BIOELECTRICAL IMPEDANCE DERIVED PHASE ANGLE AS MORTALITY PREDICTOR IN HEMODIALYSIS PATIENTS

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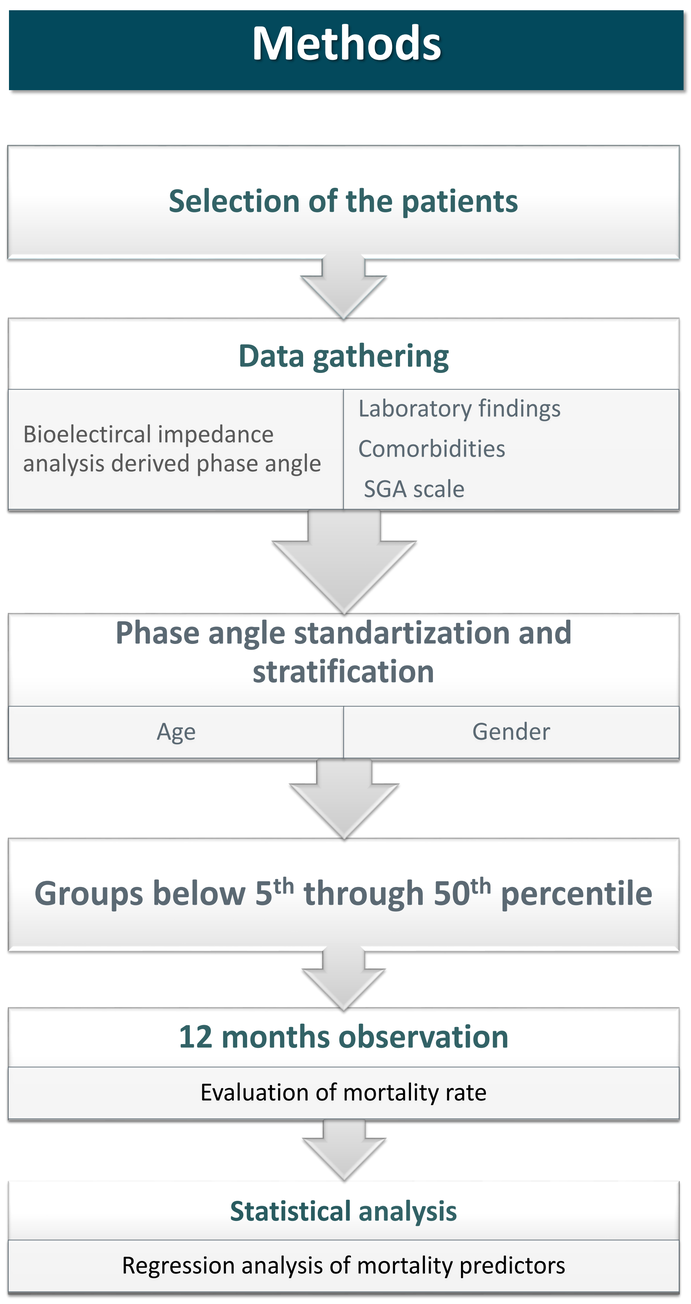
Introduction

The National Institute of Diabetes and Digestive and Kidney Diseases reports that the five - year survival rate for dialysis patients is 35,8%, in comparison to five-year survival rate of 85,5% for transplant patients. Therefore effort to improve dialysis patients outcome is a constant goal in nephrology field. Bioelectrical impedance analysis (BIA) derived phase angle (PA) is hypothesized to be a marker of poor prognosis in hemodialysis (HD) patients. In light of recent research PA has been shown to be dependent on age and gender.

Aim of the study is to standardize PA by age and gender and to determine the relation of PA and mortality in HD patients.

Methods



We conducted an observational study in a tertiary reference hospital. BIA was measured post HD procedure providing measurements of PA. In addition, laboratory results, Subjective Global Assessment scale and various comorbidities and demographics were collected. Values of PA were standardized and stratified by age and gender by applying population reference values. Patients were split into groups with PA values below 5th through 50th percentile of the mean reference value[1]. The patients were observed for 12 months and the mortality rate was evaluated. Factors were entered into multivariate logistic regression model to establish independent predictors of mortality.

Results

During the study period, 99 patients were enrolled. No patients were lost to follow- up. The mortality rate was 15,2 % (n = 15).

Baseline characteristics of the patients are presented in Table 1.

Table 1. Baseline characteristics of the patients

Descriptive profile	
Male, n (%)	51 (51,5)
Age (y), mean ± SD	58,7 ± 14,38
Time on HD (y), median [IQR]	4,5 [2,0-8,5]
Diabetes, n (%)	17 (25)
Stroke, n (%)	7 (10,3)
Atrial fibrillation, n (%)	11 (16,2)
Coronary artery disease, n (%)	26 (38,2)
Charlsons comorbidity index, mean ± SD	5,77 ± 2,23
Intradialytic hypotension, n (%)	40 (40,4)
Serum albumin (g/L) , mean ± SD	37,42 ± 2,98
SGA group A, n (%)	57 (57,6)
SGA group B, n (%)	28 (28,3)
SGA group C, n (%)	14 (14,1)
Hemoglobin (g/L) , mean ± SD	108,22 ± 14,58
Platelets (*10^9 /L) , mean ± SD	183,06 ± 66,96
WBC (*10^9 /L), mean ± SD	6,63 ± 2,27
Creatinine (µmol/l)	891,14 ± 268,76
Urea (mmol/l)	25,18 ± 6,54
BIA parameters	
FFMI (kg/m2), mean ± SD	17,74 ± 2,35
BMI, mean ± SD	26,31 ± 6,03
Phase angle (degrees), mean ± SD	4,69 ± 1,21
Extracellular water / total body water ratio (L) , mean ± SD	0,40 ± 0,01

Factors related to mortality are presented in Table 2. These factors were entered into multivariate logistic regression model and standardized PA (OR 2,439, CI 95% 1,035-5,745, p= 0,041) with albumin (OR 0,671, CI 95% 0,503- 0,895, p= 0,007) were established as independent predictors of mortality.

Conclusions

- Independent predictors of mortality in hemodialysis patients were PA and albumin.
- Standardization by age and gender is necessary before implementing PA into clinical practice for HD patients.
- Further research with a larger sample is needed to verify the results.

Figure 1. Boxplots of mortality predictors

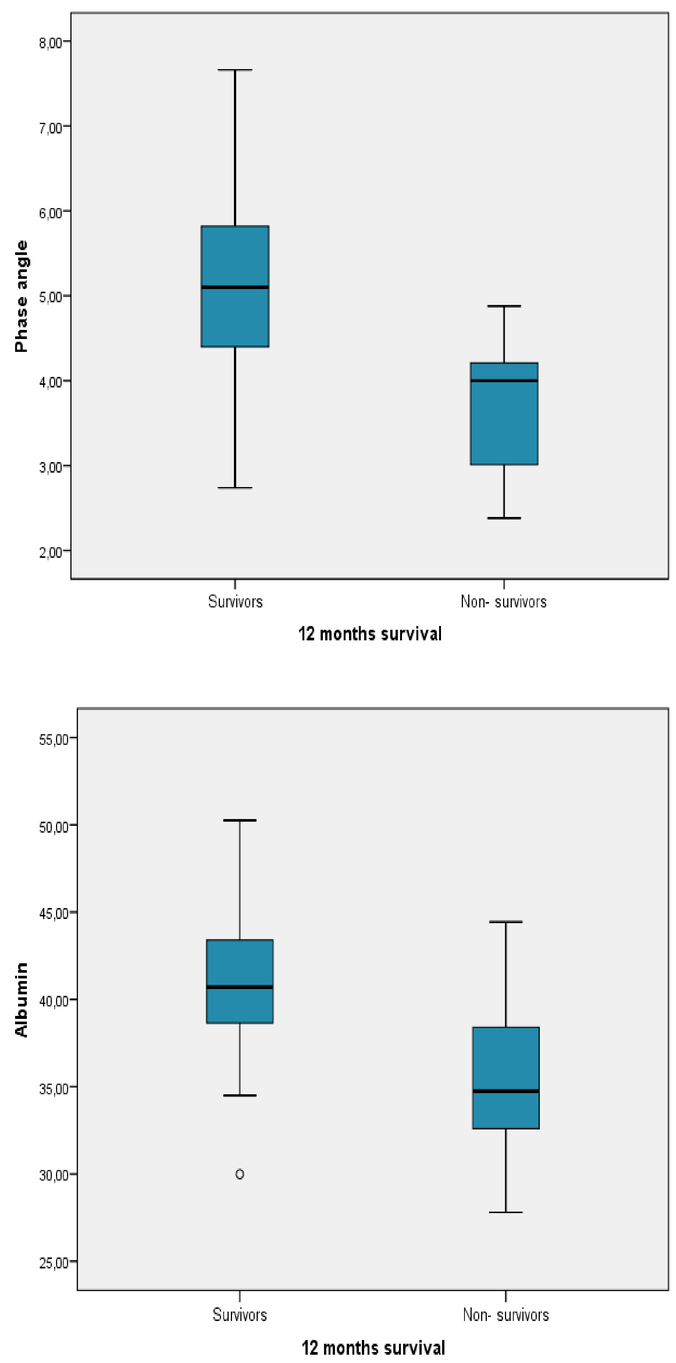


Table 2. Multivariate Regression Analysis of the Mortality Predictors

Factor	Odds ratio		P-value	Odds ratio		P-value
	Estimate	95% CI		Estimate	95% CI	
	Univariate			Multivariate		
Standardized Phase angle (per 5 percentile units)	2,273	1,281- 4,033	0,005	2,439	1,035- 5,745	0,041
Albumin (per 1 g/l)	0,673	0,544-0,832	<0,001	0,671	0,503-0,895	0,007
Creatinine (per 1 µmol/l)	0,997	0,994-0,999	0,01	n.s.		
Urea (per 1 mmol/l)	0,883	0,796-0,980	0,02	n.s.		
Stroke	6,800	1,315-35,170	0,022	n.s.		
Atrial fibrillation	7,350	1,808-29,881	0,005	n.s.		
Intradialytic hypotension	3,60	1,126-11,514	0,031	n.s.		

n.s., not significant with p value > 0,05;
CI, Confidence interval.

References:

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