Electrocardiographic Changes in Mild, Moderate and Severe Anaemia

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ABSTRACT

Anaemia is one of the most common nutritional burden of world. Anaemia is one of the common most leading causes of disabilities and death. Out of all complications of anaemia, cardiovascular complications are easily diagnosed by the safest and cheapest investigation, which is ECG. We found majority of the patients with anaemia are having ECG changes. In current study, we found 186 (62%) patients who had ECG changes associated with anaemia. There were only 114 (38%) patients who didn't have any ECG changes. Majority of the patients in our study had shown ECG changes, with significant association between the severity of anaemia and presence of ECG changes. There were specific associations between the severity of anaemia and presence of ST segment changes, T wave changes, presence of LVH and presence of prolonged "QT" interval.

Keywords: Anaemia, medicine, T wave changes, ECG, blood

INTRODUCTION

Anaemia is one of the most common nutritional burden of world. Anaemia is one of the common most leading causes of disabilities and death[1]. The term "anaemia", is generally used in medicine for reduction below normal in concentration of haemoglobin or red blood cells in blood. It must be remembered that the mean normal value and the lower limits of the "normal" range depend upon the age (childhood or adult life) and gender[2]. Iron deficiency is a preventable cause. It is stated that more than half of Indian women and approximately 25 percent of Indian children suffer from anaemia[3]. India and other parts of south-east Asia have more than 40% anaemic patients. The most common type of anaemia is nutritional anaemia among it more important one is the Iron deficiency anaemia. The current study is planned in the above view to see for changes and their correlation according to severity of anaemia.

AIM AND OBJECTIVES
AIM
To Study the Electrocardiographic changes in mild, moderate and severe Anaemia.

OBJECTIVES
To Evaluate variations in Electrocardiogram (ECG) waves, segments and intervals in Anaemia. To correlate ECG changes with mild, moderate and severe Anaemia.

REVIEW OF LITERATURE
The term "anaemia", is generally used in medicine for reduction below normal in concentration of haemoglobin or red blood cells in blood. One should always remember that mean value and the lower limits of the "normal" range depend upon the age like childhood or adult life and gender[4]. Anaemia is the world's second most leading cause of disability and death. It is responsible for about 1 million deaths a year, out of which three-quarters occur in Africa and South-east Asia[5]. Herrick and Nuzum (1918) first pointed out that anaemia may be accompanied by angina pectoris, and they reported some cases of pernicious anaemia in which anginal pain occurred after effort [6,7]. Similar cases have been described later by many authors. Coombs (1926) observed typical attacks of angina pectoris in 8 of 36 cases of pernicious anaemia. Lewis (1934) considered angina pectoris as a frequent complication of anaemia, but Willius and Giffin (1927) found only 43 cases with angina pectoris among 1560 cases of pernicious anaemia[8-10]. Hochrein (1932) and Scherf (1932) stated that anaemia alone causes neither anginal pain nor myocardial damage, and some disturbances of the coronary circulation in anaemia are always due to organic disease of the coronary arteries [11, 12]. Jagic and Flaum (1935) supposed that there is always a pre-existent latent myocardial damage which becomes manifest in anaemia[13]. Electrocardiographic changes in anaemia were mentioned by Ussoff (1911) and later by Coombs (1926) [8, 14]. Barry M et al reported that the chelation therapy in thalassemia major patients improved clinical features including cardiac parameters on ECG, thus concluding anemia treatment helps in improving cardiac functions [15]. Lindsay J et al also reported cardiac involvement in anemia cases denoted by ECG changes like left ventricular hypertrophy [16]. The study by Hakema SH. Hassan found that patients with aplastic anaemia with ECG (ST segment) changes had higher heart rate than those without ECG changes at the same concentration of Haemoglobin Level (6 g\dl). The study had 60% males and 40% females. The mean age was 31.96 with a standard deviation of 15.45 years. Mostly (80%) the subjects were married. When they studied presentation of symptoms, they found highest percentage 100% was Pallor also shows that 52% with exertional dyspnoea; 40% with chest pain 28% with weakness and fatigue and the same percentage with anxiety and 24% with palpitations. The comparison of patients with or without 'ST-T' changes according to the same concentration of Haemoglobin Level (6 g/dl) showed significant difference between positive and negative ECG „ST-T" changes according to the heart rate.

MATERIALS AND METHODS
Study Design
This was an Observational cross-sectional descriptive study.

Study Setting

This study was conducted at Krishna Hospital and Medical Research Centre, a tertiary care hospital and teaching institute in Maharashtra.

Study Period

The study was conducted for a period of 18 months. During this period, data was collected from December 2016 to May 2018 and data was analysed for a period of 6 months till October 2018.

Sample size

The sample size was calculated after considering the formula for sample size calculation. According to a study conducted by GV Shashikala et al, the total proportion of patients having ST depression was 24%.[15]

So, P = 24% = 0.24

The formula used was

$$N = \frac{Z^2 \times P\,(1-P)}{e^2}$$

$$Z = 1.96,$$
$$e = \text{allowable error} = 0.05$$
$$P = \text{prevalence} = 0.05$$

$$N = \frac{1.96^2 \times 0.24 \times 0.76}{0.05 \times 0.05}$$

$$N = 280.3 \approx 281$$

Rounding it up to 300, so a total of 300 patients will be included in our study. The study used a pre-tested semi structured proforma which was contained detailed information of the subjects which included personal details like demographic data, occupation, their admission or OPD registration number, medical histories like any past history, personal history, addictions. General and systemic examination of the patients was done. In general examination patients was examined for pulse, blood pressure, temperature, any signs of pallor, icterus, cyanosis, clubbing, lymphadenopathy, pedal oedema.

RESULTS

Table 1: Age group wise and distribution of the patients

Age Group	Number (n=300)	Percent
18 – 30	117	39
31 – 50	139	46.33
>50	44	14.67
Total	300	100
\Mean = 37.37; SD ± 13.22 years		

In current study, 139 (46.33%) patients belonged to the age group of 31-50 years. Then 117 (39%) patients belong to the age group of 18-30 years. 44 (14.67%) patients belong to the age group of more than 50 years. The mean age of the patients was 37.37 ± 13.22 years. (Table 1).

Table 2: Gender wise distribution of the patients

Gender	Number (n=300)	Percent
Male	122	40.67
Female	178	59.33
Total	300	100

The gender-wise distribution of the patients in the current study saw that majority of the patients were females, to be precise there were 178 (59.33%) females and rest 122 (40.67%) were male patients. The male: female ratio was 0.68:1. (Table 2)

Table 3: Distribution of severity of anaemia

Severity of Anaemia	Number (n=300)	Percent
Mild	130	43.33
Moderate	117	39
Severe	53	17.67
Total	300	100

According to the severity of anaemia among the patients, there were 130 (43.3%) patients who had mild anaemia and 117 (39%) who had moderate anaemia and 53 (17.67%) who had severe anaemia. The study had more mild to moderate cases as they are usually neglected as symptoms are less and subtle. (Table 3)

Table 4: Systolic Blood pressure of the patients

SBP	Number (n=300)	Percent
≤100	12	4
102 – 120	57	19

122 – 140	163	54.34
>140	68	22.66
Total	300	100
Mean= 128.06; SD±14.09		

In current study we also studied the systolic Blood Pressure of patients and found that there were 163 (54.34%) patients who had systolic BP in the range of 122-140mm Hg and there were least number of patients who had SPB<100mm Hg who were only 12 (4%). There were 57 (19%) who had SBP in the range of 102-120mm Hg. There were 68 (22.66%) patients who had SBP>140 mm Hg. The mean systolic blood pressure was 128.06 ±14.09mm Hg. (Table 4)

DISCUSSION

In current study, 139 (46.33%) patients belonged to the age group of 31-50 years. Then 117 (39%) patients belong to the age group of 18-30 years. 44 (14.67%) patients belong to the age group of more than 50 years. The mean age of the patients was 37.37 ± 13.22 years.

The study by Gyeongsil Lee et al, had higher age group patients who belonged to the mean age of 54.2 ± 8.9 years.[17] In current study among the moderate anaemia group, we had more cases that is 54 (46.15%) patients who had "ST" segment depression and 4 (3.41%) patients who had "ST" segment elevation and 10 (8.54%) patients who had flat "ST" segment. There were 43 (36.75%) patients who had "T" wave inversion and only 1 (0.85%) patient with tall "T" wave and 2 (1.70%) patients who had flat "T" wave. In current study among the severe anaemia group, we had 27 (50.94%) patients who have "ST" segment depression and 1 (1.88%) patient who had "ST" segment elevation and 7 (13.20%) patients who had flat "ST" segment. There were 18 (33.96%) patients who had "T" wave inversion.

The study by Neha H. Pandya et al, also had similar findings ECG abnormality as the current study. There were 3 (1.3%) patients who belonged to mild anaemia who had "ST" segment depression and 2 (1%) who had flat "ST" segment and 2 (1%) who had "T" wave inversion and 2 (1%) who had flat "T" wave. In moderate group, 5 (2%) had "ST" depression and 4 (1.5%) had "T" wave inversion.[18] The study by Shashikala GV, et al, saw similar finding of increasing "ST" depression with increasing severity of anaemia. They observed that 50% patients showing "ST" depression, 30% showed "T" wave changes and 25% had LVH in severe anaemia.[19] In a study by P. Szekely had 5 cases who had "ST" segment depression.[10] In current study, Difference RR interval was present in 1 patient of mild anaemia, 3 patients of moderate anaemia and 3 patients of severe anaemia. There was no any significant association between the Severity of anaemia and difference in RR interval. The L. M. Sanghvi et al, study saw no association between severity of anaemia and the ECG changes in case of difference RR interval. [20] In a study conducted by Stanojevic et al, they found difference in RR interval in 3 cases and concluded that the association was significant.[13]

CONCLUSION

Anaemia is one of the most common preventable diseases in India. Out of all complications of anaemia, cardiovascular complications are easily diagnosed by the safest and cheapest investigation, which is ECG. We found majority of the patients with anaemia are having ECG changes. We observed that there were more number of females having anaemia. Mild cases of anaemia were more than moderate or severe. Age also had an effect on severity of anaemia as did gender, with increasing severity of anaemia in increasing age and female sex. The patients in our study showed significant association between the severity of anaemia and increased heart rate. Majority of the patients in our study had shown ECG changes, with significant association between the severity of anaemia and presence of ECG changes. There were specific associations between the severity of anaemia and presence of "ST" segment changes, "T" wave changes, presence of LVH and presence of prolonged "QT" interval. Our study helps to give an idea about different ECG changes present in anaemia patients and their association with severity of anaemia. This study also helps in making necessary plan to diagnose cardiovascular complications of anaemia with the help of ECG and treat them promptly.

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