The Silent Conspirator: The Effects of Stress in Medical Illness

Teresa Gevedon, MD
Associate Professor
UK Department of Psychiatry

Objectives

• Discuss the nature of the stress response
• Describe the physiological effects of stress based on current research
• Recognize the role of stress in illness
• Identify risk factors and design interventions for patient stress reduction
Introduction
Distress may be apparent, but impact on disease may be covert.

Stress?

“Stressed out?”

What are we talking about?
Stress Response

• Triggered by perceived threat/challenge
• Includes physiological, emotional and behavioral changes
• Goal is to maintain integrity/safety
• Protective
• Adaptive

Stress Response (cont’d)

This complex dance of events is directed on the stage of the brain involving the

• Pre-frontal cortex*
• Hippocampus*
• Amygdala*
Stress Response (cont’d)

...and extends through the HPA axis.

Neuroendocrine Response (Non-Linear)

Release of
• Catecholamines
• Cortisol
• Pro- and anti-inflammatory cytokines
Involvement of
• Sympathetic nervous system
• Parasympathetic nervous system

Result: All systems on ALERT!!
• Increased heart rate: Decreased digestion
• Increased blood pressure: Decreased immune function
• Increased BS: Increased anxiety
• Shunting of blood: Etc.
Acute Stress Response

- Immediate, intense
- “Fight or Flight”
- Or “Excite?”
- Generally beneficial, adaptive
- Resolves to baseline

Chronic Stress

- Ongoing stressors
- Not “turning off the response” when not needed
- Results in “wear and tear” on system

Allostasis:  
(Stirling & Eyer, 1988)

- Active process by which the body responds to daily events and maintains homeostasis
- Achieving stability through change
Allostasis:  
(Sterling & Eyer, 1988) (cont’d)

Dysregulation of allostasis, chronic stress, can result in pathology via these same systems which become inefficient.

Allostatic Overload:  
(McEwen, 1993)

“Wear and tear” due to chronic stress. Includes changes in behavior (poor sleep, increased eating and drinking, smoking, decreased exercise)

“Hyperactivity of stress responses results in changes over time in the circuitry of the brain.”

Effects on the Brain: (McEwen, 1998, 1007, 2008) (cont’d)

Adrenal steroids interact with neurochemicals (serotonin, GABA, excitatory amino acids like glutamate). Dendrites are then reorganized and shortened.
Structural Plasticity

Hippocampus
- Numerous cortisol receptors
- One of the most malleable areas
- And important to cognitive function

Structural Plasticity (cont’d)

Chronic stress is associated with
- Decreased grey matter
- Decreased hippocampal volume
- Decreased memory and focus
- Increased fear and aggression ("stressed out")
- ? BDNF (research unclear)
Effects on CVD, Stroke

- Increased blood pressure
- Increased heart rate
- Constriction of coronary arteries
- Deposition of fat around the abdomen (“apple”)

Effects on CVD, Stroke (cont’d)

When stressed
↑ Increased appetite for “comfort foods”
↑ Increased tendency to smoke
↓ Decreased exercise

(Increased “allostatic load”)
Effects on CVD, Stroke (cont’d)

Stress-induced cardiomyopathy (Takotsubo) –

“Broken Heart Syndrome”

Effects on angina, MI –

Whitehall Study
INTERHEART Study

Effects on Depression/Anxiety

• Long accepted that stress hormones/cortisol involved (remember DST?)
• Decreased volume of hippocampus (depression, PTSD)
  —Suggests HPA dysfunction
• Serotonin, NE, decreased dopamine levels
Effects on Diabetes

- Stress – Increased blood glucose
- Insulin resistance
- Increased appetite, weight gain
- Poor glucose control associated with decreased hippocampal volume

Effects on GI System

- IBS
  - Most common, most influenced by stress
  - Stress – Decreased small bowel activity, increased large bowel activity
  - With IBS – Decreased synchronicity; one/other overreacts
Effects on GI System (cont’d)

- Ulcer *(JAMA, 1999)*
  - Stress – Increased stomach acid, decreased production of mucus lining
  - Increased vulnerability to *H. pylori*

Effects on Immunity

- Stress leads to decreased immune function which leads to increased vulnerability to infection.
  - *JAMA, 1998* – If stress, particularly financial concerns, lasts longer than one month, there is a greater susceptibility to colds
  - Decreased rate of wound healing
  - Increased autoimmune/allergy symptoms
Effects on Obesity

• ↑ Increased “comfort foods”  
  (? ↑ Increase ghrelin)
• ↑ Increased fatigue, ↓ decreased exercise interest
• Abdominal fat deposits

Effects on Sex

• Female – Irregular cycles, ovulation, infertility
• Male – Erectile dysfunction
• Both – Impaired desire
Effects on Sleep

- Decreased sleep quality leads to decreased ability to make good decisions
- Increased fatigue and irritability
- Disrupted circadian rhythm
  - Increased cortisol, blood pressure
  - Study of night shift workers revealed increased obesity, DM and CAD

Effects on Aging

- Cells bombarded by stress signals
- Little recovery time
- Decreased telomeres
- Increased cell “shrinkage”/death
But we don’t all cope with stress the same way . . .

Risk Factors

- Environment
- Genetics
- Early experiences/temperament
Environment

- Sense of control important
- Whitehall studies indicate increased heart disease with low job control
- Social support system

Genetics

- ? Role of serotonin transporter gene
- ? BDNF gene
Early Experiences/Temperament

- Trauma
- Abuse/neglect
- Deprivation
- Low self-esteem

Stress Reduction Interventions
Exercise

- Increased BDNF, neurogenesis in hippocampus
- New guidelines (HHS, 10/08) – 2.5 hrs/wk
- Out in nature is best

Sleep

- 6-8 hrs/night
- Very important!
Diet

• Regular balanced meals
• Avoid/limit alcohol, nicotine
• ? Multivitamin

Relaxation/Meditation

• Breathing exercises
  – Slowly inhale through nose to count of four
  – Slowly exhale through mouth to count of seven
• Tai chi, yoga
Music

- Type not important
- Simple rhythm, slower tempo, pauses
  - Decreased heart rate and respiratory rate
  - Decreased stress hormones, increased immune activity

Socialization

- Social network – friends, family, church
- Community service
- Avoid isolation
Positive Outlook

• Decreased cortisol production and CRP
• Humor! Laughter!
• Communicate
• Positive reinforcement
• Realistic expectations

Positive Outlook (cont’d)

• Counseling
• Brief use of symptomatic meds
  – Beware of dependence, side effects
• ? Use of Omega-3s
To Suggest

1. Why Zebras Don’t Get Ulcers, by Robert Sapolsky, PhD
2. “Stress: Portrait of a Killer,” National Geographic/KET

References


10. Up-to-date website.