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Impaired Arousal in Older Adults is Associated with Prolonged Hospital Stay and Discharge to Skilled Nursing Facility

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Abstract

Background—Poor cognitive function is associated with negative consequences across settings of care, but research instruments are arduous for routine clinical implementation. This study examined the association between impaired arousal, as measured using an ultra-brief screen, and risk of two adverse clinical outcomes: hospital length of stay and discharge to a skilled nursing facility (SNF).

Design, Setting, & Participants—A secondary data analysis was conducted using two separate groups of medical ward patients: a VA medical center in the northeast (N=1,487, between 2010 and 2012) 60 years and older and a large tertiary care, university-based medical center (N=669, between 2007 and 2013) 65 years and older in the southeastern United States.

Measurements—The impact of impaired arousal, defined by the Richmond Agitation Sedation Scale (RASS) as anything other than “awake and alert,” was determined using Cox Proportional Hazard Regression for time to hospital discharge and logistic regression for discharge to a SNF. Hazard ratios (HR) and odds ratios (OR) with their 95% confidence intervals (CI) are reported, respectively. Both models were adjusted age, sex, and dementia.

Results—The 2,156 total patients included in these groups had a mean age of 76 years, of whom 16.4% in group one and 28.5% in group two had impaired arousal. In the first group, patients with

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normal arousal spent an average of 5.9 days (SD 6.2) in the hospital, while those with impaired arousal spent 8.5 days (9.2). On any given day, patients with impaired arousal had 27% lower chance of being discharged (adjusted hazard ratio 0.73 (95%CI: 0.63 – 0.84). In the second group, individuals with normal arousal spent 3.8 (4.1) days in the hospital compared to 4.7 (4.6) for those with impaired arousal; indicating a 21% lower chance of being discharged [adjusted HR 0.79 (95%CI: 0.66 – 0.95). With regard to risk of discharge to SNF, those with impaired arousal in group 1 had a 65% higher risk than those without impaired arousal [adjusted OR 1.65 (95%CI: 1.21 – 2.25)], and those in group 2 had a non-significant 27% higher risk [adjusted OR 1.27 (0.80 – 2.03)]. Due to the quality improvement nature, this analysis did not control for comorbidities, which is a significant limitation.

Conclusions—In this study of over 2,000 older hospitalized patients, the simple observation of an abnormal arousal level may be an independent predictor of a longer hospital stay and discharge to SNF.

Keywords

Arousal; Cognition; Acute Care; Transitional Care

Introduction

For older patients, poor in-hospital cognitive function is associated with negative outcomes, such as longer lengths of stay, increased morbidity and mortality, and higher costs of care.^{1–4} Such assessments of cognition during hospitalization are often conducted just once over a period of 5 to 15 minutes, as compared to routinely, and only by those with a special understanding of instruments such as a Mini-Mental State Examination (MMSE) or more indepth tools.^{5–8} If bedside clinicians, such as registered nurses, could apply a bedside clinical tool that took only a few seconds, patients' prognosis could be more routinely determined.

The Richmond Agitation Sedation Scale (RASS) was developed as a measure of arousal, sedation, and consciousness in critically ill individuals in the intensive care setting⁹ and a modified version exists for hospitalized older patients.¹⁰ The RASS been suggested as an ultrabrief monitor for mental status, an important indicator of overall function.¹¹ Arousal is conceived as the ability to respond to or interact with the environment¹⁰ and is important component of cognition because it is generally preserved in chronic cognitive disorders, such as dementia.¹² Thus, an alteration in arousal may be a harbinger of more acute impairment in need of evaluation.⁹ This study examined the association between the RASS and the hospital outcomes of length of stay and new discharge to a SNF using two distinctly different groups. Findings from this study provide clinicians with an ultra-brief, less than 15 seconds, measure to identify individuals with impaired arousal who would benefit from additional cognitive evaluation, assessment, and discharge planning to potentially avoid adverse clinical events.¹¹

Methods

This is a secondary analysis of data collected from two groups at different sites. The RASS was conducted upon admission, discharge outcomes were collected, and covariates were abstracted from the medical record.

Setting

Group One—A quality improvement database from a delirium risk modification program was used to conduct this secondary data analysis. This project was conducted from October 2010 through September 2012 at a VA tertiary referral center for the New England region. A convenience sample of patients aged 60 or older and admitted to medical wards were screened upon admission or transfer to the facility and provided appropriate interventions to modify delirium risk. Excluded were individuals admitted as observational status or those readmitted within 30 days of initial screening. The facility Institutional Review Board (IRB) reviewed and approved secondary data analysis of the quality improvement project.

Group Two—A prospective group study database from studies evaluating delirium in an emergency department was used to conduct this data analysis.^{13,14} These studies were conducted from May 2007 until February 2013 at a large, tertiary care, university-affiliated medical center located in the southeastern US. For this analysis, patients were included if they were aged 65 or older, in the emergency department for less than 12 hours, and admitted to the hospital. Individuals who were excluded were non-English speaking, deaf or blind, those who could not or would not consent, comatose or unable to follow simple commands prior to their acute illness. The IRB approved the study with a requirement for verbal consent to be obtained.

Measures

Arousal—The assessment of arousal utilized the Richmond Agitation and Sedation Scale (RASS). The RASS is an ultra-brief, reliable, observational tool used to determine level of arousal.^{9,10} Administration of the RASS was done across both sites by trained study staff that approached patients, using verbal and tactile stimuli as necessary. The RASS was scored using the -5 to +4 rating scale. Alert and calm (RASS equal to zero) is considered normal, with positive numbers related to increased arousal, while negative numbers denote decreased levels. In group one, a modified version of the RASS¹⁰ was used for assessment which also includes an informal test of attention, while in group two the original version was used.⁹ For the regression analysis, the level of arousal was dichotomized if the score was not zero because of the U-shaped relationship with arousal and outcome.

Outcomes—Two outcomes were measured in both groups using chart review: (1) hospital length of stay and (2) new discharge to a SNF. Hospital length of stay was calculated as the number of days between screening and discharge. New discharge to a SNF refers to individuals previously community-dwelling who were transferred to a SNF for rehabilitation after hospitalization.

Covariates—Covariate data included: age, gender, and dementia status. Age and gender were obtained from patient chart and medical record. Pre-existing dementia status was recorded as the presence of a pre-existing dementia diagnosis in the medical record history and physical or by the use of a medication typically prescribed for dementia (i.e., a cholinesterase inhibitor).

Analysis

Measures of central tendency and dispersion for continuous variables were reported as means and standard deviations (SD) for parametric data or as medians and interquartile ranges (IQR) for non-parametric data. Proportions were reported for categorical variables. To determine if impaired arousal was associated with hospital length of stay, the cumulative probability of remaining in hospital was obtained using a Cox proportional hazards regression model was performed. The dependent variable was time to hospital discharge; patients were considered to be censored if they died in the hospital or after 25 days. Hazard ratios (HRs) with 95% confidence intervals (95%CI) were reported. A HR less than 1 indicated that patients with impaired arousal were less likely to die. To determine if impaired arousal was associated with discharge to a skilled nursing facility, logistic regression was performed. Odds ratios (ORs) with 95%CI were reported. Univariate and multivariable models were performed. The multivariable models were adjusted for age, gender, and dementia presence. All data analyses were performed using STATA Version 11 (StateCorp, College Station, TX) and SAS Version 9.4 (SAS Institute, Carey, NC). P-values less than 0.05 were considered statistically significant.

Results

Study population characteristics are described in Table 1; group one included 1,487 individuals. Consistent with the hospitalized Veteran population, the mean age was 76.3 years (SD: 9.4) and 1,465 patients were male (98.5%), and 223 (15.0%) had a dementia documented in the medical record. Impaired arousal was present in 244 (16.4%) patients. Group two included 669 individuals. The mean age was 76 years (SD: 7.7), 312 (46.6%) were male, and 80 (12.0%) had dementia documented in the medical record. Impaired arousal was present in 191 (28.5%) patients.

Impaired arousal was associated with prolonged hospital length of stay for both groups (Tables 2 and 3). In group one, individuals with a normal arousal had a hospital length of stay of 5.6 days (SD: 5.7). Participants with impaired arousal were at significantly reduced hazard for discharge in group one (HR = 0.73, 95%CI: 0.63 – 0.84) after adjusting for age, gender, and dementia. Similar findings were observed in group two. Those with a normal arousal spent a mean of 4.0 days (SD: 4.3) days. Participants with impaired arousal were at significantly reduced hazard for discharge in group two (HR = 0.79, 95%CI: 0.67 – 0.95) after adjusting for age, gender, and dementia.

Correspondingly, patients with impaired arousal were more likely to be discharged from the hospital to a skilled nursing facility (Table 4). For groups one and two, patients were excluded if they were admitted to the hospital from a skilled nursing facility or if they died within the hospital. In group one, a total of 83 (34.0%) patients with impaired arousal and

295 (23.7%) with normal arousal were discharged to a skilled nursing facility. This relationship persisted after adjusting for age, gender, and dementia status in which individuals with impaired arousal were 65% more likely to be discharged to a skilled nursing facility (OR: 1.65; 95%CI: 1.21 – 2.25). In group two, a total of 34 (17.8%) patients with impaired arousal and 63 (13.2%) with normal arousal were discharged to a skilled nursing facility. Adjusting for age, gender, and dementia status, there was a trend towards increased risk of new skilled nursing home placement (OR: 1.27; 95%CI: 0.80 – 2.03).

Discussion

The clinical implications are an ultra-brief assessment of cognitive arousal is clearly demonstrated across two distinct groups, in which up to 29% experienced impaired arousal. This assessment was associated with an increased length of hospital stay and increased risk of new discharge to a skilled nursing facility, independent of age, gender, and dementia status.

Prior work in cognitive screening has focused on more time consuming and more complex instruments. By focusing on an ultra-brief instrument such as the RASS this study developed an enhanced understanding of a measure of arousal that does not require paper or props, is easily able to be incorporated into clinical flow, and is associated with outcomes. Also, trained staff not involved in the direct clinical care of patients administered the RASS, suggesting that support personnel could conduct the screening. This also has implications for older adults upon transition to a SNF or a rehabilitation setting where delirium is common.^{15–17}

This analysis provides additional insight in the selection of measures of arousal, a complex concept that involves components of awareness and awakedness; external stimuli; and self-awareness.^{18–20} Deficits in arousal and awareness are also key features of delirium^{5,12} and may be indicative of more global changes in cognition.²¹ Arousal, as measured by the RASS, has also been shown to be a potential indicator of delirium.^{22,23} Arguments have been made that to attend to a stimuli, one has to have a certain level of arousal, while others have found an ability to attend to stimuli even in the presence of an unconscious level of attention.^{19,20} As a result, an abnormal RASS should be followed by a more comprehensive assessment of mental status, because of the association with negative outcomes demonstrated here and the potential for more severe disorders.

A delayed discharge was seen across both groups and for group one, an increased risk of discharge to a SNF was demonstrated; even after adjusting for age, gender, and dementia status. Although this is a limited number of confounders, it is suggested that impaired arousal may be a potential indicator of hospital outcomes even across individuals with pre-existing cognitive impairment. A group that is at significant risk for further cognitive and functional decline after hospitalization.^{2,3,24} This is also a vulnerable group often neglected in research due to their inability to consent and fully participate, indicating the need for additional action. Additional research needs to be done in this area using diverse, prospective groups while accounting for confounders to determine the clinical utility of this ultra-brief screen as a first step in cognitive evaluation.

A major strength of this analysis is the finding of similar outcomes with abnormal RASS performance in two markedly different clinical settings improving the validity and generalizability. Group one was conducted at a VA located in the northeast US. Group two was conducted at academic, tertiary care hospital located in the southeast US. Additionally, the samples were robust, with a total of more than 2,000 individuals.

Limitations include a one-time administration of the RASS on admission. Inherently, there are also limitations of the RASS itself. The RASS relies on patient visual and auditory ability, limiting its utility in individuals with these impairments who are some of the most vulnerable to impaired arousal.^{9,10} Also, this tool may not be sensitive enough to discriminate between those who have impaired arousal, but remain responsive to auditory or visual stimulation.⁹ The quality improvement focus of the first group limited the amount of covariate data that was analyzed. Variables identifying premorbid function, comorbidities, and reason for hospitalization would have been beneficial. Also, dementia was determined based on chart review, which is not an objective measure to assess for the presence of pre-existing cognitive impairment. Dementia is under-diagnosed²⁵ within the medical record, which has significant limitations for this analysis. Additional research needs to be done in this area using objective measures in divers, prospective groups while accounting for confounders to determine the clinical utility of this ultra-brief screen as a first step in cognitive evaluation.

Impaired arousal during hospitalization has been associated with many negative outcomes including delirium, falls, pressure ulcers, and functional decline.^{1-4,26,27} Objective, ultra-brief assessment of impaired arousal was independently linked to increased length of hospital stay and new discharge to an institutional setting in over 2,000 older adults. With implementation, this assessment has potential, significant individual and economic influences.

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Table 1

Baseline Characteristics

	Cohort 1 (N=1,487)	Cohort 2 (N=669)
Characteristic	Result	
	Median (IQR) [†] or % (N)	
Age, years	77 (68,84)	75 (60,81)
Sex, male	98.5% (1,465)	46.6% (312)
Pre-admission SNF	4.1% (95)	10.0% (67)
Dementia, in medical record	15.0% (223)	12.0% (80)
RASS		
-2	2.1% (31)	4.2% (28)
-1	10.0% (148)	22.4% (150)
0	83.6% (1,243)	71.5% (478)
1	4.0% (59)	1.6% (11)
2	0.4% (6)	0.3% (2)
Length of Stay, days	4 (2,7)	3 (2,6)
Death or Hospice	2.1% (31)	1.4% (9)

RASS – Richmond Agitation Sedation Scale; IQR – interquartile range; SNF – Skilled nursing facility

Table 2

Impaired Arousal and Outcome Measures

Cohort 1 (N=1,487)			Cohort 2 (N=669)	
RASS	Length of Stay Mean (SD)	Discharge to SNF % (N)	Length of Stay Mean (SD)	Discharge to SNF % (N)
-2	11.4 (11.5)	35.5% (11/31)	7.7 (7.1)	21.4% (6/28)
-1	8.0 (8.4)	29.7% (44/148)	4.1 (3.3)	18.0% (27/150)
0	5.9 (6.2)	23.7% (295/1243)	3.8 (4.1)	13.2% (63/478)
1	7.4 (8.7)	40.7% (24/59)	5.9 (7.8)	7.7% (1/13)
2	10.0 (10.1)	66.7% (4/6)	-	-

RASS – Richmond Agitation Sedation Scale; SD – Standard deviation; SNF – Skilled nursing facility

Table 3

Associations between Impaired Arousal and Hospital Length of Stay

	Cohort 1 (N=1,487)		Cohort 2 (N=669)			
	Length of Stay Mean (SD)	Unadjusted HR (95% CI)	Adjusted HR (95% CI)	Length of Stay Mean (SD)	Unadjusted HR (95% CI)	Adjusted HR (95% CI)
		0.75 (0.65, 0.86)	0.73 ((0.63, 0.84)		0.79 (0.67, 0.94)	0.79 (0.67, 0.95)
Normal	5.9 (6.2)			3.8 (4.1)		
Abnormal	8.5 (9.2)			4.7 (4.6)		

Cox proportional hazard regression models were performed to determine if delirium is associated with hospital length of stay. A hazard ratio (HR) less than 1 indicates that patients were less likely to be discharged from the hospital. Both univariate and multivariable models adjusted for age, sex, and dementia are presented.

RASS – Richmond Agitation Sedation Scale; SD – Standard deviation; HR – Hazard ratio; 95% CI – 95% Confidence Interval; SNF – Skilled nursing facility; OR – Odds ratio

Table 4

Associations between Impaired Arousal and New Discharge to Skilled Nursing Facility

Cohort 1 (N=1,487)		Cohort 2 (N=669)				
	Discharge to SNF* % (n/N)	Unadjusted OR (95% CI)	Adjusted OR (95% CI)	Discharge to SNF† % (n/N)	Unadjusted OR (95% CI)	Adjusted OR (95% CI)
		1.79 (1.33, 1.42)	1.65 (1.21, 2.25)		1.42 (0.91, 2.25)	1.27 (0.80, 2.03)
Normal	23.7% (295/1243)			13.2% (63/478)		
Abnormal	34.0% (83/244)			17.8% (34/191)		

Logistic regression was performed to determine if delirium is associated with discharge to a skilled nursing facility. A hazard ratio (HR) less than 1 indicates that patients were less likely to be discharged from the hospital. Both univariate and multivariable models adjusted for age, sex, and dementia are presented.

SNF – Skilled nursing facility; RASS – Richmond Agitation Sedation Scale; SD – Standard deviation; OR – Odds ratio; 95% CI – 95% confidence interval.