Latest on Neuroscience and Trauma

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Overview of talk

• Neural models of PTSD – the past and the future

• How can we understand the impact of refugee trauma on the brain?
  • Preliminary brain imaging evidence

• What is the role of culture?
  • Preliminary eye tracking and brain imaging evidence.
Neural Models of PTSD

1. Alterations in fear learning
2. Overactive threat detection
3. Diminished emotion regulation and executive function system
Neural Models of PTSD: Fear Learning

Fear Circuitry Models of PTSD

Current evidence base

- Single incident trauma
- Military trauma

High arousal
Intrusive trauma-related memories

Fear Circuitry Models of PTSD: Subtypes

- Hypoarousal
- Depersonalisation
- Derealisation
- Emotional numbing/withdrawal

Current evidence base

- Sexual violence
- Childhood maltreatment

Yeduda et al (2015); adapted from Lanius et al., (2010)
PTSD as a disorder is highly heterogeneous
Deficient Context Processing

Core Affect Disturbances

- **Psychological constructionist approach** to emotion (Barrett, 2014).
  - No specific fear network (Kober et al., 2008)
  - Distributed brain systems that construct psychological states
- Core affect connects internal with external information to determine salience and behavioural response
- Exposure to trauma results in disturbance to this homeostasis, disrupting multiple brain systems and altering core affect (Suvak & Barrett, 2009)
Socio-Interpersonal Model of PTSD

Implications for neural substrates of PTSD?

- Culture impacts many of the same neural mechanisms known to be aberrant in PTSD (Liddell and Jobson, 2016):
  - Threat processing and emotion regulation
  - Attentional biases
  - Emotional and autobiographical memory
  - Self-referential processing
  - Interpersonal processing and attachment
Refugee Trauma, Torture and the Brain

Characteristics of torture and refugee trauma

- Severe Interpersonal Trauma
- Cumulative trauma
- Sustained exposure
- Uncontrollable
- Fractured sense of self and world
- Post-migration living difficulties
- Cultural differences
Refugee Trauma, Torture and the Brain

Characteristics of torture and refugee trauma

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The impact of torture on brain structure

- Cortical thinning in prefrontal (anterior cingulate) and temporal regions (Eckart et al., 2011); also visual regions and cerebellum (Zanideh et al., 2016)

- Reduced hippocampal volume in torture survivors with PTSD (Zanideh et al., 2016)

- Evidence that cumulative nature and severity of trauma associated with reduced amygdala volume (Mollica et al., 2009)
The impact of torture on brain function

PTSD group showed:
• Early enhanced prefrontal activity – alarm system (Adenauner et al., 2010)
• Reduced later parietal-occipital activity later – subsequent disengagement from threat (Adenauner et al., 2010)
• Supports hypervigilance-avoidance model
• Degree of disengagement found to correlate with torture severity and dissociative symptoms (Catani et al, 2009)

Adenauner et al., (2010)
What we don’t know yet

• What are the specific effects of torture on the emotional brain?
  • Does torture exposure have a long term effect on the brain’s threat processing systems regardless of PTSD symptoms?

• Do avoidance, emotional-numbing or dissociative symptoms have differential neural correlates according to whether a refugee is a torture survivor or not?

• How does refugee trauma accord with neural models of PTSD?
## Participants

<table>
<thead>
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<th>80 participants with a refugee background</th>
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<td><strong>Gender</strong></td>
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<td><strong>Age</strong></td>
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</table>
| **Country-of-origin** | Iran (38.8%)  
Iraq (16.1%)  
Sri Lanka (7.5%)  
Afghanistan (5%)  
Range of other countries – Africa, Asian and South America (32.6%) |
| **Number of trauma types** | 11.25 event types |
| **% torture survivors** | 38.75% |
| **Length of time in Aus** | 3.3 years, range 2 months – 30 years |
Defining Torture

UN Convention Against Torture (UNCAT): 5 core characteristics of the event

1. Government or organized authority hurt or inflicted pain/suffering
2. Deliberate/intentional acts
3. For purposes of obtaining information/confession; punishment; intimidation or coercion
4. Results in severe pain and suffering
5. Not incurred as part of “legal” punishment regime

Torture Screening Check List (TSCL); Rasmussen et al (2012), J Psychology, 219, 143-149.

“any act by which severe pain or suffering, whether physical or mental, is intentionally inflicted on a person for such purposes as obtaining from him or a third person information or a confession, punishing him for an act he or a third person has committed or is suspected of having committed, or intimidating or coercing him or a third person, or for any reason based on discrimination of any kind, when such pain or suffering is inflicted by or at the instigation of or with the consent or acquiescence of a public official or other person acting in an official capacity. It does not include pain or suffering arising only from, inherent in or incidental to lawful sanctions”. (Office of the United Nations High Commissioner for Human Rights, 1984).
Study procedure

Step 1: Referral and screening
STARTTS or self-referral

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

- Symptoms measured via the Posttraumatic Symptoms Scale (DSM-V)
- Trauma history via the Harvard Trauma Questionnaire
- Torture Severity via Torture Experiences Questionnaire
- Current stress by the Postmigration Living Difficulties Scale (Steel et al., 2005)
- Dissociative symptoms - DES
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
# PTSD Symptoms and Trauma history

<table>
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<tr>
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<th>Torture Survivors (n = 31)</th>
<th>Non – Torture Survivors (n=49)</th>
</tr>
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<tbody>
<tr>
<td>PTSD Dx (DSM-V)</td>
<td>N = 13 (42%)</td>
<td>N = 19 (39%)</td>
</tr>
<tr>
<td>Trauma load</td>
<td>13.1 (SD 3.6) ***</td>
<td>10.1 (SD 3.2)</td>
</tr>
<tr>
<td>PTSD Symptom severity</td>
<td>27.8 (SD 14.0) *</td>
<td>21.6 (SD 13.9)</td>
</tr>
<tr>
<td>Re-experiencing</td>
<td>8.0 (SD 4.8) **</td>
<td>5.0 (SD 4.2)</td>
</tr>
<tr>
<td>Avoidance</td>
<td>2.7 (SD 1.9)</td>
<td>2.6 (SD 2.1)</td>
</tr>
<tr>
<td>Alterations in mood/cognition (emotional numbing)</td>
<td>9.5 (SD 5.7)</td>
<td>7.8 (SD 5.4)</td>
</tr>
<tr>
<td>Hyperarousal</td>
<td>7.6 (SD 4.8)</td>
<td>6.0 (SD 4.4)</td>
</tr>
<tr>
<td>Dissociative symptoms</td>
<td>13.4 (SD 12.8)</td>
<td>10.9 (SD 13.9)</td>
</tr>
<tr>
<td>Post-migration Living difficulties</td>
<td>44.2 (SD 11.6)</td>
<td>44.6 (SD 12.2)</td>
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***p<.001; ** p<.01; * p<.1
Correlates with Torture Severity and Trauma Load

In torture exposed group –
Correlates with greater torture severity

Torture Survivor > Non-Torture Survivor
Correlates with trauma dosage

P<.05 FWE-corrected
Correlates with Avoidance Symptoms

Torture Survivor cohort only

*Increased avoidance* symptoms

- Left anterior insula
- Right hippocampus

Torture Survivor > Non-Torture Survivor

- Left anterior and posterior insula

P<.05 FWE-corrected
Correlates with Emotional Numbing/Mood Symptoms

Torture Survivor cohort only
Decreased mood/cognition symptoms

Ventral anterior cingulate

Torture Survivor > Non-T torture Survivor

Bilateral hippocampus

P<.05 FWE-corrected
Correlates with Hyperarousal

**Torture Survivor cohort only**

*No correlates*

**Non-Torture Survivor > Torture Survivor group**

Bilateral hippocampus, Right cluster parahippocampal gyrus fusiform gyrus

$P < .05$ FWE-corrected
Correlates with Re-experiencing and Dissociative Symptoms

No significant group differences or correlates within the torture group
Discussion

- Torture may have a long term impact on fear systems in the brain
  - This impact is related to the severity of torture exposure
  - This effect is irrespective of current levels of post-traumatic stress symptoms
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- Torture may have a long term impact on fear systems in the brain
  - This impact is related to the severity of torture exposure
  - This effect is irrespective of current levels of post-traumatic stress symptoms

- Reflective of emotion over-modulation neural model of PTSD observed in dissociative subtype of PTSD (Lanius et al., 2010)
  - This neural profile was not associated with active emotional numbing or dissociative symptoms

- Could makes post-trauma adjustment and recovery period very difficult
Discussion

• Traumatized refugees with and without torture exposure appear to display different neural correlates with PTSD symptom clusters

• Torture survivors:
  ➢ Neural correlates of avoidance – right anterior insula
  ➢ Neural correlates of emotional numbing – bilateral hippocampus, reduced vACC
  ➢ Neural correlates of arousal – diminished bilateral hippocampus/fusiform gyrus

• Re-experiencing and dissociative symptoms – no group differences or significant correlates

• Neural model of PTSD may be different amongst survivors of torture

• May be important to consider the severity of the trauma or trauma dosage in neural models of PTSD
What is culture?

- Framework for understanding the self in the world
- Information system shared by a group, facilitating survival and deriving meaning from life (Kitayama & Juang, 2013)
- Reinforced practices of cultural groups impact on the psychology of the individual (Kitayama & Uskul, 2011).
- Results in a diversity in ways of thinking about, behaving and engaging in the world (Henrich et al., 2010).
- Cultures differ substantially in the conceptualization of the self (Markus & Kitayama, 2010).
Cultural Differences in Self-construal

**Individualists**
- Independent
- Autonomy
- Personal achievement
- Analytical thinking
- Western-based cultures
- Biased towards salient, focal objects and gist of scene

**Collectivists**
- Interdependent
- Relatedness
- Social harmony
- Holistic thinking
- East Asian and other non-Western cultures
- Biased towards contextual, peripheral, holistic processing
Culture and the Brain

- **Cultural variations in self-construal shape behaviour and brain function** (Park & Huang, 2010; Han et al., 2013; Han & Ma, 2014).

- **Visual perception, attention, memory, cognitive processes** (Goh et al., 2010; Gutches, 2009; Engelmann, 2013)

- **Culture can play a significant role in the emotional lives of individuals** (Ford & Mauss, 2015; Rogers et al., 2014; Mesquita, 2001; Jack et al., 2012; Chiao et al., 2009; Adams et al., 2010)

- **Cultural factors modulate amygdala engagement to fear faces and attentional deployment to face cues** (Adams et al., 2010; Chiao et al., 2009; Derntl et al., 2012; Jack et al., 2012; Blais et al., 2008)

How might culture impact on emotion processing when event is highly threatening or traumatic?
Group x Valence x Region interaction: \(F(1, 76) = 7.034, p = 0.010, \eta_p^2 = 0.085\).
PTSD x Culture - Trauma-exposed Refugees

Interaction between PTSD and Self-construal Group

- Insula/superior temporal cluster
- Temporal pole
- Amygdala/hippocampus

PTSD: Collectivists > Individualists

- Dorsal anterior cingulate
- Right insula extending to putamen and superior temporal gyrus
- Right parahippocampal gyrus
What are we learning so far?

- Torture exposure may have specific effects on the brain
  - Prefrontal regulatory function

- It may be important to consider cultural factors in PTSD
  - Exposure to and perception of potentially traumatic events
  - Manifestation of PTSD symptoms
  - Recovery pathways
Future Questions

- How does torture and refugee trauma accord with neural models of PTSD?
  - Torture effects – specific to fear?
  - Connectivity between neural regions; whole brain systems engagement
- What is the inter-relationship between PTSD symptoms, trauma, culture, and current living difficulties and the impact on the brain?
- What are the mechanisms of resilience and recovery?
Acknowledgements

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