

PHYSICAL ACTIVITY IN CHRONIC HEMODIALYSIS

Afaf Abouzoubair*, Loubna Benamar, Tarik Bouattar, Naima Ouzeddoune and Rabia Bayahia

Department of Nephrology-Dialysis and Kidney Transplantation, Ibn Sina University Hospital. Rabat. Morocco.

***Corresponding Author: Dr. Abouzoubair Afaf**

Department of Nephrology-Dialysis and kidney transplantation, Ibn Sina University Hospital, Rabat. Morocco.

Article Received on 02/04/2019

Article Revised on 23/04/2019

Article Accepted on 13/05/2019

SUMMARY

Introduction: Chronic hemodialysis patients often exhibit excessive asthenia, osteo-articular complications and muscle loss, leading to a significant limitation of their physical activity. It has been shown in this population, in numerous studies, that the risk of morbidity and mortality increases with sedentary lifestyle. The aim of our work is to evaluate physical activity in our chronic hemodialysis patients and to determine the risk factors associated with the absence of this activity. **Material and method:** We performed a multicenter cross-sectional study in November 2016, including 65 chronic hemodialysis patients from the Ibn Sina University Hospital Center and the Moulay Youssef Hospital that are both located in Rabat. To assess the physical activity of our patients, we used the Baecke questionnaire with three indices: work activity index, sport activity index and leisure activity index. In addition, we have gathered demographic, clinical and biological data parameters from patients' medical records in order to study the factors influencing this physical activity. **Results:** Our study included 65 chronic hemodialysis patients. The average age of our patients is 49.06 ± 11.81 years. We noticed a male predominance with a sex ratio of 35M/30F. More than half of our patients report no physical activity (58.5%). Concerning the professional activity, 75.4% of the patients have no professional activity. Only 29.2% of patients practice regular sports. All these three indices correspond to a very limited physical activity in the three aspects of our patients' daily life. The absence of physical activity is significantly correlated with the elderly, women and the age of dialysis. **Conclusion:** The integration of physical activity into the management of chronic hemodialysis patients has become paramount. All modalities will be effective, in group or individual, during or outside hemodialysis sessions. Physical activity in chronic hemodialysis patients is so low that the slightest increase is necessarily beneficial.

KEYWORDS: Physical activity, chronic renal insufficiency, hemodialysis, pain, cardiopathy, secondary hyperparathyroidism, quality of life.

INTRODUCTION

In Morocco, hemodialysis is the most frequent supplement to chronic End-Stage Renal Disease (ESRD), far outpacing peritoneal dialysis and even more renal transplantation. In fact, the incidence of ESRD is between 100 and 150 patients per million inhabitants, that is to say, more than 3000 Moroccans will annually reach the end of the Chronic Kidney Disease (CKD) and 8000 to 10000 patients are currently under renal supplementation therapy and more than 95% in conventional hemodialysis in more than 180 dialysis centers.^[1]

Hemodialysis has made it possible, especially with advances in technology, to improve the quality and life expectancy of patients with ESRD. Side effects are added to the ESRD and to hemodialysis and will inevitably affect this quality of life as well as morbidity and mortality.

It has been shown that lack of physical activity (PA) is a prognostic factor on the mortality of these patients. Conversely, the maintenance of a regular PA improves life expectancy, cardiovascular status, appetite, mood,

and many other parameters.

The aim of our work is to evaluate PA in our chronic hemodialysis patients and to determine the risk factors associated with the absence of this type of activity.

MATERIAL AND METHODS

We conducted a multicenter cross-sectional study, comprised of 65 chronic hemodialysis patients from the Ibn Sina University Hospital and the Moulay Youssef Hospital that are both located in Rabat.

To evaluate the PA of our patients, we used the Baecke questionnaire.^[2,3] It is a self-administered questionnaire, in the form of 16 questions analyzing 3 indices representative of the subject's usual physical activity: the index of work activity (IWA), the sports activity index (SAI) and the leisure activity index (LAI). Each question is scored on a scale of 1 to 5.

The finalization of the questionnaire involved several steps in order to adapt it to our Moroccan cultural

context. The adaptation methodology we have followed can be summarized as follows:

- Independent translations (from French to the Moroccan Dialect), prior to the synthesis translation which is carried out by a group of professionals representing different disciplines (Nephrologists, Psychosociologists, Teachers of French literature ... etc).
- Modification of the questionnaire according to the equivalence of the Arabic Dialect version with respect to the original questionnaire on one hand, and according to the remarks and incomprehension of the hemodialysis patients HD who participated in the pre-test on the other hand.
- Counter-translation into French. (Annex 1)

In cases where self-administration was not possible due to illiteracy, the questionnaire was administered by the medical staff during the hemodialysis sessions. Consent was obtained from all participants before the study started. In addition, demographic, clinical and biological data parameters were collected from patient medical records to investigate the factors influencing this PA. As demographic characteristics, we included age, gender, education, and occupation. Occupations were classified into three groups according to the intensity of the effort provided: low, medium and large effort.

Clinical features include initial nephropathy, medical and surgical history, comorbidities including arterial hypertension, diabetes, body mass index (BMI), cardiovascular disease, rheumatology and the various prescribed medicines.

For biological characteristics, we noted hemoglobin (anemia defined by a drop of hemoglobin below 11 g/dl),

ferritinemia, serum calcium, phosphatemia, parathormone, 25-hydroxy vitamin D, total alkaline phosphatases, lipid balance, and C-Reactive Protein (CRP).

Fore dialytic parameters, we noted the age of hemodialysis, the number of hours of hemodialysis per week, the quality of the purification evaluated by the Kt/V (K: dialyzer clearance of urea; t: dialysis time; V: volume of distribution of urea) and the PRU (Percent Reduction of Urea). For all our patients we use high-performance synthetic membranes, a bicarbonate buffer, a dialysate calcium of 1.5mmol/l, a dialysate potassium of 2meq/l and an isoglycemic dialysate (1g/l).

The statistical analysis was carried out by using SPSS software version 24.0. The quantitative variables are expressed as mean \pm SD (Standard Deviation) and qualitative variables as a percentage. A $p < 0.05$ value is considered significant.

RESULTS

Our study included 65 chronic hemodialysis patients. The average age of our patients is 49 ± 12 years. The majority of our patients are younger than 60 years of age (92.3%). We noted a male predominance with a sex ratio of 1.16. For the educational level, 27.7% of the patients are illiterate, 48.2% have a primary education level, 10.8% have a secondary education level and 12.3% have a university level. Causal nephropathy is unknown in 49.2% of cases, vascular in 9.2% of cases, diabetes in 6.2% of cases and glomerular in 29.2% of cases (Figure 1). Cardiac involvement such as hypertensive heart disease, dilated cardiomyopathy or ischemic heart disease is noted in 22 patients. Seven patients had a BMI of less than 18 kg/m^2 . More than 50% of patients have bone discomfort.

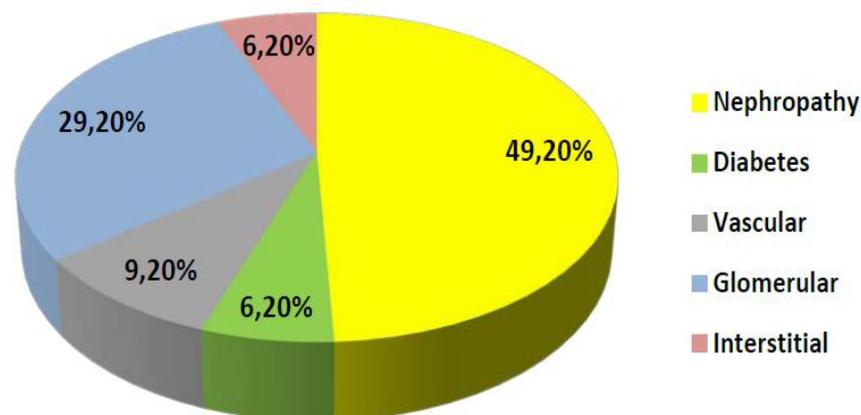


Figure 1: Causal nephropathy.

On the biological level, 44.61% of patients are anemic with an average hemoglobin of 10.2 g/dl and an average ferritin level of $212 \mu\text{g/l}$. Secondary hyperparathyroidism defined by a value greater than 9 times normal is noted in 35.38% of patients. One-third of these patients (31%) had a 7/8 parathyroidectomy. Table I summarizes the

various biological parameters.

Therapeutically, 83% of patients are treated with erythropoietin (EPO), 62% with injectable iron, 81% with calcium supplementation, 38% with phosphorus binders, and 79% with native vitamin D.

Table I: Biological parameters

Biological parameters	Mean +/- standard deviation
Hemoglobin (g/dl)	11± 3
Parathormone (PTH1-84) (pg/l)	539±423
Serum calcium (mg/l)	82,67±16,3
Phosphatemia (mg/l)	55,03±13,8
25-hydroxyvitamin D (ng/ml)	20,3±10, 3
Alcaline phosphatases (UI /l)	109±21
Cholesterol g/l	2,02±0,8
Triglycérides g/l	1,80 ± 0,5

Regarding PA, 38 patients (58.5%) reported no PA, three-quarters had no occupational activity (75.4%), and only 19 patients (29.2%) regularly practice a sport's activity.

The calculation of the 3 PA indices recorded by the Baecke questionnaire showed a very limited PA. In sports-active patients, the median sports activity index is 2.3. The median intensity is 1.3. The median duration is 2.5 hours per week and the median proportion is 0.67, which is 7 to 9 months per year. In occupationally active patients, the median labor force index is 2.6. The median

index of leisure activity is 2.2.

We have interpreted the absence of PA according to the different demographic, clinical and biological parameters (Table II). It was found that in univariate analysis, the absence of PA was significantly correlated with advanced age ($p<0,03$), female sex ($p<0,001$) and hemodialysis age ($p<0,03$). In contrast, there was no significant correlation between PA and cardiovascular disease or secondary hyperparathyroidism. In multivariate analysis, only the female sex persists as a risk factor with a p at 0.003.

Table II: Risk factors of the absence of physical activity.

Parameters	Univariate analysis			Multivariate analysis		
	P	Or	Ic	P	or	Ic
Age/year	0,031	1,05	[1,005-1,11]	0,08	1,04	[0,99-1,10]
Gender	<0,001	8,46	[2,6-27,53]	0,003	6,58	[1,92-2,58]
Education level	0,77	1,08	[0,63-1,84]			
Diabete	0,39	0,44	[0,069-2,86]			
cardiovascular pathology	0,54	1,38	[0,48-3,98]			
BMI<18 kg/m ²	0,46	1,89	[0,33-10,57]			
Hemodialysis age (year)	0,03	1,09	[1,008-1,18]	0,11	1,07	[0,98-1,14]
Hyperparathyroïdism	0,38	0,56	[0,15-2,05]			
Anemia	0,59	1,3	[0,48-3,54]			

DISCUSSION

The constraints of chronic dialysis are numerous and contribute to the reduction of patient's PA. This reduction is demonstrated in several studies that used either questionnaires or other tools such as a pedometer.^[4,5]

Per the DOPPS (Dialysis Outcomes and Practice Patterns Study), 60% of patients, in France, do less than one exercise per week. This inactivity increases the risk of mortality that is already considered high for these patients.^[1] The DMM2 (Dialysis Morbidity and Mortality Study Wave2) showed that out of 4024 dialysis patients, the risk of death at 1 year was 11% in the sedentary and 5% in the non-sedentary.^[2]

At the same time, the DOPPS study noted that PA is associated with a better quality of life but also a better prognosis in dialysis patients.

In our study, more than two-thirds of patients reported no PA or minimal PA requiring no effort. This decrease in PA in chronic hemodialysis and even in patients with

chronic renal insufficiency without dialysis is well established and several factors that we detail below are of cause.

The inactivity is due to the asthenia induced by the chronic kidney disease, to the side effects of the drugs and to the session of hemodialysis. After the session, recovery time is required, varying from one patient to another, influenced by several parameters such as age, duration of the session and interdialytic weight gain.

This inactivity is also favored by the comorbidities as well as by the duration of the hemodialysis session which is considered a dead time without even a minimal activity.

The prevalence of pain in hemodialysis varies between 60% and 70%.^[6,7] This pain may be due to vascular, digestive or neurological^[7] but mainly osteoarticular. Its impact on the quality of life is reflected in several studies.^[8] A study carried out by Bouattar et al in 2009 showed that in 2/3 of the patients, the pain was responsible for the discomfort of the PA.^[9]

Osteoarticular involvement often emerges as a factor responsible for chronic pain in the hemodialysis, which may be secondary to secondary hyperparathyroidism.^[10,7] Amyloid arthropathy has also been implicated as a risk factor.^[11]

On the muscular level, atrophy can be explained by several mechanisms, in particular, metabolic disorders and oxidative stress. Renal disease is associated primarily with increased protein loss due to synthetic impairment but also increased degradation.^[12,13] Chronic metabolic acidosis is known that it also contribute to this degradation^[12], which leads in an important way to the reduction of the muscular force and the capacity of regeneration.

Inactivity maintains and aggravates muscular atrophy. It is at the same time a cause and a consequence.

Inflammation, owing to chronic renal insufficiency and dialysis, limits PA. Chronic hemodialysis patients had an inverse correlation between thigh muscle mass and markers of inflammation, including CRP and interleukin-6.^[14] The impairment of renal function is closely related to the increase of inflammatory markers which leads to increased oxidative stress and decreased antioxidant defense.

Other factors may contribute to this inflammatory state, in particular infections, bio- films of catheters and circuits of treated water, bio-incompatibility of materials and dialysis solutions.^[15]

The degree of anemia in hemodialysis is associated with decreased aerobic and anaerobic exercise capacity.^[16] The increase in hemoglobin after EPO treatment was correlated with the improvement in aerobic performance.^[17] In our study, anemia did not emerge as a risk factor for non-activity.

All of these factors combine and significantly reduce the patient's PA. The absence of physical exercise is therefore considered to be a major factor leading to impaired physical fitness, reduced exercise capacity and also muscle loss.^[18]

Patients on hemodialysis are significantly less active than sedentary controls^[19] and their PA may decrease to 3.4% each month after dialysis begins.^[20] Stack et al., showed that the risk of mortality is higher in patients with moderate limitation of PA compared to those with no or minimal limitation. This risk is even lower in patients with regular activity.^[21]

The various studies carried out over the last thirty years on physical activity in patients with ESRD have proved two overall facts. On one hand, patients on hemodialysis are significantly less active and this decrease in physical activity is linked to a risk of mortality. On the other hand, they proved the advantages of a regular PA on the

improvement of the cardiac function^[22] and the decrease of the blood pressure.^[23]

Aerobic exercise has been proved to be effective in reducing levels of triglycerides and LDL (Low-Density Lipoproteins). It has also been proved to be effective in increasing HDL (High-Density Lipoprotein) levels and improving vascular stiffness, dialysis quality, appetite and the quality of life in general. Nevertheless, PA is not yet integrated into the management of chronic hemodialysis patients.

CONCLUSION

It is well established that lack of PA is a negative prognostic factor for hemodialysis survival. The integration of PA into the management of chronic hemodialysis patients has become paramount. Success requires patience, team support and motivation. All modalities will be effective, either as a group or as individuals, during or outside the hemodialysis sessions. Physical activity in hemodialysis patients is so low that the slightest increase is necessarily beneficial.

REFERENCES

1. Tentori F, Elder SJ, Thumma J, Pisoni RL, Bommer J, Fissell RB, et al. Physical exercise among participants in the Dialysis Outcomes and Practice Patterns Study (DOPPS): correlates and associated outcomes. *Nephrol Dial Transplant*, 2010 Sep; 25(9): 3050–3062.
2. Zamojska S, Szklarek M, Niewodniczy M, Nowicki M. Correlates of habitual physical activity in chronic haemodialysis patients. *Nephrol Dial Transplant*, 2006 May; 21(5): 1323–1327.
3. O'Hare AM, Tawney K, Bacchetti P, Johansen KL. Decreased survival among sedentary patients undergoing dialysis: results from the dialysis morbidity and mortality study wave 2. *Am J Kidney Dis.*, 2003; 41: 447–454.
4. Poux JM, Lagarde C, Peyronet P, Boudet R, Gontier Y, Benevent D. La douleur en hémodialyse : résultat d'une enquête prospective chez 172 patients utilisant un questionnaire multidimensionnel d'auto-évaluation. *Nephrol Ther.*, 2005; 1: S77–137.
5. R. El Harraqui, N. Abda, Y. Bentata, I. Haddiya. Évaluation et analyse de la douleur en hémodialyse chronique. *Nephrol Ther.*, 2014 Dec; S 500- 506.
6. Nasr M, Hadj Ammar M, Khammouma S et al. Haemodialysis and its impact on the quality of life. *Nephrol Ther*, 2008 Feb; 4(1): 21-7.
7. Bouattar T, Skalli Z, Rhou H, Ezzaitouni F et al. The evaluation and analysis of chronic pain in chronic hemodialysis patients. *Nephrol Ther.*, 2009 Dec; 5(7): 637-41.
8. Stenvinkel P, Barany P, Chung SH, Lindholm B, Heimbürger O. A comparative analysis of nutritional parameters as predictors of out-come in male and female ESRD patients. *Nephrol Dial Transplant*, 2002; 17: 1266–1274.
9. Sakkas GK, Ball D, Mercer TH, Sargeant AJ,

- Tolfrey K, Naish PF. Atrophy of non-loco- motor muscle in patients with end-stage renal failure. *Nephrol Dial Transplant*, 2003; 18: 2074–2081.
10. Adey D, Kumar R, McCarthy JT, Nair KS. Reduced synthesis of muscle proteins in chronic renal failure. *Am J Physiol Endocrinol Metab*, 2000; 278: 219–225.
 11. Graham KA, Reaich D, Channon SM, Downie S, Goodship TH. Correction of acidosis in hemodialysis decreases whole-body pro-teiin degradation. *J Am Soc Nephrol*, 1997; 8: 632–637.
 12. Kaizu Y, Ohkawa S, Odamaki M: Association between inflammatory mediators and muscle mass in long-term hemodialysis patients. *Am J Kidney Dis.*, 2003; 42: 295–302.
 13. Rieu P. End stage renal failure is a chronic inflammatory disease. *Nephrologie*, 2003; 24(7): 329-33.
 14. Mayer G, Thum J, Graf H: Anaemia and reduced exercise capacity in patients on chronic haemodialysis. *Clin Sci (Lond)*, 1989; 76: 265–268.
 15. Painter P, Moore GE. The impact of recombinant human erythropoietin on exercise capacity in hemodialysis patients. *Adv Ren Replace Ther.*, 1994; 1: 55–65.
 16. Tawney KW, Tawney PJ, Kovach J. Disablement and rehabilitation in end-stage renal disease. *Semin Dial.*, 2003; 16: 447–452.
 17. Johansen KL, Chertow GM, Ng AV. Physical activity levels in patients on hemodialysis and healthy sedentary controls. *Kidney Int.*, 2000; 57: 2564–2570.
 18. Johansen KL, Kaysen GA, Young BS, Hung AM, da Silva M, Chertow GM. Longitudinal study of nutritional status, body composition, and physical function in hemodialysis patients. *Am J Clin Nutr.*, 2003; 77: 842–846.
 19. Stack AG, Molony DA, Rives T, Tyson J, Murthy BV. Association of physical activity with mortality in the US dialysis population. *Am J Kidney Dis.*, 2005; 45: 690–701.
 20. Deligiannis A, Kouidi E, Tassoulas E, Gigis P, Tourkantonis A, Coats A. Cardiac effects of exercise rehabilitation in hemodialysis patients. *Int J Cardiol*, 1999; 70: 253–266.
 21. Anderson JE, Boivin MR Jr, Hatchett L. Effect of exercise training on interdialytic ambulatory and treatment-related blood pressure in hemodialysis patients. *Ren Fail*, 2004; 26: 539–544.