GENDER, SLEEP AND PAIN

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Pain

Depression/Anxiety

Opioid use

Poor sleep

Poor functioning
The Pain “Experience”

Modulation & Coping
Top-down, descending controls

Sensing
Ascending nociceptive pathways

Pain Experience
Pain Pathways

- cortex
- thalamus
- periaqueductal grey matter
- spinal cord
- peripheral sensory nerve

DNIC
Pain and Gender


Women = 80% of chronic pain populations (Croft P, 2002)

Common pain disorders (fibromyalgia & IBS) > in women (Fillingim et al., 2009)

Women have increased sensitivity to laboratory pain (Fillingim et al., 2000 & 2009)

Women and men respond differently to pain treatments (Fillingim et al., 2009)
Pain and Sleep (and Gender)

Sleep disturbance
- Prevalent in chronic pain (50-80%)
- Risk factor for chronic pain syndromes
- Heightens pain sensitivity
- Much more common in females


Impaired or absent pain inhibition
- Fibromyalgia, IBS, tension headaches
- High-rates of co-morbid sleep disturbance
- More prominent in females

(Julien et al., 2005, Wilder-Smith, et al., 2004, Pielsticker et al., 2005)
Rationale

Most common forms of chronic pain disorders are more prevalent in females

Females are more likely to suffer with sleep disturbance

Females may be more sensitive to the effects of sleep disturbance on pain

Because chronic pain is confounded by many factors, start with laboratory paradigm in healthy volunteers
Specific Aims

52 healthy volunteers

Evaluate for gender differences in

1. Laboratory measurements of pain

2. Subjective pain reports, somatic symptoms, and stress response

Before and after sleep disruption
<table>
<thead>
<tr>
<th>TIME</th>
<th>PROCEDURE</th>
</tr>
</thead>
<tbody>
<tr>
<td>8:00-8:15 AM</td>
<td>Salivary sample</td>
</tr>
<tr>
<td>8:15-8:45 AM</td>
<td>Baseline Scales</td>
</tr>
<tr>
<td>9:00-9:28 AM</td>
<td>Baseline pain laboratory measures</td>
</tr>
<tr>
<td>9:30AM</td>
<td>Discharge to return at 8:00PM</td>
</tr>
<tr>
<td>8:00-8:30PM</td>
<td>Salivary sample + assessment #1 (VAS, RR interval)</td>
</tr>
<tr>
<td>8:30-9:30PM</td>
<td>Wind-down</td>
</tr>
<tr>
<td>9:30PM</td>
<td>Sleep</td>
</tr>
<tr>
<td>11:30PM</td>
<td>Forced Awakening #1, salivary sample</td>
</tr>
<tr>
<td>12:30AM</td>
<td>Forced Awakening #2</td>
</tr>
<tr>
<td>1:30AM</td>
<td>Forced Awakening #3, salivary sample</td>
</tr>
<tr>
<td>2:30AM</td>
<td>Forced Awakening #4</td>
</tr>
<tr>
<td>3:30AM</td>
<td>Forced Awakening #5, salivary sample</td>
</tr>
<tr>
<td>4:30AM</td>
<td>Forced Awakening #6</td>
</tr>
<tr>
<td>5:30AM</td>
<td>Forced Awakening #7, salivary sample</td>
</tr>
<tr>
<td>6:30AM</td>
<td>Forced Awakening #8</td>
</tr>
<tr>
<td>7:15-8:00AM</td>
<td>Breakfast</td>
</tr>
<tr>
<td>8:00-8:15 AM</td>
<td>Salivary sample</td>
</tr>
<tr>
<td>8:15-9:00AM</td>
<td>Assessment #2</td>
</tr>
<tr>
<td>9:00-9:28 AM</td>
<td>Pain laboratory measures</td>
</tr>
<tr>
<td>9:28-9:45 AM</td>
<td>Debriefing, Compensation, Discharge to confirmed transportation</td>
</tr>
</tbody>
</table>
Pain Laboratory Testing
### Pain Measures
Before and After Sleep Disruption (n=4)

<table>
<thead>
<tr>
<th>Pain Measure</th>
<th>Pre</th>
<th>Post</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mechanical Pain Thresh (trap)</td>
<td>142.9 (59)</td>
<td>111.6 (30)</td>
<td>.121</td>
</tr>
<tr>
<td>Mechanical Pain Thresh (brach)</td>
<td>123.5 (62)</td>
<td>108.9 (27)</td>
<td>.492</td>
</tr>
<tr>
<td>Thermal Pain Threshold</td>
<td>43.6 (2.2)</td>
<td>42.8 (2.6)</td>
<td>.125</td>
</tr>
<tr>
<td>DNIC (trap)</td>
<td>218.6 (97.6)</td>
<td>171.5 (65.9)</td>
<td>.111</td>
</tr>
<tr>
<td>DNIC (brach)</td>
<td>171.1 (59)</td>
<td>130.1 (50)</td>
<td>.004</td>
</tr>
<tr>
<td>DNIC Index</td>
<td>144.7 (34)</td>
<td>133.5 (26.5)</td>
<td>.340</td>
</tr>
<tr>
<td>Thermal Wind-Up Pain</td>
<td>43.2 (2.3)</td>
<td>42.4 (2.7)</td>
<td>.250</td>
</tr>
<tr>
<td>PVT</td>
<td>121.5 (1.7)</td>
<td>121 (1.41)</td>
<td>.731</td>
</tr>
</tbody>
</table>
Pain Inhibition (DNIC Index) Before and After Sleep Disruption (n=4)
Pain Inhibition (DNIC Index)
Before & After Sleep Disruption (n=18)
Summary and Conclusions

Preliminary analyses suggest that females may be more likely than males to demonstrate a breakdown of central pain inhibition mechanisms following sleep deprivation.

Descending modulation pain pathways appear to be a good target for gender differences in pain.
Limitations and Future Directions

One night of sleep disruption, acute pain, healthy people

Need to evaluate in organic pain syndromes

Future study looking at DNIC testing in chronic pain before and after normalizing sleep (using guanfacine)
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