

Association of phase angle on bioelectrical impedance analysis and dialysis frequency with survival of chronic hemodialysis patients

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Abstract. Phase angle, a parameter by Bioelectrical Impedance Analysis, can detect body composition changes, so it can be used as a prognostic indicator in some chronic conditions. This study was for determining the relationship between PhA and hemodialysis frequency with the survival of chronic hemodialysis patients. This longitudinal retrospective study involved 173 chronic hemodialysis patients at Rasyida Renal Hospital. The Kaplan-Meier method is used to determine the survival. Cox proportional hazard analysis is used to determine which variables significantly increase mortality. During the study period, 89 patients underwent hemodialysis 3x a week (4 hours/session), and 84 patients underwent HD 2x a week (5 hours/session). Demographic and clinical characteristics in both groups were similar. There was no difference in PhA value in groups of 3x a week and group 2x a week (4.02 ± 1.13 vs 4.25 ± 1.12). Patients with twice a week hemodialysis had a shorter survival than the 3x week group (35.14 ± 2.76 vs 38.62 ± 3.03) although it was not statistically significant ($p = 0.126$).

1. Introduction

The survival of chronic hemodialysis patients is very low. In North America, the 5-year survival rate of chronic hemodialysis patients is about 20% with mortality rates 2-3 times higher than with prostate and breast cancer of the same age.[1]

Phase angle (PhA), a parameter by Bioelectrical Impedance Analysis (BIA), can detect body composition changes so it can be a prognostic indicator for survival in some chronic conditions.[2,3]

Research has shown that hemodialysis doses affect patient outcomes. But since the inception of long-term dialysis therapy, the problem of how optimal the dialysis dose remains in debate. The observational study found that the relative risk (RR) mortality could be decreased by 5-7% if Kt / V was increased by 0.1% of the minimum dosage recommended by the NKF-DOQI hemodialysis adequation work group of 1.2 for HD 3 times a week. But randomized clinical trials conducted by HEMO and ADEMEX found that there was no benefit in the outcome of patients whose dialysis dose was increased. The frequency of HD 2 times a week can still be used in elderly patients, women with low body mass index and early commencement of dialysis, but not recommended in patients with remaining kidney function $<2\text{ml} / \text{min} / 1.73\text{m}^2$. However, it remains unclear whether high doses of dialysis are the best choice because in developing countries almost $\frac{3}{4}$ HD patients chronically undergo HD twice a week.[4-7]



The purpose of this study was to determine the relationship between the value of PhA in BIA and dialysis frequency with the survival of chronic HD patients.

2. Methods

This longitudinal retrospective study involved 173 chronic HD patients at Rasyida Renal Hospital from 2006 to September 2011. The inclusion criteria for this study were ≥ 18 years old, undergoing HD 2-3 times a week for ≥ 3 months and performed the big examination. Patients who have a stroke with a weakness of limbs and have joint abnormalities and loss of contact so that survival cannot be known removed from the study. Patients were divided into 2 groups of dialysis dose: group 3 times a week (4 hours/session) and group 2 times a week (5 hours/session). Demographic and BIA data were obtained from the medical record.

2.1. Statistical Analysis

The categorical data are presented as frequency (%) while continuous data are presented as mean $\pm$ SD or mean $\pm$ 95% CI. Student's t-test was used to assess differences between continuous variables and Chi-square tests for categorical variables. The survival is assessed from the date of the first BIA examination determined by the Kaplan-Meier method. Life expectancy comparison using log-rank test. Multivariate Cox proportional hazard analysis is used to determine the dominant variable affecting survival. It is significant if the p-value < 0.05 . All statistical calculations use SPSS 17 program.

3. Results

Demographic and clinical characteristics of 173 patients grouped on HD / week frequency can be in Table 1. Up to the end of the study only 90 surviving patients with an average survival of 37.40 ± 2.24 months.

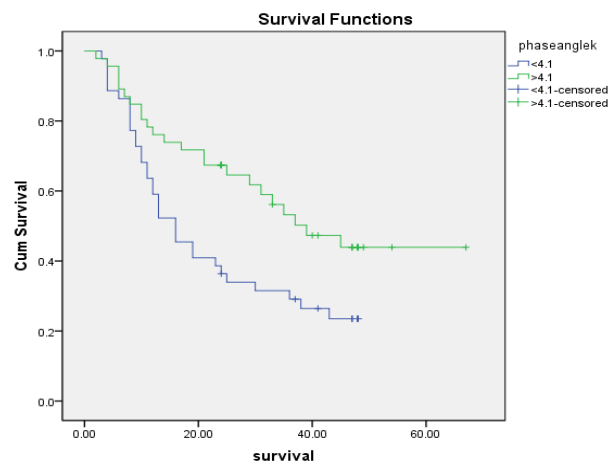
Table 1. Comparison of demographic and clinical characteristics of HD patients (n = 173).

Parameter	3x/weeks	2x/weeks	p-value
Amount (n)	89	84	
Status (%):			0.214
• Not survive	54.7	45	
• Survive	45.3	55	
Gender (%):			0.903
• Men	65.2	64.3	
• Women	34.8	35.7	
PhA:	4.02 $\pm$ 1.13	4.25 $\pm$ 1.12	0.174
Duration of HD (weeks):	43.97 $\pm$ 48.62	43.48 $\pm$ 47.19	0.741
Age at initiation of HD (%):			0.304
• <40 years	12.4	64.3	
• 40-60 years	57.3	20.2	
• >60 years	30.3	26.2	
Main renal disease (%):			
• Diabetes	46.1	73.8	0.007
• Non diabetes	53.9	26.2	

Table 2 shows that survival correlated with PhA statistically, primary renal disease, an age of HD initiation and duration of HD (p < 0.05). However, after multivariate Cox proportional hazard analysis turns out that survival is greatly influenced by PhA and diabetes (p < 0.05).

Table 2. Relationship between several characteristics of survival and its effect on the relative risk (RR) of death.

Parameter	Survival (month) (CI 95%)	P	RR (CI 95%)	P
PhA:		0.000		0.0
• <4.1	• 25.15(20.13-30.17)		1.720(1.047-2.825)	
• >4.1	• 45.04 (39.23-50.81)		1	
The frequency of HD:		0.126	-	-
• 2x/week	• 35.14(29.90-41.96)			
• 3x/week	• 38.62(31.36-42.76)			
Underlying renal disease:		0.000		0.0
• Diabetes	• 20.47 (15.61-25.33)		0.379(0.229-0.627)	
• Non diabetes	• 46.21 (40.87-51.54)		1	
Starting age of HD: (years)		0.003		0.1
• <40 years	• 42.57 (34.01-51.14)		1	
• 40-60 years	• 39.45 (33.83-45.06)		0.725(0.452-1.162)	
• >60 years	• 26.45 (19.25-33.66)		0.765(0.317-1.845)	
Duration of HD (month):		0.000		0.0
• <60	• 26.89 (23.67-30.12)		7.030(.915-54.029)	
• 60-120	• 50.25 (41.81-58.69)		1.721(0.209-14.192)	
• >120	• 63.83 (55.82-71.85)		1	
Gender:		0.516		
• Men	• 37.06(31.87-42.27)		-	-
• Women	• 34.09 (28.64-42.46)			

**Figure 1.** Survival based on PhA.

Figures 1 and 2 show survival curve based on the value of PhA and HD frequency.

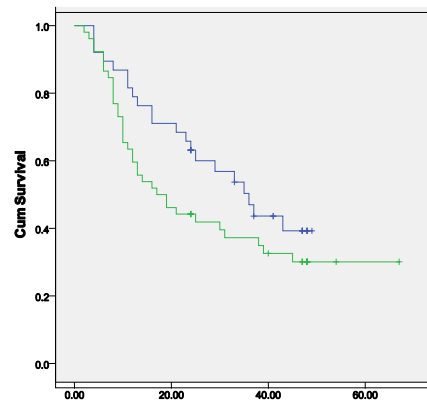


Figure 2. Long life expectancy based on HD frequency.

Table 3. Survival based on PhA and HDfrequency.

Frequency of HD	PhA		P
	<4.1	>4.1	
2 times/week	29.31±3.99	41.31±3.74	0.341
3 times/week	21.82±3.23	46.48±4.07	

PhA <4.1

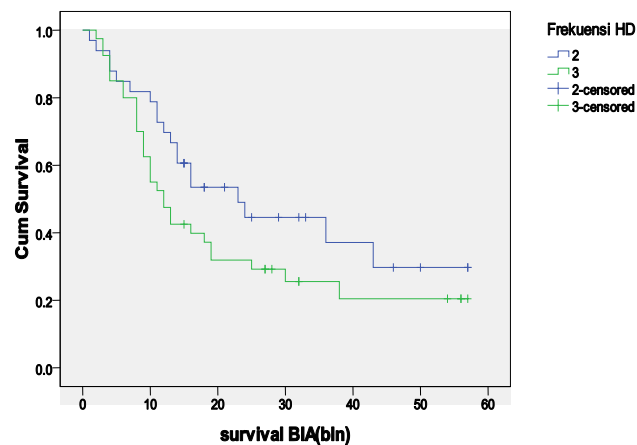


Figure 3. Survival of chronic HD patients with PhA<4.1 based on HD frequency.

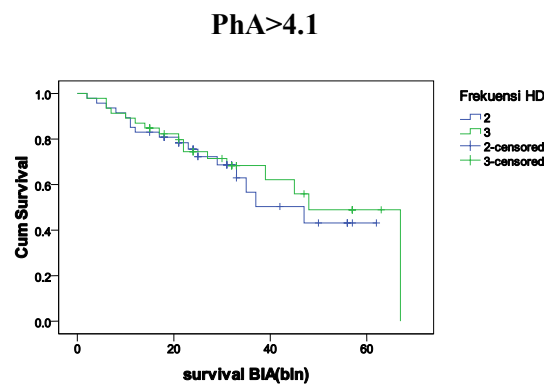


Figure 4. Survival of chronic HD patients with PhA>4.1 based on HD frequency.

From table 3 we can see that the survival of chronic HD patients with PhA> 4.1 was longer than patients with PhA<4.1. The survival of patients who were HD 3 times a week was longer in the group of patients with PhA>4.1, although this was not statistically significant.

4. Discussion

PhA has been as a prognostic marker in certain circumstances where cell membrane integrity and fluid balance are disrupted, such as HIV infection, liver cirrhosis, chronic obstructive pulmonary disease, sepsis, and HD.[8]

This study found that the survival of chronic HD patients with PhA<4.1 was shorter than PhA> 4.1 ($p = 0.000$), where mortality risk of patients with PhA<4.1 higher 1.720 times than patients with PhA>4.1 ($p = 0.032$). Toso et al found that the average PhA value of lung cancer patients was 4.47 with a shorter survival if their PhA value was lower than this value, as did Selberg et al. Who obtained an average grade of 5.4 liver cirrhotic patients also concluded that survival lower if the value of PhA is low.[9]

In this study also found that diabetes affects survival, where survival of diabetes patients is longer than patients without diabetes ($p = 0.000$). This is by the United States Renal Data System report in 2007 which found that the leading cause of HD patients death was diabetes with a ten years survival only 4%.[10]

This study found that patients' survival of 3 times a week HD was longer than patients with two times a week HD although statistically, this was not significant.

5. Conclusion

The survival of HD patients is strongly influenced by PhA and the presence of diabetes. Although the frequency of HD 3 times a week shows a longer survival than the 2 times a week, statistically this is not meaningful.

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