

# Review

## STRESS MANAGEMENT IN DIABETES MELLITUS

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### ABSTRACT

Stress, which is defined as a 'stimulus event of sufficient severity to produce disequilibrium in the homeostasis of physiological systems' can result from a variety of stressors. It is mediated by neuroendocrine changes that translate the signals into pathophysiological alterations. A variety of psychological reactions may occur in diabetes: denial, anger, guilt, depression and resolution. Stress can be managed by either removing the source of stress, or by altering the emotional response, without changing the stressor. Even though the former is often preferable, the latter approaches may be necessary in certain situations. Coping with stress depends on many factors such as positive belief, social skills, social support and monetary resources. The focus of managing chronic diseases such as diabetes must change from 'didactic provision of information to interventions teaching problem solving and coping skills.'

**KEY WORDS:** Stress response; Metabolic syndrome, Coping strategies, Relaxation response

### INTRODUCTION

*Stress* is defined as a 'stimulus event of sufficient severity to produce disequilibrium in the homeostasis of physiological systems'. *Stressor* is the threat that exceeds an individual's ability to meet the challenge and thereby evokes a stress response. It is perceived as stressful depending on the meaning that is ascribed to the stimulus, which in turn results in a sensory or metabolic process that is inherently stressful. Therefore, the definition of stress and stressor depends on the person's interpretation of the stimulus as being stressful (1). *Strain* is the person's psychological or physiological response(s) to a stressor (2). It may take the form of anger, anxiety, frustration or autonomic nervous activation.

Humans are aware of subtle social cues that can affect self-esteem. The balance between stress and resilience determines one's vulnerability to its adverse

effects. It also depends on both genetic influences and early life experiences. Genetic polymorphisms, early life and later life events may all activate the stress response inappropriately (1).

### CLASSICAL STAGES OF STRESS RESPONSE

Classically, three stages of stress response are described (3)

*Phase I or 'Fight or flight response.* This is the first response, which is often protective, at least in the short term. It incorporates the effects of catecholamines to impending threat. Physiological systems are activated to either escape threat, or to defend oneself against it.

*Phase II or Forbearance response.* In the next stage, the physiological upset is tolerated. Blood is diverted away from organs not immediately important for survival (e.g. those for growth and reproduction).

*Phase III or Fortitude response.* The last stage is to the organism, what apoptosis is to the individual cell. When stress is overwhelming, major organ systems are shut down, and death is hastened.

One should recognize that not all stages are necessarily applicable to human beings. Besides, this does not take into account either the benefits of civilization or of resuscitation facilities.

### BIOCHEMISTRY OF STRESS RESPONSE

The hypothalamus in the brain produces corticotrophin releasing factor that stimulates the anterior pituitary to secrete corticotrophin or ACTH. ACTH in turn stimulates the adrenal cortex to secrete stress hormones. Arginine vasopressin, a product of the posterior pituitary is synergistic with CRH in stimulating ACTH. Alone however, vasopressin has little secretagogue activity.

The autonomic nervous system responds to stress rapidly. The sympathetic and parasympathetic limbs of the autonomic nervous system regulate

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cardiovascular, respiratory, renal and endocrine systems. The brain ultimately orchestrates the global stress response by fine tuning the secretion of several neurotransmitters: CRH, AVP, opioid peptides, dopamine and norepinephrine, along with prolactin, glucagon, neuropeptide Y and others such as GABA, brain angiotensin II and protein kinase C (1, 4-6).

The combined stress response involving peripheral and central nervous system, blood cell composition and various activities initiated via a large number of genes, orchestrate the differential activation and suppression of systems for survival and adaptation to changing stimuli (7).

### **PHYSIOLOGICAL CORRELATES OF STRESS RESPONSE**

To measure the degree of stress in real life situations, heart rate and respiratory rate are useful surrogates (8). Fall in heart rate and the respiratory rate correlation coefficient is objective criteria of emotional stress at work. Such cross-correlation coefficients provide integral means to assess emotional stress (8).

There is increasing evidence that environmental factors cause illness by acting through the central nervous system. Effort is on to tease apart the effect of social environment on the biology of disease (9), with the aim of preventing disease, rather than trying to cure it. There is complex interaction of social structure, environment, workplace, along with material factors and psychological factors which influence health behavior.

*Metabolic syndrome and hypothalamic-pituitary adrenal axis (HPA) (1):* Bjorntop postulated that stress could activate the sympathetic nervous system and result in the metabolic syndrome through hormonal dysregulation. Psychosocial stress may trigger the onset of visceral obesity and other components of the metabolic syndrome. Difference in response among individuals to the same stimuli may be responsible for the stress being perceived as 'distress' or 'eustress'.

HPA has been shown to be more active in centrally obese men and in the pre-menopausal centrally obese women. Central android obesity and peripheral gynecoid obesity may be associated with differential regulation of HPA, besides being targeted to

metabolically important tissues such as liver and visceral fat.

Preferential deposition of fat in the abdomen may be due to activity of enzymes that metabolize glucocorticoids. The enzyme 11 beta HSD exists in two isoforms: type 1 (11 beta HSD1) and type 2 (11 beta HSD2). The type 2 isoform irreversibly inactivates cortisol and corticosterone, oxidizing their 11 beta hydroxy groups to metabolites which bind only weakly to hormone receptors. The type 1 isoform catalyzes both the inactivating and activating reactions, which is principally seen in the liver. Stress related metabolic response via glucocorticoids may be modulated by the different isoforms of the enzyme. The 11 beta HSD oxo-reductase activity in subcutaneous abdominal fat tissue was increased in obese individuals, which may activate local glucocorticoid receptors, promoting obesity. There is also evidence that 11 beta HSD activity in the placenta may be responsible for active forms of stress hormones passing through the placenta, resulting in adverse effects in utero.

Intrauterine exposure to stress may activate the HPA axis. In populations undergoing health transition, metabolic syndrome and low birth weight may be linked through activation of HPA. Experimental animals, when prenatally exposed to the corticosteroid dexamethasone, had lower birth weight, permanent elevation of blood pressure and hyperinsulinism. A resetting of neuroendocrine pathways may be responsible for this constellation of changes. Therefore, along with maternal under nutrition, maternal exposure to stress may also contribute to the occurrence of the metabolic syndrome.

The Hoorn Study was a clinical investigation to test the Bjorntop hypothesis. Chronic psychological stress was correlated with prevalence of type 2 diabetes mellitus and with visceral adiposity. More than 2000 adults aged 50-74 years without a history of diabetes mellitus were studied for the number of major stressful events during the preceding five years. An oral glucose tolerance test was given after the history taking. The number of stressful events was positively associated with the prevalence of newly diagnosed diabetes. Anxiety and depression occur in persons with diabetes more frequently than in the general population. In addition other problems are also common including fear of the future, restriction of leisure activities and depression partly as a result of physical disability.

## CLINICAL APPROACH TO STRESS IN DIABETES

A variety of psychological reactions can occur in the course of managing diabetes (1):

**Denial:** As a defense measure one may believe there could be a mistake in the test or the report. It is a reaction against some restrictive or uncomfortable situations. Up to a point denial is a normal reaction, but it can keep from taking proactive measures to overcome ill health. One could deal with denial by asking: *What does diabetes mean to me? How do I know if I have trouble accepting my diabetes? Am I avoiding my treatment plan? Am I avoiding telling others I have diabetes? What can I do if I have problems living with diabetes? Can I talk it out with someone else?*

**Anger:** Anger at the time of unexpected, unwanted or uncontrollable change may be normal. However the expression of anger should not be hurting to oneself or others. When angry, ask:

Why am I angry? Is it my diabetes or something else? Do the same circumstances make me angry all the time? What do I do when I am angry? Do I shout at my spouse or children? Do I stop taking care of my diabetes? What could I do when I am angry? Can I do something to express my anger without hurting others or myself such as talking it over with family, friends, or perhaps yelling in an empty room?

**Guilt:** Guilt may occur in a realistic or unrealistic situation. It may be useful, for example by feeling guilty about events under ones' control and correcting them.

**Depression:** Depression may result from unpleasant, uncorrectable situations. It may be similar to denial, but should not become overwhelming or long lasting. It may be countered by talking over one's feelings, or becoming involved in distracting activity or by making changes, one at a time. If depression is persistent, professional help is needed. When depressed, one can ask oneself: *Why do I feel depressed? Is it because I have diabetes or is it due to some other reason? How am I reacting because of my depression? Am I withdrawing from activities, sleeping less or more, eating less or more, or frequently complaining about little aches and pains?*

Depression can be tackled by talking over ones feelings or becoming involved in a special enjoyable activity or finally by making changes one at a time. If

it persists one should seek professional help.

**Acceptance** means that one feels good about oneself as a person with diabetes. It can take time and patience, along with help from others.

**Resolution** and acceptance may take up to a year after diagnosis of diabetes. It requires full understanding of why diabetes sets in; it's metabolic basis and is consolidated when successful glycemic control is established within the parameters of ones lifestyle.

## COPING WITH STRESS

In general one can cope with stress by focusing either on the emotional effects of stress or solving the problems of stress, or both (10). In *emotion focused coping*, cognitive changes are affected that lead to viewing stressful situations as less stressful; i.e. the situations themselves are unchanged, only the emotional response is sought to be altered. Denial or defense mechanisms are commonly employed methods and they may be useful for a certain period. Ultimately it often becomes necessary and effective to confront and change the stressors directly. In *problem focused coping*, one acquires problem solving skills to directly deal with the stressor and change it. The latter may not always be possible, e.g. emotion focused coping may be required in situations such as end-stage renal disease or other conditions.

### Resources for Coping

**Positive Beliefs:** A positive self-image and a positive attitude are especially significant coping resources. Such positive belief can come from a belief in oneself or in others. People who feel they have an *internal locus of control*, i.e. a feeling they have significant control over the events in their lives, tend to cope better than those who feel they have no control

- **Social skills** The better one's social skills, the less the stress. Social skills also help in communicating ones need, to enlist help and to decrease hostility.
- **Social support** is an important coping resource, be it from families, friends or social organizations such as diabetes self care groups. Support groups help not only by providing other people for relief, but also

because it is possible to learn techniques for coping from others in similar situations.

- *Material resources* are invaluable in coping with stress. In facing minor or major stresses, people with money who can use it effectively generally fare better and experience less stress than those without money.

### **Family Support (Indian Data)**

Recently we evaluated social support in diabetes mellitus (n:249; 146 men, mean age 49.25 years, mean duration of diabetes 6.13 years; 103 women; mean age 48.29 years, mean duration of diabetes 5.36 years) (1). *Attitude towards the patient*: About 65% (n: 145) of spouses felt that the problem of diabetes was minor which requires minimum support. More than 60% of the children felt their parents were normal. *Support in adhering to treatment (diet, exercise, medications)*. Most of the men (n: 102) received support from their spouse in adhering to diet. Most of the men (n: 99) and a little under half the women (n: 36) motivated themselves to exercise. More women (n: 33) than men (n: 23) depended on the spouse to go for exercise. Seventy to ninety percent of both men (n: 127) and women (n: 82) depended either on themselves or on their spouses in taking medications. About half of both men and women with diabetes conversed about the disease. About a quarter conversed about the disease with their family members, who in turn spoke with the doctor.

This information may represent changing social and family norms either as a whole or specific to families with chronic non-communicable diseases. It can be taken as a roadmap to improving compliance to treatment.

### **Practical Stress Relief**

Sit in a comfortable position with head supported, Start breathing slowly and deeply. Let the entire body go limp and try to let go of tension that remains. Visualize the body getting more relaxed. Systematically tense and release each part of the body, beginning with the toes.

Exercise helps in reducing the negative effects of stress, besides the positive effects on cardiovascular fitness. Regular aerobic exercise is good for relieving stress as well.

The relaxation response may be defined as “a set of integrated physiological mechanisms and

adjustments that are elicited when a subject is engaged in a repetitive mental or physical activity and passively ignores distracting thoughts.” Other relaxation responses include meditation, yoga or autogenic training, which act through similar molecular mechanisms as stress, but in the reverse direction. They also decrease sympathetic nervous activity (11).

## **THE CONCEPT OF SELF MANAGEMENT**

It is becoming clear that physicians must be trained to deal increasingly with chronic diseases such as diabetes mellitus. This involves active involvement of patient in the management. More than simple adherence to treatment guidelines, it is essential to incorporate psychological and social management of living with chronic diseases (12). A variety of interventions have been studied:

### **Educational Approach**

In the educational approach, knowledge is imparted to the patient. However knowledge is necessary, but often not sufficient to change the behavior (13).

### **Social Cognitive Theory**

In social cognitive theory, behavior is affected by one's expectations. Self efficacy and self sufficiency are important. Skills are imparted for goal setting and problem solving

### **Stress Coping Model**

In stress coping model, individuals are taught coping strategies to deal with the stress of the disease

### **Readiness to Change**

This concept refers to how prepared an individual is to make behavioral changes. The focus is to assess one's motivation to change, and to adapt appropriate approaches.

In summary management of diabetes mellitus needs to change from 'didactic provision of information to interventions teaching problem solving and coping skills' (12).

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