Risk factors for aspiration pneumonia in geriatric patients with dementia and prolonged dysphagia
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Abstract:
Background: Dysphagia is an obvious risk factor for aspiration pneumonia in old age patients, especially those with dementia. The study aimed to determine the risk factors responsible for developing aspiration pneumonia in geriatric patients with dementia and dysphagia to enable the development of a particular preventive program accordingly.

Patients and Methods: The study recruited 98 patients diagnosed with dementia and dysphagia classified into patient and control groups according to the presence of aspiration pneumonia. Data collected included demographic and medical assessment data. Dementia severity was assessed with the clinical dementia rating (CDR) scale. According to the results of bedside clinical swallowing assessment and the Fiberoptic endoscopic evaluation of swallowing (FEES) results, the severity of swallowing impairment was determined by using the functional oral intake scale (FOIS), oropharyngeal secretion collection, penetration aspiration scale (PAS), and pharyngeal stasis scale.

Results: Patients with aspiration pneumonia were of longer hospital stay duration, with more malnutrition, recent stroke, and comorbidities with RR (risk ratio) of 3.22, 1.59, and 3.8, respectively. FEES outcome revealed significant differences between the two groups in all measures of dysphagia severity. The risk factors of aspiration pneumonia were severe penetration aspiration, combined tube, and oral feeding, malnutrition, comorbidities, and severe dementia.

Conclusion: The predictive risk factors for the development of aspiration pneumonia in dementia patients with dysphagia were malnutrition, comorbidities, severe dementia, and severe aspiration scale and tube feeding. These findings should be integrated into clinical practice to prevent aspiration pneumonia.

Keywords: Aspiration pneumonia, dementia, dysphagia, risk factors, FEES.

Introduction

Aspiration pneumonia (AP) is a prominent cause of admission and death in dementia patients, particularly in older ages.1,2 Moreover, aspiration pneumonia is the evident type of community-acquired pneumonia (CAP), and its incidence ranges from 7 to 24% from (CAP) in many studies.3,4 Dysphagia is an obvious risk factor for...
aspiration pneumonia in old age patients, especially those with dementia. Patients with dementia and dysphagia have a higher risk of aspiration pneumonia than non-demented patients. As patients with dementia suffer from impairment in their cognitive and functional abilities, behavioral eating obstacles become more evident and hinder their feeding and swallowing skills. Dysphagia can occur in the early stage of dementia with gradual eating problems as food refusal, visual agnosia, swallowing and feeding apraxia, food pocketing, food spitting, rapid eating, inadequate chewing, and impaired pharyngeal swallow.

Swallowing assessment to detect aspiration in the patients with dementia starts by bedside evaluation, proceeding to a clinical swallow evaluation. It allows not only to document the signs and symptoms of dysphagia but also to evaluate functional aspects of swallowing, such as feeding and eating behaviors. These evaluations are not sufficient to assess aspiration, as it could not estimate the aspiration risk in individuals who aspirate. Fiberoptic endoscopic evaluation of swallowing (FEES) is a practical, validated procedure to evaluate dysphagia, diagnose aspiration risk, and guide the management of dysphagia. FEES enhances the physicians to determine the patient’s progress, make clear plans based on reliable clinical findings that help in the prevention of aspiration pneumonia. However, there are few studies that use FEES in assessing the aspiration pneumonia risk factors with prolonged dysphagia in patients having dementia, especially in the Gulf region.

Studies on risk factors of aspiration pneumonia in patients with dementia and dysphagia are critical for reducing the incidence of aspiration pneumonia in this vulnerable geriatric population. The study of risks of AP in patients with dementia and dysphagia is not studied sufficiently in the literature, as many studies compare patients with dementia with and without dysphagia. A previous study compares the incidence of aspiration pneumonia between the patients’ group with dementia alone and a group with dementia and dysphagia. Their findings identified that participants with dementia and dysphagia had a statistically significant association with aspiration pneumonia. Moreover, screening for dysphagia and aspiration risk significantly lower the incidence of pneumonia.

The objectives of the study: The study aimed to determine the risk factors responsible for the development of aspiration pneumonia in geriatric patients with dementia and dysphagia in order to develop a particular preventive program accordingly.

**Patients and Methods:**

It is an observational cross-sectional study of 98 participants of geriatric patients admitted as inpatients or followed up in the swallowing clinic during the period from April 2018 to February 2020. All the patients were diagnosed with dementia and having dysphagia for more than three months duration. Patients were divided into two groups the 1st group are the subjects who experienced at least an attack of aspiration pneumonia in the last three months, and the 2nd group is the control group of patients who did not report any attack of aspiration pneumonia.

Aspiration pneumonia was diagnosed by the treating physician using standardized criteria (Mann criteria pneumonia). AP diagnosis based on the presence of 3 or more of the following variables: fever (≥38°C), cough with purulent sputum, abnormal respiratory examination (tachypnea ≥22/min), inspiratory crackles, abnormal
chest radiograph, arterial hypoxemia (PO2, 70 mm Hg), and positive gram stain and culture. The inclusion criteria included patients with dementia who have prolonged dysphagia for more than three months. We excluded any patient with dementia who has normal swallowing, improved dysphagia, dysphagia less than three months, refused, or did not complete the assessment program.

All the participants were subjected to a complete history and examination, including the demographic data for each patient. Data collected included; the age, sex, duration of hospital stay, history of recent strokes, duration of the dysphagia, mode of feeding (oral, modified oral, a nasogastric tube (NG), or percutaneous endoscopic gastrostomy (PEG) feeding), tracheostomy, comorbidity of other disorders and nutritional state including BMI and malnutrition. Malnutrition in geriatric patients was defined as a BMI of less than 22 kg/m2 and weight loss of more than 5% in the last 3-6 months.

Dementia severity was measured with the clinical dementia rating (CDR) scale. The Dementia Rating scale is a structured and clinician-rated interview that collects information on cognitive capacity from both the collateral source and patient to determine stages and the severity of dementia. Six factors are evaluated using a 5-point scale (except for the personal care domain) and then constructed to give a Global CDR score. The domains are memory, orientation, judgment and problem solving, community affairs, home and hobbies, and personal care. Impairment is defined only when caused by cognitive loss, not by physical disability or other non-cognitive factors.

Assessment of swallowing consisted of a standardized bedside clinical assessment and a Fiberoptic endoscopic evaluation of swallowing (FEES). The bedside assessment consisted of an initial measure of the patients’ feeding status, posture, breathing, and cooperation levels before examining the patients’ oral musculature, oral reflexes, pharyngeal swallow, and a trial feed with a 5–10-mL water bolus.

FEES was done by well-trained phoniatrician according to the standard protocol described by Langmore. All patients were assessed using the FEES Digital Swallowing Workstation by Kay PENTAX (Lincoln Park, NJ07035-1488, USA). The patient was asked to remain in the sitting position or a semi-upright position on the bed according to the patient's abilities. A flexible fiberoptic laryngoscope was inserted trans-nasally into the pharynx. The presence of oropharyngeal secretions was assessed and scored. The sensation tested by touching with the tip of the endoscope to various areas of the larynx, and reflex adduction of the vocal folds or reflex cough and chocking were observed. Different food consistencies, such as fluids (water), semisolids (thick juice/yogurt), and solids (a piece of biscuits or bread), mixed with green dye, were used to evaluate swallowing. Pharyngeal stasis after swallowing was scored. The salient findings noted were residue, penetration, and aspiration into the larynx. FEES was graded according to the Penetration Aspiration Scale (PAS), as proposed by Rosenbek. The highest Penetration-Aspiration score achieved in the two trials was taken as the final score.

Outcome Measures: According to the results of bedside clinical swallowing assessment and the FEES results, the severity of swallowing impairment was determined by using the functional oral intake scale (FOIS), oropharyngeal secretion collection, Penetration Aspiration Scale (PAS), and pharyngeal stasis scale.
Ethics: The study was approved by the Dubai health authority research and ethics Committee. A clear explanation was given about the study objectives and plan. They were free to terminate participation in this study without the affection for their clinical management. An informed consent, including the explanation was obtained from all subjects involved in the study or their guardians before participation.

Statistical analysis:

The sample size calculated using Cohen's Tables and G. Power. The minimum recommended sample size is 85 at a confidence interval of 95%, 0.05 significance, .80 power, and four predictors.

Statistical analyses were performed with SPSS 20.0 software (SPSS Inc, Chicago, IL). The bivariant analysis was calculated to determine the independent variables that may show a significant relationship. These variables were included in the contingency tables and analyzed by Fisher's exact test. Independent factors influential on the presence of aspiration pneumonia and results of logistic regression analysis were expressed as levels of significance, estimated relative risks (approximated odds ratio-OR), and 95% confidence intervals. Results at a significance level of p<0.05 within a 95% confidence interval were accepted as statistically significant values.

Continuous variables were compared using the Student's t-test when variables were normally distributed and the Mann-Whitney U test when variables were non-normally distributed.

First, we used bivariate analysis and logistic analysis to examine the effect of each of the risk factors individually. Then we used multiple simultaneous logistic regression to examine which of these factors had a significant independent effect.

Results:

The study recruited 98 (58 male and 40 female) patients diagnosed with dementia and dysphagia, the mean age was 81.97±7.35, and the duration of hospitalization was 16.2±15.6 days.

Dysphagia duration was 156±141, and the CDR score was 7.98±3.93.

We compare the aspiration pneumonia (AP) group with the control group with negative AP in different outcome measures, as shown in table 1. There was no significant difference in age, dysphagia duration, and the presence of tracheostomy between the two groups.

Positive AP was found in 58.6% of male patients and 20% of female patients, with a significant difference between genders as males have a higher risk to develop AP than females.

Patients with AP were of longer hospital stay duration, with more malnutrition, recent stroke, and comorbidities with RR (risk ratio) of 3.22, 1.59, and 3.8, respectively, as shown in table 2 and figure 1.

Both CDR score and severity show a significant difference between the two groups. FEES outcome revealed significant differences between the two groups in all measures of dysphagia severity as penetration aspiration scale, degree of pharyngeal stasis, and secretion levels, as shown in table 1. Multinomial logistic regression revealed that PAS 4 or above has predictive value for aspiration pneumonia (pseudo R square was .521 by Cox and Snell test), pharyngeal stasis (r=.420) and secretion collection (r=.287).

The mode of feeding analysis revealed that tube feeding (NG or PEG) with supplementary oral feeding has a higher risk of aspiration pneumonia in
dementia patients than other moods of feedings, as shown in figure 2. The same for functional oral intake vs feeding where the higher predictive value was in FOIS level 3, where the patient is Tube-dependent with consistent oral intake of food or liquid with r = .472.

Table 3 shows the risk factors of aspiration pneumonia by multinomial logistic regression analysis. The independent risk factors were severe penetration aspiration with PAS 4 or above, Combined tube and oral feeding, malnutrition, comorbidities, and dementia of grade 2 or above.

Table 1 Comparison of aspiration pneumonia group and control group in outcome measures

<table>
<thead>
<tr>
<th>Variables</th>
<th>Aspiration pneumonia group (Mean± SD)</th>
<th>Negative AP group (Mean± SD)</th>
<th>sig</th>
<th>CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>83.33±7.69</td>
<td>80.96 ± 6.79</td>
<td>.121</td>
<td>-.568-5.32</td>
</tr>
<tr>
<td>Hospital stay</td>
<td>26.19±17.9</td>
<td>8.92±7.24</td>
<td>.001</td>
<td>11.4-23.2</td>
</tr>
<tr>
<td>Dysphagia duration</td>
<td>182.66±146.14</td>
<td>136.71±135.17</td>
<td>.111</td>
<td>-10.7-103.7</td>
</tr>
<tr>
<td>Penetration aspiration scale</td>
<td>4.09±5.32</td>
<td>2.50±1.09</td>
<td>.000</td>
<td>1.23-1.96</td>
</tr>
<tr>
<td>Bolus stasis level</td>
<td>2.04±.698</td>
<td>1.120±.603</td>
<td>.000</td>
<td>.73-1.27</td>
</tr>
<tr>
<td>Secretion collection</td>
<td>1.42±.859</td>
<td>.535±.785</td>
<td>.000</td>
<td>.56-1.22</td>
</tr>
<tr>
<td>FOIS</td>
<td>3.19±1.38</td>
<td>4.50±1.51</td>
<td>.000</td>
<td>-1.90-7.18</td>
</tr>
<tr>
<td>CDR score /18</td>
<td>9.38±3.74</td>
<td>6.92±3.77</td>
<td>.002</td>
<td>.92-3.97</td>
</tr>
<tr>
<td></td>
<td>R= .095</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CDR severity 0-3</td>
<td>1.57±.73</td>
<td>1.25±.51</td>
<td>.046</td>
<td>.056-.572</td>
</tr>
</tbody>
</table>

Significance P ≤ .05%
CI: confidence interval
FOIS: functional oral intake scale
CDR: clinical dementia rating
Table 2. Bivariate analysis of risk factors of aspiration pneumonia

<table>
<thead>
<tr>
<th>Variables</th>
<th>Aspiration pneumonia group (42)</th>
<th>Negative AP group (56)</th>
<th>Sig</th>
<th>RR</th>
<th>CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sex (No, %)</td>
<td>Male 58</td>
<td>34 (58.6%)</td>
<td>24 (41.3%)</td>
<td>.001</td>
<td>.517</td>
</tr>
<tr>
<td></td>
<td>Female 40</td>
<td>8 (20%)</td>
<td>32 (80%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Malnutrition</td>
<td>34 (81%)</td>
<td>12 (21.4%)</td>
<td>.001</td>
<td>3.222</td>
<td>1.697-5.348</td>
</tr>
<tr>
<td>Recent stroke</td>
<td>20 (47.6%)</td>
<td>14 (25%)</td>
<td>.031</td>
<td>1.594</td>
<td>1.027-2.473</td>
</tr>
<tr>
<td>Comorbidity</td>
<td>30 (71.4%)</td>
<td>8 (14.3%)</td>
<td>.000</td>
<td>3.800</td>
<td>2.027-7.125</td>
</tr>
<tr>
<td>Tube feeding</td>
<td>30 (71.4%)</td>
<td>12 (21.4%)</td>
<td>.000</td>
<td>2.75</td>
<td>1.67-4.52</td>
</tr>
<tr>
<td>tracheostomy</td>
<td>10 (23.8%)</td>
<td>6 (10.7%)</td>
<td>.073</td>
<td>1.626</td>
<td>.844-3.133</td>
</tr>
<tr>
<td>FEES PA scale ≥ 4</td>
<td>24 (57.1%)</td>
<td>9 (16%)</td>
<td>.001</td>
<td>2.92</td>
<td>1.21-7.04</td>
</tr>
<tr>
<td>FEES stasis level ≥ 2</td>
<td>36 (85.7%)</td>
<td>10 (17.8%)</td>
<td>.000</td>
<td>4.06</td>
<td>2.33-7.10</td>
</tr>
<tr>
<td>FEES secretion ≥ 2</td>
<td>20 (47.6%)</td>
<td>6</td>
<td>.000</td>
<td>5.34</td>
<td>.56-1.22</td>
</tr>
<tr>
<td>FOIS ≤ 3</td>
<td>32 (76.1%)</td>
<td>12 (21.4%)</td>
<td>.000</td>
<td>-4.39</td>
<td>-1.90-7.18</td>
</tr>
<tr>
<td>CDR ≥ 2</td>
<td>18 (42.8%)</td>
<td>12 (21.4%)</td>
<td>.028</td>
<td>1.375</td>
<td>1.02-1.85</td>
</tr>
</tbody>
</table>

Significance P ≤ .05%
CI: confidence interval
RR: Relative risk
FEES PA scale: Fiberoptic endoscopic evaluation of swallowing Aspiration penetration scale
FOIS: functional oral intake scale
CDR: clinical dementia rating

Table 3. Risk factors of aspiration pneumonia by multinomial logistic regression analysis.

<table>
<thead>
<tr>
<th>Covariates</th>
<th>Coefficient</th>
<th>P-value</th>
<th>OR</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Penetration aspiration severity</td>
<td>1.812</td>
<td>.001</td>
<td>6.35</td>
<td>2.81-10.10</td>
</tr>
<tr>
<td>Combined tube and oral feeding</td>
<td>1.571</td>
<td>.003</td>
<td>7.98</td>
<td>1.81-14.91</td>
</tr>
<tr>
<td>Malnutrition</td>
<td>0.984</td>
<td>.014</td>
<td>8.422</td>
<td>2.975-21.459</td>
</tr>
<tr>
<td>Comorbidities</td>
<td>1.625</td>
<td>.031</td>
<td>2.295</td>
<td>1.036-3.125</td>
</tr>
<tr>
<td>Severe dementia</td>
<td>0.754</td>
<td>.047</td>
<td>4.143</td>
<td>2.056-6.572</td>
</tr>
</tbody>
</table>

Significance P ≤ .05%
OR: Odd Ratio
CI: confidence interval
Fig. 1. Histogram showing Comparison of the two groups in different risk factors of aspiration pneumonia

![Comparison of the 2 groups in different risk factors of aspiration pneumonia](image)

- Malnutrition
- Recent stroke
- Comorbidity
- Tube feeding
- Tracheostomy
- FES-PA: scale 2-4
- FESS: scale 2-2
- FESS: G3
- CDR-2

- Positive Aspiration Pneumonia
- Negative AP

Fig. 2. Histogram showing percentage of aspiration pneumonia in both groups according to the mode of feeding

![Aspiration pneumonia according to mode of feeding](image)

- Oral
- Modified oral
- Nasogastric
- PEG
- NG plus oral
- PEG plus oral

- No aspiration pneumonia
- Positive aspiration pneumonia
- Column1
Discussion:

The geriatric population with dementia and dysphagia has been increasing worldwide, and it is widely known that aspiration pneumonia is one of the most likely causes of death among them. In the present study, we compared patients with dementia and dysphagia, with and without aspiration pneumonia, in different outcome measures to investigate risk factors of aspiration pneumonia. This study clearly shows that malnutrition, comorbidities, severe dementia, and severe aspiration scale were independently and significantly associated with aspiration pneumonia in patients with dementia and dysphagia. Oropharyngeal dysphagia, old age, and dementia have been recognized as major geriatric syndromes and have been identified as major risk factors for AP. Studies reported aspiration risks to include cerebrovascular disease, oropharyngeal dysphagia, old age, and severe dementia, malnutrition, of antipsychotic drugs, use, and GERD.

Advanced age and male gender were known to be risk factors for aspiration pneumonia. Previous studies have shown that the possibility of aspiration pneumonia increases with age. However, given that we included very old patients with dementia in this study with their mean age was above 81 years, age itself may not be a risk factor for dementia. The male gender carries a higher association with AP agrees with the previous studies.

Dysphagia severity measures using FEES revealed that the aspiration pneumonia group has a higher penetration aspiration scale, degree of pharyngeal stasis, and secretion levels. FEES is a useful test for the evaluation of swallowing function in elderly patients; the cognitive function should be evaluated before performing a swallowing test. In dementia, the presence of dysphagia could cause many serious health problems like dehydration, renal impairment, malnutrition, and aspiration pneumonia. Patients with dementia have high levels of pharyngeal dysfunction and aspirate around 45% of the time; as dementia progresses, the patients may develop reduced pharyngeal clearance, reduced upper esophageal opening, and penetration and aspiration.

The study results can assume that tracheostomy is not a risk factor for AP. Five tracheostomized patients developed AP before tracheostomy, and tracheostomy was done due to AP and prolonged ventilation. Evidence regarding aspiration risk of tracheostomy is inconclusive. Tracheostomy is not a preventive measure for AP; nevertheless, it may increase risk due to decreased airway protective mechanism and salivary pooling. Aspiration is the entry of oropharyngeal secretions into the larynx and the respiratory tract. In contrast, aspiration pneumonia is an infectious process due to the aspiration of oropharyngeal contents containing pathogenic bacteria. Patients with a tracheostomy that aspirate could be protected from developing AP by tube cuffs or airway suctioning.

The present study findings suggest that patients with tube feeding (NG or PEG) with consistent complimentary oral intake have a higher risk of aspiration pneumonia than other moods of feedings. Elderly patients with tube feeding and those dependent on others for oral hygiene are associated with oropharyngeal colonization of more pathogenic bacteria and aspirate more when compared with orally fed patients. If the patient is given oral food and tube feeding, the risk of aspiration of this pathogenic bacterium could progress to AP.
Previous studies found that AP is the most frequent cause of death in PEG and NGT feeding patients.\textsuperscript{27} Results of previous studies comparing NG from PEG feeding are controversial. Some studies find that PEG is a better choice for prolonged tube feeding than NGT as it decreased the risk of Aspiration pneumonia.\textsuperscript{28-30} Meta-analyses of AP risk did not detect that patients with NG were at higher risk than PEG; however, there is high statistical heterogeneity between different studies.\textsuperscript{31} Studies have shown that tube placement decreases lower oesophageal sphincter tone, potentially increasing regurgitation risk. NG tube also passes through cricopharyngeal sphincter that may interfere with the protective cough reflexes causing aspiration. Aspiration of gastric contents produces pneumonitis with the resultant inflammatory response allowing for the establishment of infection by less virulent organisms.\textsuperscript{30}

In the present study, we investigate risks of aspiration pneumonia which are more relevant clinically than the risks of aspiration. While the aspiration risks can be risks for AP, the two sets of risks are not the same, and patients with risks of aspiration do not automatically develop aspiration pneumonia.\textsuperscript{50} The pathophysiology of aspiration pneumonia comprises three main risk factors: dysphagia with poor protective swallowing functions (aspirations), general health weakness with immunological abnormalities, and poor oral health with colonization by pathogens.\textsuperscript{32} The risks for aspiration pneumonia include aspiration risks, pathogens factors, and the host defense. The host defense aspects associated with the AP pathogenesis include old age, male gender, malnutrition, diabetes mellitus, cerebrovascular stroke, and severe dementia. Understanding the relations between the patient, the pathogen, and the environment are essential for a better interpretation of the processes that trigger aspiration pneumonia and for creating successful plans for its prevention.\textsuperscript{20} A recent meta-analysis study concluded that 50% of patients with dementia died due to pneumonia, and this rate may be much higher than the clinician's anticipations. They recommended that clinicians must pay careful attention to cases of AP among dementia patients to increase patients' life expectancy and quality.\textsuperscript{33}

These findings are useful in the development of clinical guidelines for the management and prevention of aspiration pneumonia in these frail older patients with multiple risk factors. This information should be incorporated into an educational plan about long-term management for health care providers, patients, and family members.

**Conclusion:**

Our study results can conclude that the predictive risk factors for the development of aspiration pneumonia in dementia patients with dysphagia were malnutrition, comorbidities, severe dementia, and severe aspiration scale and tube feeding with consistent complimentary oral intake. These findings should be integrated into clinical practice to prevent aspiration pneumonia.

**Competing interests:** Authors have no conflict of interest to declare.

**Funding:** This study has no funding sources.

**Author contributions:** All authors have contributed to designing the study, collecting and analyzing, interpretation of data, preparing and revising the manuscript.
Reference:


15. Langmore SE, Schatz K, Olsen N. Fiberoptic endoscopic examination


## Appendix (1)

### The Clinical Dementia Rating (CDR)

<table>
<thead>
<tr>
<th>CDR</th>
<th>0: no cognitive impairment</th>
<th>Questionable 0.5</th>
<th>Mild 1</th>
<th>Moderate 2</th>
<th>Severe 3</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Memory</strong></td>
<td>No memory loss or slight; inconsistent forgetfulness</td>
<td>Consistent slight forgetfulness; partial recollection of events; “benign” forgetfulness</td>
<td>Moderate memory loss: more marked for recent events; defect interferes with everyday activity</td>
<td>Severe memory loss only high learned material retained new material rapidly lost</td>
<td>Severe memory loss only fragments remain</td>
</tr>
<tr>
<td><strong>Orientation</strong></td>
<td>Fully oriented</td>
<td>Fully oriented but with slight difficulty with time relationships</td>
<td>Moderate difficulty with time relationships; oriented for place at examination; may have Severe difficulty with time relationships; usually disoriented to time, often to place</td>
<td>Oriented to person only</td>
<td></td>
</tr>
<tr>
<td><strong>Judgment and problem solving</strong></td>
<td>Solves everyday problems and handles business and financial affairs well; judgment good in relation to past performance</td>
<td>Slight impairment in solving problems, similarities and differences</td>
<td>Moderate difficulty in handling problems, similarities and differences; social judgment usually maintained</td>
<td>Severely impaired in handling problems, similarities and differences; social judgment usually impaired</td>
<td>Unable to make judgments or solve problems</td>
</tr>
<tr>
<td><strong>Community affairs</strong></td>
<td>Independent function as usual in job, shopping, volunteer, and social groups</td>
<td>Slight impairment in these activities</td>
<td>Unable to function independently at these activities though may still be engaged in some; appears normal to casual inspection</td>
<td>No pretense of independent function outside the home; appears well enough to be taken to functions outside the family home</td>
<td>Appears too ill to be taken to functions outside the family home</td>
</tr>
<tr>
<td><strong>Home and hobbies</strong></td>
<td>Life at home, hobbies and intellectual interests well maintained</td>
<td>Life at home, hobbies and intellectual interests slightly impaired</td>
<td>Mild but definite impairment of functions at home; more difficult chores, and complicated hobbies and interests abandoned</td>
<td>Only simple chores preserved; very restricted interests, poorly maintained</td>
<td>No significant function in the home</td>
</tr>
<tr>
<td><strong>Personal care</strong></td>
<td>Fully capable of self-care</td>
<td>Fully capable of self-care</td>
<td>Needs prompting</td>
<td>Requires assistance in dressing, hygiene and keeping of personal effects</td>
<td>Requires much help with personal care; frequent incontinence</td>
</tr>
</tbody>
</table>

CDR-0: no cognitive impairment  
CDR-0.5: questionable or very mild dementia  
CDR-1: mild  
CDR-2: moderate  
CDR-3: severe