Stress and Disease

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Stress

• A person experiences stress when a demand exceeds a person's coping abilities, resulting in reactions such as disturbances of cognition, emotion, and behavior that can adversely affect well-being

Dr. Hans Selye

- Worked to discover a new sex hormone
- Injected ovarian extracts into rats
- Witnessed structural changes
 - Enlargement of the adrenal gland
 - Thymic and other lymphoid structure atrophy
 - Development of bleeding ulcers in the stomach and duodenal lining
- Dr. Selye witnessed these changes with many agents. He called these stimuli "stressors."

General Adaptation Syndrome (GAS)

- Three stages
 - Alarm stage
 - Arousal of body defenses
 - Stage of resistance or adaptation
 - Mobilization contributes to fight or flight
 - Stage of exhaustion
 - Progressive breakdown of compensatory mechanisms
 - Onset of disease
- GAS Activation
 - Alarm stage
 - Stressor triggers the hypothalamic-pituitary-adrenal (HPA) axis
 - Activates sympathetic nervous system
 - o Resistance stage
 - Begins with the actions of adrenal hormones
 - Exhaustion stage
 - Occurs only if stress continues and adaptation is not successful

Stress Response

- Nervous system
- Endocrine system
- Immune system

Psychologic Mediators and Specificity

- Reactive response
- Anticipatory response
- Conditional response



Psychoneuroimmunologic Regulation

- Interactions of consciousness, the brain and spinal cord, and the body's defense mechanisms
- Immune modulation by psychosocial stressors leads directly to health outcomes
- Corticotropin-releasing hormone (CRH) is released from the hypothalamus

Neuroendocrine Regulation

- Catecholamines
 - Released from chromaffin cells of the adrenal medulla
 - Epinephrine released
 - Mimic direct sympathetic stimulation
- Cortisol (hydrocortisone)
 - Activated by adrenocorticotropic hormone (ACTH)
 - Stimulates gluconeogenesis
 - Elevates the blood glucose level
 - Powerful anti-inflammatory and immunosuppressive agent

Cortisol and Immune System

- Glucocorticoids and catecholamines
 - Decrease cellular immunity while increasing humoral immunity
 - Increase acute inflammation

Stress-Induced Hormone Alterations

- β-Endorphins
 - Proteins found in the brain that have pain-relieving capabilities
 - Released in response to stressor
 - Inflamed tissue activates endorphin receptors
 - Hemorrhage increases levels, which inhibits blood pressure increases and delay compensatory changes

Stress-Induced Hormone Alterations

- Growth hormone (somatotropin)
 - Produced by the anterior pituitary and by lymphocytes and mononuclear phagocytic cells
 - Affects protein, lipid, and carbohydrate metabolism and counters the effects of insulin
 - Enhances immune function
 - o Chronic stress decreases growth hormone
- Prolactin
 - Released from the anterior pituitary
 - Necessary for lactation and breast development
 - o Prolactin levels in the plasma increase as a result of stressful stimuli



Stress-Induced Hormone Alterations - continued

- Oxytocin
 - Produced by the hypothalamus during childbirth and lactation
 - Produced during orgasm in both sexes
 - May promote reduced anxiety
- Testosterone
 - Secreted by Leydig cells in testes
 - Regulates male secondary sex characteristics and libido
 - o Testosterone levels decrease because of stressful stimuli
 - Exhibits immunosuppressive activity

Role of Immune System

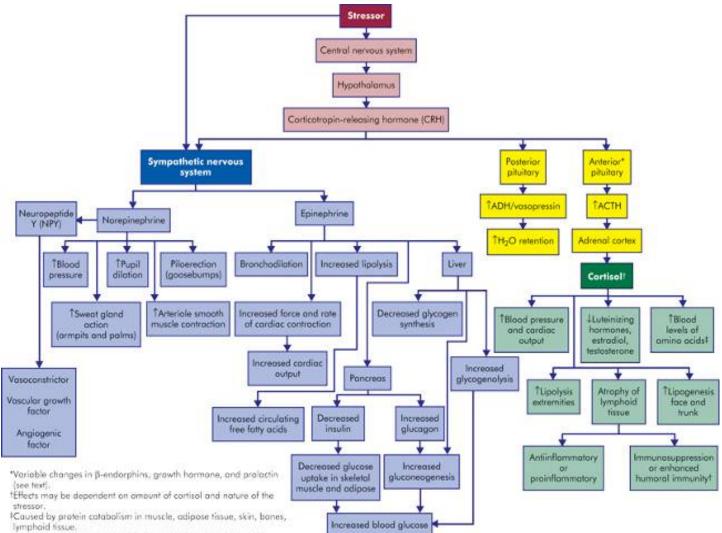
- Stress directly related to proinflammatory cytokines
- Link between stress, immune function, and disease
- Immune system affected by neuroendocrine factors
- Stress response decreases T cell cytotoxicity and B cell function

Stress, Personality, Coping, and Illness

- A stressor for one person may not be a stressor for another
- Psychologic distress
 - General state of unpleasant arousal after life events that manifests as physiologic, emotional, cognitive, and behavior changes

Aging and Stress

- Stress-age syndrome
 - Excitability changes in the limbic system and hypothalamus
 - o Increased catecholamines, ADH, ACTH, and cortisol
 - o Decreased testosterone, thyroxine, and other hormones
 - Alterations of opioid peptides
 - o Immunodepression
 - o Alterations in lipoproteins
 - Hypercoagulation of the blood
 - Free radical damage of cells



ADH, Antidiuretic hormone; ACTH, odrenocorticotropic hormone.