



EREDETI  
KÖZLEMÉNY

ORIGINAL ARTICLE

# Validity and reliability of the Turkish version of the Informant Assessment of Geriatric Delirium Scale

Buket CELIK<sup>1</sup> , Ozlem BILIK<sup>1</sup> , Zeynep Deveci KOÇBILEK<sup>2</sup> , Hale Turhan DAMAR<sup>3</sup> , Didem ÖZ<sup>4</sup> , Zeynep DENIZMEN<sup>4</sup>

<sup>1</sup>Surgical Nursing Department, Dokuz Eylul University Faculty of Nursing, Izmir, Turkey

<sup>2</sup>Pamukkale University, Faculty of Health Science, Denizli, Turkey

<sup>3</sup>Elderly Care Department, Vocational School of Health Services, Izmir Democracy University Izmir, Turkey

<sup>4</sup>Dokuz Eylul University Hospital, Department of Neurology, Izmir, Turkey

English | <https://doi.org/10.18071/isz.77.0111> | [www.elitmed.hu](http://www.elitmed.hu)

## Az Informant Assessment of Geriatric Delirium Scale török verziójának érvényessége és megbízhatósága

Celik B, RN, PhD; Bilik O, RN, PhD; Koçbilek ZD, RN, PhD; Damar HT, RN, PhD; Öz D, MD; Denizmen Z, MD

### Correspondent:

Buket CELIK, RN, PhD,  
Dokuz Eylul University Faculty  
of Nursing, Balçova/Inciralti,  
Izmir, Turkey.  
Telephone: +90 232 4126975,  
e-mail: buket.celik@deu.edu.tr  
<https://orcid.org/0000-0003-3229-1845>

### Érkezett:

2023. augusztus 9.

### Elfogadva:

2023. október 27.

**Background and purpose** – Delirium is a common complication developing in elderly patients. Therefore, it is important to diagnose delirium earlier. Family caregivers play an active role in early diagnosis of delirium and build a bridge between health professionals and patients. The purpose of this research was to achieve the validity and reliability of the Turkish version of the Informant Assessment of Geriatric Delirium Scale (I-AGEd).

**Methods** – This is a methodological study. The sample comprised 125 caregivers accepting to participate in the study and offering care to older patients with hip fracture aged ≥60 years. Data were gathered preoperatively and on postoperative days 0, 1 and 2. After achieving the linguistic and content validity of the scale, the known-groups comparison was used to achieve its construct validity. The ROC curve analysis was made to determine the sensitivity and specificity of the scale. Item-total correlations, item analysis based on the difference between the upper 27% and lower 27%, Kuder–Richardson 20 (KR-20) coefficient and parallel forms reliability with the NEECHAM Confusion Scale were adapted to assess discriminant indices of the items in the I-AGEd.

**Results** – The item-total correlation coefficients of the scale ranged from 0.54 to 0.89 and KR-20 coefficient ranged from 0.09 to 0.91 depending on the measurement times.

**Háttér és cél** – Az idős betegeknél a delírium gyakran kialakuló szövődmény, ezért fontos korai diagnózisa. A gondoskodó családtagok aktív szerepet játszanak a delírium korai diagnosztikájában, és hidat építenek az egészségügyi szakemberek és betegek között. Kutatásunk célja az volt, hogy elérjük az Informant Assessment of Geriatric Delirium Scale (I-AGEd) török verziójának érvényességét és megbízhatóságát.

**Módszerek** – Ez egy módszertani tanulmány. A minta 125 gondozóból állt, akik vállalták a részvételt a tanulmányban, és 60 éves vagy a feletti csípőtöréssel idős betegeket gondoztak. Az adatokat műtét előtt és a műtét utáni 0., 1. és 2. napon gyűjtöttük össze. A skála nyelvi és tartalmi érvényességét elérve az ismert csoportok összehasonlítását alkalmaztuk a szerkezeti érvényesség eléréséhez. A ROC-görbe elemzését végeztük el a skála érzékenysége és specifikitásának meghatározásához. Az elem-összeg korrelációk és az elemanalízis az alsó 27% és a felső 27% közötti különbségeken alapultak, a Kuder–Richardson 20 (KR-20) együtthatót, valamint a NEECHAM Konfúzióskálával való párhuzamos formák megbízhatóságát alkalmaztuk az I-AGEd-elemek diszkriminanciaindicatorainak értékelésére.

**Eredmények** – A skála elem-összeg korrelációs együtthatói 0,54-től 0,89-ig terjedtek, és a KR-20 együttható 0,09-től 0,91-ig terjedt a mérési időtől függően. Az ROC-görbe

According to the ROC curve analysis, the sensitivity and specificity of the scale were  $\geq 91\%$  and  $\geq 96\%$  respectively. The parallel forms reliability analysis showed a highly significant, strong negative relation at each measurement between the I-AGeD and the NEECHAM Confusion Scale.

**Conclusion** – The I-AGeD is valid and reliable to diagnose delirium in older Turkish patients in perioperative processes.

**Keywords:** delirium, caregiver, geriatry, patient

elemzése szerint a skála érzékenysége és specifikitása  $\geq 91\%$  és  $\geq 96\%$  volt. A párhuzamos formák megbízhatósági elemzése minden mérésnél nagyon szignifikáns, erős negatív összefüggést mutatott az I-AGeD és a NEECHAM Konfúzióskála között.

**Következtetés** – Az I-AGeD érvényes és megbízható eszköz a delírium diagnosztizálására idős török betegeknek a perioperatív folyamatok során.

**Kulcsszavak:** delírium, gondozó, geriátria, betegek

Delirium is a common clinical syndrome characterized by impaired consciousness with a sudden onset and fluctuating course accompanied by cognitive dysfunction and distorted perception<sup>1</sup>. The prevalence of delirium is reported to range from 4% to 57% in the literature<sup>2-4</sup>. Delirium increases mortality and the length of hospital stay<sup>1, 3, 4</sup>. Delirium is multifactorial and has various predisposing and precipitating factors. Predisposing factors include age above 70 years, male gender, and dementia. The most common precipitating factors are medications, acute illness, infections, and exacerbation of chronic medical diseases.<sup>5</sup> Among these etiological factors, it is particularly emphasized that advanced age and dementia have a more significant impact on the development of delirium<sup>5, 6</sup>. The incidence of delirium increases with age. An aging-related reduction in the brain's functional reserve may explain why delirium is more frequent in older people than in younger people, as the reserve becomes inadequate to cover the metabolic requirements critically increased by stressors<sup>7</sup>. Delirium and dementia are the most common causes of altered mental status in elderly patients. With dementia being one of the predisposing factors for delirium, often the two coexist, and sometimes when the dementia is rapidly progressive, it can be challenging to differentiate the two in patients without a prior history of dementia. This situation highlights the interprofessional team's role in the evaluation and management of patients with delirium and dementia<sup>8</sup>.

Delirium can be prevented if its risk factors are identified and diagnosed earlier<sup>9</sup>. Family caregivers play an important role in early diagnosis and serve as a bridge between patients and health professionals<sup>10, 11</sup>. Bond et al. have stated that family caregivers play an active role in early detection of delirium<sup>12</sup>. In a systematic review on the effects of family caregivers' experiences and roles in the caregiving process on delirium management, the caregivers were found to contribute to early detection and

prevention of delirium. Besides, it was suggested that caregivers-based tools directed towards prevention and early diagnosis of delirium should be used<sup>10</sup>.

The Informant Assessment of Geriatric Delirium Scale (I-AGeD) was developed by Rhodius-Meester et al. in 2013 to determine delirium in older people based on information from family caregivers. It was found to be a valid and reliable tool to diagnose delirium in hospitalized older patients<sup>13</sup>.

To our knowledge, there has not been a family caregiver-based tool to diagnose delirium or a study testing the validity and reliability of the I-AGeD in the Turkish population. Therefore, the aim of the present study was to adapt the I-AGeD into Turkish. Achieving the validity and reliability of the Turkish version of the I-AGeD could contribute to early diagnosis of delirium and improvement of the patient care quality.

## Methods

### Setting and participants

Ethical (approval number: 2012/17-23) and institutional (approval number: 48844) approvals were obtained. The family caregivers' oral and written informed consent was obtained. The study had a methodological design and was conducted in an orthopedics and traumatology outpatient clinic of a university hospital between March and October in 2022. The study sample included patients aged over 60 years, having hip surgery and accepting to participate in the study, and their caregivers. Inclusion criteria for the caregivers were age of  $\geq 18$  years, volunteering to participate in the study, being literate, taking care of the patient for minimum 48 hours and knowing general cognitive status of the patients before hospitalization. Exclusion criteria were a psychiatric disorder diagnosed and a hearing or speech problem of the caregiver. It is recommended that the sample size would be at least five-

ten times the number of the items in a scale. Since the scale has ten items, the sample included 125 individuals meeting the inclusion criteria<sup>14</sup>.

## Measures

Data were collected with a descriptive characteristics form, the I-AGeD and The Neelon and Champagne (NEECHAM) Confusion Scale.

### *Descriptive Characteristics Form*

The form has two sections. The first section is composed of nine questions about family caregivers' age, gender, education, occupation, marital status, income, degree of the relation with the patient and staying with the patient. The second section is composed of five questions about patients' age, gender, diagnosis, type of anesthesia and chronic diseases (diagnosis of neurological and psychiatric conditions).

### *The Informant Assessment of Geriatric Delirium Scale*

I-AGeD was developed by Rhodius-Meester et al. in the Netherlands in 2013 to facilitate diagnosis of delirium likely to appear in older patients based on information from caregivers. The scale consists of ten items. Responses to the items can be yes (corresponding to 1 point) or no (corresponding to zero point). The highest and lowest scores on the scale can be ten and zero respectively. The cut-off point for the diagnosis of delirium was reported to be four. Scores higher than four indicate delirium. Cronbach's alpha for the scale was reported to be 0.85. The sensitivity and specificity of the scale were 88.90% and 100% respectively when patients with delirium and those without delirium were compared. The scale was reported to be valid and reliable to diagnose delirium based on information from family caregivers<sup>13</sup>. The validity and reliability of the scale have not been tested in other cultures yet.

### *The Neelon and Champagne Confusion Scale*

The NEECHAM Confusion Scale was created by Neelon et al. in 1996 and has nine items and three subscales<sup>15</sup>. The total score ranges from zero to 30 on the scale. The scores zero-19 show moderate to severe confusion, the scores 20-24 show early to mild confusion, the scores 25-26 show lack of confusion but presence of a high risk of confusion and the scores 27-30 show normal functions. The sensitivity and specificity of the scale were reported to be 95% and 78%, respectively. The NEECHAM Confusion Scale was a valid and reliable scale that can be used by health professionals to screen and diagnose delirium in hospitalized patients in Turkey<sup>16</sup>.

## Data collection

Written and oral informed consent was obtained from the patients and their family caregivers on admission to hospital. The family caregivers were asked to fill in the I-AGeD and assessed with NEECHAM Confusion Scale on admission to hospital and postoperative days 0, 1, and 2 and put in a sealed envelope. At the same time, the patients were assessed by a neurologist using the Diagnostic and Statistical Manual of Mental Disorders (DSM IV) criteria. Then data obtained by the neurologist and researcher were compared and analyzed.

## Adaptation of the I-AGeD into Turkish

The scale was translated from English to Turkish by two health professionals who are familiar with the terminology in the scale and experienced in translation from English to Turkish and have good command of Turkish and English. A single Turkish version of the scale was created and examined by five experts who have good command of both languages and cultures, knowledge about the content of the scale, and how it is administered. The experts approved the Turkish version. Finally, the Turkish version of the scale was translated back to English by two English language specialists who did not see the original scale<sup>17, 18</sup>.

## Examination of the psychometric properties of the scale

For content validity, expert opinion was requested from three neurologists and five nurse academicians specializing in delirium to determine whether each item and the whole scale are appropriate for their goal of measurement. Davis technique was utilized to assess the content validity and the experts were requested to rate each item of the scale by selecting the responses "a) totally acceptable", "b) acceptable", "c) acceptable but needed modifying slightly" and "d) unacceptable". The total number of the items "a" and "b" was divided by the number of the experts and the item, and the scale content validity indexes were found to be 1. The desirable item and scale content validity indices in the Davis technique are over 0.80<sup>19</sup>. The content validity index of over 0.80 showed that the I-AGeD measured what it was expected to measure.

The known groups comparison, and item analyses were performed to test the construct validity of the scale. Therefore, item-total-score correlation analyses made for the reliability assessment of the scale were also examined to determine the construct validity of the scale<sup>20, 21</sup>. Besides, receiver operating characteristic (ROC) curve analyses were utilized to examine the sensitivity and specificity of the scale regarding diagnosis of delirium.

**Table 1.** Descriptive characteristics of the patients and their caregivers

| Characteristics                           | Number              | Percentage |
|-------------------------------------------|---------------------|------------|
| <i>Patients</i>                           |                     |            |
| Age (years)*                              | 79.29±9.89 (60–96)  |            |
| <i>Gender</i>                             |                     |            |
| Female                                    | 89                  | 71.20      |
| Male                                      | 36                  | 28.80      |
| <i>Place of living</i>                    |                     |            |
| Alone                                     | 20                  | 16.00      |
| With family                               | 101                 | 80.80      |
| Nursing home                              | 4                   | 3.20       |
| <i>Cognitive disorder</i>                 |                     |            |
| None                                      | 90                  | 72.00      |
| Dementia                                  | 20                  | 16.00      |
| Alzheimer's disease                       | 7                   | 5.60       |
| Dementia + Alzheimer's disease            | 8                   | 6.40       |
| <i>Caregivers</i>                         |                     |            |
| Age (years)*                              | 53.56±10.11 (30–80) |            |
| <i>Gender</i>                             |                     |            |
| Female                                    | 98                  | 78.40      |
| Male                                      | 27                  | 21.60      |
| <i>Education</i>                          |                     |            |
| Primary education                         | 66                  | 52.80      |
| High school                               | 30                  | 24.00      |
| University or a higher level of education | 29                  | 23.20      |
| <i>Occupation</i>                         |                     |            |
| Unemployed                                | 58                  | 46.40      |
| Civil servant                             | 39                  | 31.20      |
| Retired                                   | 28                  | 22.40      |
| <i>Marital status</i>                     |                     |            |
| Married                                   | 100                 | 80.00      |
| Single                                    | 25                  | 20.00      |
| <i>Income</i>                             |                     |            |
| Higher than expenses                      | 7                   | 5.60       |
| Equal to expenses                         | 45                  | 36.00      |
| Lower than expenses                       | 73                  | 58.40      |
| <i>Degree of relationship</i>             |                     |            |
| Spouse                                    | 18                  | 14.40      |
| Daughter                                  | 75                  | 60.00      |
| Son                                       | 8                   | 6.40       |
| Daughter-in-law                           | 24                  | 19.20      |

\* mean ± standard deviation (minimum-maximum)

To test the reliability of I-AGeD, item-total correlations used to assess the discriminant indices of the items, item analysis based on the difference between the upper 27% and lower 27%, Kuder-Richardson 20 (KR-20) internal reliability coefficient and parallel forms reliability were utilized.

## Data Analysis

Data were analyzed with SPSS 24. Descriptive characteristics were examined by numbers, percentages, mean, and standard deviation. Item-total correlation and parallel forms reliability were tested with Pearson correlation analysis. The correlation coefficients were evaluated as: 0.00-0.19: very weak correlation, 0.20-0.39: weak correlation, 0.40-0.69: moderate correlation, 0.70-0.89: strong correlation, and 0.90-1.00: very strong correlation<sup>22</sup>. Item analyses were made with Student's t-test and discriminant validity was analyzed with McNamer's test. The sensitivity and specificity of the scale were examined with ROC curve analysis. The values under the curve were evaluated as: 0.90-1.00: excellent, 0.80-0.89: good, 0.70-0.79: moderate, 0.60-0.69: weak, and 0.50-0.59: ineffective<sup>23, 24</sup>.

## Results

Descriptive characteristics of the patients and their caregivers are presented in **Table 1**. The mean age of the patients was 79.29±9.89 years. Of all the caregivers, 78.40% (n=98) were female, 52.80% (n=66) were primary school graduates, 66.40% (n=83) were the patients' children.

## Reliability of the scale

Results of the item analysis are outlined in **Table 2**. Item-total correlation coefficients for the scale ranged from 0.541 to 0.846 before surgery (T0), from 0.627 to 0.875 on postoperative day 0 (T1), from 0.613 to 0.877 on postoperative day 1 (T2) and from 0.603 to 0.895 on postoperative day 2 (T3). In the item analysis, there was a significant difference between the upper 27% and the lower 27% on each measurement time (p<0.001). The Kuder-Richardson internal reliability coefficient was 0.911 on T0, 0.916 on T1, 0.916 on T2 and 0.907 on T3.

**Table 2.** Results of the Item Analysis for The Informant Assessment of Geriatric Delirium Scale

| Items                                                                                             | Item-total score |       |       |      | Difference between upper 27% and lower 27% |         |         |         |
|---------------------------------------------------------------------------------------------------|------------------|-------|-------|------|--------------------------------------------|---------|---------|---------|
|                                                                                                   | T0               | T1    | T2    | T3   | T0                                         | T1      | T2      | T3      |
| 1. I haven't noticed a change in his/her general behavior.                                        | .809*            | .798* | .854* | .822 | 9.220*                                     | 12.819* | 12.819* | 9.220*  |
| 2. I have to frequently repeat the things I do to attract his/her attention.                      | .834*            | .875* | .877* | .869 | 9.911*                                     | 19.044* | 15.716* | 14.283* |
| 3. He/she is less frequently awake and/or is sleepy during the day.                               | .769*            | .794* | .866* | .895 | 11.662*                                    | 23.685* | 19.044* | 16.233* |
| 4. He/she less frequently move spontaneously and has difficulty in moving his/her hands and arms. | .553*            | .653* | .717* | .675 | 5.050*                                     | 8.073*  | 9.220*  | 7.585*  |
| 5. He/she is usually awake at night and always sleepy during daytime.                             | .725*            | .632* | .613* | .603 | 8.073*                                     | 6.733*  | 5.667*  | 6.000*  |
| 6. He/she has been more forgetful recently.                                                       | .814*            | .741* | .710* | .632 | 16.233*                                    | 12.819* | 11.662* | 7.585*  |
| 7. He/she closes his/her eyes when we stop speaking.                                              | .714*            | .706* | .785* | .733 | 5.667*                                     | 9.220*  | 9.220*  | 6.733*  |
| 8. It is difficult to wake him/her up.                                                            | .541*            | .656* | .668* | .618 | 3.688*                                     | 6.733*  | 5.667*  | 4.761*  |
| 9. He/she is irritable and struggles to free himself/herself.                                     | .784*            | .627* | .648* | .708 | 9.220*                                     | 7.585*  | 7.585*  | 7.141*  |
| 10. He/she says irrational, strange things.                                                       | .846*            | .817* | .774* | .793 | 11.794*                                    | 16.233* | 11.254* | 7.984*  |

\* p<0.001, T0: before surgery, T1: postoperative day 0, T2: postoperative day 1, T2: postoperative day 2.

To assess parallel forms reliability, the mean score on the I-AGeD and the mean score on the NEECHAM Confusion Scale were compared (**Table 3**). There was a highly significant, strong negative correlation between the mean scores of the scales on each measurement time (p<0.001). The presence of a negative correlation showed that parallel forms reliability of the I-AGeD was achieved.

Validity of the scale

For the known groups validity, **Table 4** shows the comparison of the patients diagnosed as delirium by the neurologist using DSM IV criteria and based on their total score on the I-AGeD and those without the diagnosis of delirium. Out of the patients found to have delirium based on their mean scores on the I-AGeD, 91.4% were

diagnosed as delirium by the neurologist using DSM IV criteria before surgery and 92.5%, 94.2% and 93.3% were diagnosed as delirium by the neurologist using DSM IV criteria on postoperative day 0, 1 and 2, respectively. None of the patients without delirium based on their mean I-AGeD scores at all measurement times were diagnosed as delirium by the neurologist. This indicates that the I-AGeD has construct validity.

Sensitivity and specificity of the scale

The ROC curve analysis is presented in **Figure 1** and **Table 5**. Since the area under the curve was over 0.90 at all the measurements, the discriminative power of the I-AGeD was considered excellent. The cut-off point for the scale was calculated by using Youden index. The

**Table 3.** The comparison of the mean score on The Neelon and Champagne Confusion Scale with the mean score on The Informant Assessment of Geriatric Delirium Scale

|                              | The mean score on the NEECHAAM Confusion Scale |      |       |      |       |      |       |      |
|------------------------------|------------------------------------------------|------|-------|------|-------|------|-------|------|
|                              | T0                                             |      | T1    |      | T2    |      | T3    |      |
|                              | R                                              | p    | R     | p    | R     | p    | r     | p    |
| The Mean Score on the I-AGeD | -.937                                          | .000 | -.905 | .000 | -.917 | .000 | -.913 | .000 |

**Table 4.** *The comparison of the patients diagnosed as delirium with those without delirium based on the mean I-AGeD scores and DSM IV criteria*

| Time | Mean Score on the I-AGeD | Diagnosis of delirium based on DSM IV criteria |      |                     |      |       |     |
|------|--------------------------|------------------------------------------------|------|---------------------|------|-------|-----|
|      |                          | Presence of delirium                           |      | Absence of delirium |      | Total |     |
|      |                          | n                                              | %    | N                   | %    | n     | %   |
| T0   | Presence of delirium     | 32                                             | 91.4 | 3                   | 8.6  | 34    | 100 |
|      | Absence of delirium      | 0                                              | 0    | 90                  | 100  | 90    | 100 |
|      | X <sup>2</sup>           | 1.333                                          |      |                     |      |       |     |
|      | P                        | .250                                           |      |                     |      |       |     |
| T1   | Presence of delirium     | 49                                             | 92.5 | 4                   | 7.5  | 53    | 100 |
|      | Absence of delirium      | 0                                              | 0    | 72                  | 100  | 72    | 100 |
|      | X <sup>2</sup>           | 2.250                                          |      |                     |      |       |     |
|      | P                        | .125                                           |      |                     |      |       |     |
| T2   | Presence of delirium     | 49                                             | 94.2 | 3                   | 5.8  | 52    | 100 |
|      | Absence of delirium      | 0                                              | 0    | 73                  | 100  | 73    | 100 |
|      | X <sup>2</sup>           | 1.333                                          |      |                     |      |       |     |
|      | P                        | .250                                           |      |                     |      |       |     |
| T3   | Presence of delirium     | 42                                             | 93.3 | 3                   | 6.7  | 45    | 100 |
|      | Absence of delirium      | 0                                              | 0    | 80                  | 96.4 | 80    | 100 |
|      | X <sup>2</sup>           | 1.333                                          |      |                     |      |       |     |
|      | P                        | .250                                           |      |                     |      |       |     |

T0: before surgery, T1: postoperative day 0, T2: postoperative day 1, T2: Postoperative day 2. X<sup>2</sup>: Mcnamer's test

point at which Youden index is the closest to +1 was accepted as the cut-off point. It was 4.5 for T0, T1 and T2 measurements and 4 for T3 measurement. Although the sensitivity of the scale varied with the measurement times, it was  $\geq 91\%$  and its specificity was  $\geq 96\%$  for each measurement. The rate of positive likelihood was over 24 for each measurement. These results indicated that the I-AGeD have high sensitivity and specificity and can be reliably used to diagnose delirium.

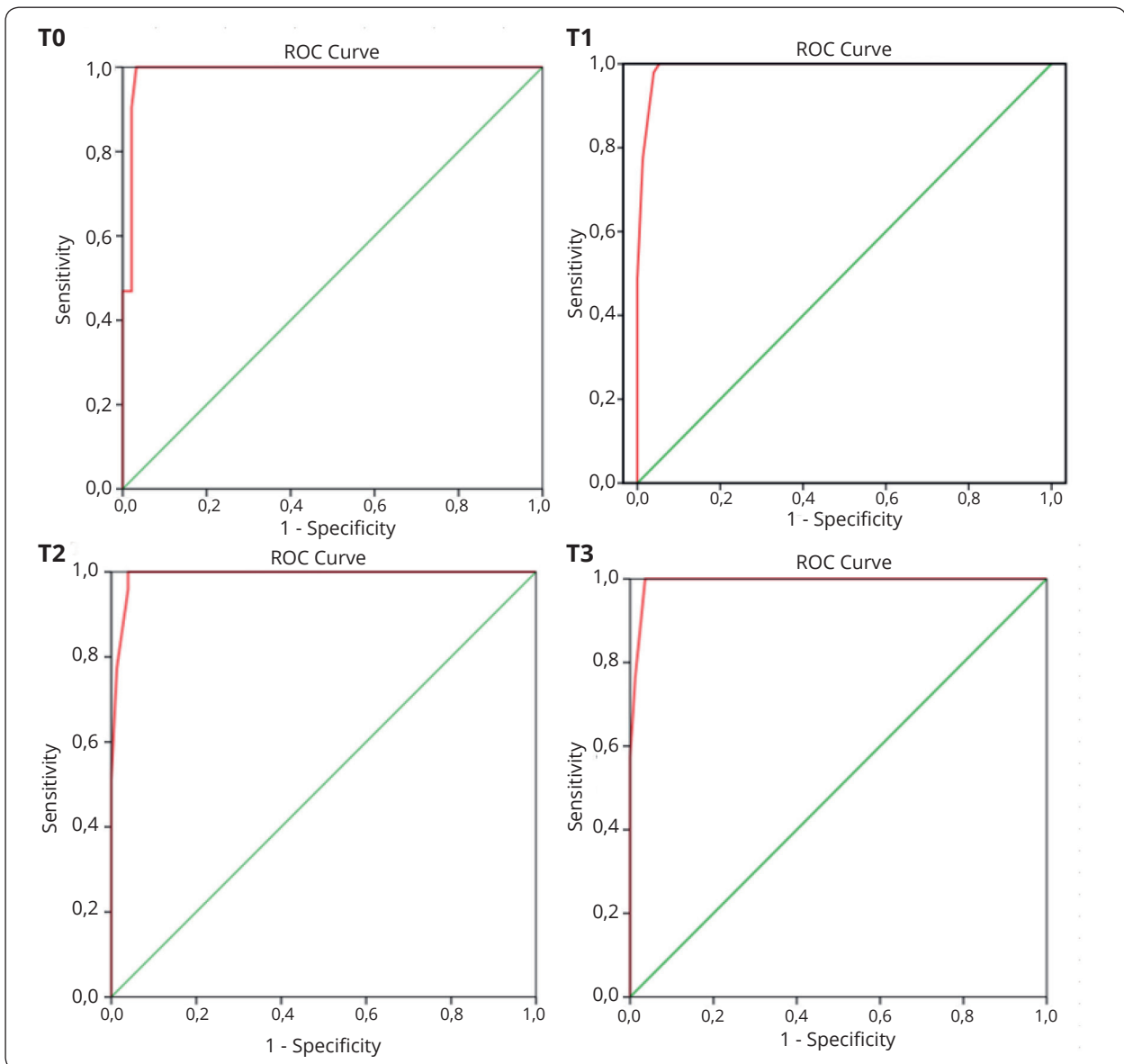
## Discussion

Delirium is a common complication developing in patients with hip fracture<sup>25</sup> and its incidence varies between 20% and 50%<sup>15</sup>. The original scale was developed for caregivers for geriatric patients. The validity and reliability of the Turkish version of the scale were tested in family caregivers providing care for patients aged  $\geq 60$  years and having hip fracture.

After linguistic and content validity of the I-AGeD were achieved, the construct validity of the scale was tested with the known groups comparison. To this aim, the same scale is administered to two different groups and the presence of a significant difference between them

indicates that the scale has construct validity<sup>20</sup>. Older patients undergoing surgery usually develop delirium in postsurgical 24-72 hours<sup>26, 27</sup>. Therefore, in the present study, the I-AGeD was used to make four measurements, i.e. before surgery and on postsurgical days 0, 1 and 2. The patients diagnosed as delirium by a neurologist using DSM IV criteria and those found to have delirium based on the scores on the I-AGeD filled in by their family caregivers at each measurement were compared. No significant difference was found in the diagnosis of delirium at each measurement between the I-AGeD filled by the caregivers and the neurologist using DSM IV criteria ( $p < 0.05$ ). This finding also shows that the construct validity of the scale was achieved. Besides, a ROC curve analysis was made to assess the power of the I-AGeD to distinguish between the patients diagnosed as delirium and those without delirium. Since the value of the area under the curve was over 0.90 at all measurements, the discriminative power of the I-AGeD was regarded as excellent.

The reliability of a scale shows how consistently that scale can make measurements. It is recommended that KR-20 coefficient should be used to achieve reliability of a scale whose items are coded dichotomously and as



**Figure 1.** The results of the ROC curve analysis

T0: Before surgery, T1: postoperative day 0, T2: postoperative day 1, T3: postoperative day 2

zero-one. KR-20 coefficient is expected to be over 0.70<sup>28</sup>. In the present study, KR-20 was over 0.90 at all the measurements. Cronbach's alpha for the original scale was reported to be 0.85<sup>13</sup>. Another method utilized to test reliability is item analysis. It shows the ability of the items in a scale to represent that scale and contributions of the items to the scale<sup>29</sup>. The item analysis based on the difference between the upper 27% and lower 27% was used to analyze reliability of the I-AGeD. Presence of a significant difference in the scores on a scale and its items between the groups indicates that the scale is reliable and has high discriminatory power<sup>30</sup>. In the present study, there was a significant difference in the scores on the

I-AGeD and its items at all the measurements between the upper 27% and lower 27%. This finding indicates that the I-AGeD has internal consistency.

Another way to test reliability of a scale is parallel forms reliability. This method allows examination of the correlation between the scores on two parallel forms created to measure the same concept and administered to a sample at the same time or at two different times.<sup>29</sup> To achieve the parallel forms reliability in the present study, the I-AGeD and the NEECHAM Confusion Scale were administered simultaneously and obtained mean scores on the scales were compared<sup>13, 16</sup>. Lower scores on the NEECHAM Confusion Scale and higher scores on the

**Table 5.** The cut-off point, predictive values, area under the curve values and rates of likelihood for The Informant Assessment of Geriatric Delirium Scale in detection of delirium

|    | Cut-off points | Sensitivity | Specificity | p     | Area under the curve (95% confidence interval) | Mean  |
|----|----------------|-------------|-------------|-------|------------------------------------------------|-------|
| T0 | 4.5            | 0.91        | 0.97        | 0.000 | 0.988 (0.97–1.00)                              | 42.14 |
| T1 | 4.5            | 0.98        | 0.96        | 0.000 | 0.992 (0.98–1.00)                              | 24.81 |
| T2 | 4.5            | 0.96        | 0.96        | 0.000 | 0.992 (0.98–1.00)                              | 24.30 |
| T3 | 4.0            | 1.00        | 0.96        | 0.000 | 0.993 (0.98–1.00)                              | 27.66 |

T0: before surgery, T1: postoperative day 0, T2: postoperative day 1, T3: postoperative day 2

I-AGeD can show delirium. A significant, strong negative correlation was found between the mean scores on the scales ( $p < 0.001$ ). This finding indicated that the parallel forms reliability of the I-AGeD was achieved.

## Conclusion

Delirium is not usually recognized in its early stage. It is important to obtain information from all sources including caregivers to diagnose this important, serious condi-

tion consistently and timely<sup>13</sup>. The I-AGeD was reported to be a tool that can be utilized to diagnose delirium quickly and easily. In light of the results of the present study, it can be suggested that it is a valid and reliable scale to detect delirium in older patients perioperatively in Turkey.

ACKNOWLEDGEMENTS – The authors would like to thank all the participants.

## References

- Delirium in adults. National Institute For Health And Care Excellence (NICE). 2019. Available at: <https://www.nice.org.uk/guidance/qs63/resources/delirium-in-adults-pdf-2098785962437> Accessed February 20, 2023.
- Bellelli G, Morandi A, Di Santo SG, Mazzone A, Cherubini A, Mossello E, et al. "Delirium Day": a nationwide point prevalence study of delirium in older hospitalized patients using an easy standardized diagnostic tool. *BMC Med* 2016;14:106. <https://doi.org/10.1186/s12916-016-0649-8>
- Tosun Tasar P, Sahin S, Akcam NO, Dinckal C, Ulusoy MG, Sarikaya OF, et al. Delirium is associated with increased mortality in the geriatric population. *Int J Psychiatry Clin Pract* 2018;22(3):200-5. <https://doi.org/10.1080/13651501.2017.1406955>
- Watt CL, Momoli F, Ansari MT, Sikora L, Bush SH, Hosie A, et al. The incidence and prevalence of delirium across palliative care settings: A systematic review. *Palliat Med* 2019;33(8):865-77. <https://doi.org/10.1177/0269216319854944>
- Ramirez Echeverria MDL, Schoo C, Paul M. Delirium. StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2022.
- Inouye SK, Westendorp R, Saczynski JS. Delirium in elderly people. *Lancet* 2014;383(9920):911-22. [https://doi.org/10.1016/S0140-6736\(13\)60688-1](https://doi.org/10.1016/S0140-6736(13)60688-1)
- Bugiani O. Why is delirium more frequent in the elderly? *Neurological sciences: official journal of the Italian Neurological Society and of the Italian Society of Clinical Neurophysiology* 2021;42(8):3491-503. <https://doi.org/10.1007/s10072-021-05339-3>
- Gogia B, Fang X. Differentiating delirium versus dementia in the elderly. StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2023.
- Carbone MK, Gugliucci MR. Delirium and the family caregiver: The Need for Evidence-based Education Interventions. *Gerontologist* 2015;55(3):345-52. <https://doi.org/10.1093/geront/gnu035>
- Finucane AM, Lugton J, Kennedy C, Spiller JA. The experiences of caregivers of patients with delirium, and their role in its management in palliative care settings: an integrative literature review. *Psychooncology* 2017;26(3):291-300. <https://doi.org/10.1002/pon.4140>
- Paulson CM, Monroe T, McDougall GJ Jr, Fick DM. A family-focused delirium educational initiative with practice and research implications. *Gerontol Geriatr Educ* 2016;37(1):4-11. <https://doi.org/10.1080/02701960.2015.1031896>
- Bond SM, Dietrich MS, Shuster JL Jr, Murphy BA. Delirium in patients with head and neck cancer in the outpatient treatment setting. *Support Care Cancer* 2012;20(5):1023-30. <https://doi.org/10.1007/s00520-011-1174-0>
- Rhodijs-Meester HF, van Campen JP, Fung W, Meagher DJ, van Munster BC, de Jonghe JF. Ontwikkeling en validering van de Informant Assessment of Geriatric Delirium Scale (I-AGeD). Herkenning van delier bij geriatrie patiënten [Development and validation of the Informant Assessment of Geriatric Delirium Scale (I-AGeD). Recognition of delirium in geriatric patients]. *Tijdschr Gerontol Geriatr* 2013;44(5):206-14. <https://doi.org/10.1007/s12439-013-0028-2>
- Tavşancıl E. Measurement of attitudes and data analysis with spss. 4th edition. Ankara: Nobel Yayın Dağıtım; 2016.
- Neelon VJ, Champagne MT, Carlson JR, Funk SG. The NEECHAM Confusion Scale: construction, validation, and clinical testing. *Nurs Res* 1996;45(6):324-30. <https://doi.org/10.1097/00006199-199611000-00002>

16. *Elibol N, Karaöz S.* Turkish adaptation of NEECHAM confusion scale. *Anatolian Journal of Psychiatry* 2019;20(1):48-54. <https://doi.org/10.5455/apd.26002>
17. *International Test Commission.* (2017). The ITC Guidelines for Translating and Adapting Tests (Second edition). [www.InTestCom.org]
18. *World Health Organization (WHO).* Process of translation and adaptation of instruments. 2017. Available at: [http://www.who.int/substance\\_abuse/research\\_tools/translation/en/](http://www.who.int/substance_abuse/research_tools/translation/en/) Accessed February 20, 2023.
19. *Politi DF, Beck CT, Owen SV.* Is the CVI an acceptable indicator of content validity? Appraisal and recommendations. *Res Nurs Health* 2007;30(4):459-67. <https://doi.org/10.1002/nur.20199>
20. *Şencan H.* Validity and reliability in social and behavioral measurements: 1st ed. Ankara. Seçkin Yayıncılık 2015:50-420. [In Turkish].
21. *Gözüm S, Aksayan S.* A guide for transcultural adaptation of the scale II: Psychometric characteristics and cross culture adaptation. *Hemşirelikte Araştırma Geliştirme Dergisi* 2003;5(1):3-14. [In Turkish].
22. *Cevahir E.* Guide to quantitative data analysis with SPSS. Kibele Yayınları. İstanbul. 2020. [In Turkish].
23. *Dirican A.* Evaluation of the diagnostic testis performance and their comparisons. *Cerrah- paşa J Med* 2001;32:25-30. [In Turkish]. <https://doi.org/10.1163/156855902760262736>
24. *Kiliç S.* ROC analysis in clinical decision making. *Journal of Mood Disorders* 2013;3(3):135-40. [In Turkish]. <https://doi.org/10.5455/jmood.20130830051624>
25. *Mosk CA, Mus M, Vroemen JP, van der Ploeg T, Vos DI, Elmans LH, et al.* Dementia and delirium, the outcomes in elderly hip fracture patients. *Clin Interv Aging* 2017;12:421-30. <https://doi.org/10.2147/CIA.S115945>
26. *Ahluwalia P.* Strategies to prevent postoperative cognitive dysfunction. *Indian Journal of Clinical Anaesthesia* 2019;6(3):310-1. <https://doi.org/10.18231/j.ijca.2019.059>
27. *Rudolph JL, Marcantonio ER.* Review articles: postoperative delirium: acute change with long-term implications. *Anesth Analg* 2011;112:1202-11. <https://doi.org/10.1213/ANE.0b013e3182147f6d>
28. *Özen Y, Gülaçtı F, Kandemir M.* The problem of validity and reliability in educational research. *Erzincan Eğitim Fakültesi Dergisi* 2006;8 (1):68-89. [In Turkish].
29. *Gürbüz S, Şahin F.* Research methods in social sciences. 4th ed. Seçkin Yayıncılık, Ankara, 2017. [In Turkish].
30. *Şahin B, Güllerlioğlu HD.* Examination of the psychometric properties of scales developed through item analysis techniques that are used to select items for likert-type. *Asian Journal of Instruction* 2013;1(2):18-28.