The Cause of Delirium in Patients With Hip Fracture

Christopher Brauer, MD; R. Sean Morrison, MD; Stacey B. Silberzweig, MS, RD; Albert L. Siu, MD, MSPH

Objectives: To ascertain the most common causes of delirium, to establish the initiation and timing of delirium, and to determine the duration of delirium in patients with hip fracture.

Methods: Five hundred seventy-one (88%) of 650 patients with hip fracture admitted to 4 New York City hospitals were prospectively interviewed on a daily basis, 5 days a week, with the Confusion Assessment Method for the presence of delirium. The patients were enrolled within 48 hours of admission. Their medical charts and the data collected by the study staff were reviewed and summarized. Two of us (R.S.M. and A.L.S.) reviewed the case summaries independently and assigned a cause based on a previously developed classification system, estimated the onset of the delirious episode, and determined whether the delirium had cleared, improved, or persisted at discharge. Subsequently, discrepancies in cause, timing of initiation, and mental status on discharge between the 2 physicians reviewers were discussed until consensus was reached.

Results: The prevalence of delirium was 9.5% (54/571; 95% confidence interval, 7.0-11.9). Seven percent of episodes were assigned a definite cause, 20% a probable cause, 11% a possible cause, and 61% were attributable to 1 or more comorbid conditions. Twenty-eight (53%) of 54 subjects developed delirium after surgery. The delirium had cleared or improved in 40 (74%) of 54 subjects at the time of discharge.

Conclusions: Delirium in patients with hip fracture appears to be a different syndrome from that observed in patients who are otherwise medically ill; it also appears to follow a different clinical course. These results have important implications for the management of delirium in patients with hip fracture.

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Delirium occurs in 11% to 42% of the hospitalized elderly and is associated with increased mortality, delayed rehabilitation efforts, prolonged length of hospital stay, poorer functional outcomes, and increased risk of nursing home placement. Several studies have identified specific patient characteristics, medical conditions, and iatrogenic interventions that place patients at increased risk for the development of delirium, and it is now possible to identify high-risk patients and to correct or avoid modifiable risk factors. Once delirium develops, the cornerstone for its management is the treatment of the underlying cause. Surprisingly, there have been few studies that have systematically described the frequency of different causes of the delirium syndrome, and the current recommended diagnostic approach is thus largely empirical and based on expert opinion. The data that are available are drawn from 3 relatively small studies. Moses and Kaden reported a case series involving 105 patients with delirium. In their study, no single cause was found in 47% of cases, a medication was implicated in 17%, a fluid or electrolyte abnormality in 12%, and hypoxia or hypotension in 10%. Another series of 56 patients with delirium reported that the “discharge diagnoses” were related to toxic diagnoses in 39% of cases, fluid and electrolyte problems in 11%, alcohol withdrawal in 11%, and other diagnoses less commonly. The most systematic classification of cause was in a study of 229 elderly patients, 50 of whom developed delirium during hospitalization. Fluid and electrolyte abnormalities had a possible role in 40% of cases, infection in 40%, drug toxicity in 30%, metabolic disorders in 26%, sensory and environmental problems in 24%, and low perfusion in 14%. In sum-
PATIENTS AND METHODS

PATIENTS

We reviewed daily admissions to 4 New York City metropolitan area hospitals for patients admitted with hip fracture during a 12-month period starting in August 1997. We included patients with fractures of the proximal femur and excluded patients younger than 50 years; patients with fractures that occurred during their hospital stay; patients transferred from the inpatient service of another hospital after surgical repair; and patients with bilateral fractures, isolated pelvic or acetabular fractures, fractures accompanied by internal injury, pathologic fractures, and fractures in a previously fractured or surgically treated hip. Six hundred fifty of 802 subjects screened met these eligibility criteria, and 571 (88%) gave informed consent to participate.

METHODS

Within 48 hours of hospital admission, all patients were interviewed by a research nurse who used the confusion assessment method (CAM) developed by Inouye et al.12 to assess for delirium. We selected the CAM because it is a standardized algorithm that is feasible for a research nurse to administer on a daily basis in the hospital in less than 5 minutes (unlike standardized questions of memory and orientation).14 The CAM was used to detect delirium based on the presence of acute onset and fluctuating course, inattention, disorganized thinking, and altered level of consciousness. Its feasibility, reliability (interobserver κ, 0.81-1.0), sensitivity (94%-100%), and specificity (90%-95%) have been characterized.13 Subjects were assessed with the CAM on a daily basis, 5 days a week. All patients who were found to be delirious by the CAM were included in this study. In addition to administering the CAM, the study staff reviewed the medical records daily and spoke to hospital staff. The results of these observations were recorded concurrently for all patients who developed delirium according to the CAM. The mental status of patients without delirium was assessed by interviewing patients and surrogates as to the presence of Alzheimer disease, another dementing illness, or a history of memory loss and by reviewing chart notes for a history of dementia or memory loss.

DELIRIUM CLASSIFICATION

All patients’ medical charts and the data collected by the study staff were reviewed and summarized by one of us (C.B.). Specifically, all references to confusion, agitation, or altered mental status were recorded verbatim from the chart along with the date and time of the entry. Any relevant medical investigations and/or abnormal test results were recorded. All pain and psychotropic medications given were documented.

We modified an instrument, based on the work of Francis et al.,10 for classifying the causes of delirium. Francis and colleagues classified possible causes into 8 categories (ie, drug-induced delirium, infection, fluid-electrolyte disturbance, metabolic disturbance, intracranial process, low perfusion state, alcohol and drug withdrawal, and sensory/environmental delirium). We expanded the metabolic disturbance category to include metabolic and endocrine disturbances that could cause delirium. The low-perfusion state category was renamed cardiopulmonary compromise and/or hypoxia and was expanded to include not only low cardiac output, but also pulmonary compromise and cerebrovascular insufficiency. The full instrument that was used for classifying the causes of delirium may be found in Table 1.

The causes were then classified as definite, probable, possible, or comorbid based on the number of criteria that were present in the case. For a cause to be considered definite, all clinical criteria had to have been met and no criteria for another cause were present. A cause was considered probable if all 3 clinical criteria were met but criteria for another cause were also present. A cause was considered possible if 2 criteria were met and no other criteria for another cause were found. Finally, we attributed the delirious episode to a comorbid condition if only 1 or 2 criteria for a given cause were present (ie, no single definite, probable, or possible cause could be identified).

Two of us (R.S.M. and A.L.S.) reviewed the case summaries independently and assigned a cause to the delirious episode based on the classification system described in Table 1. The physician reviewers were permitted to override any classification derived from Table 1 if the physician believed that another characterization of the cause was more appropriate. Also, the reviewers estimated whether the delirium was present on admission or developed either preoperatively or postoperatively and whether the delirium had cleared, improved, or persisted at discharge. After independently reviewing each case and recording their observations, the 2 reviewers discussed discrepancies in cause, classification of cause, time of initiation of delirium, and the mental status of each patient on discharge.

The physician reviewers had a 61.5% agreement on the independent classification of the causes of delirium on initial review. After subsequent discussion, the reviewers reached consensus on all cases. Similarly, the reviewers had a 67.3% agreement on the independent estimation of the initiation of delirium and reached consensus after discussion in all cases. Finally, the reviewers had a 70.4% agreement on their initial independent estimation of the patients’ mental status on discharge (cleared or improved vs persistent) and 100% agreement on the final classification after discussion.

mary, the studies that have systematically examined causes have been few in number, relatively small in size, and have focused primarily on medically ill patients.

We describe the pathogenesis of delirium in a surgical population consisting of patients with hip fracture. Hip fracture is a good clinical model for studies of delirium because it is a common disease in the geriatric population and the prevalence of delirium in hip fracture patients is high, ranging from 28% to 50% in published studies.11 Furthermore, internists are nearly universally involved in the care of patients with hip fracture, particularly those who develop delirium.12 This study was designed to ascertain the most common causes of delirium, to establish the initiation and timing of the delirium, and to determine the duration of the delirium episode.
The prevalence of delirium in patients with hip fracture in this study was 9.5% (54/571; 95% confidence interval, 7.0-11.9). The median age of the 54 patients was 85 years (age range, 69-101 years); 81% were women; and the median length of hospital stay was 9 days (range, 3-34 days). The consensus timing of delirium was as follows: 4 patients (7%) were delirious on admission; 16 patients (30%) became delirious before surgery; 5 patients (9%) became delirious on the day of surgery; and 29 patients (54%) became delirious after surgery. The consensus causes of delirium are shown in Table 2. Of the 54 episodes of delirium, 4 (7%) were assigned a definite cause, 11 (20%) were classified as possible, 6 (11%) were classified as probable, and the remaining 33 (61%) were determined to be related to a comorbid condition. Of note, there were 74 identifiable causes attributable to the 33 comorbid cases. The most frequent comorbid causes were infective/environmental and drug use, and fluid-electrolyte disturbances.

Although there was disagreement between the 2 reviewing physicians concerning mental status on discharge, disagreements were frequently about whether the delirium had cleared or merely improved, and this variance was often attributable to sparse chart documentation. After consensus, 40 (74%) of the 54 subjects were determined to have a cleared or improved mental status on discharge. By the time of discharge, the delirium had cleared in 4 patients (7%), improved in 30 patients (67%), and was persistent in 13 patients (24%). One patient’s mental status could not be determined at the time of discharge.

Table 2. Consensus Causes of Delirium Among 54 Patients With Hip Fracture

<table>
<thead>
<tr>
<th>Cause</th>
<th>Definite</th>
<th>Probable</th>
<th>Possible</th>
<th>Comorbid</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drugs</td>
<td>1 (2)</td>
<td>0</td>
<td>2 (4)</td>
<td>16 (30)</td>
<td></td>
</tr>
<tr>
<td>Infection</td>
<td>2 (4)</td>
<td>4 (7)</td>
<td>2 (4)</td>
<td>17 (31)</td>
<td></td>
</tr>
<tr>
<td>Fluid-electrolyte</td>
<td>1 (2)</td>
<td>0</td>
<td>0</td>
<td>11 (20)</td>
<td></td>
</tr>
<tr>
<td>Metabolic/endocrine</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1 (2)</td>
<td></td>
</tr>
<tr>
<td>Intracranial</td>
<td>0</td>
<td>1 (2)</td>
<td>0</td>
<td>1 (2)</td>
<td>3 (6)</td>
</tr>
<tr>
<td>Cardiopulmonary</td>
<td>0</td>
<td>4 (7)</td>
<td>1 (2)</td>
<td>3 (6)</td>
<td></td>
</tr>
<tr>
<td>Drug withdrawal</td>
<td>0</td>
<td>1 (2)</td>
<td>0</td>
<td>2 (4)</td>
<td></td>
</tr>
<tr>
<td>Sensory/environmental</td>
<td>0</td>
<td>1 (2)</td>
<td>1 (2)</td>
<td>24 (44)</td>
<td></td>
</tr>
</tbody>
</table>

* Total comorbid cases, 33; total comorbid causes will exceed total cases owing to multiple causation.

The results of this study suggest that delirium in patients with hip fracture may be a different syndrome from...
that observed in patients who are medically ill. Delirium in hip fracture appears to result from different causes and appears to follow a different clinical course. These findings have important implications for the management of delirium in the patient with hip fracture.

In our study, we found a prevalence of delirium that was much lower than that found in previous studies. The findings from our study suggest that delirium in patients with hip fracture may be a different syndrome from that observed in the medically ill. Our data also suggest that the current recommended strategy for managing delirium (ie, a search for the underlying cause) may need to be modified in the hip fracture population. Therefore, because an underlying cause could not be identified in the majority of our patients, and because the patients improved or got better without a cause being identified, we suggest that a focused search directed at the most likely cause should be undertaken and that, in concert, efforts should be directed toward the symptomatic management of the delirious episode using environmental, behavioral, and pharmacologic interventions (eg, major tranquilizers) rather than on an exhaustive (and perhaps futile) search for all common causes.

The findings from our study suggest that delirium in patients with hip fracture may be a different syndrome from that observed in the medically ill. Our data also suggest that the current recommended strategy for managing delirium (ie, a search for the underlying cause) may need to be modified in the hip fracture population. Therefore, because an underlying cause could not be identified in the majority of our patients, and because the patients improved or got better without a cause being identified, we suggest that a focused search directed at the most likely cause should be undertaken and that, in concert, efforts should be directed toward the symptomatic management of the delirious episode using environmental, behavioral, and pharmacologic interventions (eg, major tranquilizers) rather than on an exhaustive (and perhaps futile) search for all common causes. Finally, as delirium in patients with hip fracture appears to result from causes that are different from those seen in the medically ill, further studies are needed to explore whether previously identified risk factors for the development of...
delirium in the medically ill are applicable to patients with hip fracture and whether there are other conditions unique to hip fracture (eg, pain and anesthesia) that predispose these patients to the development of delirium.

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Corresponding author: R. Sean Morrison, MD, Hertzberg Palliative Care Institute of the Department of Geriatrics and Adult Development, Box 1070, The Mount Sinai School of Medicine, New York, NY 10029.

REFERENCES