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Research Article

Measuring Delirium Severity in Patients with Dementia: A Nurses' 'Delirium in Dementia Assessment Scale' (DIDAS)

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Abstract

Objectives: Prevalence of delirium is increased in patients with dementia. Monitoring of the severity of Delirium Superimposed on Dementia (DSD) may help to improve the quality of care in patients suffering from this condition. This proof-of-concept study aims to provide a first exploration of the reliability, validity and sensitivity to change of the Delirium-In-Dementia-Assessment-Scale (DIDAS), a 10-item nurses' observation scale to be used as a tool to screen for symptoms and measure severity of DSD.

Methods: A first cross sectional and repeated measurement study of the DIDAS was conducted in a closed psychogeriatric unit of a general psychiatric hospital. All patients admitted to this ward were enrolled in this study to assess DIDAS' validity, reliability, discriminative power and ability to measure delirium severity.

Results: 589 DIDAS questionnaires were completed in 17 patients yielding a high internal consistency (α = 0.86) for the total DIDAS scores. Mean day DIDAS scores were significantly higher in patients with DSD compared to patients without DSD (Cohen's d 1.02). The effect size on item level ranged from Cohen's d of 0.27 to 0.72. A statistically significant correlation (Spearman's Rho 0.626) was found between the mean DIDAS score per patient per day and a Likert score for global clinical severity.

Conclusion: The DIDAS seems a reliable instrument for nurses to measure severity of DSD and monitor the course of DSD severity over time.

Introduction

Delirium is a very common clinical syndrome in geriatric patients with a prevalence above 20% in older persons with dementia [1]. Early recognition and treatment is needed to alleviate the burden of delirium in patients and caregivers a like and to possibly prevent adverse outcomes, as evidence shows that Delirium Superimposed on Dementia (DSD) is associated with a prolonged hospital stay, poor health outcomes and accelerated cognitive decline in dementia [2,3,12-15]. Because of overlapping and even similar symptoms of pre-existing cognitive impairment and incident delirium, DSD is often poorly recognized and under- or misdiagnosed [8]. There are no validated tools available to screen for DSD or to monitor delirium severity in psychogeriatric patients [9-11].

For this purpose, a 10-item nurses' observation scale the Delirium-In-Dementia-Assessment-Scale (DIDAS) was developed. This proof-of-concept study aims to determine the reliability and validity of the DIDAS to be used as a tool to screen for symptoms and measure severity of hypoactive and hyperactive delirium superimposed on dementia.

Methods

Design and study sample

A cross sectional and repeated measurement study was conducted in a 17-bed closed psychogeriatric unit of a general psychiatric hospital. All patients in this ward are diagnosed with a pre-existing cognitive impairment and were admitted because of severe behavioral disruption and/or problems with self-care.

Symptom assessment

The DIDAS (appendix 1) consists of 10 items: consciousness, attention, apathy, motor behavior, fluctuations, anxiety, delusions, hallucinations, affect and behavior. Its development was inspired by the Delirium-O-Meter (DOM), an observation scale designed to cover the symptomatology of delirium in the setting of a general hospital [16]. Through an iterative process of daily application, and evaluation with the nursing staff, DIDAS items were adapted during its development. All 10 items that were developed in this way, are scored on a three-point scale (0 = no disturbance; 1 = mild disturbance; 2 = severe disturbance), yielding a total DIDAS score ranging from 0 to 20 points.

Procedures

First, two members of the nursing staff were invited to complete DIDAS scoring independently, in duplicate for each patient, irrespective of possible symptoms of delirium, during the day and evening shift, in order to assess the interrater variability. Subsequently, the DIDAS was completed only for patients who experienced symptoms of delirium during the first period, for patients with a

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Table 1: Patients characteristics.

N of patients	
Total	17
Patients discharged during study	3
Patients newly admitted during study	1
Sex- N (%)	
Female	9 (53%)
Male	8 (47%)
Age-years	
Mean (SD)	76.9 (SD±8.02)
Range	61-88
Length of admission at start study- days	
Mean (SD)	90 (SD±98.42)
Range	0-305
Number of completed DIDAS questionnaires per patient (SD)	
Median	35 (SD±15)
Range	16-53
Diagnosis at admission	
Neurocognitive disorder with unknown causes	8
Alzheimer'sdisease	5
Vascular dementia	1
Neurocognitive disorder due to alcohol abuse	1
Lewy body dementia	1
Bipolar disorder	1
Schizophrenia	3

newly developed delirium and for newly admitted patients with a (suspected) delirium. Blinded for the nurses' DIDAS score, a geriatric physician or senior geriatric nurse practitioner independently assessed presence and severity of any deliriumsymptom each day based on their own clinical observations, reports from colleagues, and other information from the electronic patient file. This clinical assessment was used to diagnose (or refute) DSD based on concept-criteria for diagnosing a DSD as proposed by van Gool et al., [17,18].

Analysis

The interrater reliability was assessed with the intraclass correlation coefficient for consistency by using the repeated DIDAS measures. Test-retest reliability was determined by the level of absolute agreement between the independent observers [19]. Cronbach's alpha (α) was calculated for the total DIDAS score. The difference of daily mean DIDAS scores in patients with and without a clinical diagnosis of DSD, quantified as Cohen's d, was taken to reflect DIDAS' discriminative power. To explore its potential to screen for symptoms of DSD the predictive value of low, medium and high DIDAS scores were analyzed in relation to a clinical diagnosis of DSD. Based on clinical impression, the geriatric physician or senior geriatric nurse practitioner globally assessed the severity of a patient's condition and delirium symptoms using a 10-point Likert Scale, disregarding any other pre-existing illnesses different from delirium. Spearman's Rho was used to evaluate the correlation between the mean DIDAS score per day and the corresponding Likert scale score.

Results

Patient characteristics

The 17 patients included in this study were 76.9 years old on average and represented a heterogenous population of which details are provided in Table 1. The total number of diagnoses exceeds the number of patients as some patients had multiple diagnoses (Table 1).

DIDAS scores

A total of 589 DIDAS was completed, of which 368 during day shifts and 202 during evening shifts. In this way, 379 mean DIDAS scores per patient per shift and 259 mean DIDAS scores per patient per day could be calculated. In 21 of the collected DIDAS questionnaires (3.6% of total), one or more items remained unscored, which resulted in a total of 0.5% of missing data. The items missing mostly were the items reflecting a patient's consciousness, fluctuations and delusions. In the case of missing items, the total DIDAS score was corrected according to the maximum achievable score.

Reliability

For analysis of the interrater consistency, 187 sets of DIDAS scores of two observers could be included. The internal consistency

Table 2: DIDAS interrater agreement on item level.

Items	Total			DSD		
	ICC consistency (95%-CI)	%agree[1]	%agree±1[2]	ICC consistency (95%-CI)	%agree[1]	%agree±1[2]
Consciousness	0.51** (0.40 - 0.61)	86%	100%	0.58** (0.41-0.72)	79.20%	100%
Attention	0.59** (0.49 - 0.68)	71.10%	98.40%	0.56** (0.38-0.70)	62.50%	100%
Apathy	0.50** (0.38 - 0.60)	80.10%	98.90%	0.56** (0.38-0.70)	73.60%	98.60%
Motor behavior	0.54** (0.43 - 0.64)	82.90%	96.30%	0.57** (0.39-0.70)	69.90%	95.90%
Fluctuations	0.42** (0.30 - 0.53)	58.90%	97.30%	0.36* (0.14-0.54)	49.30%	94.40%
Anxiety	0.46** (0.34 - 0.57)	76.80%	98.90%	0.44** (0.23-0.61)	56.90%	94.40%
Delusions	0.54** (0.43 - 0.63)	70.10%	98.90%	0.56** (0.37-0.70)	61.10%	97.20%
Hallucinations	0.51** (0.40 - 0.61)	76.80%	98.40%	0.52** (0.32-0.67)	62.50%	97.20%
Affect	0.42** (0.29 - 0.53)	63.20%	98.90%	0.47** (0.27-0.63)	57.70%	100%
Behavior	0.52** (0.41 - 0.62)	78.50%	97.80%	0.46** (0.26-0.63)	55.60%	97.20%
Total score	0.749*	-		0.704	-	

[1]indicating identical scores, [2]indicating either identical scores or scores with a difference of 1 point, *p<0.001; **p<0.0005

Table 3: Mean DIDAS scores (SD) per shift and day for patients with and without delirium during study.

	MeanDIDAS score (SD)				Cohen's d
	No DSD	N	DSD	N	
Mean Day shift	1.87 (SD 2.01)	126	4.58 (SD 3.85)	85	0.88
Mean Evening shift	3.08 (SD 3.51)	77	5.91 (SD 4.15)	56	0.74
MeanTotal day	2.07 (SD 2.34)	149	5.23 (SD 3.70)	100	1.02

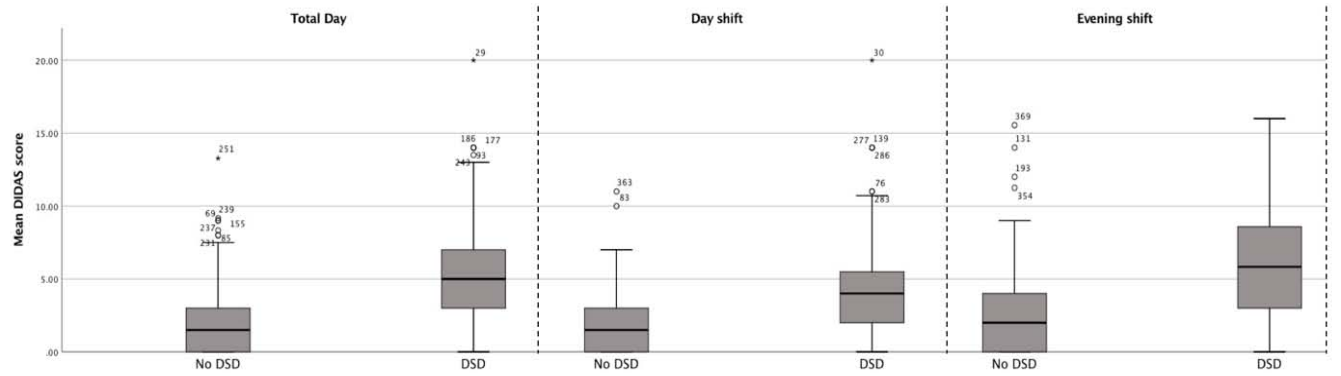

Figure 1: Box plots of mean DIDAS score per day, day shift and evening shift in patients free from DSD and those suffering from DSD.

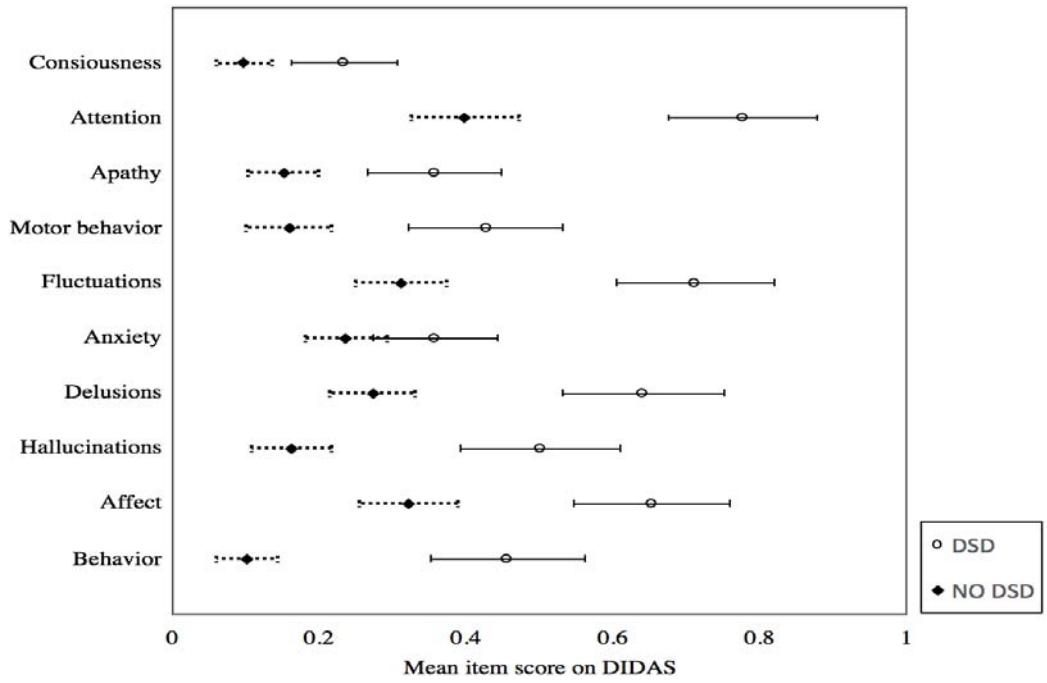

Figure 2: Mean item scores with 95%-confidence interval for DIDAS.

reliability was high for the total DIDAS scores (Cronbach's alpha α =0.86), as well as in patients with DSD (α =0.827) or free from DSD (α =0.781). The interrater consistency on item level ranged from 0.42-0.59 (Table 2). The percentage of absolute agreement between observers ranged from 63.2-82.9% for all patients, and 49.3-79.2% for patients with DSD.

Discriminative power and predictive value

Box plots of the mean DIDAS score per day and per shift for patients with DSD and patients free from DSD are shown in figure1. Mean DIDAS score per day in patients with DSD was significantly higher compared to patients without DSD (Cohen's d 1.02) (Table 3 and Figure 1).

Mean scores on item level are shown in figure 2 for patients with DSD and no DSD. Statistically significant differences between DSD and no DSD were found for all ten items, with effect sizes expressed in Cohen's d ranging from 0.27 to 0.72 (Figure 2).

Out of 589 DIDAS questionnaires, 50 corresponding clinical DSD diagnoses were missing leaving 539 DIDAS scores for the analysis of

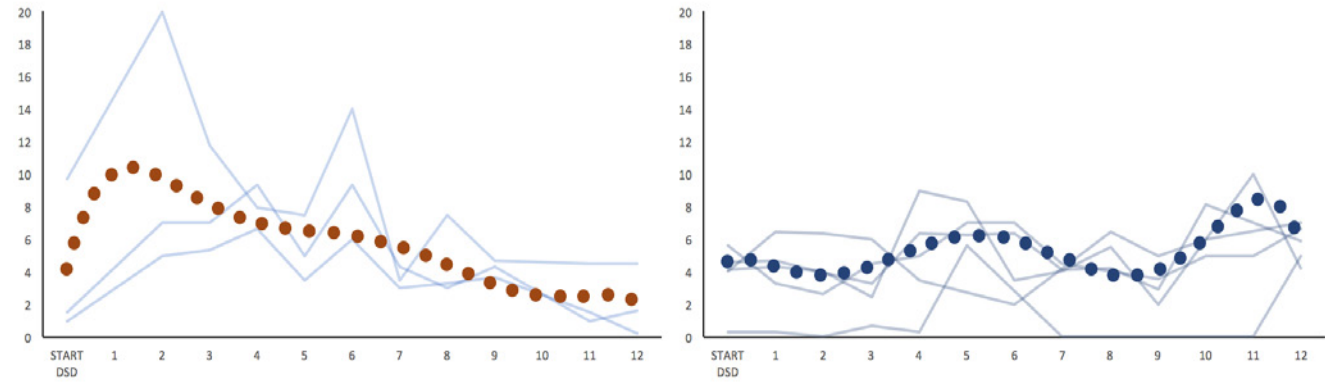

Figure 3: Course of the DIDAS scores over time.
The trend line in the left panel is constructed on the basis of average daily DIDAS scores in three patients who tended to recover from DSD after 8-10 days. The trend line in the right panel depicts the course of DSD severity in five patients not showing any trend of recovery from DSD (right).

Table 4: Negative and Positive Predictive Value (NPV resp. PPV) for individual DIDAS scores.

DIDAS score	No DSD (n)	DSD (n)	NPV	PPV
Low (<3)	253	90	73.80%	26.20%
Middle (4-9)	64	96	40.00%	60.00%
High (>10)	5	31	13.90%	86.10%

the predictive value of the DIDAS score. The positive predictive value (PPV) and Negative Predictive Value (NPV) for individual DIDAS scores are shown in (Table 4).

The correlation (Spearman's Rho) between the daily mean DIDAS score per patient and the corresponding Likert score of clinical severity was calculated at 0.626 ($p<0.01$). The courses of the daily mean DIDAS scores over twelve days in DSD are shown in Figure 3 for eight patients (Figure 3).

Discussion

This proof-of-concept study shows that the Delirium-In-Dementia-Assessment-Scale (DIDAS, in the supplementary material to this paper) seems a reliable instrument that can be used by nurses to follow-up on (early) symptoms of delirium superimposed on dementia and to monitor the course of delirium severity. The DIDAS seems to be well applicable by nurses for this specific patient population as this study documented limited missing data and a good discriminative power between patients with and without DSD. Both scores on item level as well as mean DIDAS score per day or shift were statistically significant higher in patients with DSD, with generally large effect sizes in comparison to patients free from DSD.

In general, the nurses' compliance and willingness to fill in the DIDAS was good. Since their participation to this study was added in addition to regular tasks and clinical routine, only on a small number of days lack of time was reported to adequately observe all patients and fill in the DIDAS. This mainly affected obtaining the repeated measures. In 21 of the collected DIDAS questionnaires (3.6% of total), one or more item remained unscored. Presumably these items are not missing at random, but they were not completed because observers experienced difficulties with scoring because it was not possible to adequately assess a patient's behavior or in case of suspected delusions or hallucinations, due to a language barrier in one of the subjects who did not speak Dutch.

The interrater consistency for the total DIDAS score was high. The interrater consistency on item level ranged from 0.42-0.59, which corresponds with a poor to moderate consistency [19-23]. Just like for the total DIDAS score, the consistency estimate on item level was higher when including all patients in the analysis compared to only including patients with DSD. Scoring absence ('0-score') of symptoms in patients free from DSD can be expected to limit interrater variation in comparison to choosing between mild or severe symptoms (corresponding to '1' or '2' item-scores) in the presence of DSD. 'Fluctuations', 'Anxiety' and 'Affect' proved to be the items with the lowest interrater consistency. In addition, in patients with DSD, the 'Behavior'-item also scored low on consistency. Possibly, these items are more sensitive to observers' own interpretation compared to the other items. For example, changes in 'motor behavior' are probably less subject to interpretation than scoring of 'anxiety' and 'affect'. Another factor that may have increased the interrater variability, especially in DSD, may be the actual fluctuations in clinical symptoms as one of the key criteria of delirium. Therefore, even within one shift, observations of a particular nurse can differ from the observation of another nurse and thereby explain a variation in scores.

The DIDAS questionnaire seems to be a reliable scale for measuring delirium severity in patients with pre-existing cognitive impairment, for there was a strong and significant correlation between the mean DIDAS score per day and the global clinical assessment of the severity of clinical symptoms in DSD as reflected in the Likert scale scores of severity as scored by independent observers.

Even though the DIDAS is not constructed as a diagnostic tool, as the diagnosis of DSD will always require painstaking clinical evaluation, the predictive value of high scores reported here suggest that alertness for DSD is warranted when DIDAS scores are high, suggesting the need for detailed clinical examination and adequate follow-up in these patients.

Even though follow-up data over twelve days of only eight patients with DSD could be visualized, the observed trends suggest that the DIDAS may be sensitive to change, in accordance with clinical observation of increasing or declining severity of DSD. The

ascend and (slow) descend in three patients recovering from DSD correspond with the general conception that a delirium is an acute arising and transient clinical syndrome, but that some symptoms of the delirium may persist for a longer period [21,22,24].The preliminary data presented here suggest the DIDAS may be a interesting tool that should be studied in more detail in the course of DSD.

Limitations

The nurses in the psychogeriatric ward participating in this study are specially trained and highly experienced with severe behavioral disturbance and advanced stages of dementia. This might have led to observer bias for that they may have been less likely to score certain behavior as deviating or disturbed. This may have limited the discriminative power of the DIDAS as patients with DSD can be expected to show more disrupted behavior compared to patients without delirium.

In this study, all patients admitted to the psychogeriatric ward under study were included. This implicated that we included also patients with psychiatric comorbidity (schizophrenia and bipolar disorder), or those who did not speak the Dutch language. This may have negatively impacted estimates of DIDAS test characteristics. However, considering the intended use of the DIDAS in mixed and diverse patient populations, it can also expected to have contributed to the external validity of the present findings.

The main limitation to this study may be that there is no golden standard for the diagnosis of DSD nor for measures of severity in this condition. Therefore, the reference standard for both in this study was based on the clinical assessments by independent observers, experienced geriatric physicians or a specialized senior nurse practitioner, applying concept criteria for DSD [18]. Because several items that are assessed in the DIDAS (fluctuations, attention and consciousness) are also key criteria of the reference standard for DSD diagnosis, they might therefore have inflated the sensitivity as well as the discriminative power of the DIDAS. However, the DIDAS is not designed to diagnose DSD as such, but rather to monitor presence and severity of delirium symptoms and to adequately follow their course in time. DSD remains a diagnosis reflecting a complex and comprehensive clinical syndrome in the realm of cognitive, affective and psychomotor behavioral dimensions that simply cannot be restricted to a list of criteria or a cut-off point on a diagnostic scale. Therefore, the emphasis of this study remains DIDAS' reliability and the ability to measure severity of delirium symptoms during the course of (suspected) DSD and not its discriminative, diagnostic potential. High or even rising DIDAS scores do not irrefutably imply a diagnosis of DSD but they can be taken as an indication of an emerging DSD and as such they should alert clinicians to perform more detailed clinical examination and to initiate early intervention or install preventive measures.

Conclusion

This proof-of-concept study shows that the uptake of the DIDAS by nurses is satisfactory and suggests that DIDAS scores represent a useful tool for measuring severity of delirium symptoms in patients with pre-existing cognitive impairment. Multiple observations are recommended for the assessment of suspected DSD, as the discriminative effect size and interrater reliability were best when analyzing mean scores over a day. Further research, including larger groups of patients and observations over longer periods of time, is required to analyze the potential of the DIDAS in monitoring DSD in more detail.

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