

PSYCHOBIOLOGICAL FACTORS THAT CONTRIBUTE TO THE PREDISPOSITION TO SUICIDAL BEHAVIOR

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Abstract:

The predisposition to suicidal behavior comprises three components that can be described from a neuroanatomical, neurobiological, neuropsychological and cognitive perspective. There is thus increasing evidence that the suicidal behavior has as a substrate the cortical and subcortical interconnected brain structures and the function of these structures is mediated by serotonin, noradrenaline, HPA axis and dopamine. The three core cognitive psychological characteristics of suicidal behavior are associated with deficiencies in neuropsychological functioning that point out attention, memory and fluency, respectively.

Key words: suicidal brain, psychobiological, serotonin

Introduction

The latest researches in suicidology have proved that suicidal behavior can be described through a neurobiological and neuropsychological view and these characteristics can be associated, in fact, with an increased risk of its occurrence. These factors relate to a diathesis for suicidal behavior that referring to persistent biological and psychological characteristics that may predispose individual to autolysis.

According to these discoveries, it can be demonstrated why some depressed individuals attempt or commit suicide, while others do not.

Neurobiological factors related to suicidal behavior

The „suicidal brain“ comprises different cortical and subcortical brain structures which constitute the social cognitive (a sensitivity to particular social circumstances) and behavioral expressive (dysregulation of anxiety and / or aggression) processes – components of the predisposition for suicidal behavior. Researches over these components were supported by studies of the neurobiological modulation of neuropsychological functions.

As regards the neurobiological systems implicated in suicidal behavior, it seems that serotonergic system is involved mainly in the predisposition of this behavior, findings from post mortem, cerebrospinal fluid (CSF) and functional neuroimaging studies proved a decreased serotonergic activity.

Therefore, findings over the noradrenergic system and HPA axis not relate to predisposition – trait, but to an acute condition – state, is correlated with the increased noradrenaline and hormones of the HPA axis and this is, probably, the expression of an increased stress response before a suicidal act.

The core of the neuroanatomy of suicidal behaviour is the basolateral circuit that consists in the brain's prefrontal and temporal cortices, in close connection with the subcortical formations – amygdala and hippocampus, the concept of „social brain“ (Deakin JF, 1996).

Psychobiological factors related to suicidal behavior

The first cognitive subsystem refers to a sensitivity to particular social circumstances that signal the „loser“ status own to biases in selective attention (Becker et al, 1999) or is associated with the temperamental dimension named „reward dependence“ (the bias in reacting to actual rewards and thereafter in maintaining behavior previously associated with rewards) (Cloninger CR, 1994).

It was suggested the modulatory role of noradrenaline in attentional processes (Kodama et al, 2002); therefore, noradrenaline and serotonergic system mediated by 5-HT_{1A} receptors (Cloninger CR et al, 1998) and activation of HPA axis activity is negatively correlated with urinary cortisol secretion (Van Heeringen et al, 2000). These results are correlated with low scores at the temperamental dimension named „reward dependence“ and this reflects a decreased resistance towards psychosocial stressors. A decreased resistance is expressed through a detached personality leading to an activation of stress systems when the individual is confronted with adverse situations (Van Heeringen et al, 2000).

The first subsystem has a substrate the temporal cortex in conjunction with the hippocampus and the HHA axis and is thought to be involved in the processing of sensory information. The function of this subsystem is realized by noradrenergic system and serotonergic system mediated by the 5-HT_{1A} and is represented by the adaptation to stress, the dysfunction of the system may lead to depressive ideation.

The second cognitive subsystem addresses to the executive functions and represent the behavioral expression of social cognitive processes. One component is the perception of „no escape“ and this is associated with deficiencies of problem-solving skills and, in fact, with deficiencies in autobiographical memory (Sidley GL et al, 1997). This connection regards the attainment of the efficacy of some solutions that derive from anterior life experiences.

The declarative memory is a memory domain that contains the autobiographical memory that stores multiple response alternatives to different problems acquainted over time which are needed to prevent the development of a perception that there is „no escape“ from psychosocial adversity. Also, the declarative memory can modify the unconscious automatic responses to stressors determined by temperamental dimensions in the first years – that are stored initially in procedural memory system – using information stocked in autobiographical memory system.

Neurobiologically, this cognitive system is sustained, as a structure, by the temporal lobe in conjunction with the hippocampus, formations that serve the autobiographical memory, and with the prefrontal cortex involved in work memory, a component of autobiographical memory. Glutamate and gamma-aminobutyric acid are involved in the development of the declarative memory (Nutt DJ, 2001).

The third cognitive system, the other component of the behavioral expression of social cognitive processes refers to the perception of „no rescue“, faced to particular life events, mediated by deficient prospective cognitive processes and leading to feelings of hopelessness which is the lack of generating future positive events.

By using a fluency test, it was demonstrated that participants who had attempted suicide were less fluent in coming up with positive events that might happen in the future (Williams & Pollock, 2001). Using SPECT it has been demonstrated a negative correlation between prefrontal (dorso-lateral) binding to 5-HT_{2A} receptors in the brain of attempted suicide patients on the one hand, and their levels of hopelessness and harm avoidance (behavioral inhibition characterized by uncertainty and worrying about the future) on the other hand (Van Heeringen et al, 2003).

This system consists of prefrontal cortex in connection with the amygdale; his function of avoidance behavior is realized by serotonergic system, mediated by the 5-HT_{2A} and dopaminergic modulations, and the dysfunction of this subsystem is translated through the anxiety and hopelessness.

Behavioral inhibition (avoidance) leads to suicidal behavior only in the presence of an increased dopamine transmission that breaks the inhibition induced by the serotonin and manifests as a hostility or aggression. This may explain the association between serotonergic dysfunction and

impulsivity or aggression as found in post mortem studies of those who have died by suicide (Mann JJ et al, 1999). It has been shown that a depletion of serotonin disinhibits aggressive behavior (De Deurwaerdere & Spampinato, 1999). There are few studies that demonstrate the participation of dopamine in suicidal behavior (Mann JJ, 2003).

Although such a dissection of predisposition to suicidal behavior can be regarded as a simplistic view, beside the multiple motivations that may be implicated, this review shows indeed the complexity of the cortico-subcortical circuits involved in different components of the predisposition to suicidal behavior, their neuropsychological expression and their neurobiological modulation may well reflect the complexity of predicting and treating suicidal ideation and behavior.

Conclusions:

Researches over the suicidal behavior from a biological and neuropsychological point of view constitute an important step to create medical modalities that can be implemented in a specific way in the suicidal behavior. It is necessary to amplify researches in this area, but in a tight conjunction with the psychosocial and cultural aspects in order to comprehend this complex human phenomenon, actually, so complex.

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