Introduction

Biomarkers that could allow some objective evaluation of pain perception would have important physiological and clinical implications. Recently, several studies have implicated gamma band oscillations (GBO) within the somatosensory system as a correlate of pain perception (Gross et al. 2007, Zhang et al. 2012) and Tiemann et al. 2010), whilst others have characterised GBO arising from SI following non-painful stimuli (Tecchio et al. 2003; Fukuda et al. 2008; 2010). The reported differences between these studies may in part be explained by the differences in stimuli (Laser v Electrical).

Rationale for study

The distal oesophagus is mediated by vagal afferents of the Aδ and C-fibre class, thus providing an alternative approach to exploring pain mediated GBOs to these afferent projections alone. The purpose of this study therefore was to evaluate the nature of gamma band oscillatory activity following both somatic and visceral pain stimuli both within and between subjects.

Method

Participants: 12 healthy participants (6 female; age range = 21-36 years)

Experimental procedure: 2 datasets were collected for each participant; visceral pain and somatic pain.

Stimuli: Electrical pulses of 200μs with a frequency of 0.2Hz.

Somatic stimulations: Two disk electrodes on the pads of the right index finger of each participant, approximately 1cm apart. Visceral stimulations: Intubated with a naso-oesophageal tube with a pair of platinum bipolar ring electrodes sited 5cm from the tip of the intraluminal catheter. Distal Oesophageal stimulation excites Vagal afferents which are largely unmynelated C-fibres and A-delta fibres

Analysis

Peak latencies of evoked responses were used to perform an Event-Related Beamformer analysis on the data to determine the sources contributing to the evoked fields at specific latencies (Cheyne et al. 2007). To compare activations within and between individuals, a Region of Interest (ROI) analysis was undertaken. Talairach co-ordinates were determined for each individual and ROI boundaries determined from previous literature (Figure 1).

Conclusion

• Painful stimulation of the oesophagus activating A-delta / C-fibres does yield gamma band activity in both SI and Opercular-insular cortex.
• Latencies of gamma band co-activation supports the notion of ‘binding’ of cortical sites within the matrix.
• Gamma within the pain network is more complex than previously interpreted.

References


