Study of Electrocardiographic Findings in Severe Anaemia

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ABSTRACT

BACKGROUND

Anaemia is a worldwide problem which has major consequences on human health. It also poses a huge social and economic burden. World Health Organisation defines a haemoglobin level of less than 8 gm / dL as severe anaemia. It affects multiple organs, cardiovascular system being one of them. The clinical features of anaemia are a result of diminished oxygen carrying capacity of the blood. The clinical presentations vary depending on the age of the patient, rapidity of onset of anaemia and its severity. The cardiac changes are reflected as electrocardiographic abnormalities. In clinical practice such electrocardiographic findings simulate those of ischemic heart disease leading to a battery of investigations.

METHODS

This was a retrospective study. Forty five anaemia patients admitted in medicine wards of S. Nijalingappa Medical College and HSK hospital over a period of 6 months from 1st July 2019 to 31st Dec 2019 were studied. Complete hemogram and electrocardiography were obtained and analysed.

RESULTS

Anaemia was more common among females who constituted 30 (66.66 %) patients as compared to males constituting 15 (33.33 %) patients. 31 patients (68.88 %) with severe anaemia showed ECG changes. Most common finding was sinus tachycardia seen in 17 (37.77 %) of patients followed by T inversions 11 (24.44 %) and ST depressions 4 (8.88 %). Anaemia was most commonly seen in the age group of 15 - 30 years constituting 23 (51.11 %) patients. ECG findings were more common in females as compared to males. 22 (73.33 %) of female patients had ECG changes as compared to 9 (60 %) in males.

CONCLUSIONS

ECG abnormalities are common in patients with severe anaemia more so in females. These mimic changes seen in patients with ischemic heart disease.

KEYWORDS

Severe Anaemia, Electrocardiographic Findings, Sinus Tachycardia

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BACKGROUND

World Health Organization (WHO) defines anaemia as haemoglobin level less than 13 gm / dL in men and less than 12 gm / dL in women[1]. Anaemia is a worldwide problem affecting 1.62 billion people globally which corresponds to 24.8 % of the population[2]. It has major consequences on human health as well as poses a huge social and economic burden.

Anaemia is classified as mild (11 - 12.9 gm / dL in men and 11 - 11.9 gm / dL in women), moderate (8 - 10.9 gm / dL in both men and women) and severe (less than 8 gm / dL irrespective of gender) based on the haemoglobin levels[3]. The clinical features of anaemia are a result of diminished oxygen carrying capacity of the blood. The clinical presentations vary depending on the age of the patient, rapidity of onset of anaemia and its severity. It affects multiple organs, cardiovascular system being one of them. Anaemia results in a state of hyper dynamic circulation causing supply-demand mismatch. This subsequently leads to myocardial ischemia.

Compensatory mechanisms like increase in cardiac output, decrease in circulation time persist as long as the patient is anaemic[4]. In an otherwise healthy person, a measurable increase in resting cardiac output does not occur until haemoglobin is less than 7 gm % and clinical signs of cardiac hyperactivity usually are not present until haemoglobin concentration reaches even lower levels.[5] the cardiac disturbances are known to revert with correction of anaemia[6]. These cardiac changes are reflected as ECG abnormalities and are reversible[7]. In clinical practice such ECG findings simulate those of ischemic heart disease (IHD) leading to a battery of investigations.

Our study would throw light on the ECG findings in patients with anaemia thereby guiding the clinicians in streamlining the investigations thus preventing diagnostic dilemma. This would as well reduce the financial burden on patient because of additional investigations conducted and make rational use of available resources.

METHODS

Our study was a retrospective study. Patients diagnosed with severe anaemia, admitted in Medicine wards, S. Nijalingappa Medical College and HSK hospital, Bagalkot, over a period of 6 months from 1st July 2019 to 31st December 2019 were studied. Diagnosis of severe anaemia was made based on haemoglobin values as per WHO definition. Case records and ECG were collected and analysed.

Inclusion Criteria

Patients aged 15 years or more with severe anaemia as per WHO definition.

Exclusion Criteria

1. Previous history of Ischemic Heart Disease (IHD).
2. Present history and examination suggestive of IHD.
3. Pre-existing cardiac ailment like valvular heart disease and congenital heart disease.

Investigations

1. Complete blood count, ESR, peripheral smear
2. ECG
3. RBS, blood urea, serum creatinine.
4. Serology for HIV, HBsAg, HCV.
5. Chest X-ray, USG.

RESULTS

In our study, 45 cases of severe anaemia admitted over a period of 6 months were analysed for ECG changes.
Age wise distribution of anaemia patients is as shown in Table 1.

Age in Years	Number of Patients	% of Patients
15 - 30	23	51.11 %
31 - 60	17	37.77 %
More than or equal to 61	5	11.11 %

Table 1. Age Wise Distribution of Anaemia Patients

Maximum percentage of severe anaemia patients were seen in the age group of 15 - 30 years.

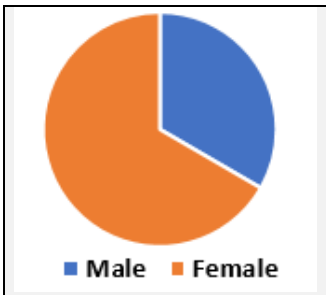

Figure 1. Sex Wise Distribution of Anaemia Patients

Anaemia patients were shown in the following pie chart. There were 15 (33.33 %) male patients with anaemia whereas females outnumbered males amounting to 30 (66.66 %) patients.

ECG Changes	Number of Patients	Percentage
Absent	14	31.11 %
Present	31	68.88 %

Table 2. Number of Severe Anaemia Patients with ECG Changes

ECG Findings	Number of Patients	Percentage
Sinus tachycardia	17	37.77 %
Normal	14	31.11 %
T inversions	11	24.44 %
ST depressions	4	8.88 %
Sinus bradycardia	1	2.22 %

Table 3. Different ECG Findings Seen in Patients with Severe Anaemia

ECG changes were found in 31 (68.88 %) of our patients. Different ECG findings seen in our patients of severe anaemia are depicted in the following Table 3.

Thirty one of 45 severe anaemia patients showed ECG changes. Sinus tachycardia was the most common ECG

finding found in 17 patients followed in order by normal ECG and T inversions found in 14 and 11 patients respectively. ST depressions were found in 4 patients. One patient with associated dengue fever showed sinus bradycardia. These cardiac manifestations of dengue fever resolved once he recovered from dengue. Age wise distribution of ECG findings in anaemia patients is as shown below in Table 4.

	Normal ECG	Sinus Tachycardia	T Inversions	ST Depressions	Sinus Bradycardia
15 - 30 (n = 23)	7 (30.43 %)	10 (43.47 %)	8 (34.78 %)	0 (0 %)	0 (0 %)
31 - 60 (n = 17)	7 (41.17 %)	3 (17.64 %)	2 (11.76 %)	4 (23.52 %)	1 (5.88 %)
More than or equal to 61 (n = 5)	0 (0 %)	4 (80 %)	1 (20 %)	0 (0 %)	0 (0 %)

Table 4. Age Wise Distribution of ECG Findings in Anaemia Patients

ECG of two patients in the age group of 15 - 30 years showed more than one ECG changes. Sinus tachycardia was the most common ECG change noted in the age groups of 15 - 30 and more than or equal to 61 years. Whereas normal ECG was the most common finding in the age group of 31 - 60 years. Sex wise distribution of ECG changes is as shown below in Table 5.

ECG Changes	Male (n = 15)	Female (n = 30)
Sinus Tachycardia	8 (53.33 %)	9 (30 %)
Normal ECG	6 (40 %)	8 (26.66 %)
T Wave Inversions	2 (13.33 %)	9 (30 %)
ST Segment Depression	1 (6.66 %)	3 (10 %)
Sinus Bradycardia	0 (0 %)	1 (3.33 %)

Table 5. Sex Wise Distribution of ECG Changes

As seen in above table most common ECG finding in males was sinus tachycardia. Whereas females shared equal distribution in both sinus tachycardia and T wave inversions. Second common finding was normal ECG in both the sexes.

DISCUSSION

In our study majority of the patients were in the age group of 15 - 30 years constituting 51.11 % of patients. Such predominance of anaemia in younger age group was noted in a study conducted by Azad KL et al.[8] Anaemia was less commonly seen in elderly patients in our study which was similar to the results of study conducted by Khatri et al.[9] Anaemia was seen more commonly in females (66.66 %). Similar findings were noted in study of Talwelkar et al.[10]

Out of 45 patients studied, 31 (68.88 %) had ECG abnormalities. In a study conducted by Khatri et al[9], 86.79 % of patients with severe anaemia had ECG changes and 13.21 % did not have any ECG changes. Similarly, in a study conducted by Renuka B.G et. al,[11] 52 % of anaemia patients had ECG changes and 48 % patients had normal ECG.

The most common ECG finding in patients with severe anaemia in our study was sinus tachycardia, noted in 17 patients (37.77 %). This coincides with results of a study conducted by Renuka BG et al[11], who showed that 41 % of patients had ECG changes in form of sinus tachycardia. Study conducted by Dhamanagaonkar MP et al[12] showed contradictory results suggesting that T wave changes (29.78 %) were the most common followed by sinus tachycardia (26.59 %). Whereas T wave inversions (24.44 %) were the second most common finding in our study and ST segment depression was seen in 4 (8.88 %) of the patients. In studies by Dhamangaonkar MP et al[12] and Renuka BG et al[11] ST depressions were found in 10 (10.63 %) and 22 (22 %) patients respectively. Sinus bradycardia was found in only one patient. Similarly Renuka BG[11] et al concluded that only 1 % of the total study patients had sinus bradycardia. Both these studies have evaluated ECG changes in the entire spectrum of anaemia. However, we have studied the ECG changes in a subset of severe anaemia. This could possibly explain the subtle discrepancies in the ECG changes compared between the studies.

A study conducted by Khatri et al[9] divided anaemia patients into mild, moderate and severe and analysed their ECG. According to them 66.03 % of patients with severe anaemia had ST segment changes. T wave changes were seen in 33.96 % of patients whereas prolonged QT interval was seen in 5.66 % of patients. Conversely, we have not noted any changes in QT interval in our study.

When age wise distribution was considered, anaemia was most commonly seen in age group of 15 - 30 years with number of patients amounting to 23 (51.11 %). Renuka BG et al have demonstrated highest number of ECG changes in the 16 - 20 years age group[11]. In our study, ECG of two patients in the age group of 15 - 30 years showed more than one ECG changes. Sinus tachycardia was the most common ECG change noted in the age groups of 15 - 30 (43.47 %) and more than 60 years group (80 %). In the age group of 31 - 60 years most common ECG finding was ST depression seen in 4 (23.52 %) of patients.

ECG changes were more common in females (73.33 %) compared to males (60 %). Most common ECG finding in males was sinus tachycardia (53.33 %). However, sinus tachycardia and T inversions were noted to be equally common (30 %) in females.

CONCLUSIONS

A significant number of patients with severe anaemia showed ECG changes. Most common among them was sinus tachycardia, others being ST segment changes and T wave inversions. These changes can be easily mistaken for underlying cardiac ailment or may well be considered a consequence of systemic diseases other than anaemia. This can also mislead the treating physician to extensively evaluate with endocrine work up, electrolyte panel etc. Our study reveals that ECG changes are commonly seen in patients with severe anaemia. We recommend the use of this knowledge to prevent extensive investigations.

Data sharing statement provided by the authors is available with the full text of this article at jebmh.com.
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