Amygdala pharmacology and crime behavior, dysfunctions to be considered as a disease?

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ABSTRACT

We don’t have today drugs specifically registered for amygdala dysfunctions as preventable agents towards some kind of crime behavior. This Neuro psychiatric condition or organ state are to be considered and treated in preventive way as common disease.

There is an amygdala physio-pathological Level of activation. Still we are not sure to call this dysfunctions status as disease and drugs are needed or efficacy to control it. A neuro-pharmacology research of amygdala can give the response also using imaging Techniques. Studies demonstrated that Amygdala activation is involved in aggressive behavior. The aim of this work is to investigate in this relationship and to find if there is a level of activation.

Keywords: Amygdala activation level, Pharmacology Neuro Imaging, Antisocial personality disorder.

INTRODUCTION

Amygdala is activated in some condition such as anger Anxiety, fear, predatory behavior, aggressive behavior, defense or subjugate behavior. Emotion: behavior and physiological response (vegetative and hormonal) involved in behavior and communication adjustment.

“The hippocampus, amygdala, bed nucleus of the stria terminalis, septal area, cingulate gyrus, and prefrontal cortex project to these structures directly or indirectly and thus can modulate the intensity of attack and rage”[1]

Amygdala- SNC connections and other systems involved

Receive connections from frontal temporal limbic (olfactory way) and send connections to frontal, hippocampus hypothalamus encephalic trunk (behavior and vegetative response).

Amygdala stimulation increase emotional response and drugs as Benzodiazepines, morphine reduces amygdala activation. Hypothalamus and aggressivity: defensive and predation behavior.

Orbitofrontal cortex: involved in emotion interpreting Morality, caution behavior in social situation.

Connected with temporal area, limbic. And amygdala cingulum.

The temporal lobe is involved in theory of mind and its dysfunction is often implicated in violent psychopathy.[2]

Face emotional recognize. Innate, transcultural controlled by right hemisphere (neuroimaging studies). Face emotional expression: happiness, sadness, anger, fear and other stereotyped behaviors. Aggressive behavior is involved in physiological adjustment. Serotonin neuron activation
Hormones can modulate moral behavior through their factors. Androgen increase aggressivity and associate to increase aggressivity. Preoptical medial area: male sexual aggressivity involved.

Neuroimaging results say that Amygdala has a level of activation for GABAergic Gene and it excretes serotonin. “Among the anatomical structures implicated in morality are the frontal, temporal and cingulate cortices”.[2] “Brain areas participating in moral processing can be influenced also by genetic, endocrine and environmental factors”.[2]

“Hormones can modulate moral behavior through their effects on the brain. Finally, genetic polymorphisms can predispose to aggressivity and violence, arguing for a genetic-based predisposition to morality”.[3]

“The violence-specific modulation of prefrontal-amygdala networks appears to control aggressive behavior and provides a neurobiological model for the anti-aggressive effects of quetiapine” klasen et al.[3]

“Biochemical data suggests that heightened anxiety-like behavior and aggression is associated with increased plasma levels of corticosterone and elevated oxidative stress. Significant alterations in dopamine (DA), norepinephrine (NE) and epinephrine (EPI) were observed within the hippocampus, amygdala, and the prefrontal cortex, suggesting potential involvement of dopaminergic and noradrenergic systems in regulation of aggressive behaviors”.[4]

“We found novel evidence that childhood aggressive behavior is related to decreased amygdala volume, decreased sensorimotor cortical thickness, and decreased global right hemisphere gyrification”.[5]

J P Hayes, ET AL. “In recent years, neuroimaging techniques such as functional magnetic resonance imaging (fMRI) and positron emission tomography (PET) have played a significant role in elucidating the neural underpinnings of posttraumatic stress disorder (PTSD)”.[6]

Results demonstrated that the region’s most consistently hyper activated in PTSD patients included mid- and dorsal anterior cingulate cortex, and when ROI studies were included, bilateral amygdala. These results provide evidence for a neuro circuitry model of PTSD that emphasizes alteration in neural networks important for salience detection and emotion regulation”.[6] Sergerie K, et al.[7] “Functional neuroimaging studies have provided strong support for a critical role of the amygdala in emotional processing. However, several controversies remain in terms of whether different factors—such as sex, valence and stimulus type—have an effect on the magnitude and lateralization of amygdala responses. We conducted a meta-analysis of functional neuroimaging studies of visual emotional perception that reported amygdala activation. Critically, unlike previous neuroimaging meta-analyses, we took into account the magnitude (effect size) and reliability (variance) associated with each of the activations. Our results confirm that the amygdala responds to both positive and negative stimuli, with a preference for faces depicting emotional expressions. We did not find evidence for amygdala lateralization as a function of sex or valence. Taken together, results from this meta-analysis shed new light on several of the models proposed in the literature regarding the neural basis of emotional processing”.

“The amygdala is involved in the response to fearful and sad facial expressions”.[8]

It is suggested that amygdala dysfunction is one of the core neural systems implicated in the pathology of psychopathy.[8,9]

Neuroimaging studies confirmed that amygdala dysfunction is associated with psychopathy. Tiihonen et al. used volumetric magnetic resonance imaging (MRI) to explore the relationship between amygdaloid volume and degree of psychopathy in violent offenders as measured by the PCL-R.

High levels of psychopathy were associated with reduced amygdaloid volume.

Kiehl et al. used functional MRI to examine neural responses in individuals with high and low scores on the PCL-R during an emotional memory task where the participant processed words of neutral and negative valence. They found a reduced amygdala response in the high-scoring group, relative to the low-scoring group, during the processing of words of negative valence.

On the basis of neuropsychological and neuroimaging findings for violent offenders, it has been argued that the frontal cortex could be dysfunctional. There are crucial differences between the general population of violent offenders and these individuals. Neuropsychological work with individuals with psychopathy, unlike work with individuals who are violent, has repeatedly found frontal functioning to be intact.

The basic causes of the pathology remain unclear; however, there are interesting possibilities. One is that pathology in the noradrenergic system can lead to the observed amygdala dysfunction. Certainly, administration of the β-adrenergic blocker propranolol, as well as amygdala damage, blocks the improvement in episodic memory for emotionally arousing events, as well as disrupting the processing of sad facial expressions.[9]

Neuro Imaging Functional Studies (that used the paradigm of induced anger), showed that the activation of orbitofrontal cortex is inhibitory towards emotions regulation. Injury in prefrontal cortex are associated with reduction in inhibitory capacity to control emotions and violent behavior even if other cognitive function remains the same.

“Theory, research, and clinical reports suggest that moral cognitions play a role in initiating and sustaining criminal behavior. The 25 item Criminogenic Cognitions Scale (CCS) was designed to tap 5 dimensions: Notions of entitlement; Failure to Accept Responsibility; Short-Term Orientation; Insensitivity to Impact of Crime; and Negative Attitudes Toward Authority. Results from 552 jail inmates support the reliability, validity, and predictive utility of the measure. The CCS was linked to criminal justice system involvement, self-report measures of aggression, impulsivity, and lack of...
empathy. Additionally, the CCS was associated with violent criminal history, antisocial personality, and clinicians’ ratings of risk for future violence and psychopathy (PCL:SV). “With PubMed research using keyword amygdala associated to the word: crime, pharmacology, neuroimaging, we have find various scientific articles that demonstrated a link between amygdala and aggressive behavior in collaboration with other systems. The article on PubMed demonstrates a strictly influence of amygdala and related aggressive behavior. In future can be interesting to find various scientific articles that amygdala associated to the word: crime, pharmacology, neuroimaging, and violence. Neurobiology and anatomy, heterogeneity, phenotypes, pathophysiological findings, neurochemistry, molecular genetics, regional volumes, functional studies, neurochemistry, interregional connectivity says that amygdala-frontal circuitry is very related to crime. Pharmacological researches say that this region excretes serotonin 5,7-dihydroxytryptamine (5,7-DHT). American Psychological Association (APA) published a paper on a criminal mind. They told that that amygdala is the main reason behind crime and aggressive behavior. D. Pardini found in the University of Pittsburgh found that lower amygdala volumes were more than three times aggressive. This trait remains in a man before many years than the people crimes. Raine et al, 1997 in Department of Criminology (the University of Pennsylvania) studied on amygdala function on 1,795 children of 3 years old. After 20 years, they discovered that the children which had deficit of fear conditioning in amygdala predisposes to crime at 23 years.[10] The anterior cingulate cortex which plays a major role in behavior regulation and impulsivity, has also been linked to crime, this volume is reduced in the criminals or prisoners Goodman et. al. demonstrated that dialectical behavior therapy(DBT) can be used as a therapy for amygdala functions. So the neurobiology of crime says that amygdala is associated with crime and aggression and therapies can be given on amygdala. Functional imaging studies suggest abnormalities in limbic brain activity during emotional information processing in impulsively aggressive subjects with Intermittent Explosive Disorder (IED).[12] These data reveal that IED Intermittent Explosive Disorder (IED). is associated with a significant loss of neurons in both the amygdala and hippocampus.[12] Goodman et. al. demonstrated that dialectical behavior therapy(DBT) can be used as a therapy for amygdala dysfunctions.[13] Neurobiology of crime indicates that amygdala is associated with crime and aggression. Therapies can be given on a pathological amygdala which could be consider a solution of criminal behavior in future. Neuropharmacological interventions is the key to prevent these kind of amygdala related aggressive behavior. In future can be interesting to investigate in this filed.

DISCUSSION

Because abnormal moral behavior can arise from both functional and structural brain abnormalities that should be diagnosed and treated, the neurology of moral behavior has potential implications for clinical practice and raises ethical concerns.[2]

“The complex interaction among these neurotransmitters occurs at the level of brain areas and neural circuits such as the orbito prefrontal cortex, anterior cortex, amygdala, hippocampus, periaqueductal gray, and septal nuclei, where the receptors of these neurotransmitters are expressed. The neurobiological mechanism of aggression is important to understand the rationale for using atypical antipsychotics, anticonvulsants, and lithium in treating aggressive.”[14] “A better understanding of the neurological bases of psychopathy could improve therapeutic interventions, reducing the related social costs”.[15] Emotional processing and learning, and several social and affective decision-making functions are impaired in psychopathy, which correlates with specific changes in neural functions.[15] “A better understanding of the neural mechanisms and substrates regulating aggression and rage and thus establish a rational basis for treatment of disorders associated with these forms of aggression”. [1] Various physiological systems are involved in aggressive behavior. But as every organs and apparatus we can think a physiological level of function that classify as physiological from pathological State we can find also for amygdala systems a Basal level to think a pathological status or malfunctions. For various organ and apparatus, we have diagnostic tests in order to monitoring Physiology or pathological status (ex imaging or other lab. Test) but in order to verify amygdala functionality we do not have a diagnostic system to delimited pathological status of iпер activation in objective way.

CONCLUSION

we conclude that is needed to find an objective diagnostic system to verify the basic level of activation status of amygdala in stress conditions and also to find if a drugs therapy systems can be considered if we have an organic pathology conditions. As others physiological apparatus: a pathological activation and status can be controlled by specific pharmacological therapy. Other implication (moral, ethical, legal) are not considered in this paper.

What this study adds:

1. What is known about this subject?

Amygdala is found to be activated in conditions such as anger Anxiety, fear, predatory behavior, aggressive behavior, defense or subjugate behavior.

2. What new information is offered in this study?

We need to diagnose the level of activation of Amygdala during stressful conditions and further Drugs system can be used to modify that level of...
REFERENCES


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