Apathy, Anhedonia, and Psychomotor Retardation in Elderly Psychiatric Patients and Healthy Elderly Individuals

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ABSTRACT

Normal aging of the brain affects the basal ganglia-thalamocortical circuits. These circuits are implicated in several neuropsychiatric disorders. Normal aging may therefore influence the symptomatology of psychiatric disorders in the elderly. We investigated motivational behavior that is associated with the function of these circuits, such as apathy, anhedonia, and psychomotor retardation in healthy elderly subjects and psychiatric inpatients (age ≥ 60 yr). Apathy, anhedonia, and psychomotor retardation were assessed with the Apathy Evaluation Scale, the Snaith-Hamilton Pleasure Scale, and the Widlöcher Retardation Rating Scale. Other measurements included the Comprehensive Psychopathological Rating Scale, the Mini-Mental State Examination, and the assessment of vascular risk factors. We found some evidence for age-related changes in motivational behavior. In the healthy elderly group (n = 64), increasing age was associated with anhedonia, and in the patient group (n = 62), increasing age was associated with psychomotor retardation. Motivational disturbances could be the effect of an interaction between brain aging and the neuropathology of psychiatric disorders in the elderly. (*J Geriatr Psychiatry Neurol* 2001; 14:11–16).

One of the assumptions of old-age psychiatry is that changes in the brain due to aging may influence emerging or existing psychiatric disorders in the elderly. Postmortem and structural neuroimaging studies show that normal aging of the brain affects the frontal lobe cortices (mainly the dorsolateral prefrontal and orbitofrontal areas), anterior cingulate cortex, thalamus, and striatum preferentially.[1–3] Changes are mainly accounted for by neuron loss, neuronal shrinkage, axonal degeneration, changes in neurochemistry, and/or cerebrovascular changes.[1,3] Structural or functional abnormalities in these areas and their connecting circuits (e.g., the basal ganglia-thalamocortical or frontosubcortical circuits) have been related to several neuropsychiatric disorders, such as depression, secondary mania, psychotic disorders, obsessive-compulsive disorders, and personality changes.[4–6]

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Is there evidence that age-related changes in these brain areas lead to changes in behavior in the elderly? In healthy elderly individuals, the age-associated decrease in dopamine D_2 receptor availability in the striatum has been found to be associated with decreased motor function and decreased performance on frontal tasks.[7] Another study found an association between mobility measures and periventricular white-matter lesions and ventricular volume in healthy elderly.[8] Furthermore, cerebral white-matter lesions and enlarged ventricles in healthy elderly individuals are associated with poor performance on neuropsychological tests of frontosubcortical functions, such as executive functions, attention, and speed of processing.[9] With advancing age, individuals tend to become socially withdrawn and more introverted.[10] An increase in the prevalence of alexithymia (inability to experience and verbalize emotion) among the elderly appears to be closely associated with social anhedonia (loss of interest).[11,12]

Is there evidence that these age-related behavioral changes emerge as psychopathology in elderly psychiatric patients? The prevalence of "minor" depression or depressive symptoms increases with age, whereas the incidence of major depression does not.[13] Indeed, that depressive disorders are expressed differently in elderly patients is supported by the finding that subgroups with different symptomatology exist, such as "motivational"

versus "emotional" symptomatology.[14] Neuroimaging studies provide further evidence for age-related changes in the brains of depressed patients. There are more structural changes in the brains of elderly depressed patients than in the brains of younger depressive patients or healthy elderly controls.[15] These changes are mainly subcortical white-matter lesions and/or periventricular hyperintensities. The symptomatology of schizophrenia also changes with age. Particularly in chronically ill elderly patients with schizophrenia, the positive symptoms decrease in severity,[16,17] whereas the negative symptoms such as anhedonia/asociality, avolition/apathy, and alogia worsen with age.[18,19] These negative symptoms belong to a cluster of motivational disturbances, which can also be considered as an interaction between psychiatric disorder and normal aging.

The changes in behavior and neuropsychological function related to normal aging could be classified into a 'motivational cluster.' Important elements within this cluster are loss of energy/initiative (apathy), loss of interest (anhedonia), and slowing of cognitive and motor processes (psychomotor retardation).

The aim of this study was to investigate the behavior of this 'motivational cluster' in a healthy elderly population and an elderly population with mixed psychiatric diagnoses. We hypothesized that increasing age is associated with increasing apathy, anhedonia, and psychomotor retardation in both healthy elderly and elderly psychiatric patients. Second, in elderly patients with a psychiatric disorder, we expected an augmentation of motivational behavior disturbances as the result of an interaction between psychiatric disorder-related functional changes in the brain and normal age-related changes in the same circuits. Therefore, we hypothesized that apathy, anhedonia, and psychomotor retardation are related to psychopathology in the patient group, regardless of diagnoses. Because age-related changes in the brain have been associated with ischemic injury (i.e., white-matter hyperintensities), data about vascular risk factors were collected from the patients' records to study associations between vascular risk factors and global cognitive functioning, motivational behavior, and psychopathology.

METHODS

Subjects

Healthy Elderly Group

The healthy group was recruited from a large population study of social determinants of normal aging in Groningen (a city in the north of the Netherlands): The Groningen Longitudinal Ageing Study (GLAS).[20] Subjects for the GLAS study were recruited through 27 general practitioners in the region of Groningen. Baseline data were obtained for over 5000 people, who were further assessed for chronic medical conditions and screened for depressive and anxiety symptoms. Based on these findings, those with disabilities or psychological distress were included in one of the GLAS studies. In collaboration with the GLAS study, we were able to recruit subjects who were not participating in any of these GLAS studies and therefore had no disabilities or psychological symptoms. Subjects were approached by letter with information regarding the study including a registration form for enrolment. Included were those older than 60 years; excluded were those with any psychiatric disorder, known dementia or known neurologic disorders affecting the central nervous system, a history of substance abuse, a Mini-Mental State Examination (MMSE)[21] score ≤ 18 (in order not to exclude people with mild and possible reversible cognitive dysfunction), and a score ≥ 5 for the physical functioning subscale of the Medical Outcomes Study (MOS) survey.[22] This survey screens for any major limitations in physical activities due to health factors, and people with a score ≥ 5 are considered to be limited in their ability to perform strenuous activities. We chose this survey in order to select a relatively healthy and independent group of elderly individuals. In the first part of the interview, the MOS survey, the MMSE, and data about marital status and education level, somatic complaints, medication, and alcohol and drug use were assessed. If individuals had a score ≥ 5 for the MOS survey or a score ≤ 18 for the MMSE, the interview was discontinued. Subjects were visited at home for the interview after written informed consent was obtained.

Patients

The study was approved by the Ethics Committee of the University Hospital of Utrecht. From April to December 1997, all patients admitted to the ward for old-age psychiatry of a large psychiatric hospital in the province of Utrecht were eligible for participation in the study. Included were patients older than 60 years; excluded were those with known dementia or known neurologic disorders affecting the central nervous system, a history of substance abuse, or a MMSE score ≤ 18. In the first week after admission, patients were asked to participate in the study, and a signed written informed consent was obtained. Medical records were reviewed for demographic data, data concerning health status, prescribed medication at the time of admission, and vascular risk factors. Medication status was recorded as follows: (1) no medication, (2) use of antipsychotic drugs, (3) use of antidepressant drugs, and (4) use of other neuroleptic drugs (e.g., lithium, benzodiazepines). A vascular risk factor score was composed from the patient's medical records by adding up the following conditions (absent = 0, present = 1): diabetes, smoking, hypertension for which medication was used, a history of vascular and heart disease, and hypercholesterolemia for which medication was used. This resulted in a score ranging from 0 to 5, depending on the total number of vascular risk factors. Patients were diagnosed by their attending clinical

physician according to *Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition* (DSM-IV), criteria.

Instruments

Assessment of Motivational Behavior

In order to assess the three behavioral dimensions of interest, three scales were used. The Apathy Evaluation Scale (AES)[23] is an 18-item scale designed to measure apathy, representing the range between highly motivated states and severe apathetic states such as abulia or akinetic mutism. The AES score range is 18 to 72; a higher score indicates greater apathy. The Snaith-Hamilton Pleasure Scale (SHAPS)[24] is a 14-item self-assessment questionnaire that measures the ability to experience pleasure or the anticipation of a pleasurable experience (hedonic tone). The SHAPS score range is 0 to 14; a higher score indicates greater anhedonia. The Widlöcher Retardation Rating Scale (WRRS)[25] was designed to measure the motor and mental features of depressive slowing and consists of an objective (motor and verbal items) and a subjective subscale (ideational items). In this study, we used the objective scale (oWRRS), which is considered highly specific for retardation[26]; this is a six-item scale and the score range is 0 to 24; a higher score indicates greater psychomotor retardation. The WRRS has been translated and validated in a Dutch psychiatric population.[27] The AES and the SHAPS were translated into Dutch and back-translated into English by a native English-speaking translator in order to be able to compare the Dutch-translated scales with the original version for textual and conceptual differences. The AES and the oWRRS were completed by a trained physician or a trained social scientist; the SHAPS is a self-assessment list and was therefore completed by the patient herself/himself.

Assessment of Psychopathology

The Comprehensive Psychopathological Rating Scale (CPRS) is a semistructured interview to assess psychopathologic symptoms.[28] The psychometric properties of the Dutch version have been investigated in a heterogeneous group of psychiatric patients.[29] The CPRS consists of four categorical subscales and five dimensions. The subscales are the Montgomery-Åsberg Depression Rating Scale (MADRS),[30] a scale for the assessment of depression severity; the Brief Scale for Anxiety[31]; an obsessive behavior scale[32]; and a scale for the assessment of schizophrenia or psychosis-related behavior.[32] The five CPRS dimensions were obtained by principal-component analysis[33]: (1) a dimension of emotional dysregulation was constructed from anxious and depressive items; (2) a dimension of motivational dysregulation with items regarding the dysregulation of appetite or interest and psychomotor retardation or disinhibition items, which was divided into a retardation component and a disinhibition component for further analysis; (3) a dimension of perceptual disintegration with items relating to psychotic symptoms; (4) a dimension of behavioral disintegration with items relating to confusion, attentional dysfunction, and retardation; and (5) a dimension of autonomous dysregulation with items relating to acute somatic stress responses. The CPRS was completed by a trained interviewer (a social scientist). All interviews were completed within 2 weeks of admission.

Statistical Analyses

Data were analyzed with SPSS version 8.0. Differences in data between groups were analyzed using chi-square tests or Student's *t*-tests. For non-normally distributed data, the Mann-Whitney U test was used. Pearson's correlation coefficient (R) was calculated to examine the effect of age on the motivational behavior scores and the CPRS scales. For nonlinear associations, we used Spearman's rank-order correlation coefficient (R_s). For analyses of age, the groups were divided into older (≥ 75 years) and younger (60–74 years) subjects. For analyses of medication status, we dichotomized a variable for the use of medication: whether patients did or did not use antipsychotic drugs, antidepressant drugs, or other neuroleptic drugs. We used a chi-square analysis to calculate associations between medication use and age groups. For analysis of vascular risk factors, the patient group was divided into those with zero to one vascular risk factor (low risk; n = 48) and those with ≥ two vascular risk factors (high risk; n = 14). The level of significance was set at .05, and all tests were two-tailed. Only the results of tests that reached a significance < .05 are reported.

RESULTS

The healthy elderly group consisted of 64 individuals. Eighty patients were eligible, of whom 62 (77.5%) consented to participate. Demographic variables for the healthy and patient groups are shown in Table 1. Patients were more often single. The frequencies of the various DSM-IV diagnoses in the patient group are presented in Table 2. Scores for apathy, anhedonia, and psychomotor retardation are shown in Table 3. These scores were significantly higher in the patient group than in the

Table 1. Study Groups

	Healthy Group (n = 64)	*Patient Group (n = 62)*
Age (± SD)	71.5 (± 7.1)	70.6 (± 6.6)
Women	41 (64%)	42 (68%)
Marital status*		
Married/living together	32	24
Single	4	11
Divorced	9	16
Widowed	19	11
Education†‡		
Low	28	31
Middle	26	12
High	10	9

*P = .037; †P = .125; ‡missing values in the patient group (n = 10) are excluded from analysis.

healthy group (all $P < .0001$). Patients with zero to one vascular risk factor (low risk) were compared with patients with two or more vascular risk factors (high risk). We found no differences (comparisons of means; results not shown) between the high-risk and the low-risk groups with regard to MMSE scores, motivational behavior scores, or psychopathology (CPRS scales).

Relations Between Age and Motivational Behavior Scores in the Healthy Elderly

In the healthy elderly group, significant correlations were found between increasing age and anhedonia scores ($R_s = .326$, $P = .008$) but not for apathy and psychomotor retardation scores. Mean anhedonia scores were significantly higher in the older age group (1.35 ± 1.46) than in the younger age group (0.39 ± 0.87; $P = .011$).

Relations Between Age and Motivational Behavior Scores in the Elderly Patients

In the patient group, we found a modest but significant positive correlation ($R_s = .267$; $P = .036$) between age and psychomotor retardation. Mean retardation scores were significantly higher in the older age group (7.56 ± 4.42) than in the younger age group (4.95 ± 3.88; $P = .025$). These age groups did not differ with regard to medication status at the time of admission (chi-square analysis; results not shown). To exclude an effect of a diagnostic category on these findings, we looked at the correlation between age and psychomotor retardation in the patients with depression, which comprised the greatest diagnostic group (n = 29), and the group with other diagnoses (n = 33). Correlations in both groups were similar in size and direction but were not significant (results not shown). We found no association between increasing age and apathy or anhedonia scores in the patients.

Relations Between Motivational Behavior and Psychopathology

The CPRS dimension of motivational retardation was the only one of all CPRS subscales that was highly correlated ($R > .550$) with all three behavioral motivation scales (bivariate correlation analysis: apathy, $R = .683$; anhedonia, $R = .589$; psychomotor retardation, $R = .607$; all, $P < .001$). These correlations remained significant after controlling for MADRS score (partial correlation analysis: apathy, $R = .400$; $P = .001$; anhedonia, $R = .283$; $P = .027$; psychomotor retardation, $R = .699$; $P = .000$). Although no significant correlation was found between increasing age and the CPRS motivational retardation scores, we did find modestly higher scores (score range 0–30) in the older age group (8.78 ± 4.27) than in the younger age group (6.23 ± 4.44; $P = .039$).

Table 2. Frequency of a DSM-IV Diagnosis in the Patient Group

	Frequency	*%*
Depressive disorders	29	46.8
Schizophrenia and other psychotic disorders	11	17.7
Bipolar disorders	8	12.9
Cognitive/amnestic disorders*	5	8.1
Adjustment disorders	3	4.8
Delirium†	2	3.2
No axis 1 diagnosis	2	3.2
Anxiety disorders	1	1.6
Impulse-control disorders	1	1.6
Total	62	100

*Four of these patients were diagnosed with 294.9 Cognitive disorder NOS, accompanied by a general medical condition. These conditions were (1) vitamin B_{12} deficiency, (2) DMII and malnutrition, (3) deafness, and (4) recent hip fracture. One patient was diagnosed with 294.8 Amnestic disorder NOS.
†One patient was diagnosed with 780.09 Delirium NOS; the other patient was diagnosed with 292.82 Adrenal cortical steroid-induced delirium. Patients with delirium were included in the study when the major delirium symptoms subsided.

Table 3. Mean Scores for Apathy, Anhedonia, and Psychomotor Retardation in Patient and Healthy Groups

	Healthy Group (n = 64)	*Patient Group (n = 62)*
AES	26.95	43.40
Range (SD)	18–46 (6.52)	21–64 (10.59)
SHAPS	0.69	3.45
Range (SD)	0–5 (1.17)	0–13 (3.43)
oWRRS	1.61	5.71
Range (SD)	0–10 (2.36)	1–18 (4.18)

DISCUSSION

This study investigated the contribution of age to motivational behavior and psychopathology in healthy elderly people and elderly psychiatric patients. The design was an open study with healthy elderly persons and a psychiatric inpatient population, and the main object was to explore the relationship between age and certain motivational behavior (e.g., apathy, anhedonia, and psychomotor retardation) and psychopathology (as measured with the CPRS) in these groups.

By examining motivational behavior, we used a dimensional approach to the study of age-related changes instead of directly studying diagnostic categories. Especially in the elderly, the use of diagnostic categories may give rise to a certain selection of subjects because criteria for diagnosis are often based on information from younger populations, thus excluding elderly individuals who do not fulfill the diagnostic criteria. For example, depressive symptoms and minor depression have been found to increase with age, whereas the prevalence of major depression remains the same or is even lower.[13,34] Furthermore, the co-occurrence of somatic complaints in the elderly, such as appetite and sleep disturbances, may confound the criteria for psychiatric disorders. A possible drawback of studying behavior and the use of behavioral scales is the overlap of scale items with illness-related symptoms. However, based on the face validity of the behavioral scales we used, we could only find four items of overlap for the three scales and the 65 CPRS items. Another limitation is that the scales we used for the assessment of dimensional behavior may not be sensitive enough to detect a small change in behavior in healthy

elderly. In the literature, we could not find any data of normative values for younger healthy persons, except for the SHAPS[24]; therefore, we were limited in the comparison of our elderly population to younger age groups.

Our first hypothesis was that increasing age is associated with increasing apathy, anhedonia, and psychomotor retardation in healthy elderly and elderly psychiatric patients. We found some evidence to support this hypothesis. In the healthy elderly group, an association between increasing anhedonia score and increasing age was found. Other studies have shown a relationship between increasing age and alexithymia (the inability to experience emotions), which is closely related to anhedonia.[11,12] On the basis of the results of animal studies, it has been hypothesized that anhedonia is related to dysfunction of the dopamine reward system. This system involves dopaminergic neurons of the ventral tegmentum area and its projections to parts of the limbic system (e.g., the mesolimbic dopaminergic system). Anatomically adjacent to the ventral tegmentum area are the dopaminergic cells of the substantia nigra with efferents to, among others, the striatum and the ventral medial nucleus of the thalamus. These areas are part of the basal ganglia-thalamocortical circuits that are likely involved in normal aging of the brain. We did not find apathy or psychomotor retardation to be associated with age in the healthy elderly group. Psychomotor retardation as a consequence of normal age-related dopamine loss in the nigrostriatal system[7,35] may only become clinically evident in psychiatric patients due to the effect of the psychiatric illness. Furthermore, as discussed above, the properties of the scales we used may also explain the lack of findings.

In the patient group, we found an association between increasing age and psychomotor retardation. Medication status at the time of admission was not different between the older and the younger patients. Brodaty et al[36] also found an age-related increase in psychomotor disturbances, as assessed with the CORE rating scale in depressed patients. The clinical presentation of patients with recurrent depression was similar to that of patients experiencing their first episode of depression, and it was therefore suggested that the influence of disease or treatment-related factors was minimal. Our findings can be explained by an interaction between normal age-related dopamine losses and neuropathology related to the psychiatric disorder in the same areas, for example, structural or biochemical changes in the striatum. Another explanation can be given by the use of psychopharmaceuticals, especially dopamine-blocking agents, in elderly psychiatric patients, which may lower the threshold for the appearance of psychomotor disturbances to the point that the retardation becomes clinically evident. However, in our study, the majority of patients (61%) did not use antipsychotic medication at the time of admission, therefore making a major role for the use of antipsychotic medication as a confounder in our findings less plausible. We did not find a relationship between anhedonia and age in the patient group. The SHAPS may lack sufficient dimensional properties to measure (an)hedonia in psychiatric patients, as shown by the skewed distribution of normal hedonic states and anhedonia in this group. Although the distribution was also skewed in the healthy group, the range of scores was much greater in the patient group. Age-related changes in anhedonia may be more difficult to distinguish in psychiatric patients because of higher (disease-related) anhedonia scores in this population.

Our second hypothesis was that apathy, anhedonia, and psychomotor retardation are related to psychopathology in the patient group. We found an association between apathy, anhedonia, and psychomotor retardation and the CPRS dimension of motivational retardation in the patient group, even after controlling for the severity of depression. Consistent with others, these results suggest that these behavioral disturbances may also occur independent of depressive symptoms.[37] Furthermore, older patients were more impaired on motivational scores than younger patients. Apathy, anhedonia, psychomotor retardation, and other negative symptoms of motivational retardation may be the result of an interaction between normal age-related changes in the basal ganglia-thalamocortical circuits and neuropathology related to the psychiatric disorder.

Finally, we collected data about vascular risk factors from the patients' records to study associations between vascular risk factors and global cognitive functioning, motivational behavior, and psychopathology. Vascular disease has been associated with depressive disorders.[38] Depression occurs frequently after stroke or vascular lesions.[39] Cardiovascular disease, such as a history of stroke or myocardial infarction, and atherosclerosis of carotid arteries or the arteries of the lower extremities have also been associated with a decline in global cognitive functioning in healthy elderly individuals.[9] Consistent with others, we did not find such an association.[40] However, it is possible that the method we used to collect information about vascular risk factors from patients' records lacks sufficient validity to determine these risk factors. For this reason, vascular risk factors should be assessed in a clinical setting by means of standardized questionnaires and physical examination, standardized measurement of blood pressure, and the use of blood samples for determining plasma cholesterol and/or blood glucose levels.

In summary, we found evidence for age-related changes in anhedonia in healthy community-living elders and for age-related changes in psychomotor retardation in elderly psychiatric patients. This behavior was associated with motivational retardation in the elderly patients. Motivational disturbances could indeed be the effect of an interaction between brain aging and the neuropathology of psychiatric disorders in the elderly. Instruments with improved dimensional properties

should be developed to assess behavior in both healthy elderly and psychiatric patients. Further studies of motivational behavior changes with age are needed as well as studies that investigate the relationship between this behavior and brain structure in the elderly.

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