The Effects of Refugee Experience on the Brain

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Why Study the Brain?

• The brain underpins all our experience, including emotional and social processes
• We know that refugees experience marked difficulties in these processes
• Mainstream health interventions have grown enormously in past decade because of what we know about the brain’s functions
• Despite this explosion in neuroscience in mainstream areas, a focus on refugees has been largely ignored
Neural impact of torture?

- Neural processes underpinning trauma and PTSD in torture survivors and refugees are largely unknown

- Impact on brain *structure*:
  - *Cumulative trauma* associated with cortical thinning in prefrontal and temporal regions
  - *Trauma severity* associated with reduced amygdala volume (Mollica et al., 2009)

- Impact on brain *function*
  - Increased activity over superior parietal regions during processing emotional is associated with torture severity and dissociative symptoms (Catani et al, 2009)
Impact of daily stress on the brain

• Chronic stress (socioeconomic stress) impacts on emotion regulation systems- at functional, neurocircuitry and cellular level (McEwen, 2010; Hackman et al., 2010)

• Childhood poverty exerts long-term impact by diminishing prefrontal cortical regulation over fear systems in adulthood (Kim et al., 2013).

• Healthy 2nd-generation migrant participants showed enhanced subjective and biological responses to induced stress, including increased activity in the ventral/perigenual anterior cingulate cortex (Akdeniz et al., 2014)

  • This activity correlated with perceived discrimination
Two neural models of emotion dysregulation in PTSD

**Emotion Undermodulation: Classic PTSD**
- Re-experiencing and hyperarousal symptoms
- Increased sympathetic arousal responses to trauma reminders
- Hypervigilance to threat

**Emotion OVERmodulation: Dissociative subtype**
- Emotional numbing, withdrawal, avoidance
- Dissociation, depersonalisation, derealisation
- Null sympathetic arousal responses to trauma reminders

## Participants (N = 54)

<table>
<thead>
<tr>
<th></th>
<th>Torture survivor n=18</th>
<th>No torture history n=36</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td>90% male</td>
<td>53% male</td>
</tr>
<tr>
<td>Age</td>
<td>43 years (SD 12)</td>
<td>32 years (SD 9.5)</td>
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<tr>
<td>Trauma load</td>
<td>12 traumatic events (SD 3.1)</td>
<td>10.2 (SD 4.2)</td>
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<tr>
<td>Depression (Hopkins score)</td>
<td>1.65 (SD .72)</td>
<td>1.76 (SD .49)</td>
</tr>
<tr>
<td>Country of Origin</td>
<td>Iraq – 2, Iran – 2, Sri Lanka – 2, Kuwait – 1, Laos – 1</td>
<td>Iraq – 5, Iran – 4, Sri Lanka – 1, Kuwait – 1, Ethiopia – 1, Morocco – 1</td>
</tr>
</tbody>
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Study procedure

Step 1: Referral and screening
- STARTTS;
- refugee services;
- self-referral

Step 2: Interview
- Intensive 2 session clinical interview, including trauma history

- Symptoms measured via the Posttraumatic Diagnostic Scale (DSM-V)
- Trauma history via the Harvard Trauma Questionnaire
- Current stress by the Postmigration Living Difficulties Scale
# Indexing torture severity

<table>
<thead>
<tr>
<th>Torture exposure category (based on the Istanbul Protocol)</th>
<th>Examples of specific torture events</th>
<th>Degree of exposure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Category 1: Deprivation</td>
<td>Food, water, sanitation, health care</td>
<td>1. Single event</td>
</tr>
<tr>
<td>Category 2: Sensory Discomfort</td>
<td>Extreme temperature; bright lights; darkness</td>
<td>2. Multiple events</td>
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<tr>
<td>Category 3: Forced positioning</td>
<td>Restraint, suspension</td>
<td>3. Sustained &amp; prolonged exposure</td>
</tr>
<tr>
<td>Category 4: Physical torture</td>
<td>Blunt instrument, burns, electric shocks, chemical, insects</td>
<td></td>
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<tr>
<td>Category 5: Humiliating treatment</td>
<td>Verbal abuse, forced nakedness</td>
<td></td>
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<tr>
<td>Category 6: Psychological/manipulation-based torture</td>
<td>Death threats, mock executions</td>
<td></td>
</tr>
<tr>
<td>Category 7: Sexual torture</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Study procedure

Step 1: Referral and screening
STARTTS; refugee services; self-referral

Step 2: Interview
Intensive 2 session clinical interview, including trauma history

Step 3: fMRI scan
Tasks include emotion perception task
Task

- Stimuli: Facial stimulus set balanced on culture and gender (Montreal Set of Facial Displays of Emotion)
- Fear and neutral faces
- Attended viewing task
- Stimuli presented for 500ms; ISI 1500ms; block of 8 stimuli; pseudorandomised
Results: Correlations with Torture severity

**Correlations between fear processing and higher torture severity**

- **Left precentral gyrus**
  - $z = -8$
- **Bilateral posterior dorsal medial prefrontal cortex**
  - $z = 6$
- **Left superior parietal lobule**
  - $z = 38$

**Correlations between fear processing and lower torture severity**

- **Left fusiform gyrus**
  - $z = -8$
- **Right lingual gyrus and middle temporal gyrus**
  - $z = -2$
- **Bilateral ventrolateral prefrontal cortex** (inferior frontal)
  - $z = 6$

$p < .001; \text{cluster size corrected}$
Results: Correlations with PTSD symptoms

Correlations between fear processing and elevated PTSD symptoms

- Bilateral lateral prefrontal Cortex (IFG)
  Left putamen
  $y = 18$

- Right dorsolateral prefrontal Cortex (MFG)
  $z = 62$

- Right middle temporal gyrus
  $z = 14$

$p < .05$ FWE, cluster size corrected
Results: Correlations with current stress

Correlations between fear processing and greater contextual stress

- Left insula: $Z = 6$
- Bed nucleus of the stria terminalis: $X = -2$
- Dorsomedial prefrontal: $Z = 52$
- Bilateral precuneus: $Z = 18$

Correlations between fear processing and lower contextual stress

- Bilateral lateral prefrontal (IFG): $Y = 14$
- Dorsal ACC/ SMA: $X = 8$
- Right supramarginal gyrus: $Z = 32$

$p < .005$ cluster size corrected
Conclusions

• Torture severity, PTSD symptoms and current stressors modulate different components of the fear processing network in refugees

• Findings suggest a long-term impact of torture on emotion functioning over and above PTSD symptoms and current stressors

• Impact appears to be moderated by the severity of torture exposure
Conclusions

• Current stress engaged autonomic and arousal centres
• Suggests the importance of considering the impact of contextual stress on brain function in refugees
What About Emotion Regulation?

- Emotion regulation capacity is fundamental to managing and responding effectively to strong emotions

- Emotion regulation is frequently disrupted in psychopathology

- Cognitive reappraisal: changing how one thinks about an emotional event, in order to reduce its emotional impact
Neural basis of cognitive reappraisal

Dorsomedial prefrontal DMPFC

Ventromedial prefrontal VMPFC

Amygdala

Ventral striatum

Insula

Dorsolateral prefrontal DLPFC

Temporal cortex
Emotion regulation task
Reappraisal: Torture Exposure

Torture Survivor

Left insula
Caudate, brainstem

Region of interest:
Bilateral amygdala

No torture history

Left vACC
Dorsomedial PFC
Preliminary conclusions

- **Torture history impacts adversely on reappraisal success:**
  - Negative affect ratings indicate impaired reappraisal success
  - Increased activity in amygdala, insula and ventral striatum
  - Torture may have a long term impact on emotional regulation function, over and above current PTSD symptoms
What Are We Learning?

• Torture has long-term impact on brain functioning
• The profile of torture survivors’ brains compares with Complex PTSD
• Suggests that the emotion dysfunctions associated with torture is beyond ‘standard’ PTSD
Where to From Here?

• One of the key issues for understanding refugee mental health is *attachment*
Attachment theory: John Bowlby

• Attachment-related connections begin at birth, binding the infant to their primary care-giver

• Attachment behavioural system essential for survival and meeting basic needs

• Extends to enable the child to use the security and safety of their attachment relationship to explore and engage with the world around them
Attachments = automatic coping mechanisms

Perceived Threat → Activate attachment system → Seek proximity to attachment figure

Are they available?

Attachment security: Effective co-regulation

Bowlby, 1982; Shaver & Mikulincer, 2002
Impact of attachment figures on coping


- Hands held by:
  1. Husband
  2. Stranger
  3. No-one

- Husband hand-holding: Decreased activation in automatic threat detection networks
  - Amount of deactivation correlated with the quality of the subject’s relationship with her husband

- Decreases in threat networks also evident during stranger hand-holding compared to no support
Impact of attachment figures on coping with physical pain

Secure vs Insecure Attachment Style

• Attachment relationships developed in childhood can determine the dominant attachment style exhibited in adulthood relationships
  • As we grow, we learn to internalize attachments

• **Secure attachment**
  • Developed via attentive care-giving by attachment figure
  • Self-belief in coping with challenges
  • Knowledge that support is accessible and available if necessary

• **Insecure attachment**
  • Developed by absent, aversive or non-attentive care-giving
  1. **Avoidant attachment style**: Highly independent, maintain emotional distance in relationships.
  2. **Anxious attachment style**: High need for closeness with others, fear of separation and rejection.
Attachment Insecurity

Perceived Threat

Activate attachment system

Seek proximity to attachment figure

Are they available?

Attachment insecurity

No

Attachment security: Effective co-regulation

Yes

Attachment

Anxiety:
Hyperactivating attachments

Avoidance:
Deactivating attachments

Bowlby, 1982; Shaver & Mikulincer, 2002
Attachment style – changes the brain

- Changes size of brain structures, particularly in regions important for emotion processing (Bennetti et al., 2012)
- Reduces heart rate variability (Maunder et al, 2006; Diamond and Hicks, 2005)
- Protection conferred by attachment on the experience of physical stress evident only in low avoidant group (Bryant & Hutanamon, under review)
  - Highly avoidant unable to extract attachment support from even a present attachment figure
- Severe interpersonal trauma can trigger insecure avoidance (PoWs)
- Torture severity associated with disordered attachment
Next Steps

• We are finishing off our current study
• We are commencing a new study to understand how attachment systems in the refugee brain function
• How do they operate to regulate emotion?
• Can we enhance them to boost emotion regulation?