Stress and Your Heart
Kelleen Fitzgerald, MD
March 14, 2015
What is stress?

Physiological/emotional response to a threat.

- Acute stress: “Fight or flight”
- Energy mobilization

Stimulates the Hypothalamic-Pituitary Axis and the Sympathetic Nervous System.
What is Acute stress?

Acute Anger
  Interpersonal conflicts
  Sports matches
  Traffic
What is Acute stress?

Social/Evaluative Threat
Performance
Rejection
Discrimination
What is Acute stress?

Acute bereavement
Trauma
  Assault, abuse
Witness to violence
Natural/Environmental disasters
  Katrina
Earthquake

TABLE 1. Comparison of Demographic and Clinical Historical Data in Acute Myocardial Infarction Admissions Before and After Hurricane Katrina and Years 1-3 and 4-6 After Hurricane Katrina

<table>
<thead>
<tr>
<th>Variable</th>
<th>6 y before Katrina (n=299)</th>
<th>6 y after Katrina (n=1177)</th>
<th>( P ) value</th>
<th>Years 1-3 after Katrina (n=418)</th>
<th>Years 4-6 after Katrina (n=759)</th>
<th>( P ) value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (y)</td>
<td>64.0±14</td>
<td>61.9±12</td>
<td>.007</td>
<td>62±13</td>
<td>62±12</td>
<td>.99</td>
</tr>
<tr>
<td>Sex men</td>
<td>171 (57.2%)</td>
<td>698 (59.3%)</td>
<td>.67</td>
<td>281 (67.2%)</td>
<td>417 (54.9%)</td>
<td>.01</td>
</tr>
<tr>
<td>Race: white</td>
<td>144 (48.1%)</td>
<td>457 (38.8%)</td>
<td>.03</td>
<td>194 (46.4%)</td>
<td>263 (34.6%)</td>
<td>.002</td>
</tr>
<tr>
<td>Coronary artery disease</td>
<td>109 (36.4%)</td>
<td>578 (49.1%)</td>
<td>.004</td>
<td>161 (38.4%)</td>
<td>417 (54.9%)</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Previous coronary artery bypass</td>
<td>60 (20.0%)</td>
<td>180 (15.3%)</td>
<td>.07</td>
<td>57 (13.6%)</td>
<td>123 (16.2%)</td>
<td>.27</td>
</tr>
<tr>
<td>Hypertension (systolic blood pressure &gt;140 mm Hg or therapy)</td>
<td>213 (71.1%)</td>
<td>811 (68.9%)</td>
<td>.68</td>
<td>301 (72%)</td>
<td>520 (67.2%)</td>
<td>.34</td>
</tr>
<tr>
<td>Hyperlipidemia (low-density lipoprotein &gt;160 mg/dl or therapy)</td>
<td>136 (45.4%)</td>
<td>641 (54.5%)</td>
<td>.05</td>
<td>193 (46.2%)</td>
<td>449 (59.1%)</td>
<td>.004</td>
</tr>
<tr>
<td>Diabetes</td>
<td>94 (31.3%)</td>
<td>411 (34.9%)</td>
<td>.30</td>
<td>126 (30.2%)</td>
<td>285 (37.5%)</td>
<td>.04</td>
</tr>
<tr>
<td>Psychiatric disease</td>
<td>20 (6.7%)</td>
<td>145 (12.3%)</td>
<td>.01</td>
<td>27 (6.5%)</td>
<td>118 (15.5%)</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Substance abuse</td>
<td>31 (10.2%)</td>
<td>173 (14.7%)</td>
<td>.06</td>
<td>55 (13.2%)</td>
<td>118 (15.5%)</td>
<td>.32</td>
</tr>
<tr>
<td>Smokers</td>
<td>101 (34.9%)</td>
<td>618 (52.5%)</td>
<td>&lt;.001</td>
<td>238 (56.9%)</td>
<td>381 (50.2%)</td>
<td>.16</td>
</tr>
<tr>
<td>Unemployed</td>
<td>22 (7.2%)</td>
<td>210 (17.8%)</td>
<td>&lt;.001</td>
<td>65 (15.3%)</td>
<td>146 (19.2%)</td>
<td>.13</td>
</tr>
<tr>
<td>Uninsured</td>
<td>25 (8.3%)</td>
<td>140 (11.9%)</td>
<td>.09</td>
<td>65 (15.6%)</td>
<td>75 (9.9%)</td>
<td>&lt;.001</td>
</tr>
</tbody>
</table>

*Data are expressed as mean ± SD or as No. (percentage).

*To convert low-density lipoprotein to mmol/L, multiply by 0.0259.
Twenty-four–hour ambulatory systolic blood pressure (SAP; top line [solid], top panel), mean arterial pressure (MAP; middle line [dashed], top panel), diastolic blood pressure (DAP; bottom line [solid], top panel), and heart rate (HR; dashed line, middle panel) tracings obtained for subject on March 26 and 27, 1998.

Northridge Earthquake, L.A.
4:31 a.m., January 17, 1994

Spike in daily numbers of sudden cardiac deaths on the day of the earthquake. There was no increase in non-coronary deaths.

Leor et al., NEJM 1996

Sudden cardiac deaths clustered around the time of the earthquake (in comparison with similar times 1 week before).
What is Chronic stress?

Childhood Adversities
Occupational
Caregiving Burdens
What is Chronic stress?

Socioeconomic
Social/Lack of emotional support
Marital/Relationship
Personality
Negative Emotions
Here are ways in which some key body systems react.

1. **Nervous System**
   When stressed — physically or psychologically — the body suddenly shifts its energy resources to fighting off the perceived threat. In what is known as the “fight or flight” response, the sympathetic nervous system signals the adrenal glands to release adrenaline and cortisol. These hormones make the heart beat faster, raise blood pressure, change the digestive process and boost glucose levels in the bloodstream. Once the crisis passes, body systems usually return to normal.

2. **Musculoskeletal System**
   Under stress, muscles tense up. The contraction of muscles for extended periods can trigger tension headaches, migraines and various musculoskeletal conditions.

3. **Respiratory System**
   Stress can make you breathe harder and cause rapid breathing — or hyperventilation — which can bring on panic attacks in some people.

4. **Cardiovascular System**
   Acute stress — stress that is momentary, such as being stuck in traffic — causes an increase in heart rate and stronger contractions of the heart muscle. Blood vessels that direct blood to the large muscles and to the heart dilate, increasing the amount of blood pumped to these parts of the body. Repeated episodes of acute stress can cause inflammation in the coronary arteries, thought to lead to heart attack.

5. **Endocrine System**
   Adrenal glands
   When the body is stressed, the brain sends signals from the hypothalamus, causing the adrenal cortex to produce cortisol and the adrenal medulla to produce epinephrine — sometimes called the “stress hormones.”

   Liver
   When cortisol and epinephrine are released, the liver produces more glucose, a blood sugar that would give you the energy for “fight or flight” in an emergency.

6. **Gastrointestinal System**
   Esophagus
   Stress may prompt you to eat much more or much less than you usually do. If you eat more or different foods or increase your use of tobacco or alcohol, you may experience heartburn, or acid reflux.

   Stomach
   Your stomach can react with “butterflies” or even nausea or pain. You may vomit if the stress is severe enough.

   Bowels
   Stress can affect digestion and which nutrients your intestines absorb. It can also affect how quickly food moves through your body. You may find that you have either diarrhea or constipation.

7. **Reproductive System**
   In men, excess amounts of cortisol produced under stress, can affect the normal functioning of the reproductive system. Chronic stress can impair testosterone and sperm production and cause impotence.

   In women, stress can cause absent or irregular menstrual cycles or more painfull periods. It can also reduce sexual desire.
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Four types of allostatic load.

Exaggerated reactivity
Anger
PTSD

Prolonged Response
Rumination
Worry

Blunted Reactivity
Depression
Obesity

Bruce S. McEwen Physiol Rev 2007;87:873-904
The Atlanta Internists, LLC 2015
Apply the Hypothesis

- Increased heart rate
- Increased blood pressure
- Constriction of blood vessels

- Hypertension
- Stroke
- Atherosclerosis
- Myocardial ischemia
  - Induced with physical stress testing
  - Psychological stress test
Takotsubo Cardiomyopathy
An Example

- Triggered by emotional stress
- 90% of cases in women
- Severe, reversible heart muscle dysfunction
- Ballooning of apex of heart on echocardiogram
- High plasma catecholamines (SNS hormones)
Stress Reduction

• Exercise (ideally 3 hours a week)
• Daily relaxation
  - Yoga/Tai Chi/meditation
• Positive self talk
• Find purposeful pleasure
  - Hobbies
  - Social interaction
  - Music/nature
• Proper Sleep Hygiene
  - Avoid electronics before bed.
  - Avoid Caffeine and Nicotine
Benefits of Relaxation

- Decreased Blood Pressure
- Improved Glucose tolerance
- Improved Lung function
- Decrease in Inflammatory markers
- Decreased Anxiety
- Decreased Depression
- Reduce Pain sensitivity