Does Delirium Contribute to Poor Hospital Outcomes?
A Three-Site Epidemiologic Study

Sharon K. Inouye, MD, MPH, Julia T. Rushing, MStat, Marquis D. Foreman, PhD, RN, Robert M. Palmer, MD, MPH, Peter Pompei, MD

OBJECTIVE: To determine the independent contribution of admission delirium to hospital outcomes including mortality, institutionalization, and functional decline.

DESIGN: Three prospective cohort studies.

SETTING: Three university-affiliated teaching hospitals.

PATIENTS: Consecutive samples of 727 patients, aged 65 years and older.

MEASUREMENTS AND MAIN RESULTS: Delirium was present at admission in 88 (12%) of 727 patients. The main outcome measures at hospital discharge and 3-month follow-up were death, new nursing home placement, death or new nursing home placement, and functional decline. At hospital discharge, new nursing home placement occurred in 60 (9%) of 692 patients, and the adjusted odds ratio (OR) for delirium, controlling for baseline covariates of age, gender, dementia, APACHE II score, and functional measures, was 3.0, (95% confidence interval [CI] 1.4, 6.2). Death or new nursing home placement occurred in 95 (13%) of 727 patients (adjusted OR for delirium 2.1, 95% CI 1.1, 4.0). The findings were replicated across all sites. The associations between delirium and death alone (in 35 [5%] of 727 patients) and between delirium and length of stay were not statistically significant. At 3-month follow-up, new nursing home placement occurred in 77 (13%) of 600 patients (adjusted OR for delirium 3.0; 95% CI 1.5, 6.0). Death or new nursing home placement occurred in 165 (25%) of 663 patients (adjusted OR for delirium 2.6; 95% CI 1.4, 4.5). The findings were replicated across all sites. For death alone (in 98 [14%] of 680 patients), the adjusted OR for delirium was 1.6 (95% CI 0.8, 3.2). Delirium was a significant predictor of functional decline at both hospital discharge (adjusted OR 3.0; 95% CI 1.6, 5.8) and follow-up (adjusted OR 2.7; 95% CI 1.4, 5.2).

CONCLUSIONS: Delirium is an important independent prognostic determinant of hospital outcomes including new nursing home placement, death or new nursing home placement, and functional decline—even after controlling for age, gender, dementia, illness severity, and functional status. Thus, delirium should be considered as a prognostic variable in case-mix adjustment systems and in studies examining hospital outcomes in older persons.

KEY WORDS: delirium; acute confusional state; risk adjustment; geriatrics; hospital outcomes.


Delirium, defined as an acute disorder of attention and global cognitive functioning, has assumed increasing importance in the United States, with the burgeoning population of older citizens. In 1993, 35% of the population aged 65 years and older was hospitalized during the year, accounting for 36% of all hospital stays and 48% of all days of hospital care. The oldest group (>75 years) is the most rapidly growing sector of the U.S. population, and is particularly vulnerable to developing delirium during acute illness and hospitalization. Previous studies have estimated that delirium occurs in 14% to 56% of elderly hospitalized patients, with associated hospital mortality rates of 10% to 65%.

Previous studies have documented that delirium is associated with poor outcomes, such as increased mortality rates, prolonged length of hospital stay, increased rates of institutional placement, and functional and cognitive decline. However, the unanswered question remains: Does delirium itself contribute to this poor prognosis, or does delirium simply serve as a marker identifying patients with poor prognostic features due to severe illness, dementia, functional impairment, advanced age, and the like? Unfortunately, many of the previous studies, which were not all designed to address this research question directly, were hindered by inadequate control for these potential confounders and by small numbers of relatively infrequent outcome events.

The objective of the present study was to examine the independent contribution of baseline delirium to hospital mortality, institutionalization, functional decline, and length of stay in three large prospective cohort studies of elderly hospitalized patients. Uniform prospective data collection for this project facilitated collection of standardized information on delirium, study outcomes, and potential confounders. Our underlying hypothesis was that baseline delirium (present at admission) would be an important prognostic predictor even after controlling for underlying illness severity, age, dementia and functional status.

METHODS

Study Populations

The three study populations (University of Chicago Hospitals, University Hospitals of Cleveland, and Yale-New Haven Hospital) participated as part of the Hospital Outcomes Project for the Elderly (HOPE) examining func-
tional decline in hospitalized older patients. The studies have been described in detail previously—including inclusion and exclusion criteria. In brief, all of these acute care facilities are large urban teaching hospitals, serving extensive community as well as referral populations. All sites enrolled prospective cohorts of consecutive elderly subjects admitted to these acute care hospitals on non-intensive-care wards, but the entry age criteria differed (Chicago included age ≥65 years; Cleveland, age ≥75 years; and Yale, age ≥70 years). All sites included medical patients; Chicago and Yale included surgical patients as well. All sites excluded terminally ill patients. The enrollment periods varied from 5 to 8 months, from 1989 to 1990.

Assessments

Trained researchers carried out standardized interviews with the patients at admission and at hospital discharge. The same standardized questionnaires and interviewer training manuals were used across all sites with the exception of a shortened version of the Mini-Mental State Examination (MMSE) (first 21 items) being used at Cleveland. The admission patient interview, completed within 48 hours of hospital admission, included demographic information, activities of daily living (ADLs), instrumental activities of daily living (IADLs), MMSE, and Confusion Assessment Method (CAM) rating. The discharge interview included ADLs, MMSE, CAM rating, and determination of discharge location. For patients with substantial cognitive impairment, self-reported information was confirmed by surrogates. Medical records were reviewed for medical diagnoses, admission vital signs, and laboratory data. All subjects received a 3-month follow-up telephone interview to determine ADLs and new nursing home placement. Surrogate interviews were carried out for subjects who were deceased or unable to be interviewed.

The interviewers and medical record reviewers were blinded to the research question and study hypothesis. In addition, medical record reviewers and telephone interviewers were blinded to the delirium status of the subjects. Reliability checks of primary study variables, including CAM, ADLs, and IADLs, were carried out at each site.

Informed consent was obtained from each subject and from the closest relative for those with significant cognitive impairment. The study was approved by the Institutional Review Boards of University of Chicago Hospitals, University Hospitals of Cleveland, and Yale University School of Medicine/Yale–New Haven Hospital.

Identification of Delirium

Delirium was identified at admission and discharge interviews based on the diagnostic criteria of CAM, which required the presence of acute onset and fluctuating course, inattention, and either disorganized thinking or altered level of consciousness. In a previous validation study, these criteria had sensitivity rates of 94% to 100% and specificity rates of 90% to 95%, when compared with the ratings of geropsychiatrists. A subsequent study demonstrated that the CAM instrument had comparable performance with other delirium measures when used by trained research assistants.

Definition of Variables

The complete 30-point MMSE was administered at the Chicago and Yale sites. A shortened version, consisting of the first 21 points of the MMSE, was administered at Cleveland. The score on the 21-point scale at Cleveland was adjusted to a denominator of 30 points for purposes of comparison across sites. For the present study, dementia was defined at the admission interview as an MMSE score below 20 (on the 30-point scale) and no evidence of acute onset or fluctuating course by the CAM rating at admission. The cutoff point of 20 on the MMSE was selected to account for the relatively low mean scores in these elderly populations and to increase specificity for clinically important dementia.

The ADL score was a simple additive sum of the number of activities of daily living as described by Katz et al., on which the subject was independent (i.e., needed no assistance), including bathing, dressing, feeding, toileting, continence, and transferring; the total score ranged from 0 to 6. Similarly, the IADL score was a simple additive sum of the number of instrumental activities of daily living on which the subject was independent, including using the telephone, grocery shopping, using transportation, preparing meals, doing housework, taking medications, and handling money; the total score ranged from 0 to 7. To approximate the patient’s prehospitalization status, both the ADLs and IADLs were referent to the patient’s status 2 weeks prior to hospital admission. Predictive validity for these measures (i.e., ability to predict future mortality, rehospitalization, and institutionalization) has been documented in previous studies.

The APACHE II score, used as an index of illness severity at hospital admission, was scored based on admission vital signs, laboratory data, medical record data, and admission interview data. Primary medical problems were defined by the leading discharge diagnoses, based on groupings of related categories coded according to the International Classification of Diseases, Ninth Revision, Clinical Modification (ICD-9-CM).

Study Outcomes

The four major study outcomes were death, new nursing home placement, death or new nursing home placement, or ADL decline. Definitions of the four major study outcomes were either cumulative from the admission assessment until discharge or 3-month follow-up (e.g., death, new nursing home placement, death or new nursing home placement) or referent to the admission as-