

**Cognitive Impairment among Hemodialysis Patients: A Moroccan Study**B.A, Chouhani<sup>\*1</sup>, S Lamrani<sup>1</sup>, N. Ech chouiyeck<sup>1</sup>, F.Diallo<sup>1</sup>, A Chrifi Alaoui<sup>1</sup>, C.Elmaaroufi<sup>2</sup>, N. Kabbali<sup>1</sup>, C. Nejjar<sup>3</sup>, M Er rassfa<sup>3</sup>, T. Sqalli<sup>4</sup><sup>1</sup>MD Resident in Nephrology Hospital University Fes, Fez, Morocco<sup>2</sup>MD Nephrologist at Elghassani Hospital, Fez, Morocco<sup>3</sup>MD, PHD Epidemiology University Hospital Fes, Fez, Morocco<sup>4</sup>MD, PHD nephrologist university hospital Fes, Fez, Morocco**Original Research Article****\*Corresponding author**

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**Article History**

Received: 17.04.2017

Accepted: 27.04.2017

Published: 30.09.2018

**DOI:**

10.21276/sjpm.2018.3.9.5



**Abstract:** In Morocco, the number of people aged 60 and over has increased. This draws attention to conditions whose prevalence increases with age including chronic kidney failure and dementia. This population appears to have a higher risk of cognitive impairment. The aim of our study is to determine the prevalence of cognitive disorders in our dialyzed patients, to define the types of this decline and identify the factors associated with cognitive decline. Observational, cross-sectional study of 116 patients taking hemodialysis from El Ghassani hemodialysis center in Fez. We used the Montreal cognitive assessment test before the hemodialysis session, A Moca  $\leq 24/30$  indicate the presence of cognitive impairment. The Moca was abnormal in 70% of our patients. The average score was lower for women. The areas most affected were attention and short-term memory. We found a strong correlation between the decrease in the Moca score and the progression in age ( $p < 0.001$ ). Hypertension was correlated with a Moca score with an average score in the hypertensive population of  $20 \pm 5.4$  ( $p < 0.006$ ). The relationship between cardiac disease and Moca was significant with an average score in patients with heart disease of 19 ( $p < 0.01$ ). Taking an erythropoiesis-stimulating agents were linked to the Moca test ( $p < 0.05$ ). The number of sessions per week was significantly correlated with Moca ( $r: 0.25, p < 0.005$ ). Albumin and hemoglobinemia were correlated with the Moca score ( $r: 0.2, p < 0.027$ ) and ( $r: 0.2, p < 0.02$ ) respectively.

**Keywords:** Cognitive impairment, Hemodialysis, Moca, age, albuminemia, hemoglobin.

**INTRODUCTION**

In Morocco, the number of people aged 60 and over rose from 833,000 to 2.4 million between 1960 and 2010, an annual increase of 2.3% [1]. This growth draws attention to conditions whose prevalence increases with age including chronic kidney failure and dementia.

Self-management of the patient on dialysis requires some vigilance on his part; multiple intakes and dietary prescriptions sometimes complex can be difficult to manage especially with cognitive decline. Patients with chronic renal failure appear to have a higher risk of cognitive impairment. Thus, 28.9% [2] to 80% [3] of dialysis patients develop a cognitive disorder. Several studies have attempted to explain the mechanisms involved, and have criminalized classic cardiovascular factors, the accumulation of uremic toxins, metabolic and endocrine complications associated with chronic renal failure, and the side effects associated with the dialysis technique including oxidative stress.

The diversity of cognitive impairments suggests that the tests used to monitor them are numerous. Indeed, the studies used a set of tests whose sensitivity and specificity especially in the dialysis and the renal insufficiency remains to be proved. MOCA and MMSE are the most widely used in hemodialysis with a higher sensitivity of MOCA for the detection of mild disorders. The management of these attacks remains complicated; Prevention with early diagnosis and improvement of the parameters in question remains the appropriate solution.

The aim of our study is to assess the prevalence and extent of cognitive impairment in our chronic hemodialysis population, to identify factors that may affect cognitive impairment in our patients and to specify areas of neurological impairment.

**MATERIALS AND METHODS****Type of study and population studied**

In this observational cross-sectional study, we included 120 hemodialysis patients from Elghassani center of hemodialysis in fez, between January 18 and February 09, 2017. We excluded any unwilling patient,

any patient under 18 years of age, with a psychiatric history, who presents an acute illness with need for hospitalization, any patient deaf-mute or blind.

**Ethical aspects**

Our study has obtained approval for the conduct of neuropsychological examinations issued by the university ethics committee of the university hospital. The test was administered after oral consent of our patients.

**Tools**

The clinical and biological features of the included patients were collected on a data sheet including age, sex, intellectual and occupational level, medical history including neurological or cardiovascular disease, dyslipidemia, Smoking, the presence of diabetes mellitus or high blood pressure, ongoing treatments, and the presence or absence of infection during the period of the test. Information on hemodialysis sessions including weekly dialysis duration, the time being in of hemodialysis, presence or absence of residual renal function have been gathered.

The neuropsychological evaluation test used was the Montreal Cognitive Assessment Test (MOCA) (Figure-1), available in classical Arabic and adapted for illiterate patients in dialectal Arabic by a neurology team experienced in neuropsychology.

The assessment of the disorders was carried out by a trained nephrologist with the help of a nurse. The test was performed a few hours before the hemodialysis session and lasted 10 to 15 minutes. The set of tests evaluates the executive functions, visuo-spatial capabilities, language, attention and orientation in 13 major questions. The total score is 30, the test being considered abnormal if the total score was less than or equal to 24.

We processed the data using the SPSS statistical software version 21.0. We used the Z-tests; T to compare two means, the Khi [2] test to compare the percentages, ANOVA (variants analysis) to compare several averages and the correlation for the quantitative variables.

التاريخ: تاريخ الولادة، التاريخ		الاسم: مستوى الدراسة، الجنس		التقييم المعرفي المتبع في مونتريال (MOCA) باللغة العربية	
علامات	ارسم ساعة حائط (الساعة العادية عشرة وعشر دقائق) (3 علامات)	ارسم المكعب	بصري فراغي / تنبؤي		
	الحيطة [ ] الأرقام [ ] العنابر [ ]	[ ]	[ ]		
علامات	التسمية		الذاكرة		
	[ ]	[ ]	[ ]	خادي نقولك 5 الكلمات، اسمع مزيان وقلنا لتسالي هاتدهم مورايا و حاول تفل عليهم الترتيب ما نابهمش. بعد الاختيار مرتين.	
علامات	الانتباه		الانتباه		
	عين حريز جامع ينعمان أزرق		خادي نقولك مجموعة من الأرقام خالص تسع مزيان و لغردهم: نفس الترتيب: 4 5 8 1 2     بالعكس تسال الترتيب اللي للقدم له: 2 4 7		
علامات	اللغة		اللغة		
	عيني حريز جامع ينعمان أزرق		خادي نقولك مجموعة من العروف: اتبه مزيان، خالص تقرب يدك فوق الطيلة لكل مرة تسع حرف الألف ٧ حركات (٥ كلمة الألفاء <= 2 ف ب ا س م ن ا ج ك ل ب ا ف ا ك د م ا ا ج ا م و ف ا ا ب		
علامات	التجريد		التجريد		
	عيني حريز جامع ينعمان أزرق		خادي نقولك 7 كلمات على نقولك اسم: 93 [ ] 86 [ ] 78 [ ] 72 [ ] 65 [ ] ٤ أو ٥ حركات مسموعة 3 علامات. 2 أو 3 كلمات مسموعة حركات مسموعة واحدة مسموعة. علامة. سطر حركات مسموعة ٧ علامة		
علامات	التذكير		التذكير		
	عيني حريز جامع ينعمان أزرق		خادي نقولك واحد العروف، و تحلب منك تعطيني آخر عدد من الكلمات اللي كتبتها بذلك العرف، بمنتك تعطيني جميع الكلمات، من غير أسماء العوم و الأسماء المشقة (مثلا) حرف الباء: حنك بقلة واحدة		
علامات	اختياري		اختياري		
	عيني حريز جامع ينعمان أزرق		خادي نقولك واحد العروف، و تحلب منك تعطيني آخر عدد من الكلمات اللي كتبتها بذلك العرف، بمنتك تعطيني جميع الكلمات، من غير أسماء العوم و الأسماء المشقة (مثلا) حرف الباء: حنك بقلة واحدة		
علامات	الاختبار		الاختبار		
	عيني حريز جامع ينعمان أزرق		خادي نقولك واحد العروف، و تحلب منك تعطيني آخر عدد من الكلمات اللي كتبتها بذلك العرف، بمنتك تعطيني جميع الكلمات، من غير أسماء العوم و الأسماء المشقة (مثلا) حرف الباء: حنك بقلة واحدة		
علامات	الاختبار		الاختبار		
	عيني حريز جامع ينعمان أزرق		خادي نقولك واحد العروف، و تحلب منك تعطيني آخر عدد من الكلمات اللي كتبتها بذلك العرف، بمنتك تعطيني جميع الكلمات، من غير أسماء العوم و الأسماء المشقة (مثلا) حرف الباء: حنك بقلة واحدة		

Fig-1: Adaptation of the Montreal Cognitive Assessment (MOCA) test to dialectal Arabic

**RESULTS AND DISCUSSION**

Out of 121 hemodialysis patients eligible for study, we were able to include 116 patients with an average age of  $50 \pm 15$  years and a sex ratio of 0.9. The average number of years spent on hemodialysis is  $9 \pm 5.8$  years. Participants in the study did not differ from those who refused to participate in terms of age, gender or level of education. Our patients had a low level of education (41% were illiterate or had courses against illiteracy, 29.3% stopped primary school, 16.3% reached middle school or high school, 12.9% Higher education). The other characteristics of our patients are summarized in Table-1.

The Moca test was abnormal in 70% of the hemodialysis patients, with an average score of  $22 \pm 5.13$ . We also observed that the average Moca score was lower in women, with an average of  $20 \pm 5.6$  and  $24 \pm 5.1$  men. We found a strong correlation between the decrease in the Moca score and the progression in age in quantitative descriptive analysis and in

correlation with ( $p < 0.001$ ). Hypertension was also correlated with a Moca score with an average score in the hypertensive population of  $20 \pm 5.4$  ( $p < 0.006$ ).

We noticed that there was a significant link between the initial nephropathy and the Moaca with an average score of 19, 5 in patients with vascular nephropathy and 23, 16 in patients with tubulo-interstitial nephropathy

The relationship between cardiac disease and Moca was significant with an average score in patients with heart disease of 19 ( $p < 0.01$ ). Albumin, hemoglobin and erythropoiesis-stimulating agents were linked to the Moca test with ( $p < 0.01$ ), ( $p < 0.04$ ) and ( $p < 0.05$ ), respectively. On the other hand, other parameters explored, including neuropathy, residual renal function, body mass index, parathyroid hormone, serum calcium, phosphoric acid, CRP were not significantly related to the Moca score.

**Table-1: Features of the studied population**

Studied parameters	Results
Age (Average in Years)	$49,7 \pm 15.22$
Male gender	47,4%
Educational level n (%)	
Illiteracy	48 (41,3%)
Primary school	34 (29,3%)
Middle and high school	19 (16,3%)
Higher education	15 (12,9%)
Hypertension history	65 (56%)
Diabetes mellitus history	21 (10%)
History of smoking	16 (13%)
History of heart disease	16 (13,7%)
History of neuropathy	7 (6%)
Time of being in hemodialysis (years)	$9 \pm 5.7$
Preserved residual renal function n (%)	13 (12%)
Biological data	
Pré dialysis uremia g/l	$1,15 \pm 0,39$
Hemoglobin g/dl	$9,8 \pm 2,03$
total Cholesterol g/l	$1,5 \pm 0,41$
Triglycerides g/l	$1,3 \pm 0,55$
LDLc g/l	$0,88 \pm 0,35$
HDLc g/l	$0,4 \pm 0,30$
Albumin g/l	$40 \pm 4,41$
Calcium mg/l	$95 \pm 8,7$
Phosphorus mg/l	$47 \pm 18,6$
Parathormon >1000 ng/l	33 (28, 4%)
C reactive protein mg/l	$7 \pm 6,5$
Statins	13 (11%)
Body mass index (kg/m <sup>2</sup> )	$22,9 \pm 4,17$
Current infection (%)	11 (9%)

The number of sessions per week was significantly correlated with Moca ( $r: 0.25$ ,  $p < 0.005$ ). Albumin and hemoglobinemia were also correlated with

the Moca score with ( $r: 0.2$ ,  $p < 0.027$ ) and ( $r: 0.2$ ,  $p < 0.02$ ) (Table-2).

Focusing on the domains affected by Moca, we observed a predominance of attention attainment (64%) and short-term memory (75.9%). Visuo-spatial and executive performances were affected only in 23%.

We observed a correlation between visuo spatial involvement and executive performance with

age and uremia, whereas attention Impairment was also related to the number of hours of hemodialysis. In linear regression, progression in age, number of hours of dialysis per week and hypoalbuminaemia were related to the decrease of the Moca test score.

**Table-2: Determinants factors of the Moca score**

	<b>r</b>	<b>r 2</b>	<b>p</b>
<b>Age (years)</b>	-0,52	-0.27	0.001
<b>Number of hours /week</b>	0,26	0.06	0.005
<b>Uremia (g/l)</b>	0.19	0.03	0.03
<b>Total Cholesterol (g/l)</b>	-	-	0.5
<b>Calcemia (mg/l)</b>	-	-	0.08
<b>Phosphorus (mg/l)</b>	-	-	0.6
<b>Albuminemia (g/l)</b>	0,20	0.04	0,027
<b>Parathormon (pg/ml)</b>	-	-	0.66
<b>Hemoglobin (g/dl)</b>	0.20	0.04	0,029
<b>CRP (mg/l)</b>	-	-	0.60
<b>BMI (kg/m²)</b>	-	-	0.14

From mild decline to dementia, cognitive disorders have been the subject of several studies in the renal impairment and particularly the dialysis. The diversity of cognitive impairments suggests that the tests used to monitor them are numerous. Indeed, the studies used a set of tests whose sensitivity and specificity especially in the dialysis and renal insufficiency remain at the slit. The Moca evaluation was recommended as an ideal screening tool for problems in hemodialysis patients with a sensitivity of 56 to 100% and specificity to be achieved by 87%. This test was developed on the basis of the clinical intuition of one of the authors (Ziad S. Nasreddine) concerning the areas of common impairment in mild cognitive disorders and better adapted to the screening test [4].

Our study confirmed the extent of cognitive impairment in our hemodialysis patients. It reaches 70% of the cases, which corresponds to the study of Tiffin Richards *et al.*, [3]. On the other hand, our population has a younger average age. Other studies have chosen Moca thresholds lower in a population with cerebrovascular disease [5]. Cognitive disorders were present only in 18.8% of hemodialysis patients in the Odagiri and al study among 154 patients tested with MMSE.

The predictive factors identified for cognitive impairment in our study were: a history of high blood pressure, smoking, initial nephropathy, hypoalbuminemia, hemoglobin and erythropoietin intake.

Our study showed a correlation between cognitive impairment and age progression, which has been demonstrated in most studies [3, 5, 6] with a predominance of dementia. Similarly, conventional

cardiovascular risk factors are associated with the development of cognitive impairment. Ischemic pathologies and vascular endothelial involvement appear to play the greatest role [7]. Our study showed that hypertension was associated with a Moca score, which corresponds to Iseki's study [8]. We did not find any significant relationship with diabetes, dyslipidemia or presence in the history of neuropathy.

Hypoalbuminaemia in our study was associated with cognitive decline. This could be explained by undernutrition, or albuminuria, which is also a factor independently associated with cognitive decline [9]. We did not find a study with the same results.

The hemoglobin level turned out to be correlated with the Moca score in our study; several hypotheses have been proposed to establish the link between cognitive impairment and anemia. It is thus known that the first cause of anemia in elderly patients suffering from chronic renal failure is a decrease in the secretion of erythropoietin. This factor should not be considered as the sole etiology of these disorders [10]. A decrease in hematocrit would reduce the oxygen supply to the brain and impair metabolism at this level [11]. However, the direct causal link between anemia and dementia has never been demonstrated [9]

The number of hours of dialysis per week was related to a low Moca score, which would probably be related to the accumulation of uremic toxins [9]. Furthermore, we did not find a correlation between the inflammatory state of the patients, evaluated by the CRP and the decrease of the Moca score, although it was reported that a high CRP would predict quarantine in the study of the "Honolulu Asia Aging study", the

development of dementia and Alzheimer's disease [12]. Increases in inflammatory cytokines such as IL-6 and homocysteine, prostaglandin D2 synthetase, contribute to the development of brain lesions [13, 14]. The cognitive deficit profile in our hemodialysis patient population showed a greater alteration in attention and short-term memory. The disorders affecting the executive and visuo-spatial capacities were less in our population, unlike the study by Tiffin Richards, where the latter were the most affected [5]. We observed a correlation between visual-spatial damage and executive performance with age and uremia. Attainment of attention was related to age, hemodialysis hours, and urea. There was a correlation between short-term memory score with age and urea rate.

### CONCLUSION

Altered cognitive abilities are common in hemodialysis, even at an early age. The medical, social and economic impact of these attacks is not negligible, hence the value of an early and systematic evaluation in this population.

The cognitive impairment of our population is correlated with age, the number of hours of dialysis per week and hypoalbuminemia. It predominated in the domain of attention and memory

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