Title: Nurse screening for delirium in older patients attending the Emergency Department

Authors: Malcolm Hare BSc (Hons)[1]
Glenn Arendts MMed[2]
Dianne Wynaden PhD[3]
Gavin Leslie PhD[3]

Affiliations:
1. Fremantle Hospital, Fremantle, Australia
2. University of Western Australia, Nedlands, Australia
3. Curtin University, Bentley, Australia

Correspondence: A/Prof G Arendts
Emergency Medicine
University of Western Australia
Level 2 R Block
QEII Medical Centre
Nedlands, Western Australia, 6009
61 8 92248458
glenn.arendts@uwa.edu.au

Abstract

Objectives

Delirium in older emergency department (ED) patients is common, associated with many adverse outcomes, and costly to manage. Delirium detection in the ED is almost universally poor. The authors aimed to develop a simple clinical risk screening tool that could be used by ED nurses as part of their initial assessment to identify patients at risk of delirium

Methods

A prospective cross sectional study in patients aged 65 and over attending a single ED

Results

In 320 enrolled patients, 23 (7.2%) had delirium. Logistic regression analysis revealed three risk factors strongly associated with delirium risk: cognitive impairment, depression and an abnormal heart rate/rhythm. Weighting these variables based on the strength of their association with delirium yielded a risk score from 0-4 inclusive. A cut off of 2 or more in that score would have sensitivity 87%, specificity 70% and NPV 99%, whilst avoiding further diagnostic workup for delirium in around two thirds of all patients, when used as an initial screen

Conclusions

A simple risk screening tool using factors evident on initial nurse assessment can be used to identify patients at risk of delirium. Further trials are needed to test whether the tool improves patient outcomes

Introduction

Up to 20% of patients aged 65 years and over have delirium present on arrival in the Emergency Department (ED) [1-4], or develop delirium as a complication of hospitalisation [5-8]. Delirium is associated with longer hospital stays, increased costs and adverse clinical outcomes [9-13]. In spite of the frequency with which delirium occurs and impact of negative outcomes associated with delirium, the condition often remains unrecognised and untreated [4 14-16].

Multiple interventions can prevent or reduce the duration and severity of an episode of delirium, but are resource intensive if applied universally [6 15 17-19]. Nonetheless, an approach of early identification of delirium risk, and the targeting of interventions to those most at risk, is easily justified using the substantial financial burden alone of delirium in older patients [20].

A number of risk factors for delirium have been identified, and a variety of studies have shown that combinations of these risk factors can be used to stratify risk of delirium for specific groups of patients and aid delirium diagnosis [21-28]. However, the studies that have examined risk factors have mostly been conducted in specific in-patient populations during the post-acute phase of admission. Fewer studies have examined delirium risk factors within the ED [24]. The ED is busy, noisy, distracting and time-pressured compared to other environments. This may impact on both the patient's cognitive state and the clinician's ability to accurately assess cognition [4 29].

Nurses are usually the first clinician to assess the ED patient and continue to have contact with the patient throughout their ED stay. Routine screening by ED nurses for delirium has previously been recommended, but existing instruments may be too time consuming or cumbersome for regular use in the ED [2 24]. A brief but accurate screen applied at the first point of significant patient contact could provide a resource-effective method of identifying delirium risk and provide a basis for further definitive diagnostic assessment and targeted intervention.

This pilot study was conducted to derive, from risk factors found on an initial nursing assessment, a brief screening tool to predict the presence of delirium in older patients presenting to ED.

Methods

We conducted a prospective observational study with a cross sectional design using the Confusion Assessment Method (CAM) as the diagnostic standard for delirium, incorporating the Mini Mental State Examination (MMSE) [30] as the requisite cognitive assessment.

A literature search was conducted using the Medline database and the terms "delirium" OR "acute confusion" AND "risk factors" to find published risk factors for delirium. Risk factors were considered for inclusion if they were predisposing or precipitating risk factors [31]. Each risk factor identified from this search was then included in our study if:

1. the risk factor could be operationally defined in terms likely to be meaningful to lay patients and/or an ED nurse conducting the initial patient assessment; and
2. the risk factor did not require a physician-ordered or time consuming investigation to determine its presence (for example blood tests or radiology); and
3. the presence of the risk factor was likely to be readily apparent, or information about the presence was likely to be readily available to the nurse at the time of the assessment.

This process is illustrated by figure 1.

The risk factors included after this filtering process[32-40] are listed in Table 1 with their operational definitions.

A small team of nurses was trained in the use of the MMSE [30] and CAM [41] by two geriatricians from the health service where this study was conducted.

Following a one week run-in period during which inter-rater reliability was established, the nurses conducted assessments on a convenience sample of consenting patients. A minimum of one study nurse was present in the ED from 0700 to 1530 for 13 weeks. To be included in the study, patients had to be aged 65 years or over and present to the ED during this time. The assessments consisted of a CAM incorporating the MMSE, data collection of the identified risk factors and demographic information.

The study was approved by the health service area and university Human Research Ethics Committees (HREC). The HREC required informed consent from the patient or from a relative or carer where the patient was unable to consent due to a serious cognitive deficit. Patients were excluded from this study if they were not able to confidently speak English; aphasic; unable to provide consent and no relative or carer available to consent on the patient's behalf; too drowsy or otherwise affected by analgesia or other neurologically active medication administered in the ED; or deemed to be critically ill by the treating ED physician.

Data was entered contemporaneously at the bedside into a spreadsheet with analysis subsequently performed using SPSS Statistics v20. Logistic regression was performed using the diagnosis of delirium as dependent variable and all risk factors as explanatory variables. Variables were entered in stepwise fashion and retained if they were statistically significant associations with delirium. Variables in the final model were then allocated a score based on the β value of each variable, where $\beta=\ln(OR)$. A receiver operating characteristic (ROC) curve, plotting sensitivity on the y axis against (1-specificity) on the x axis for each score integer, was used to explore the optimal cut-off for the score, with an area under the curve calculated to give an overall measure of how well the tool performed.

Results

During the study period, a total of 1822 patients aged 65 and over attended the ED and 320 consented (directly or via proxy) and were enrolled (figure 2).

Table 2 describes the study cohort. The mean age of the study sample was 80 (SD 8), with 178 female participants (56%).

Most patients had more than one risk factor, with the number of risk factors per patient ranging from one to eleven with a median of seven. Table 3 lists risk factors found in the sample, listed from most to least frequent.

A total of 23 (7%) of the 320 patients met the diagnostic criteria for delirium on CAM.

In a logistic regression model, three risk factors were highly discriminatory: history of dementia or other cognitive deficit (OR 11.4, β 2.4, $p<0.001$), history of depression (OR 3.4, β 1.2, $p= 0.012$) and abnormal heart rate/rhythm (OR 3.1, β 1.1, $p= 0.022$). From this model, a risk stratification score was developed from the β estimate of each risk factor, rounded to the nearest whole integer to give a score of 2 for dementia and 1 each for depression and abnormal heart rate/rhythm. Each patient therefore is allocated a score from 0 to 4 depending upon the presence or absence of these three risk factors. The area under the ROC using this risk stratification score vs delirium diagnosis was 0.864.

Table 4 show metrics of the risk score compared to positive delirium diagnosis for different cut-off points.

It can be seen that a cut off score of 1/4 would provide 100% sensitivity and negative predictive value, but would require almost three quarters of patients (n=232, 72.5%) to undergo a CAM. A cut off of 2/4 would reduce the CAM requirement to 108 (33.75% of patients). This would have missed three cases of probable delirium but may be a more practical cut-off resource wise whilst retaining good negative predictive value and sensitivity. Higher cut-off scores become progressively less sensitive. The appendix shows how the tool will be used in its final form, with operational definitions of each risk factor (dementia, depression and cardiac rhythm disturbance) and the management and diagnostic pathways not included.

Discussion

Delirium is often present on a patient's arrival in ED but not diagnosed[1 2 4 42-44]. This may be due to the difficulty of assessing for delirium in the ED environment. However, it but may also relate to the time required to apply formal delirium diagnosis methods in a time-poor environment to a large number of individuals. In this study, we have shown that a simple risk score shows promise in identifying patients most at risk of delirium, allowing the CAM or other diagnostic methods to be targeted to those patients.

We deliberately designed this study to yield a risk screening tool that relied entirely on clinical assessment rather than investigations, was inexpensive and able to be used by nurses on their initial assessment. This would provide a time- and cost-effective way of assessing for delirium and reduce one of the potential barriers to delirium assessment in a busy ED – the time factor. It would also allow identification of episodes of delirium that are presently missed [4 16 45], and could therefore potentially shorten the hospital stay of patients with delirium [46 47], reduce complications and poor outcomes [9 12 48], reduce the risk of discharge to residential care [5] and save health system costs [20 46 49]

The ideal features of a screening program are well known – the disease should be common, early detection of the disease should beneficially alter its clinical course, and the test must be accurate, safe, cost effective and widely available. A clinical screening test for delirium used by nursing staff as part of their routine assessment, as we describe in this study, fulfils these criteria. Using a score cut off of 2 would allow two thirds of all ED patients aged 65 and over to avoid further assessment for delirium whilst missing few cases of the disease. This would provide an acceptable trade-off between sensitivity and specificity, detecting the majority of at risk patients whilst avoiding a CAM or other delirium diagnostic workup in two thirds of patients.

There is minimal literature on delirium risk assessment in the ED, with only one study examining risk factors as a delirium screen in the ED published [24]. This study also

examined risk factors for delirium about which information is readily available from the patient or other sources at the time of arrival in ED, and found that risk factors can be used to screen for delirium. The model in that study found an area under the ROC curve of 0.82, similar to our study even though there was only one common risk factor to both models – dementia.

To incorporate the screening tool we have derived into clinical practice will require the tool to be validated in a different population and, more importantly, demonstration that use of the tool can improve outcomes for older patients. With the overwhelming evidence that current levels of delirium detection are very low, and outcomes from overlooked delirium poor, it is reasonable to assume that this tool will improve these shortcomings but that assumption needs to be tested in further trials. As such this study can be considered a pilot study and the first step toward developing clinically meaningful practice change.

Screening for delirium followed by assessing for delirium in the ED provides the added benefit of establishing an admission baseline for cognitive function during hospital admission. This is particularly important at a time of increasing health costs, when delirium has recently been considered for inclusion in the list of hospital-acquired complications for which reimbursement would be restricted in the US health system [50].

Our study used a cross sectional design whereby the assessment for the presence of chosen risk factors from which we derived our risk score, and the CAM, were performed as part of one nursing assessment. Because delirium may be consequent to suboptimal care in the ED, or otherwise evolve during the ED stay, our design is a potential weakness of this study as it only provides a "snapshot" at one point soon after ED arrival. Serial assessments for delirium throughout the hospital stay may have provided a more comprehensive assessment method.

Our study has several other limitations. It was a single institution study. The delirium rate of 7% was on the lower side of published figures as to the delirium incidence in older ED patients. The exclusion of critically ill patients, those unable to speak English, and those in whom a history and consent could not be obtained from proxies

may have excluded delirious patients from the study, reflected by the low delirium rate. As noted the cross sectional design may also have reduced the number of detected delirious patients. The exclusion of these groups, especially critically ill people, limits the generalizability of the tool to all older people in the ED setting. The nurses determining risk factor presence or absence were not blinded to the CAM result. We chose the CAM as the formal diagnostic standard for the study as it is widely used as an acceptably accurate diagnostic tool, but others have argued different adjudication methods are superior for delirium diagnosis[28 51]. The CAM, for instance, provides no indication as to the severity of the delirium.

Conclusions

Using risk factors to screen for delirium risk in the ED may provide an effective filtering process, so identifying patients for formal diagnostic assessment using validated but more specialised and resource intensive methods. The risk factors and risk model described in this study provide a very brief screen that can be performed by ED nurses in the context of the first patient assessment, using information readily available without requiring additional tests, time or resources.

Disclosures

The authors disclosed no proprietary or commercial interest in any product mentioned or concept discussed in this article.

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