

Active Smoking is Associated with Lower Dialysis Adequacy in Prevalent Dialysis Patients

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Abstract

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BACKGROUND: Dialysis adequacy measured by single pool Kt/V (spKt/V) lower than 1.2 or urea reduction rate (URR) lower than 65% is associated with a significant increase in patient mortality rate. Patients' adherence to the medical treatment is crucial to achieve recommended targets for spKt/V. Smoking is a recognized factor of non-adherence.

AIM: In this study we sought to assess the association of active smoking and dialysis adequacy.

METHODS: A total of 134 prevalent dialysis patients from one dialysis center were included in an observational cross-sectional study. Clinical, laboratory and dialysis data were obtained from medical charts in previous 6 months. The number of missed, on purpose interrupted or prematurely terminated dialysis sessions was obtained. Dialysis adequacy was calculated as spKt/V and URR. Patients were questioned about current active smoking status. T-test and Chi-Square test were used for comparative analysis of dialysis adequacy with regard to smoking status.

RESULTS: The majority of patients declared a non-smoking status (100 (75%)) and 34 (25%) were active smokers. Male gender, younger age and shorter dialysis vintage were significantly more often present in the active smokers (9 (26%) vs 25 (73%), $p = 0.028$; 57.26 ± 12.59 vs 50.15 ± 14.10 , $p = 0.012$; 118.59 ± 76.25 vs 88.82 ± 57.63 , $p = 0.030$), respectively. spKt/V and URR were significantly lower and Kt/V target was less frequently achieved in smokers (1.46 ± 0.19 vs 1.30 ± 0.021 , $p = 0.019$; 67.14 ± 5.86 vs 63.64 ± 8.30 , $p = 0.002$; 14 (14%) vs 11 (32%), $p = 0.023$), respectively. Shorter dialysis sessions, larger ultra filtrations and higher percentage of missed/interrupted dialysis session on patients' demand were observed in smokers (4.15 ± 0.30 vs 4.05 ± 0.17 , $p = 0.019$; 3.10 ± 0.78 vs 3.54 ± 0.92 , $p = 0.017$; 25 (0.3%) vs 48 (1.8%), $p = 0.031$), respectively.

CONCLUSION: Active smokers, especially younger men, achieve lower than the recommended levels for dialysis adequacy. Non-adherence to treatment prescription in smokers is a problem to be solved. Novel studies are recommended in patients on dialysis, to further elucidate the association of dialysis adequacy with the active smoking status.

Introduction

Dialysis adequacy measured by single pool Kt/V (spKt/V) lower than 1.2 or urea reduction rate (URR) lower than 65% is associated with a significant increase in patient mortality rate [1], [2]. Duration of dialysis session [2], [3], blood flow [4], [5], adequate vascular access [6] and dialyzer membrane surface [3] influence dialysis adequacy. Patients adherence to the medical treatment is crucial to achieve recommended targets for spKt/V [7], [8]. Smoking is a

recognized factor of non-adherence, and it is associated with chronic kidney disease [9], [10]. Patients on chronic dialysis are burdened not only by the disease itself, but also by the treatment regime, dialysis prescription and many diet restraints. Non-compliance is well known among dialysis patients, affecting their dialysis adequacy [11], [12]. Recent studies recognize smoking as a hazard for morbidity and mortality in dialysis patients [13], [14]. In this study we sought to assess the association of active smoking and dialysis adequacy.

Material and Methods

A total of 134 prevalent dialysis patients from one dialysis center were included in an observational cross-sectional study. Dialysis duration was prescribed for 4-5 hours, three times per week. Low flux dialyzers with membrane surfaces from 1.3 to 1.8 m² were used. Dialysis vintage of less than 9 months, twice a week dialysis prescription and significant residual renal function were exclusion criteria. Clinical, laboratory and dialysis data were obtained from medical charts for the previous 6 months. Number of missed or on purpose interrupted/prematurely terminated dialysis sessions was noted. Dialysis adequacy was calculated as spKt/V and URR. Patients were questioned about their current active smoking status. T-test and Chi-Square test were used for comparative analysis of dialysis adequacy with regard to smoking status.

Results

Sociodemographic, clinical and laboratory data are shown in Table 1. The mean age of study participants was over 55 years, 57% were men and the dialysis vintage was 111.034 months. Diabetes was present in 18% of the patients and 25% were active smokers. Anemia was managed to mean level of hemoglobin 116.36 ± 8.45 g/L. The mean albumin level was 38 g/L, CRP was 7.06 g/L and BMI 23.74 Kg/m².

Table 1: Sociodemographic, clinical and laboratory data of the study population

	Mean ± SD
N = 134	
Age (years)	55.45 ± 13.33
Dialysis vintage (months)	111.034 ± 72.95
Men (%)	76 (57%)
Diabetes (%)	24 (18%)
Active smokers (%)	34 (25%)
Hemoglobin (g/L)	116.36 ± 8.45
Albumin (g/L)	38.45 ± 2.54
C-reactive protein (mg/L)	7.06 ± 8.71
Body Mass Index (kg/m ²)	23.74 ± 4.6

Dialysis variables are shown in Table 2. The mean dialysis adequacy measurements spKt/V and URR were in recommended target ranges: 1.38 ± 0.20 and 66.27 ± 6.7%, respectively. The mean dialysis session time was 4.08 hours, while the mean ultrafiltration volume per dialysis session was 3.22 litres.

Table 2: Dialysis variables

	Mean ± SD (%)
N = 134	
Catheter as vascular access	5 (4%)
Kt/V	1.38 ± 0.20
URR (%)	66.27 ± 6.7
Dialysis session time (hours)	4.08 ± 0.21
Ultrafiltration (L)	3.22 ± 0.84

The comparative analysis between patients with regard to smoking status is presented in Table 3.

Table 3: Comparative analysis between patients regarding smoking status

variable	Non Smokers N = 100	Active smokers N = 34	p
Men	9 (26%)	25 (73%)	0.028
Diabetes	15(63%)	9 (37%)	0.194
Catheter	5 (5%)	0 (0%)	0.329
Age (years)	57.26 ± 12.59	50.15 ± 14.10	0.012
Vintage (months)	118.59 ± 76.25	88.82 ± 57.63	0.030
Albumin (g/L)	38.66 ± 2.54	39.40 ± 2.54	0.156
Hb (g/L)	116.63 ± 8.89	115.57 ± 7.03	0.487
CRP (mg/L)	6.87 ± 7.54	7.62 ± 11.56	0.669*
BMI (Kg/m ²)	23.74 ± 4.7	23.77 ± 4.33	0.966
Kt/V	1.46 ± 0.19	1.30 ± 0.021	0.019
Kt/V < 1.2	14 (14%)	11 (32%)	0.023
Time (hours)	4.15 ± 0.30	4.05 ± 0.17	0.019
URR (%)	67.14 ± 5.86	63.64 ± 8.30	0.002
UF (L)	3.10 ± 0.78	3.54 ± 0.92	0.017

* non-parametric test was applied.

Out of 58 women, 9 (15%) were active smokers and out of 76 men, 25 (33%) were active smokers. Men had 1.26 higher odds to be smokers (OR 1.26 95% CI: 1.229-2.516), p = 0.028 (Figure 1).

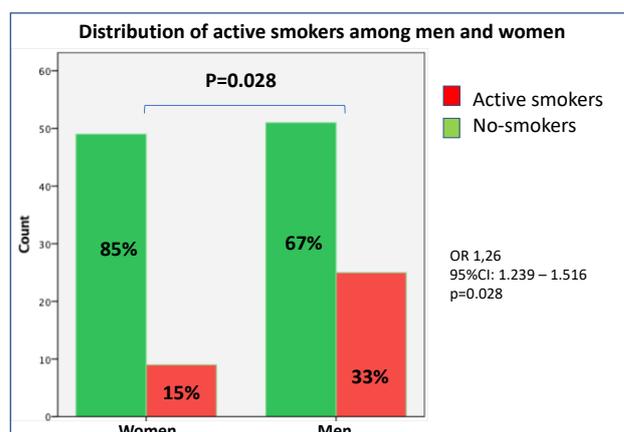


Figure 1: Distribution of gender and smoking habits

Non-smokers were significantly longer time on dialysis (118.59 ± 76.25 vs. 88.82 ± 57.63, p = 0.030, respectively). The mean age of patients who smoked was 50.15 and of non-smokers 57.26 years and this difference was significant, as shown in Figure 2.

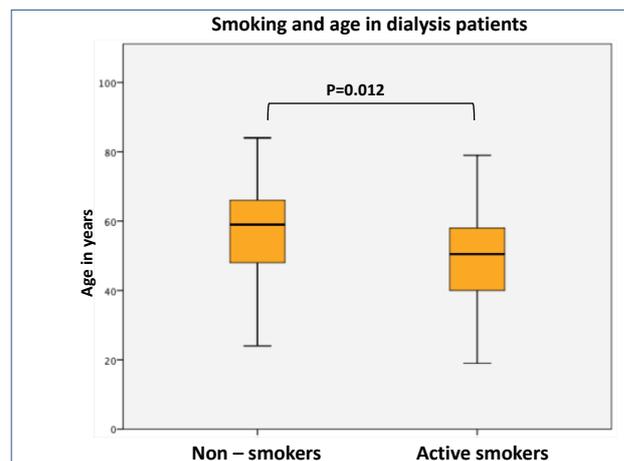


Figure 2: Distribution of age according to smoking status

The two groups did not differ in the laboratory values for albumin, hemoglobin and CRP as well as for BMI. In terms of dialysis variables, in non-smokers out of 7700 prescribed dialysis sessions, [25] 0.3% were missed/interrupted and for the 2618 dialysis sessions in active smokers that percentage was significantly higher: (48)1.8%, ($p = 0.031$). Also, the mean time per dialysis session in non-smokers lasted longer and the ultrafiltrations were lower than in smokers (4.15 ± 0.30 vs. 4.05 ± 0.17 , $p = 0.019$; 3.10 ± 0.78 vs. 3.54 ± 0.92 , $p = 0.017$), respectively. Non-smoking patients achieved better adequacy when calculated spKt/V and also URR (1.46 ± 0.19 vs. 1.30 ± 0.021 , $p = 0.019$; 67.14 ± 5.86 vs. 63.64 ± 8.30 , $p = 0.002$), respectively. Considering targets for spKt/V > 1.2, lower percentage of patients with spKt/V below 1.2 were present in non-smokers (14 (14%) vs 11 (32%), $p = 0.023$), respectively.

Discussion

In spite of therapeutic and medical technology improvements, patients receiving renal replacement treatment still have low survival rates. In the latest European Renal Association-European Dialysis and Transplant Association Registry Annual report for patients commencing RRT during 2006-10, the 5-year unadjusted patient survival probabilities on all RRT modalities combined was 50.0% (95% confidence interval 49.9-50.1) [15]. There is still a real need for recognizing the modifiable factors influencing the high mortality. In dialysis patients both traditional and non-traditional factors affect the all-cause and cardiovascular mortality [16]. The interplay among those factors aggravates the burden of comorbidities and survival. In this study we sought to associate the dialysis adequacy and compliance with smoking, as both are well recognized survival factors in dialysis patients [2], [12]. There are not many published studies on this matter, but in general, smoking is, non-debatably, a risk hazard for human health [17], and it is also connected with acceleration of chronic kidney disease [10], [18], [19]. It is known that chronic exposure to nicotine increases or upregulates the number of high-affinity nicotine binding sites and the receptors undergo long lasting changes and desensitization which explains the receptor modulation and addiction to nicotine [20]. Perry *et al.*, found markedly higher nicotine levels in hemodialysis patients compared to control subjects, when measured before and after hemodialysis, and also after several hours [21]. To our knowledge, there are no studies on nicotine dialyzability [22]. We assume that if dialysis does not provide adequate clearance of nicotine, non-compliance and shortening dialysis sessions would aggravate the problem of addiction. A recent meta-analysis of 26 studies and 6536 dialysis patients showed that active smoking is associated

with a significant increase in all-cause mortality [14]. The percentage of active smoking was 15%, but the CHOICE study implied that the number was mostly underestimated [23]. In our study that percentage was much higher (25%) which is in line with the Longeneckers study [20]. Compliance to life style is in general less achieved in younger generations and it especially affects smoking [24]. Considering the association of age and smoking, we found younger persons to be more likely smokers, and this finding is in agreement with other dialysis groups [14] as well. A limitation of our study could be that we did not clarify if non-compliance was due to smoking, or maybe to younger age and male sex, which was more commonly present in the smoking group. Also, we cannot underestimate the lower dialysis vintage of the smoking group as a potential factor for non-compliance because these patients could presumably be less well educated and experienced, and thus comply less well to the rules that are beneficial to them. We studied compliance to dialysis prescription through time of dialysis session, ultrafiltration and number of skipped/interrupted dialysis sessions. Smokers performed worse on all of these markers resulting in lower spKt/V values. Patients who smoked had significantly lower Kt/V, URR and achieved lower than the recommended values for Kt/V. With this study we associated non-compliance with lower dialysis adequacy. Considering the prognostic value of KtV for survival [1], [2], we found education of young patients for smoking cessation of great importance. Our study was performed in patients treated by low-flux hemodialysis. We consider this as a limitation. Further studies should address dialysis adequacy in patients treated by high-flux hemodialysis, since it is today current treatment modality.

In conclusion, active smokers, especially younger men, achieved lower than the recommended levels for dialysis adequacy, when treated with low-flux dialysis. Non-adherence to dialysis treatment in smokers was an additional problem to be solved. Novel studies are recommended in patients treated with high-flux dialysis to further elaborate the association between active smoking status and dialysis adequacy.

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