

A STUDY ON PHYSIOLOGICAL CHANGES IN CERTAIN PSYCHOSOMATIC DISORDERS WITH REFERENCE TO CORTISOL, BLOOD GLUCOSE AND LIPID PROFILE

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(Received on November 27, 1995)

Abstract : Plasma cortisol, blood glucose, serum lipids and lipoproteins were estimated in diseased human subjects and normal control volunteers. Serum triglyceride (Tg) total cholesterol (Tc) and cholesterol content of very low density lipoprotein (VLDLc), low density lipoprotein (LDLc) and high density lipoprotein (HDLc) were assayed under lipid profile. Clinical investigations were carried out on 115 subjects which involved 30 control, 25 irritable bowel syndrome (IBS), 30 bronchial asthma and 30 rheumatoid arthritis patients. The results of this preliminary study showed a significant change in the levels of all the biochemical parameters in diseased subjects in comparison with controls. Increased levels of atherogenic lipids, Tg, VLDLc and LDLc were found in rheumatoid arthritis subjects. This suggests that arthritis subjects are relatively at higher risk of developing coronary heart disease. Furthermore hypercholesterolemia may aggravate the risk condition in arthritis patients by arteriosclerosis. The significant elevation in the levels of plasma cortisol reveals the fact that rheumatoid arthritis is a stabilized and chronic psychosomatic disorder, since, homeostatic competence is disrupted following decline in the tendency of stress-response to return to normalcy.

Key words : stress psychosomatic disorder HPA axis
homeostasis glucocorticoid atherogenic lipids

INTRODUCTION

A psychosomatic disorder is a stress-disorder whose principal cause is psychological in origin but its manifestations are predominantly observed on the body (1). Stress as stated by Selye, is the exaggerated systemic biological

response of an individual to different kinds of stressors (2, 3). Stress response consists of a series of neurohumoral, endocrine and metabolic alterations with related physiological changes involving almost entire body parts and systems albeit to varying degrees. Normally these stress-induced physiological changes are adaptive

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compensatory and self limiting but when stressful state is intense, frequent and chronic and over ride certain limits, these changes become rather irreversible and pathological leading to various organic changes (4). The diseases like IBS, bronchial asthma and rheumatoid arthritis are very much associated with stress factors. Epidemiological studies indicate that there is a very close association between stressful experience and disturbed bowel function (5). Indeed a high prevalence of psychological symptoms and psychoneurotic personality traits have been identified in IBS patients, compared to healthy controls (6, 7). Prolonged and aggravated muscle response under stress is the root cause of etio-pathology of rheumatoid arthritis. Increased bronchoconstriction and mucosal edema are the principal factors in the pathogenesis of bronchial asthma.

Cortisol, a principal glucocorticoid in human produced by adrenal cortex under the control of brain via hypothalamic-pituitary adrenocortical (HPA) axis has a multitude of effects in stress physiology (8). The major effects of cortisol are to reduce inflammation, stabilize blood glucose, maintain muscle strength and promote fluid excretion. Furthermore cortisol, prevents bronchospasm and mucosal edema in bronchial asthma. Cortisol, besides regulating glucose metabolism, exerts profound effects on lipid metabolism. Keeping in view, the multifarious effects of cortisol, under stress, the present study was undertaken to evaluate the pattern of plasma cortisol blood glucose and lipid profile in certain psychosomatic disorders with respect to normal control.

METHODS

The total number of subjects studied were 115 (30 control, 25 IBS, 30 bronchial asthma and 30 rheumatoid arthritis). They all belonged to middle socio-economic class of families aged 35-65 yr. Prior to their participation in the present clinical study, all the subjects were thoroughly examined by expert clinicians and no other associated disease was diagnosed

therewith. Each subject was asked to fill a proforma containing detailed information about their past history. Ten ml of blood sample was collected in supine state of the subjects from antecubital vein after an overnight (12-14 h fast). However, to avoid diurnal variation in plasma cortisol level, blood was drawn between 0900-1000 h. Serum was separated by centrifugation at 3000 rpm for 10 min and was employed for estimating lipids and lipoproteins. Plasma cortisol was assayed fluorimetrically, by procedure of Mattingly et al (9) whereas blood glucose and total cholesterol were estimated as per methods of King and Wootton (10, 11). Serum Tg, HDLc, LDLc and VLDLc were estimated as per respective methods (12-14). Student's 't' test was used for the analysis of data.

RESULTS

Table II shows the levels of different biochemical parameters in normal control and patients. Laboratory, data exhibit a remarkable change in the levels of all the parameters except HDLc which was found moderately reduced in diseased subjects with respect to normal control values. There were no significant differences in the age, height and weight between normal control and patients (Table I). Significantly elevated levels of plasma cortisol and blood glucose ($P < 0.01$) were observed in rheumatoid arthritis subjects. Bronchial asthma patients exhibited significant rise in the plasma cortisol level. Lipid contents were also raised in diseased subject in comparison to controls excepting HDLc which was found reduced. The levels of Tc was most significantly enhanced ($P < 0.05$) in subjects of rheumatoid arthritis. LDLc and VLDLc were also significantly raised in rheumatoid arthritis cases with 24.5% and 55.7% respectively. Plasma cortisol was elevated by 181% and 120% in arthritis and asthmatic subjects.

DISCUSSION

A psychosomatic disorder is a stabilized state of physiological aberrations and structural or functional deviations produced by

TABLE I: Physical characteristics of subjects under study.
(Data are Mean \pm SD)

Groups	No. of subjects	Age (yr)	Height (cm)	Weight (kg)
Normal Control	30 22 males + 8 females	38.4 ± 4.2	168.0 ± 6.2	62.4 ± 6.5
I B S	25 20 males + 5 females	36.8 ± 3.6	167.6 ± 5.8	61.5 ± 5.8
Bronchial Asthma	30 23 males + 7 females	41.6 ± 5.3	168.6 ± 6.0	60.8 ± 7.2
Rheumatoid Arthritis	30 16 males + 14 females	42.8 ± 6.6	167.4 ± 6.3	61.2 ± 6.4

psychological stress. Stress is the most dominant factor which plays a lasting role in etiology of various disorder eg, IBS, bronchial asthma and rheumatoid arthritis etc. Cortisol a principal glucocorticoid in man, produced by adrenal cortex, an integrated part of hypothalamic-pituitary-adrenocortical (HPA) axis, has a multitude of effects in health and disease (15). Hypersecretion of cortisol is a natural adaptive response under stress, which helps to restore and maintain homeostatis (16). Under

stressful states more and more body fuels (glucose and lipids) are required to avoid the exhaustion of the body. Cortisol helps in the maintenance of internal homeostatis through the processes of gluconeogenesis and lipogenesis.

Hyperglycemic effects of cortisol are associated with hyperlipidaemia as is evident from the observations (Table II). There is a good positive correlation between plasma cortisol and blood glucose levels as is evident from data in Table II. The extent of elevations for Tc, LDLc and VLDLc are quite remarkable in arthritis subjects with respect to normal controls. As regards Tg and HDLc, they were not so significantly changed. Several workers have reported drastic alterations in cortisol, blood glucose and lipid profile in stress-induced clinical cases (17). Our results are in good agreement with findings of those workers. Furthermore, our findings establish that rheumatoid arthritis is a chronic and late onset psychosomatic disorder because prolonged and recurrent exposure to stress disrupts the efficacy of HPA axis to modulate cortisol secretion and hypercortisolism becomes a pathophysiological syndrome of such disorders (18).

TABLE II: Laboratory data in control and diseased clinical subjects.
(Data are Mean \pm SD of number of subjects shown in parenthesis).

Groups	Plasma cortisol ($\mu\text{g/dl}$)	Blood glucose	Tg (mg/dl)	Tc	HDLc	LDLc	VLDLc
Normal Control (n=30)	11.26 ± 1.82	82.64 ± 11.28	106.14 ± 12.10	194.20 ± 24.80	52.88 ± 7.80	118.60 ± 18.22	28.76 ± 6.67
I B S (n=25)	17.74 ± 2.15	96.42 ± 10.16	115.58 ± 14.64	206.00 ± 28.28	51.26 ± 8.34	121.28 ± 16.52	26.50 ± 5.48
Bronchial Asthma (n=30)	24.82* ± 2.36	108.75 ± 12.84	119.30 ± 16.60	224.60** ± 26.42	46.68 ± 7.70	128.84 ± 14.68	31.16 ± 6.86
Rheumatoid Arthritis (n=30)	31.68* ± 3.54	128.68* ± 14.64	168.00 ± 18.40	258.28** ± 24.78	45.40 ± 8.16	146.00** ± 18.40	44.80** ± 7.38

*P<0.01; **P<0.05

Association between anomalous lipid pattern and various cardiovascular disorders has been a recognised and established fact. There is a direct relationship between LDLc and VLDLc contents and atherosclerosis which leads to coronary artery disease (19). Increased levels of LDLc and VLDLc in rheumatoid arthritis subjects indicate that such patients are at high risk of developing coronary artery disease. A remarkable increase in blood glucose in arthritis

subjects appears to be the outcome of stress hyperglycemia. Present clinical study reveals the physiological changes with related hormonal and metabolic derangements. This study suggests that patients of rheumatoid arthritis on steroidal anti-inflammatory drugs should be given more attention because prolonged steroid treatment may further aggravate the complications by affecting glucose and lipid contents at metabolic levels.

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