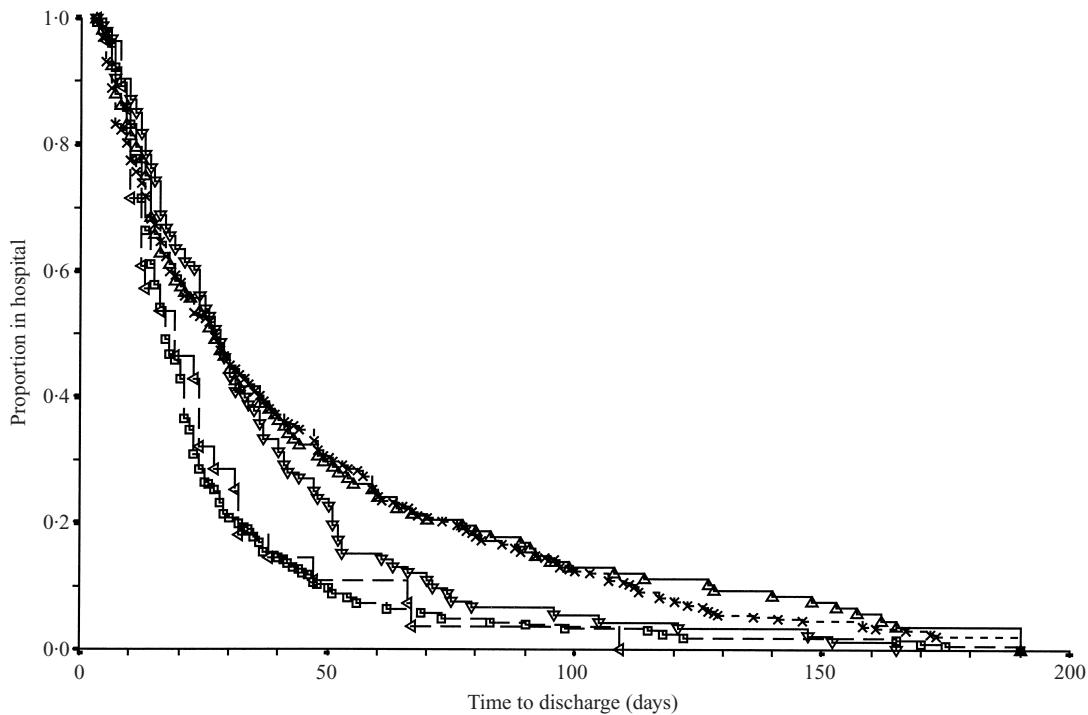
FIG. 1. The effect of psychiatric illness on length of hospital stay after hip fracture surgery. (Psychiatric status: ◁——◁, Other $N = 28$; ▽——▽, Depression $N = 93$; △——△, Delirium $N = 108$; ×——×, Dementia $N = 294$; ☐——☐, Well $N = 208$.)

be seen, 10 (1·1%) did not undergo surgery, eight were dysphasic, one spoke no English and one was transferred early to another hospital. One hundred and seventy-two potential participants were excluded leaving a sample size of 731, 78·6% of the total.

The mean age of the participants was 82·1 years (S.D. 7·7, range 65–99), with 602 females and 129 males. Three hundred and fifty-five participants were seen at the General Infirmary at Leeds and 376 at St James's University Hospital.

Physical status during admission

Three hundred and seven participants had an inter-trochanteric fracture, 292 a subcapital fracture, 94 an intracapsular fracture and 38 another fracture type. Three hundred and fourteen underwent insertion of a dynamic hip screw, 269 an Austin–Moore prosthesis, 67 a cannulated hip screw, 46 a hemiarthroplasty and 35 another form of surgery. Most participants (549, 75%) underwent surgery within one day of admission, 650 (89%) within 2 days and 81 (11%) at ≥ 3 days. General anaesthesia was

used in 520 participants, with 205 having a spinal anaesthetic and six a local anaesthetic.

Concurrent physical illness was common: only 146 participants (20%) were rated as well, 322 (44%) had mild illness, 232 (32%) moderate illness and 31 (4%) severe physical illness. In 245 participants serum albumin was measured at admission; the mean was 34 g/l (S.D. 4·9). Use of drugs for physical illness was also common, with a median of three drugs (range 0–14); only 93 participants (13%) were not on medication for physical illness pre-fracture. Participants were generally physically independent, with a median pre-fracture Barthel score of 19 (range 0–20, inter-quartile range 16–20).

Social and psychiatric status at admission

Three hundred and thirty-nine participants (46%) lived alone, 208 (28%) with spouse or family, 176 (24%) in nursing or residential homes, six in psychiatric continuing care and two in religious communities. Psychotropic medication was taken on admission by 245 participants (34%), with some overlap: anti-depressants alone were being taken by 81;

Table 2. *Multifactorial analysis of relative risks over 6 months after hip fracture of discharge from hospital and mortality in 731 elderly patients*

Variable		Discharge		Mortality	
		Relative risk	95% CI	Relative risk	95% CI
Age	Per year	0·99	0·98 to 1·00	1·04	1·02 to 1·06
Sex *v.* male	Female	0·95	0·77 to 1·17	2·31	1·61 to 3·32
Fracture *v.* intertrochanteric	Subcapital	1·05	0·89 to 1·25	0·78	0·57 to 1·06
	Intracapsular	1·27	1·00 to 1·62	1·02	0·64 to 1·64
	Other	1·01	0·71 to 1·44	0·46	0·20 to 1·06
Living arrangements *v.* alone	Family	1·28	1·06 to 1·54	1·04	0·71 to 1·52
	Residential care	2·66	2·17 to 3·27	1·54	1·07 to 2·21
	Other	1·20	0·29 to 5·03	(No deaths)	
Social deprivation *v.* low	Medium	1·01	0·82 to 1·24	0·70	0·47 to 1·04
	High	0·89	0·74 to 1·08	1·20	0·84 to 1·73
	Unknown	1·33	0·97 to 1·82	0·50	0·27 to 0·93
Physical illness *v.* none	Mild	0·98	0·79 to 1·22	1·06	0·65 to 1·71
	Moderate	0·89	0·70 to 1·13	1·76	1·08 to 2·85
	Severe	1·12	0·74 to 1·70	3·54	1·88 to 6·67
Physical drugs *v.* none	1 to 3	0·95	0·74 to 1·22	1·90	1·03 to 3·51
	> 3	0·96	0·73 to 1·27	2·01	1·05 to 3·81
Albumin *v.* not done	Normal	1·22	0·95 to 1·56	0·58	0·33 to 1·03
	Low	0·81	0·64 to 1·03	0·85	0·56 to 1·29
Psychiatric diagnosls *v.* well	Dementia	0·47	0·38 to 0·58	2·57	1·65 to 4·01
	Delirium	0·53	0·41 to 0·68	2·88	1·76 to 4·72
	Depression	0·61	0·47 to 0·79	1·01	0·53 to 1·94
	Other	1·05	0·70 to 1·58	0·33	0·04 to 2·43

benzodiazepines alone by 77; antipsychotics alone by 39; benzodiazepine with antidepressant by 28; benzodiazepine with antipsychotic by 12; antidepressant with antipsychotic by five; and all three by three participants.

Psychiatric measures

At the time of interview between 2 and 5 days after surgery, 208 participants (28·5%) were psychiatrically well and 402 (55·0%) had cognitive impairment, with dementia in 294 (40·2%) and delirium in 108 (14·8%). Of the remainder, 93 (12·7%) had a depressive disorder, 12 (1·6%) had alcohol misuse and 16 (2·2%) had other psychiatric diagnoses (seven with anxiety disorder, four with schizophrenia, four with phobias and one with obsessional neurosis). There were no significant differences in prevalences of psychiatric illness between those assessed on different post-operative days. Table 1 shows the relation between psychiatric diagnosis and aspects of physical and social status.

Outcome of admission

Length of stay

The length of hospital stay for the whole sample ranged from three to 190 days (median 23 days), with 11 participants (1·5%) still in hospital at 6 months. The effect of psychiatric illness on length of stay is shown in Fig. 1. A Cox Proportional Hazards model revealed that the presence of dementia, delirium and depression each independently decreased the relative risk of being discharged sooner (i.e. increased the risk of remaining in hospital) during the 6 months following fracture, after adjustment for age, sex, hospital, fracture type, residence (as a proxy for activities of daily living skills), deprivation score, physical illness and physical drugs. Other psychiatric illnesses had no significant effect on the relative risk of discharge. Increased age had no effect. Those who lived with spouse or family or in residential care were more likely to be discharged sooner (see Table 2).
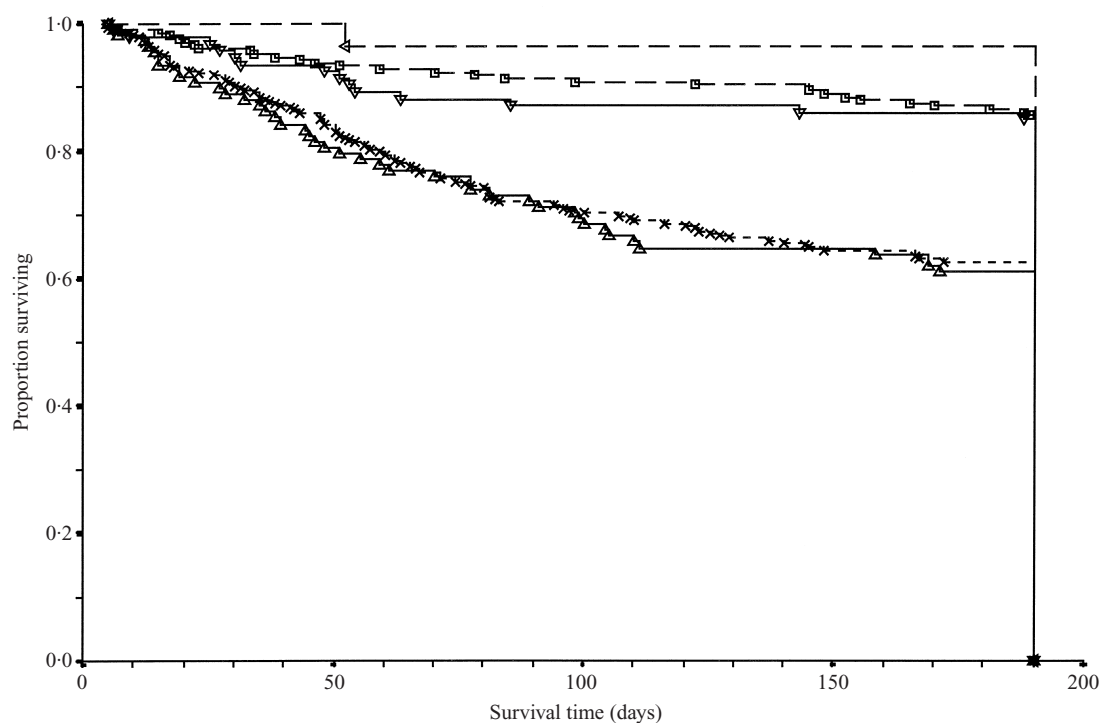
Fig. 2. The effect of psychiatric illness on survival after hip fracture surgery. (Psychiatric status: ◁——◁, Other $N = 28$; ▽——▽, Depression $N = 93$; △——△, Delirium $N = 108$; ×——×, Dementia $N = 294$; □——□, Well $N = 208$.)

Table 3. *The discharge destination of 465 participants admitted from non-residential settings and discharged alive*

| Psychiatric diagnosis | Discharge address | | | | Total |
| | Home | | Residential or nursing home | | |
	N	(%)	N	(%)	
Well	178	(97·8)	4	(2·2)	182
Dementia	76	(60·8)	49	(39·2)	125
Delirium	44	(69·8)	19	(30·2)	63
Depression	63	(92·6)	5	(7·4)	68
Other	25	(92·6)	2	(7·4)	27
Total	386		79		465

Pearson $\chi^2 = 124·97$, $P < 0·001$.

Mortality

At 6 months 195 (26·7%) of the total sample had died, with 96 participants (13·1%) dying in hospital. Survival data were available for all participants at 6 months. The effect of psychiatric illness on survival is shown in Fig. 2. A Cox Proportional Hazards model revealed that the presence of dementia and delirium each independently increased the relative risk of death during the 6 months after hip fracture, after adjustment for age, sex, hospital, fracture type, residence (as a proxy for activities of daily living skills), deprivation score, physical illness and physical drugs. The presence of depression or other psychiatric illnesses had no significant effect on survival at 6 months. The relative risk of death was also increased by increasing age, female sex, living in residential care, the presence of moderate or severe physical illness and the

consumption of drugs for physical illness prior to admission (see Table 2).

Physical dependence

Physical dependence, as measured by the Barthel score, increased at discharge in all groups. The presence of psychiatric illness significantly increased physical dependence, although the median decline in function was not great in any group (see Table 1). Increased physical dependence was significantly related to residence in institutional care.

Change in residence

Of those who left hospital, 513 (70·2%) were discharged to their previous residence, 79 (10·8%) who were previously independent went into care (63 (8·6%) in nursing home and 16 (2·2%) in residential home), 20 (2·7%) who were in residential homes went into nursing homes, six (0·8%) to convalescence and six (0·8%) to other destinations. In participants admitted from a non-institutional setting, the presence of dementia, delirium and depression all significantly increased the chance of discharge to a residential or nursing home (see Table 3).

DISCUSSION

We have demonstrated high rates of depression, dementia and delirium associated with hip fracture in the elderly, and we have found significant effects of psychiatric morbidity on several outcomes. The likelihood of discharge was decreased in the presence of dementia, delirium and depression, leading to increased length of stay. Survival in the 6 months after fracture was decreased in dementia and delirium, although not in depression. Poor survival in dementia and delirium confirms previous results but the lack of an effect for depression at six months contradicts other findings (Shamash *et al.* 1992), perhaps because we had a relatively short follow-up period. Levels of physical dependence at discharge also showed a small but significant increase in the presence of dementia, delirium and depression. For those previously living independently, the presence of depression, dementia and delirium also increased the likelihood of placement in residential care.

Our findings are based on a large sample, reducing the likelihood of their being obtained by chance. The sample was comprehensive and representative, with good recruitment and follow-up rates, to diminish the effects of bias. We adjusted for the effect of physical and psychosocial confounding factors in the analysis, using a proxy measure in the case of physical dependence because of concern over recall bias. The findings, therefore, support the suggestion that, in the elderly, dementia, delirium and depression identified early after surgery for hip fracture can predict poor outcomes. The outcomes studied include mortality and rate of discharge after hip fracture, both chosen by the NHS Executive as clinical performance indicators for acute hospital services (Performance Assessment Framework 1999).

These findings have important implications for clinical practice. Routine screening for cognitive impairment and depression is well tolerated by patients in this population (Shepherd & Prescott, 1996) and has been recommended (Royal College of Physicians of London 1989) but such screening rarely occurs and a large proportion of psychiatric illness is not identified in routine orthopaedic care. For example, one study in elderly hip fracture found that only half the cases of delirium identified by researchers were recognized by medical or nursing staff (Gustafson *et al.* 1991).

Lack of recognition clearly results in illness going untreated. However, even when psychiatric morbidity is identified, little or no further action may be taken (Brannstrom *et al.* 1989; Ashman 1998). For example, of the 93 participants identified as depressed in this study, only a quarter received antidepressants and none received any formal psychological intervention. Busy ward environments and lack of knowledge mean that psychiatric disorders may be inadequately investigated or treated with inappropriate drugs, which may themselves hamper rehabilitation. It is therefore likely that treatment opportunities are being missed, through failure to identify cases, through therapeutic passivity with known cases, or through lack of knowledge of appropriate treatments.

Up to the present, intervention trials in hip fracture have focused on the detection and treatment of physical illness through orthogeriatric liaison. They have been inconclusive; new models and further evaluations are needed (Cameron *et al.* 1999). One way in which the

care of patients with psychiatric illness in general hospitals might be improved is with the introduction of liaison psychiatry services. The results of trials of liaison psychiatry interventions in general medical settings have been mixed (Katon *et al*. 1992; Levenson *et al*. 1992; Gater *et al*. 1998; Levenson, 1998), but the results of some are encouraging. One American orthopaedic intervention study found a 2 day reduction in length of hospital-stay in the intervention group and an overall cost benefit when screening for the presence of psychiatric illness and referral to a liaison psychiatry service was compared to treatment as usual after hip fracture (Strain *et al*. 1991). Unfortunately, the intervention in this study was not well described and the result has not been replicated, so the model is difficult to generalize.

We believe that a service model worth evaluating would be based on a screening programme carried out by psychiatric staff working on the orthopaedic ward, with identified cases offered treatment defined by standardized protocols. While awaiting such a trial, we think it is reasonable to recommend screening for psychiatric illness after hip fracture, followed by the investigation and treatment of what can be easily managed within the orthopaedic team and psychiatric referral where specialist assessment or treatment is needed.

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