

Is the decrease in bodily response to auditory chills specific to insula damage?



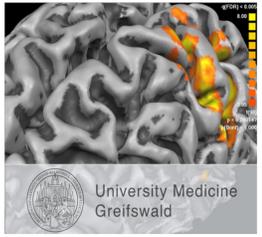
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INTRODUCTION

Chills are seen as indicators of high emotional peaks and are associated with bodily reactions (e.g. goosebumps, shivers) (Panksepp et al., 1995). During these events skin conductance responses (SCR) are typically increased and can therefore be used as reliable markers. Since the insular cortex plays a key role in processing bodily reactions and the integration of these reactions to emotional responses (Craig et al., 2002), patients with insular lesion should show an impaired processing of chill-inducing stimuli which is also suggested by case reports (Griffiths et al., 2004). In this study we investigated whether patients with insular lesions show a reduced subjective and bodily reaction to chill-inducing acoustic stimuli of both valences compared to healthy controls (HCs).

PARTICIPANTS AND DESIGN

Table 1: Characteristics of the sample

	Healthy controls (HC)	Stroke participants	p
n	14	20	
Age - years	62.29 ± 15.56	60.35 ± 13.20	0.698
Male sex - no. (%)	6 (42.9)	13 (65)	0.212
Years of education	10.29 ± 1.33	10.05 ± 1.23	0.599
Lesion volume - in ml	-	29.48 ± 36.09	-
Left hemispheric stroke - no. (%)	-	10 (50)	-
Latency - months	-	24.85 ± 27.369	-

We applied an auditory chill task including 6 music excerpts and 6 harsh sounds (Klepzig et al., 2019) in a group of 20 patients in the chronic stage following stroke (Figure 1) and 14 matched controls (HCs; Table 1). Chills were reported via a handle device while SCR was continuously recorded. Numbers of chills and SCR were compared using rmANOVA. Structural imaging was performed with a 3T Siemens Magnetom Verio. Voxel-based lesion-symptom mapping (VBLM) was conducted to examine the relevance of specific lesion sites for SCR. Diffusion tensor imaging (DTI) was used to measure structural connectivity by quantifying fractional anisotropy (FA) in tracts from 4 insular seeds (Figure 2).

Figure 2: location of the insular seeds processed in DTI
1: to the primary somatosensory cortex and superior parietal lobe
2: into the lateral prefrontal cortex
3: to the inferior temporal and the occipital cortex
4: into the temporal pole

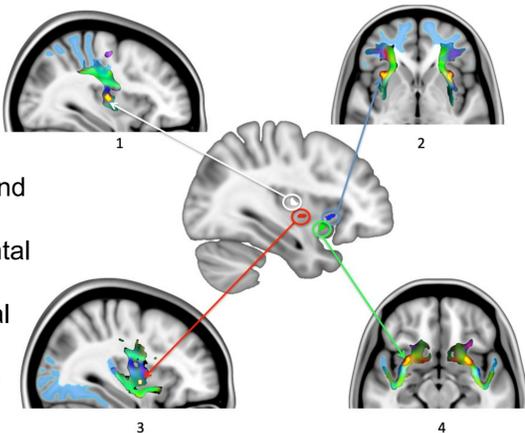
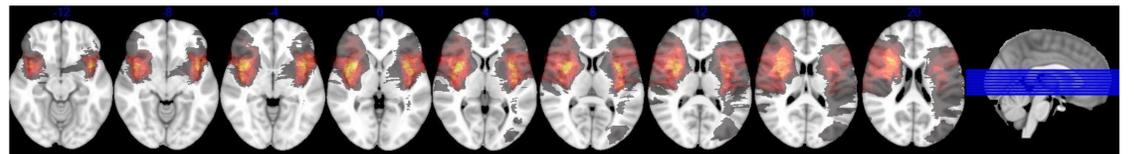


Figure 1: Lesion overlap maps of the stroke patients



RESULTS

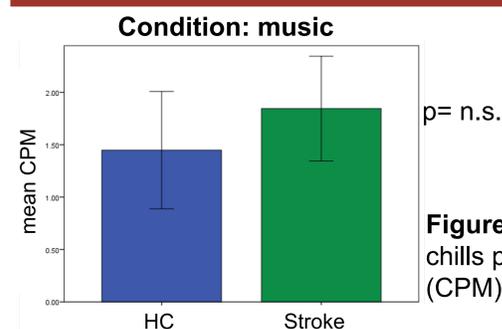


Figure 3A: chills per minute (CPM)

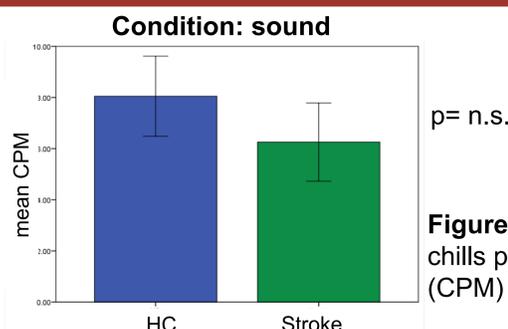


Figure 3C: chills per minute (CPM)

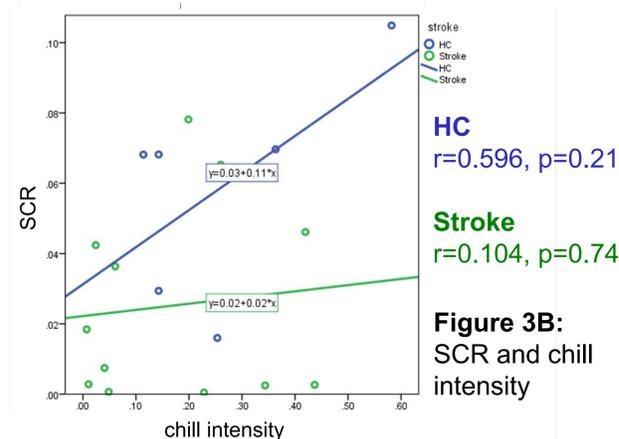


Figure 3B: SCR and chill intensity

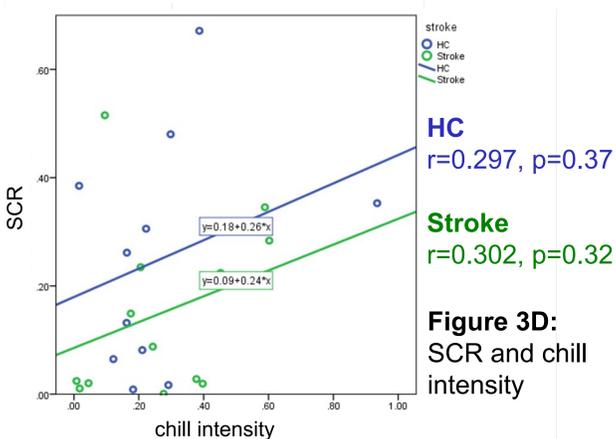


Figure 3D: SCR and chill intensity

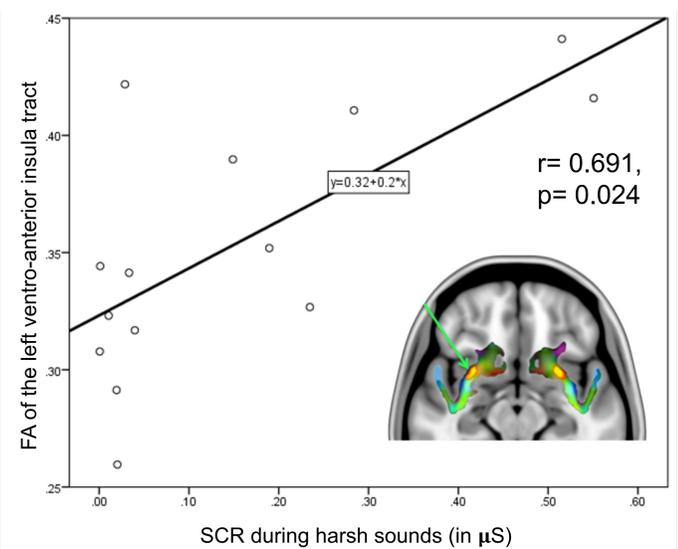


Figure 4: SCR and FA (inf. ant. insula to the left temp. pole)

DISCUSSION

Our work showed a decrease in bodily response towards acoustic chill stimuli which might explain the loss of music enjoyment previously shown in stroke patients while IC lesions might be especially critical. Results of the DTI analyses suggest that both lesion sites but also affected tracts needs to be considered. The temporal pole is a key structure in evaluation of emotional state (Terasawa et al., 2013) and thus a impaired structural connectivity from the ventro-anterior insula may result in a reduced SCR during emotional auditory stimuli.

References:

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