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Performance of the modified Richmond Agitation Sedation Scale in identifying delirium in older emergency department patients

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ABSTRACT

Background: Delirium in older emergency department (ED) patients is associated with severe negative patient outcomes and its detection is challenging for ED clinicians. ED clinicians need easy tools for delirium detection. We aimed to test the performance criteria of the modified Richmond Agitation Sedation Scale (mRASS) in identifying delirium in older ED patients.

Methods: The mRASS was applied to a sample of consecutive ED patients aged 65 or older by specially trained nurses during an 11-day period in November 2015. Reference standard delirium diagnosis was based on Diagnostic and Statistical Manual of Mental Disorders (DSM-IV-TR) criteria, and was established by geriatricians. Performance criteria were computed. Analyses were repeated in the subsamples of patients with and without dementia.

Results: Of 285 patients, 20 (7.0%) had delirium and 41 (14.4%) had dementia. The sensitivity of an mRASS other than 0 to detect delirium was 0.70 (95% confidence interval, CI, 0.48; 0.85), specificity 0.93 (95% CI 0.90; 0.96), positive likelihood ratio 10.31 (95% CI 6.06; 17.51), negative likelihood ratio 0.32 (95% CI 0.16; 0.63). In the sub-sample of patients with dementia, sensitivity was 0.55 (95% CI 0.28; 0.79), specificity 0.83 (95% CI 0.66; 0.93), positive likelihood ratio 3.27 (95% CI 1.25; 8.59), negative likelihood ratio 0.55 (95% CI 0.28; 1.06).

Conclusion: The sensitivity of the mRASS to detect delirium in older ED patients was low, especially in patients with dementia. Therefore its usefulness as a stand-alone screening tool is limited.

1. Introduction

Delirium is frequent in older emergency department (ED) patients and associated with adverse outcomes such as mortality, prolonged hospitalizations, as well as persistent cognitive and functional decline [1,2]. However, in the ED, detection of delirium is often difficult, especially if delirium is superimposed on dementia [3].

Several two-step bedside tests have been developed to aid ED clinicians in systematically screening for and assessing delirium. These are, in essence, adaptions of the original Confusion Assessment Method [4-8]. As inattention is one of the cardinal symptoms of delirium, a first step is screening for inattention. The application of such tools is feasible, but is dependent on patients' ability to cooperate and communicate [6]. Therefore, a simple alternative is observing patients' level of consciousness because an altered level of consciousness is another main feature of delirium. Level of consciousness can readily be evaluated with the Richmond Agitation Sedation Scale (RASS) [9]. In a trial investigating several screening tools in the ED [5], the RASS performed well: a RASS score other than zero revealed a sensitivity of 0.840 (95% CI 0.738–0.942), specificity of 0.876 (95% CI 0.842–0.911), positive likelihood ratio of 6.8 (95% CI 5.0–9.2), and negative likelihood ratio of 0.2 (95% CI 0.1–0.3) [10]. However, analyses in that study were conducted in a convenience sample without stratification into patients with and without dementia. We therefore aimed to investigate the performance of the RASS in identifying delirium in a consecutive sample of older ED patients both with and without dementia.

2. Methods

This was a pre-planned subanalysis of data collected in a larger prospective trial in which we tested the performance of the modified Confusion Assessment Method for the ED (mCAM-ED) [6] (ClinicalTrials.gov NCT02782143). The study was approved by the local ethics committee (EKNZ-2015-123). We included a consecutive sample of ED patients aged 65 and older presenting to our institution's ED during an 11 day period in November 2015. Approximately 50,000 adult patients from all medical specialties except ophthalmology, gynecology and

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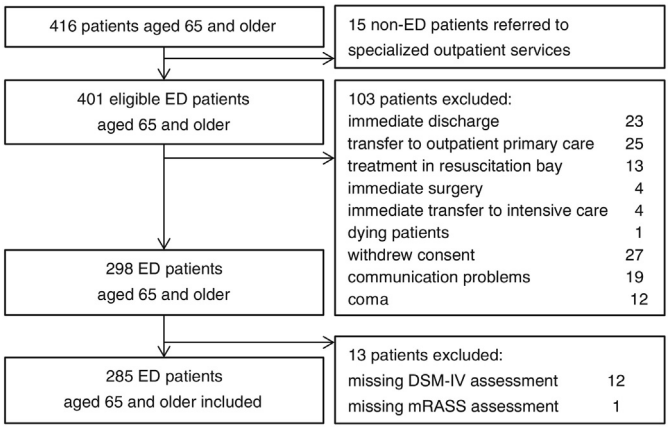

Fig. 1. Flow of participants.

obstetrics are treated in our ED per year. The intended sample size according to Zhou was 492 patients [11].

The Richmond agitation and Sedation Scale (RASS) is a tool developed originally to assess the level of sedation or agitation in the intensive care unit [9]. It has increasingly been used to assess level of consciousness across various care settings and has therefore been modified to the mRASS in order to meet characteristics of non-intensive care patients [12]. The mRASS ranges from −5 (unarousable) to +4 (combative). In our study, values different from 0 (alert and calm) were defined as altered level of consciousness and, therefore, considered as an indicator for delirium. The mRASS was applied to all included patients by specially trained nurses.

Reference standard for delirium diagnosis was based on Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition, Text Revision (DSM-IV-TR) criteria and was established by attending geriatricians within an hour of the mRASS assessment who were not aware of the mRASS result 24/7. These geriatricians are associated with the University Center for Medicine of Aging. Nurses and geriatricians who were involved in data collection had no other clinical duties during the study.

Performance criteria of the mRASS were estimated and presented together with their two-sided 95% confidence intervals. Additionally, analyses were repeated in the two subgroups of patients with and without dementia. Analyses were conducted with R version 3.2.1.

3. Results

During the study period, 416 patients aged 65 and older presented to our ED (Fig. 1) of which 285 were included in the analysis. The median age was 79.9 years (interquartile range 72.4; 86.7) and 58.9% were female. Most patients were assigned Emergency Severity Index 3 (56.7%) and 2 (26.8%). Cross tabulation of the mRASS by delirium is displayed in Table 1.

The performance of the mRASS to diagnose delirium is shown in Table 2. An mRASS other than 0 had a sensitivity of 0.70 (95% CI 0.48; 0.85) and a specificity of 0.93 (95% CI 0.90; 0.96). Performance differs in the subgroups of patients with and without dementia. Sensitivity in patients with and without dementia were 0.55 (95% CI 0.28; 0.79) and 0.89 (0.57; 0.98), respectively.

Table 2
Performance criteria of the modified Richmond Agitation Sedation Scale (mRASS other than 0) to detect delirium in ED patients aged 65 years or older using DSM-IV-TR as reference standard in the total population, and in patients with and without dementia

	Total population ($n = 285$)		Patients with dementia ($n = 41$)		Patients without dementia ($n = 244$)	
	Delirium prevalence: 7.0%		Delirium prevalence: 26.8%		Delirium prevalence: 3.6%	
	Estimate	95% CI	Estimate	95% CI	Estimate	95% CI
Sens	0.70	(0.48; 0.85)	0.55	(0.28; 0.79)	0.89	(0.57; 0.98)
Spec	0.93	(0.90; 0.96)	0.83	(0.66; 0.93)	0.94	(0.91; 0.97)
PPV	0.44	(0.28; 0.61)	0.55	(0.28;0.79)	0.38	(0.21; 0.59)
NPV	0.98	(0.95; 0.99)	0.83	(0.66; 0.93)	1.00	(0.98; 1.00)
LR+	10.31	(6.06; 17.51)	3.27	(1.25; 8.59)	16.07	(9.03; 28.60)
LR-	0.32	(0.16; 0.63)	0.55	(0.28; 1.06)	0.12	(0.02; 0.75)

DSM-IV-TR, Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition, Text Revision; CI, confidence interval; Sens, sensitivity; Spec, specificity; PPV, positive predictive value; NPV, negative predictive value; LR+ positive likelihood ratio; LR−, negative likelihood ratio.
95% CI for sensitivity, specificity, positive predictive value, and negative predictive value were computed according to Agresti & Coull [15].
95% CI for positive and negative likelihood ratios were computed according to Zhou et al. [11].

4. Discussion

4.1. Main discussion

The RASS is different from other delirium screening tools in that it can be administered by simply observing patients. This makes it attractive for use in a busy ED setting [7,8]. However, there are only few other studies on the performance of the RASS to identify delirium [10,12–14], of which only two were performed in the ED setting [10,13]. In an explanatory study on hip fracture patients the RASS had a sensitivity of 0.80, and specificity 0.79 for delirium [14]. In another study, serial administration of the mRASS was able to detect new onset delirium during hospital stay with a sensitivity of 0.85 (95% CI 0.65; 1.00) [12]. Over the course of a longer ED stay, this approach might be useful, especially in patients who initially have normal level of consciousness. In a study on patients with dementia, including few ED patients, the mRASS had a sensitivity of 0.71 (95% CI 0.66; 0.75) and a specificity of 0.85 (95% CI 0.81; 0.89) [13]. The included ED patients were also part of the convenience sample of the study by Han et al. [10] In that study sensitivity was 0.84 (95% CI 0.74; 0.94), and specificity 0.88 (95% CI 0.84;0.91) when the RASS was performed by a research assistant. However, performance criteria for patients with dementia were not shown. Compared to Han et al. [10], our study revealed a weaker performance, especially in patients with dementia. Aspects that might contribute to this finding include the setting, the selected reference standard (geriatrician versus psychiatrist), and the inclusion procedure (consecutive versus convenience sampling). Furthermore, the study populations were different regarding the prevalence of dementia (14.4% in our study versus 5.9%).

The differences in the performance of the RASS is most likely due to the heterogeneity of the study samples and settings. Based on the available data, the feature of an altered level of consciousness alone does not establish a delirium diagnosis in older ED patients. The combination with other features such as inattention appears to be necessary.

Table 1
Cross-tabulation of modified Richmond Agitation Sedation Scale (mRASS) results by DSM-IV-TR delirium diagnosis

	Total population ($n = 285$)		Patients with dementia ($n = 41$)		Patients without dementia ($n = 244$)	
	DSM-IV-TR		DSM-IV-TR		DSM-IV-TR	
	Delirium	No delirium	Delirium	No delirium	Delirium	No delirium
mRASS ≠ 0	14	18	6	5	8	13
mRASS = 0	6	247	5	25	1	222

DSM-IV-TR, Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition Text Revision.

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4.2. Limitations

Because this is a single center study, the generalizability of our results is limited. An unexpectedly low number of ED patients during the predefined study period of 11 days, a high number of excluded patients, and low prevalence of delirium resulted in broad confidence intervals, thus making our results less robust.

Although we did not actively exclude patients with advanced dementia, some of the excluded patients who were unable communicate might have had advanced dementia. This might have affected overall performance of the mRASS.

We used the modified mRASS [12] to assess the level of consciousness while Han et al. [10] used a different modification of the RASS. However, the two scales differ only slightly and, though unlikely, this might have affected comparability.

4.3. Conclusion

In this consecutive sample of older ED patients, the mRASS had a good specificity. Older ED patients with altered level of consciousness probably have delirium. On the other hand, the sensitivity of the mRASS was insufficient to support its usefulness as a screening tool for delirium both in patients with and without dementia. The combination with other features of delirium such as inattention appears to be necessary.

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