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Delirium in the Nursing Home Emergency Department Patient

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Abstract

Objectives—Nursing home patients are an important segment of the aging population, but are often neglected in emergency department (ED) delirium studies. We sought to determine if nursing home patients are more likely to present to the ED with delirium compared to non-nursing home patients, and explore how variations in their delirium risk factor profiles contribute to this relationship.

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Design—Prospective cross-sectional study.

Setting—Tertiary care, academic ED.

Participants—Three hundred forty one English speaking patients who were 65 years and older.

Measurements—Delirium status was determined by using the Confusion Assessment Method for the Intensive Care Unit (CAM-ICU) administered by trained research assistants. Multivariable logistic regression was used to determine if nursing home residence was associated with delirium. Odds ratios (OR) with their 95% confidence intervals (95%CI) were reported.

Results—Of the 341 patients enrolled, 58 (17%) resided in a nursing home. A total of 38 (11.2%) patients were considered to have delirium in the ED. Twenty two (37.9%) and 16 (5.7%) of nursing home and non-nursing home patients, respectively, had delirium in the ED with an unadjusted OR (95%CI) of 10.2 (4.9 – 21.2). After adjusting for dementia, a Katz ADL < 5, hearing impairment, and the presence of systemic inflammatory response syndrome (SIRS), nursing home residence was independently associated with delirium in the ED (adjusted OR = 4.2, 95%CI: 1.8 – 9.7).

Conclusion—In the ED setting, nursing home patients were more likely to present with delirium, and this relationship persisted after adjusting for delirium risk factors.

Keywords

delirium; emergency department; nursing home; elder

Introduction

Delirium disproportionately affects nursing home patients. According to studies conducted in long-term care facilities, up to 40% of residents experience delirium.¹ This form of acute brain dysfunction has been associated with accelerated cognitive and functional decline, higher death rates, prolonged hospitalization, and increased hospital costs.² Despite the high prevalence of delirium in nursing home residents and its negative sequelae, the epidemiology of delirium in this high risk population remains unclear, especially in the emergency department (ED) setting. Nursing home patients are often under represented and often excluded in ED and hospital delirium studies.^{3, 4} Because nursing home patients are more likely to have dementia and functional impairment compared to community dwelling elders, cohort studies with a predominance of community dwelling elders cannot be generalized to this unique patient population.⁵

Improving our understanding of delirium in the nursing home ED patient is a fundamental component to enhancing the quality of ED care delivered to the aging population. According to the National Nursing Home survey, approximately 1.5 million nursing home residents exist in the United States and are frequent users of the ED. Up to 25% of all nursing home patients will visit the ED for an acute illness.^{6, 7} Additionally, 43% of community dwelling elders will enter a nursing home during their lifetime.⁸ Given the projected exponential growth of the number of older Americans over the next several decades,⁹ the number of nursing home patients presenting to the ED will likely increase substantially. In order to clarify the relationship between the nursing home ED patient and delirium, we sought to

determine if nursing home patients are more likely to present to the ED with delirium compared to non-nursing home patients, and explore how variations in their delirium risk factor profiles contribute to this relationship.

Methods

Study Design and Setting

This was a prospective cross-sectional study conducted in a tertiary care, academic ED with an annual census of approximately 55,000 visits. Of these, approximately 10% were 65 years and older.

Participants

We enrolled a convenience sample of ED patients who were 65 years and older and were in the ED for less than 12 hours at the time of assessment. Patients were excluded if they refused consent, were previously enrolled, had a surrogate who was not reachable in patients who were not capable of providing consent, were not able to follow simple commands at their baseline status, were comatose, were non-English speaking, or had incomplete data. Patients who were not able to follow simple commands at baseline were designated as having severe dementia. This was primarily determined from interviewing the surrogate or the patient's nurse at the nursing home. Patients with incomplete data either withdrew from the study or the prospective data collection could not be completed because they left the ED before a delirium assessment could be completed. Patients without any exclusion criteria were enrolled in the study after verbal consent was obtained from the patients or their authorized surrogates. Patients were initially enrolled between May 2007 and July 2007 from 8AM to 10PM. However, we extended the enrollment period for nursing home patients until May 2008 in order to capture additional nursing home patients. Because this was a non-funded study, our sampling window was based upon research assistant availability.

Measurements

Delirium was determined by trained research associates using the Confusion Assessment Method for the Intensive Care Unit (CAM-ICU).¹⁰ The CAM-ICU is a modification of the Confusion Assessment Method (CAM) and was chosen for its brevity (less than 2 minutes) and ease of use. This allowed us to administer the instrument with minimal interruptions in the busy ED environment and maximize the number of patients enrolled over a short period of time. The CAM-ICU uses the exact same construct as the CAM and consists of four features: 1) acute onset of mental status changes or a fluctuating course, 2) inattention, 3) disorganized thinking, and 4) altered level of consciousness.¹¹ Like the CAM, a patient must possess features 1 and 2, and either 3 or 4 in order to meet criteria for delirium. Unlike the CAM, however, the CAM-ICU uses objective testing to determine inattention (feature 2) and disorganized thinking (feature 3).¹⁰ The CAM-ICU has been validated in both mechanically ventilated and non-mechanically ventilated patients and is highly sensitive (93 – 100%), specific (98 – 100%), and reliable (kappa 0.84 – 0.95).^{10, 12} Acute onset of mental status changes or fluctuating course (Feature 1) was determined by surrogate history, examination of the nursing home record or nursing home staff interview. Because of the waxing and

waning nature of delirium, the CAM-ICU was performed at 0- and 3-hours. A patient was considered to have delirium if either 0-hour or 3-hour assessment was positive.

Functional baseline status was measured using the Katz Activities of Daily Living (Katz ADL), in which assesses the patient's independence in bathing, dressing, toileting, transferring, continence, and feeding.¹³ Patients with a Katz ADL < 5 were considered to be functionally dependent. Dementia was determined from the medical record, Mini-Mental State Examination (MMSE),¹⁴ or short form of the Informant Questionnaire on Cognitive Decline in the Elderly (IQCODE).¹⁵ The MMSE was only performed in patients who were CAM-ICU negative because this instrument would not have accurately reflected a delirious patient's premorbid cognitive status. Patients who had a documented history of dementia, a MMSE less than 24, or an IQCODE greater than 3.38 were considered to have dementia.

Patient demographics, past medical history, number of medications prescribed, residence, visual or hearing impairment and recent hospitalization were obtained from the patients, their surrogates, or from the medical record. Type of medication was not recorded. Chief complaint, ED physician diagnosis, vital signs, and emergency severity index (ESI) at triage were also obtained from the medical record.¹⁶ Charlson Comorbidity Index was used to measure comorbidity burden using data obtained from the medical record.¹⁷ The presence of systemic inflammatory response syndrome (SIRS) was used as a surrogate for severity of illness.¹⁸ To meet criteria for SIRS, patients needed two or more of the following: 1) heart rate > 90 beats per minute, 2) body temperature < 36 or >38 degrees Celsius, 3) respiratory rate > 20 breaths per minute, or 4) white blood cell count <4,000 cells / mm³ or >12,000 cells / mm³.¹⁹ All medical record reviews were performed after patient enrollment and were double checked for accuracy.

Data Analysis

For descriptive statistics, proportions were reported for categorical variables. Medians and interquartile ranges were reported for continuous variables because of their non-parametric distribution. For univariate comparisons, we used chi-square tests and Fisher Exact tests for categorical data, and Wilcoxon Rank Sum tests for continuous data. In order to assess association between nursing home residence and delirium while controlling for potential confounding, we performed multivariable logistic regression. The dependent variable in the models was delirium status (as measured by the CAM-ICU) and the primary independent variable was nursing home residence. Additional covariates which were known to be delirium risk factors were considered for the model: age, gender, race, dementia, Katz ADL < 5, visual impairment, hearing impairment, Charlson Comorbidity Index, number of home medications, triage ESI, SIRS, ED diagnosed infection, and hospitalization within the past week.²⁰ Given the number of events, we restricted our model to no more than four covariates to avoid overfitting.²¹ Each covariate was evaluated as an additional variable to nursing home residence in the logistic regression model; covariates with a pre-specified amount of discriminant power for delirium in the ED (at least 5% improvement in c-statistic in addition to nursing home residence) were chosen as candidates for the final model. The final model was then determined using a strategy which was a combination of clinical reasoning and backward selection with Akaike's information criterion (AIC) as the stopping rule. The final

model was validated via bootstrapping to estimate the model's likely performance on new samples of patients from a similar patient pool. Odds ratios (OR) with their 95% confidence interval (95%CI) were reported. All statistical analyses were performed using Open source R software version 2.7.0 or later (R Development Core Team 2007).

Results

Of the 525 patients screened in the ED, 341 patients met inclusion and exclusion criteria (Figure 1). Of these, 58 (17%) resided in a nursing home. Patient demographics, past history, and clinical presentation are listed in Table 1. The nursing home group was older and had a higher proportion of females compared to non-nursing home patients. No differences in the proportion of non-white race were observed. Nursing home patients were also more likely to have dementia, be functionally dependent, have higher comorbidity burden, be on more medications, have visual or hearing impairment, and be hospitalized in the past one week. In addition, nursing home patients were more likely to have an ED diagnosed infection and be admitted to the hospital. No differences were observed in the proportion of patients meeting SIRS criteria and triage ESI between the nursing home and non-nursing home groups.

Of the 341 patients enrolled, 90 (26.4%) had a 3-hour CAM-ICU assessment. Thirty two patients (9.6%) were CAM-ICU positive at 0-hours. An additional 6 patients became CAM-ICU positive with the 3-hour assessment. Therefore, a total of 38 (11.2%) of patients were considered to have delirium in the ED. Stratified by residence, 22 (37.9%) and 16 (5.7%) of nursing home and non-nursing home patients, respectively, had delirium in the ED (unadjusted OR = 10.2, 95%CI: 4.9 – 21.2). After adjusting for dementia, a Katz ADL < 5, hearing impairment, and the presence of SIRS, nursing home residence was independently associated with delirium in the ED (adjusted OR = 4.2, 95%CI: 1.8 – 9.7). The Hosmer-Lemeshow test was 0.185 and the Pearson Chi-Square Test was 0.191 indicating goodness-of-fit. The final model was validated through bootstrapping and performed well.

Discussion

The epidemiology of delirium in nursing home patients is unclear, especially in the ED setting. Most ED and hospital delirium studies have either excluded or had a limited sample of nursing home patients.^{3, 4} In order to improve our understanding of delirium in this unique patient population, we performed a delirium comparison between nursing home and non-nursing home patients in the ED. We observed that delirium disproportionately affects nursing home patients, because they have a higher proportion of delirium risk factors compared to non-nursing home patients.

The proportion of nursing home ED patients affected with delirium in our study was striking; nursing home patients had a ten-fold increased unadjusted odds of presenting to the ED with delirium compared to community dwelling older patients. Our findings are consistent with Elie et al., who observed that nursing home patients in the ED were more likely to present with delirium compared to community dwelling elderly patients (23.5% versus 7.8%).²² However, no additional analyses were performed in this study.

The strength of our study is that we were able to compare delirium risk factor profiles between nursing home and non-nursing home groups. Indeed, nursing home patients had a higher proportion of delirium risk factors that have been previously identified in the literature.²⁰ After adjusting for delirium risk factors, however, nursing home residence remained an independent predictor. This finding is most likely attributable to the presence of unmeasured confounders. One potential unmeasured confounder is frailty. Frailty is a geriatrics syndrome which affects the nursing home patients and is a state in which the patient has increased vulnerability for adverse health outcomes.²³ Fried et al. defined frailty as having three or more of the following criteria: unintentional weight loss, self-reported exhaustion, weakness, slow walking speed, and low physical activity.²⁴ Patients classified as frail were more likely to have functional decline, fall, be hospitalized, and die.²⁴ Frailty may be an important predisposing factor for the development of delirium. However, the relationship between delirium and frailty still needs to be elucidated with future research.

Other potential unmeasured confounders exist and merit discussion. Nursing home patients may have higher degrees of baseline cognitive impairment and thus, be more susceptible to developing delirium.²⁵ Adjusting for dementia severity may have decreased the strength of association observed between nursing home residence and delirium. Unfortunately, we were not able to capture dementia severity in our study since we had no continuous objective measure of cognitive impairment on all participants and particularly those with delirium. In addition, nursing home patients reside in a supervised health care setting. It is possible that only nursing home patients who were sicker and required a higher level of care were sent to the ED. In order to capture severity of illness, we used SIRS criteria as a surrogate. However, this the presence of SIRS may not have adequately captured this important covariate. Lastly, it is possible that nursing home patients were more likely to be on home benzodiazepines, narcotics, and medications with anti-cholinergic properties which have all been known to precipitate delirium.²⁶ Though we attempted to account for this by measuring the number of home medications, this measurement may not have adequately captured these potential confounders.

Our findings suggest several potential areas for intervention. Because delirium occurs so frequently in nursing home patients, delirium screening should be universally performed in this high risk patient population. If delirium is present, a diagnostic evaluation to search for the most underlying etiology, such as infection, should commence. However, beyond finding the underlying cause, delirium management protocols in the ED setting are virtually non-existent. Several hospital-based multi-component delirium interventions have been developed, but their effectiveness is equivocal.²⁷

Instead, preventing delirium in the nursing home may have a larger impact on patient outcomes. In hospitalized patients, delirium prevention strategies have shown to improve clinical outcomes in a cost-effective manner.^{28, 29} These delirium prevention protocols typically use interventions to improve orientation, provide cognitive stimulation, enhance sleep, improve mobilization, address vision and hearing impairments, and treat dehydration early.²⁹ However, these protocols were tested in hospitalized patients who were mostly from the community setting, limiting the external validity of these protocols to the nursing home.

As a result, it is imperative that delirium prevention strategies in the nursing home setting be developed and studied.

Limitations

Our study has several notable limitations. First, a significant proportion of nursing home patients were not enrolled because their surrogates were not available. These patients are most likely the most frail and vulnerable patients and are most likely to have delirium. As a result, we may have underestimated the proportion of nursing home patients with delirium. Second, the CAM-ICU has not been formally validated in the ED setting. However, the CAM-ICU uses the exact same diagnostic criteria as the CAM, which has been validated for use in the ED.³⁰ Third, our sample size was relatively small, so certain important confounders may have been excluded from our model. However, our c-statistic was 0.87, indicating that our final model predicted and explained delirium well. Fourth, this was a convenience sample and only enrolled patients from 8AM to 10PM. Selection bias may have been introduced as patients presenting from 10PM to 8AM may have had a higher severity of illness and may have been more likely to present with delirium. As a result, the proportion of delirious patients may have been underestimated. Lastly, the IQCODE has not been validated for the nursing home patient population.¹⁵ However, very few dementia assessments have been specifically validated for this patient population.

Conclusions

In the ED setting, nursing home patients were more likely to present with delirium because they are more likely to have risk factors. However, this relationship persisted after adjusting for delirium risk factors.

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Figure 1.

Patients meeting inclusion and exclusion criteria. *2 patients withdrew and 7 patients left the emergency department before the CAM-ICU could be completed.

Table 1

Patient demographics, past history, and clinical presentation stratified by nursing home status. Continuous variables are represented as median (interquartile range) and categorical variables are represented as absolute number (proportion). IQR, interquartile range; ADL, activities of daily living; SIRS, systemic inflammatory response syndrome; ESI, emergency severity index; ED, emergency department.

Variable	Nursing Home N=58	Non-Nursing Home N=283	P-Value
Median Age (IQR)	84 (78, 89)	74 (68, 75)	<.001
Male	17 (29.3)	129 (45.6)	0.023
Non-white	11 (19.0)	46 (16.3)	0.614
Median Charlson (IQR)	3 (2, 4)	2 (1, 4)	<.001
Median Total Medications (IQR)	8 (5, 13)	7 (4, 11)	<.001
Dementia	39 (67.2)	108 (38.2)	<.001
Katz ADL<5	37 (63.8)	52 (18.4)	<.001
Visual Impairment	33 (56.9)	62 (21.9)	<.001
Hearing Impairment	20 (34.5)	41 (14.5)	<.001
Hospitalized in past week	12 (20.7)	20 (7.1)	0.001
SIRS Criteria	33 (56.9)	125 (44.2)	0.077
Triage ESI			0.898
1	0 (0.0)	0 (0.0)	
2	35 (60.3)	182 (64.3)	
3	22 (37.9)	95 (33.6)	
4	1 (1.7)	5 (1.8)	
5	0 (0.0)	1 (0.4)	
ED Diagnosed Infection	22 (39.9)	44 (15.6)	<.001
Admitted to Hospital	48 (82.8)	151 (56.9)	<.001