Stress, Blood Pressure, and the Aging Cardiovascular System

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Stress and Cardiovascular Disease

Subject A

Subject B

Heart Rate (bpm)

5 Sec  Warn Subject  Begin Task
Stress and Blood Pressure Control

- Young adults at risk for hypertension show exaggerated CV stress reactivity
  - Sympathetic nervous system (blocked by propranolol)
  - High BP, over time, can remodel the arterioles
  - These structural changes with aging yield a more permanent, fixed essential hypertension
    - Treatment challenges
    - Increased risk for coronary heart disease

- Are there ways to reverse the process before the relatively permanent structural changes occur?
  - Aerobic fitness
  - Stress management
  - Mechanism of action (endogenous sympathoinhibitory opioids)
Stress and Cardiovascular Disease: Endogenous Opioids?

Papaver Somniferum

Beta-Endorphin
Effect of Opioid Blockade on BP Response to Stress

Effect of Opioid Blockade on BP Response to Stress

Stress Management: Reduce Risk?

GET YOUR BLOOD PRESSURE DOWN
Managing Stress: Exercise and Fitness

Heart Rate Response (bpm)

-2 0 2 4 6 8

Math 1  Math 2  Rec 1  Rec 2

- Athlete
- Nonathlete
Progressive Relaxation
Hormone Replacement, Cardiovascular Disease Risk, and BP Reactivity in Postmenopausal Women (age=57)

Endorphins and Pain?

Beta-Endorphin activates our morphine receptors
Morphine also makes painful stimuli less threatening
Blood Pressure and Regulation of Affect

- Maybe pain is just the tip of the iceberg
- Persons with hypertension underreport stress
Positivity Bias or Emotional Dampening?

Normal Range of Emotion

Negative Positive

Emotional Dampening

Negative Positive

Positivity Bias

Negative Positive
TABLE 2. Zero-Order Correlations Between Emotional Ratings of Pictures and Resting Cardiovascular Measures ($N = 65$)

<table>
<thead>
<tr>
<th>Type of photograph</th>
<th>Type of rating</th>
<th>Systolic BP</th>
<th>Diastolic BP</th>
<th>Heart rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Positive</td>
<td>Valence</td>
<td>$-0.18$</td>
<td>$-0.07$</td>
<td>$-0.12$</td>
</tr>
<tr>
<td></td>
<td>Arousal</td>
<td>$-0.24^{++}$</td>
<td>$-0.13$</td>
<td>$-0.08$</td>
</tr>
<tr>
<td>Negative</td>
<td>Valence</td>
<td>$-0.29^*$</td>
<td>$-0.28^*$</td>
<td>$0.03$</td>
</tr>
<tr>
<td></td>
<td>Arousal</td>
<td>$-0.29^*$</td>
<td>$-0.13$</td>
<td>$-0.02$</td>
</tr>
<tr>
<td>Positive</td>
<td>Combined</td>
<td>$-0.26^*$</td>
<td>$-0.13$</td>
<td>$-0.11$</td>
</tr>
<tr>
<td>Negative</td>
<td>Combined</td>
<td>$-0.35^{**}$</td>
<td>$-0.22^+$</td>
<td>$0.00$</td>
</tr>
<tr>
<td>Combined</td>
<td>Combined</td>
<td>$-0.34^*$</td>
<td>$-0.20$</td>
<td>$-0.07$</td>
</tr>
</tbody>
</table>

$^{+} p < .08$  
$^{++} p < .06$  
$^{*} p < .05$  
$^{**} p < .01$.  

Being sure that his players did nothing wrong, a coach demands an explanation from the referee about the penalty call.
Emotional Dampening and BP

(106 older African Americans, age=53)

<table>
<thead>
<tr>
<th></th>
<th>Systolic BP</th>
<th>Diastolic BP</th>
</tr>
</thead>
<tbody>
<tr>
<td>PAT Total</td>
<td>-0.30*</td>
<td>-0.24*</td>
</tr>
<tr>
<td>PAT Faces</td>
<td>-0.31*</td>
<td>-0.19*</td>
</tr>
<tr>
<td>PAT Sentences</td>
<td>-0.23*</td>
<td>-0.22*</td>
</tr>
<tr>
<td>PAT Negative</td>
<td>-0.24*</td>
<td>-0.20*</td>
</tr>
<tr>
<td>PAT Positive</td>
<td>-0.33*</td>
<td>-0.24*</td>
</tr>
</tbody>
</table>

* p < .01
+ p < .05

SETH MEYERS – “A new study suggests that people with high blood pressure suffer from “emotional dampening,” and have trouble recognizing emotions in others…

They’re called dads. ‘Look, if you tell me why you’re cryin’, maybe I can help you out…”” (mild laughter)
Emotional Dampening and Alexithymia

- Alexithymia- No words for emotions
- Personality trait linked to psychiatric and medical disorders, including hypertension
- Results- Not alexithymia
The Emotional Dampening Cascade

- Increase psychosocial distress
  - Communication dysfunction
  - Lack empathy
  - Respond inappropriately
  - Cannot recognize and avoid stressful situations
  - Increased cynical mistrust and hostility
  - Loss of social support
  - Reduced threat appraisal → High risk behavior
What happens during stress in pregnancy?
Birth Outcome

Women with larger BP responses to stress have newborns with lower birthweight

What happens to the fetus when mother is under stress?

Prenatal Programming of adult disease?

Conclusions

- Young people at risk for hypertension
  - Mildly elevated resting blood pressure
  - Exaggerated circulatory response to stress
  - Opioid peptide dysfunction
    - Diminished opioid inhibition of sympathetic nervous system
    - Opioid analgesia
  - Emotional dampening
    - Cascade of psychosocial dysfunction
    - Increased stress exposure
- Origins of risk?
  - Genetic markers
  - Familial environment
  - Maternal stress hormones and the prenatal environment