EFFECT OF EXAMINATION STRESS ON BLOOD CELL PARAMETERS OF STUDENTS IN A PAKISTANI MEDICAL COLLEGE

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Background: Physiological studies show that stress can alter the blood cells parameters in healthy individuals. We tried to determine whether exams in medical schools are stressful enough to produce such changes. **Methods:** A randomized selection of female students from Women Medical College, Abbottabad, Pakistan, was carried out. After preliminary medical checkup blood samples were taken before and during exams. Students having temperature or high blood pressure at the start of study were excluded. Finally 37 students were included. Estimations of red blood cells, hematocrit, neutrophils, lymphocytes, eosinophils, monocytes, basophils and platelets were carried out.**Results:** Compared with pre-examination results the blood samples taken during exams showed a significant decrease in eosinophil, basophil, lymphocyte and monocyte count. An increase in platelet and neutrophil count was also observed. No significant changes were observed in red blood cell and hematocrit readings. **Conclusion:** It is concluded that examinations in medical schools are stressful enough to produce changes in blood cells parameters which include increase in neutrophils, and platelets, while eosinophils, monocytes basophils and lymphocytes decreased in number.

INTRODUCTION

All of us are fearful of exams. Whether it is a driving test or an annual promotion exam, it does cause us to loose some sleep. Physiological studies have shown that stress can affect the blood cell parameters[1]. These changes include increase in red blood cells, platelets and neutrophil count whereas eosinophils, lymphocytes and monocytes are said to decrease in number. We thus designed a study to confirm the same in our college students.

SUBJECTS AND METHODS

Forty-one girl students of Women Medical College, Abbottabad, Pakistan, were enrolled randomly for the study. Selection was done one month prior to first terminal examination, the girls being unaware of the forthcoming examination. They were subjected to preliminary medical check up including blood pressure and temperature recordings. Three girl students were excluded as they were suffering from acute rhinitis, increased blood pressure and mild fever respectively. Final enrollment of 38 girl students was made. They were of ages between 18 to 20 years (mean-19). None of the students were taking any long term medications or drugs such as hormones, hematinics, vitamins etc. The sample of blood was collected under aseptic conditions between 8am and 8.30am.1.2 mg of anhydrous salt of E.D.T.A. per milliliter of blood was used as an anticoagulant[3].

It was made sure that no frothing of blood occurred during transferring of blood from syringe to the bottle. Counting of red blood cells, total leucocytes and platelets was done by visual means making use of improved Neubauer counting chamber.

Red blood cells were counted making a 1:200 dilution of blood in formal citrate solution. Leucocyte count was done making a 1:20 dilution in Turk solution. Counting of platelets was carried out making 1:20 dilution with 1% ammonium oxalate solution. For differential leucocyte counts, blood films were stained with Leishman's stain which occupies an intermediate position in Romanowsky stain. Compound microscopes were used throughout the study. The record of various blood cells was entered in specially designed tables.

Similar procedure was repeated on the day of practical and oral part of the exam. Out of 38 students one was suffering from fever and so was excluded from the study. Values obtained during examinations were compared with those taken before exams to find out any changes.

RESULTS

A rise in systolic blood pressure by an average of 15mm Hg. was observed in 88% of the students as compared to pre-examination readings.

The parameters of blood cells determined prior to examination and during examination were compared. These results are summarized and presented in Table-1 and Figure-1.

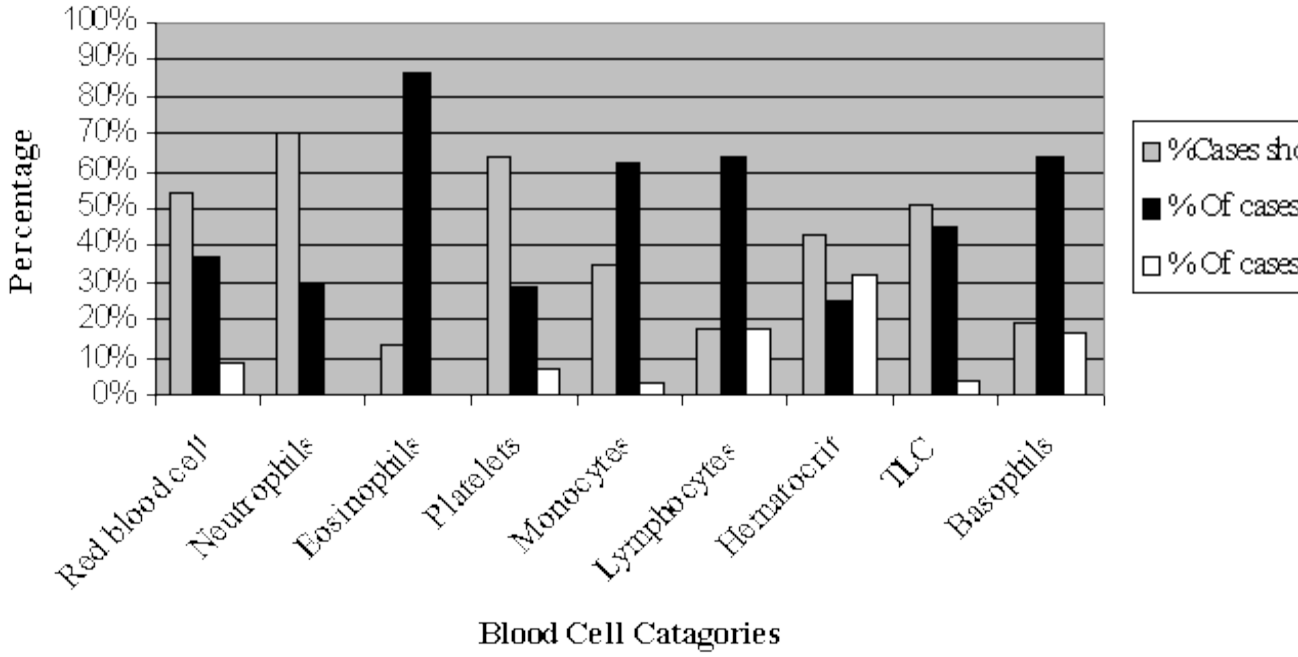
Table 1: Comparison of Blood Cell Parameters Before and During Exam.

Variables	Pre-Exam	During-Exam	Difference	P-Value
RBC millions/cu.mm.	3.81± 0.03	3.81 ± 0.03	0 ± 0.03	N. S.
NEUTROPHIL /cu.mm	4560 ± 65.14	4687.02 ± 65.14	127.02 ± 65.14	<0.01

EOSINOPHIL /cu.mm	226.48 ± 7.14	218.10 ± 7.14	8.38 ± 7.14	<0.0001
PLATLETS/cu.mm	213648.64±928.82	220918.91 ± 928.82	7270.27 ± 928.82	<0.0001
MONOCYTE /cu.mm	167.02 ± 4.59	178.51±4.59	11.49 ± 4.59	<0.01
LYMPHOCYTE /cu.mm	2447.29 ± 52.21	2284.45 ± 52.21	162.84 ±52.21	<0.001
Hematocrit (%)	37.37 ± 0.22	37.08 ± 0.22	0.29 ± 0.22	N.S
Total Leucocyte Count /cu.mm	7397.02 ± 82.38	7363.51 ± 82.38	33.51 ± 82.38	N.S
BASOPHIL / cu.mm	22.16 ± 3.44	13.64 ± 3.44	8.52 ± 3.44	<0.01

Values are expressed as mean ± S.E.M

Figure-1: Percentage Change In Blood Cells



The values observed in our study, as shown in the table and figure show significant changes in during-exam values in white blood cell categories. More marked changes were observed in basophil, eosinophil, lymphocyte and monocyte counts. In red blood cell category no significant changes were observed and the hematocrit was also not disturbed.

DISCUSSION

Stress refers to conditions that arouse anxiety or fear. Anxiety can be defined as an emotion characterized by feelings of anticipated danger, tension and distress and by tendencies to avoid or escape. Human lives are filled with anxieties of different types in danger, chronic burdens, life changes and hassles. Life would be simple indeed if our needs could always be satisfied. But as we know, there are many obstacles … both environmental and internal, which interfere with gratification of our needs and complicate our strivings towards our goals. Delays, lacks, failures, losses, restrictions, conflicts and pressures buffet us all. Such events place adjustment demands or stress on us.

This study which employed real life stress situation of acute nature i.e. examination, showed that the stress of examinations in our college students was significant enough to produce changes in blood cell parameters. The common observation of transient rise in systolic blood pressure during stress was also present in our study.

Physiological studies have shown that stress from any source can influence on the endocrine, hemopoietic and immune systems. Cytokines and cortisol seem to play an important role in the communication between these systems[1,2] .The well documented changes that occur are increase in erythrocytes, neutrophils and platelets, whereas lymphocytes, eosinophils and monocytes decrease in number. The magnitude of stress-induced changes is significantly reduced in adrenalectomised animals. It is suggested that endocrine factors released during stress modulate leucocyte trafficking and result in the redistribution of leucocytes between the blood and other immune compartments[4]. The activation of sympathetic nervous system may also have a role to play. Lymphocytes and monocytes express receptors for several stress hormones, including norepinephrine and epinephrine. Thus stressful events could alter immune function[5]. This alteration in immune function due to decrease in lymphocytes and basophils was found in the subjects of this study, confirming the stress related changes reported in the literature.

Stress of academic examinations also significantly affects the erythron variables. There is increase in number of large red blood cells with increased hemoglobin, which cannot be explained by shifts of fluid out of the intravascular space, concentrating non-diffusible blood constituents[1]. Moreover, it has been suggested that stress induced pro-inflammatory cytokine production may stimulate the proliferation of hemopoietic cells[6].

Studies have confirmed a significant increase in hemoglobin and mean corpuscular volumes in volunteers put under stress. Interestingly, a similar observation on a large number of students was recently reported after the stress caused by academic examinations[1]. An increase in volume of erythrocytes has been reported after short intensive exercise and such a change has been interpreted to be due to an increase in lactate uptake[7]. In our study no significant change in red blood cells or hematocrit was observed. This finding could be explained on the basis of certain physiological factors pertaining to females such as menstruation, low red blood cell count etc.

All of us are familiar with the stress we undergo during exams. This stress can vary from mild to severe. The importance of that particular exam determines the amount of stress we undergo. Exams in medical schools are particularly stressful as they involve much study and also that the results do affect the future study or training of the student. No one has yet come up with a magical shortcut or substitute for adequate preparation through study. Of course, mastery of the subject is sometimes not enough if the student is emotionally upset, fails to interpret questions properly, has his knowledge organized in such a way as to interfere with quick recall, or is overtired. Exams emphasize the ability to understand, organize and recall information. The student is expected to show the depth and breadth of his knowledge. All these can be affected by sheer stress of the situation. Fear of failure or poor performance is quite overwhelming. It is common to hear remarks such as “I forgot”, “I studied but failed to recall”, and “I just got confused”. All these are due to the stress; the exam puts on the student. In this world of competition, unfortunately exams are currently the only means to judge students knowledge. In the foreseeable future things don’t seem to change. Students need to adjust themselves so as to cope with this stress effectively. The teachers, instructors and other staff members have an important role in behavioral therapy to students. High social support appears to attenuate the magnitude of changes in immune cells suggesting a role for social support in protecting against immune decrements during times of stress[6]. This will enable the students to cope adequately with exam stress and will improve their performances.

The study done in our college was exclusively done on female students. The notion that females are more prone to stress could be an additional factor causing these changes. A study including male students would be quite useful in making this observation. One such study is contemplated.

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