Original article:

Cardiovascular changes due to examination stress in First Year MBBS students

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Abstract

Introduction: Competitiveness in today's world has made stress inevitable in life. First MBBS students find qualifying exam very stressful. This study was conducted to find cardiovascular changes due to exam stress in First year MBBS students.

Methods: This study was carried out on 199 Students of First MBBS, in Mumbai's government medical college. Out of this, 63 were female and 136 were male students. All were healthy young adults without any cardiovascular disease in age group of 17-23 years. Parameters used were Weight, Waist Circumference, Pulse Rate and Systolic and Diastolic Blood Pressure. Data was collected three times in the academic year first on admission to MBBS, second before first (terminal) examination, and third before preliminary examination.

Observation: Data was analysed with the help of Friedman Repeated Measures ANOVA tests. The findings of this study suggest that the examination stress causes stastically significant rise in (a) Pulse rate before terminal examination (Z= -9.485, P<0.0005) and before Preliminary examination (Z= -6.757, P<0.0005) & (b) systolic blood pressure before terminal examination (Z= -7.199, P<0.0005) and before preliminary examination (Z= -4.850, P<0.0005). A significant rise is systolic BP found between two examination (Z= -2.659 P< 0.0005). The study also found that diastolic blood pressure also increased before terminal examination (Z= -6.293, P<0.0005) and Preliminary examination (Z= -6.481, P<0.0005) compared to the readings on admission.

Conclusion: Examination causes stress in students which affect the cardiovascular system adversely and this need to be managed efficiently to prevent long term effects in students.

Key words: Stress, Systolic blood pressure, Diastolic blood pressure, Pulse rate, Medical students

Introduction

The goal of medical education is that graduates become knowledgeable, skillful and professional. To achieve these goals, MCI has designed a curriculum of didactic lectures, modeling, supervised practice, and practicals. The syllabus itself is vast and there is continuous evaluation of students through examination. Unfortunately, some aspects of the training process have unintended negative consequences on students' personal health. A major stressor for the first year medical students is the quantum and the complexity of material to be learned in a period of one year and in that to pass in the university examination seems to be challenging task.

The term stress was coined by endocrinologist Hans Selve in 1930s (1) . Stress is a word used to describe experiences that are challenging emotionally and physiologically. Stress arouses anxiety and fear. Several studies have examined the relationship between the source of stress and psychological morbidity in medical students. Studies indicate that medical students face unique academic challenges

810

that make them more vulnerable to stress and anxiety than students in other faculties [2].

Although minimal amount of stress is desirable and is necessary to spark in a healthy competitive spirit, the undue stress has undesirable impact on students [3].

Physiological studies have shown that stress has an impact on endocrine, haemopoietic and immune systems [4]. Psychological stress increases the activity of hypothalamic-pituitary-adrenocortical (HPA) axis and this leads to increase in glucocorticoid levels [5, 6]. Thus, hypothalamic-pituitary-adrenocortical (HPA) axis activates sympathetic system leading to changes in pulse rate, blood pressure, rate and depth of respiration, reaction time, body temperature and galvanic skin resistance [7].

Aims and Objectives

The aim of present study was:

    i.   To determine the changes in cardiovascular parameters (pulse rate and systolic and diastolic blood pressure) caused due to examination stress in first year MBBS students

    ii.   To assess effect of examination stress on body weight and waist circumference

Materials and Methods

Present study was conducted in a Government medical college, Mumbai on 199 first year MBBS students. There were 63 female and 136 male students in age group of 17-23 years and apparently healthy (with no history of cardiovascular disorder). Ethical approval from Institute's Ethical Committee was obtained. Informed and written consent from the volunteers was also obtained.

Physiological parameters- height, weight, waist circumference, pulse rate and systolic & diastolic blood pressure, were measured thrice in an academic year. First reading was taken immediately at the start of the academic course which acted as control in this study. Second reading was taken before terminal examination whereas the third one was taken before the preliminary examination. The reading was taken on 8th day of start of course and also 8 days prior to both the examinations.

1. **Height:**
   Height of all subjects was measured on standardized Stadiometer.

2. **Weight:**
   Weight of subjects was recorded in Kilograms (kgs) using standard weighing machine.

3. **Waist Circumference:**
   Recorded with the help of measuring tape in centimeters (cms).

4. **Pulse rate:**
   Pulse rate of subject was noted on right arm in a sitting position when the subject is at rest and composed. It is counted for a full minute.

5. **Blood Pressure:**
   A standard Sphygmomanometer of Diamond India of ISI mark was used along with Microtone Stethoscope to assess systolic and diastolic blood pressure. Blood pressure was recorded in a sitting position on a right arm when subject is relaxed. The systolic and diastolic blood pressure was recorded by auscultatory method.

This data obtained was analyzed using Friedman repeated ANOVA tests using SPSS software. The mean, standard deviation, median and interquartile range of each parameter in all the three readings of the study were calculated.

Observation and Results

Table no.1 - Comparison of Height at different time intervals among the subjects

Height (cm)	Mean	SD	Median	Interquartile Range	Chi-Square	p-value
At start of course	162.98	9.34	164.00	15.00	1.364	0.506
Before terminal exam	162.98	9.36	164.00	15.00	Difference is not significant	
Before Preliminary exam	162.98	9.36	164.00	15.00		

Table no.2 - Comparison of Weight at different time intervals among the subjects

Weight (Kgs)	Mean	SD	Median	Interquartile Range	Chi-Square	p-value
At start of course	57.91	13.95	55.00	17.00	1.364	0.506
Before terminal exam	58.07	13.58	55.00	15.00	Difference is not significant	
Before Preliminary exam	57.85	13.16	55.00	15.00		

Table no.3 - Comparison of Waist Circumference at different time intervals among the subjects

Waist Circumference (cms)	Mean	SD	Median	Interquartile Range	Chi-Square	p-value
At the start of course	74.92	11.24	73.00	13.00	1.071	0.585
Before terminal exam	75.43	11.57	74.00	12.00	Difference is not significant	
Before Preliminary exam	75.66	12.27	74.00	11.00		

Table no.4 - Comparison of Pulse Rate (per min) at different time intervals among the subjects

Pulse Rate (per min)	Mean	SD	Median	Interquartile Range	Chi-Square	p-value
At start of course	79.54	5.01	80.00	4.00	101.827	7.7E-23
Before terminal exam	84.36	4.93	84.00	8.00	Difference is significant	
Before Preliminary exam	83.83	7.02	84.00	8.00		

Table no.5 - All Pairwise Comparison by Wilcoxon's signed-rank test (Pulse Rate)

Comparison	Z score	P <= 0.05
At start of course vs. Before terminal exam	-9.485	<0.0005
At start of course vs. Before Prelim exam	-6.757	<0.0005
Before terminal exam vs. Before Prelim exam	-1.318	0.188

Table no.6 - Comparison of Systolic BP (mm of Hg) at different time intervals among the subjects

Systolic BP (mm of Hg)	Mean	SD	Median	Interquartile Range	Chi-Square	p-value
At start of course	115.21	11.33	110.00	10.00	61.027	5.6E-14
Before terminal exam	121.52	10.77	120.00	10.00	Difference is significant	
Before Preliminary exam	119.47	11.94	120.00	20.00		

Table no.7 - All Pairwise Comparison by Wilcoxon's signed-rank test (Pulse Rate) (Systolic BP)

Comparison	Z score	P <= 0.05
At start of course vs. Before terminal exam	-7.199	<0.0005
At start of course vs. Before Prelim exam	-4.850	<0.0005
Before terminal exam vs. Before Prelim exam	-2.659	0.008

Table no.8 - Comparison of Diastolic BP (mm of Hg) at different time intervals among the subjects

Diastolic BP (mm of Hg)	Mean	SD	Median	Interquartile Range	Chi-Square	p-value
At start of course	75.05	8.62	70.00	10.00	53.365	2.6E-12
Before terminal exam	79.62	7.95	80.00	4.00	Difference is significant	
Before Preliminary exam	79.79	8.54	80.00	16.00		

Table no.9 - All Pairwise Comparison by Wilcoxon's signed-rank test (Pulse Rate) (Diastolic BP)

Comparison	Z score	P <= 0.05
At start of course vs. Before terminal exam	-6.293	<0.0005
At start of course vs. Before Prelim exam	-6.481	<0.0005
Before terminal exam vs. Before Prelim exam	-0.134	0.893

In this study, total 199 undergraduate medical students were included and they were having an average height of 162.98 cms and the average age 18.33 years. In the present study, the mean weight during the examination was 58.07 kgs as compared to mean weight at the start of course was 57.91 kgs. Mean waist circumference before examination was 84.36 cms as compared to mean waist circumference at the start of course was 79.54 cms. These parameters i.e. height, weight and waist circumference were not statistically significant.

It is very clearly evident from table no. 4 & 5 that during both the examinations (terminal & preliminary), pulse rate was statistically highly significant ($p < 0.0005$) when compared to the start of the course. It increased from mean value of 79.54 beats/min to mean value of 84.36 beats/min & 83.83 beats/min respectively for period before terminal & preliminary exam. Similar findings were noted for systolic & diastolic blood pressures (table no. 6 -9) where there was statistically significant difference between the readings recorded before the two exams & at the start of course.

Discussion

Stress is perceived discrepancy between the demands of a situation and an individual's resources – biological, psychological or social [8]. Examination stress is one of the most widely suffered problem in academics with no exception in medical students. First year MBBS students are at high stress as they are exposed to professional course for first time in their life with a lot of pre-set high expectations [9]. In our study, there was highly significant increase in pulse rate, systolic as well as diastolic blood pressure before examination periods when compared with the parameters recorded at the start of the course. These results were consistent with the other studies [10, 11, 12]. Florence L et al found changes in pulse rate and systolic BP before examination but he found no significant difference in diastolic blood pressure [13]. Various studies like Somnath Salgar, Shah C et al, Reem Rachel Abraham and Supe A N confirmed that

814

there is considerable amount of stress among medical students which is process oriented [14, 15, 16, 17]. Mannapurb et al observed that the students with psychological stress were found to be involved in addiction like tobacco chewing, smoking and even alcoholism [18]. Singh A and Singh S found average stress of the professional group is significantly higher than non-professional group of students [19].

Stowell had revealed that the stress levels in medical students are increased during academic examinations [20]. The significant increase in pulse rate and systolic and diastolic blood pressure prior to both the examinations occurs possibly as a result of sympathetic activation. This is consistent with findings of Freychuss et al and Malathi et al who contributed it to increased epinephrine levels [21, 22]. Epinephrine secretion is increased in response to a stressor like examination where the outcome is unpredictable. This sympatho-adrenal response to stressful situations occurs in various forms like raised pulse rate and systolic and diastolic blood pressure.

There is no significant variation between the readings of pulse rate and diastolic blood pressure of two examinations whereas significant variation was noted in systolic blood pressure before terminal examination in comparison to preliminary examination. This rise in systolic blood pressure during first examination was attributable to rise in sympatho-adrenal activity and mostly students get adapted to the examination which is reflected in decreased systolic blood pressure readings compared to the readings of terminal examination.

The higher stress levels, vast medical syllabus, lesser social support, an academic achievement are certain factors which affect the medical student's performance. . The key for reducing stress among student's is providing students with feeling of control over their education, information about what to expect and feedback regarding what can be done to improve their performance

Conclusion

All these findings and observations show that medical students are under stress and it considerably increases during examinations. Examination causes increase in cardiovascular parameters like pulse rate and systolic and diastolic blood pressure Medical educators should, hence aim to find students with higher stress levels very early in the curriculum. Approaches are needed to reduce the negative aspects of stress on students' health which lessen students learning and performance. Wellness and mental health programmes are needed to help students make smooth transitions between different learning environments with changing learning demands and growing burden. Medical colleges should consider incorporating training in coping skills into the medical curriculum to reach the students who need it the most. Counseling sessions could be provided to overcome stress.

References

1. Shah NP. Stress among medical students. IMA Kerala Medical Journal. 2012; 2(2):53-56.

2. Helmers KF, Danoff D, Steinert Y, Leyton M, Young SN. Stress and depressed mood in medical students, law students, and graduate students at at McGill University. Acad Med. 1997; 72(8):708-14.

3. Funkenstein DH. The learning and personal development of medical students and the recent changes in universities and medical school. J Medical Education 1968; 43; 883-887.

4. Dorshkind K, Horseman NS. Anterior pituitary hormones, stress, and immune system homeostasis. Bioessays. 2001; 23:288–94.

5. Raison CL, Miller AH. When not enough is too much: the role of insufficient glucocorticoid signaling in the pathophysiology of stress-related disorders. Am J Psychiatry. 2003;160:1554–65.

6. Tsigos C, Chrousos GP. Hypothalamic-pituitaryadrenal axis, neuroendocrine factors and stress. J Psychosom Res. 2002;53:865–71.

7. Shruti J Shah, Hitendra M Patel. Effect of Examination Stress on Parameters of Autonomic Functions in Medical Students; Int. J of Science & Reserch. 2014; 3(7);273-76.

8. Mishra BN, Gupta MK, Shukla SK. A comparative evaluation of stress factors indifferent groups in rural areas of Loni, Pravaranagar and PIMS. Pravara Medical Review. 2008; 3(4):10-14.

9. Kharche JS, Pranita A, Phadke AV, Joshi AR .Evaluation Of Examination Stress In I MBBS Medical Students. NJIRM; 2012; 3(5): 27- 31

10. Deepti Thakur, Elvy R Oomen. Effect of examination stress on physiological & psychological parameters among undergraduate medical students; IRMPS; Vol 1(3);2015;64-68.

11. Balkrishna Sharma, Rajshekhar Wavare, Ajit Deshpande. A study of academic stress & its effects on vital parameters in final year medical students at SAIMS medical college, Indore, Madhaya Pradesh; Biomedical Reserch 2011;22(3); 361-365.

12. Rajesh Kathrotia, Manish Kakaiya, Dinesh Parmar. Variable response of first MBBS students to exam stress; NJIRM;2010; Vol 1(3);1-5

13. Florence L, Uttam Banik, Basanti N. Effect of pre-examination stress on blood pressure & pulse rate of undergraduate students; J of Dental & Medical Sciences; Vol 13(12);2014;101-103.

14. Somnath Salgar. Stress in first year medical Students; Journal of Biomedical & Advance Reserch; 2014; 05(01).

15. Shah C. et al (2009) : Common stressors and coping of stress by medical students. Journal of Clinical and Di-agnostic Research. August 2009; Vol. 3, Issue 4, 1621-1626.

16. Reem Rachel A. (2009) : A report on stress among first year students in an Indian medical school. South East Asian Journal of Medical Education Vol. 3 no. 2, 2009, 78-81.

17. Supe AN (1998) : A study of stress in medical students at Seth G.S. Medical College. Postgrad Med. 1998 Jan-Mar;44(1), 1-6.

18. Mannapur B. et al (2010) : A study of Psychological stress in undergraduate Medical students at S N Medi-cal College, Bagalkot, Karnataka. Journal of Clinical and Diagnostic Research. August 2010; Vol. 4, Issue 4, 2869-2874.

19. Singh A. and Singh S. (2008): Stress and adjustment among professional and non-professional students. Industrial Psychiatry Journal 2008. 17 (1), 26-27.

20. Stowell, J. R. (2003) : Use and abuse of academic examinations in stress research. Psychosom Med 2003; 65:1055–57.

21. Freychuss U. Hjemdahl P. Juhlin Dannfelt A. Linde B. Cardiovascular & Sympathoadrenal Responses To Mental Stess- Influence Of β- Blockade. Am.J.Physiol. 1998; 255: 1443- 1451.

22. A.Malathi, Vidya G. Parulkar. Evaluation Of Anxiety Status In Medical Students Prior To Examination Stress. Indian J. Physiol. Pharmacol. 1992; 36(2): 121-122.