

STUDY OF ELECTROCARDIOGRAPHIC CHANGES IN A PATIENT OF ANEMIA IN A TERTIARY HOSPITAL.

General Medicine

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ABSTRACT

Background And Aim: Anaemia, common nutritional burden of world with universal incidence, very common in tropical countries. Current research aimed to study the electrocardiographic changes in mild (9-11%), moderate (7-9%) and severe (<7%) anemia. **Material And Method -** Hospital based Observational Cross-sectional study conducted on patients with age between 18 to 65 years admitted in hospital (IPD/OPD), meeting inclusion criteria under Department of Medicine, Mahatma Gandhi Hospital, Jaipur from January 2021 to September 2022. **Result -** In this study, out of 100 subjects, 63% were males and 37% were females. Maximum subjects were from age group of 31-40 years (30%) followed by 41-50 years (28%). Mean age among the study subjects was 41.29±11.50 years. Mild, moderate and severe anemia was reported among 39%, 39% and 22% of the subjects respectively. Mean±SD heart rate among the study subjects was 98.32±20.72. ECG findings viz. ST Depression, ST Elevation, ST Flat, T Inversion, T Tall, T Flat and QT Prolongation was reported among 35%, 4%, 6%, 29%, 3%, 1% and 8% of the subjects respectively. In this study, mean age in mild, moderate and severe anemia was 36.32±9.58, 41.08±10.12 and 44.62±11.49 years respectively. Hence anemia was related with old age having significant association. In this study, severe anemia was associated more with females as compared to males with statistically significant association. In this study, mean heart rate in mild, moderate and severe anemia was 91.95±20.93, 96.97±16.70 and 112±21.27 respectively. Hence anemia was related with higher heart rate having significant association. ST elevation was not found to be associated with grading of anemia. ST flat was associated more with severe grading of anemia as compared to mild as compared to moderate anemia, though no statistically significant difference was found. T inversion was associated more with severe grading followed by moderate anemia with statistically significant difference. T tall was not found to be associated with grading of anemia. T flat was not found to be associated with grading of anemia. QT Prolongation was associated more with severe grading followed by moderate anemia with statistically significant difference. **Conclusion:** According to our study, females were more affected by anaemia than males. We found more cases of mild anaemia than moderate or severe ones. Age was also a criterion by which severity of anaemia differ, as did gender. Severity of anaemia increased with an increase in age and female sex. The patients in our study also showed significant relationships between the severity of anaemia and increased heart rate. The majority of the patients in our study had shown ECG changes, which are related to the severity of anaemia. There were specific associations between the severity of anaemia and the presence of ST segment changes, T wave changes, and the presence of prolonged QT interval.

KEYWORDS

INTRODUCTION

Anaemia, common nutritional burden of world with universal incidence, very common in tropical countries. One of the common most leading cause of disabilities and death. Anaemia, defined as reduced haemoglobin concentration, affects more than 2 billion people globally.

Anaemia affects body by decreased oxygen carrying capacity of the blood. There are enough evidences, indicates, anaemia contributes to cardiac disease and death.

The major physiological consequence of anaemia, reduction in oxygen carrying capacity of the blood, hence, cardiac output is increased to maintain an adequate oxygen supply to the tissues.

The physiological role of haemoglobin is the delivery of oxygen to vital organs, including the heart. It causes O₂ supply – demand myocardial mismatch causing myocardial ischemia.

These cardiac disturbances are reversible and persist as long as the anaemia is severe. In severe long standing anaemia, cardiac dilatation and hypertrophy are naturally expected due to hyperdynamic state. To substantiate this, ECG studies for cardiac disturbances have been made less frequently. There is diversity of opinion available, on reports of ECG changes in anaemia.

Early reports have described a decrease in QRS amplitude, T wave

flattening and minor degrees of atrioventricular (AV) conduction disturbances, but these have not been observed in more recent studies. Later studies have reported frequent non-specific ST-T wave changes. The incidence of ECG abnormalities, varies significantly in different studies ranging from 10-80%.

MATERIAL AND METHOD –

Hospital based Observational Cross-sectional study conducted on patients with age between 18 to 65 years admitted in hospital (IPD/OPD), meeting inclusion criteria under Department of Medicine, Mahatma Gandhi Hospital, Jaipur from January 2021 to September 2022.

Inclusion Criteria

- 1) Patients age more than 18 years.
- 2) Patients diagnosed as anaemic irrespective of aetiology in which Hb levels are below 11 gm% are selected for the study.
- 3) Patient willing to participate in the study and signs Consent form.

Exclusion Criteria:

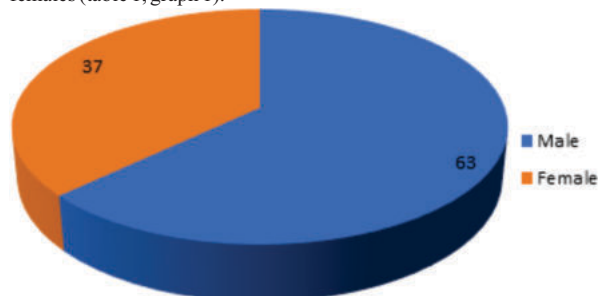
- 1) Patients with history of smoking, alcoholism.
- 2) Patients who are known cases of heart disease, coronary artery disease.
- 3) Patients in acute exacerbation of bronchial asthma, chronic anemia.

RESULTS

Table 1: Gender Distribution Among The Study Subjects

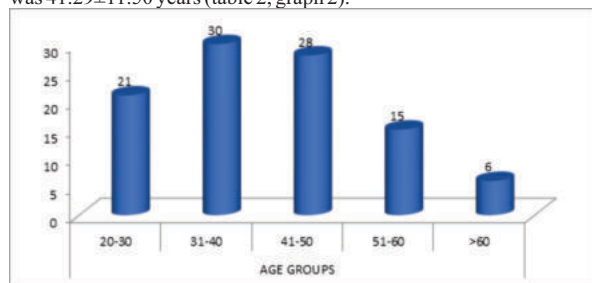
Gender	N	%
Male	63	63
Female	37	37
Total	100	100

In this study, out of 100 subjects, 63% were males and 37% were females (table 1, graph 1).

**Graph 1:** Gender distribution among the study subjects**Table 2: Age Distribution Among The Study Subjects**

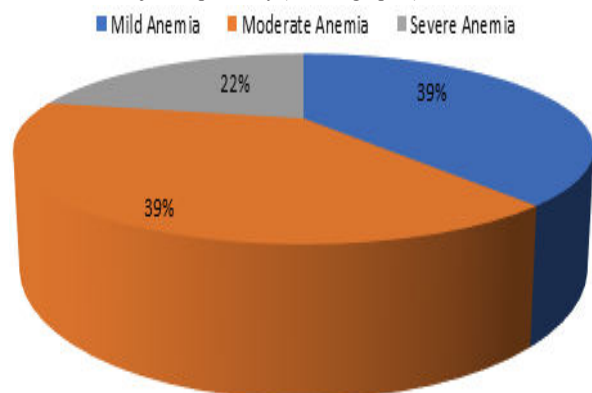
Age Group (in years)	N	%
20-30	21	21
31-40	30	30
41-50	28	28
51-60	15	15
>60	6	6
Total	100	100
Mean±SD	41.29±11.50	

Maximum subjects were from age group of 31-40 years (30%) followed by 41-50 years (28%). Mean age among the study subjects was 41.29±11.50 years (table 2, graph 2).

**Graph 2:** Age distribution among the study subjects**Table 3: Grading Of Anemia Among The Study Subjects**

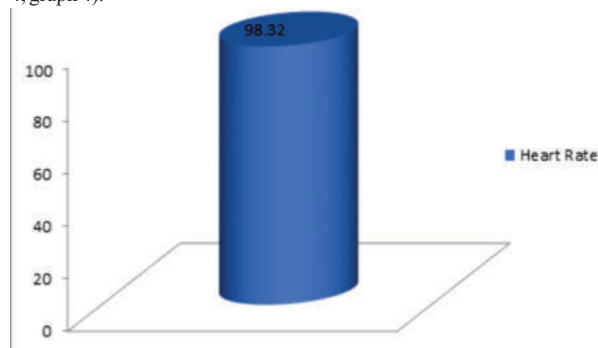
Grading	N	%
Mild Anemia	39	39
Moderate Anemia	39	39
Severe Anemia	22	22
Total	100	100
Mean±SD	8.25±1.85	

Mild, moderate and severe anemia was reported among 39%, 39% and 22% of the subjects respectively (table 3, graph 3).

**Graph 3:** Grading of anemia among the study subjects**Table 4: Descriptive Analysis Of Heart Rate Among The Study Subjects**

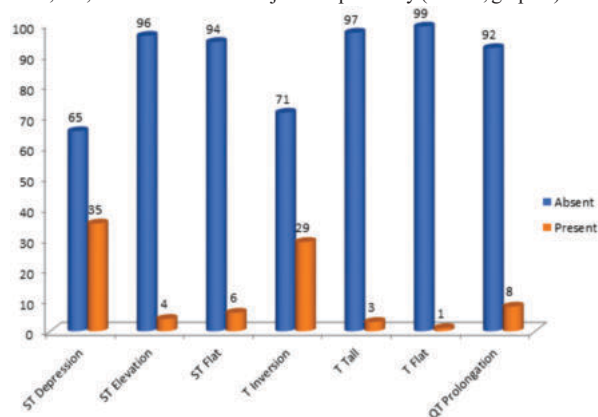
Heart Rate	Value
Mean	98.32
SD	20.72

Mean±SD heart rate among the study subjects was 98.32±20.72 (table 4, graph 4).

**Graph 4:** Descriptive analysis of heart rate among the study subjects**Table 5: ST Depression, ST Elevation, ST Flat, T Inversion, T Tall, T Flat and QT Prolongation**

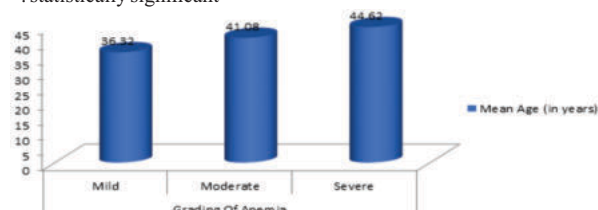
Variables	Absent	Present
ST Depression	65	35
ST Elevation	96	4
ST Flat	94	6
T Inversion	71	29
T Tall	97	3
T Flat	99	1
QT Prolongation	92	8

ECG findings viz. ST Depression, ST Elevation, ST Flat, T Inversion, T Tall, T Flat and QT Prolongation was reported among 35%, 4%, 6%, 29%, 3%, 1% and 8% of the subjects respectively (table 5, graph 5).

**Graph 5:** ST Depression, ST Elevation, ST Flat, T Inversion, T Tall, T Flat and QT Prolongation**Table 6: Comparison Of Age According To Anemia**

Grading Of Anemia	Mean Age (in years)	SD	Anova test	p value
Mild	36.32	9.58	3.59	0.036*
Moderate	41.08	10.12		
Severe	44.62	11.49		

*: statistically significant

**Graph 6:** Comparison of age according to anemia

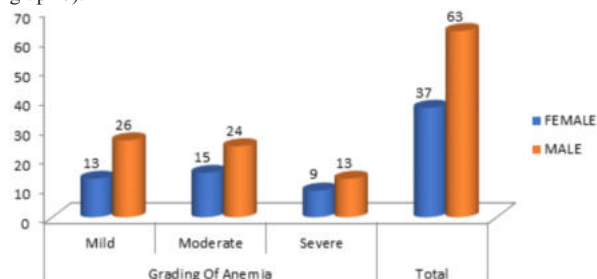
In this study, mean age in mild, moderate and severe anemia was 36.32 ± 9.58 , 41.08 ± 10.12 and 44.62 ± 11.49 years respectively. Hence anemia was related with old age having significant association (table 6, graph 6).

Table 7: Comparison Of Gender According To Anemia

		SEX		Total
		Female	Male	
Grading Of Anemia	Mild	13	26	39
	Moderate	15	24	39
	Severe	9	13	22
	Total	37	63	100
Chi Square		4.98		
p value		0.043*		

*: statistically significant

In this study, severe anemia was associated more with females as compared to males with statistically significant association (table 7, graph 7).



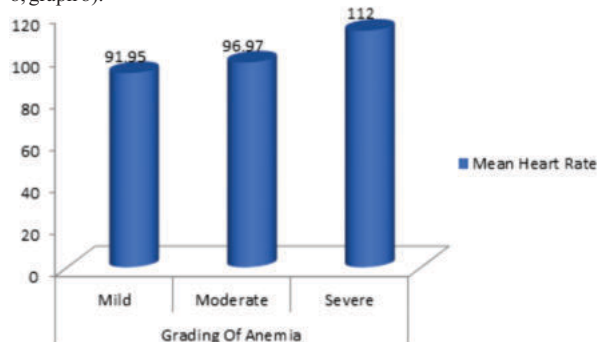
Graph 7: Comparison of gender according to anemia

Table 8: Comparison Of Heart Rate According To Anemia

Grading Of Anemia	Mean Heart Rate	SD	Anova test	p value
Mild	91.95	20.933	7.62	0.001*
Moderate	96.97	16.701		
Severe	112.00	21.265		

*: statistically significant

In this study, mean heart rate in mild, moderate and severe anemia was 91.95 ± 20.93 , 96.97 ± 16.70 and 112 ± 21.27 respectively. Hence anemia was related with higher heart rate having significant association (table 8, graph 8).



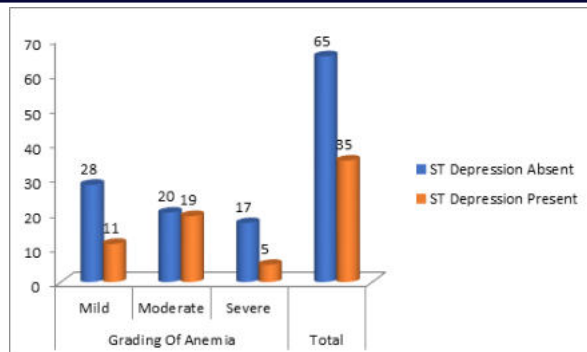
Graph 8: Comparison of heart rate according to anemia

Table 9: Comparison Of ST Depression According To Anemia

		ST Depression		Total
		Absent	Present	
Grading Of Anemia	Mild	28	11	39
	Moderate	20	19	39
	Severe	17	5	22
	Total	65	35	100
Chi Square		5.47		
p value		0.039*		

*: statistically significant

ST depression was associated more with severe grading followed by moderate anemia with statistically significant difference (table 9, graph 9).

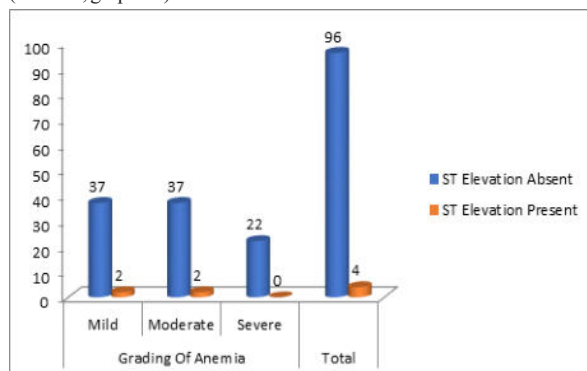


Graph 9: Comparison of ST Depression according to anemia

Table 10: Comparison Of ST Elevation According To Anemia

		ST Elevation		Total
		Absent	Present	
Grading Of Anemia	Mild	37	2	39
	Moderate	37	2	39
	Severe	22	0	22
	Total	96	4	100
Chi Square		1.18		
p value		0.56		

ST elevation was not found to be associated with grading of anemia (table 10, graph 10).

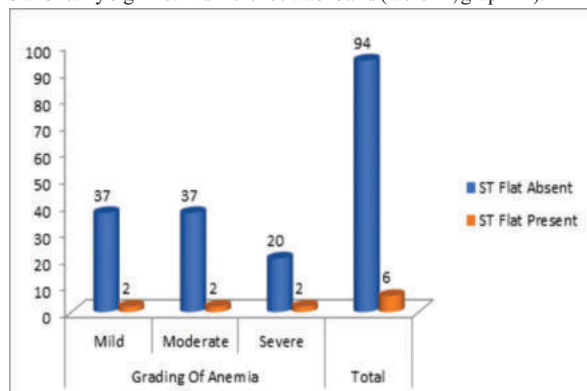


Graph 10: Comparison of ST Elevation according to anemia

Table 11: Comparison Of ST Flat according to anemia

		ST Flat		Total
		Absent	Present	
Grading Of Anemia	Mild	37	2	39
	Moderate	37	2	39
	Severe	20	2	22
	Total	94	6	100
Chi Square		0.48		
p value		0.79		

ST flat was associated more with severe grading of anemia as compared to mild as compared to moderate anemia, though no statistically significant difference was found (table 11, graph 11).



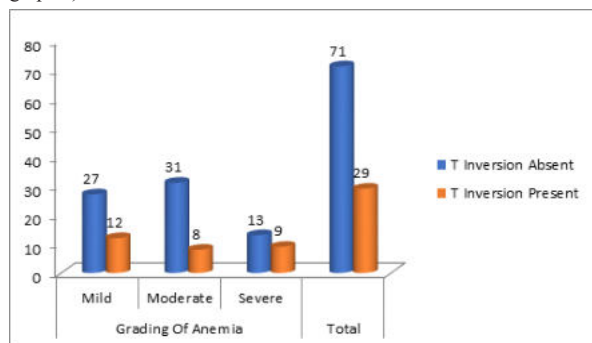
Graph 11: Comparison of ST Flat according to anemia

Table 12: Comparison Of T Inversion According To Anemia

		T Inversion		Total
		Absent	Present	
Grading Of Anemia	Mild	27	12	39
	Moderate	31	8	39
	Severe	13	9	22
	Total	71	29	100
Chi Square		4.86		
p value		0.047*		

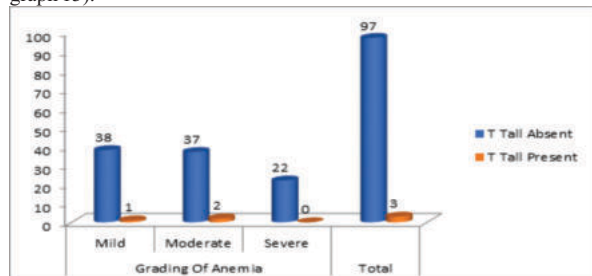
*: statistically significant

T inversion was associated more with severe grading followed by moderate anemia with statistically significant difference (table 9, graph 9).

**Graph 12: Comparison of T Inversion according to anemia****Table 13: Comparison Of T Tall According To Anemia**

		T Tall		Total
		Absent	Present	
Grading Of Anemia	Mild	38	1	39
	Moderate	37	2	39
	Severe	22	0	22
	Total	97	3	100
Chi Square		1.31		
p value		0.52		

T tall was not found to be associated with grading of anemia (table 13, graph 13).

**Graph 13: Comparison of T Tall according to anemia****Table 14: Comparison of T Flat according to anemia**

		T Flat		Total
		Absent	Present	
Grading Of Anemia	Mild	39	0	39
	Moderate	38	1	39
	Severe	22	0	22
	Total	99	1	100
Chi Square		1.58		
p value		0.54		

T flat was not found to be associated with grading of anemia (table 14, graph 14).

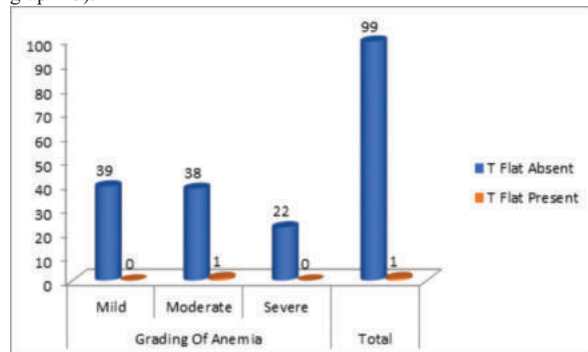
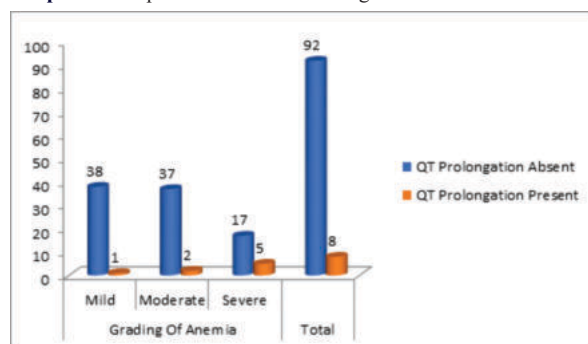
Table 15: Comparison of QT Prolongation according to anemia

		QT Prolongation		Total
		Absent	Present	
Grading Of Anemia	Mild	38	1	39
	Moderate	37	2	39
	Severe	17	5	22

	Total	92	8	100
Chi Square	4.87			
p value	0.046*			

*: statistically significant

QT Prolongation was associated more with severe grading followed by moderate anemia with statistically significant difference (table 15, graph 15).

**Graph 14: Comparison of T Flat according to anemia****Graph 15: Comparison of QT Prolongation according to anemia**

DISCUSSION

The association of anaemia with changes in ECG has been documented well in literature.

Decrease in haemoglobin results in decreased oxygen carrying capacity in anaemia contributes to cardiac disease, which can be diagnosed by ECG.

Changes in ECG, like changes in T waves or ST segment, which are due to cardiac related issues.

Though a few case reports have documented the changes in ECG in anaemic patients but it has not been studied systematically.

Age

There was a significant association between age and grading of anaemia as shown in our study. In this study, mean age in mild, moderate and severe anemia was 36.32 ± 9.58 , 41.08 ± 10.12 and 44.62 ± 11.49 years respectively. Hence anemia was related with old age having significant association.

As there was slight increase in cases of moderate and severe anaemia in older age group we can say that the age had an effect on severity of anaemia. This may be due to the failure to meet nutritional demands as older age group patients usually neglect their nutrition and health.

ECG Changes/ Investigative Profile

In this study, ECG findings viz. ST Depression, ST Elevation, ST Flat, T Inversion, T Tall, T Flat and QT Prolongation was reported among 35%, 4%, 6%, 29%, 3%, 1% and 8% of the subjects respectively.

CONCLUSION

The most common preventable disease in India is ANAEMIA. There are a lot of complications of anaemia, but out of them, cardiovascular complications are the ones that are easily diagnosed by the safest and cheapest investigation, which is ECG. And we also found that the

majority of these patients are having ECG changes. Our study helped to understand an idea about different ECG changes present in anemic patients and their association with the severity of Anaemia. This study also helps in taking important steps to diagnose cardiovascular complications of anaemia with the help of ECG and treat them accordingly.

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