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Short-term memory, memory abilities in everyday life activities and mood in patients with different insight into their cognitive functioning

Abstract

The goals of the study were (1) to evaluate the relationship between short-term memory, everyday memory skills, and mood in stroke patients; (2) to investigate the differences between patients with inadequate and adequate insight into their own cognitive abilities; and (3) to determine the level of patient insight into his everyday memory abilities and mood.

In stroke patients significant correlations were obtained between (a) the subjective evaluation of short-term memory and everyday memory skills; and (b) everyday memory skills and mood. In comparison to participants with adequate insight into their own cognitive abilities, patients with inadequate insight manifested significantly lower results in both short-term memory and everyday memory. Affective states influence memory self-reports and determine the goals and the course of neuropsychological rehabilitation.

Keywords: short-term memory, everyday memory skills, mood, insight into cognitive functioning

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Streszczenie

Celem podjętych badań było określenie u osób po udarze mózgu: (1) wzajemnych zależności między pamięcią krótkotrwałą, możliwościami pamięciowymi przejawiane w codziennej aktywności oraz nastrojem; (2) różnic pomiędzy pacjentami z nieadekwatnym i adekwatnym wglądem we własne funkcjonowanie poznawcze; (3) poziomu wglądu w możliwości pamięciowe przejawiane w codziennej aktywności oraz nastrój.

Uzyskano istotne korelacje między możliwościami pamięciowymi przejawianymi w codziennej aktywności a subiektywną oceną pamięci krótkotrwałej oraz nastrojem. W porównaniu do osób z adekwatnym wglądem, pacjenci z nieadekwatnym wglądem przejawiali istotnie niższe możliwości w zakresie pamięci krótkotrwałej oraz pamięci dotyczącej codziennej aktywności. Stan emocjonalny pacjentów w znaczący sposób wpływa na subiektywną ocenę własnych funkcji pamięciowych oraz determinuje sposób organizacji i przebieg rehabilitacji neuropsychologicznej.

Słowa kluczowe: pamięć krótkotrwała, pamięć przejawiana w codziennej aktywności, nastrój, wgląd we własne funkcjonowanie poznawcze.

Introduction

Short-term memory (STM) refers to memory that decays following a matter of seconds. Neuropsychological tests or clinical tasks are usually used to measure STM. Everyday memory abilities refer to episodic memory and are assessed both objectively and subjectively (Garcia et al., 1998; Abdulrab & Heun, 2008; Rayner, Wrench, & Wilson, 2010). Not all laboratory memory tests are reliable indicators of everyday memory, possibly because of the procedural aspects of these tests (Giovagnoli, Mascheroni, & Avanzini, 1997). Traditional tests employed to evaluate memory functions may fail to assess accurately the same memory skills as those required in everyday situations. Subjective and objective measures may not assess the same type of memory. Standard memory tests may be not sensitive enough to detect memory impairments, which are important in everyday life (Abdulrab & Heun, 2008). It raises the possibility that patients' insight into poor memory may be more strongly associated with greater reduction in quality of life than a neuropsychological objective assessment may be (Hall, Isaac, & Harris, 2009). Subjective memory complaints may have an important value in an early diagnosis of dementia (Abdulrab & Heun, 2008). Questionnaires seem to be useful in evaluating subjective aspects of patient functioning. Patients and their relatives

report difficulties retrieving events or experiences that have happened to a patient on a daily basis (Hall, Isaac, & Harris, 2009).

Numerous studies have tried to identify an association between subjective memory impairment and objective memory performance (Piazzini et al., 2001; Au et al., 2006; Hall, Isaac, & Harris, 2009; Rayner, Wrench, & Wilson, 2010). Many patients with brain pathology perform within the normal range on neuropsychological memory tests, while they report memory difficulties; others show severe memory deficits but do not report memory problems. Research show ambiguous relationships between objective and subjective memory. Some studies reveal that the results of memory tests agree with the reports of patients and their relatives (Hermann et al., 1995). Other researchers report that objective performance does not correlate highly or consistently with subjective memory (Hall, Isaac, & Harris, 2009), many demonstrate weak associations (Clarnette et al., 2001), and others show no such correlations (Riedel-Heller et al., 1999). Connections between memory self-reporting and objectively measured memory may be modified by an inaccurate insight into memory problems. Lack of insight into memory impairments may reflect a patient's deficient self-awareness (Pannu & Kaszniak, 2005). Subjective memory may also be influenced by emotional and personality factors such as mood, low self-esteem, and anxiety (Giovagnoli, Mascheroni, & Avanzini, 1997; Au et al., 2006; Rayner, Wrench, & Wilson., 2010). Results from many studies show a markedly stronger association between subjective memory and mood than between subjective and objective memory (Piazzini et al., 2001; Banos et al., 2004; Au et al., 2006). These findings suggest that emotional factors may distort the reporting of everyday memory difficulties (Hall, Isaac, & Harris, 2009), but some investigations show that mood does not always correlate with subjective memory complaints (Butler, Bhaduri, & Acosta-Cabronero, 2009; Lineweaver et al., 2004). Rayner, Wrench, & Wilson (2010) show that depressive symptoms, a history of mood disturbance, and objective memory deficits may determine subjective memory complaints.

The goals of the current study were to evaluate in stroke patients the relationship between (a) short-term memory and everyday memory skills; and between (b) memory functioning and mood. Additionally, the question was considered if the stroke patients' insight into select cognitive abilities is related to different aspects of memory functioning. The next step of the study was to investigate the differences between patients with inadequate insight into their cognitive abilities and subjects with adequate insight with regard to short-term memory, everyday memory abilities, and mood. The study attempted to develop previous findings, and to determine the level of insight into everyday memory abilities and mood in patients with inadequate insight into short-term memory. The evaluation of mood

and everyday memory skills was conducted from two perspectives: the patient's (subjective) and the relative's (more objective).

Method

Participants

Thirty-nine right-handed patients after an ischaemic stroke (mean age = 66.6, *S* = 8.8; years of education = 10.1, *S* = 2.2) were recruited from the neurological rehabilitation ward of the Neuropsychiatric Hospital in Lublin. The average duration of illness was 71.7 weeks and the presence of brain damage was confirmed by computerized tomography (CT). Patients were assessed with a modified version of "Assessment of cognitive functioning in patients with brain damages - a set of experimental tasks" (Łucki, 1995) in accordance with clinical–experimental procedure. The subjects who showed reasoning deficits and aphasic symptoms were excluded from further examination. The presence of psychiatric disorders (confirmed by medical documentation, and interviews with patients and their relatives) was also exclusion criterion. The remaining participants were placed into two groups: those with adequate (AC) and inadequate (IC) insight into their short-term memory abilities. The applied procedure for qualifying patients is one of the methodological approaches available in clinical neuropsychological research (Hochstenbach, Prigatano, & Mulder, 2005; Prigatano, 2010; Daniluk & Zawadzka, 2000). The procedure focuses on the comparison between the results of objective assessment and self-evaluation. Criterion for the patients' classification was the degree of agreement between the Subjective Evaluation of Memory (SEM) and the Rey Auditory Verbal Learning Test (RAVLT). In the SEM task patients were asked to anticipate how many words they could memorize from the list of 15 elements. The first RAVLT task assessed the patients' actual memory abilities (both measures are described in the section Measures). Accuracy of insight into memory skills was calculated on the difference between the SEM and RAVLT first task results. Inadequate insight was identified in cases when the difference was at least four points. The value is based on the confidence interval for the average (*M* = 2.59) and when it is larger than the upper bound of this interval (1.36 – 3.82).

The average age in the AC group (n = 22) was 63.5 (*S* = 9.6) and the average years of education was 11.2 (*S* = 2.7). The group included nine females (41%) and 13 males (59%). The mean time period after the stroke onset was 74 weeks. In the IC group (n = 17) the mean age was 69.8 (*S* = 8.1); there were eight women (47%) and nine men (53%); the average educational level was 9.1 (*S* = 1.7) years.

The patient mean was 69.5 weeks after stroke. The AC and IC groups did not differ significantly with respect either to age (t = -1.12; n.s.), education (t = 1.07; n.s.), and the duration of illness (t = -0.15; n.s.).

Measures

The Subjective Evaluation of Memory (SEM) was an original experimental task to assess patients' self-evaluation of their short-term memory abilities. The subjects were asked to anticipate how many products from a fifteen-item shopping list they could memorize.

The first task of the Rey Auditory Verbal Learning Test (RAVLT; Polish version by Choynowski & Kostro, 1980) was employed to assess patient's short-term memory. The method is a serial learning task which uses one list of 15 concrete nouns. Subjects were read the list five times with recall tested following each reading.

A modified version of the Self-Evaluation Scale BEx (Owczarek et al., 1995) was utilized to measure the memory abilities in everyday life activities and the patients' mood. The whole questionnaire consists of 25 items related to memory, attention, mood and activity level. Two scales were taken into account:

- Memory scale (ME) – describing memory abilities used in everyday life (e.g., "I clearly remember what happened yesterday"; the more points patients obtained the worse their abilities were);
- Mood scale (MO) – assessing the patient's mood (e.g., "Despite mild difficulties my mood is getting better and better"; the more points the subjects received the lower mood they manifested). Subjects evaluated memory abilities and mood using the 7-point Likert-type scale. They specified their agreement or disagreement on a symmetric agree-disagree scale for a series of statements: strongly disagree, disagree, rather disagree, neutral, rather agree, agree, and strongly agree.

The questionnaire was administered in two forms: the self-report form (S form) and the observational form (O form) filled out by a relative. The patients' close relatives (*informants*; n = 39) were asked to evaluate the patient's behaviour. Informants, who lived with the patient in the same household, were the patients' children (n = 22), spouses (n = 8), grandchildren (n = 6), and others (n = 3).

Statistical analysis

The Student's t-test for independent samples was used to evaluate differences in means between the two groups. To assess the differences between patients' and relatives' reporting, we used the Student's t-test for dependent samples. We

used Pearson's correlations to determine the relationship between (a) short-term memory and everyday memory skills, (b) memory functions and mood, and (c) the level of insight into select cognitive abilities and memory. All data were analyzed using SPSS, version 17.0.

Results

Relationship between short-term memory and everyday memory skills

There was no significant correlation between RAVLT's first task and the objective measure of everyday memory functioning in the stroke patient group (r = -0.22; n.s.). The relationship between short-term memory and everyday memory skills in subjective evaluation was also established. There were significant negative low correlations between the Subjective Evaluation of Memory task results and the subjective evaluation of everyday memory skills in the stroke patient group (r = - 0.31; p = 0.05). The higher the self-evaluations of short-term memory, the higher the self-evaluations were of everyday memory skills.

Memory abilities and patient mood

Memory abilities and patient mood were assessed subjectively and objectively. RAVLT's first task (objective assessment of short-term memory) was uncorrelated with the relatives' evaluation (BExMO) of patient mood (r = -0.05; n.s.). The patients' subjectively evaluated short-term memory likewise did not correlate with mood self-evaluation (r = -0.38; n.s.). The same statistical analysis was conducted in respect of everyday memory abilities. Significant positive moderate correlations were found between relative ratings (objective assessment) of the patient's everyday memory abilities and his mood (r = 0.68; $p < 0.00$). Significant positive moderate correlations were also obtained between subjective assessment (S) of memory abilities in everyday life and self-rated (S) mood (r = 0.58; $p < 0.00$).

Insight into select cognitive abilities and memory

The level of insight into select cognitive abilities (calculated on the basis of Subjective Evaluation of Memory task and RAVLT's first task) moderately correlated with the short-term memory index (r = -0.49; p = 0.002). The lower the results that patients obtained in the short-term memory test, the more they overestimated their memory abilities. The everyday memory skills reported by relatives did not correlate with the level of patients' insight into their cognitive abilities (r = 0.21; n.s.).

Further analyses dealt with two groups of stroke patients representing different insight into their short-term memory abilities: patients with adequate (AC) and those with inadequate (IC) insight.

Comparison of patients with adequate and inadequate insight

Patients with inadequate insight and those with adequate insight were investigated according to their short-term memory, everyday memory skills and mood. A Student's t-test for independent samples was used to compare these two stroke patient groups. In comparison to participants with adequate insight into cognitive abilities (AC), patients with inadequate insight (IC) manifested significantly lower results in RAVLT's first task ($t = 2.98$; $p = 0.005$), and were described by their relatives as revealing poorer abilities in everyday memory functioning ($t = -2.43$; $p = 0.02$). The groups did not show the significant differences in mood reported by the relatives ($t = -1.59$; n.s.; see Table 1).

Table 1. Comparison of short-term memory (RAVLT first task), everyday memory abilities (BExME in objective [O] evaluation), and mood (BExMO in objective [O] evaluation) between AC and IC groups

	AC (n=22)		IC (n=17)		t-Student
	M	S	M	S	
RAVLT first task	5.6	2.3	3.9	1.1	2.98 ($p = 0.005$)
BExME (O)	25.0	6.4	30.6	7.9	-2.43 ($p = 0.02$)
BExMO (O)	27.5	4.7	30.9	7.8	-1.59 ($p = 0.123$)

Intragroup differences between objective and subjective evaluations

The last step was to determine if patients with inadequate insight into short-term memory manifested adequate insight into their everyday memory abilities or mood. Subjective and objective valuations of everyday memory skills and mood

were compared. In the (IC) group no significant differences between subjective and objective valuation of everyday memory skills were found (t = -0.54; n.s.). There were also no significant differences between objective and subjective evaluation of mood (t = -0.93; n.s.; see Table 2). Similarly, in the AC group no significant differences were found (compare Table 2).

Table 2. Differences between subjective and objective valuations of everyday memory kills (BEx ME) and mood (BEx MO) in the AC and IC groups

Compared indexes	IC (n=17)		t-Student	AC (n=22)		t-Student
	M	S		*M*	S	
BExME (O) BExME (S)	30.6 29.5	7.9 8.9	-0.54 (p = 0.59)	25.0 28.1	6.4 7.9	1.55 (p = 0.14)
BExMO (O) BExMO (S)	30.9 29.5	7.8 6.8	-0.93 (p = 0.37)	27.5 27.9	4.7 7.1	0.32 (p = 0.75)

Conclusions

Patients after stroke often manifest memory problems in their everyday life activities, but neuropsychological tests sometimes fail to detect consistent deficits. Studies have sought to identify an association between memory measured with standard tests and everyday memory abilities, but with conflicting results. Previous research has either demonstrated moderate associations, or no such relationship (Piazzini et al., 2001; Clarnette et al., 2001; Riedel-Heller et al., 1999; Au et al., 2006; Hall, Isaac, & Harris, 2009; Rayner, Wrench, & Wilson, 2010). Our present study highlights that when evaluated objectively, short-term memory is not related to memory skills in everyday life. This means that these aspects of memory are relatively independent; thus laboratory tests like RAVLT may be poor indicators of everyday memory problems; for example, patients getting better in short-term memory tests may show persistent problems in their everyday lives (Garcia et al., 1998; Hall, Isaac, & Harris, 2009). Limited sensitivity of formal memory tests to patients' memory problems experienced in natural life activity proves low ecological value of the methods. The questionnaire method based on the observation of patients' daily behaviour seems to meet

ecological criteria far better than memory tests do. Spared skills and abilities like executive functions, reasoning, shifting attitude, and attention contribute to more successive everyday complex task performances in spite of memory deficits. Emotional attitude and motivation in purposeful and meaningful activity derived from personal interests influence the efficacy of everyday memory activity and have an impact on better adjustment. The important finding relating emotional state and memory was that mood regarded as an emotional state connected with the experience of illness was interrelated to everyday life memory abilities estimated both by patients and by their relatives. The better that mood is evaluated, the greater will be the memory abilities recognized by patients and their relatives. Abdulrab and Reinhard (2008) underline that further research is needed to identify memory aspects that are connected to emotional dysfunction. Our findings have clearly indicated that affective states play an important role in determining patient memory in natural circumstances. In contradistinction to everyday memory, short-term memory is not associated with mood, as evaluated by patients as well as by their relatives in all tested stroke subjects. This finding suggests that objective short-term memory performance may be less sensitive to patients' affective conditions as reported by themselves, than to everyday memory difficulties reported by patients.

The study revealed that the level of insight into one's own short-term memory abilities is an important stroke patient characteristic. The lower level of the insight, the worse is the patient's short-term memory. Low short-term memory and limited everyday life memory skills seem to be distinctive features of patients with inadequate insight into their cognitive abilities. The short-term memory deficit may be considered as a direct symptom of brain damage, but poor everyday memory skills probably are secondary consequences of brain dysfunction. Memory abilities in complex life situations are mediated by different cognitive and emotional functions; for example, declining executive functions, short-term memory deficits, or low mood may disturb everyday memory task performance. Certain aspects of memory appear necessary to process conscious information (Damasio, 1996), which was confirmed in our research by poor short-term memory abilities coexisting with disturbed insight and by reciprocal relationships between these processes. Limited insight into one's own abilities is not a unique phenomenon and may occur independently in relation to varied spheres of functioning. The study showed that limited insight into short-term memory co-occurred with full insight into mood. What is more, it revealed that the level of insight into memory was differentiated in relation to the memory aspects: limited insight into short-term memory went together with adequate insight into everyday memory abilities.

Encapsulating, the present study has the following methodological and clinical applications:

- questionnaires are useful tools for evaluating subjective aspects of a patient's functioning; nevertheless they should be completed not only by the patient but by significant others as well;
- the clinical use of questionnaires, completed by both patients and relatives, must be considered with care (compare also Garcia et al., 1998; Hall, Isaac & Harris, 2009);
- questionnaires are recommended not to be used as the sole instruments of evaluation of everyday memory and emotional state; they cannot be treated as a substitute for direct observation;
- assessing everyday memory abilities seems to be a necessary component of neuropsychological evaluation;
- it is worth considering the effects of both the affective state in interpreting memory self-reports and the level of insight into short-term memory in providing data for developing neuropsychological counseling and rehabilitation;
- memory self-evaluation is influenced by a larger spectrum of subjective factors than just formal tests.

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