

## Psychopathology of Brain Frontal Lobe Tumors : When the Neurosurgery Meets Psychiatry

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### Abstract

Brain tumors occur when abnormal cells form within the brain. There are two main types of tumors: malignant and benign tumors. Then, tumors can be divided into primary that start within the brain, and secondary tumors that have spread from somewhere else, known as brain metastasis tumors. Secondary brain tumors occur in approximately 15 % of cancer patients with about half of metastases coming from lung cancer. Primary brain tumors occur in around 250,000 people a year globally, making up less than 2% of whole body tumors. According to American Brain Tumor Association the most common types of primary tumors are gliomas, representing 74,6 % of all malignant tumors and meningiomas ( 36,6% ) while more affected region is frontal lobe, about 22 % . Particularly, prefrontal cortex ( PFC ), the anterior part of the frontal lobe that is highly developed in humans plays a role in the regulation of personality, emotional, and behavioral functioning, leading to serious cognitive impairments (1). These are the psychological signs of frontal lobe tumors, in addition to other functions such as the expressive language of Broca's area or those relating to voluntary movement, linked to frontal cortical motor areas. It relates to the so-called higher nervous functions, concerning the life of relationship and communication. The PFC physiology explains the psychological mechanisms of its associated functions: connections with the limbic cortex, thalamus, hypothalamus, basal ganglia and other subcortical areas. The regions of the PFC at the base of the psychophysiological mechanisms involved are basically the dorso-lateral, the ventro-medial, the orbito-frontal establishing contacts primarily with limbic structures, such as the cingulate gyrus, hippocampus, amygdala.

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## Fondamental Studies

Karl Kleist (1934) described the pseudo-depression syndrome, a condition characterized by indifference, apathy, lethargy, decreased spontaneity, reduced sexual interest, reduction in the expression of emotions, inability of anticipation (pseudo-depressive personality) [1,2]. Pseudo-depression syndrome or apathic syndrome is related to PFC lobe tumors involving dorso-lateral areas, as confirmed by Blumer and Benson (1975), while Luria (1969) described the apathetic-akinetic-abulic syndrome, characterized by a marked passivity, inertia and inactivity, as a result of extensive and bilateral frontal lesions, clinically little distinguishable from a catatonic state [3]. Kleist also found that patients with orbital frontal lesions were likely to exhibit puerile facetious behaviour, and unstable mood. Blumer and Benson then distinguished two frontal lobe syndromes: pseudo-depression characterized by apathy, indifference, slowness and decreased tendency to initiate conversation; and the pseudopsychopathic or pseudo-maniac syndrome, characterized by puerility, euphoria and garrulous speech. Pseudo-depression closely resembles the psychomotor poverty syndrome seen in schizophrenia, while the pseudo-maniac syndrome resembles the disorganization syndrome. There is controversy concerning the location within the frontal lobe of lesions likely to produce these two frontal syndromes. In accord with Kleist, Blumer and Benson propose that pseudo-depression arises from lesions of the dorsal frontal lobe, while orbital lesions result in the pseudo-maniac syndrome. In contrast, Kolb and Whishaw (1980) suggest that pseudo-depression arises from left frontal lesions and the pseudo-maniac syndrome arises from right frontal lobe lesions. Pseudo-maniac syndrome is called moria or moriatic syndrome because changes of morality [4].

### Role of Neurotransmitters

In general, the evidence suggests that pseudo-depression syndrome is associated with dopaminergic underactivity, while pseudo-mania and reality distortion are associated with dopaminergic overactivity. The role of other monoamine neurotransmitters, the well-known excitable properties of serotonin 5-HT<sub>1C</sub> and 5-HT<sub>2</sub> receptor agonists

suggest that serotonin can be involved in reality distortion. The ventral-medial region seems to be involved in memory functions, through ventro-medial PFC- hippocampus circuits and in particular a PFC damage that does not affect hippocampal connections causes the working memory alterations, short-term memory type withholding voluntary control. The limbic cortex is closely related to PFC, one controlling the other, the rational consciousness that keeps and restrains emotions.

Psychopathological syndromes arise from the imbalance of the PFC and limbic cortex, caused by tumors that affect the fronto-limbic circuits, creating pseudo-depressive and pseudo-maniac symptoms. Personality changes, memory disturbances, altered behavior represent practically the result of the distortion of the fronto-limbic connections, caused by the tumor. The PFC syndrome is a full psychiatric condition, with which the neurosurgeon has to deal. Mental disorders (early and constant) have here tumor a very special character, which is very often assessed only in retrospect. The sufferer has poor psychomotor initiative, devoid of concern for their family and for their business and with disaffection and hypo-emotionality. He seems, for example, realize perfectly of his physical condition and to be the bearer of a brain tumor, and therefore having to be subjected to surgery: however, this does not seem to interest him. Symptoms more frequent early: the pseudo-depression syndrome, with inattention, disinterest, apathy followed by heedless of his own person, his own cleaning and also devoid of modesty. Language can become obscene, childish, silly and full of gaiety of word games (moria, that is folly and extravagance).

*What the Neurosurgeon Would make with a Frontal Tumor? The Answer is Complex Because Depending on Some Factors*

Type of tumor, malignant or benign, expansion, symptomatology, risk assessment and surgical complications. Prefrontal tumors have often an onset cognitive symptomatology such as the one so far described. If the tumor is a meningioma, the complete removal ensures regression of symptoms. If the tumor is malignant, such as glioma, the program changes, the surgeon taking some precautions. Is tumor large size,

infiltrating, located in the left hemisphere ? In this case, it is dangerous to proceed surgically at once. Neurosurgeon must consider possibility of damage to the Broca's area of language and motor pathways. Cortical brain mapping in awake surgery may be useful to preserve such functions, saving these important areas [5]. The patient operated in vigil is able to show the appearance of any deficits, offering neurosurgeon possibility to avoid irreversible damages. This practice is the most secure to save the so called eloquent areas [6]. Regarding cognitive functions, to say that whether the tumor is operated or is not operated, these remain altered, cause anatomofunctional alterations already present. This occurs in malignant frontal lobe tumors poor prognosis. Brain frontal lobe tumors, especially PFC tumors, cause a psychopathological syndrome, affecting behavior, personality, memory, in short all functions involved in various aspects of social life, whose alterations determine the so called sociopathies. In conclusion, when the neurosurgery meets psychiatry : cognitive functions are altered by brain frontal lobe tumors, causing a serious psychiatric pathology, against which the neurosurgeon must fight.

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