

CHANGES IN CARDIAC ACTIVITY UNDER HIGH EMOTIONAL STRESS

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Radiotelemetric recording of the pulse rate and electrocardiogram of 36 students during examinations revealed an increase in the pulse rate, increase in amplitude of the R and T waves, and an increase in the systolic index. Flattening of the T wave was observed in 7 students.

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During responses to emotional factors various changes are observed in the cardiovascular system [1, 4, 5, 7], including changes in the ECG [9, 10, 14]. Investigation of physiological changes during sustained nervous activity is of special interest [2, 8, 13].

The object of the present investigation was to study changes in the pulse rate and ECG in clinically healthy subjects during examinations.

EXPERIMENTAL METHOD AND RESULTS

The investigation was carried out on 36 students in classes III-IV aged 20-27 years, free from cardiovascular pathology. The technique of radiopulsometry and radioelectrocardiography was used [11, 12].

Before the examination began the radioelectrocardiogram (RECG) of the subjects was recorded and their pulse rate counted (by ear from an audible signal in a radio receiver). Later, from the time the student received his admission ticket until the end of the examination, the pulse was counted continuously and the RECG recorded at definite times: during selection of the examination ticket, while preparing for his reply, during his reply, and again 3 min after the end of the examination.

The mean duration of the examination (from the time of entering the examination room until the end of the examination) was 99 min. During that period the subjects' pulse rate reached a mean value of 107/min, the changes being greatest when choosing the ticket and when answering. After the end of the examination the heart rate returned to normal fairly rapidly, indicating well marked compensation of function in young subjects (Table 1).

TABLE 1. Radiopulsometry during Emotional Stress (mean results of 36 observations)

Time of investigation	Pulse rate					
	mean value			maximum		
	$M \pm m$	limits of variations		$M \pm m$	limits of variations	
Before examination	103 \pm 2,2	78	141	117 \pm 3,7	84	156
Choosing ticket*	132 \pm 2,6	90	168	—	—	—
Preparing to answer	111 \pm 2,3	91	142	128 \pm 2,3	96	156
Answering	115 \pm 2,1	87	149	135 \pm 2,4	108	168
3 min after examination	98 \pm 1,7	76	125	106 \pm 2,1	78	130

* Because only one count was made no figures for maximal changes can be given.

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TABLE 2. Changes in RECG (mean results of 36 observations)

Time of investigation	Duration of cardiac cycle (in sec)	Changes in systolic index (in percent of theoretical)	Amplitudes (in mV)			
			P	R	T	R/T
Before examination	0,58	$+4,9 \pm 0,56$	0,24	1,33	0,5	2,7
Choosing ticket*	0,49	$+9,2 \pm 1,4$	0,25	1,34	0,4	3,2
Preparing to answer	0,56	$+6,5 \pm 1,06$	0,23	1,53	0,5	3,1
Answering	0,53	$+9,7 \pm 3,5$	0,28	1,73	0,6	2,8
3 min after examination	0,64	$+5,3 \pm 0,73$	0,19	1,61	0,6	2,8

Data for changes in the RECG indices are given in Table 2. At certain times changes in the systolic index and amplitudes of the RECG waves of the students were observed. Quickening of the rhythm was nearly always accompanied by an increase in the systolic index. No change took place in the temporal characteristics of the P wave and the P-Q and QRS intervals. So far as amplitudes are concerned, a definite tendency was found for the R and T waves to increase at moments of maximal emotional stress. This can be attributed to increased activity of the sympathetic nerves caused by anxiety before the examination. With a general tendency for the T waves to increase, in some subjects changes of the opposite nature were observed. In 7 of the 36 students, for instance, the amplitude of the T waves was lowered and the wave flattened.

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