Short Communication

Continuous Performance Test in Iranian Patients Undergoing Hemodialysis

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Objective: Memory and concentration may be affected by hemodialysis in end-stage renal disease. In this study, changes in cognitive function parameters such as attention, impulsiveness, and reaction time were measured and evaluated in the Iranian hemodialysing patients.
Methods: In this analytic observational study, cognitive function of 38 hemodialysis patients was measured before and after hemodialysis sessions using Conners' continuous performance test.
Results: Mean age of patients was 37.97 ± 12.58 years. There wasn't any significant difference between numbers of matches successfully recognized, number of Miss Faire and mean of reaction time of those matches successfully recognized before and after hemodialysis. There weren't any differences between history of hemodialysis and number of matches successfully, matches missed and mean reaction time of matches. Educational level of patients was significant effect on number of Miss Faire during hemodialysis.
Conclusions: It has been concluded that hemodialysis did not have any significant impact on the cognitive function. However, this hypothesis needs to be checked and confirmed by careful selection of patients and other cognitive function tests.
Keywords: *Memory, Hemodialysis, Cognitive function*

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Old age , prevalence of stroke and cardiovascular risk factors in hemodialysis patients have put these patients in a high risk group for cognitive impairment (1). Memory and concentration abnormalities are one of the most frequent symptoms among those suffering from end-stage renal disease (ESRD) who undergo hemodialysis (2). In these patients, recall ability reduced with age increases; and this has a positive relationship with the patients' level of education. Educational information received by the patients during hemodialysis, was related to their age and educational level (3). Previous researches have shown that dialysis improves cognitive functioning in hemodialysis patients through improvement in their anemia. Improvements in cognitive performance may lead to improved levels of self-care and adherence with treatment (4).

Borgas et al reported that the Continuous Performance Test (CPT) has been used for the last 40 years to measure sustained attention or vigilance in many different populations.

Different versions of the test have been developed and are correlated with each other at a level consistent with construct validity (5), Continuous Performance Test was used in several studies for evaluation of psychological conditions (6-8). There are several ideas about the effects of hemodialysis on cognitive function in ESRD patients.

Fazekas believed that cerebral damage has a high rate in patients undergoing chronic hemodialysis. In ESRD patients, brain degeneration most likely has a toxic-metabolic etiology which is associated with severe cognitive impairment of these patients (9). Altmann declared that cognitive function deteriorates in hemodialysis patients (10). Some researchers such as Vasil'eva believed that intellectual and memory function remains unaffected in Hemodialyzed patients (11). Other researchers have observed several cognitional changes in these patients. Murray noted that further studies are needed to determine whether dialysis exacerbates the cognitive impairment attributable to the underlying disease. Cognitive testing in hemodialysis patients prior to dialysis initiation and periodically may be warranted (1). According to the mentioned data, in the present study, we decided to evaluate changes in attention, impulsiveness, and reaction time in the Iranian hemodialysing patients.

Materials and Method

Through an analytic observational study in the fall and winter of 2006, the cognitive function of 45 Iranian

hemodialysis patients were evaluated before and after hemodialysis, using Conners' Continuous Performance Test (CPT) at Hajar Hospital in the city of Sharekord.7 patients were excluded for not adjusting to test situation; thus, this study was performed on 38 patients. Chronic hemodialysing patients in Sharekord were included in the study. Furthermore, only the patients that were not susceptible to CPT test due to sever medical or psychological conditions were excluded. CPT was performed on the patients 15 minutes prior to the start of hemodialysing.

In this test, the program achieves visual CPT by showing sequence symbols which represent a card, trial was completed, the resulting data was sent to a data file and the name of the user/patient would then be specified.

selected as either being of diamonds or clubs, and as having a value of 1 to 9. A card was displayed as simply a number next to the appropriate card symbol. At certain points along the sequence where one card was identical to its predecessor, the matches occurred. The patients had to spot these matches, and respond by pressing the space bar button on the keyboard when they saw the second card. The reaction times were recorded for successful recognitions, and the number of miss fires and matches missed were counted. Once the trial was completed, the resulting data was sent to a data file and the name of the user/patient would then be specified.

The number of matches occurring in the sequence was precisely determined from the program parameters and could be changed if required. The program guaranteed the exact number of the matches and also ensured that no groups of three identical cards appear together. When the patient hit the space bar button on the keyboard, a result was recorded for the card: i.e., either the reaction time was recorded (for a match), or a miss fire total was incremented (if not matched). This could only occur once per card, so if the patient hit the fire button repeat ably, the appropriate record was made only on the first time the button was hit, all others were ignored until the next card appeared. An acceptable response was made any time that the matching card appeared at the point which the next card emerged. The patients had to recall the target sign that was shown among several signs and to press the key in their hands. The main variables in this study were the number of matches successfully recognised, the number of missed fires during the trial and the mean reaction time of the matches successfully recognised and missed fire objects.

Duration of each stimulus was 1 second and the duration between each stimulus was 1.5 seconds. CPT was performed in 5 minutes for each patient after 3 minutes test presentation for adoption of the patients with the test. Other information such as demographic data, duration of hemodialysis, education, occupation, and etc were obtained from the designed questionnaire. In this study, the relationship between the main variables and other variables were analyzed. The data was entered in SPSS software and was analyzed by student t-test and chi square statistical tests. All significances less than 0.05 were assumed as significant. This study was approved by ethical committee of Sharekord medical university.

Results

Demographic variables

Overall, 37 patients (97.4%) had a high school diploma or held a lower educational level and only one patient had a higher educational level than a high school diploma.. The mean age of the patients was 37.97 ± 12.58 years. Among the subjects, 24 (63.2%) were married and 22 (57.9%) lived in villages.

Evaluation of CPT variables

In this study, cognitive function of 38 hemodialysis patients was evaluated using Conners' Continuous Performance Test before and after hemodialysis. The mean number of matches successfully recognized was 37.58 ± 160.22; the mean number of missed fires during the trial was 39.82 ± 160.52 and the mean of reaction time of the matches successfully recognized was 27.08 ± 161.93 seconds before and 27.05 ± 161.93 seconds after hemodialysis. According to the result of Paired sample t-test, no significant difference was observed between the number of matches successfully recognized before and after hemodialysis. (P-value = 0.096)

The mean of the number of missed fires before and after hemodialysis was 39.82 ± 160.52 seconds and 38.63 ± 160.86 seconds respectively. No significant difference was found between the number of Miss Faire before and after hemodialysis. (P-value = 0.49) No significant difference was observed between the mean of reaction time of the matches successfully recognized before and after hemodialysis. (P-value = 0.35) No differences were observed between the history of hemodialysis and the number successful matches, the matches missed and the mean reaction time of the matches. (P-value > 0.05)

Discussion

In this study, Cognitive function of 38 hemodialysis patients was evaluated using Conners' Continuous Performance test (CPT). Several groups investigated the effects of hemodialysis on cognitive functions.

Table 1. Mean and standard deviation of number of matches successfully recognized or missed and mean reaction time of matches according to duration of renal disease

Duration	Less than 6 months			6 – 12 months			12 – 24 months			More than 24 months			Total		
	N	mean	S.D	N	mean	S.D	N	mean	S.D	N	mean	S.D	N	mean	S.D
number of matches successfully recognised	4	13.75	0.50	6	13.67	0.82	8	12.13	2.30	18	66.72	232.68	36	39.86	164.44
number of matches missed during trial	4	1.25	0.50	6	3	4	8	2.87	2.30	18	58.44	234.75	36	30.50	30.50
mean reaction time of those matches successfully recognised	4	0.69	17	6	0.90	0.50	8	0.75	0.14	18	56.23	235.28	36	28.51	166.37

Table 2. Mean and standard deviation of number of matches successfully recognized or missed and mean reaction time of matches according to age of patients

Age	Less than 30 years old			30 – 50 years old			More than 50 years old			Total		
	N	mean	S.D	N	mean	S.D	N	mean	S.D	N	mean	S.D
number of matches successfully recognized	12	12.17	3.07	17	12.24	2.99	9	122.11	328.84	38	38.24	160.09
number of matches missed during trial	12	3.67	3.80	17	2.76	2.99	9	113.22	332.17	38	29.21	161.60
mean reaction time of those matches successfully recognised	12	0.88	0.47	17	0.71	0.13	9	111.67	332.75	38	27.05	161.93

We did not find any significant differences between the cognitive functions before and after hemodialysis.

Ratner, D.P advocated that despite the significant daily changes in the serum levels of toxic substances retained in uremia, there was little or no evidence to suggest that well-dialyzed patients undergo daily fluctuations in their cognitive functioning (12). Smith, B.C in his study suggests that renal patients may have decreased cognitive functioning during the hemodialysis treatment (13). Intelligence in hemodialysis patients remains unaffected and there are no dialysis-related dementia, recent memory and attention deterioration. Psychic adaptation to chronic hemodialysis proved unrelated to mental capacity (11).

Renal patients may have decreased cognitive functioning during the hemodialysis treatment. The dialysis period may not be the best time to teach the patients though a convenient and popular time for their education (13). But Altmann, P in his research believed that cognitive function deteriorates in hemodialysis patients (10).

Murray, A.M advocated that severe cognitive impairment is common and undiagnosed in hemodialysis patients. He mentioned that further studies are needed to determine whether dialysis exacerbates the cognitive impairment attributable to underlying disease. Cognitive testing in hemodialysis patients before dialysis initiation and periodically may be warranted (1). Singh, N.P in his research indicated that administration of recombinant human erythropoietin (EPO) in patients of anemia with Chronic renal disease resulted in a significant improvement in the electrophysiological markers of cognitive function (14).

Kurella, M believed that dementia is associated with adverse outcomes among end stage renal disease patients. Dialysis providers should consider instituting routine screening for cognitive impairment among elderly patients in order to identify those at risk for associated adverse outcomes (15). Short daily hemodialysis has no clear effects on cognitive function (16). Tyrrell, J recommended that regular assessments of cognitive ability and quality of life (17).

Conclusion

According to the aforementioned researches performed for evaluation of cognitive functions in hemodialysis patients, we need to assess the Iranian patients because of the differences in their background and cognitive abilities. It has been concluded from our results that hemodialysis did not have any significant impact on the cognitive function. Nevertheless, this hypothesis must be checked and confirmed by other cognitive function tests and careful selection of patients.

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