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Visual Analogue Scales for Pain Assessment in Alzheimer's Disease

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Key Words
Pain assessment · Pain intensity · Pain affect · Visual analogue scales · Alzheimer's disease

Abstract
Background: In earlier studies, pain assessment in patients with Alzheimer's disease (AD) was conducted by interview, for which reliability is questionable considering the decline in expressive and receptive language abilities in AD. As similar language problems occur in young children, the reliability of pain assessment in this latter population is increased by employing visual analogue scales. ***Objective:*** By employing visual analogue scales, the current study investigated whether (1) nondemented elderly persons and AD patients comprehend the purpose of the scales and (2) AD patients, compared to nondemented elderly persons, report suffering less pain intensity and pain affect. ***Methods:*** Three visual analogue scales, i.e. the Colored Analogue Scale (CAS), the Faces Pain Scale (FPS), and the Facial Affective Scale (FAS) were administered to patients in an early and midstage of AD and to nondemented elderly persons. ***Results:*** The results show that the percentage of subjects who comprehended the CAS, FAS and FPS was for the nondemented elderly persons 100, 75 and 100%, respectively, for the early AD group 100, 50 and 60%, respectively, and for the midstage AD group 80, 20 and 30%, respectively. Furthermore, elderly persons without dementia reported experiencing more intense pain and pain affect than the early and midstage AD group. Interestingly, the early and midstage AD patients did not differ in reporting pain affect. ***Conclusion:*** Visual analogue scales may improve pain assessment in those AD patients who fully comprehend the meaning of the scales. As only the minority of midstage AD patients understood the purpose of the FAS and FPS, the search for tools, particularly to assess pain affect in this population, must continue.

Introduction

Compared to elderly persons without dementia, patients with Alzheimer's disease (AD) appear to use fewer analgesics [1, 2]. The low use of analgesics in AD is often explained by patients' inability to communicate information about their pain [3, 4]. This explanation would imply that the progressive communicative deterioration in AD will be reflected in a progressive decrease in use of analgesics. However, the findings of a recent study show that the

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use of analgesics appeared to be independent of the stage of AD [5]. An alternative explanation is that, compared to nondemented elderly persons, AD patients may have an altered pain experience. Indeed, the hypothalamus, the septohippocampal region, the amygdala, and the intralaminar nuclei of the thalamus which play a significant role in the affective responses to pain [6, 7], are affected in AD [8, 9].

An alteration in pain experience in AD is also supported by clinical evidence. It has been observed that, compared to nondemented elderly persons, elderly persons with dementia suffered less from the postlumbar puncture headache, an affective painful condition [10, 11]. In another study, several pain questionnaires including items on both pain intensity and pain affect were administered to AD patients and elderly persons without dementia [Scherder and Bouma, unpubl. data]. The results reveal that AD patients, compared to normal elderly persons, report suffering less pain intensity and pain affect. Some investigators observed that the administration of pain questionnaires can take place in a reliable way in mild and moderate cognitively impaired elderly persons [12, 13]. However, it remains unclear whether AD patients were included in these studies. So far, in the few studies concerning pain in AD patients [5; Scherder and Bouma, unpubl. data], pain assessment took place through the use of questionnaires which completely depends on patients' expressive and receptive language abilities, functions which deteriorate during the course of AD [14, 15]. Consequently, it is hard to exclude the possibility that the patient misunderstood one or more items of the questionnaire. Young children (<7 years) also have problems with expression and understanding language [16], and the reliability of pain assessment in this population has been found to increase by the administration of visual analogue scales [16, 17]. Therefore, in the present study three visual analogue scales, particularly developed for young children, were administered to patients in an early and midstage of AD and to elderly persons without dementia. We examined whether (1) the subjects fully comprehended the purpose of these scales and (2) compared to elderly persons without dementia, AD patients suffer from lower pain intensity and pain affect.

Methods

Subjects

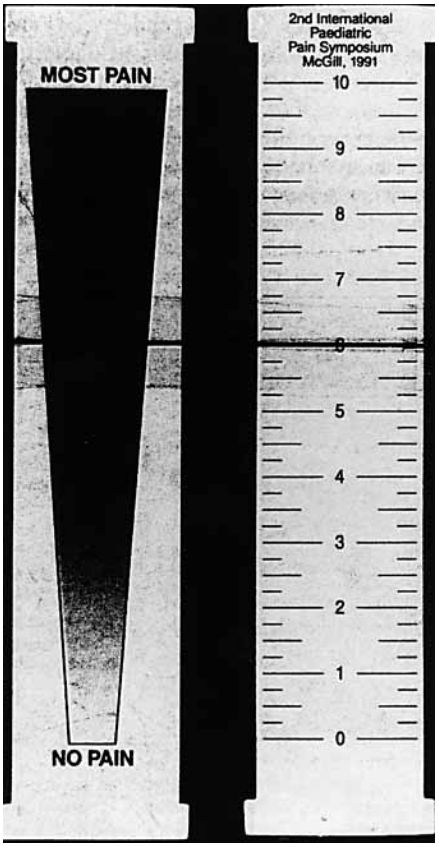
The sample consisted of three groups: 20 AD patients (17 females, 3 males) in a relatively early stage, i.e. stage 5 of the Global Deterioration Scale (GDS) [18]; 20 AD patients (16 females, 4 males) in a midstage, i.e. stage 6 of the GDS, and 20 elderly persons without dementia (17 female, 3 males). The three groups did not differ in age ($F(2,57) = 0.74$, NS). The early AD patients had a mean age of 86.8 (range 75–95) the midstage AD patients had a mean age of 82.3 (range 76–92), and the mean age of the nondemented elderly persons was 87.1 (range 76–96). Moreover, the early AD group, the midstage AD group and the nondemented group were matched for education (five categories: elementary school not finsihed: score = 1; elementary school: score = 2; lower secondary school: score = 3; higher secondary school: score = 4; higher vocational training for 18+/university: score = 5): M = 2.8, M = 2.7 and M = 2.8, respectively.

All AD patients met the NINCDS-ADRDA criteria for the clinical diagnosis of probable AD [19]. Subjects were excluded from participation in this study if they had vision problems, a history of psychiatric disorder, particularly depression, alcoholism, cerebral trauma, cerebrovascular disease, hydrocephalus, neoplasm, epilepsy, disturbances of consciousness, or focal brain disorders.

Level of cognitive functioning was assessed by using a shortened 12-item version [21] of the Mini-Mental State Examination (MMSE) [20]. The 12-item MMSE version (maximum score 12) evaluates orientation to time and place, registration, recall, attention, and calculation, language and praxis, and visuoconstructive abilities [21]. Subjects with a score of <7, which is comparable to a score of <18 of the 20-item MMSE version (maximum score 30) [21], were classified as having serious cognitive disturbances. A score of <11, which is comparable to a score of 24 of the 20-item MMSE version [21], indicated mild cognitive deterioration. The mean score of the control group, early stage and midstage AD group was 11.35 (range 11–12), 8.0 (range 7–10) and 3.70 (range 1–6), respectively.

Characteristics of Painful Conditions. The three groups also had to be matched for chronic painful conditions, i.e. painful conditions with a duration of at least 6 months. Separate conditions which might cause pain for those with and without dementia were collected by one of the authors (E.J.A.S.) by reviewing the medical records which were kept by the former general practitioner and by the present nursing home physician. These medical records included the subjects' medical history and their present mental and physical status. Reports from the neurologist, orthopedist, psychiatrist, and neuropsychologist were added as well. The following four categories of painful conditions emerged, i.e. (1) arthritis/arthrosis; (2) recent fractures (within the last year); (3) postoperative states (e.g. total hip) and (4) miscellaneous (tendinitis and diabetes neuropathia). These painful conditions are similar to those generally observed in nursing home residents [22]. In the present study, subjects had either one or two painful conditions. The number of chronic painful conditions appeared not to differ between the three groups ($\chi^2 = 0.53$, df = 2, NS). As for the nature of the painful conditions, only fractures occurred significantly more ($\chi^2 = 6.09$, df = 2, $p < 0.05$) in the midstage AD patients (40%), compared to the early stage AD patients (15%) and control group (10%).

Comorbidity. The prevalence of specific categories of illness in demented and nondemented subjects were compared to ascertain whether the latter group have diseases which might contribute to their pain experience. Specific categories of illness included congestive heart failure, peripheral vascular disease, chronic pulmonary disease, diabetes mellitus, chronic renal failure, tumors, ulcer disease, anemia, hyper/hypothyroidism, cholecystectomy, hearing and vision problems, urology, hypertension, Dupuytren's disease, migraine, diverticulosis, esophagitis, liver disturbances, psoriasis, and Menière's disease. First, for each separate category of illness, compari-



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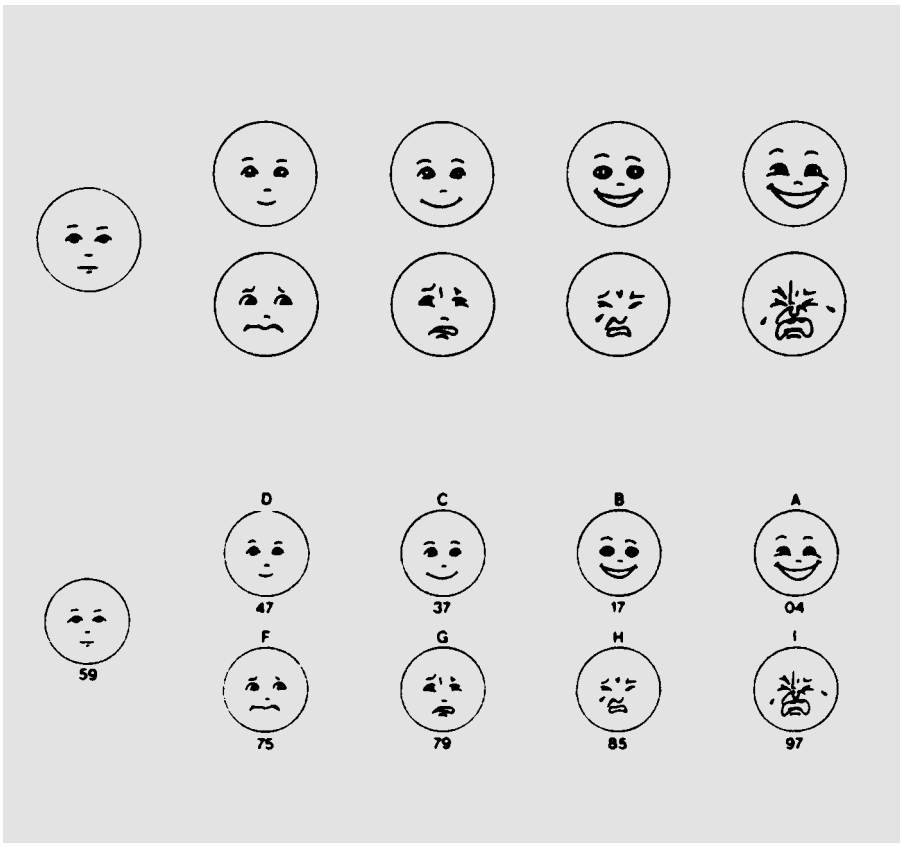

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Fig. 1. The CAS to rate pain intensity. Left: front of the CAS as seen by the subjects; right: back of the CAS which shows the numerical value of the rating shown on the CAS. Reprinted from McGrath et al. [17], with permission from Elsevier Science.

Fig. 2. The ordered FAS to rate pain affect. Top: front of the FAS as seen by the subjects; bottom: back of the FAS which shows the numerical values. Reprinted from McGrath et al. [17], with permission from Elsevier Science.

sons were made between the three groups employing χ^2 tests. Only hypertension occurred with a significantly higher frequency in the nondemented group (55%), compared to the early stage AD group (20%) and the midstage AD group (15%) ($\chi^2 = 9.05$, df = 2, $p < 0.02$), a finding which has been reported in an earlier study [3]. Subsequently, the total number of illnesses between the three groups was compared. The results reveal that the total number of illnesses differed significantly between the control group (M = 2.80) and the midstage AD group (M = 1.55) (Mann-Whitney U: Z = 3.24, $p < 0.002$).

Materials and Procedure

Visual Analogue Scales

As the present study was meant to assess whether nonverbal measures could contribute to a reliable assessment of pain intensity and pain affect, three visual analogue scales were administered. These three scales minimize cognitive demands and are, therefore, particularly suitable for adult populations with cognitive deterioration like AD. The three scales were administered in the following order.

The Colored Analogue Scale (CAS) [17] (fig. 1): The CAS is designed to assess the intensity of pain children are experiencing, in a nonverbal manner. The different scale positions are marked by different colors and areas which facilitate the subject's selection of a scale position which best reflects his pain intensity [17]. Selecting the appropriate scale position takes place by sliding a horizontal marker from the bottom (no pain) to the top (maximum pain). The subject's score is the numerical value on the back of the scale which matches the selected scale position.

The Facial Affective Scale (FAS) [17] (fig. 2): The FAS is primarily aimed at assessing the affective components of pain [17]. The FAS includes line drawings of nine faces, ranging in expression from very happy (no pain) to very painful (most severe pain). As the original faces are 2 cm high, they were enlarged up to 4 cm. On the back of the faces, numerical values are printed, ranging from 0.04 (very happy: no pain) to 0.97 (very painful: most severe pain). The numerical values for the FAS were calculated in an earlier study [23]. The subject's score is reflected in the numerical value on the back of the faces.

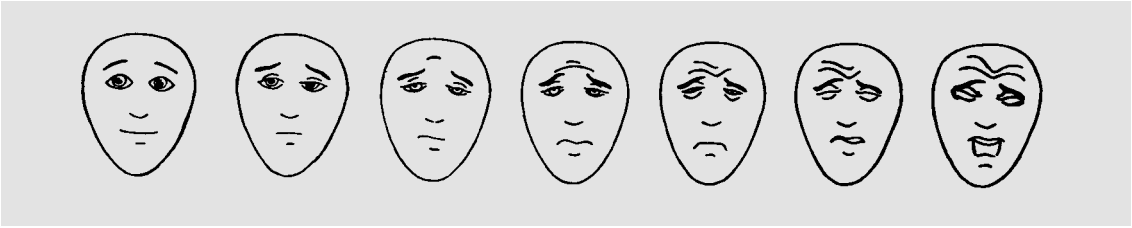

Fig. 3. The FPS. Reprinted from Bieri et al. [16], with permission from Elsevier Science.

The Faces Pain Scale (FPS) [16] (fig. 3): The FPS primarily measures the severity of pain and possibly, to a lesser extent, its affective components [16]. This scale can be reliably and validly administered to children as young as 3 years of age [16]. The FPS consists of line drawings of seven faces, i.e. one neutral face and six faces which express increasing feelings of pain. Each face is 6 cm high. The faces were rank-ordered from 0 to 6, from left to right. Subjects could rank their feelings from 'no pain' (score 0, the neutral face, at the extreme left side), to most severe pain (score 6, the face expressing most feelings of pain, at the extreme right side). The subject's score is identical to the scale number, i.e. ranging from 0 to 6.

Administration of Scales. For each scale, subjects were first tested for comprehension of the concept. For the FAS and FPS, they were asked to indicate which face showed most pain and which face showed least pain. For the CAS they were asked to indicate at what level the marker should be positioned when a person had the most severe pain (top of the scale) or no pain at all (bottom of the scale). The were then asked to point on the FPS to the face which best reflected the pain they currently experience, and on the FAS to choose the face that matched his/her deep inner feelings and not just the way they felt when in pain. On the CAS they were asked to indicate where the marker should be to match their own pain level.

Data Analyses

The SPSS-PC program was used for statistical analyses, including one- and two-tailed paired t-tests, χ^2 tests and Mann-Whitney U-tests at a 0.05 significance level [24].

Results

For each separate scale, the data will be presented as follows: (a) comprehension of the scale, i.e. the number of subjects who did and did not comprehend the purpose of the scale, and (b) report of pain experience. Only those subjects who did unterstand the scale were included in the analyses.

The Colored Analogue Scale (CAS)

Comprehension of the scale (table 1): The three groups showed a significant difference in comprehending the scale ($\chi^2 = 8.57$, df = 2, $p < 0.02$). Interestingly, the 20 nondemented elderly persons and the 20 early AD patients understood perfectly well the meaning of the scale. As even 16 out of 20 midstage AD patients also comprehended the purpose of the scale, only a trend was observed between this group and both the nondemented and the early AD group (Fisher's exact: $p < 0.06$).

Report of pain experience: The results show that the intensity of pain is reported significantly differently by the three groups ($F(2,53) = 56.98$, $p < 0.002$). More specifically, elderly persons without dementia experienced significantly more intense pain when compared to early and midstage AD patients (table 2). Furthermore, compared to the early AD patients, midstage AD patients reported experiencing the least intense pain (table 2).

The Facial Affective Scale (FAS)

Comprehension of the scale (table 1): In understanding the proper meaning of the scale, the three groups showed a significant difference ($\chi^2 = 12.15$, df = 2, $p < 0.003$). It is noteworthy that only 15 out of 20 nondemented elderly persons could identify the correct minimal and/or maximum pain face. Although 10 early AD patients showed correct identification, the difference between both groups appeared not to be significant ($\chi^2 = 2.67$, df = 1, $p < 0.11$). However, comparison of the percentage of nondemented elderly persons who identified the appropriate face with the percentage of the midstage AD patients (20%) who did, revealed a significant difference ($\chi^2 = 12.13$, df = 1, $p < 0.001$). The early and midstage AD groups also differed significantly ($\chi^2 = 3.96$, df = 1, $p < 0.05$).

Report of pain experience: Experience of pain affect varied significantly between the three groups (Kruskall-Wallis: $\chi^2 = 18.70$, df = 2, $p < 0.0001$). As table 2 shows, the nondemented elderly persons indicated suffering significantly more pain affect than the early and midstage AD group. However, no significant difference was found between the early and midstage AD group.

Table 1. Percentage of nondemented elderly persons, early AD patients and midstage AD patients who fully comprehended the purpose of the three visual analogue scales

	Comprehension of the scales					
	CAS		FAS		FPS	
	n	%	n	%	n	%
Nondemented elderly persons (n = 20)	20	100	15	75	20	100
Early AD (n = 20)	20	100	10	50	12	60
Midstage AD (n = 20)	16	80	4	20	6	30

Table 2. Means, number of subjects, and Mann-Whitney U tests of the three visual analogue scales concerning subjects' actual pain experience

	Controls		Early AD		Midstage AD		Mann-Whitney U-test					
	mean	n	mean	n	mean	n	controls – early AD		controls – midstage AD		early stage – midstage AD	
							Z	p	Z	p	Z	p
CAS	8.4	20	2.9	20	1.5	16	4.89	<0.0001	4.93	<0.0001	1.75	<0.05
FAS	86.33	15	51.67	9	38.67	3	3.96	<0.0001	2.71	<0.01	0.68	NS
FPS	4.90	20	1.91	11	0.80	5	4.21	<0.00001	3.55	<0.001	2.05	<0.05

Controls = Nondemented elderly persons; AD = Alzheimer's disease.

The Faces Pain Scale (FPS)

Comprehension of the scale (table 1): The results show that all 20 nondemented elderly persons, 12 out of 20 early AD patients, and 6 out of 20 midstage AD patients comprehended the scale. Hence, the three groups differed significantly with respect to the percentage of subjects who comprehended the scale (χ^2 = 21.24, df = 2, $p < 0.00001$). More specifically, a significant difference was observed between the 20 nondemented elderly persons and the 12 early AD patients (Fisher's exact: $p < 0.02$), and between the 20 nondemented elderly persons and the 6 midstage AD patients (Fisher's exact: $p < 0.00001$). The difference between the early and midstage AD group who comprehended the scale showed a trend (χ^2 = 3.64, df = 1, $p < 0.06$).

Report of pain experience: Between the three groups, a significant difference was observed with respect to the extent to which subjects reported suffering pain (Kruskal-Wallis: χ^2 = 24.68, df = 2, $p < 0.0001$). Elderly persons without dementia reported experiencing significantly more pain than both early and midstage AD patients (table 2). Early AD patients indicated perceiving significantly more pain than midstage AD patients.

Discussion

Comprehension of the Various Scales

CAS: The results of the present study show that the CAS was correctly interpreted by all elderly persons without dementia and by early AD patients, and even by 80% of the midstage AD patients.

FAS and FPS: The second best interpreted scale appeared to be the FPS which was fully comprehended by all nondemented elderly persons, and by 60 and 30% of the early and midstage AD patients, respectively. In other words, for all nondemented elderly persons and for the majority of the early AD patients, the FPS might substantially contribute to the assessment of both pain intensity and pain affect. The least clear-cut scale seemed to be the FAS, i.e. even 25% of the elderly persons without dementia, and 50 and 80% of the early and midstage AD patients, respectively, misinterpreted the scale. Interestingly, 25% of the nondemented elderly persons and 50% of the early AD patients failed to identify the smiling face as the no-pain face. Specifically, this finding confirms the concern of Bieri et al. [16] who replaced this face by a neutral face.

Recently in another study, a nonverbal observational tool, i.e. the Checklist of Nonverbal Pain Indicators (CNPI), also appeared to assess pain in a valid way in a cognitively impaired sample [25]. As it is not clear which groups of patients were included in that study [25], it would be interesting to use the CNPI in a further study with AD patients. Taken together, it is concluded that, compared to the FPS and the FAS, the CAS works best for both mildly and moderately demented patients. In addition, the CAS and the FPS could be used in nondemented elderly persons.

Report of Pain Experience

As only a small number of midstage AD patients comprehended the FAS and the FPS, the conclusions about these patients' reports of pain experience relative to nondemented elderly persons and early AD patients should be considered with caution.

The results of the CAS and FPS show that, compared to early and midstage AD patients, nondemented elderly persons indicated that they experienced much more intense pain. Furthermore, within the AD group, early AD patients reported a higher pain intensity than midstage AD patients. The results of the FAS suggest that, compared to early and midstage AD patients, nondemented elderly persons indicated that they suffered much more from the affective components of pain. The decrease in report of pain affect appeared to be similar in both AD groups. It is important to note that the present study is primarily concerned with the assessment of comprehensibility of the scales and the evaluation of the scales by the patients' report of pain. However, the patients' report of pain should not be equated with their actual pain experience. The data of the present study do not provide evidence that, compared to nondemented elderly persons, AD patients perceived less discomfort due to neuropathological changes in affected brain areas. The only method to really assess pain experience in AD would be to evaluate the patients' responses to experimental pain stimuli. We suggest that such a study should be done in the future.

Limitations

The present study has several limitations: (1) Although the three groups were matched for chronic painful conditions (only fractures occurred significantly more in the midstage AD group, compared to the two other groups), the question arises whether the painful conditions have an identical impact on the subjects. For example, the severity of the painful condition might vary between the subjects of the three groups. (2) The total number of illnesses (comorbidity) was much higher in the control group than in the midstage AD group. Although most of these illnesses are not directly related to pain, they provide discomfort which might indirectly influence pain experience. (3) The scales were administered in the following order: CAS, FAS, FPS. During the administration of the FAS the subjects were confronted with faces whose affective meaning they had to evaluate for the first time. It may be that the results of the FPS were influenced by the fact that the patients had already seen a similar set of faces in the FAS. To avoid any bias in future, the FAS and FPS should not be administered in succession. (4) Considering the progressive decline in memory in AD, only the patients' pain experience at the moment of administration of the scales can be reliably assessed. A suggestion for future research may be to diagnose AD patients' pain experience (pain intensity and pain affect) on a daily basis during a longer period (e.g. 3 months). Daily pain assessment may minimize the influence of memory disturbances on AD patients' pain report.

Conclusion

In sum, visual analogue scales may improve pain assessment in those AD patients who fully comprehend the meaning of the scales. The finding that the CAS was least understood in the midstage AD group and that the FPS was less well understood in both early and midstage AD patients emphasizes that when using both scales, the clinician or nurse must first make sure that the patient comprehends the concept. Finally, the present findings show that the search for tools, especially to assess pain affect in this population, must continue.

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