

Original Article

Study of Deleterious Outcome of Severe Anaemia on Circulatory Hemodynamics Using Simple Physiological Parameters

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ABSTRACT

Introduction: Anaemia is one of the most common diseases worldwide and a common cause of death in pregnant women and the children. Also, various hemodynamic effects are seen in the anemics. **Aim:** of the study was to find out the hemodynamic changes in the severe anemics. **Materials and Methods:** Physiological parameters like heart rate and systolic and diastolic blood pressure were measured and compared between the severe anemics and the age matched subjects. **Results:** A statistically significant difference was found in heart rate and blood pressure of anemics as compared to the controls. **Conclusion:** There is altered hemodynamics in anemics, the common cause of which could be decrease peripheral resistance in anemics.

Key words: Severe anemics, peripheral resistance.

INTRODUCTION

Anaemia is one of the most prevalent health problem faced by children and pregnant women. The prevalence of anaemia is higher among the people of low socio economic status. Anaemia is defined by haemoglobin value of <12 gm/dl in women and <13 gm/dl in men. In 1920, Barcroft proposed that tissue oxygenation depends on hemoglobin concentration ([Hb]), oxygenation of blood by the lungs and cardiac output.^(1,2) Thus anaemia is also defined as the decreased oxygen carrying capacity of blood due to decrease in haemoglobin level.

It has been seen that in anaemia the Cardiovascular system shows many hemodynamic changes in the form of increase heart rate, increase stroke volume, decrease in blood pressure, arrhythmias. The study was conducted to find out the changes in hemodynamics using the simple techniques

AIMS AND OBJECTIVES

The aim of the study was to study the circulatory hemodynamic changes occurring in severe anemics.


Study was conducted in a teaching medical institute in urban area of Mumbai in year 2010 to 2012 with prior permission of ethical committee. 60 patients of severe anaemia with haemoglobin level less than 7 gm %^(3,4) were selected for study. Out of 60 patients 30 patients were males & 30 were females. All the 60 patients belonged to the age group of 20 to 40 years. For statistical comparison 60 healthy controls from the general population of the same age group that is 20 to 40 years and same socioeconomic status were selected. Controls were having haemoglobin level more than 13 gm% in males and more than 12 gm% in females.⁽²⁾

Materials used

- 1) Sphygmomanometer: used for the measurement of basal systolic and diastolic blood pressure.
- 2) Sysmex k 100: A fully automated electronic quantitative hematology analyser used for measuring the Hb level and also for counting the other cell counts like total leucocytes count and differential counts, for the total RBC count and platelets count. In this study this machine is used for measuring the Hb level of both, the patients and controls.

MATERIALS AND METHODS

In the beginning of procedure, purpose of the study was explained to the subjects. Written consent was taken. Hb level was measured with the help of electronic counter

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like measuring blood pressure and heart rate in anemics.

Sysmex k-100. After finding the result the patients and subjects were selected for the study.

1. Resting Heart Rate and Blood Pressure.

The subjects and controls were monitored for the heart rate by an electrocardiographic tracing (ECG tracing) and blood pressure was monitored in the right upper extremity by sphygmomanometer. Blood pressure and heart rate were recorded in the beginning and then, after continuous rest in supine position. When two consecutive heart rate and blood pressure readings taken 5 minutes apart were identical then that reading was taken as the final reading. This meant that in all probability they had reached their basal values. (5)

RESULTS

60 patients of severe anaemia formed the study group and 60 healthy volunteers formed the control group. Both the study group and control group belonged to the age group of 20-40 years.

Statistical analysis was done by using GraphPad InStat^R software version 3.10, created on July 10, 2009. Descriptive statistics i.e. mean and standard deviation was used for numerical data. Comparison of numerical variables among groups was done by using unpaired t-test, p - value < 0.05 was considered as statistically significant.

Table 1: Comparison of Age in Cases and Controls

Age(Yrs)	Group wise comparison of age			Unpaired t- test applied		
	Group	Mean	SD	t-value	P-value	Significance
Cases		25.45	3.92	0.7524	0.4533	Not significant
Controls		25.85	1.23			

In above table, the age of iron deficiency anaemia patients (mean 25.45 ± 3.92) is compared with the age of controls (mean 25 ± 1.23) with the help of unpaired t test, showing that there is no significant difference between the ages of patients and the controls.

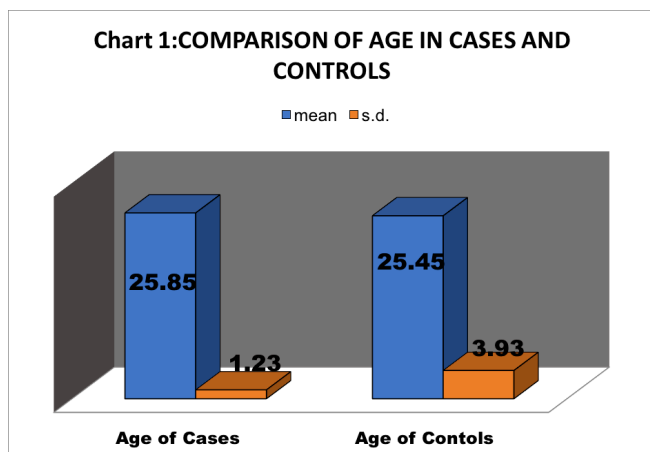


Table No. 2: Comparison of heart rate in cases and controls:

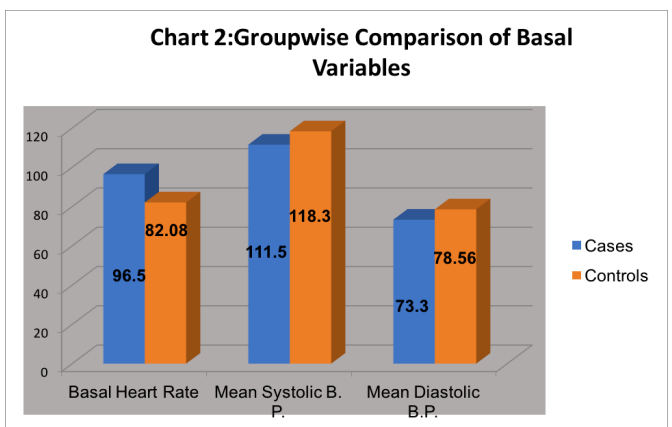
Heart Rate (Beats/Min)	Group wise comparison of Heart Rate			Unpaired t- test applied		
	Group	Mean	SD	t-value	p-value	Significance
Cases		96.5	9.63	8.93	<0.0001	Significant.
Control		82.08	7.94			

Table No. 3: Comparison of basal systolic blood pressure in cases and controls:

Basal Systolic Blood pressure (mm/Hg)	Group wise comparison (BBDP)			Unpaired t- test applied		
	Group	Mean	SD	t-value	p-value	Significance
Cases		111.50	10.10	4.42	<0.0001	Significant.
Control		118.30	6.30			

Table No. 4: Comparison of basal diastolic blood pressure in cases and controls:

Basal diastolic Blood pressure (mm/Hg)	Group wise comparison of age			Unpaired t- test applied		
	Group	Mean	SD	t-value	p-value	Significance
Cases		73.30	8.01	4.28	<0.0001	Significant.
Control		78.56	5.14			



The tables and the bar diagram above shows the means and the standard deviations of various parameters like heart rate, systolic blood pressure, diastolic blood pressure in anemics as compared to the controls. It also shows the statistical comparison between the two using unpaired t test.

The mean heart rate of patients was found to be 96.5 ± 9.63 and that of controls was 82.08 ± 7.94, when the unpaired t-test was applied it was found that the heart rate of cases was significantly higher than that of controls.

The mean systolic blood pressure of patients was found to be 111.50 ± 10.10 and that of controls was 118.30 ± 6.30. When the unpaired t- test was applied it was found that the systolic blood pressure of cases was significantly lower

than that of controls. The mean diastolic blood pressure of patients was 73.30 ± 8.01 and that of controls was 78.56 ± 5.14 . When the unpaired t - test was applied, it was found that the diastolic blood pressure of cases was significantly lower than that of controls.

DISCUSSION

Both the study groups (patients of severe anaemia and controls) were matched for age. This is very important because to eliminate the effect of age on circulatory hemodynamics.⁽⁶⁾ The basal heart rate, basal systolic and diastolic blood pressure were recorded in both severe anaemia patients and controls.

Resting heart rate: when comparison between the resting heart rate in severe anemics and controls was done, it was found that the basal heart rate in severe anemics was 96.5 with a standard deviation of 9.63 and in controls it was 82.08 with a standard deviation of 7.94. Thus it was found that the heart rate of anemics is higher and also the higher values are statistically significant. The finding of the study is in accordance with the study of Nitya Nand et al & Lakhotia et al. The cause of the increased heart rate in severe anemics could be the decreased peripheral resistance in severe anemics due to the hypoxia of the tissue as well as the blood vessels.^(7,8) This decreased peripheral resistance leads to increased heart rate in anemics to full fill the oxygen demand of the tissue.

Resting blood pressure: The mean systolic blood pressure in severe anemics was 111.50 with a standard deviation of 10.10 and in controls it was 118.30 with a standard deviation of 6.30. Thus the systolic blood pressure is significantly lower in severe anemics patients. Also the mean diastolic blood pressure in severe anemics was 73.30 with a standard deviation of 8.01 and in controls it was 78.56 with a standard deviation of 5.84. This means diastolic blood pressure was also significantly lower in severe anemics. The finding of the study is similar to the finding of study of Nitya Nand et al.⁽⁷⁾

In anaemia, oxygen carrying capacity is decreased but tissue oxygenation is preserved at [Hb] well below 100 g/L. Adaptive responses include a shift in the oxyhemoglobin dissociation curve, hemodynamic alterations and micro-circulatory alterations.⁽⁹⁾ The blood pressure is defined as the lateral force exerted by the flowing blood against any unit area of vessel wall.⁽¹⁰⁾ In severe anemics, to maintain oxygen supply to tissue with decrease haemoglobin content of blood, there occurs increase in stroke volume leading to increase cardiac output. The cause of increased cardiac output could be decrease in peripheral resistance resulting from a fall in blood viscosity and arteriolar dilatation, an elevation of right heart filling pressures. Also this increased cardiac output could be due to stimulation of chemoreceptors sensitive to a decreased partial pressure of oxygen, the action of a non-catecholamine humoral mediator, and the activity of the adrenergic nervous system.⁽¹¹⁾

For the mechanism of decreased peripheral resistance in anaemia various theories have been put forth. Justus et al in

their study recommended that increased cardiac output and decreased peripheral resistance was due to humoral agents. According to them several possible humoral agents which decrease peripheral vascular resistance include adrenal medullary hormones (V.E.M. serotonin and others).⁽¹¹⁾ Whereas Glick et al postulated a neural mechanism for decrease peripheral vascular resistance. According to this study in the year 1964, anaemia profoundly reduces the tissue oxygen tension. Such a reduction in tissue oxygen tension, lowers the total systemic resistance through local effects.⁽¹²⁾ Local fall in oxygen tension initiate a program of vasodilatory gene expression secondary to production of Hypoxia inducible factor- 1α , thus causes arteriolar dilation results in secondary increase in cardiac output.⁽¹³⁾

CONCLUSION

Thus the results of present study showed a significant fall in both systolic and diastolic blood pressure as compared to controls and this fall in blood pressure may be due to decreased peripheral resistance resulting due to anaemia.⁽¹⁴⁾

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