

## Electrocardiographic Abnormalities in Severe Anaemia and its Reversibility after Correction of Anaemia

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### ABSTRACT

**Introduction :** Anaemia is one of the commonest clinical problems in our country. It affects various organs including the heart. Clinical manifestations of anaemia referable to cardiovascular system may closely simulate symptoms and signs of organic heart disease. It includes some ECG changes also. ECG changes in anaemia show correlation to Hb concentration and the changes are reversible after correction of anaemia.

### Aims and objectives:

- 1) To study electrocardiographic changes in patients with severe anaemia.
- 2) To correlate ECG changes with haemoglobin concentration
- 3) To study their reversibility after treatment of anaemia.

**Materials and methods:** 94 patients admitted in medicine wards in government general hospital, Solapur for severe anaemia (Hb concentration less than or equal to 7 gm %) were studied for ECG changes. Hb concentrations in patients with ECG changes were between 2 gm% to 6.5 gm% with an average of 4.4 gm%. 29 patients were having ECG changes. Out of which 25 patients were having Hb concentration less than or equal to 5 gm%. All patients were reassessed for reversibility of changes after treatment.

### Results:

- 1) Out of 94 patients with severe anaemia, 38 patients were having Hb % of 2 to 5 gm %. Of which 29 patients were having ECG changes (22 were females and 7 were males)
- 2) Out of 29 patients, 25 were having Hb concentration 5 gm%
- 3) All ECG changes were reverted to normal after correction of anaemia, except one patient (showed pre-treatment T wave inversion and post-treatment flat T waves)

**Conclusion:** ECG abnormalities in patients with severe anaemia are more common in females. ECG abnormalities in patients with severe anaemia (Hb 5 gm%) can get reverted to normal after correction of anaemia.

**Key words:** Haemoglobin concentration, Anaemia, ECG changes

### INTRODUCTION:

**A**naemia is one of the commonest clinical problems in our country. Anaemia has two principle effects.

- 1) A decrease in the amount of oxygen transported by each unit volume of blood, thus tending to produce tissue hypoxia and

- 2) A decrease in blood viscosity associated with reduction in red cell mass.<sup>1</sup>

Most of the clinical features of anaemia are due to the consequences of diminished oxygen carrying power of the blood to the tissues and cardiovascular & ventilatory adjustments to compensate the decrease in red cell mass.

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The clinical presentation depends upon the rapidity of the onset of anaemia, its severity, age of the patient and capacity of the cardiovascular system to adjust to it.<sup>2</sup> Anaemia affects various organs including the heart. It is one of the commonest causes of hyperdynamic state of heart at rest.<sup>3</sup> This leads to increased oxygen demand to myocardium and subsequently supply-demand mismatch resulting in myocardial ischaemia or infarction. The cardiac disturbances persist as long as anaemia is severe<sup>3</sup> and quite strikingly these changes can be rapidly reverted by partial correction of anaemia.<sup>4</sup>

Clinical manifestations of anaemia referable to cardiovascular system may closely simulate symptoms and signs of organic heart disease. On the other hand, severe anaemia may precipitate or intensify heart failure or coronary insufficiency in a pre-existing cardiac or coronary disease. Therefore it is necessary to diagnose and correct anaemia to evaluate the extent to which anaemia is partially or entirely responsible for the symptoms and signs.<sup>5</sup>

With reduction in haemoglobin content of 25% or less, the blood volume is increased; there is generalised vascular dilatation in muscles and skin, a rise in venous blood pressure and a high cardiac output with tachycardia.<sup>6</sup> Congestive heart failure, angina pectoris and ECG changes in anaemia are correlated to the severity of anaemia and increase in cardiac output.<sup>7</sup>

Many studies have shown evidence of congestive heart failure and ECG changes in patients with sickle cell anaemia and leukaemia.<sup>8</sup>

## **MATERIALS AND METHODS:**

### **Criteria for selection:-**

Male and female patients with haemoglobin 7 gm%  
Age - 15 years and above

### **Criteria for exclusion:-**

- 1) Recent history of major blood loss
- 2) Pre-existing heart disease like valvular heart disease, hypertensive heart disease, congenital heart disease and thyrotoxicosis
- 3) Systemic disorders which are likely to affect cardiorespiratory dynamics like renal failure, cor-pulmonale, tuberculosis and other respiratory diseases
- 4) Pregnancy
- 5) Presence of skeletal disorders or neuromuscular diseases which are likely to affect exercising capacity like kypho-scoliosis, polio-myelitis etc.
- 6) Leukemias.

All patients were studied for ECG changes. Following ECG changes were observed,

- 1) Sinus tachycardia
- 2) T wave changes like flat T wave and T wave inversion
- 3) ST segment depression

Later, all patients were subjected to the following treatment:

- 1) Deworming
- 2) Oral or parenteral iron therapy OR blood transfusion for correction of anaemia

All the parameters were reassessed after increase in haemoglobin percentage by 3 – 5 gm %

### **OBSERVATIONS:**

Out of 94 patients, 61 were males and 33 were females. 38 patients had Hb in the range of 3 to 5 gm %. ECG changes were seen in 29 patients, of which

22 patients were males and 7 were females. The changes observed are shown in Table 1. In 9 patients, there were ST segment changes as well as T wave changes. T wave changes were seen in 28 patients. Inferior wall was most commonly affected (18 patients)

**Table1. ECG changes observed in patients of anaemia (males, females and total)**

Sr.no	Findings	Female (no. of patients)	Male (no. of patients)	Total (no. of patients)
1)	Sinus tachycardia -	14	11	25
2)	T wave changes	21	07	28
3)	ST segment changes	08	2	10

The following treatment was given for the patients:

- 1) Deworming – Mebendazole 1 bid for 3 days
- 2) Oral or parenteral iron (IM OR IV infusion) or blood transfusion for correction of anaemia.

On an average, haemoglobin increased by 3-5 gm%. All ECG changes disappeared after treatment, except in one patient who had pre-treatment T wave inversion and post-treatment T wave flattening.

All patients were subjected to 2-D echocardiography to exclude any organic heart disease.

#### DISCUSSION:

In the present study, out of 94 patients with severe anaemia (Hb concentration 7 gm%), 38 patients had Hb in the range of 3 to 5 gm %. Out of 38 patients, 29 patients showed ECG changes. These changes were sinus tachycardia, ST segment depression & T wave inversion.

No chamber hypertrophy or QRS abnormality were found in the present study. There is a great diversity on reports of ECG changes in anaemia.<sup>9</sup> ECG abnormalities range from minor repolarization alterations to bundle branch block in anaemia.<sup>10</sup> Decrease in QRS amplitude, T wave

flattening and minor degrees of arterioventricular conduction defects have been noted.<sup>11</sup> ST-T wave changes were also noted.<sup>12</sup> The changes in ECG may be proportional to severity of anaemia.<sup>7</sup> Incidence of ECG changes was higher in patients with Hb % 1 to 5 gm %. 50-75% showing ST depression, 29-50% showing T wave changes and 25-30% showing LVH (left ventricular hypertrophy).<sup>13</sup> In the present study, Hb % of patients was in the range of 2 to 7 gm % and ECG changes were seen in patients with Hb % 2 to 5 gm %. (Not less than 2 gm %). Most studies have shown dramatic improvement in clinical and electrocardiographic changes after correction of anaemia.<sup>14</sup>

We have not considered the type of anaemia, duration of anaemia or bone marrow picture in the present study and treatment modality was independent to ECG changes.

#### CONCLUSION:

Severe anaemia can produce ECG abnormalities and may raise the suspicion of true ischaemic heart disease. These changes are more common in females and in those with Hb % 5 gm %. After treatment and correction of anaemia (increase in Hb % by 3-5%) these abnormalities show reversibility of changes.

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