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RELATIONSHIP BETWEEN COMORBIDITY AND VIOLENCE RISK ASSESMENT IN FORENSIC PSYCHIATRY - THE IMPLICATON OF NEUROIMAGING STUDIES

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SUMMARY

Violence is an important social problem. Violence in the community has important social relevance for the political, criminal justice, and health care systems. Studies of homicide offenders have suggested a high prevalence of neurologic dysfunction due to organic brain damage such as traumatic brain injury, epilepsy and dementia have been observed to exhibit excessive violence. Moreover, violence in the mentally ill can be viewed as an important medical and mental health problem with significant implications for forensic psychiatry and the community. Although numerous previous studies showed that rate of violent behavior in the community is not much higher in patients with serious mental disorders (schizophrenia) than in healthy controls, that rate is substantially higher in patients with psychiatric comorbidity and substance abuse. A high proportion of patients in forensic psychiatric facilities are diagnosed with comorbidity, most often with schizophrenia, paranoid psychosis, organic brain syndrome, various personality disorders and comorbid substance abuse. These patients represent a high risk group for violence within forensic psychiatric facilities, and repetitive violent behavior in the community. Understanding the neurobiological basis of aggressive behavior clearly has important social and clinical implications. By introduction of neuroimaging studies (MRI, fMRI, PET, SPECT) as a useful tool in forensic psychiatry, the neurobiological aspect of violence is better understood. Previous studies have shown that individuals with frontotemporal brain dysfunction are frequently displaying antisocial behavior (disinhibition, impulsivity, lack of empathy) that justify the diagnosis of "acquired sociopathy/psychopathy". A correlation between the potential for impulsive aggression mediated by limbic brain structures, and the control of the aggression by frontotemporal brain regions has been shown. The individuals with such brain dysfunction have an increased risk of violent behavior and scored high on the Webster's and Hare's violence risk assessment scale. This article reviews the relationship between psychiatric comorbidity, violence risk assessment and neuroimaging in forensic psychiatry and showing the useful directions for future research, screening and prevention of violent behavior among mentally ill criminal offenders.

Key words: *comorbidity - violence risk assessment – neuroimaging - forensic psychiatry*

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Comorbidity and violence risk assessment in forensic psychiatry

For the past several years a numerous studies related to forensic psychiatry has confirmed a close causal relationship between violent offenders and psychiatric comorbidity, including psychiatric disorders coupled with comorbid substance abuse (Zarkovic Palijan et al. 2009, Fortuna 2009, Rueve & Welton 2008, Marshall & Farell 2007, Kertesz et al. 2006, Hatters-Friedman et al. 2005, Snowden 2001, McKenna & Jasper 1999, Drake et al. 1998). The comorbid substance abuse in violent offenders was very often unrecognized and misdiagnosed. In the majority of criminal offences such as attempted murder and homicide, which are causally related to polysubstance abuse, the psychiatric evaluation and assessment often results in establishing multiple psychiatric diagnoses during assessment of offenders with statistically significant prevalence of personality disorders, most often antisocial personality disorder. The most frequent comorbid psychiatric diagnoses, classified according to ICD-10 (2004) and DSM-IV-TR (2000) international diagnostic criteria for mental disorders, are belonging to a broad range of personality disorders (antisocial, borderline, paranoid, schizoid, schizoaffective, passive-dependant, dissocial), affective disorders (bipolar, depressive, anxiety, PTSD), Attention Deficit Hyperactivity Disorder (ADHD), paranoid psychosis and schizophrenia (EMCDDA 2008; Brady & Sinha 2005). Moreover, various studies in the field of criminology and criminal behavior have been shown a close causal relationship between psychiatric disorders, mainly personality disorders, substance abuse and criminal behavior (Rueve & Welton 2008, Marshall & Farell 2007, Kertesz et al. 2006). Among large group of criminal offenders with positive history of severe drug and alcohol abuse, either before the criminal offence or at the time of the offence, the antisocial personality disorder is the most common psychiatric disorder (Weber 2008, Rueve & Welton **2008,** Mueser et al. 2006). The relationship between antisocial personality disorder, history of drug and alcohol abuse and previous criminal offences are strong predictive factors for violence risk assessment (HCR-20) among group of violent offenders (Webster & Hucker 2008, Webster et al. 2006, Webster et al. 2002). On the other hand, a diagnosis of a major mental disorder - especially a diagnosis of schizophrenia - was associated with a lower rate of violence than a diagnosis of a personality disorders and comorbid substance abuse while co-occurring diagnosis of substance abuse was strongly predictive of violent behavior. Systematic assessment of

the risk of harm to others is now generally accepted to be a crucial component in the effective management of violent offenders. Using the method of structured professional judgment, violence risk assessment is directed towards the design of a comprehensive risk management plan. Published guidelines following this approach have long been applied in prisons and forensic mental health services in Britain and North America and are now in use in many countries. With growing recognition of the need for multidisciplinary involvement in risk assessment and risk management planning, as well as an increased awareness of its relevance in any setting where people with histories of violence are encountered, an increasing number of professionals are being expected to contribute to the process (Mossman et al. 2007, Quanbeck 2006). The HCR-20 is a useful tool for assessing general violence risk and it is commonly applied risk assessment tool (Webster & Hucker 2006, Webster et al. 2002, Webster et al. 1997). It provides guidelines for integrating information from a broad range of risk factors associated with violence recidivism. Furthermore, psychopathy, as measured by a screening version of the Hare Psychopathy Checklist, was more strongly associated with violence than any other risk factor. Psychopathic personality disorder represents an important risk factor for violence. Additionally, it has relevance for treatment and risk management. The Psychopathy Checklist Revised (PCL-R) is currently the best validated measure of psychopathy. The use of the PCL-R has become widespread across many agencies; it provides a standard methodology for assessing this important risk factor. The “antisocial behavior” component of psychopathy, as well as impulsivity, emotional detachment, lack of empathy and remorse accounted for most of the relationship between psychopathy, violent behavior and violence recidivism (Hare 2003, Hare 1991). Finally, neuroimaging studies have used classic moral dilemmas to identify the neural circuitry underlying moral decision-making in healthy individuals, but it is unknown how this circuit functions in immoral, psychopathic individuals. Functional magnetic resonance imaging (fMRI) and PET has been shown that psychopathic individuals have reduced activity in the amygdala during emotional moral decision-making, with particularly conning and manipulative individuals showing reduced activity in the entire frontotemopral neural circuit. These results provide initial evidence that psychopaths exhibit deficits in brain regions essential for moral judgment in normal individuals.

Neuroimaging studies of violent behavior and violence risk assessment

Applied neuroscientific knowledge such as brain neuroimaging has widespread application in the medical diagnostic and treatment areas, as well as understanding of the neural basis of impulsive and aggressive behavior have important social and clinical implications (APA 2009, Aharoni et al. 2008, Mossman et al. 2007, Raine & Young 2006, Bufkin & Luttrell 2005). The neurobiological aspects of violence are beginning to be better understood. It is clear that many neurobiological causes and correlates exist, and that these interact both with each other and with non-neurobiological factors. Recent advances in brain imaging techniques (fMRI, PET, SPECT) allow a closer approach to the neural correlates of personality, moral judgments and decision-making (APA 2009, Radeljak et al. 2009, Aharoni et al. 2008, Mossman et al. 2007, Raine & Yung 2006). Functional neuroimaging studies in motor planning, awareness of actions, organization, social reasoning, and theory of mind have recently targeted a small group of brain networks thought to be instrumental in offender’s decision making and mental criteria of offender personality. In addition, some of the posited causes of violence, such as impulsivity, psychopathy, and fear-processing deficits, involve brain regions that have been associated with violence. Dysfunction in the frontal and temporal lobes has been strongly associated with violent behavior (Radeljak et al. 2010, Radeljak et al. 2009, Webber et al. 2008, Glenn & Raine 2008, Webber et al. 2008, Raine & Young 2006). Using the PET technique, American medical researchers Adrian Raine and colleagues have been studying murderers, with startling results. They found that 41 homicide offenders have a much decreased level of brain functioning in the prefrontal cortex than normal persons, indicating a deficit related to violence. In other words, even when no visible pathological alteration was present, frontal damage was apparent by a abnormal lower activity of the brain in that area. "Damage to this brain region," Raine noted, "can result in impulsivity, loss of self-control, immaturity, altered emotionality, and the inability to modify behavior, which can all in turn facilitate aggressive acts" (Glenn & Raine 2008, Raine & Young 2006). Other abnormalities observed by the PET study of the murderer’s brain included reduced neural metabolism in the superior parietal gyrus, left angular gyrus, and the corpus callosum, and abnormal asymmetries of activity in the amygdala, thalamus, and medial temporal lobe. It is probable that these effects are related to violence and criminality; because some of these structures are part of the limbic brain which processes emotions and emotional behavior (Aharoni et al. 2008, Webber et al. 2008, Raine & Young 2006). Furthermore, recent studies have revealed that human brain areas specifically associated with violent behavior are located in the prefrontal cortex, medial temporal regions and limbic regions. Key regions commonly found to be impaired in population of violent homicide offenders include prefrontal cortex, temporal gyrus, amygdala-hippocampal complex, and anterior cingulate cortex. Moreover, a close link between structural brain abnormalities in homicidal patients has been found, supporting the neuroscientific hypothesis that impulsive homicide offenders lack the prefrontal “inhibitory” machinery. Introduction of nerobiological criteria (based on advanced neuroimaging techniques) in the

field of forensic psychiatry and establishing the rules to what extent such biological criteria will be more reliable choice in evaluating mentally ill offenders would be of fundamental value in the modern forensic psychiatry (Radeljak et al. 2010, Radeljak et al. 2009, Zarkovic-Palijan et al. 2009). Taken all together, neuroimaging studies provided a useful tool for understanding a relationship between brain dysfunction, psychiatric comorbidity and violence risk assessment.

Disscussion

The practice of clinical risk assessment and management has changed greatly in the last five years. Predicting harmful outcomes in clients continues to be the first line of response by mental health practitioners trying to prioritize large caseloads of demanding and potentially at-risk patients. Recent research makes it clear that different prediction tools make a comparison between a particular patient and a group of research participants with a known rate of re-offending in order to predict harmful outcomes (Davies 2009, Mossman et al. 2007, Webster & Hucker 2006, Bloom et al. 2005, Hare 2003) Also, risk prediction facilitates an individual risk management planning assessment using a risk prediction tool and it encourages understanding about why harmful outcomes are a possibility or the mechanism by which treatment, supervision and monitoring processes can lead to managed risk. Personality disorder assessment such as Hare's psychopathy check list can be an important undertaking in forensic settings, for example, to clarify diagnosis and comorbidity, to formulate the association between mental health needs and criminal behavior, and to justify specific treatment and management pathways within the criminal justice system (Aharoni et al. 2008, Hare 2003). Forensic mental health settings are increasingly being required to demonstrate reliability to evidence based practice by means of policies and protocols. To date, despite the fact that risk assessment is a core function of forensic services, most organizations have yet to articulate a policy statement and corresponding protocol on risk assessment practice. It seems possible, that absence of ratified protocols leaves clinicians, managers, patients and the public vulnerable. Without a clear statement, it can be difficult to secure the necessary resources and clinical governance is impossible. Recently, a promising research is focused on the investigation of brain anatomy relevant to the expression of violence (Radeljak et al. 2009, Wahlund & Kristiansson 2009, Glenn & Raine 2008, Webber et al. 2008). These studies use the lesion method of behavioral neurology to find associations between structural brain damage and a behavioral pattern. Whereas no "violence center" exists in the brain, the limbic system and the frontal and temporal lobes are the most implicated brain areas in generation of violent behavior. The limbic system is the neuroanatomic substrate for many aspects of emotion and its structure, most often implicated in violent behavior, is the amygdala; lack of empathy and remorse has been described in humans with bilateral amygdala damage, whereas violence has been observed in those with abnormal electrical activity in the amygdala. The frontal lobes are regarded as the "storage area" of the most advanced functions of the brain. In particular, the prefrontal and orbitofrontal cortex are responsible for inhibition of aggression. Individuals with orbitofrontal injury have been found to display antisocial traits (disinhibition, impulsivity, lack of empathy) that justify the diagnosis of "acquired sociopathy," and some have an increased risk of violent behavior (APA 2009, Craig et al. 2009, Mossman et al. 2007, Webster & Hucker 2006, Hare 2003). A balance thus exists between the potential for impulsive aggression mediated by limbic structures, and the control of this drive by the influence of the frontal regions. The HCR-20 is a useful tool for assessing general violence risk and it is the most commonly applied risk assessment tool that provides guidelines for integrating information from a broad range of risk factors associated with violence recidivism (Webster & Hucker 2006, Webster at al. 2002, Webster et al. 1997). Furthermore, psychopathy, as measured by a screening version of the Hare Psychopathy Checklist is strongly associated with violence than any other risk factor (Hare 2003, Hare 1991). Psychopathic personality traits and comorbidities such as organic brain damage or substance abuse are representing high risk factors for violence and it all has relevance for treatment and risk management. The Psychopathy Checklist Revised (PCL-R) is currently the best validated measure of psychopathy (Hare 2003). The use of the PCL-R has become widespread across many agencies; it provides a standard methodology for assessing this important risk factor for psychopathy. Since high proportion of patients in forensic psychiatric facilities are diagnosed with comorbidity, most often with schizophrenia, paranoid psychosis, organic brain syndrome and psychopathy, with comorbid substance abuse, they are representing a high risk group for violence within forensic psychiatric facilities, as well as for repetitive violent behavior and criminal recidivism in the community. Thus, by applying different tools during psychiatric assessment of mentally ill violent offenders such as establishing the right diagnosis and comorbidity, neuroimaging studies and violence risk assessment according to HCR-20 (Webster et al. 1997), as well as PCL-R screening for psychopathy (Hare 2003) we could establish the relationship between violent behavior and violence recidivism in forensic population.

Conclusions

While the social sciences have devoted much attention to the origin and prevention of violence, relatively little biomedical study has been conducted so far. Human behavior is determined by a complex combination of genetic and environmental influences

governing brain structure and function. Violence, therefore, ultimately derives from the operations of the brain, and recognizing the importance of neurobiology in forensic psychiatry will inform and invigorate study of this urgent problem. Recent neuroimaging studies have provided more detailed information on the neurobiological correlates of violence and antisocial behavior. The HCR-20 and PCL-R appear to be useful tools for assessing violence risk mentally ill violent offenders in forensic psychiatric facilities and are perhaps the most commonly applied risk assessment tools in general psychiatry. HCR-20 and PCL-R are providing guidelines for integrating information from a broad range of risk factors associated with violence recidivism.

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