Assessment of delirium in ICU patients: a literature review

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Abstract - A psycho-organic disorder such as delirium is a frequently occurring and serious disorder especially on Intensive Care units. Nowadays, more attention is paid to this problem by physicians, nurses and by researchers, but assessment of delirium in all ICU patients is still not common practice. If patients are not screened for delirium in a standard manner, once or several times a day, the delirium diagnose will be missed. In this systematic review we describe and analyse six delirium screening instruments available from the literature: the Cognitive Test for Delirium (CTD), the abbreviated CTD, Intensive Care Delirium Screening Checklist (ICDSC), Delirium Detection Score (DDS), NEECHAM confusion scale and the Confusion Assessment Method-ICU (CAM-ICU). Each assessment tool its characteristics, reliability and validity testing is briefly described. We conclude that important delirium criteria are not integrated into some screening tools (CTD and aCTD, DDS), or an important group of ICU patients cannot be tested (NEECHAM). The ICDSC and the CAM-ICU appear to represent the most feasible instruments for delirium screening in the ICU. Of these two tests, the CAM-ICU prevails because of the validated Dutch version and its reported high sensitivity and specificity.

Keywords - Delirium, assessment tool, Intensive Care, critically ill

Introduction

The word delirium is derived from the Latin “lira” meaning track or trail. Delirium can be translated in terms of “derailment” or “to get off track”. A delirium is a psycho-organic disorder, which implies that a physical cause leads to cognitive dysfunction, whereas the symptoms are psychological. According to the Diagnostic and Statistical Manual of Mental Disorders (DSM-IV) the diagnostic criteria for delirium are [1].

- acute condition: characterized by a sudden onset (hours, days) and inclined to fluctuate throughout the day.
- disturbances in consciousness: reduced clarity of awareness of the environment with a decreased attention span, reduced ability to focus, sustain and shift attention.
- change in cognition (memory deficit, disorientation, language disturbance) or the development of a perceptual disturbance that is not accounted for by a pre-existing, established, or evolving dementia.
- from the history, physical examination, or laboratory findings there is evidence that the perceptual disturbance is caused by the direct physiological consequences of a general medical condition.

According to Peterson [2] three subtypes of delirium can be distinguished:

1. hyperactive subtype: the patient is hyperalert or agitated
2. hypoactive subtype: the patient is hypoalert or lethargic
3. alternating or mixed subtype: characterized by alternating hyper- and hypoactive symptoms.

The hyperactive subtype, usually associated with delusions, hallucinations, agitation and disorientation, occurs in approximately 1-2% of patients with delirium. The hypoactive subtype, characterized by lethargy, psychomotor slowing and inappropriate speech or mood, occurs in approximately 35% of patients with delirium. In older patients, the prevalence of the hypoactive subtype is higher than that of the hyperactive subtype [2]. The alternating or mixed subtype has the highest incidence rate at up to 64%. The hypoactive subtype is often not recognized and the diagnosis is therefore easily missed. Because of the fluctuating course of delirium it can be assumed that this is also true, but to a lesser degree, of the alternating subtype.

Delirium is a general and serious issue in hospitalized patients, as well as in critically ill patients in the Intensive Care Unit (ICU). In ICU patients, reported incidences range widely between 11-89%, depending on the intensity and duration of screening measurements [2-4]. Independently of age and APACHE score, delirious patients have more prolonged ICU and hospital stays than non-delirious patients [5,6]. Patients suffering from delirium have a significantly higher mortality rate (34% vs. 15%) than patients without delirium and is mentioned as an independent predictor of mortality [7].

Although it is unclear if effective treatment of delirium will improve the prognosis of the patient, its early detection is important to enable the rapid treatment that may possibly prevent some of its consequences. Observational data show that each day the delirium continues, the risk of persisting cognitive disorders and death multiplies by approximately 10% [5].
The gold standard to diagnose delirium is examination by a psychiatrist/geriatrician, who assesses the delirium based on the above-mentioned DSM-IV criteria. In clinical ICU practice this is barely feasible, especially considering the fluctuating course of delirium and the fact that symptoms more often manifest themselves outside office hours, after sundown. The most practical solution to this problem is recognition of delirium by the nurse. After all, of all carers, nurses spend most hours by the patient’s bedside and are in the best position to closely observe the patient’s behaviour for long periods. However, evidence indicates that physicians and nurses are not sufficiently able to identify delirium, especially the hypoactive- and sometimes also the alternating subtype of delirium. This results in under-diagnosis of the syndrome. According to Inouye et al., the most important reason for this is the lack of a usable tool to adequately assess delirium [8]. Studies show that if patients are not screened for delirium in a standard manner, more than 60% of patients with delirium are missed by ICU nurses and more than 70% by physicians [9,10].

Since the early nineties an increasing number of assessment tools have been developed that enable early detection of delirium by professionals other than psychiatrists [11]. Although there is no evidence for the optimal number of times a day patients should be assessed, because of the fluctuating course of delirium it seems insufficient to assess patients only once a day.

Various assessment tools enable nurses to identify a delirium at an early stage. Examples of such tools are the Confusion Assessment Method (CAM) [8] and the Delirium Observation Screening Scale (DOS) [12]. While these instruments may be valid and reliable tools for assessment of delirium in non-ICU populations, they are less suitable for ICU patients, as for example, they are often intubated. Intubation, as well as their critical illness, may make it impossible for patients to respond (verbally) to all items of the assessment instrument.

In this review we will give an overview of delirium assessments tool for ICU patients available from the literature.

**Literature search**

We performed a systematic search of the literature in Medline, Pubmed, Embase and Cinahl from 1995 to June 2009. The following search strategy was used. MeSH terms, key and free text words used were ‘delirium’, ‘confusion’, ‘delirium assessment tool’, ‘delirium screening’, ‘validity’, ‘reliability’, ‘critical care’ or ‘intensive care’. Articles were included if they concerned the development or validity and reliability of a delirium assessment tool. Articles were also included if they described a delirium assessment tool that was used in critical care patients. We also checked the references of the included articles for any articles that we may have missed in our literature search. Articles on delirium assessment tools were excluded if they were used in non-critically ill patients only. There were no exclusion criteria concerning language or publication type.

**Results**

The extensive literature search resulted in six delirium assessment tools applicable to an Intensive Care Unit:
1. Cognitive Test for Delirium (CTD)
2. Abbreviated Cognitive Test for Delirium (aCTD)
3. Intensive Care Delirium Screening Checklist (ICDSC)

### Table 1. Validity and reliability testing of the delirium assessment tools

<table>
<thead>
<tr>
<th>ARTICLE</th>
<th>AIM OF STUDY</th>
<th>VALIDITY</th>
<th>RELIABILITY</th>
<th>QUALITY OF PERFORMANCE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hart [13] Cognitive Test for Delirium (CTD)</td>
<td>Validation study N=22 (medical ICU)</td>
<td>CTD versus MMSE Sensitivity: 100% Specificity: 95%</td>
<td>α-coefficient 0.87 IRR unknown</td>
<td>Fluctuation in consciousness is missing in assessment tool. No use of gold standard. No neurological patients included.</td>
</tr>
<tr>
<td>Hart [14] abbreviated CTD</td>
<td>Validation study N=19 (medical ICU)</td>
<td>aCTD vs. CTD Sensitivity: 94.7% Specificity: 98.8%</td>
<td>α-coefficient 0.79 IRR unknown</td>
<td>Fluctuation in consciousness is missing in assessment tool. No neurological patients included.</td>
</tr>
<tr>
<td>Bergeron [15] Delirium Screening Checklist (ICDSC)</td>
<td>Validation study. N=93 (mixed ICU)</td>
<td>ICDSC vs. DSM-IV Sensitivity: 99 % Specificity: 64 %</td>
<td>α-coefficient 0.71-0.79 IRR 0.94 (between nurses and physicians)</td>
<td>Low specificity. No neurological patients included.</td>
</tr>
<tr>
<td>Otter [18] Delirium Detection Score (DDS)</td>
<td>Validation study N=1093 (surgical ICU)</td>
<td>DDS vs. Ramsay score, Sedation Agitation Score and clinical observation of severity of delirium Sensitivity: 67 % Specificity: 75 %</td>
<td>Cronbach-α 0.67 IRR 0.47-0.82</td>
<td>No comparison with gold standard. Modified test from the Clinical Institute Withdrawal Assessment for Alcohol Scale (CIWA-Ar). Covers not all aspects of delirium. No medical or neurological patients included.</td>
</tr>
<tr>
<td>Van Rompaey [21]</td>
<td>Comparison CAM-ICU and NEECHAM N=172 (mixed ICU)</td>
<td>CAM-ICU is reference assessment for NEECHAM; Sensitivity: 87%, Specificity: 95%</td>
<td>No IRR calculated</td>
<td>CAM-ICU used as gold standard. No intubated patients included.</td>
</tr>
</tbody>
</table>

Legend. IRR interrater reliability.
4. Delirium Detection Score (DDS)
5. NEECHAM confusion scale
6. Confusion Assessment Method-ICU (CAM-ICU)

Abbreviated Cognitive Test and Cognitive Test for Delirium
This testing instrument, developed by Hart et al. [13], was designed especially for ICU patients. The test is solely focused on evaluation of the cognitive functions of the patient. The attending nurse evaluates orientation, attention span, memory, comprehension and vigilance by asking the patient questions, while the patient looks at pictures and tries to recognize printed letters. It takes about 10-15 minutes to screen the patient with the CTD. Hart et al. [14] also developed the abbreviated CTD because it was found that visual attention span and recognition memory for pictures had better reliability and could better discriminate delirium from other cognitive disorders such as dementia and schizophrenia than the other items on the CTD. The CTD can only be used in patients with a certain level of consciousness, a cooperative attitude, absence of visual or hearing impairment and if the patients are able to express themselves verbally.

Validation studies (Table 1) do not state whether the patients were intubated or not. While conducting the test, nearly 25% of the patients could not be assessed due to a reduced level of consciousness, lack of cooperation, agitation and language barriers [13]. This tool also misses the assessment of fluctuating level of consciousness - a unique characteristic of delirium. Also the cognitive function of the patient prior to admission to the ICU is not taken into account, and presently neither test is available in Dutch.

Intensive Care Delirium Screening Checklist
The Intensive Care Delirium Screening Checklist (ICDSC) was developed by Bergeron et al. in 2001 [15]. The ICDSC is an observational instrument, which consists of an eight-item checklist based on the DSM-IV criteria (Box 1). The eight items scored are: altered level of consciousness, inattention, disorientation, hallucination/delusion/psychosis, psychomotor agitation or retardation, inappropriate speech or mood, sleep/wake cycle disturbance, symptom fluctuation.

These items are evaluated based on observations made by the attending nurse. If an item is present or positive, one point is scored. If a particular item cannot be assessed, the same score is allocated as if the symptom were absent. A score of four or greater is a positive screen for delirium.

The first step of the ICSDS is assessment of the level of consciousness, using five categories (A - E). In cases of no response or the need of vigorous stimulation (category A or B), the patient is considered to be in a coma or stupor and evaluation stops at that point. Category C scores one point for drowsiness or if mild to moderate stimulation is required for a response. Category D is wakefulness or a sleeping state from which the patient can easily be aroused, which is considered normal and scores no points. Hypervigilance is rated in category E, scoring one point.

The correlations between the different items on the scale reflecting its internal consistency, were moderate (0.71-0.79). The interrater reliability appears to be very good (reported Cohen’s kappa 0.94) between ICU nurses and the physicians (Table 1). The sensitivity of the test was found to be very high: 99% (DSM-IV criteria as reference standard), but specificity was only 64%. This implies that in 36% the test result showed ‘delirium’, while in reality (DSM-IV criteria) the patients were not suffering from delirium. According to the investigators this low specificity could be attributed to the liberal inclusion criteria of the trial. In 14 out of 15 false positive cases there were concomitant conditions, such as another psychiatric diagnosis, dementia, neurological defect or encephalopathy. This proves that it is difficult to develop an instrument that is able to discriminate delirium from another neurological defect or psychiatric disorder. Although it is unclear how

### Table 2. Advantage and disadvantages of the 6 delirium assessment tools

<table>
<thead>
<tr>
<th>Tool</th>
<th>ADVANTAGE</th>
<th>DISADVANTAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Cognitive Test for Delirium (CTD) and</td>
<td>- easy to perform</td>
<td>- covers not all criteria of delirium</td>
</tr>
<tr>
<td>2. Abbreviated CTD</td>
<td>- can discriminate between other cognitive disorders</td>
<td>- uselessness in intubated patients unknown</td>
</tr>
<tr>
<td>3. Intensive Care Delirium Screening Checklist (ICDSC)</td>
<td>- useful in intubated patients</td>
<td>- Dutch version not validated</td>
</tr>
<tr>
<td></td>
<td>- easy to integrate in daily practice</td>
<td>- relatively low specificity</td>
</tr>
<tr>
<td></td>
<td>- high sensitivity</td>
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<tr>
<td></td>
<td>- available in Dutch</td>
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</tr>
<tr>
<td>4. Detection Score (DDS)</td>
<td>- useful in intubated patients</td>
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<td></td>
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</tr>
<tr>
<td></td>
<td>- available in Dutch</td>
<td>- not available in Dutch</td>
</tr>
<tr>
<td>5. NEECHAM confusion scale</td>
<td>- easy to integrate in daily practice</td>
<td>- not useful in intubated patients</td>
</tr>
<tr>
<td></td>
<td>- available in Dutch</td>
<td>- use in practice is time consuming</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Dutch version not validated</td>
</tr>
<tr>
<td>6. Confusion Assessment Method-ICU (CAM-ICU)</td>
<td>- high sensitivity and specificity</td>
<td>- momentary test</td>
</tr>
<tr>
<td></td>
<td>- validated Dutch version</td>
<td>- predictive value of CAM-ICU unknown if used by bedside ICU nurses</td>
</tr>
</tbody>
</table>
much time it takes to complete the checklist, the performance of the ICDSC seems simple. Apart from that, research reports do not state whether the participants were intubated or not, and although a Dutch version available of the ICDSC is available [16], this version has not yet been validated. A comparison study between the ICDSC, the CAM-ICU and the gold standard - the DSM-IV criteria, showed that the ICDSC had a higher specificity than the CAM-ICU (95% versus 88%), but the sensitivity of the CAM-ICU was higher than the sensitivity of the ICDSC, 64% versus 43% [16]. The interrater reliability between these two assessment tools is, with 0.80 Cohen’s kappa, good [17].

Delirium Detection Score
The Delirium Detection Score (DDS) is an observational screening tool developed by Otter et al. [18], and was especially designed for intubated and non-intubated patients in an ICU. The nine domains (agitation, anxiety, hallucination, orientation, seizures, tremor, paroxysmal sweating and altered sleep-wake rhythm) are considered to be the characteristics of delirium. A patient scores 0, 1, 4 or 7 points for each of the nine domains, with a maximum of 56 points in total. The sensitivity and specificity are relatively low (67% and 75%). The interrater reliability between physicians and nurses is sufficient (Cohen’s kappa between 0.47-0.82), but is lower than that of other delirium instruments. Although the investigators suggest that the DDS can be used by physicians and nurses without any specific training, training may possibly result in a higher interrater reliability. It is important to note that the DDS is a modification of a test assessing symptoms of alcohol withdrawal. There may be a good match with the domains of hyperactive delirium, but they may be less applicable to the characteristics of a delirium of the hypoactive subtype. Therefore a validation study should be conducted in the future. This instrument has not yet been translated into and validated in Dutch.

NEECHAM confusion scale
The NEECHAM confusion scale is an observational assessment instrument developed by Neelon and Champagne [19] and was developed for use by nurses. In 1999 this scale was translated into Dutch by Milisen [20]. The scale is not specifically designed for the ICU patient. Although no validation studies have been performed in ICU patients, the NEECHAM was compared (Table 2) with the CAM-ICU in non-intubated ICU patients [21]. In this study the sensitivity and specificity of the NEECHAM confusion scale were 87% and 95%, whereas the CAM-IU was used as gold standard. Interrater reliability scores have not been reported.

This test enables cognitive functions such as attention, command and orientation to be measured. The NEECHAM confusion scale consists of nine items, separated into three different categories; ability to process information, behaviour and physiological condition. The items attention, command and orientation are categorized in the domain of information processing, with a score varying from 0 to 14. The items appearance, motor and verbal belong to the domain of behaviour, with a subtotal score varying from 0 to 10. The items vital functions (blood pressure, heart rate, respiration, oxygen saturation and temperature) and urinary continence are categorized in the domain of physiological condition and vary from 0 to 6. A lower score indicates a higher chance of delirium. A non-confused patient can obtain a maximum score of 30 points in total. A score of 0-19 indicates moderate to severe confusion. A score between 20 and 24 indicates mild confusion or cognitive impairment and a score of 25-26 reflects that the patient is not in an acute confused state, but the patient does have an increased risk of becoming confused. A score greater than 26 indicates the absence of delirium and reflects normal functioning.

Research shows that the physiological parameters do not actually add any value and can be removed from the instrument [9]. Furthermore, the verbal condition cannot be assessed in intubated and mechanically ventilated patients, which makes the NEECHAM scale less appropriate for most ICU patients. Apart from that, it is very time consuming to score nine items, adding up the sum of the different domains and then interpreting the NEECHAM score.

Confusion Assessment Method-Intensive Care Unit
The CAM-ICU is a modification of the Confusion Assessment Method (CAM) developed by Inouye et al. [8]. In 2001 the CAM-ICU was especially designed by Ely et al. for use on ICU by ICU nurses, physicians and research personnel [22]. The CAM-ICU has been translated into and validated in Dutch by Vreeswijk et al. [23] and can be found on the delirium.org website (http://www.icudelirium.org/delirium/CAM-ICUTraining.html). The CAM-ICU is not an observational scale. While conducting the CAM-ICU, the patient is tested for cognitive functions and consciousness by using a two-step approach (Box 2). After determining the level
of consciousness with the Richmond Agitation Sedation Scale (RASS), the first feature addresses if there is an acute onset of mental status change or a fluctuating course. If a patient scores negative on a feature, this feature of delirium is absent and therefore the patient is considered not to be suffering from delirium. If this first feature is positive, the following feature ‘attention, memory and focus’ is tested. This can be done with an auditory test or a visual test, the latter developed by Hart et al. [13]. If feature 2 is positive, disorganized thinking is tested. Level of consciousness (alert/calm, vigilant/hyper alert, lethargic or stupor) is assessed by feature 4. Only if features 1 and 2 and 3 and/or 4 are positive, is the patient diagnosed as being delirious.

The CAM-ICU is easy to carry out and is reported to take an average of 2-3 minutes to complete. However, the members of the ICU team need to be educated first. In our experience, interrater reliability increased from 0.78 to 0.89 during a 60-minute training session combined with extra training on the job of a maximum of 15 minutes. Several reviews show that the CAM-ICU appears to be a valid and reliable instrument when used by research personnel on the ICU, both in mechanically ventilated as well as in non-mechanically ventilated patients [5,22,24,25]. The interrater reliability is high (0.79-0.95), as are the sensitivity and specificity (95-100% and 93-98%) [5]. Although the sensitivity and specificity of the CAM-ICU appear to be high, it is important to realize that all the reported data were obtained from tests performed by dedicated research personnel. Therefore, both sensitivity and specificity are likely to be lower in normal clinical practice. A drawback of the test is that it requires the patient to have a cooperative attitude and no visual or hearing impairment. Observational features of delirium are hardly taken into account in this test.

**Conclusions**

In this systematic review we described and analyzed six delirium screening instruments, and we conclude that the CAM-ICU represents the most suitable and feasible screening tool for detecting delirium in ICU patients.

In both the (a)CTD and the DDS screening tools one of the DSM-IV delirium criteria are lacking. The observational NEECHAM scale seems suitable, but can only been conducted if patients are extubated. This can result in the relatively late detection of delirium. Besides this important item, this assessment tool has not been validated in (ventilated) ICU patients and therefore cannot be recommended for use in ICU patients. The ICDSC and the CAM-ICU, are the most feasible screening tools for ICU patients. The ICDSC is an observational screening instrument which can easily be integrated into daily nursing practice. However, the specificity is lower than the specificity of the CAM-ICU, which results in a larger number of missed delirium patients. Moreover, the Dutch version of the ICDSC has not yet been validated. World-wide, the CAM-ICU is the best validated and most used delirium assessment instrument in ICU patients by non-psychiatrists. Currently, the use of the CAM-ICU prevails over the other assessment instruments. In daily practice it is common for ICU nurses to screen the patient with the CAM-ICU. The sensitivity and specificity of the CAM-ICU compared with the gold standard is unknown. Further research is necessary to determine the accuracy of the CAM-ICU when used by ICU nurses in daily practice. A disadvantage of the CAM-ICU is that it is a momentary test. Because of the fluctuating course of delirium, this can incorrectly lead to a false negative result. If delirium is suspected by the nurse or physician, the patient should be tested more frequently. The optimal frequency to conduct the CAM-ICU in ICU patients is not known.

Furthermore, patients who do not respond to vocal stimuli cannot be assessed for delirium using the CAM-ICU, but this also applies to the other delirium assessment tools. Possibly, these patients may suffer from delirium that cannot be diagnosed by any of the screening tests. Another disadvantage is the lack of discrimination of delirium from the distress/confusion we observe in patients with neurological defects occurring after contusion or resuscitation. Unfortunately, there is no instrument that can clearly make this differentiation. Due to the fluctuating course of delirium, delirium assessment has to be carried out several times a day, currently once per shift, but its optimal frequency is not clear. Although the therapeutic effects of treatment of delirium are not clear, in view of the observational data concerning the association between the presence and duration of delirium and the clinical outcome of patients, it appears plausible that early detection of delirium may be of great importance for the patient. The importance of early recognition is also acknowledged by the Dutch Inspectorate of Health. It is possible that in the near future, screening for delirium will become a quality indicator to enhance patient safety. This will further facilitate delirium screening becoming part of the daily routine care for the critically ill patient.

**Box 2. Two-step approach of the CAM-ICU**

Feature 1: Acute onset of mental status changes or a fluctuating course

**AND**

Feature 2: Inattention

**AND**

Feature 2: Disorganized Thinking

**OR**

Feature 4: Altered Level of Consciousness

= DELIRIUM
References