

## ORIGINAL ARTICLE

# Serum Hemoglobin and Potassium Levels in Sudden Cardiac Death patients at Hemodialysis Center of Aziz Bhatti Shaheed Teaching Hospital Gujrat

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## ABSTRACT

**Background:** Sudden cardiac arrest has become a serious pandemic and a substantial public health burden. Significant morbidity and death are linked to it. Hemodialysis is considerably a heavy burden on cardiac patients. A sudden cardiac arrest is sometimes a disastrous event that happens without warning and is regrettably a significant cardiac disease manifestation in individuals surviving on kidney dialysis.

**Aim:** To determine Serum Hemoglobin and potassium levels in sudden cardiac death patients admitted in hemodialysis center of Aziz Bhatti Shaheed Teaching Hospital Gujrat.

**Study Design:** Cross-Sectional Study

**Methodology:** This research study was conducted at the hemodialysis center of Aziz Bhatti Shaheed Teaching Hospital Gujrat. The Ethics Committee approved to conduct of this descriptive cross-sectional study on 40 (20 males and 20 females) sudden cardiac patients. All information and the goal of the research project were explained to patients or their relatives before the collection of blood serum. Prescription drug lists, smoking histories, and medication or dialysis report data were randomly evaluated. Laboratory results from recent month were collected, together with dialysis run sheets and cardiac arrest data forms.

**Results:** Results of this result study showed that the mean value of age was 50 years with a mean standard deviation of 15.1 ( $p < 0.001$ ). The mean BMI ( $\text{kg/m}^2$ ) was estimated as 26.8 with a mean standard deviation value of 2.6 ( $p = 0.01$ ). Almost 21.6% of male patients were smokers and overall 36.1% were associated with cardiac arrest due to coronary artery disease. Systolic blood pressure (mmHg) was 165 (95% CI of 117-140) ( $p < 0.001$ ), diastolic blood pressure (mm Hg) was 89 (95% CI of 64-72) ( $p < 0.001$ ), hemoglobin level was 0.73 (95% CI of 0.70-0.76) ( $p < 0.001$ ), Hemoglobin A1 c was 6.4% (95% CI of 5.8-7.6) ( $p < 0.001$ ), Urea was 56 (95% CI of 41-79) ( $p < 0.001$ ), and estimated glomerulus filtration rate ( $\text{mL/min per } 1.73\text{mm}^2$ ) was 1.16 (1.10-1.22) in sudden cardiac patients with low K (serum  $< 4.0\text{mmole/L}$ ). For the sudden cardiac patients with higher K level (serum  $> 4.0\text{mmole/L}$ ) showed that there was a significant change in the estimated values i.e. estimated glomerular filtration rate ( $\text{mL/min per } 1.73\text{ mm}^2$ ) was 0.67 (95% CI of 0.54-0.58) ( $p < 0.01$ ).

**The practical implication** of this research study suggests that the higher proportion of cardiac patients were reported higher concentration of K level serum. For diagnosis purposes K-level was directly associated with the cardiac disease progression.

**Conclusion:** Hemodialysis patients with sudden cardiac arrest had reported very low concentrations of potassium levels. Dialysate prescriptions should be continuously reviewed and changed, especially after hospitalization in high-risk patients, to lower the risk of adverse cardiac events during hemodialysis. It was suggested that in the high-normal range of serum potassium seems to be safe and is linked to better outcomes.

**Keywords:** Sudden cardiac arrest, Hemodialysis, serum potassium level, Hemoglobin

## INTRODUCTION

Mortality rates for hemodialysis users are reported 3.5 times higher than those for general cardiac patients. About half of the fatalities are due to myocardial infarction, cardiac arrest, or other cardiac causes, making cardiovascular illness the leading cause of mortality<sup>1,2</sup>. For end-stage kidney disease (ESKD) patients on hemodialysis, sudden cardiac arrest (SCA) is the leading cause of death, occurring at a rate 30 times higher than the patients suffering from any other disease. Administration of life-sustaining medication while reducing the risk exposure for SCA is thus one of the biggest issues in managing the majority of ESKD patients who require hemodialysis therapy. The first step in solving this issue is to identify the characteristics of people with advanced chronic kidney disease (CKD) who are more susceptible to SCA.

Several studies have examined the factors that predict cardiac death in hemodialysis patients and have observed that all sudden cardiac patients were receiving kidney maintenance therapy. Skeletal and cardiac muscles can respond differently to potassium. The excitability and rhythm of the heart muscle vary

with any variation in potassium content. The sodium-potassium pump and the body's demands determine how much potassium is in the average blood, which ranges from 3.5 to 5 mEq/L<sup>3-5</sup>. Cardiac patients are more likely to experience low serum potassium levels due to the diuretic medication they have to receive, which can lead to ventricular arrhythmias and non-potassium-sparing diuretics and often lead to left ventricular failure<sup>6</sup>.

Only a few studies are available globally that address epidemiological, and clinical aspects of cardiac arrest in a dialysis unit. This research study was a successful attempt based on the determination of potassium levels in serum and characteristic properties observed in cardiac patients admitted to dialysis units.

## METHODOLOGY

This research study was conducted at the hemodialysis center of Aziz Bhatti Shaheed Teaching Hospital Gujrat. The Ethics Committee of the hospital approved to conduct this descriptive cross-sectional study on 40 (20 males and 20 females) sudden cardiac patients. Selected candidates for this research study were provided with duly informed consent forms. Before the collection of blood serum and gathering of details from participants all details and the purpose of the research study were discussed. Prescription

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lists, smoking histories, or data on medication or dialysis reports, make it unable to provide a reliable assessment. Recent month laboratory values were gathered, and cardiac arrest data forms and dialysis run sheets were evaluated. Autopsy results and other in-depth descriptions were not frequently available in situations of death brought on by cardiac arrest.

**Inclusion group:** Only sudden cardiac patients admitted (age = 30-60 years) in the hemodialysis unit were selected to conduct this study.

**Exclusion group:** Patients with renal failure, several heart diseases, immuno-compromised, or diagnosed with any carcinoma or malignancy were not included in this research work.

**Statistical analysis:** Statistical analysis was done by using SPSS software version 22. Data was represented in form of quantitative variables (means, Standard deviation). The description of the qualitative variables was evaluated in form of frequency and percentage. The chi-square test was used to find associations between different selected parameters. The p-values >0.05 was considered significant.

### RESULTS AND DISCUSSION

Demographic analysis of sudden cardiac patients revealed that the mean value of age was 50 years with a mean standard deviation of 15.1 (p= <0.001). The mean BMI (kg/m<sup>2</sup>) was estimated as 26.8 with a mean standard deviation value of 2.6 (p= 0.01). Almost 21.6% of male patients were smokers and overall 36.1% were associated with cardiac arrest due to coronary artery disease (Table 1).

Table 1: Demographic analysis of sudden cardiac patients admitted at hemodialysis centre of Aziz Bhatti Shaheed Teaching Hospital Gujrat (n=40)

Parameters	N=40 patients	P value
Age	50±15.1	<0.001
Gender (Female/Male)	(20/20)	-
BMI (kg/m <sup>2</sup> )	26.8±2.6	0.01
Tobacco use (%) by male	21.6	0.218
Coronary artery disease (%)	36.1	0.014
Creatinine (mmol/L)	7.6±4.5	<0.005
Pre-dialysis serum potassium	4.6±2.5	<0.01

Multivariate analysis of SPSS (version 22) was used for the analysis of hemoglobin levels in sudden cardiac patients. This analysis was carried out in a contrasting manner to determine the clinical analysis of hemoglobin levels in low (< 4.0 mmole/L) and high potassium concentrations (>4.0 mmole/L). Results showed that systolic blood pressure (mm Hg) was 165 (95% CI of 117-140) (p= <0.001), diastolic blood pressure (mm Hg) was 89 (95% CI of 64-72) (p= <0.001), hemoglobin level was 0.73 (95% CI of 0.70-0.76) (p= <0.001), Hemoglobin A1 c was 6.4% (95% CI of 5.8-7.6) (p= <0.001), Urea was 56 (95% CI of 41-79) (p= <0.001), and estimated glomerulus filtration rate (mL/min per 1.73mm<sup>2</sup>) was 1.16 (1.10-1.22) in sudden cardiac patients with low K (serum <4.0 mmole/L). For the sudden cardiac patients with higher K level (serum >4.0 mmole/L) showed that there was a significant change in the estimated values i.e. estimated glomerular filtration rate (mL/min per 1.73 mm<sup>2</sup>) was 0.67 (95% CI of 0.54-0.58) (p=<0.01) and Hemoglobin (g/dL) was 0.19 (95% CI of 0.01-0.1).

Table 2: Clinical analysis of hemoglobin level in low and high potassium concentration by multivariate analysis logistic regression for individual parameter

Parameters for low K (serum K<4.0mmole/L)	Odd ratio (95% CI)	p-value	Parameters for low K (serum K >4.0mmole/L)	Odd ratio (95% CI)	p-value
Systolic blood pressure (mmHg) of the sudden cardiac patient	168 (117-140)	<0.001	*Estimated Glomerular filtration rate (mL/min per 1.73mm <sup>2</sup> )	0.67 (0.54-0.58)	<0.001
Diastolic blood pressure (mm Hg) of the sudden cardiac patient	89 (64-72)	<0.001	*Hemoglobin (g/dL)	0.19 (0.01-0.1)	
Hemoglobin (g/dL)	0.73 (0.70-0.76)	<0.001			
Hemoglobin A1 c (%)	6.4 (5.8-7.6)	<0.001			
Urea (mg/dL)	56 (41-79)	<0.001			
Estimated Glomerular filtration rate (mL/min per 1.73mm <sup>2</sup> )	1.16 (1.10-1.22)	<0.001			

\*Square root transformed multivariate analysis significant on univariate analysis  
CI= confidence interval <0.05 is statistically significant

Potassium levels in sudden cardiac patients were estimated by using Cox regression of Univariable. At <3.5mmole/L K level was 2.58 (95% CI of 1.89-3.57) (p >0.01), >3-4 mmole/L K level was 1.16 (95% CI of 0.94-1.54) (p=0.10), at <4-5 mmole/L K level was 1 (reference value), at 5-6 mmole/L K level was 1.27 (95% CI of 0.85-1.82) (p= 0.20), at 6 mmole/L K level was 1.48 (95% CI of 1.02-1.09) (p= 0.006), at >6 mmole/L K level was 1.88 (95% CI of 1.15-2.94) (p=0.008).

Table 3: Univariable analysis of Potassium levels in sudden cardiac patients (n=40) admitted in the hemodialysis center by Cox-regression

Potassium levels	Cardiac arrest (hazard ratio) 95% confidence interval	P value
<3.5 mmole/L	2.58 (1.89-3.57)	>0.001
> 3-4 mmole/L	1.16 (0.94-1.54)	0.10
4-5 mmole/L	1 (standard/reference value)	-
5-6 mmole/L	1.27 (0.85-1.82)	0.20
6 mmole/L	1.48 (1.02-1.09)	0.006
>6 mmole/L	1.88 (1.15-2.94)	0.008

### DISCUSSION

A significant public health issues due to sudden cardiac arrest has been reported and has developed into a dangerous epidemic. It has a significant morbidity and mortality rate. For patients with heart disease, hemodialysis has become significant. The Aziz Bhatti Shaheed Teaching Hospital in Gujrat served as the site for

this research study's hemodialysis facility. This descriptive cross-sectional study has involved 40 patients with sudden cardiac arrest (20 men and 20 women). Prior to the blood serum was collected, patients or their relatives were given a thorough explanation of the research project's objectives. A random evaluation was done on prescription drug lists, smoking histories, and data from medication or dialysis report forms. A collection of cardiac arrest data forms, dialysis run sheets, and laboratory findings from the most recent month were also made. The mean age and mean standard deviation of patients with sudden cardiac arrest were 50 years old and 15.1 years old, respectively, according to demographic analysis (p 0.001). With a mean standard deviation value of 2.6 and a mean BMI (kg/m<sup>2</sup>) of 26.8 (p = 0.01), the calculation was made. Nearly 21.6% of male patients were smokers, and altogether, 36.1% of heart arrests were associated with coronary artery disease. The estimated glomerular filtration rate (mL/min per 1.73mm<sup>2</sup>) was 0.67 (95% CI of 0.54-0.58) (p=0.01) and haemoglobin (g/dL) was 0.19 (95% CI of 0.01-0.1) for the sudden cardiac patients with higher K levels (serum >4.0 mmole/L).

Overall current research study inferred that in old age candidates were more at risk of sudden cardiac failure. In sudden cardiac patients, the supply of hemoglobin and estimated filtration rate significantly differ in reduced potassium concentrations and high potassium concentrations<sup>7,8</sup>. However, the low concentration of K was more associated with sudden cardiac arrest. In contrast to our study, Kim et al. suggested that high levels of K were

considered normal and low concentration was the main cause of sudden cardiac congestion<sup>9</sup>.

Using Cox regression of Univariable, potassium levels in sudden cardiac arrest cases were calculated. At <3.5mmole/L K level was 2.58 (95% CI of 1.89-3.57) ( $p > 0.01$ ), >3-4mmole/L K level was 1.16 (95% CI of 0.94-1.54) ( $p=0.10$ ), at <4-5mmole/L K level was 1 (reference value), at 5-6mmole/L K level was 1.27 (95% CI of 0.85-1.82) ( $p= 0.20$ ), at 6mmole/L K level was 1.48 (95% CI of 1.02-1.09) ( $p= 0.006$ ), at >6mmole/L K level was 1.88 (95% CI of 1.15-2.94) ( $p=0.008$ ). Results suggested that the lower the K level in serum greater will the chance of progression of cardiac disease. Similar to our research study, Pun et al<sup>10</sup> reported a study of a large cohort of 502 cardiac patients. He inferred that predialysis serum potassium levels have a role in leading to sudden cardiac mortality. The elevated risk was connected to both low and high pre-dialysis blood potassium concentrations. The risk was shaped like a U, with the lowest risk occurring at a predialysis serum potassium reading of 5 mEq/L.

## CONCLUSION

High and low concentrations of K and a drop in hemoglobin supply were directly associated with the risk of sudden cardiac arrest. and Dialysate and hemodialysis prescriptions should be examined and changed continuously, especially after hospitalization in high-risk patients, to lower the risk of adverse cardiac events on hemodialysis.

**Conflict of interest:** Nil

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