MEMORY, DEPRESSION, AND PROGRESSING OLD AGE IN WOMEN

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In this study we investigated the interrelationships among memory function, depression, and progressing age in the elderly women. We hypothesized that memory deficit would increase with progressing old age and would be further enhanced in the presence of depression. The study was conducted on 44 female volunteers of the mean age of 67.8 ±1.1(SE) years (range 55-83). The population sample was dichotomized into the depressed and non-depressed subgroups. All subjects were closely homogenous with respect to the post-menopausal status and general life factors. The methodology was based on a group survey in which The Center for Epidemiologic Studies Depression Scale questionnaire and a visual letter recall test were used for the assessment of depression and memory, respectively. The results failed to support the hypothesis. In the first place we found that the mean memory deficit was similar in both depressed and non-depressed subjects, amounting to about 40% of missed letters on recall. Memory deficit progressed with age only in the subgroup of depressed women, but rather surprisingly, it was not associated with the level of depression that actually declined with age in this subgroup. We conclude that progressing old age alone is not necessarily entwined with the intensification of either depression or memory decline. Depression is a factor in memory decline through brain mechanisms unrelated to the intensity of depressive symptoms.

Key words: depression, elderly, memory, old age, women

INTRODUCTION

Memory worsens with advancing age and there is a consensus that mild memory deficits, often referred to as ‘forgetfulness’, may be part of the physiological aging process (1, 2). A number of studies also have shown that
depressive symptoms can adversely affect memory function (3, 4). Interrelationships among depression, memory, and age are less clear. Some epidemiological studies show a greater prevalence of depression in younger cohorts of the age 18-29 years, in which memory deficits are rather unusual, with the lowest in those over 65 years (5). Other sources show that whereas the prevalence of depression is about 10-12% in the general adult population, it might be twice as much or more in the population over the age of 60 years, particularly in elderly persons afflicted with other illnesses (6, 7). On the high prevalence side, there are reports, such as that by Marquez Cardoso et al (8) who have shown depressive symptoms in 277 adults out of the 384 tested (72.1%), with a significant predominance of female subjects. The interpretation of studies dealing with the relation between depression and memory is confounded by methodological variations, heterogeneous or clinically selected populations, and possibly unrecognized comorbidities.

In the present study we set out to examine the relation between short-term memory function and depressive symptoms in healthy elderly women. We chose a population of postmenopausal women on the premise that depressive symptoms develop in females, particularly in the old ones, more often than in males (8, 9, 10). We reasoned that any effect of depression on memory function would then easier come to sight in women of a relatively homogenous postmenopausal hormonal status. We hypothesized that memory deficits would be greater in the elderly women with depressive symptoms compared with those who were not depressed and that memory deficits would be enhanced with progressing age. The findings of the study were incongruous with the hypothesis. We found that memory dysfunction, on average, was of similar magnitude in both depressed and non-depressed women, it increased with progressing old age only in the depressed women, and, rather surprisingly, the increase was not associated with the intensity of depressive symptoms.

MATERIAL AND METHODS

Setting

The study conformed to the guidelines of the Declaration of Helsinki for human research. Informed consent was obtained from all subjects. Memory and depression surveys were conducted in a sample of 44 elderly female subjects from whom complete data were obtained. The mean age of the testees was 67.8 ±1.1(SE) yr (range 55-83 yr). All subjects were recruited for the Warsaw-Mokotów University of the Third Age in Warsaw. Because literature data suggested that the gender and the hormonal status (11) may be of importance for the assessment of both depression and memory function, we chose postmenopausal women only for the study. All women were healthy non-smokers, had no overt psychological or somatic disorders, and were not taking any medications that could interfere with completion of the measures, in particular psychoactive or hormonal drugs. The women represented a closely homogenous sample concerning other general life factors. All of
them were retirees, had at least high school education, belonged to the lower middle-class or the middle-class with respect to the socioeconomic status, and led an average sedentary lifestyle.

**Measures**

The study was conducted as a group survey. The Center for Epidemiologic Studies Depression Scale (CES-D) questionnaire and a silent visual memory recall test were administered, along with a demographic data form, to all of the participants on one occasion.

The CES-D evaluates the level and intensity of depressive symptoms (12). The CES-D scale consists of 20 items. Respondents indicate the frequency with which they experienced the symptoms during the preceding week. The frequency is categorized into <1 day (rarely or none of the time), 1-2 days (some or a little of the time), 3-4 days (occasionally or a moderate amount of the time, and 5-7 days (most or all of the time). The respective scores are from 0 to 4, yielding a total possible score of 60. Sixteen of the items are negatively and 4 are positively worded. Scoring for the latter was reversed so that the highest score represented the non-depressed condition. The score is the sum of the 20 item weights. A score of 16 or more is considered indicative of depression and we adopted that standard cutoff for the study. The CES-D is a sensitive and specific self-reporting tool that distinguishes depressive symptoms in the general population across various age groups. Validity and test-retest reliability of this widely used scale have been extensively confirmed (12, 13).

A visual memory recall test was modeled on that provided on-line by the University of Washington, Seattle, USA. The test was rearranged and modified for the current use by P. Siwiec of the Institute of Psychology of Opole University in Opole, Poland. The test assessed performance on immediate visual letter recall. It consisted of 6 sets of randomly chosen letters, with increasing number of letters in each: 2, 4, 6, 8, 10, and 12. Each set flashed on a screen for 5 s and the subject had another 10 s to write down as many letters as he remembered after they had disappeared.

**Data analysis**

Data are expressed as means ±SE. Memory deficit was calculated in each subject as the percentage of missed letters from the total number of letters present in all letter sets. Differences between the mean data for the depressed and non-depressed subgroups were evaluated with a two-tailed unpaired t-test. Correlations between age and score of depressive symptoms, age and score of memory deficit, and between scores of depression and memory deficit were made with linear regression analysis according to the equation: \( y = ax + b \) where \( a \) is the slope of the regression line and \( b \) is the intercept with the vertical axis on a scatter diagram. A value of \( P<0.05 \) was considered to indicate a statistically significant change for all data.

**RESULTS**

**Dichotomization of the population studied**

We dichotomized the subjects into depressed and non-depressed as based on the results of the CES-D score. The demographic and memory deficit data for both subgroups are presented in Table 1. There were no remarkable differences between the mean data for the females of both subgroups, except for the obvious difference in the score of depressive symptoms that differentiated the two subgroups.
Depressive symptoms and age

Of the 44 females studied, 18 (40.9%) had the CES-D score above the cutoff level corresponding to depression. Depressive symptoms were usually mild-to-moderate, not exceeding 40 on the 60-point scale (Fig. 1A). Interestingly, depressive symptom scores were higher in the junior old women than in the senior ones. The decline in depression intensity with progressing old age, within the studied age span of 55-77 years, was significant and amounted to 0.5 depression score points/year ($r=0.47$, $P<0.05$). There was no association between depressive symptom score and age in the non-depressed subgroup (Fig. 1B).

Memory deficit and age

Memory deficit was assessed from the percentage of forgotten letters on visual letter recall. Overall, the mean memory deficit scores were inappreciably different in both depressed and non-depressed subgroups, oscillating about 40-43% (see Table 1). The influence of the progressing senior age on memory deficit in both subgroups is shown in Fig. 2 (Panel A and Panel B). Memory deficit was increasing with progressing age in the depressed women, the increase was about 1%/year ($r=0.66$, $P<0.01$; Fig. 2A). No such association was noted in the non-depressed women (Fig. 2B).

Memory deficit and depression

The association between memory deficits and the intensity of depressive symptoms in both subgroups of female subjects is presented in Fig. 3. Regression analysis failed to reveal a significant correlation between memory function and depression in either depressed (Panel A) or non-depressed (Panel B) subjects.

### DISCUSSION

Several main findings emerged from this study in which we attempted to sort out the interrelationships among depression, memory function, and age. The first finding was that in the group of depressed elderly women the intensity of

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<tr>
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<th>Depressed ($n=18$)</th>
<th>Non-depressed ($n=26$)</th>
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<tbody>
<tr>
<td></td>
<td>Mean ±SE  Range</td>
<td>Mean ±SE  Range</td>
</tr>
<tr>
<td>CES-D Score</td>
<td>25.5 ±1.7  16-39</td>
<td>8.3 ±0.8*  0-15</td>
</tr>
<tr>
<td>Age (yr)</td>
<td>69.4 ±6.4  55-77</td>
<td>66.6 ±1.4  56-83</td>
</tr>
<tr>
<td>Memory deficit (%)</td>
<td>43.1 ±2.5  24-62</td>
<td>40.1 ±2.1  23-64</td>
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*P<0.00001 between the two subgroups
Fig. 1. Associations between the score of depressive symptoms and age in the subgroups of elderly depressed (A) and non-depressed (B) female subjects. Depression was significantly less with progressing age in the depressed. The lines are regression lines in both panels. In Panel A the correlation coefficient = 0.47 (P<0.05).

Fig. 2. Associations between memory deficits expressed as the percentage of forgotten letters on visual memory recall and age in the subgroups of elderly depressed (A) and non-depressed (B) female subjects. The lines are regression lines in both panels. In Panel A the correlation coefficient = 0.66 (P<0.01).
depressive symptoms was declining with progressing old age. This is rather an unexpected finding that points out that aging and depression are not inevitably entwined. Another finding was that progressing old age increased memory deficits in the depressed, but not so in the non-depressed women. Therefore, age alone did not seem indispensable to adversely affect memory. Nor did the level of memory deficit depend on the intensity of depressive symptoms in the depressed women in whom memory deficit increased but depression decreased with age.

The proportion of depressed subjects in the present study amounted to about 41%. This percentage may be considered high in comparison with the baseline 14% rate of depression found in the general adult population across all age groups (14). In that study, however, only about 20% of the subjects were of the senior age corresponding to that in our study and no clear gender separation was provided. On the other side, there are reports showing that depression may reach the range of 70% in some adult populations, with the predominance of the elderly aged >65 (8). The population sample of elderly females selected for our study was characterized by a number of factors such as the postmenopausal age, and consequently low estrogen status, rather low economic status, low physical activity, all of which are known to foster the appearance of depression (11, 14, 15).

Fig. 3. Associations between memory deficits expressed as the percentage of forgotten letters on visual memory recall and the score of depressive symptoms in the subgroups of elderly depressed (A) and non-depressed (B) female subjects. The lines are regression lines in both panels. No significant association was noted in either subgroup.
The prevalence of depressive symptoms in older adults is debatable. There are studies that point to the highest prevalence in younger cohorts of 18-29 years with the lowest in individuals aged 65 and more (5). Others report that depression may be about twice as frequent in the elderly as it is in younger adults (6, 7). The controversy concerning depression prevalence may partially stem from different symptomatology of depression in the old age and possible difficulties in diagnosis.

The present findings demonstrate that the mean memory deficit scores were comparable in the depressed and non-depressed women, oscillating about 40% in both subgroups (Table 1). Interestingly, memory deficit did not worsen in healthy non-depressed women throughout the progressing old age studied. This is at variance with a generally adopted view that memory function might be vulnerable to normal aging (2, 16). In our study memory deficit evidently worsened with progressing age but in the depressed women. Depression is often associated with memory decline, particularly impairing the episodic or working memory system (17). However, in the current study the intensity of depression did not apparently factor in the memory worsening, for the depressive symptom score was actually decreasing with age alongside simultaneously increasing memory dysfunction. These findings suggest that depression per se may not be causative in memory decline. Rather, depression may activate untoward processes in executive brain systems, leading to diminished attentional resources, self-confidence, and the like, which, in turn, negatively affects memory. That would be in accord with the understanding of memory as a complex set of distinct processes carried out in the mind that depend on a combination of several systems in the brain.

The design of this study was different from other similar studies in that we correlated memory and depression changes across the thirty years of the senior age range of 55-85, rather than making cross-sectional age-group comparisons. That may have changed the angle of observation, showing the actual decline of depression with age and the lack of dependence of memory impairment on the intensity of depressive symptoms. This study, however, has a number of limitations that could have borne on the outcome. We examined a highly selected and gender-specific population sample, which may not apply to the general population. The tools used for the measurement of visual recall ability and depressive symptoms, albeit validated and frequently employed, understandably fall short of allowing one to gain a deep insight into the complex brain function. Thus different results might emerge with different criteria for memory impairment or depression. Despite these limitations, we believe we have shown that progressing old age may not necessarily be associated with intensified depression or memory impairment, and if the latter is present then the symptoms of depression should be sought for. Given the high prevalence of both memory dysfunction and depression and the progressively increasing longevity, further investigations into the association between memory integrity, depression and age seem warranted. Such investigations could help advance potential strategies for maintaining memory in the aged.
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REFERENCES


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