original article

Delirium and correlates of delirium among newly admitted elderly patients: a cross-sectional study in a Saudi general hospital

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BACKGROUND: Delirium is a common, often undiagnosed disorder in elderly patients, but no studies have been conducted in Saudi Arabia.
OBJECTIVES: To determine the prevalence of delirium among elderly patients on admission and to identify associated factors.
DESIGN: A cross-sectional study.
SETTING: Tertiary care hospital, Saudi Arabia.
PATIENTS AND METHODS: Elderly patients were evaluated for delirium within 24 hours of admission using the Confusion Assessment Method (CAM). The medical records were also reviewed to identify associated factors and whether the diagnosis of delirium was documented by the admitting physician.
MAIN OUTCOME MEASURES: Prevalence of delirium.
RESULTS: Of 147 patients aged 60 or over screened for delirium within 24 hours of admission, 32 (21.8%) patients were identified with delirium. Seven (21.9%) of the 32 patients with delirium had documentation of their diagnosis in the patient chart by the attending physician. Univariate logistic regression identified greater age (OR=2.70, 95%-CI: 1.21-6.02), higher unemployment rate (OR=3.30, 95%-CI: 1.43-7.61), more often had 3-5 co-morbidities (OR=2.69, 95%-CI: 1.14-6.33), and more cognitive impairment (OR=38.90, 95%-CI: 8.78-172.34) as risk factors for delirium on admission. Multivariate logistic regression analysis identified greater age (OR=2.53, 95%-CI: 1.08-5.88), higher unemployment rate (OR=3.73, 95%-CI: 1.52-9.13) and 3-5 co-morbidities (OR=3.31, 95%-CI: 1.30-8.46) as risk factors for delirium.
CONCLUSIONS: Delirium was common and frequently not recognized in elderly patients admitted to the hospital. Administration of the CAM was very helpful in identifying delirium at admission.
LIMITATIONS: The main limitation of our study was the relatively small number of patients which might have limited the power to detect some associations.

Delirium is an acute neuropsychiatric disorder characterized by failure of cognition and attention. Unlike dementia, delirium develops rapidly (over several hours to days), can fluctuate in severity and may be reversed by eliminating the causative factor. In some cases, it can become chronic or result in irreversible cognitive changes.[1] The occurrence of delirium is highest among the hospitalized elderly population. In fact, a recent review estimated that 50% of all hospitalized patients older than the age of 65 are affected by delirium.[2] The risk is even higher when special subpopulations are considered. For example, the prevalence of delirium in intensive care units, palliative care units and post-surgical settings may be as high as 80%, 85%, 70%, respectively.[3-5]

Interestingly, greater than 30% of delirium cases can

be prevented[6,7] and hence preventive measures can reduce both the occurrence as well as adverse outcomes of delirium. In a recent systematic review, the commonest risk factors for incident delirium in hospitalized elderly patients were advanced age, dementia, comorbidities, reduced activities of daily living, immobility, use of urinary catheters, high-risk medication use, certain laboratory abnormalities (levels of albumin, sodium, urea/creatinine ratio) and increased hospital stay.[8]

Irrespective of its etiology, delirium is associated with adverse patient outcomes. Symptoms of delirium, such as agitation and lethargy can increase risk of aspirations, ulcers, pulmonary emboli and reduced oral intake.[1] In some cases, delirium can lead to long-term functional and cognitive decline, which persists even after treatment or the withdrawal of causative factors.[9,10] It may also lead to longer hospital stay, institutionalization, psychological stress, and mortality.[11,12] Due to the varied clinical presentations of delirium, the fluctuating symptoms and the lack of routine cognitive assessments in hospitals, the diagnosis of this condition is often difficult, leading to under recognition of the problem. Moreover, delirium is sometimes present along with pre-existing dementia, making it hard to differentiate the two.[13]

In the existing literature, several studies have evaluated the occurrence of delirium in hospitalized elderly patients. However, similar studies have not been conducted in Saudi Arabia. Therefore, the present study aimed to determine the prevalence of delirium among newly hospitalized patients aged 60 years and over within 24 hours of their admission to a general hospital. In addition, we aimed to identify the associated factors and to determine the recognition rate of delirium by hospital staff.

PATIENTS AND METHODS

Between January and March 2016, we included all patients aged 60 years and older who were admitted to the medical and surgical wards at King Fahad General Hospital, Jeddah Saudi Arabia. Patients with a language barrier, aphasia, hearing impairment, severe cognitive dysfunction, reduced level of consciousness, or with unstable medical illnesses were excluded. Eligible patients were evaluated for delirium by trained medical staff within 24 hours of admission using a protocol approved by the Institutional Review Board of Ministry of Health. The questionnaire included items on age, sex, education, marital status, employment, and living conditions. It also included selected clinical characteristics such as admission diagnosis, comorbidities, polypharmacy, premorbid functional status, and basic laboratory results.

According to the American Psychiatric Association's Diagnostic and Statistical Manual, 5th edition (DSM-5), five key characteristics are used to diagnose delirium.[14] These features include attention disturbances, acute onset of symptoms, additional cognitive disturbances, and the absence of other neurocognitive disorders to explain symptoms. However, the DSM-5 is not easily applied at the patient's bedside. Hence, several other diagnostic tools exist to identify delirium.

The Confusion Assessment Method (CAM) is a standardized and validated bedside diagnostic tool that is widely used to detect delirium.[15] This method relies on the following criteria for diagnosis of delirium: acute onset, fluctuating symptoms, diminished attention, disorganized thinking or altered consciousness. In a meta-analysis, CAM demonstrated high sensitivity (94%), specificity (89%) and inter-rater reliability.[16] A comparison of bedside diagnostic instruments to detect delirium reported CAM as the most accurate test.[17] CAM is most reliable when performed in conjunction with formal cognitive testing and by trained interviewers.

The short portable mental status questionnaire (SPMSQ) is a 10-item cognitive screening questionnaire that is widely used in clinical practice to detect the presence and severity of cognitive impairment in elderly patients.[18] As per the SPMSQ scoring system, 0-2 errors indicate normal mental function, 3-4 errors indicate mild cognitive impairment, 5-7 errors indicate moderate cognitive impairment, and ≥8 errors indicate severe cognitive impairment.[19]

The Katz Index of Independence in Basic Activities of Daily Living (BADL) is a reliable instrument to assess the functional status of elderly individuals.[20] The index assesses six primary functions: bathing, dressing, toileting, transferring, continence, and feeding. The independence in each function is scored with a yes/no. A score of 6 reflects full function, a score of 4 reflects moderate functional impairment, and ≤2 indicates presence of severe functional impairment.[21]

We planned a cross-sectional study with consecutive patient selection as a sampling technique. Assuming 10% of our study participants had delirium, we needed to study 138 patients to estimate the prevalence of delirium with a 5% margin of error so we included 147 patients in our study. To describe our study population, we used frequencies and absolute numbers for categorical variables. Differences between two categorical variables were assessed using the two-sided chi-squared test or the two-sided Fisher exact test when the data were sparse in one or more category. Associations between delirium and risk factors were estimated by odds ratios and their corresponding 95% confidence

intervals. To adjust for potential confounding variables, multivariate regression models were constructed. The dependent variable was delirium diagnosed by the screening staff that evaluated patients within 24 hours of admission at KAUH. The independent variables were age, gender, marital status, living status, educational level, occupational status, department, admission diagnosis, number of comorbidities, admission medications, Katz index 2 weeks before admission and SPMSQ at admission. A backwards elimination procedure was used to select the variables for the regression model. For all statistical tests, a *P* value of <.05 was defined as a level of significance. No adjustments were made for multiple comparisons. We examined potential collinearity between age and occupational status using the Pearson correlation coefficient as well as tolerance and variance inflation factor as collinearity diagnostics in multivariate regression. We used the IBM SPSS version 21 for data analysis.

RESULTS

Of 147 consecutive patients aged 60 or older included in our study, 65.3% (n=96) of the patients were 60 to 74 years of age and 34.7% (n=51) were 75 or older. Women accounted for 40.8% (n=60) of the study population and about two-thirds of the patients were married (65.3%, n=96). Most were living with their family prior to hospitalization (93.2%, n=137). About 50% of the patients were illiterate (n=73 and 53.7% (n=79) were employed. Most of the patients were admitted for the treatment of an acute medical illnesses (75.5%, n=111). Cardiac disorders were the most common admission diagnosis (23.8%, n=35), followed by gastrointestinal (19.7%, n=29) and neurologic disease (19.0%, n=28). Two or more comorbidities were found in 63.3% of patients and 38.1 % (n=56) were taking 5 or more medications. The mean (SD) Katz Index two weeks before admission was 3.83 (2.25) (**Table 1**).

Of 32 (21.8%) of the 147 patients diagnosed with delirium by the screening staff, 7 (21.9%) had documentation of their diagnosis in the patient chart by the attending physician. Compared to patients without delirium, patients with delirium were older (chi-square, *P*=.01), educated (chi-square, *P*=.02), had a lower employment rate (chi-square, *P*=.004), and less intact cognitive function as determined by SPMSQ testing (chi-square, *P*=<.001). No significant differences were found in other sociodemographic and clinical characteristics of patients with and without delirium (**Table 2**). The most common clinical factors associated with delirium were taking three or more medications (62.5%), use of a urinary catheter (20/32, 31.3%), acute pain (10/32,

Table 1. General characteristics of study participants.

Variable	Result	Variable	Result
Gender		**Department**	
Male	87 (59.2)	Medical	98 (66.7)
Female	60 (40.8)	Surgical	49 (33.3)
Age		**Admission diagnosis**	
60-74 years	96 (65.3)	Cardiac	35 (23.8)
>74 years	51 (34.7)	Endocrine	6 (4.1)
Marital status		Gastrointestinal	29 (19.7)
Unmarried	51 (34.7)	Hematologic	2 (1.4)
Married	96 (65.3)	Infection	7 (4.8)
Living status		Musculoskeletal	6 (4.1)
With family	137 (93.2)	Neurologic	28 (19.0)
Alone	10 (6.8)	Respiratory	12 (8.2)
Educational status		Urinary	18 (12.2)
Illiterate	73 (49.7)	Vascular	4 (2.7)
≤High school	60 (40.8)	**Number of Co-morbidities**	
>High school	14 (9.5)	None	14 (9.5)
Occupational status		1 Co-morbidity	40 (27.2)
Employed	79 (53.7)	2 Co-morbidities	60 (40.8)
Unemployed	68 (46.3)	3 Co-morbidities	23 (15.7)
Katz Index 2 weeks before admission	3.83 (2.25)	4 Co-morbidities	8 (5.4)
		5 Co-morbidities	2 (1.4)
SPMSQ at admission		**Admission medications**	
No deficit	85 (57.8)	<5 Medications	91 (61.9)
Mild deficit	25 (17.0)	>5 Medications	56 (38.1)
Moderate deficit	13 (8.8)	**Admission diagnosis**	
Severe deficit	24 (16.3)	No delirium	115 (78.2)
		Delirium	32 (21.8)
		Chart documentation	
		Delirium not documented	25 (17.0)
		Delirium documented	7 (4.8)
		Patients without delirium	115 (78.2)

Data are mean (standard deviation) (Katz index) or number (percentage).

Table 2. Characteristics of study participants with and without delirium.

Variable	Patients without delirium (n=115)	Patients with delirium (n=32)	*P* value
Age (years)			
60-74	81 (84.4)	15 (15.6)	
>74	34 (66.7)	17 (33.3)	.01
Gender			
Male	72 (82.8)	15 (17.2)	
Female	43 (71.7)	17 (28.3)	.11
Marital status			
Unmarried	36 (70.6)	15 (29.4)	
Married	79 (82.3)	17 (17.7)	.10
Living status			
With family	109 (79.6)	28 (20.4)	
Alone	6 (60.0)	4 (40.0)	.23*
Educational status			
Illiterate	50 (68.5)	23 (31.5)	
≤High school	53 (88.3)	7 (11.7)	
>High school	12 (85.7)	2 (14.3)	.02
Occupational status			
Employed	69 (87.3)	10 (12.7)	
Unemployed	46 (67.6)	22 (32.4)	.004
Department			
Medical	73 (74.5)	25 (25.5)	
Surgical	42 (85.7)	7 (14.3)	.14*
Admission diagnosis			
Cardiac	32 (91.4)	3 (8.6)	
Endocrine	3 (50.0)	3 (50.0)	
Gastrointestinal	22 (75.9)	7 (24.1)	
Hematologic	2 (100.0)	0 (0.0)	
Infection	6 (85.7)	1 (14.3)	
Musculoskeletal	6 (100.0)	0 (0.0)	
Neurologic	17 (60.7)	11 (39.3)	
Respiratory	9 (75.0)	3 (25.0)	
Urinary	16 (88.9)	2 (11.1)	
Vascular	2 (50.0)	2 (50.0)	.047*
Number of comorbidities			
0-2	94 (82.5)	20 (17.5)	
3-5	21 (63.6)	12 (36.4)	.02
Admission medications			
<5	72 (79.1)	19 (20.9)	
>5	43 (76.8)	13 (23.2)	.74
Katz Index 2 weeks before admission			
Independent	32 (78.0)	9 (22.0)	
Dependent	83 (78.3)	23 (21.7)	.97
SPMSQ at Admission			
Intact	83 (97.6)	2 (2.4)	
Impaired	32 (51.6)	30 (48.4)	< .001

Data are number (percentage). **P* value of Fisher exact test.

31.3%) and stroke (9/32, 28.1%). Several abnormalities were also noted on admission laboratory blood testing. Six patients (18.8%) had a low blood hemoglobin level and 9 (28.8%) had a leukocytosis. Random blood sugar, blood urea nitrogen and creatinine levels were elevated in 78.1% (n=25), 93.1% (n=30) and 87.5% (n=28), respectively (**Table 3**).

Using univariate logistic regression, patients with delirium, compared to non-delirious patients, were older (OR=2.70, 95%-CI: 1.21 - 6.02, *P*=.01) had a higher unemployment rate (OR=3.30, 95%-CI: 1.43 -7.61, *P*=.004), higher rate of 3-5 co-morbidities (OR=2.69, 95%-CI: 1.14-6.33, *P*=.02) and had more impaired cognitive function (OR=38.90, 95%-CI: 8.78 - 172.34, *P*<.0001) than patients without delirium. Patients with less than high school and more than high school education were less likely to have delirium (OR=0.29, 95%-CI: 0.11-0.73 and OR=0.36, 95%-CI: 0.08–1.75 respectively), compared to illiterate patients (**Table 4**). The slight difference in the OR might be due to the small number of patients with more than high school education (n=14), i.e. low statistical power.

In the multivariate logistic regression, patients with delirium were older (OR=2.53, 95%-CI: 1.08-5.88), had

Table 3. Clinical characteristics of patients with delirium (n=32).

Variable	Frequency (%)
Risk factors	
Pain	31.3
Malnutrition	15.6
Use of restraints	0.0
Use of urinary catheter	31.3
Alterations in oxygenation	9.4
Infection	15.6
Changes to electrolyte or acid base	3.1
Withdrawal from alcohol or Benzodiazepine	0.0
Introduction of three or more medications	62.5
Stroke	28.1
Acute fracture	9.4
Heart failure	3.1
Liver failure	6.3
Kidney failure	9.4
Hypoglycemia	0.0
Invasive procedures	9.4
Surgery	15.6

Table 3A. Clinical characteristics of patients with delirium (n=32).

Variable	Frequency (%)		
	Normal	Low	High
Blood test			
Hemoglobin level	81.3	18.8	0.0
White blood cell	68.8	3.1	28.1
Random blood sugar	21.9	0.0	78.1
Blood urea nitrogen	6.3	0.0	93.8
Creatinine level	12.5	0.0	87.5
Alanine transaminase	90.6	6.3	3.1
Aspartate transaminase	84.4	6.3	9.4
Blood calcium	90.6	9.4	0.0

a higher unemployment rate (OR=3.73, 95%-CI: 1.52 - 9.13) and a higher rate of 3-5 co-morbidities (OR=3.31, 95%-CI: 1.30 - 8.46) than patients without delirium (Nagelkerke R^2= 0.192).. We found no evidence of collinearity. The Pearson correlation coefficient between age and employment status was weak (r=0.098). When we used the multivariate regression model, we found the tolerance of the variables (measure of multicollinearity) age and employment status to be 0.987 and 0.984, respectively, and the variance inflation factor of the variables age and employment status to be 1.013 and 1.016, respectively. The high values of tolerance (>0.1) and the low values of VIF (<2.5) indicated lack of collinearity.

DISCUSSION

Delirium was diagnosed in 21.8% of newly admitted hospitalized elderly patients by the screening group we employed with a similar frequency (21.8%) as in previous reports.[2] Only 21.9% of patients identified by screening were similarly diagnosed by the treating physician. The low recognition rate points out the need for screening at-risk patients for the diagnosis of delirium within 24 hours of admission and periodically during their stay. This has been recommended by the National Institute for Health and Clinical Excellence.[22] The CAM is a validated screening instrument with a sensitivity of 94-100% and specificity of 90-95% in diagnosing delirium.[15,16] If administered on admission, it can facilitate the diagnosis of delirium and improve patient treatment.[16]

Risks factors for delirium by univariate analysis included increased age, illiteracy, unemployment, impaired cognitive functioning, and the presence of 3-5 co-morbidities. Increased age, unemployment, and the presence of 3-5 co-morbidities were confirmed as risk factors by multivariate analysis. These findings are also in accord with previous reports.[2,23]

The evidence from 19 studies, included in a systematic review, confirmed the effectiveness and safety of most multicomponent interventions in preventing delirium in at-risk hospitalized patients.[24] Hospital Elder Life Program (HELP) is a widely recognized multicomponent intervention program to prevent delirium.[2,25] It is used internationally at over 60 institutions for delirium prevention and consists of standardized interventions that address six key risk factors – cognitive impairment, sleep deprivation, immobility, diminished vision or hearing, and dehydration.[26,27]

A strength of this study was the evaluation of all patients admitted to the hospital that were 60 years of age or older for the diagnosis of delirium. These

Table 4. Factors associated with delirium in univariate analysis.

Variable		Odds Ratio	95% Confidence interval	*P* value
Age (years)	60-74 (Reference)	1	-	-
	>74	2.7	1.21-6.02	.02
Gender	Male (Reference)	1	-	-
	Female	1.9	0.86-4.18	.11
Marital status	Unmarried (Reference)	1	-	-
	Married	0.52	0.23-1.15	.11
Living status	With family (Reference)	1	-	-
	Alone	2.6	0.69-9.83	.16
Educational status	Illiterate (Reference)	1	-	-
	≤High School	0.29	0.11-0.73	.01
	>High School	0.36	0.08-1.75	.21
Occupational status	Employed (Reference)	1	-	-
	Unemployed	3.3	1.43-7.61	.01
Admission reason	Elective (Reference)	1	-	-
	Acute	Not estimable	Not estimable	.1
Department	Medical (Reference)	1	-	-
	Surgical	0.49	0.19-1.22	.13
Number of comorbidities	0-2 (Reference)	1		-
	3-5	2.69	1.14-6.33	.02
Number of admission medications	<5 (Reference)	1	-	-
	>5	1.15	0.52-2.55	.74
Katz Index 2 weeks before admission	Independent (Reference)	1	-	-
	Dependent	0.99	0.41-2.36	.97
SPMSQ at admission	Intact Cognitive Functioning (Reference)	1	-	-
	Impaired Cognitive Functioning	38.9	8.78-172.34	<.001

findings may not be comparable to community-based studies, but is more applicable to hospitalized patients undergoing evaluation for delirium. Moreover, our study used validated and reliable instruments to measure delirium and controlled for several risk factors.

The main limitation of our study was the relatively small number of patients which might limited the power to detect some associations. When our study population was stratified by the presence or absence of delirium, as we showed in **Table 2**, contingency tables of the variables living status, department and admission diagnosis suffered from sparse data problem; with <5 expected participants per cell. For these variables, we refrained from using the chi-square test to investigate the difference between participants with and without delirium and instead we used and reported the results of the Fisher exact test. Furthermore, based on one previous study, we assumed 10% prevalence of delirium when we calculated the required sample size of our study. However, our study found 21.8% prevalence of

delirium. Therefore, we recommend that future studies conduct sample size calculations based on a systematic and critical review of all previous studies.

Delirium was common and frequently not recognized in elderly patients admitted to the hospital. Greater age, unemployment, and the presence of 3-5 co-morbidities were risk factors for delirium in these patients. The use of confusion assessment method (CAM) to screen elderly patients for delirium on admission and then periodically is in keeping with published guidelines and should be widely adopted. Although, delirium preventive strategies have been successfully implemented in many countries, the cost-effectiveness of such programs needs to be proven in the Saudi hospital care system prior to adoption.

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Conflict of interest

The authors reported no conflict of interests.

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