Heliyon 9 (2023) e20554

Contents lists available at ScienceDirect

Heliyon

journal homepage: www.cell.com/heliyon

Thirty-day mortality among patients with acute delirium in the emergency department

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ARTICLE INFO

Keywords:
Delirium
30-Day mortality
Emergency department
Older-patients

ABSTRACT

Purpose: The number of visits to the emergency department (ED) is growing among older patients. Older people are at risk of acute delirium, which is associated with mortality. Our primary objective was to determine the 30-day mortality outcome between older patients with and without acute delirium.

Methods: From August 2018 to October 2019, we conducted a prospective cohort study in the ED of a tertiary care and university hospital. Patients over the age of 65 years who presented to the ED were included in the study. Within the first 12 h after the ED visit, delirium was assessed by using the Thai version of the Confusion Assessment Method for the Intensive Care Unit (CAM-ICU). We collected data on 30-day mortality, ED LOS, hospital length of stay (LOS), and the 30-day ED revisit rate.

Results: We enrolled 173 patients in this study; 49 (28%) patients had acute delirium according to the CAM-ICU. The overall 30-day mortality was 4% (7/173). Delirium had no effect on 30-day mortality (adjusted odds ratio [OR], 2.15; 95% confidence interval [CI], 0.37–12.55; P = 0.40). Delirium was not associated with hospital LOS (adjusted mean difference −18.83 h; 95% CI, −71.94–34.28; P = 0.49) and the 30-day ED revisit rate (adjusted OR, 1.55; 95% CI, 0.59–4.11; P = 0.37). However, an increasing trend in ED LOS was observed (adjusted mean difference 16.39 h; 95% CI, −0.160–32.96; P = 0.05).

Conclusions: We found insufficient evidence to establish an association between delirium and 30-day mortality, hospital LOS, or 30-day emergency department revisits.

Trial registration: The trial was retrospectively registered in the Thai Clinical Trial Registry, identification number TCTR2021082700 on August 27, 2021.

Key summary points

Aim

The aim of this study was to determine the effect of acute delirium in the Emergency Department on 30-day mortality in older patients.

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https://doi.org/10.1016/j.heliyon.2023.e20554
Received 13 February 2023; Received in revised form 20 September 2023; Accepted 28 September 2023
Available online 29 September 2023

Findings

We found insufficient evidence to show that delirium was associated with 30-day mortality.

Message

Our study findings provide a starting point for early assessment and diagnosis of delirium, including a care plan for prevention and treatment in the ED.

1. Background

According to data from the Population Reference Bureau, the number of people over age 65 years has increased worldwide [1]. An annual report describing the proportion of older adults among the Thai population stated that this population has increased from 12.9% in 2010 to 15.3% in 2014. Thailand is predicted to become a "complete aged society" (more than 20% of the total population age 60 years or more than 14% of the population age 65 years) in 2021, and a "super-aged society" (more than 28% of the total population age 60 years or more than 20% of the population age 65 years) in 2031 [2].

Acute delirium is an acute and fluctuating alteration of consciousness caused by a physical illness and that leads to reduced levels of attention, cognition, and perception [3]. This condition is common among older individuals who present to the emergency department (ED) and is associated with increased hospital length of stay (LOS), morbidity, mortality, and health care costs [4–6]. Ageing is associated with a greater risk of acute delirium and cognitive impairment [7–10], and lead to ED visits. The prevalence of acute delirium in the ED ranges from 8.3% to 17.2% [8,10–12]. The ED is where acute delirium is normally first detected [13], and under-diagnosis is common [12]. When dealing with older patients in the ED, the American College of Emergency Physicians (ACEP) Emergency Medicine Clinical Practice Committee recommends use of the ADEPT (Assess-Diagnose-Evaluate-Prevent-Treat) framework [6].

To evaluate patients with delirium, a comprehensive approach involving history taking and examination is necessary. Various diagnostic tools are available for delirium screening, including the Delirium Triage Screen (DTS), Brief Confusion Assessment Method (BCAM), and the Confusion Assessment Method for the Intensive Care Unit (CAM-ICU). CAM-ICU is a tool used to assess acute delirium in critically ill patients. The pooled sensitivity is 80% and the specificity is 95.9% [14]. For the older patients in the ED, the pooled sensitivity is 68–72% and the specificity is 99% for delirium when used by physicians and non-physicians, respectively [15]. The Thai version of the CAM-ICU has demonstrated good validity, reliability, and simplicity of use for diagnosing delirium in the ICU [16]. This tool could be apply in the diagnostic process of the ADEPT framework to improve patient care in the ED.

To evaluate the short-term outcome, specifically the 30-day mortality, of patients with acute delirium, it is crucial to emphasize the optimization of delirium screening, prompt implementation of pharmacologic and non-pharmacologic interventions, and effective treatment planning in order to potentially minimize morbidity and mortality rates.

The main objective of this study was to evaluate the effect of acute delirium in the ED on 30-day mortality in older patients, including the short-term outcomes ED LOS, hospital LOS, and 30-day ED revisits in older patients with delirium.

2. Methods

2.1. Study design and patient setting

We conducted a prospective cohort study and enrolled older patients who visited the ED of the tertiary university hospital in Bangkok, Thailand with approximately 50,000 annual patient visits, between August 2018 and October 2019. Older patients were defined as those over the age of 65 years. This study was approved by the Committee on Human Rights Related to Research of the institute on August 14, 2018 (IRB COA. NO. MURA2018/361).

2.2. Participants

We enrolled eligible older patients who presented to the ED during the specific scheduled periods of three physicians who had trained CAM-ICU assessment (40 h per week individually). We included patients who were evaluated using the Thai version of the CAM-ICU (Additional file) within the first 12 h of their ED visit. The exclusion criteria were: 1) physical inability to communicate including blindness, deafness, or aphasia; 2) inability to communicate in Thai; 3) severe impairment of consciousness, defined as a Glasgow Coma Scale (GCS) score <8 or a Richmond Agitation–Sedation Scale (RASS) score less than score -3; and 4) Emergency Severity Index (ESI) triage level 1 (patients requiring immediate resuscitation).

2.3. Assessment training

In our study, we included three emergency physicians who had worked in the ED for more than 3 years. These physicians were

trained in CAM-ICU assessment by the team investigator. The detections of delirium by CAM-ICU assessment of the assessors were blind to the emergency physicians who had attended the patients. Before starting to collect the data, we used the patient scenarios to examine the agreement of CAM-ICU assessment for diagnosed delirium in three assessors. The level of inter-rater agreement is good. The reliability test (Fleiss' kappa) was 0.86; 95%CI (0.58–0.95). The pooled sensitivity is 0.89; 95% CI (51.8–99.7). The pooled specificity is 0.83; 95%CI (35.9–99.6).

2.4. Data collection and measurement

The initial ED visit information included the ESI triage level, initial vital signs, initial laboratory findings, and ED visit diagnosis. Within the first 12 h after the ED visit, the assessor emergency physician examined each patient using the CAM-ICU in Thai language to determine the status of delirium. The CAM-ICU test results were not relevant to any usual care in the ED and were concealed by the assessors. The assessors were not involved in providing any care of the patient. At the time of enrollment, the baseline variables (age, sex, education level, residence, comorbidities, current medications, basic activities of daily living (basic ADL), caregiver information), and the recognition of acute delirium by attending emergency physician were recorded.

Clinical outcome information was collected 30 days later from the official medical records or via direct phone contact with the caregiver.

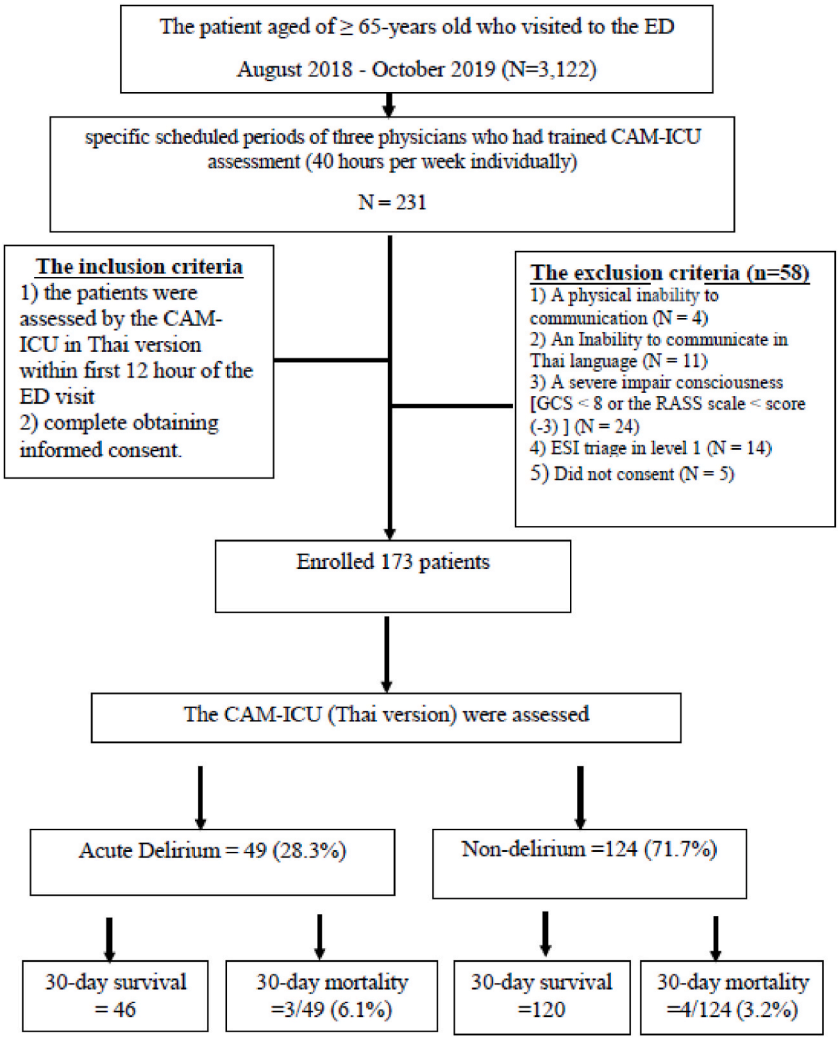

Fig. 1. Patients flow chart
ED, emergency department; CAM-ICU, Confusion Assessment Method for the Intensive Care Unit; GCS, Glasgow Coma Scale; RASS, Richmond Agitation–Sedation Scale; ESI, Emergency Severity Index.

2.5. Clinical outcome

The primary outcome was 30-day mortality. Secondary outcomes were ED LOS, hospital LOS, and the 30-day ED revisit rate.

2.6. Sample size and statistical analysis

The sample size was calculated using the N4 software application (developed by Chetta Ngamjarus; E-mail: Chetta.ngam@gmail.com) with the equation for two independent proportions for comparisons in a prospective cohort study. Sri-on et al. [12] reported the association of delirium and a higher mortality rate 4/27 (15%) in delirium group vs. 3/205 (2%) in non-delirium group, P = 0.004) which was conducted in an urban university hospital in Thailand and similar to our setting. The probability of type I error (α = 0.05) and type II error (β = 0.20) were estimated using the formula. The adjustment for data losses was 10%. The sample size for one sample was 80 and the sample size for two samples was 160 patients.

Descriptive statistics were calculated for all clinical characteristics and relevant variables; continuous variable data are presented as mean (standard deviation; SD) with a normal distribution or median in non-parametric tests, using an independent *t*-test or Mann–Whitney *U* test. Categorical data were presented as percentage, using a chi-square test or Fisher's exact test, as appropriate. The outcome analysis of 30-day mortality and the 30-day ED revisit rate were compared using multivariable logistic regression for binary outcomes and using log link and Gaussian distribution. The robust variance estimator was used for the risk difference of 30-day mortality. We compared the ED LOS and hospital LOS using multivariable regression for continuous outcomes. The adjusted covariates included age, sex, underlying diabetes, hypertension, ischemic heart disease, cerebrovascular accident, chronic kidney disease, chronic obstructive pulmonary disease, psychosis, neoplasm, systolic blood pressure, oxygen saturation, and respiratory rate. All tests were two-sided and values were considered to be statistically significant with a P-value <0.05. We performed all data analysis using Stata version 16 (Stata Corp LLC, College Station, TX, USA).

3. Results

A total of 3122 patients were all older patients who had visited ED between August 2018 and October 2019. The number of patients

Table 1
Baseline characteristics between the groups with and without delirium.

Characteristic N (%), mean (±SD)	Delirium N = 49	Non-delirium N = 124	P-value
Age, mean (±SD)[a]	79 (±8.2)	77 (±8.0)	0.32
Female sex, n (%)[b]	28 (57%)	63 (51%)	0.45
Comorbidities, n (%)[b]			
Diabetes	21 (43%)	54 (44%)	0.93
Hypertension	37 (76%)	90 (73%)	0.69
Dyslipidemia	25 (51%)	57 (46%)	0.54
Ischemic heart disease	17 (35%)	32 (26%)	0.24
Cardiovascular disease	15 (31%)	17 (14%)	0.01[a]
Chronic renal failure	10 (20%)	36 (29%)	0.27
Asthma	2 (4%)	4 (3%)	1.00
COPD	3 (6%)	9 (7%)	1.00
Neoplasm	10 (20%)	34 (27%)	0.34
Mental and ADL status, n (%)[b]			0.30
Dementia	2 (4%)	5 (4%)	
Visual impairment	0	1 (1%)	
Alcohol drinking	2 (4%)	0	
Bedridden	4 (8%)	8 (7%)	
Herbal remedy use	0	1 (1%)	
Fall history	0	3 (2%)	
Current medicine, n (%)[b]			
Haloperidol	1 (2%)	0	0.28
Benzodiazepine	5 (10%)	8 (7%)	0.39
Sedative drugs	1 (2%)	3 (2%)	0.62
Opioid drugs	5 (10%)	5 (4%)	0.11
Caregiver, n (%)[b]			0.32
No caregiver	0	5 (4%)	
Family care	49 (100%)	119 (96%)	
Level of education, n (%)[b]			0.56
Below Bachelor's degree	40 (82%)	97 (78%)	
Bachelor's degree	9 (18%)	22 (18%)	
Master's degree	0	4 (3%)	
Doctoral degree	0	1 (1%)	

COPD, chronic obstructive pulmonary disease; ADL, activities of daily living; SD, standard deviation.
[a] Student *t*-test.
[b] Chi-squared or Fisher's exact test; P < 0.05 considered significant.

in the study period of three CAM-ICU assessment trained physicians were 231. A total of 173 participants were enrolled and met the eligibility criteria. Within the first 12 h of the ED visit, all patients were assessed using the CAM-ICU in Thai language to determine their delirium status. Acute delirium was diagnosed in 49 (28.3%) patients. The main outcome of 30-day mortality was 3/49 (6.12%) in acute delirium group and 4/124 (3.26%) in without acute delirium group. Fig. 1 shows an illustration of the patient flow.

Table 1 shows the baseline characteristics of the included patients. Overall, sex, age, Comorbidities, current medications, presence of a caregiver, and education level were similar between the two groups, except that patients with delirium had a higher proportion of cardiovascular disease. Table 2 shows the information from the initial ED visit. The delirium and non-delirium groups had similar triage levels; vital signs at triage; laboratory results including hemoglobin, white blood cells, platelets, serum creatinine, electrolytes; ED diagnosis; recognition acute delirium by attending physician and ED disposition.

Table 3 demonstrates the primary outcome after adjustment that the delirium group did not show an effect on 30-day mortality (adjusted odds ratio [OR], 2.15; 95% confidence interval [CI], 0.37–12.55; P = 0.40). Risk difference (RD) of 30-day mortality between the delirium and non-delirium groups was not statistically significant (RD 4%; 95%CI (−3%) - 10%; P = 0.28). We also found that delirium had no significant effect on the mean difference in hospital LOS (adjusted mean difference −18.83 h, 95% CI, −71.94–34.28, P = 0.49) or 30-day revisits (adjusted OR, 1.55; 95% CI, 0.59–4.11; P = 0.37). However, we observed that the mean difference in ED LOS (adjusted mean difference 16.39 h, 95% CI, −0.160–32.96, P = 0.05) had an increasing trend in the delirium group. Table 4 demonstrates multivariable analysis factor of 30-day mortality outcome between delirium and non-delirium.

We found that emergency physicians recognized delirium in only 11 of 49 (22.45%) patients (Table 2). Table 5 presents a comparison of the treatment received between non-surviving and surviving delirium patients. Among the 11 patients in whom delirium

Table 2
Initial ED visit information between groups with and without delirium.

Characteristic Mean (±SD)	Delirium N = 49	Non-delirium N = 124	P-value
ESI triage level, n (%)[b]			0.79
Level 1	6 (12%)	15 (12%)	
Level 2	26 (53%)	57 (46%)	
Level 3	16 (33%)	47 (38%)	
Level 4	1 (2%)	5 (4%)	
Vital signs at triage[a]			
Heart rate (bpm)	89.4 (±18.3)	87.8 (±21.6)	0.35
Respiratory rate (/min)	22.4 (±4.2)	22.9 (±4.7)	0.56
Body temperature (°C)	36.8 (±0.7)	37.7 (±0.7)	0.32
Systolic BP (mmHg)	136.2 (±30.7)	146.6 (±31.2)	0.99
Diastolic BP (mmHg)	71.1 (±13.7)	75.4 (±13.4)	0.67
Laboratory results			
Hemoglobin, Hb (g/dL)	11.1 (±2.6)	11.2 (±2.1)	0.84
Hematocrit, Hct (%)	34.5 (±8.1)	35.2 (±6.5)	0.56
White blood cell count, (/mm^3)	10511.0(±823.7)	10493.1(±1153.0)	0.99
Neutrophil, Ne (%)	75.3 (±16.3)	71.5 (±14.0)	0.12
Lymphocyte, Lym (%)	14.8 (±8.8)	18.0 (±11.8)	0.08
Sodium, Na (mmol/L)	135.2 (±9.1)	134.6 (±18.4)	0.84
Potassium, K (mmol/L)	4.4 (±2.5)	4.1 (±0.8)	0.20
Chloride, Cl (mmol/L)	103.3 (±9.5)	100.5 (±14.7)	0.21
Carbon dioxide, CO2 (mmol/L)	21.1 (±4.7)	21.3 (±5.4)	0.80
Blood urea nitrogen, BUN (mg/dL)	29.7 (±24.2)	26.5 (±20.9)	0.39
Creatinine, Cr (mg/dL)	1.4 (±1.5)	1.7 (±1.6)	0.50
ED diagnosis categories, n (%)[b]			0.07
Pulmonary	9 (18%)	21 (17%)	
Cardiovascular	8 (12%)	22 (18%)	
Gastrointestinal	5 (10%)	19 (15%)	
Genitourinary	2 (4%)	5 (4%)	
Neurology	2 (4%)	4 (3%)	
Trauma	3 (6%)	1 (1%)	
Hematology	1 (2%)	4 (3%)	
Musculoskeletal	3 (6%)	20 (16%)	
Infectious	7 (14%)	6 (5%)	
Metabolic	0	1 (1%)	
Psychological	2 (4%)	0	
Recognize derilium by Attending physicians	11(22.45)	0	<0.01
ED disposition, n (%)			0.72
Discharged	33 (67%)	81 (65%)	
Admitted	14 (29%)	37 (30%)	
Referred	2 (4%)	5 (4%)	
Died in the ED	0	1 (1%)	

ESI, Emergency Severity Index; ED, emergency department; BP, blood pressure; bpm, beat per minute; SD, standard deviation.
[a] Student *t*-test.
[b] Chi-squared or Fisher's exact test; P < 0.05 considered significant.

Table 3
Primary and secondary outcomes in the groups with and without delirium.

Outcome Delirium/Non-delirium (base)	Delirium N = 49	Non-delirium N = 124	Adjusted odds ratio[a] Adjusted risk difference[b] Adjusted mean difference[c] (95% CI)	P-value
Primary outcome	3 (6.1%)	4 (3.2%)	[a] OR 2.15 (0.37,12.55)	0.40
30-day mortality, n (%)			[b] RD 0.04 (−0.03,0.10)	0.28
ED LOS (hour), median [Q1,Q3][c]	61 [22, 97]	32.5 [8.2, 65.7]	[c] MD 16.39 (−0.16, 32.96)	0.05
Hospital LOS (hour), median [Q1,Q3][d]	168 [48, 288]	144 [96, 360]	[c] MD −18.83 (−71.94, 34.28)	0.49
30-day ED revisit, n (%)	9 (18%)	21 (17%)	[a] OR 1.55 (0.59, 4.11)	0.37

ED, emergency department; CI, confidence interval; LOS, length of stay; OR, odd ratio; RD, risk different; MD, mean different.

[a] Adjusted odds ratio (95% confidence interval): age, sex, underlying diabetes, hypertension, ischemic heart disease, cerebrovascular accident, chronic kidney disease, chronic obstructive pulmonary disease, psychosis, neoplasm, systolic blood pressure, oxygen saturation, and respiratory rate.

[b] Adjusted risk difference: age, sex, underlying diabetes, hypertension, ischemic heart disease, cerebrovascular accident, chronic kidney disease, chronic obstructive pulmonary disease, psychosis, neoplasm, systolic blood pressure, oxygen saturation, and respiratory rate. Used Generalized linear regression with a log link and Gaussian distribution and robust variance estimator.

[c] Adjusted mean difference: age, sex, underlying diabetes, hypertension, ischemic heart disease, cerebrovascular accident, chronic kidney disease, chronic obstructive pulmonary disease, psychosis, neoplasm, systolic blood pressure, oxygen saturation, and respiratory rate.

[d] Median (interquartile range); rank-sum test.

Table 4
Multivariable analysis factor of 30-day mortality between delirium and non-delirium.

Primary outcome: 30-day mortality			
Variable	Odd ratio	95%CI	P value
Delirium	2.15	0.37–12.55	0.40
Age	0.93	0.81–1.07	0.31
Male	0.75	0.12–4.75	0.76
Diabetes	0.19	0.02–2.00	0.17
Hypertension	1.12	0.17–7.36	0.91
Ischemic heart disease	0.72	0.06–8.69	0.80
Cerebrovascular disease	0.75	0.06–8.73	0.82
Chronic kidney disease	2.17	0.26–18.25	0.48
Chronic lung disease	1.76	0.10–31.68	0.38
Psychosis	(omitted)		
Neoplasm	3.24	0.56–18.75	0.19
Systolic blood pressure	0.98	0.95–1.01	0.27
Respiratory rate	1.17	0.96–1.43	0.12
Oxygen saturation	0.99	0.97–1.01	0.55

was recognized, all of them received treatment. One patient received non-pharmacologic treatment alone, while the remaining patients received a combination of non-pharmacologic and pharmacologic treatment, including haloperidol, quetiapine, olanzapine, and sertraline. The 30-day mortality rate was 1/11 (9%) among patients with recognized delirium who received treatment, and 2/38 (5%) among patients in whom delirium was not recognized.

Table 6 shows the predictive variables in multivariable analysis related to delirium among older patients in the ED. Cerebral vascular disease was significantly predicted the delirium among older patients (OR, 3.70; 95% CI, 1.48–9.22; $P < 0.01$). Ischemic heart disease and dementia also showed a trend toward predicted the ED delirium (OR, 2.20; 95% CI, 0.93–5.20; $P = 0.07$ and OR, 5.54; 95% CI, 0.91–33.53; $P = 0.06$, respectively).

Table 5
Comparing the treatment received between non-surviving and surviving delirium patients.

Delirium N = 49 (%)	Non-Survival N = 3	Survival N = 46	P-value
Delirium Treatment	1 (33.33%)	10 (21.74%)	0.54
Non Pharmacologic Treatment alone	0	1 (2.17%)	0.50
Non Pharmacologic + Pharmacologic Treatment	1 (33.33%)	9 (19.57%)	0.50
• Haloperidol	0	1 (2.17%)	
• Quetiapine	1 (33.33%)	5 (10.87%)	
• Olanzapine	0	2 (4.34%)	
• Sertraline	0	1 (2.17%)	

Table 6
Predictive factors associated with delirium among older patients in the ED.

Clinical factor	Multivariable analysis		
	Odd ratio	(95% CI)	P-value
Age ≥80 year	1.21	0.52–2.81	0.64
Male sex	0.96	0.45–2.04	0.92
Diabetes	0.95	0.42–2.16	0.91
Hypertension	1.01	0.40–2.52	0.97
Ischemic heart disease	2.20	0.93–5.20	0.07
Cerebral vascular disease	3.70	1.48–9.22	<0.01
Chronic kidney disease	0.67	0.23–1.93	0.46
Malignancy	0.78	0.31–1.97	0.60
Dementia	5.54	0.91–33.53	0.06
Use of benzodiazepine	2.44	0.63–9.34	0.19
Anemia; Hb < 8 g/dL	1.25	0.26–5.98	0.77
Leukocytosis ≥12,000/mm^3	1.59	0.65–3.84	0.30
Hyponatremia <135 mmol/L	1.01	0.43–2.34	0.97
Hypokalemia <3.5 mmol/L	2.24	0.79–6.34	0.12
Blood urea nitrogen ≥20 mg/dL	1.68	0.73–3.87	0.22
Creatinine ≥2.0 mg/dL	0.48	0.13–1.70	0.25

ED, emergency department; Hb, hemoglobin; CI, confidence interval.

4. Discussion

The main outcome analysis of our study did not show a significant association between delirium and 30-day mortality. The mortality was 3/49 (6.12%) in acute delirium group and 4/124 (3.26%) in the group without acute delirium. The adjusted odds ratio (OR) was 2.15 with a wide confidence interval (CI) of 0.37–12.55 and a p-value of 0.49. However, it is important to acknowledge that our study may have potentially underestimated the prevalence of delirium and the resulting mortality outcomes. We detected an underpowered analysis.

In comparison to previous studies, Kennedy et al. conducted a prospective observational study and reported a higher 30-day mortality rate of 6% in the delirium group compared to 1% in the non-delirium group [19]. However, we also calculated the statistical power from the Kennedy study and found it to be underpowered. Another study by Sri-on et al. presented similar data to our patient setting, showing a higher mortality rate of 15% in the delirium group versus 2% in the non-delirium group [12]. Once again, we detected underpowered analysis from the Sri-on study. Furthermore, both previous studies lacked sufficient data to account for confounding factors, as they only reported crude proportions for the 30-day mortality outcome.

Our initial hypothesis was that delirium in the emergency department (ED) would impact 30-day mortality outcomes. However, our study was unable to demonstrate the magnitude of this effect when compared to previous studies. One potential reason for this discrepancy could be the exclusion of patients with more severe illnesses, such as those with an Emergency Severity Index (ESI) Triage level 1, which may have introduced selection bias. Additionally, the enrollment of patients by three CAM-ICU assessment trained physicians over a specific study period might have further influenced the results. To establish a clearer understanding of the effect on 30-day mortality outcomes, a larger sample size that includes patients with more severe illnesses would be necessary.

Other studies, such as those conducted by Han et al. [10] and Kakuma et al. [20], reported that delirium in the ED was associated with higher mortality rates at 6 months (hazard ratio 1.72, 95% CI, 1.04–2.86 and HR 7.2, 95% CI, 1.6–32.30, respectively) after adjusting for confounding factors such as age, sex, functional dependence, cognitive status, and comorbidity. These findings suggest that ED delirium may be linked to an elevated risk of long-term death and emphasize the potential clinical benefits of early detection and intervention in the ED. However, we were unable to draw the effect regarding long-term outcomes in our study.

Bo M. et al. reported that an ED length of stay exceeding 10 h doubles the risk of developing delirium [21] Continuous delirium assessment and prompt management during ED stay can reduce complications and improve outcomes. We observed a trend of increased ED length of stay (LOS) associated with ED delirium in our data, with a mean increase of 16.39 h; 95% CI, −0.160, 32.956 and a p-value of 0.05.

Han et al. confirm that delirium is not a transient event and frequently persists into a hospital stay. However, it is worth noting that our tertiary hospital's overcrowding in the ED could also influence patient flow and clinical outcomes, particularly if delirium is not promptly recognized and treated.

Regarding secondary outcomes, we lacked statistical power to establish correlations between delirium and hospital LOS or 30-day ED revisits, which was consistent with the results of Sri-on et al. [12]. However, Kakuma et al. reported that ED delirium may increase both hospital LOS and 30-day readmission rates [20].

To improve the detection of delirium in the ED, recommendations have been issued by the Society for Academic Emergency Medicine and the American College of Emergency Physicians [17]. Previous studies have shown that the incidence of delirium in the ED ranges from 7% to 20%, while the rate of physician detection using specific tools ranges from 11.1% to 46.0% [17]. Additionally, the data shows that between 65% and 76% of patients with delirium are not recognized by emergency physicians [10,18]. There are insufficient data on delirium in the ED from middle-income countries, particularly Thailand. Sri-on et al. reported 2016 ED data from Thailand; 12% of elderly patients experienced delirium and 59% were not recognized [12]. The number of elderly patients with acute

delirium presenting to the ED is increasing every year. We found that the prevalence of a delirium diagnosis using the CAM-ICU was 28.3%, an increase from previously reported data. In our study, we found that emergency physicians failed to recognize delirium in 77.55% of older patients. These findings highlight the need for improved recognition of delirium in the ED, as its detection remains challenging.

The Geriatric Emergency Care Applied Research (GEAR) Network reviewed the practicality of implementing apply CAM-ICU in ED settings and found that it may not be convenient due to the need for training and additional time. Assessments in emergency healthcare settings are often time-limited and interrupted. However, alternative tools like the brief CAM and the Delirium Triage Screen (DTS) have been validated for their accuracy and usability in identifying delirium and require less time to administer. Additionally, factors such as overcrowding, limited knowledge of patients' baseline functioning, and a lack of standardized assessment protocols may contribute to the failure to recognize delirium. Improving the skills and knowledge of the emergency healthcare team and reassessing protocols could potentially enhance delirium detection.

In terms of risk factors for delirium, a prior meta-analysis identified significant risks such as age, dementia, severe illness, poor vision, urinary catheter use, polypharmacy, and low albumin levels [22]. Our study identified comorbid cerebral vascular disease and cognitive function as potentially important risk factors that require greater attention. Notably, the pooled sensitivity analysis did not show significant differences regarding male sex, polypharmacy, or benzodiazepine usage in terms of delirium risk. However, implementing a delirium prevention protocol specifically targeting high-risk patients in the ED may improve patient outcomes.

Once delirium is recognized, the management process involves identifying and correcting the underlying cause or predisposing factors. Non-pharmacological interventions should be prioritized, including reorientation techniques, the use of glasses and hearing aids, encouragement, and comforting measures, as well as discontinuing medications that may trigger delirium (e.g., benzodiazepines, antihistamines, anticholinergics, opioids). However, challenges in the ED environment, such as noise, lighting, overcrowding, and retrain, can exacerbate delirium symptoms. Pharmacological interventions, such as antipsychotics and atypical psychotics, may be added to non-pharmacological approaches to reduce severity, although they do not impact mortality outcomes [23]. Monitoring for adverse effects, such as extrapyramidal symptoms and QT prolongation, is necessary for these medications. By enhancing the quality of non-pharmacological management, it may be possible to minimize the need for pharmacological interventions and improve clinical outcomes.

4.1. Limitations

First, our data were derived from a single center and the tertiary care center at a medical school. It may not be generalizable. Second, Unfortunately, by study periods of three CAM-ICU assessment trained physicians we had enrolled only 231 patients who visit ED between august 2018 and October 2019. This may have introduced a selection bias. Third, we excluded patients who had high mortality such as clinically unstable, ESI triage level 1 and severely impaired consciousness (GCS <8) that may affect the expected of the mortality outcome, potentially underestimating prevalence and lowering mortality outcomes. Our exclusion criteria and consent requirements may have introduced selection bias and under-power of our study. Fourth, we used the CAM-ICU as a diagnostic tool rather than the standard criteria of the International Classification of Diseases, Tenth Revision (ICD-10) and the recently published Diagnostic Statistical Manual of Mental Disorders, Fifth Edition (DSM-5) [24] because the CAM-ICU takes less than 2 min to complete and has excellent inter-rater reliability [25]. Although the brief CAM and the Delirium Triage Screen (DTS) may serve as alternative diagnostic tools that require less assessment time and simpler training in healthcare. Fifth, our study had under power when to detect a 30-day mortality outcome. In the future studies, we anticipate a larger sample size or multicenter study. Sixth, we had insufficient data regarding treatment of delirium, non-pharmacologic care, severity score, and new episodes of delirium throughout the ED stay. Nevertheless, our study findings provide a starting point for early assessment and diagnosis of delirium, including a care plan for prevention and treatment in the ED.

5. Conclusions

In our cohort study among 28% (49/173) older patients who presented with acute delirium in the ED, we found no significant association between delirium and 30-day mortality, 30-day ED revisits, or hospital LOS. Nevertheless, there was an increasing trend in ED LOS among patients with delirium. Potential limitations, including underestimated prevalence, low statistical power, and exclusion of patients with severe illnesses, which may have influenced the results. To overcome these limitations, a larger sample size, including patients with more severe illnesses, is needed. It highlights the need to investigate other factors or comorbidities that may contribute to the mortality risk in patients with delirium. Further research is required to improve delirium recognition in the ED, enhance healthcare team knowledge and skills, and identify risk factors such as comorbid cerebral vascular disease and cognitive function. Ultimately, a comprehensive delirium management approach in the ED should encompass prediction, screening-assessment, prevention, and treatment.

Funding

No funding was received for conducting this study.

Ethical approval and consent to participate

This study was approved by the ethics committee of the Faculty of Medicine, Ramathibodi Hospital, Mahidol University (IRB COA. NO. MURA2018/361 Date August 14, 2018). All methods were carried out in accordance with relevant guidelines and regulations such as Declaration of Helsinki, The Belmont Report, CIOMS Guidelines and the International Conference on Harmonization in Good Clinical Practice (ICH-GCP). The informed consent was obtained from all participants/patients, written informed consent was obtained from parents/guardians of all children who participated in the study.

Consent for publication

Not applicable.

Availability of data and materials

The data supporting this study's findings are openly available in [Harvard Dataverse] at "Thirty-day mortality among patients with acute delirium in the emergency department" https://doi.org/10.7910/DVN/XGM3ST.

Author contribution statement

Pitsucha Sanguanwit; Suranan Ninlamal: Conceived and designed the experiments; Performed the experiments; Analyzed and interpreted the data; Contributed reagents, materials, analysis tools or data; Wrote the paper. Thidathit Prachanukool: Analyzed and interpreted the data; Wrote the paper.

Data availability statement

Data associated with this study has been deposited at https://doi.org/10.7910/DVN/XGM3ST.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Acknowledgment

We wish to acknowledge contribution of all the medical and nursing staff of Emergency department of Ramathibodi Hospital for our collaborations. We thank the statistical consultant for our institution for all of the statistical work. We thank Analisa Avila, MPH, ELS, of Edanz (www.edanz.com/ac) for editing a draft of this manuscript.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.heliyon.2023.e20554.

List of abbreviations

ED	emergency department
LOS	length of stay
CAM-ICU	Confusion Assessment Method for the Intensive Care Unit
ACEP	American College of Emergency Physicians
ADEPT	Assess-Diagnose-Evaluate-Prevent-Treat
GCS	Glasgow Coma Scale
RASS	Richmond Agitation–Sedation Scale
ESI	Emergency Severity Index
EP	emergency physician
ADL	activities of daily living

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