Psychiatry Research: Neuroimaging 222 (2014) 43–51

Contents lists available at ScienceDirect

Psychiatry Research: Neuroimaging

journal homepage: www.elsevier.com/locate/psychresns

Neural mechanisms underlying cognitive control of men with lifelong antisocial behavior

Boris Schiffer [a,b,*], Christina Pawliczek [b,f], Bernhard Müller [c], Michael Forsting [d], Elke Gizewski [d,e], Norbert Leygraf [b], Sheilagh Hodgins [g]

[a] Division of Forensic Psychiatry, Department of Psychiatry, Psychotherapy and Preventive Medicine, LWL-University Hospital Bochum, Alexandrinenstr. 1–3, 44791 Bochum, Germany
[b] Institute of Forensic Psychiatry, University of Duisburg-Essen, Germany
[c] Department of Psychiatry and Psychotherapy, University of Duisburg-Essen, Germany
[d] Department of Diagnostic and Interventional Radiology and Neuroradiology, University, Hospital Essen, Germany
[e] Department of Neuroradiology, University Hospital Innsbruck, Austria
[f] Department of Psychiatry, Psychotherapy, and Psychosomatics, Medical School, RWTH Aachen, Germany
[g] Département de Psychiatrie, Université de Montréal, Canada; Institute of Psychiatry, King's College London, United Kingdom

ARTICLE INFO

Article history:
Received 25 April 2013
Received in revised form
1 December 2013
Accepted 19 January 2014
Available online 28 January 2014

Keywords:
Violent criminal offending
Antisocial personality disorder
Stroop test
Event-related functional magnetic resonance imaging

ABSTRACT

Results of meta-analyses suggested subtle deficits in cognitive control among antisocial individuals. Because almost all studies focused on children with conduct problems or adult psychopaths, however, little is known about cognitive control mechanisms among the majority of persistent violent offenders who present an antisocial personality disorder (ASPD). The present study aimed to determine whether offenders with ASPD, relative to non-offenders, display dysfunction in the neural mechanisms underlying cognitive control and to assess the extent to which these dysfunctions are associated with psychopathic traits and trait impulsivity. Participants comprised 21 violent offenders and 23 non-offenders who underwent event-related functional magnetic resonance imaging while performing a non-verbal Stroop task. The offenders, relative to the non-offenders, exhibited reduced response time interference and a different pattern of conflict- and error-related activity in brain areas involved in cognitive control, attention, language, and emotion processing, that is, the anterior cingulate, dorsolateral prefrontal, superior temporal and postcentral cortices, putamen, thalamus, and amygdala. Moreover, between-group differences in behavioural and neural responses revealed associations with core features of psychopathy and attentional impulsivity. Thus, the results of the present study confirmed the hypothesis that offenders with ASPD display alterations in the neural mechanisms underlying cognitive control and that those alterations relate, at least in part, to personality characteristics.

© 2014 Published by Elsevier Ireland Ltd.

1. Introduction

Most violent offenders are men who have displayed a pattern of antisocial and aggressive behaviour since childhood (Hodgins, 1994; Moffitt et al., 2002). They meet diagnostic criteria for conduct disorder (CD) before age 15 and for antisocial personality disorder (ASPD) in adulthood. Additionally, they present varying levels of the personality traits of psychopathy. Those with very high levels of these traits present the syndrome psychopathy as defined by the Psychopathy Checklist, Revised (PCL-R) (Hare, 2003). Offenders with ASPD and low levels of the personality traits of psychopathy have high levels of impulsivity (Swann et al., 2009), engage in reactive aggression, and show a hyperactive threat system (Blair, 2010), while those with high levels of psychopathic traits are less impulsive, engage in planned, pre-mediated instrumental aggression (Glenn and Raine, 2009), and show a hypo-responsive limbic system (Blair et al., 1999).

Two meta-analyses have demonstrated that impairments in executive function (EF) are associated with criminal offending (Morgan and Lilienfeld, 2000; Ogilvie et al., 2011). The most recent meta-analysis (Ogilvie et al., 2011) showed, however, that there was considerable heterogeneity in EF across samples of offenders and suggested that the association may be due to impulsivity (Ogilvie et al., 2011). Interestingly, antisocial men with ASPD and low levels of psychopathic traits showed increased scores for attentional impulsivity (Swann et al., 2009), whereas those with high levels of psychopathic traits did not (Snowden and Gray, 2011).

* Corresponding author at: Division of Forensic Psychiatry, Department of Psychiatry, Psychotherapy and Preventive Medicine, LWL-University Hospital Bochum, Alexandrinenstr. 1–3, 44791 Bochum, Germany.
Tel.: +49-234 5077-1237, fax: +49-234 5077-1119.
E-mail address: boris.schiffer@uni-due.de (B. Schiffer).

0925-4927/$ - see front matter © 2014 Published by Elsevier Ireland Ltd.
http://dx.doi.org/10.1016/j.pscychresns.2014.01.008

It is unclear how executive processes that are involved in implementing regulatory control become engaged (Cohen et al., 2000). One partial answer comes from conflict theory, which posits that monitoring of response conflict acts as a signal that engages control processes needed to overcome conflict and to perform effectively (Botvinick et al., 2001; van Veen and Carter, 2002b). For example, in the Stroop Colour-Word task, greater conflict is observed in incongruent (the word 'red' is printed in green ink) than congruent (the word 'red' is printed in red ink) trials (MacLeod, 1991), resulting in increased response times (RT) and error rates on the incongruent trials as compared with the congruent trials.

Studies of antisocial males have been conducted using different versions of the classical Stroop test. Two meta-analyses reported low effect sizes (convergent point estimate of 0.35) for combined (RT and error) interference effects (Morgan and Lilienfeld, 2000; Ogilvie et al., 2011), thereby suggesting subtle deficits in cognitive control. Most of the studies included in these meta-analyses, however, examined children/adolescents with aggressive/delinquent behaviour and/or CD (Wolff et al., 1982; Sullivan, 1992; Dery et al., 1999; Toupin et al., 2000; Golden and Golden, 2001; Kim et al., 2001; Olvera et al., 2005; Carroll et al., 2006; Herba et al., 2006) and the small group of offenders, who in addition to persistent antisocial behaviour present very high levels of the personality traits of psychopathy and who thereby meet criteria for the syndrome of psychopathy as defined by the PCL-R (Gorenstein, 1982; Sutker et al., 1983; Smith et al., 1992; Hiatt et al., 2004; Blair et al., 2006; Dvorak-Bertsch et al., 2007; Gorenstein, 1982; Pham et al., 2003). Consequently, it is not known whether impairments in cognitive control mechanisms are associated with a childhood onset of conduct problems and antisocial behaviour that persists through adulthood or with the personality traits of psychopathy.

Interestingly, all studies of adult offenders with psychopathy except one (Pham et al., 2003) found that they performed similarly to non-psychopathic offenders with regard to both RT and error interference (Gorenstein, 1982; Sutker et al., 1983; Smith et al., 1992; Dolan and Anderson, 2002; Hiatt et al., 2004; Blair et al., 2006; Dvorak-Bertsch et al., 2007). By contrast, results of studies of boys with CD, relative to typically developing boys, were inconsistent, with some studies reporting increased RT and/or error interference (Wolff et al., 1982; Dery et al., 1999; Golden and Golden, 2001; Olvera et al., 2005), with some reporting reduced interference (Sullivan, 1992; Toupin et al., 2000; Olvera et al., 2005; Carroll et al., 2006), and a few detecting no group differences (Kim et al., 2001; Herba et al., 2006).

Inconsistencies in results of these studies may result from the heterogeneity of samples, and/or might be due to the use of different versions of the Stroop task that vary in administration of stimuli and scoring of interference effects (for an overview, see Homack and Riccio, 2004). In particular, verbal responding might be problematic. Children with conduct problems and adult offenders show lower than average reading levels (Moffitt, 1990) and thereby may be less sensitive to written words than comparison subjects. This deficit would lead to increased RTs on a Stroop task, and might confound the measure of interference. An additional problem with the classical Stroop task concerns the frequency of stimuli in each condition. Stroop tasks usually require three types of responses, (1) reading a list of names of colours printed in black ink; (2) naming different colours; and (3) naming colours of the ink of names of colours (the word 'red' is printed in green ink, so the correct response is green). In contrast to computerised trial-by-trial versions commonly used in functional magnetic resonance imaging (fMRI), almost all studies of antisocial individuals used the classical Stroop task, such that neutral, congruent, and incongruent stimuli were not randomly assigned but administered in blocks. The frequency of incongruent trials, however, influences top-down mechanisms (Desimone and Duncan, 1995), and thereby affects conflict monitoring and anterior cingulate cortex (ACC) activation (Carter et al., 2000).

There are a number of studies showing that the dorsal ACC is involved in the detection and monitoring of conflicts during Stroop and Stroop-like tasks (MacDonald et al., 2000; van Veen and Carter, 2002a; Ridderinkhof et al., 2004a; Nee et al., 2007; Sohn et al., 2007). Further, the dorsal ACC (dACC) is thought to activate context representations following conflict (incongruent trials) or errors (errors being a high conflict state) in the dorsolateral prefrontal cortex (dlPFC), resulting in post-conflict adjustment, or post-error slowing (Botvinick et al., 2001; Ridderinkhof et al., 2004b; Kerns, 2006), and increased cognitive control (Carter and van Veen, 2007). When incongruent stimuli were presented frequently (or block-wise), however, individuals engaged top-down processes to overcome the pre-potent tendency to respond to the word (e.g., red) rather than the colour of the ink (e.g., green), resulting in both minimal response conflict and minimal activation in the dACC (Carter et al., 2000).

To date there is only one study of antisocial individuals (Dvorak-Bertsch et al., 2007) that used a computerised trial-by-trial version of the Stroop task allowing for experimental manipulation of strategic top-down mechanisms and the analysis of behavioural adjustments. In this study, the Stroop task included mainly congruent trials in order to determine whether attentional deficits among offenders with psychopathy were specific to trials associated with ACC-mediated cognitive control. The psychopathic and non-psychopathic offenders performed equally well. However, this study, like almost all studies that tested offenders on the Stroop task, did not include a comparison group of non-offenders. Consequently, the role of the dACC in conflict monitoring among offenders, and most particularly among violent offenders, as compared with non-offenders remains unclear.

The present study aimed to further characterise deficits in cognitive control presented by male violent offenders with a childhood onset and persistent pattern of antisocial behaviour. Violent offenders with ASPD were compared with non-offenders and matched for age, level of education, and lifetime histories of substance misuse, on brain activity assessed with fMRI while performing a modified non-verbal Stroop task. Since children with CD exhibit cognitive control dysfunction, and CD necessarily precedes ASPD, we hypothesised that offenders with ASPD would show increased RT and error interference, accompanied by reduced conflict- and error-related activity in the dACC and the dlPFC. Furthermore, we hypothesised that between-group differences in behavioural performance or neural responses would be explained by trait impulsivity rather than the personality traits of psychopathy.

2. Methods

2.1. Subjects

Participants comprised 21 incarcerated male violent offenders and 23 non-offenders. Offenders were recruited from prisons and forensic psychiatric services for offenders with substance use disorders (SUDs) (mean imprisonment duration: 6.5 years, S.D.=5.5). Non-offenders were recruited through announcements in local newspapers asking for volunteers with past histories of substance misuse and no current misuse and screened to exclude any individual with a history of violent behaviour that did or did not lead to prosecution. The non-offender sample was matched to the sample of offenders on four variables – age, education, verbal abilities (verbal IQ), lifetime histories of SUDs – known to moderate executive functioning and performance on the Stroop task. No participant met criteria for an axis I disorder other than SUDs, and none had a history of significant medical or neurologic illness, head injury, or colour blindness. All participants were unmedicated right-handed Caucasian males with estimated verbal IQ scores of 80 or higher on the multiple choice vocabulary test (MWT-B) (Lehrl et al., 1995). The MWT-B

دریافت فوری ← متن کامل مقاله

ISIArticles
مرجع مقالات تخصصی ایران

✓ امکان دانلود نسخه تمام متن مقالات انگلیسی
✓ امکان دانلود نسخه ترجمه شده مقالات
✓ پذیرش سفارش ترجمه تخصصی
✓ امکان جستجو در آرشیو جامعی از صدها موضوع و هزاران مقاله
✓ امکان دانلود رایگان ۲ صفحه اول هر مقاله
✓ امکان پرداخت اینترنتی با کلیه کارت های عضو شتاب
✓ دانلود فوری مقاله پس از پرداخت آنلاین
✓ پشتیبانی کامل خرید با بهره مندی از سیستم هوشمند رهگیری سفارشات