Screening for Preexisting Cognitive Impairment in Older Intensive Care Unit Patients: Use of Proxy Assessment

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OBJECTIVES: To determine the prevalence of preexisting cognitive impairment (CI) in patients admitted to the medical intensive care unit (ICU) and compare two different proxy measures of preexisting CI in ICU patients.

DESIGN: Cross-sectional comparative study.

SETTING: Urban university teaching hospital.

PARTICIPANTS: One hundred thirty patients aged 65 and older admitted to the medical ICU.

MEASUREMENTS: Two previously validated proxy measures of CI: the Modified Blessed Dementia Rating Scale (MBDRS) and the Informant Questionnaire on Cognitive Decline in the Elderly (IQCODE).

RESULTS: The prevalence of preexisting CI in the ICU, determined using a combination of the measures, was 42%. Agreement between the two CI measures was 86%, with a kappa of 0.69, with discrepancies being related to the different domains measured by each instrument.

CONCLUSION: There is a high prevalence of preexisting CI in patients admitted to the medical ICU. Both the MBDRS and IQCODE can be used to screen for preexisting CI in situations where direct patient assessment is not feasible. Future studies are needed to address physician recognition of CI and its effect on patient care decisions and outcomes. **J Am Geriatr Soc 51:689–693, 2003.**

Key words: critical care; aging; geriatrics; dementia; delirium

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Dr. Pisani is a Hartford Center of Excellence in Aging at Yale Scholar (Grant 97266). This work was supported in part by grants from the National Institute on Aging (RO1AG12551 and K24AG00949) and by in-kind support from the Claude D. Pepper Older Americans Independence Center (P60AG10469). Dr. Inouye is a recipient of a Midcareer Award from the National Institute on Aging and a Donaghue Investigator Award from the Patrick and Catherine Weldon Donaghue Medical Research Foundation (DF98-105). Dr. Redlich is a recipient of NIH Grant K24ES00355.

Presented at the American Thoracic Society Meeting 5/2002.

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Dementia, an acquired persistent form of cognitive impairment (CI), is an increasingly common and devastating problem for the aging U.S. population, associated with increased rates of morbidity, functional disability, institutionalization, and mortality.[1] The prevalence of CI in community samples of patients aged 65 and older ranges from 10.3% to 18.8%.[2,3] Although currently affecting 2.2 million Americans, population projections indicate that dementia will affect at least 10 million Americans by 2040.[4] Patients aged 65 and older constitute 42% to 52% of intensive care unit (ICU) admissions.[5,6] Thus, it is important to be able to assess preexisting CI in critically ill patients to determine its effect on health outcomes, delirium, and persistent CI.

For this study, preexisting CI was defined as CI that was present 1 month before the acute illness that prompted ICU admission. Medical literature suggests that CI adversely affects health outcomes independent of other medical comorbidities.[7–9] Knowledge of a patient's preexisting cognitive status provides critical information that can affect the patient's health care at many levels, including assessing decision-making capacity and ability to give informed consent for treatment, providing a baseline for evaluating changes in mental status that occur commonly during acute hospitalization, choosing treatment options that have the potential for mental status effects, and identifying patients at high risk for decline in mental status during hospitalization who may benefit from preventive measures for delirium.[10,11]

Determining the prevalence of preexisting CI in patients admitted to the ICU is the crucial first step in evaluating the effect of cognitive function, clinically and economically, on outcomes related to intensive care.

Unfortunately, it is impossible to directly assess CI that existed before an acute illness. Thus, methods to measure preexisting CI in the ICU setting are greatly needed.

No prior studies have examined the assessment of preexisting CI in an ICU population. Thus, the use of two previously validated instruments were used to assess baseline CI in an older ICU population. The specific aims of the present study were to determine the estimated prevalence of preexisting CI in patients admitted to the medical ICU and to evaluate and compare two different proxy

0002-8614/03/$15.00

instruments for identification of baseline CI in an older ICU population.

METHODS

The study participants were patients aged 65 and older consecutively admitted to the medical ICU at Yale-New Haven Hospital from September 5, 2000, through March 31, 2001. Yale-New Haven Hospital is an 800-bed urban teaching hospital with a 14-bed medical ICU. Age-eligible patients were excluded from this study if there was no identifiable proxy to provide information about the patient (n = 19) or if they were transferred from another ICU (n = 14). Of the 187 patients screened, 154 were eligible for enrollment. Of the 154 eligible patients, 130 (84%) were enrolled in this study. Of the 24 eligible but not enrolled patients, one was due to proxy refusal, six died before the proxy interview could be obtained, and 14 were not enrolled because of a holiday nonenrollment period. Demographic factors, including age, sex, and race, did not differ significantly between enrolled and nonenrolled subjects. Informed consent for participation was obtained from the proxy respondents according to procedures approved by the institutional review board of Yale University School of Medicine.

Because the patients in this study were critically ill, intubated, and poorly responsive, proxy respondents were used as the primary source of information. Proxy respondents were screened to assure that they had sufficient contact to appropriately answer questions about the patient's cognitive function and activities of daily living (ADLs) before the acute illness. Briefly, the research nurse first identified whether the participant was admitted from home or a nursing home. If the participant was admitted from home, a proxy who spent a minimum of 4 hours per week with the patient and who had known the patient for at least 5 years was identified. Proxies were also asked whether they could assess participants' memory and mental abilities. A hierarchy of proxies was developed that assessed the spouse or live-in partner first then live-in child. If there was no proxy living with the patient, then proxy screening was used to determine whether there was any other person who met the criteria to participate in the interview. If the patient was admitted from a nursing home, the proxy screen was used to identify the best person or persons to answer the questionnaire. If there was no identifiable proxy, then the patient was considered not eligible for the study. Two experienced geriatric research nurses performed the proxy interviews. To minimize reporting bias on the part of the proxy due to the stress of having a critically ill family member, the proxy interview was obtained within 48 hours of patient admission to the ICU.

To evaluate the prevalence of preexisting CI in patients admitted to the ICU, two previously validated measures of proxy assessment of CI were used: the Modified Blessed Dementia Rating Scale (MBDRS)[12] and the Informant Questionnaire on Cognitive Decline in the Elderly (IQCODE). Both of these measures were specifically developed for proxy administration and have been widely used for identification of preexisting CI in outpatient and hospital settings. Prior studies using these instruments evaluated their reliability against direct patient testing of cognitive status.[13,14] Both instruments were chosen to measure CI so that the interrelationship between the instruments could be assessed.

The MBDRS is an 11-item instrument that has been shown to correlate with pathological assessment of dementia, to discriminate between demented and nondemented subjects, and to correlate well with objective patient measures of dementia.[13,15,16] Examples of items assessed with the MBDRS include memory; coping with money; getting lost or losing things; and ability to perform household tasks, dress, toilet and feed oneself.

The IQCODE[17] is a 16-item questionnaire designed to measure cognitive decline over time, thus providing a longitudinal perspective of cognitive functioning. In previous studies, the IQCODE has been used in face-to-face, telephone, and mail interviews. The IQCODE has been shown to correlate with direct patient assessment using cognitive screening tests and has been used to evaluate the presence of dementia in non-critically ill medical inpatients and to predict the development of dementia after hospital discharge.[17–20] Examples of items assessed with the IQCODE include memory, coping with money, ability to learn new things, following a story, and ability to perform simple arithmetic.

The proxy interview consisted of patient demographics, the MBDRS[12] and the IQCODE,[17] ADLs,[21] and instrumental activities of daily living (IADLs).[22] Both the MBDRS and IQCODE were administered with an introductory statement that asked the proxy to report on cognitive status 1 month before the onset of the patient's current acute ICU illness to eliminate any effect due to acute illness or delirium immediately before hospitalization or due to a previous hospitalization. The complete proxy interview took the research nurse between 10 and 15 minutes to administer.

Scores on the MBDRS and the shortened IQCODE, using each measure separately, determined the prevalence of preexisting CI. Dichotomous variables for preexisting CI were created for each measure based on previously used validated cutpoints in the medical literature. Cutpoints were chosen to capture mild and severe cases of CI. For the MBDRS, a score of three or more was used to define preexisting CI, based on previous studies.[16,23,24] The MBDRS was coded as missing if more than two items were missing. For the IQCODE a score of 3.31 or more was used. The IQCODE was scored as missing if more than two items were missing. Scores were imputed for the IQCODE if fewer than three items were missing by summing the score and dividing by the number of items answered. Blinded research staff performed detailed medical record abstractions on all enrolled patients to investigate reasons for disparities between the two instruments used to assess preexisting CI. Items abstracted were medical comorbidities, information on prior functional status, and prior history of dementia or depression.

All analyses were performed using SAS version 8 (SAS Institute, Inc., Cary, NC). The prevalence of preexisting CI in patients aged 65 and older was determined using univariate analysis. Correlation (agreement, kappa statistics, and Pearson's correlation coefficient) between the two measures of CI was evaluated using standard procedures. Bivariate analysis of CI versus demographic variables was performed.

RESULTS

Baseline characteristics of the study population (N = 130) are presented in Table 1 and compare patients with and without CI. Respiratory system dysfunction was the most common reason for ICU admission. Thirty-six percent of the study population required intubation and mechanical ventilation. Before hospitalization, 48% were disabled in at least one item on the ADLs, and 95% needed help with at least one of the IADLs. Patients with CI were significantly older, more likely to be female, and more likely to be admitted from a nursing home.

Table 2 presents the prevalence of preexisting CI by each measure separately and breaks down CI by level of severity. Results of the MBDRS were available for 128 patients, and results of the IQCODE were available for 118 patients. The prevalence by the IQCODE alone was 31% (37/118) and by the MBDRS alone was 37% (47/128). Using a combination of the two cognitive measures, where CI was considered to be present if either measure was positive, the overall prevalence of preexisting CI in this ICU population was found to be 42% (54/130). More than 40% of the patients with CI met criteria for severe CI.

There was significant correlation between the two measures, with a Pearson correlation coefficient of 0.82 ($P < .001$). Table 3 shows the interrelationship between the IQCODE and the MBDRS in detecting preexisting CI, using predefined cutpoints, where both measures were available (n = 117). Agreement between the two CI measures was generally high (overall agreement = 86%, κ = 0.69). Disagreements between the IQCODE and the MBDRS occurred in 16 cases (14%). In 10 cases, the MBDRS but not the IQCODE indicated CI; this was due strictly to physical disability (such as stroke, multiple sclerosis, or rheumatoid arthritis) resulting in a positive MBDRS. In six cases, the IQCODE reported CI that the MBDRS did not. These cases were related to subtle CI detected only by the IQCODE and not the MBDRS.

Fifty (39%) of the proxy respondents were children of the subjects, and 38 (29%) were spouses, 12 (9%) were brothers or sisters, five (4%) were sons-in-law/daughters-in-law, five (4%) were grandchildren, five (4%) were friends, seven (5%) were other relatives, and eight (6%) were nurses from nursing homes. There were no significant differences

Table 2. Informant Questionnaire on Cognitive Decline in the Elderly (IQCODE) and Modified Blessed Dementia Rating Scale (MBDRS) Severity of Cognitive Impairment

Scale	Outcome
IQCODE (n = 118)	Mean 3.39 (range 1–5)
Normal (1–3.30)	81 (69%)
Cognitive impairment	37 (31%)
Mild (3.31–3.59)	9/37 (24%)
Moderate (3.6–4.0)	12/37 (33%)
Severe (4.01–5.0)	16/37 (43%)
MBDRS (n = 128)	Mean 3.05 (range 0–15)
Normal (0–2.99)	81 (63%)
Cognitive impairment	47 (37%)
Mild (3.0–4.0)	12/47 (26%)
Moderate (4.1–6.4)	16/47 (34%)
Severe (6.5–15)	19/47 (40%)

Note: Cutpoints for mild, moderate, and severe cognitive impairment based on previously published literature.

Table 1. Baseline Characteristics of Total Study Population by Cognitive Impairment (CI) Status (N = 130)

Demographic Characteristic	CI Absent (n = 76)	CI Present (n = 54)	*P*-value
Age, mean ± SD	76 ± 7	79 ± 8	.008
Male, n (%)	41 (54)	18 (34)	.03
White, n (%)	57 (75)	36 (68)	.38
Medicaid status, n (%)	13 (18)	16 (31)	.09
Married, n (%)	35 (46)	17 (32)	.11
Education, years, mean ± SD	11.2 ± 3.0	11.8 ± 3.4	.37
Admitting diagnosis*			
Respiratory	24 (32)	23 (42)	.20
Gastrointestinal hemorrhage	20 (26)	7 (13)	.06
Cardiac	8 (10)	2 (4)	.20
Other causes	24 (32)	20 (41)	.28
Other characteristics			
Acute Physiology and Chronic Health Evaluation II score, mean ± SD	22 ± 6.8	24 ± 6.2	.13
Intubation, n (%)	25 (37)	22 (52)	.12
Noninvasive ventilation, n (%)	16 (23)	8 (16)	.40
Pulmonary artery catheter placement, n (%)	4 (6)	1 (2)	.65
Hemodialysis, n (%)	5 (7)	6 (12)	.35
Any impairment in ADLs, n (%)	17 (22)	45 (85)	<.001
Any impairment in IADLs, n (%)	70 (92)	52 (98)	.24
Admitted from a nursing home, n (%)	5 (6)	18 (33)	<.001

Note: CI defined as having a positive Informant Questionnaire on Cognitive Decline in the Elderly or Modified Blessed Dementia Rating Scale.

*Majority of cardiac admissions admitted to a separate coronary care unit. Other causes include seizures, overdoses, infection, renal failure and electrolyte abnormalities.

SD = standard deviation; ADLs = activities of daily living; IADLs = independent activities of daily living.

Table 3. Interrelationship of Informant Questionnaire on Cognitive Decline in the Elderly (IQCODE) and Modified Blessed Dementia Rating Scale (MBDRS)

Cognitive Impairment by MBDRS	Cognitive Impairment by IQCODE		
	Present	Absent	Total
Present	30	10	40
Absent	6	71	77
Total	36	81	117

Note: Overall agreement 86%; $\kappa = 0.69$.
Cognitive impairment defined by IQCODE score of ≥3.31, MBDRS score of ≥3.

between the prevalence of preexisting CI based on type of proxy respondent, except when the proxy respondent was a nurse in a nursing home, where the prevalence of CI was expected to be high.

DISCUSSION

The estimated prevalence of preexisting CI ranged from 31% to 42% depending on the instrument used. In 40% of these patients, the CI was severe. This is higher than the prevalence of preexisting CI reported in studies of community-dwelling elderly (10–18%)[3] and in hospitalized non-ICU patients (20%),[2] but such a high prevalence is not unexpected given the understanding of CI and illness in older patients. There are no prior reports in ICU patients with which to compare these findings. The recognition of such a high prevalence of preexisting CI is an important first step in addressing the effect of preexisting CI in ICU patients. Recognition of preexisting CI is critical in optimizing care for older ICU patients and important for prevention or reduction of new CI.

It has been demonstrated that the MBDRS and IQCODE can be used to screen for preexisting CI in ICU patients. Comparison of the two measures showed that overall agreement was high. Disagreement occurred in only 14% of cases, and in 13 of the 16 cases the disagreements were due to ratings of normal versus mild CI. These disagreements occurred primarily because of the use of ADL measures to indicate dementia on the MBDRS (thus, people with conditions resulting strictly in physical disability, such as stroke or multiple sclerosis, would be misclassified with CI) and because the IQCODE detected subtler CI noted over a 5-year period than did the MBDRS.

An important strength of this study is the use of two previously validated instruments for detection of preexisting CI. The MBDRS has been validated in several studies.[13,15] The IQCODE has also been shown to correlate well with tests that screen for CI, supporting the validity of informant ratings of cognitive decline.[18] The authors chose cutpoints for CI based on prior literature in hospital and community-dwelling patients to include mild and severe CI.[15,23,25]

The major limitation of this study was the lack of a reference criterion standard for CI or dementia in patient populations. Unfortunately, no true criterion standard exists for determining preexisting CI. The authors were interested in determining the prevalence of preexisting CI before the patient's ICU admission. Direct patient assessment, before a patient's acute illness, augmented by corroborative history from family members represents the ideal method for determining baseline cognitive status, but this approach can be all but impossible in the face of acute illness or medical interventions that may alter mental status or the ability to assess mental status, such as admission to an ICU, postoperative settings, or in patients with stroke or delirium. Patients' primary care physicians and prior medical records are other possible sources for determining preexisting cognitive status upon ICU admission, but prior studies have shown that community physicians are frequently unaware of the cognitive status of their patients and that chart documentation of cognitive status is poor.[26,27] Direct assessment of the study patients was not performed because, with the critical nature of their illness and the high incidence of delirium, their cognitive status in the ICU would most likely not represent their preexisting cognitive function, before hospitalization. Testing patients after they left the ICU would not necessarily reflect their preexisting cognitive function, because many patients do not regain their baseline status for many months after a delirium episode.[28] Previous research supports the use of these proxy measures to screen for CI.

The choice of instrument to assess preexisting CI would depend on the goals of the study. Ideally both measures should be used because they measure slightly different domains and present complementary information, but, in cases where detection of mild CI is key, the IQCODE would be preferred. Nevertheless, the IQCODE does require a proxy respondent who has observed the patient over a 5-year period. In cases in which detection of moderate to severe CI is sufficient or preferred or in which proxies with knowledge of the 5-year history of the patients may not be consistently available, the MBDRS is recommended. Proxy respondents were accepting of both these instruments. One or both of these measures could be added to the ICU nurse intake questionnaire, which is administered to family members upon a patient's ICU admission. ICU caregivers would then have important information concerning patients' cognitive abilities before their acute illness. Administration of each instrument takes between 3 and 5 minutes

This study highlights several important issues concerning ICU care for older hospitalized persons. Knowledge of preexisting cognitive function can provide ICU and hospital caregivers with important information that has substantial effect on patient care. The risk of adverse effects of sedative and psychoactive medications is markedly increased in cognitively impaired older persons. The capacity for decision-making, such as informed consent to procedures, and for advance directives assumes particular importance in the ICU setting. Moreover, studies attempting to investigate the effects of hospital care and interventions on patients' cognitive status and other outcomes need to determine cognitive function that existed before acute illness. The methods tested in this study will enable clinicians to assess preexisting cognitive function when direct patient assessment is not possible, such as in the ICU and with postoperative, trauma, stroke, delirium, and nonverbal patients. Further studies are needed to address the effect of preexisting CI on outcomes of care and physician

recognition of preexisting CI and its effect on patient care decisions.

This is the first study that attempts to assess preexisting CI in an ICU setting. This study documents a high prevalence of preexisting CI in older ICU patients and presents two valid methods for assessing preexisting CI based on proxy report.

ACKNOWLEDGMENTS

The authors acknowledge the contributions of Peter Charpentier for database development, David Bruce for data management, Wanda Carr for data entry, Sandy Ginter and Karen Wu for enrolling participants and interviewing family members, and Dr. Mary Tinetti for review of the manuscript. We thank the families, nurses, and physicians in the Yale Medical Intensive Care Unit, whose cooperation and participation made this study possible.

REFERENCES

1. Froehlich TE, Bogardus ST Jr, Inouye SK. Dementia and race: Are there differences between African Americans and Caucasians? J Am Geriatr Soc 2001;49:477–484.
2. Fields SD, MacKenzie CR, Charlson ME et al. Cognitive impairment. Can it predict the course of hospitalized patients? J Am Geriatr Soc 1986;34:579–585.
3. Graham JE, Rockwood K, Beattie BL et al. Prevalence and severity of cognitive impairment with and without dementia in an elderly population. Lancet 1997;349:1793–1796.
4. Office of Technology Assessment. Losing a Million Minds. Confronting the Tragedy of Alzheimer's Disease and Other Dementias (Report no. OTA-BA-324). Washington, DC: U.S. Government Printing Office, 1987.
5. Chelluri L, Pinsky MR, Donahoe MP et al. Long-term outcome of critically ill elderly patients requiring intensive care. JAMA 1993;269:3119–3123.
6. Knaus WA, Wagner DP, Draper EA et al. The APACHE III prognostic system. Risk prediction of hospital mortality for critically ill hospitalized adults. Chest 1991;100:1619–1636.
7. Bruce ML, Hoff RA, Jacobs SC et al. The effects of cognitive impairment on 9-year mortality in a community sample. J Gerontol B Psychol Sci Soc Sci 1995;50B:P289–P296.
8. Frisoni GB, Fratiglioni L, Fastbom J et al. Mortality in nondemented subjects with cognitive impairment. The influence of health-related factors. Am J Epidemiol 1999;150:1031–1044.
9. Smits CH, Deeg DJ, Kriegsman DM et al. Cognitive functioning and health as determinants of mortality in an older population. Am J Epidemiol 1999;150:978–986.
10. Inouye SK, Bogardus ST, Charpentier PA et al. A multicomponent intervention to prevent delirium in hospitalized older patients. N Engl J Med 1999;340:669–676.
11. Marcantonio ER, Flacker JM, Wright RJ et al. Reducing delirium after hip fracture: A randomized trial. J Am Geriatr Soc 2001;49:516–522.
12. Blessed G, Tomlinson BE, Roth M. The association between quantitative measures of dementia and of senile change in the cerebral grey matter of elderly subjects. Br J Psychiatry 1968;114:797–811.
13. McLoughlin DM, Cooney C, Holmes C et al. Carer informants for dementia sufferers. Carer awareness of cognitive impairment in an elderly community-resident sample. Age Ageing 1996;25:367–371.
14. Jorm AF, Scott R, Cullen JS et al. Performance of the Informant Questionnaire on Cognitive Decline in the Elderly (IQCODE) as a screening test for dementia. Psychol Med 1991;21:785–790.
15. Juva K, Makela M, Erkinjuntti T et al. Functional assessment scales in detecting dementia. Age Ageing 1997;26:393–400.
16. Morris JC, Heyman A, Mohs RC et al. The Consortium to Establish a Registry for Alzheimer's Disease (CERAD). Part I. Clinical and neuropsychological assessment of Alzheimer's disease. Neurology 1989;39:1159–1165.
17. Jorm AF. A short form of the Informant Questionnaire on Cognitive Decline in the Elderly (IQCODE): Development and cross-validation. Psychol Med 1994;24:145–153.
18. Brodaty H, Clarke J, Ganguli M et al. Screening for cognitive impairment in general practice: Toward a consensus. Alzheimer Dis Assoc Disord 1998;12:1–13.
19. Louis B, Harwood D, Hope T et al. Can an informant questionnaire be used to predict the development of dementia in medical inpatients? Int J Geriatr Psychiatry 1999;14:941–945.
20. Harwood DM, Hope T, Jacoby R. Cognitive impairment in medical inpatients. I. Screening for dementia—is history better than mental state? Age Ageing 1997;26:31–35.
21. Katz S, Ford AB, Moskowitz RW et al. Studies of illness in the aged. The index of ADL. A standardized measure of biological and psychosocial function. JAMA 1963;185:914–919.
22. Lawton MP, Brody EM. Assessment of older people: Self-maintaining and instrumental activities of daily living. Gerontologist 1969;9:179–186.
23. Auerswald KB, Charpentier PA, Inouye SK. The informed consent process in older patients who developed delirium: A clinical epidemiologic study. Am J Med 1997;103:410–418.
24. Inouye SK, Peduzzi PN, Robison JT et al. Importance of functional measures in predicting mortality among older hospitalized patients. JAMA 1998;279:1187–1193.
25. Inouye SK, Viscoli CM, Horwitz RI et al. A predictive model for delirium in hospitalized elderly medical patients based on admission characteristics. Ann Intern Med 1993;119:474–481.
26. Roca RP, Klein LE, Kirby SM et al. Recognition of dementia among medical patients. Arch Intern Med 1984;144:73–75.
27. Arden M, Mayou R, Feldman E et al. Cognitive impairment in the elderly medically ill: How often is it missed. Int J Geriatr Psychiatry 1993;8:929–937.
28. Levkoff SE, Evans DA, Liptzin B et al. Delirium. The occurrence and persistence of symptoms among elderly hospitalized patients. Arch Intern Med 1992;152:334–333,340.