11. Walker MP, Ayre GA, Cummings JL *et al*. The Clinician Assessment of Fluctuation and the One Day Fluctuation Assessment Scale. Two methods to assess fluctuating confusion in dementia. Br J Psychiatry 2000; 177: 252–6.
12. Alexopoulos GS, Abrams RC, Young RC, Shamoian CA. Cornell scale for depression in dementia. Biol Psychiatry 1988; 2: 271–84.
13. Cummings JL, Mega M, Gray K, Rosenberg-Thompson S, Carusi DA, Gornbein J. The neuropsychiatric inventory: comprehensive assessment of psychopathology in dementia. Neurology 1994; 44: 2308–13.
14. Mukaetova-Ladinska EB, Xuereb JH, Garcia-Sierra F *et al*. Lewy body variant of Alzheimer's disease: selective neocortical loss of t-SNARE proteins and loss of MAP2 and alpha-synuclein in medial temporal lobe. Sci World J 2009; 9: 1463–75.
15. George JN. Platelet IgG: measurement, interpretation, and clinical significance. Prog Hemost Thromb 1991; 10: 97–126.
16. Hye A, Lynham S, Thambisetty M *et al*. Proteome-based plasma biomarkers for Alzheimer's disease. Brain 2006; 129: 3042–50.
17. Mitchell MB, Buccafusco JJ, Schade RF *et al*. RAGE and Aβ immunoglobulins: relation to Alzheimer's disease-related cognitive function. J Int Neuropsychol Soc 2010; 16: 72–8.
18. Fjorback AW, Varming K, Jensen PH. Determination of alpha-synuclein concentration in human plasma using ELISA. Scand J Clin Lab Invest 2007; 67: 431–5.
19. Paleologou KE, Kragh CL, Mann DM *et al*. Detection of elevated levels of soluble alpha-synuclein oligomers in post-mortem brain extracts from patients with dementia with Lewy bodies. Brain 2009; 132: 1093–101.
20. Borroni B, Colciaghi F, Corsini P *et al*. Early stages of probable Alzheimer disease are associated with changes in platelet amyloid precursor protein forms. Neurol Sci 2002; 23: 207–10.
21. Vignini A, Sartini D, Morganti S *et al*. Platelet amyloid precursor protein isoform expression in Alzheimer's disease: Evidence for peripheral marker. Int J Immunopathol Pharmacol 2011; 24: 529–34.
22. Schrijvers EM, Koudstaal PJ, Hofman A, Breteler MM. Plasma clusterin and the risk of Alzheimer disease. JAMA 2011; 305: 1322–6.
23. Ijsselstijn L, Dekker LJ, Koudstaal PJ *et al*. Serum clusterin levels are not increased in presymptomatic Alzheimer's disease. J Proteome Res 2011; 10: 2006–10.
24. Harold D, Abraham R, Hollingworth P *et al*. Genome-wide association study identifies variants at CLU and PICALM associated with Alzheimer's disease. Nat Genet 2009; 41: 1088–93.
25. Lambert JC, Heath S, Even G *et al*. Genome-wide association study identifies variants at CLU and CR1 associated with Alzheimer's disease. Nat Genet 2009; 41: 1094–9.
26. Neumann K, Farias G, Slachevsky A, Perez P, Maccioni RB. Human platelets tau: a potential peripheral marker for Alzheimer's disease. J Alzheimers Dis 2011; 25: 103–9.
27. Forlenza OV, Torres CA, Talib LL *et al*. Increased platelet GSK3B activity in patients with mild cognitive impairment and Alzheimer's disease. J Psychiatr Res 2011; 45: 220–4.
28. Trinder P, Rajaratnam G, Lewis M, Croft PP. Prophylactic aspirin use in the adult general population. J Public Health 2003; 25: 377–80.
29. Vartiainen E, Laatikainen T, Strandberg T, Salomaa V, Jousilahti P. Use of cholesterol lowering drugs could be improved further: results from the National FINRISK 2007 Study. Suomen Lääkärilehi 2009; 64: 4135–9.

Received 11 July 2011; accepted in revised form 2 November 2011

Age and Ageing 2012; **41:** 412–416
doi: 10.1093/ageing/afs021
Published electronically 4 March 2012

The impact of frailty and delirium on mortality in older inpatients

EAMONN M. P. EELES[1], SUSAN V. WHITE[1], SINEAD M. O'MAHONY[1], ANTONY J. BAYER[1], RUTH E. HUBBARD[2]

[1]Department of Geriatric Medicine, Cardiff University, Cardiff, UK
[2]Centre for Research in Geriatric Medicine, The University of Queensland School of Medicine, Building 33, Level 2, Princess Alexandra Hospital, Woolloongabba QLD 4102, Australia

Address correspondence to: E. Eeles. Tel: (+61) 731394757; Fax: (+61) 731394923. Email: Eamonn_Eeles@health.qld.gov.au

Abstract

Background: delirium and frailty are common among hospitalised older people but delirium is often missed and frailty considered difficult to measure in clinical practice.

Objective: to explore the relationship between delirium and frailty in older inpatients and determine their impact on survival.
Design and setting: the prospective cohort study of 273 patients aged ≥75 years.
Measures: patients were screened for delirium at presentation and on alternate days throughout their hospital stay. Frailty status was measured by an index of accumulated deficits (FI), giving a potential score from 0 (no deficits) to 1.0 (all 33 deficits), with 0.25 used as the cut-off between 'fit' and 'frail'.
Results: delirium was detected in 102 patients (mean FI: 0.33) and excluded in 171 (mean FI: 0.18) ($P < 0.005$); 111 patients were frail. Among patients with delirium, the median survival in fit patients was 359 days (95% CI: 118–600) compared with 88 days for those who were frail (95% CI: 5–171; $P < 0.05$).
Conclusion: delirium was associated with higher levels of frailty: the identification of frail patients may help to target those at a greatest risk of delirium. Survival following delirium was poor with the combination of frailty and delirium conferring a particularly bleak prognosis.

Keywords: *delirium, frail older adults, survival, elderly*

Introduction

Delirium [1] and frailty [2] are common among older inpatients. Since each is significantly associated with chronological age, their importance is likely to increase with the ageing of the inpatient population [3]. Each is associated with adverse outcomes. Delirium is consistently associated with high mortality even when adjusted for other factors, including illness severity [1, 4, 5]. Though it is measured in different ways, frailty, by definition identifies those at risk of adverse outcomes, including death [6]. Previous studies of community-dwelling older people have shown frailty to be more strongly associated with death than chronological age and co-morbidity [7].

The relationship between these common and important syndromes is currently incompletely explored [8]. Owing to its sporadic occurrence, fluctuating course and diverse clinical presentation, the diagnosis of delirium is often missed [9, 10]. Frailty is not yet routinely or systematically assessed in older inpatients. Some frailty measures are considered to be difficult to apply in clinical practice [11]. Others, by defining all older patients as frail, lack discriminatory utility [2].

In this cohort study, patients were screened for delirium on admission and throughout their inpatient stay. Frailty was investigated using an index of accumulated deficits. In this way, we aimed to explore the relationship between delirium and frailty in older patients and determine their impact on survival.

Methods

Design and setting

Participants were men and women aged 75 years and over admitted acutely to a general medical service at a district general hospital in South Wales. All patients were screened for inclusion in the study. Of 393 eligible patients, 278 were recruited. Reasons for non-participation were refusal of consent ($n = 98$) or assent (10) and the unavailability of proxy consent (7). Study methodology has been described in detail elsewhere [1].

The study was approved by the South East Wales research ethics committee. Informed consent for inclusion into the study was sought for each patient. In cases where individual capacity to undertake healthcare decision was impaired, relative assent was obtained.

Measures

Delirium

Patients were screened for delirium at presentation using DSM-IV criteria [12]. Ongoing, alternate day clinical assessment and screening for delirium continued for all participants during their inpatient admission.

Frailty

A frailty index (FI) on admission was constructed from 33 variables representing conditions that accumulate with age and are associated with adverse outcomes [13]. Deficits included co-morbidities and functional, sensory and cognitive impairments. Each individual's deficit points were summed and divided by the total number of deficits considered to yield an FI with theoretical range 0–1. For example, someone with five deficits would have an FI value of 0.15 (5/33).

Although the FI can be considered as a continuum with higher values representing greater frailty, 0.25 has been proposed as the cut-off between 'fit' and 'frail' [14].

Outcomes

Patients were followed for 5 years after index admission. Time to death was established from hospital records, supplemented by the local register of deaths.

Analysis

Survival was compared between frailty and delirium groups using the Kaplan–Meier plot (log-rank test). The hazard ratio for frailty was calculated and then adjusted for delirium according to Cox's proportional analysis.

Results

Delirium status, FI and 5-year survival were determined for 273 patients out of 278 patients recruited (98%). The mean age of patients was 82.3 years (SD: 7.5); 112 were men. Delirium was detected in 102 patients and excluded in 171. FI scores were normally distributed, with a mean value of 0.24 (S.D. 0.14). Patients with delirium had significantly higher FI scores than those without delirium (0.33 ± 0.14 versus 0.18 ± 0.11; $P \leq 0.005$).

A total of 162 patients were 'fit' (FI < 0.25) and 111 'frail' (FI ≥ 0.25). Delirium was detected in 29 fit patients (18%) and in 72 patients who were frail (65%) ($P \leq 0.005$).

Considering the patient cohort as a whole, the median survival following index admission was significantly longer for patients who were fit [1,368 days (95% CI: 1014–1722)] compared with those who were frail [207 days (95% CI: 88–326)] ($P < 0.005$) (Figure 1). Frailty status also impacted survival in patients with delirium. The median survival for fitter patients with delirium was 359 days (95% CI: 118–600). Inpatients with both frailty and delirium survived for a median of 88 days [(95% CI: 5–171); $P = 0.02$] (Figure 2).

Discussion

Frailty, measured by an index of accumulated deficits, was common among hospitalised older patients. The median survival of inpatients identified as frail was significantly shorter, affording validation of the frailty measure as a predictor of adverse outcomes. Since frailty is intended to be a marker of vulnerability, it is also congruent that frail patients had significantly higher rates of delirium. Survival following delirium was poor for all patients and was significantly impacted by frailty status. The median survival for inpatients in our cohort with a combination of frailty and delirium (88 days) is comparable, for example, with that of patients with malignant gastric outlet obstruction [15] or multiple brain metastases [16].

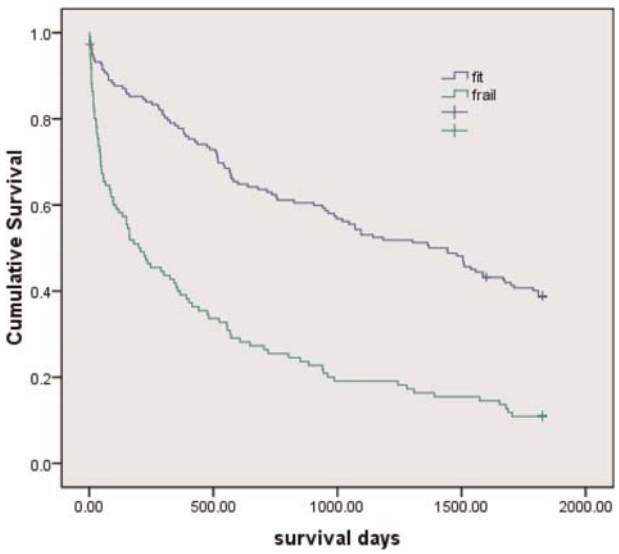

Figure 1. All patients: survival post index admission by frailty status—frail, bottom curve (frailty index ≥0.25), versus fit, top curve (frailty index <0.25).

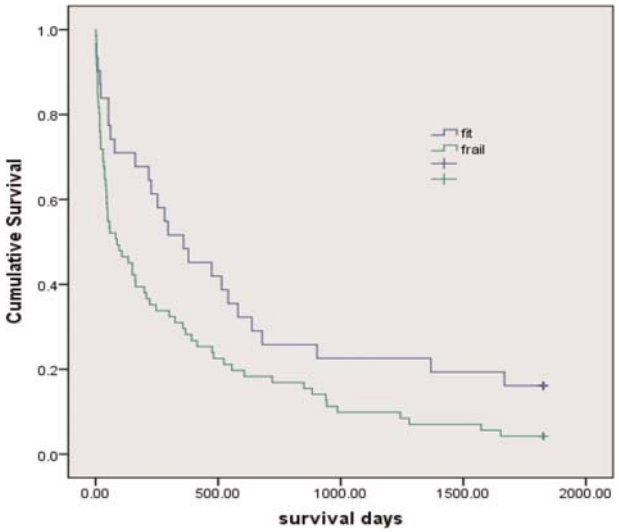

Figure 2. Patients with delirium: survival post index admission by frailty status—frail, bottom curve (frailty index ≥0.25), versus fit, top curve (frailty index <0.25).

We acknowledge methodological weaknesses. Data were only collected at a single hospital site. Multivariate analysis was not conducted as many of the factors that may influence risk could not be adjusted for as they were used in the composition of the FI itself. Furthermore, scrutiny of these individual items may well have yielded associations but the findings would not be as generaliseable as those gleaned from overall frailty status [17]. Although the characterisation of frailty using an FI is a well-validated approach [17], it is not the only one available. The most well known and widely used definition of frailty is that proposed by Fried *et al.* [18] as a syndrome or phenotype of at least three of five criteria: weight loss, exhaustion, weak grip strength, slow walking speed, low physical activity. However, older inpatients are often unable to complete these performance-based tests [19, 20] and many of our cohort could not have been evaluated using such syndromic definitions.

Our study also has certain strengths. All older patients admitted to hospital were screened for inclusion, patients were well characterised at baseline and few were lost to follow-up. Investigations of delirium are challenged by its fluctuating course and diverse presentation but here, comprehensive serial evaluation of patients throughout their inpatient episode optimised delirium detection.

Although the rate of delirium among our cohort (37%) is consistent with other studies [4, 5], the prevalence of frailty (41%) is less easy to contextualise. Frailty has been identified in between 27 and 80% of older inpatients depending on the defining criteria used [2, 21]. The challenges of frailty measurement among patients in hospital are well described [11]. Here, the FI was derived from routinely collected data and could be determined for all patients, regardless of their cognitive or functional abilities; this increases its potential utility in the clinical setting. The purpose of frailty identification has also been questioned [11]. Since the FI stratifies patients on a continuum rather than as dichotomous groups, further work could identify the different cut-offs for those most likely to benefit from interventions (including multidisciplinary rehabilitation) as well as those at highest risk of adverse outcomes.

In this cohort in non-delirious patients, frailty is an arbiter of poor outcome. However, survival following delirium was reduced in both fit and frail patients. The combination of frailty and delirium conferred a particularly poor prognosis. This raises important questions regarding patient management. Although there are proven measures to prevent delirium [22], evidence regarding interventions to improve outcomes following delirium diagnosis remains conflicting [23]. Similarly, while complex interventions such as education, optimised nutrition and exercise have been proposed to delay or prevent frailty [24], there is, as yet, no evidence that such interventions can mitigate adverse outcomes for frail older inpatients. Whether the provision of increased medical and multidisciplinary care to frail older inpatients with delirium can improve outcomes or whether these patients have an irreversible trajectory that should trigger a more palliative approach should be the focus of further enquiry.

Key points

- Delirium is associated with higher levels of frailty.
- The identification of frail patients may help to target those at a greatest risk of delirium.
- Although frailty itself is an arbiter of poor outcome, survival following delirium is poor, regardless of frailty status.
- In this cohort, the median survival of frail inpatients with delirium was 88 days.

Conflicts of interest

None declared.

References

1. Eeles E, Hubbard RE, White SV, O'Mahony MS, Savva GM, Bayer AJ. Hospital use, institutionalisation and mortality associated with delirium. Age Ageing 2010; 39: 470–5.
2. Andela RM, Dijkstra A, Slaets JP, Sanderman R. Prevalence of frailty on clinical wards: description and implications. Int J Nurs Pract 2010; 16: 14–9.
3. Thurecht L, Walker A, Harding A, Pearse J. The 'Inverse Care Law'. Population ageing and the hospital system: a distributional analysis. J Appl Econ Policy 2005; 24: 1–17.
4. Adamis D, Treloar A, Martin FC *et al*. Recovery and outcome of delirium in elderly medical inpatients. Arch Gerontol Geriatr 2006; 43: 289–98.
5. Marcantonio ER, Kiely DK, Simon SE *et al*. Outcomes of older people admitted to postacute facilities with delirium. J Am Geriatr Soc 2005; 53: 963–9.
6. Rockwood K. What would make a definition of frailty successful? Age Ageing 2005; 34: 432–4.
7. Song X, Mitnitski A, Rockwood K. Prevalence and 10-year outcomes of frailty in older adults in relation to deficit accumulation. J Am Geriatr Soc. 2010; 58: 681–7.
8. MacLullich AMJ, Hall RJ. Who understands delirium? Age Ageing 2011; 40: 412–4.
9. Lindesay J, Rockwood K, MacDonald A. Delirium in Old Age. Oxford: Oxford University Press, 2002.
10. National Institute for Clinical Excellence. Delirium. London: National Institute for Clinical Excellence, 2010.
11. Martin FC, Brighton P. Frailty: different tools for different purposes?. Age Ageing. 2008; 37: 129–31.
12. American Psychiatric Association. Diagnostic and Statistical Manual of Mental Disorders, 4th edition. Washington, DC: American Psychiatric Association, 1994.
13. Searle SD, Mitnitski AB, Gahbauer EA, Gill MA, Rockwood K. A standard procedure for creating a frailty index. BMC Geriatrics 2008; 8: 24.
14. Rockwood K, Andrew M, Mitnitski A. A comparison of two approaches to measuring frailty in elderly people. J Gerontol A Biol Med Sci 2007; 62: 738–43.
15. Schmidt C, Gerdes H, Hawkins W *et al*. A prospective observational study examining quality of life in patients with malignant gastric outlet obstruction. Am J Surg 2009; 198: 92–9.
16. Barnes EA, Chow E, Tsao MN *et al*. Physician expectations of treatment outcomes for patients with brain metastases referred for whole brain radiotherapy. Int J Radiat Oncol Biol Phys 2010; 76: 187–92.
17. Kulminski AM, Ukraintseva SV, Kulminskaya IV, Arbeev KG, Land K, Yashin AI. Cumulative deficits better characterize susceptibility to death in elderly people than phenotypic frailty: lessons from the Cardiovascular Health Study. J Am Geriatr Soc 2008; 56: 898–903.
18. Fried LP, Tangen CM, Walston J *et al*. Frailty in older adults: evidence for a phenotype. J Gerontol Biol Med Sci 2001; 56: M146–56.
19. Hubbard RE, O'Mahony MS, Woodhouse KW. Characterising frailty in the clinical setting—a comparison of different approaches. Age Ageing 2009; 38: 115–9.
20. Rockwood K, Jones D, Wang Y, Carver D, Mitnitski A. Failure to complete performance-based measures is associated with poor health status and an increased risk of death. Age Ageing 2007; 36: 225–8.
21. Purser JL, Kuchibhatla MN, Fillenbaum GG, Harding T, Peterson ED, Alexander KP. Identifying frailty in hospitalized older adults with significant coronary artery disease. J Am Geriatr Soc 2006; 54: 1674–81.

22. Inouye SK, Bogardus ST Jr, Charpentier PA *et al*. A multicomponent intervention to prevent delirium in hospitalized older patients. N Engl J Med 1999; 340: 669–76.
23. Rockwood KJ. Out of the furrow and into the fire: where do we go with delirium? CMAJ 2002; 167: 763–4.
24. Fairhall N, Langron C, Sherrington C *et al*. Treating frailty. A practical guide. BMC Medicine 2011; 9: 83.

Received 28 July 2011; accepted in revised form 19 October 2011

Age and Ageing 2012; **41:** 416–419
doi: 10.1093/ageing/afs022

Gender differences in care home admission risk: partner's age explains the higher risk for women

Mark McCann[1], Michael Donnelly[2], Dermot O'Reilly[2]

[1]Institute of Child Care Research, Queen's University Belfast, 6 College Park, Belfast BT7 1LP, UK
[2]Centre for Public Health, Institute of Clinical Sciences B, Royal Victoria Hospital, Belfast BT12 6BJ, UK

Address correspondence to: M. McCann. Tel: (+44) 02890973163; Fax: (+44) 02890973943. Email: mark.mccann@qub.ac.uk

Abstract

Background: older women have a higher risk of care home admission than men, this difference remains even after accounting for variations in health. A likely reason for this is the difference in social support provided by spouses. Older men may provide less care for their wives than women do for their husbands.
Objectives: this study assessed two competing explanations for this. First, older men are less willing to undertake traditionally feminine caring roles; secondly, older men are less physically able to provide care.
Design: the Northern Ireland Longitudinal Study (NILS), a representative (c28%) sample of the Northern Ireland population.
Findings: a total of 20,830 couples were followed over 6 years, with 415 care home admissions among NILS cohort members. Women had a higher admission risk after controlling for cohort members' age and health; however, there was no gender difference after adjusting for partner's age.
Conclusion: these results suggest that advanced age and physical frailty explain why men provide less care for their partners than women do; rather than being unwilling to undertake a caring role. The narrowing gap in life expectancy between men and women may have an effect on the future demand for formal care.

Keywords: *care home admission, informal care, gender differences, elderly*

Introduction

Most studies within the UK have demonstrated that women are more likely than men to be admitted to a nursing or residential home. This excess risk persists even after adjustment for differences in age and health status [1, 2]. Other studies have shown that the difference is mainly within married couples as admission risk is, for example, similar for men and women living alone [3].

There are two explanations for this gender difference. The first is that older men provide less care because they are less willing or less equipped to do so, due to socio-cultural gender stereotyping. This is somewhat supported by cross-sectional studies demonstrating a female preponderance of caring [4]. The second is that the difference is due to demographic factors. Women tend to marry men older than themselves [5]. This means that the partners of older women may be less physically able to provide care due to their own age-related frailty. This difference is important for future demand for care home places; the first may be a consequence of historical demarcation of roles, a pattern that may not be evident in future generations, the alternative is somewhat fixed by the age of people's partners.