



Association between brain structure and phenotypic characteristics in pedophilia

Timm B. Poepl^{a,*}, Joachim Nitschke^b, Pekka Santtila^c, Martin Schecklmann^a, Berthold Langguth^a, Mark W. Greenlee^d, Michael Osterheider^e, Andreas Mokros^{e,f}

^a Department of Psychiatry and Psychotherapy, University of Regensburg, Germany

^b Clinic of Forensic Psychiatry, District Hospital Ansbach, Ansbach, Germany

^c Department of Psychology and Logopedics, Abo Akademi University, Turku, Finland

^d Department of Experimental Psychology, University of Regensburg, Germany

^e Department of Forensic Psychiatry, University of Regensburg, Germany

^f Centre for Forensic Psychiatry, University Hospital of Psychiatry, Zurich, Switzerland

ARTICLE INFO

Article history:

Received 9 November 2012

Received in revised form

7 January 2013

Accepted 9 January 2013

Keywords:

Pedophilia
Voxel-based morphometry
Amygdala
Insula
Prefrontal cortex
Angular gyrus

ABSTRACT

Studies applying structural neuroimaging to pedophiles are scarce and have shown conflicting results. Although first findings suggested reduced volume of the amygdala, pronounced gray matter decreases in frontal regions were observed in another group of pedophilic offenders. When compared to non-sexual offenders instead of community controls, pedophiles revealed deficiencies in white matter only. The present study sought to test the hypotheses of structurally compromised prefrontal and limbic networks and whether structural brain abnormalities are related to phenotypic characteristics in pedophiles. We compared gray matter volume of male pedophilic offenders and non-sexual offenders from high-security forensic hospitals using voxel-based morphometry in cross-sectional and correlational whole-brain analyses. The significance threshold was set to $p < .05$, corrected for multiple comparisons. Compared to controls, pedophiles exhibited a volume reduction of the right amygdala (small volume corrected). Within the pedophilic group, pedosexual interest and sexual recidivism were correlated with gray matter decrease in the left dorsolateral prefrontal cortex ($r = -.64$) and insular cortex ($r = -.45$). Lower age of victims was strongly associated with gray matter reductions in the orbitofrontal cortex ($r = .98$) and angular gyri bilaterally ($r = .70$ and $r = .93$). Our findings of specifically impaired neural networks being related to certain phenotypic characteristics might account for the heterogeneous results in previous neuroimaging studies of pedophilia. The neuroanatomical abnormalities in pedophilia seem to be of a dimensional rather than a categorical nature, supporting the notion of a multifaceted disorder.

© 2013 Elsevier Ltd. All rights reserved.

1. Introduction

Despite a prevalence of sexual fantasies or sexual contact involving prepubescent children between 3% and 9% in the male population (Seto, 2009) and an estimated lifetime prevalence of pedophilia among men around .5% (Mokros et al., 2012), studies assessing the brains of pedophiles through neuroimaging techniques are still scarce.

Functional brain abnormalities in pedophilic subjects under visual sexual stimulation have been revealed by functional magnetic resonance imaging (fMRI). During sexual excitement, altered

* Corresponding author. University of Regensburg, Department of Psychiatry and Psychotherapy, Universitaetsstrasse 84, D-93053 Regensburg, Germany. Tel.: +49 941 941 2054; fax: +49 941 941 2065.

E-mail address: tim.poepl@klinik.uni-regensburg.de (T.B. Poepl).

activity has been demonstrated in regions such as dorsolateral prefrontal cortex (DLPFC), orbitofrontal cortex (OFC), middle temporal gyrus, cingulate cortex, and insula (Schiffer et al., 2008a,b; Poepl et al., 2011), however without particular overlap across studies. Moreover, there is evidence that pedophilia might be linked to reduced activation in the hypothalamus, periaqueductal gray, dorsolateral and ventrolateral prefrontal cortex (VLPFC), the lateral parietal and occipital cortex as well as in the insula in response to erotic stimuli depicting adults (Walter et al., 2007). Although these results evidently differ, a recent fMRI study suggests that, at least in pedophilic men who admit their sexual interest in prepubescent children, neuroimaging of functional brain response patterns to erotica might be a promising tool to objectify the diagnosis with high levels of sensitivity and specificity (Ponseti et al., 2012).

Aside from functional abnormalities, sexual attraction to children has also been associated with structural cerebral changes. First

results suggested reduced volume of the amygdala and related diencephalic structures such as hypothalamus, innominate substance, bed nucleus striae terminalis, and septal region (Schiltz et al., 2007). In contrast, pronounced gray matter (GM) decreases in the lateral OFC, posterior cingulate cortex (PCC), retrosplenial cortex (RSC), medial temporal lobe, middle temporal gyrus, ventral striatum, and cerebellum were observed in another group of pedophilic offenders (Schiffer et al., 2007). These differences in GM emerged from comparisons of pedophilic offenders from forensic hospitals with healthy subjects from the community which may reduce the specificity of the findings (Cantor et al., 2008). Hence, it is quite possible that at least some of these findings of impaired GM in pedophilia can be attributed to general criminality rather than to the disorder itself. Surprisingly but in line with this notion, pedophiles revealed deficiencies in white matter (WM) only when compared to other offenders (who had not committed any sexual offenses, however) instead of community controls (Cantor et al., 2008). These structural differences were located in the fronto-occipital fasciculus and in the right arcuate fasciculus and interpreted as a network disconnection syndrome of cerebral regions crucial for recognizing sexually relevant stimuli. Taken together, some of the inconsistent results in past imaging studies might be explained by the choice of comparison groups.

In the light of the previous contradictory findings, the present study sought to test the hypotheses of structurally compromised frontostriatal (Schiffer et al., 2007) and limbic-diencephalic (Schiltz et al., 2007) networks related to sexual preference for prepubescents by applying voxel-based morphometry (VBM) in an independent sample of pedophilic offenders while controlling for unspecific factors such as general criminality or chronic stress by the use of non-sexual offenders as a comparison group. In addition, we aimed to ascertain whether structural brain abnormalities might be related to specific phenotypic characteristics in pedophiles.

2. Materials and methods

2.1. Participants

Nine male pedophilic patients (diagnosed according to both DSM-IV-TR and ICD-10 criteria) and 11 male non-sexual offenders were recruited from three high-security forensic hospitals and characterized as follows: mean (M) IQ (Formann and Piswanger, 1970) = 92 ± 18 standard deviation (SD) vs. $M = 100 \pm 19$ SD, $t(18 \text{ d.f.}) = .92, p = .37$; age: $M = 45 \text{ years} \pm 8$ SD vs. $29 \text{ years} \pm 6$ SD, $t(18 \text{ d.f.}) = 5.01, p < .001$; handedness (Oldfield, 1971): non-right-handed 22% vs. 27%, $p > .99$ in a two-sided Fisher exact test. According to self-reports using the Sell Assessment of Sexual Orientation (Sell, 1996), the majority of participants ($N = 13$) were categorized as primarily heterosexual. All of the subjects who were categorized as primarily homosexual ($N = 7$) were from the pedophilic group. All pedophilic offenders had relatively high scores on the Screening Scale for Pedophilic Interests (SSPI) (Seto and Lalumière, 2001; Seto et al., 2004), a measure for identifying pedophilic interest among child molesters, which also predicts sexual offense recidivism: $M = 4.22 \pm .83$ SD. For the pedophilic participants, the mean age of their youngest victim was 7 years ± 3 SD (range: 2–13). According to their files, six pedophilic patients had abused more than one child. For two pedophiles, only female victims were reported, one pedophilic participant had both female and male victims, the remaining pedophilic patients had exclusively abused male prepubescents. No incest offenses were documented in the records. The criminal convictions of the control participants ranged from driving without driver's license to attempted homicide, but mainly consisted of property offenses. Exclusion criteria were psychiatric medication, alcohol or drug abuse, schizophrenia,

bipolar disorder, obsessive–compulsive disorder, and attention deficits. All participants provided written informed consent to the study protocol approved by the ethics committee of the School of Medicine at the University of Regensburg, Germany.

2.2. Brain imaging

High-resolution brain images were acquired on a 1.5 T MR scanner (MAGNETOM Sonata, Siemens Medical Solutions, Erlangen, Germany), adopting a 3D magnetization-prepared rapid acquisition with gradient echo sequence: repetition time 1970 msec, echo time 3.93 msec, flip angle 15°, 256 sagittal slices, voxel size 1 mm \times 1 mm \times 1 mm. Data were analyzed by means of VBM8 (<http://dbm.neuro.uni-jena.de/vbm/>), implemented as a toolbox in SPM8 (Wellcome Trust Centre for Neuroimaging, London, UK). After segmentation and normalization into standard stereotactic space of the Montreal Neurological Institute (MNI), images were smoothed using an isotropic Gaussian kernel of 8 mm full width at half maximum. First, differences in GM between pedophilic and non-sexual offenders were assessed by a two-sample *t*-test. Second, we used separate general linear models entering SSPI scores and victim age, respectively, as regressors in order to obtain correlations of GM reductions with strong pedosexual interest including higher likelihood of reoffending and with proneness to preferably young prepubescents, respectively, among child offenders. Age, handedness and IQ were included as covariates in all analyses to remove possibly confounding effects. The data were initially thresholded at $p < .005$, uncorrected. We applied a threshold of $p < .05$, corrected across the whole brain for multiple comparisons using the family-wise error (FWE) rate. For regions that had been reported to be structurally altered by two previous studies (Schiffer et al., 2007; Schiltz et al., 2007), a small volume correction, using a sphere of 16 mm radius around the respective maxima, was performed (see supplementary material for an overview of the regions). If not stated otherwise, regions are reported at $p < .05$, FWE corrected for multiple comparisons across the whole brain. When a brain area survived FWE correction for multiple comparisons after small volume correction (SVC), this is indicated by 'SVC'. If a region which has not been previously reported was significant at $p < .05$ corrected on one hemisphere and $p < .005$ uncorrected on the other, both are reported (Elliott et al., 2000). Due to the non-isotropic smoothness of VBM data, results received non-stationarity correction. Cluster correlation coefficients (Pearson's *r*) were calculated by means of SPSS (PASW Statistics 18, release version 18.0.0, SPSS, Inc., 2009; Chicago, IL, <http://www.spss.com>) after extracting data based on the regression design matrices with MarsBar (Brett et al., 2002). Brain regions were macroanatomically labeled by reference to the probabilistic Harvard-Oxford atlas (Desikan et al., 2006) included within FSLView v3.1 (<http://www.fmrib.ox.ac.uk/fsl/>). For a more precise allocation, we made use of the cytoarchitectonic maps of the human brain provided by the Anatomy Toolbox (Eickhoff et al., 2005, 2006c, 2007).

3. Results

Voxel-based comparisons of GM between pedophilic and non-sexual offenders revealed substance reductions (peak voxel location in Montreal Neurological Institute (MNI) space: x, y, z ; Z score) among pedophiles in the centromedial nuclei group (CM) of the right amygdala ($x = 30, y = -12, z = -12$; $Z = 3.38$; SVC) extending into the laterobasal nuclei group (LB) and the cornu ammonis (CA) of the hippocampus (Amunts et al., 2005) (see, Fig. 1). This effect in the amygdala region also remained significant when not covarying for age, suggesting its independence from influences of age (differences). However, when additionally controlling for the

Download English Version:

<https://daneshyari.com/en/article/327372>

Download Persian Version:

<https://daneshyari.com/article/327372>

[Daneshyari.com](https://daneshyari.com)