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Research report

Disgust and fear recognition in paraneoplastic limbic encephalitis

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ABSTRACT

Paraneoplastic limbic encephalitis (PNLE) affects limbic portions of the brain associated with recognition of social signals of emotions. Yet it is not known whether this perceptual ability is impaired in individuals with PNLE. We therefore conducted a single case study to explore possible impairments in recognising facially, vocally and bodily expressed emotions, using standardised emotion recognition tests. Facial expression recognition was tested with two forced-choice emotion-labelling tasks using static faces with either prototypical or morphed blends of basic emotions. Recognition of vocally and bodily expressed emotions was also tested with forced-choice labelling tasks, one based on prosodic cues, the other on whole-body movement cues. We found a deficit in fear and disgust recognition from both face and voice, while recognition of bodily expressed emotions was unaffected. These findings are consistent with data from previous studies demonstrating critical roles for certain brain regions – particularly the amygdala and insular cortex – in processing facially and vocally displayed basic emotions, and furthermore, suggest that recognition of bodily expressed emotions may not depend on neural structures involved in facial and vocal emotion recognition. Impaired facial and vocal emotion recognition may form a further neuropsychological marker of limbic encephalitis, in addition to the already well-described mnestic deficits.

1. Introduction

Paraneoplastic limbic encephalitis (PNLE) (Brierley et al., 1960) is a rare condition, in which antibodies produced to target tumour cells destroy the limbic portions of the central nervous system (Gultekin et al., 2000). In the majority of cases, mesiotemporal regions, but also the basal ganglia and insular cortex are affected (Vollmer et al., 1993). Clinical symptoms vary and may include psychiatric abnormalities (affective changes, hallucinations), personality changes, and cognitive deficits

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ranging from confusional states to more circumscribed deficits such as dyscalculia, apraxia and aphasia (Gultekin et al., 2000).

Neuropsychiatric descriptions have focussed mainly on memory deficits as the most salient neuropsychological marker of PNLE (Bak et al., 2001). However, neuropsychological research has shown that lesions to the amygdala can result in deficits in recognising facial and vocal expressions of fear, and that lesions to insular cortex and basal ganglia can result in deficits in recognising facial and vocal expressions of disgust (Calder et al., 2001). Since these regions are prominently affected in PNLE, deficits in emotion recognition should be evident in this disorder. Surprisingly, until now, there has been no study looking in more detail at emotion processing in PNLE. The current study therefore aimed to investigate the presence of recognition deficits for facially and vocally displayed basic emotions in limbic encephalitis using well-established and standardised neuropsychological procedures.

While lesions to the amygdala can impair recognition of facially and vocally expressed fear, there is some evidence that these lesions are not associated with impaired recognition of dynamic displays of bodily expressed fear (Atkinson et al., 2007a). It is not yet known whether an impaired ability to recognise facially and vocally displayed disgust is associated with impaired recognition of bodily expressions of disgust. A supplementary aim of the current study was, therefore, to examine the ability of our PNLE patient to recognise bodily expressed emotions.

2. Case report

2.1. Clinical presentation and history

Case H.N. is a 40-year-old university educated male who was admitted to hospital in 2002 after suffering from a grand mal seizure. An initial contrast enhanced magnetic resonance imaging (MRI) revealed abnormalities in the mesiotemporal region of the right hemisphere suggesting a possible tumour. However, stereotactic biopsy revealed inflammatory changes in this region. This finding was supported by cerebrospinal fluid (CSF) pleocytosis with 9 cells per μl. CSF analysis further showed positive oligoclonal bands as an indicator of intrathecally synthesised IgG antibodies. Following up this line of evidence, anti-MA2 antibodies were found, leading to the definite diagnosis of PNLE. Congruent with this diagnosis, H.N. reported being suspicious since 2001 of having a testicular cancer, however, close examination showed no evidence of a neoplasm but a palpable concretion in one testicle, possibly indicating the site of a former tumour successfully targeted by MA2 antibodies. Glucocorticoid treatment started immediately after diagnosis of PNLE in 2002 (5×500 mg methylprednisolone every six weeks) for up to two years. After 2 years of treatment, steroids were discontinued in 2004 because of osteoporosis and replaced by repetitive high dose intravenous immunoglobulins (3×30 g every six weeks). In addition, H.N. continues to be administered varying doses of anti-convulsive medication, as he suffered from up to 30 simple partial seizures per day, characterised by aureatic experiences of anxiety, uneasiness, and sensations of smelling chemical substances.

MRI scans were performed between 2002 and the time of testing (2006), routinely at intervals of approximately 6 months. Follow-up MRI scans from 2002 to 2004 revealed progressive atrophic changes to the right mesiotemporal/amygdalar region and insula. Since 2004, however, the condition was stable and unchanged. Fig. 1 (taken at time of neuropsychological assessment) illustrates the affected regions.

Structural alterations were accompanied by personality changes. During the course of the disease, mild obsessive–compulsive behaviour emerged. For example, H.N. fastidiously keeps notes on virtually all matters of his disease, which, at the time of testing, filled three lever arch files. When discussing matters with doctors, H.N. always has these files at hand and refers to them. New questions he intends to raise are kept in a separate loose-leaf folder.

2.2. Neuropsychology

H.N. gave written informed consent for this investigation, which had been approved by the local ethics committee of the Medical Faculty of Heidelberg University, in accordance with the Declaration of Helsinki.

2.2.1. Background testing

At time of testing in spring 2006, H.N. was well oriented to time and location. The German version of the HADS (Hospital Anxiety and Depression Scale) revealed scores in the normal range with 7 points for anxiety and 7 points for depression (cut-off is 11). A short neuropsychological battery was administered examining frontal lobe functioning (*Trail Making Test, Lexical and Semantic Word Fluency*), construction (*Rey-Osterrieth Figure, copying*), visuo-motor function *(Digit-Symbol Test)*, visual memory (*Rey-Osterrieth Figure, delayed reproduction*), and verbal memory (*Digit Span forward and backward, German version of the CVLT*). In the German version of the CVLT memory test, participants are asked to remember a list of 15 words presented five times. This is followed by a distracter list. The first list then has to be reproduced. Thirty minutes later, the participants are again asked to reproduce the first list. The results of these neuropsychological tests are given in Table 1. Results show pronounced deficits in verbal memory functions.

2.2.2. Recognition of facial expressions of emotion

To assess the ability to recognise facial expressions of basic emotions, two separate tests taken from the *Facial Expressions of Emotion: Stimuli and Tests* (FEEST) were used (Young et al., 2002).

Ekman 60 Faces test – The Ekman 60 Faces test contains photographs of the faces of 10 people from the Ekman and Friesen series (Ekman and Friesen, 1976). For each face, there are poses corresponding to each of six basic emotions (happiness, surprise, fear, sadness, disgust and anger), giving a total of 60 photographs (10 for each emotion), which are presented in random order. The maximum score is 10 for each of the 6 emotion categories.

Emotion Hexagon – The Emotion Hexagon test uses photographic-quality continua of morphed images of an individual's face from the Ekman and Friesen series (poser JJ), which were prepared by blending between prototype expressions. The test set consists in 30 stimuli, comprising 5 morphed images for