

# HYPOALBUMINEMIA; FREQUENCY OF LOW VOLTAGE QRS AMPLITUDE IN PATIENTS

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**ABSTRACT... Objective:** To determine the frequency of low voltage ECG in hypoalbuminemic patients. **Study Design:** Descriptive cross-sectional study. **Setting:** Nishtar Hospital Multan. **Duration of study:** April 2010 to September 2010. **Sampling technique:** Non-probability purposive sampling. **Methodology:** One hundred and fifty patients of hypoalbuminemia were registered after taking informed consent for participation. Serum albumin was done in all the cases. All the patients underwent ECG. QRS wave amplitude was measured from standard 12 leads ECG's using clippers and magnifying glass within 24 hours of test for serum albumin. All information was entered in a specially designed proforma. Data entered and analyzed through SPSS-11. **Results:** One hundred and fifty patients of hypoalbuminemia were included in the study. The age range was 18-90 years with mean of  $47.28 \pm 21.80$  years. There were 87 male and 63 female patients. Sixty eight (45.33%) patients with hypoalbuminemia developed low voltage ECG. Among them 37 (54.41%) were male and 31 (45.58%) female. Liver dysfunction, renal dysfunction, malnutrition and pre-eclampsia were common causes of hypoalbuminemia and present in 47 (31.33%), 35 (23.33%), 15 (10.00%) and 7 (4.66%) of patients respectively. **Conclusions:** Low voltage ECG can be seen in hypoalbuminemia. So while interpreting low voltage ECG, the physician should keep in mind the hypoalbuminemia as one of the causes and should detect it first rather than undertaking sophisticated and unnecessary expensive investigations to rule out cardiac pathology.

**Key words:** Hypoalbuminemia, Low voltage ECG, Osmotic regulation.

## INTRODUCTION

Serum albumin is a major fraction (54-58%) of the serum proteins in human. It is exclusively synthesized by the liver. It is degraded at the rate of 4% daily and has half life of 15-20 days<sup>1</sup>. Albumin plays an important role in osmotic regulation and transport of many substances like free fatty acids, hormones, vitamins, lipids, metals, pigments, drugs, enzymes, antibiotics, clotting factors, complement components and kinin precursors<sup>2</sup>. Hypoalbuminemia is a common laboratory finding in many pathological conditions like liver disorders, protein malnutrition, nephrotic syndrome, protein losing enteropathy, pre-eclampsia and chronic infections. These chronic infections are associated with increase in interleukins, tumor necrosis factor and other cytokines, all these inhibit the synthesis of serum albumin<sup>1,2,3,4</sup>. Hypoalbuminemia results in fluid retention and edema.

Low voltage electrocardiogram (ECG) can result due to many cardiac and non cardiac causes. These include pericardial effusion, myocarditis, constrictive pericarditis, obesity, pneumothorax, hypothyroidism and hypoalbuminemia<sup>5,6</sup>. Low voltage ECG can also occur in

ascites<sup>7</sup>. Heaf<sup>8</sup> was first who studied in 1985 albumin related changes in QRS complexes which showed the low voltage QRS complexes in patients with hypoalbuminemia<sup>8</sup>. Various other studies later on also showed close relation between serum albumin and low voltage electrocardiogram. In one study 47% of the patients having low albumin levels showed low voltage ECG<sup>6</sup>. Low voltage ECG in hypoalbuminemic patients has 94% specificity and 47% sensitivity<sup>6</sup>, so a low voltage ECG may also be related with low serum albumin associated conditions, so while interpreting low voltage ECG physician should keep in mind hypoalbuminemia as well. Hence, serum albumin detection in patients with low voltage ECG may be simple and cost effective, rather than going to sophisticated and unnecessary cardiac investigations. The present study was designed to determine the frequency of low voltage ECG in hypoalbuminemic patients.

## MATERIAL AND METHODS

It was descriptive case series conducted at Nishtar Hospital Multan from April 2010 to September 2010. One hundred and fifty patients with low serum albumin were

studied. Informed consent to participate in the study was taken from the patients or their attendants after explaining the procedure of the study. All adult male and female patients above 18 years of age with low serum albumin (less than 3.5 gm/dl) were included in the study. Non-probability purposive sampling technique was used. Serum albumin along with ECG was done in all patients. Patients with congestive cardiac failure, cardiomyopathy and hypertension were excluded from the study. ECG was done in all patients. QRS wave amplitude was measured from standard 12 leads ECG's using clippers and magnifying glass within 24 hours of test for serum albumin. All information were entered in specially designed proforma. Data entered and analyzed through SPSS-11.

## RESULTS

One hundred and fifty patients of hypoalbuminemia were included in the study. The age range was 18-90 years with mean of  $47.28 \pm 21.80$  years (Table-I).

Table-I. Age distribution of patients n=150

Age Group (Years)	Frequency	%age
18-30	32	21.33
31-40	18	12.02
41-50	30	20.00
51-60	20	13.33
61-70	21	14.00
71-80	22	14.66
81-90	07	4.66

There were 87 male and 63 female patients. Sixty eight (45.33%) patients with hypoalbuminemia developed low voltage ECG (Figure1). Among them 37 (54.41%) were male and 31 (45.58%) female (Figure2). Gender wise distribution normal voltage ECG is shown in figure 3. Liver dysfunction in 47 (31.33%) patients, renal dysfunction in 35(23.33%) patients, malnutrition in 15(10.00%) patients and pre-eclampsia in 7(4.66%) patients were common causes of hypoalbuminemia.

Fig-1. Percentage of patients with low voltage ECG and normal voltage ECG

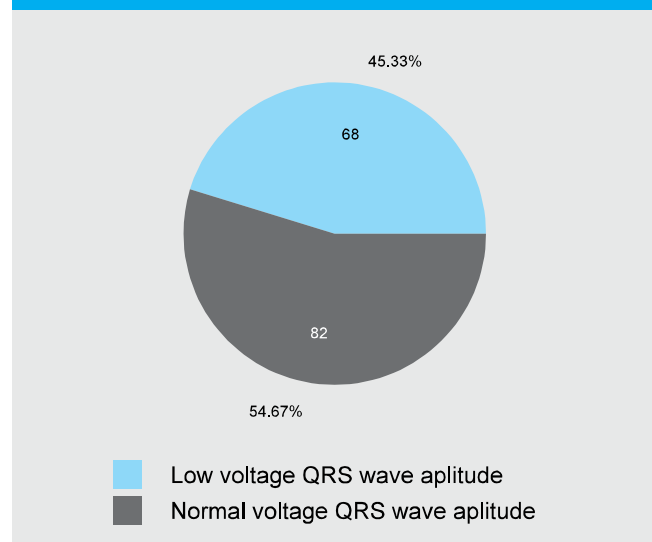
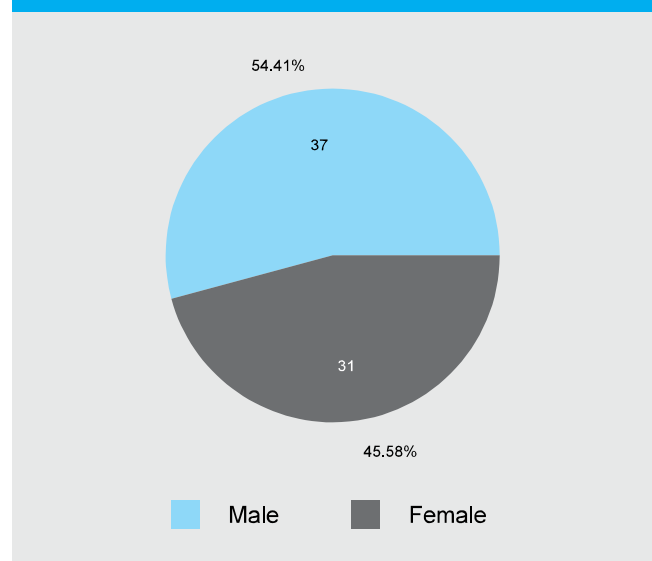


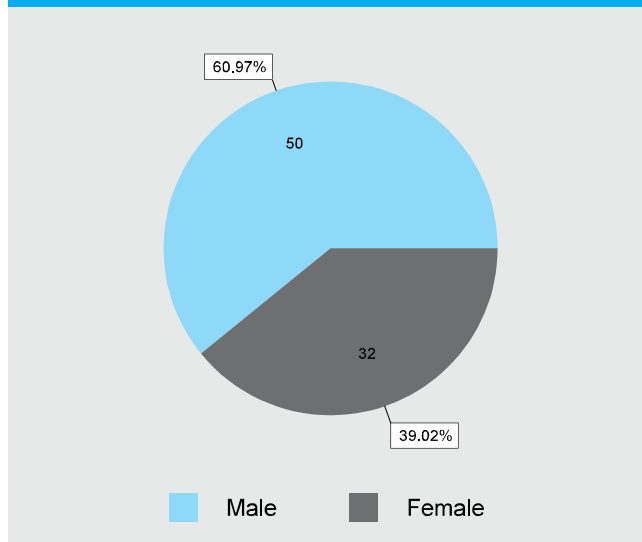
Fig-2. Gender wise distribution of low voltage ECG



## DISCUSSION

Serum albumin is most abundant plasma protein. It plays a significant role in osmotic regulation and is a major carrier protein<sup>2</sup>. Serum albumin is major component (up to 75%) for maintaining osmotic pressure and hence decrease in its level will result in edema. Electrocardiography is a commonly used investigation in various cardiac diseases. Low voltage ECG is commonly found in pericardial effusion. It can also occur in other

**Fig-3. Gender wise distribution of normal voltage ECG**



clinical conditions like myocardial disease, hypothyroidism, emphysema, obesity. Low voltage ECG is also seen in hypoalbuminemic states. Present study evaluated the relation of QRS wave amplitude in hypoalbuminemic patients free of heart disease. In our study 150 patients of hypoalbuminemia were studied. Eighty seven were male and 63 were female. Age varied from 18-90 years with mean  $47.28 \pm 21.80$  years. In our study frequency of low voltage ECG in hypoalbuminemic patients was 45.33%. Similar results have been reported in another study conducted in Kochi (Japan)<sup>6</sup> but the mean age of the patients in their study was  $70 \pm 12$  years. In our study 87 patients were male and 63 were female, in the study conducted in Kochi 83 were male and 111 were female<sup>9</sup>. Our study reflected low voltage ECG in 45.33% and among them 37 (54.41%) were male and 31 (45.59%) were female while Japanese study showed low voltage ECG in 27 patients and among them 40 % were male and 60 % were female. Low voltage ECG has also been seen in anasarca and weight gain. Hypoalbuminemia is frequently associated with weight gain or edema (anasarca), So the low voltage ECG in hypoalbuminemic patients may be due to the results of edema and anasarca. Low voltage ECG is also associated with lower colloidal osmotic pressure in patients with hypothyroidism<sup>9</sup>. Similar findings were seen in our study however we did not measure the weight of the patient. Hypoalbuminemia is commonly seen in

hepatic cirrhosis. A study conducted by Madias et al<sup>5,10</sup> regarding the attenuation of ECG voltage in cirrhotics suggested that low voltage ECG in cirrhotic patients was due to edema and hypoalbuminemia. The same has been suggested by Kudo<sup>6</sup>. Changes in albumin concentration cause changes in ECG amplitude possibly due to disturbed conductivity<sup>8</sup>. Low voltage ECG has also been reported by Cuculi<sup>7</sup>. Hypoalbuminemia is a common laboratory finding in different pathological conditions like cirrhosis of liver, nephrotic syndrome, pre-eclampsia, burns, malnutrition.

### CONCLUSIONS

Low voltage ECG can be seen in hypoalbuminemia. So while interpreting low voltage ECG the physician should keep in mind the hypoalbuminemia as one of the cause and should detect first rather than undertaking sophisticated and unnecessary expensive investigations to rule out the cardiac pathology.

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