ISSN : 2229-5097

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SURGICAL NEUROLOGY INTERNATIONAL®

AN OPEN ACCESS, INTERNATIONAL JOURNAL OF NEUROSURGERY AND NEUROSCIENCE

2014 / Vol 5 / ISSUE 1

Wolters Kluwer Health | Medknow

PubMed Included

Surgical Neurology International

OPEN ACCESS

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Editor: James I. Ausman, MD, PhD University of California, Los Angeles, CA, USA

Case Report

Comprehensive management of frontal and cerebellar tumor patients with personality changes and suicidal tendencies

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Received: 08 March 14 Accepted: 16 September 14 Published: 08 December 14

This article may be cited as:
Arifin MZ, Yudoyono F, Setiawan C, Sidabutar R, Sutiono AB, Faried A. Comprehensive management of frontal and cerebellar tumor patients with personality changes and suicidal tendencies. Surg Neurol Int 2014;5:174.
Available FREE in open access from: http://www.surgicalneurologyint.com/text.asp?2014/5/1/174/146487

Abstract

Background: Brain tumor patients have a tendency to suffer from psychiatric disturbances. One of the most frequent disturbance experienced by frontal area tumor patients are personality changes.

Case Description: In this paper, the authors report a 28-year-old male patient who presented with headache and personality changes, with no other neurological disturbance. The patient became increasingly pensive and apathetic with frontal and cerebellopontine angle tumor. The diagnosis is based on computed tomography scanning images, and histopathological examination of the excised tumor results in meningioma.

Conclusion: Before the operation was performed, the patient suffered from personality changes and suicidal tendencies. After the operation, the patient's suicidal tendency was gone, but the personality changes still persist. For this reason, a comprehensive management of the patient is required, including postoperative pharmacological and psychological treatment.

Key Words: Brain tumor, comprehensive management, personality changes, suicidal tendencies

Access this article online

Website: www.surgicalneurologyint.com

DOI: 10.4103/2152-7806.146487

Quick Response Code:

INTRODUCTION

Brain tumor patients have a predisposition to suffer from psychiatric changes. These disturbances are experienced within the natural progression of the disease of almost 50% of such patients, usually after the diagnosis of a brain tumor is announced.[7,15] These patients could suffer from cognitive changes, alteration of consciousness, personality changes, mood changes, anxiety, etc. A total of 80% of patients with psychiatric symptoms have tumors in the frontal or limbic regions. Tumors in these areas have a greater probability of manifesting personality changes.[7,10,15]

The personality changes are persistent, showing significant difference from previous personality patterns. The patient has unstable affect, disinhibition in impulse control, aggressive behavior, apathetic, paranoid, or a mix of symptoms. These changes are a part of frontal lobe syndrome, which exhibits slowing of the thinking process, impaired judgment, decreased curiosity, social withdrawal,

and increased aggression. These patients appear apathetic and ignorant, but could be suddenly aggressive with impulsive disinhibition.[15]

Other types of diagnostic tools can be used to detect more specific frontal lobe dysfunction. Both the frontal assessment battery, the Wisconsin Card Sorting Test and proverb interpretation task, can be used to assess an individual's frontal lobe functioning, frontal lobe dysfunction is characterized by both cognitive and behavioral deficits. Depending on which regions of the frontal lobe are damaged, different symptoms can occur. Damage to the prefrontal cortex is generally associated with behavioral changes; damage to the dorsolateral region results in cognitive dysfunction. Common cognitive disturbances include problems with memory, motor skills, spatial processing, attention, verbal fluency, and concentration. Perhaps the most notable behavioral effect of frontal lobe dysfunction is personality change.[6,11,20]

Suicide risk generally increases fourfold in tumor patients.[2,5] When these patients realize they have cancer, their psychological reaction includes fear of being disabled or deceased; fear of abandonment or reliance; fear of a change of relationship with others, change of their role in society, and monetary difficulties; with denial, anxiety, anger, and guilt. Even though suicidal thoughts and ideas are common in cancer patients, actual suicide rates are only slightly higher in comparison with the general public.[15] The highest suicide risk occurs after diagnosis is announced, while a study shows that 40% of suicides take place between 1 and 5 years. In Scandinavia, the reported relative risks of suicide for cancer patients are 1.55-2.5 for males and 1.35-2.9 for females, in comparison to the general.[13]

Psychiatric problems in brain tumor patients could be increased due to the disease itself, which causes focal damage; due to radiotherapy and chemotherapy, which causes more damage; or due to the use of corticosteroids to control the clinical symptoms, which could cause unstable affect and personality changes.[1] These things are exacerbated by other psychological problems, such as a reactive depression, loss of livelihood, monetary problems, and marital difficulties.[12,14] For these reasons, a comprehensive management of brain tumor patients is required, with both a curative management of the tumor, management of psychiatric symptoms, and management of the patient's quality of life.

CASE REPORT

A 28-year-old male patient presented with headache and personality changes, with no other neurological disturbance. The patient became increasingly pensive and apathetic. He had a history of retinoblastoma operation of his left eye, but a complete data could not be obtained. For his complaints, a computed tomography (CT) scan was performed, which discovered a mass of the left frontoparietal and left cerebellopontine angle. The mass was excised at the Hasan Sadikin hospital in Bandung, with a histopathological result of meningioma [Figure 1]. After 7 days inpatient stay, the patient was discharged with improvement of physical symptoms, and was lost to follow-up.

A year later, the patient presents with headache and a lump on his operative scar. CT scan shows a mass of the left frontoparietal and left cerebellopontine angle. The patient's symptoms also include behavioral changes, such as talking to himself and being angry. The patient also appears withdrawn and seeks to be alone. The patient underwent another operation for his left frontal region tumor, with similar histopathologic result of meningioma. After several days treatment, the patient's psychiatric symptoms decreased but did not disappear. The patient was scheduled for an operation for his cerebellopontine angle mass 3 weeks later, but 10 days prior to the scheduled operation, the patient became increasingly aggressive, exhibited erratic behavior, and expressed suicidal tendencies. The patient was then consulted to the psychiatric department of Hasan Sadikin hospital, and was diagnosed with mild depression and given psychotherapy [Figure 2]. The patient's left cerebellopontine angle mass was excised, with histopathological diagnosis of meningioma. After several days of inpatient care, the patient was discharged with improvements of his physical and psychiatric condition. The patient no longer has suicidal tendencies.

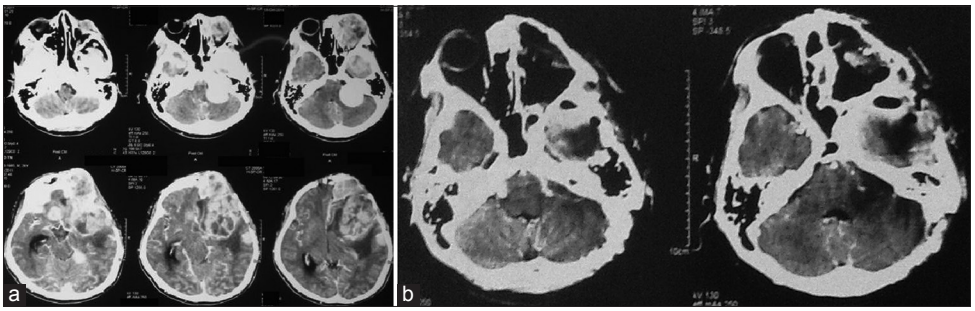

Figure 1: Clinical photographs of the patient before his operation (a) Preoperative CT, (b) Postoperative CT

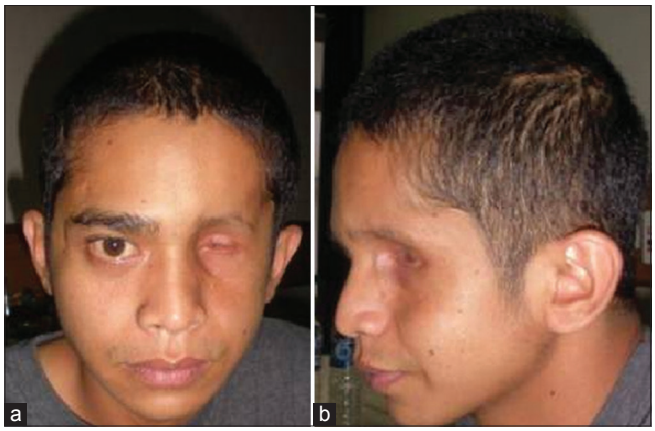

Figure 2: (a) Preoperative CT scan (Clinical picture before surgery from front) (b) CT scan after the third operation (Clinical picture from left side)

The patient returned twice for follow-up to the neurosurgery clinic, at 1 and 8 months after his operation. His psychiatric condition still shows aggression and withdrawal, although improved in comparison to his condition before the operation. The patient did not return for follow-up to the psychiatry clinic.

DISCUSSION

The neurobiologic aspect of brain tumor personality changes

The frontal lobe, including the dorsolateral and ventrolateral prefrontal cortex (DLPFC, VLPFC) and the anterior cingulate cortex (ACC), plays an important part in the control of a person's cognitive processes, thought processes, and behavior. Disturbances to these structures will distort automatic thought, attention span and memory, create dysfunctional beliefs, and create a bias in information processing, which will change the personality of the person.[16] Functionally, the frontal lobe, especially the prefrontal area is used to regulate mood; the orbitofrontal cortex (OFC) and medial prefrontal cortex (mPFC) regulates various cognitive and emotional processes, resulting in mood control such as the regulation of a person's response to aversive emotional experiences and interpretation of social and emotional cues. The subgenual anterior cingulate cortex (sgACC) also plays a part in mood regulation and the onset of depression.[9,16]

Emotions stem from basic needs such as hunger, sex, reproduction, happiness, pain, fear, and aggression. The neuroanatomical basis for these urges center around the limbic system, but other human emotions such as affection, pride, guilt, sadness, and anger are mostly learned and regulated by the cortex. The regulation of these urges requires an intact frontal cortex. The frontal and temporal lobes plan an important part in the regulation of emotions. The prefrontal cortex consists of three regions (orbitofrontal, dorsolateral, and medial), with different syndromes produced by lesions in each lobe. There is evidence of a reciprocal connection between the prefrontal cortex and all regions of the brain, which enables the use of all brain functions when performing an activity with purpose.[15] Researches using functional imaging had uncovered a decrease in the activation of frontal cortex structures (such as the sgACC) with simultaneous increase in activation of the limbic system. It is also known that abnormalities of corticolimbic connectivity affect the reciprocal relationship, between the cortical regions, which regulate mood and the limbic region which produces.[16]

Lesions of the frontal lobe also disturb executive functions, such as motivation, attention, and action regulations. The prefrontal cortex also affect mood, where activation of the activation of the left prefrontal lobe increases mood, activation of the right prefrontal cortex depresses mood. Lesions of the prefrontal area at the cortex or the subcortex level remove the mood and increase control, which results in depression and uncontrollable crying.[15,16]

Clinically significant behavioral change also manifests in patients with posterior cerebellar and vermis lesions. These changes are marked by disturbances in executive functions, such as planning, situational awareness, verbal eloquence, abstract thinking, and working memory, sometimes with perseverance, short attention span, or inattention; difficulty with spatial cognition with visuospatial and memory problems; personality changes with flattened affect, disinhibition, or inappropriate behavior; and deficits of language, such as grammatical function and disprosodia. The final effect on these disturbances on cognitive function is the decrease of intellectual function. Executive dysfunction's problem with planning, mental flexibility, adaptation to new situation, inhibition of automatic reactions, abstract thinking, verbal fluency, attention and working memory visual-spatial disturbances and visual memory dysfunctions mood disturbances, ranging from blunted and flat affect to disinhibition and hyperexcitability, language dysfunctions–dysnomia, dysgrammatism, dysprosodia.

Posterior cerebellar lobe lesions in particular are important in this syndrome, and the cerebellar vermis is consistently involved in patients with significant affective changes. A lesion in the anterior cerebellar lobe only effects minor executive function and visuo-spatial changes. This condition is called as "cerebellar cognitive affective disorder." This chain of deficits shows disturbances of cerebellar modulation of nerve circuits, which connects the prefrontal, posterior parietal, superior temporal, and the limbic cortex with the cerebellum.[18,19]

Gottwald *et al.* compared a group of healthy participants to a group of patients hospitalized for resection of

cerebellar lesions (tumors and hematomas). The affective state of participants was assessed using a German version of the Profile of Mood States (POMS) questionnaire. Most patients were assessed either soon before surgery or soon after surgery. Patients described themselves as significantly more "dejected," "tired," and having "reduced initiative" relative to the healthy comparison group. This is consistent with the many case reports that report affective symptoms in patients with cerebellar pathology. These case reports describe a wide range of mood symptoms including depression, lack of emotions, and affect dysregulation. Personality changes are also described in the literature.[4,21]

The specific definitions of executive function vary, but there is general agreement that executive function comprises related, yet distinct, abilities that enable intentional, goal-directed, problem solving. Executive function is considered to be a general, overarching construct that includes all supervisory or self-regulatory functions, which organize and direct cognitive activity, emotional response, and overt behavior. Commonly agreed upon executive subdomains include the abilities to initiate and sustain behavior, inhibit competing actions or stimuli, select relevant task goals, plan and organize problem-solving strategies, shift strategies flexibly when necessary, and monitor and evaluate one's own behavior. Retaining information actively in working memory in the service of problem-solving is also often described as central to executive functioning proposed broad classification of executive function into domains reflecting behavioral/emotional regulation versus metacognitive problem solving. They suggested that regulation of behavior and emotion is reciprocally related to effective problem solving.[3]

The disturbances experienced by the case study patient are behavioral changes, disturbance of executive function (impaired reasoning/judgment, unable to determine consequence of actions), and attention/concentration impairment. These disturbances are likely associated with his frontal lobe lesion instead of his cerebellar lesion. Cerebellar tumor symptoms such as imbalance, disturbance in coordination, and vomiting are not found in this patient. However, his psychiatric condition is exacerbated by the cerebellar tumor, and will persist after tumor removal as sequelae, as is the case in this patient.

The cause of suicidal tendencies

Almost 40% of brain tumor patients experience meaningful depression, as was found by a study by Pelletier *et al*. The prevalence of these depressive symptoms are caused by the difficult conditions of such patients, with hopelessness and loss being felt after being diagnosed with a brain tumor (especially those with a poor prognosis); worry over existential problems such as finding the meaning of life and life-threatening conditions); decrease of social and work functions; disease symptoms that resemble or exacerbate depressive symptoms (such as fatigue or cognitive problems); and the side effects of brain tumor therapy, such as chemotherapy, radiotherapy, and other interventions.[12,15]

The orbitofrontal cortex, especially Brodmann's area 11, is an area associated with disturbance of inhibition, impulsiveness, and suicidal tendencies. A postmortem study shows that in suicides, there are neurotransmitter disturbances in this area, which are decreases in serotonin transporter binding site and an increase in 5-HT1A and 5-HT2A receptor binding. This discovery is in line with decreased functional MRI (fMRI) activity at the prefrontal area, which is associated with aggressive behavior and suicidal tendencies. A postmortem fMRI study also proves that the orbitofrontal cortex, including Brodmann's area 11, plays a part in inhibiting and regulating factors that contribute to suicide, such as impulsiveness, aggressiveness, and anxiety. Other studies also show that the cerebellum plays a part in this process through the cerebro-cerebellar pathway in regulating cognitive function.[5,8,19]

In America, a study was performed to analyze brain tumor patients and their families, which reveals why the financial cost of brain tumors is so high. The cost for medicine, doctor's fee, hospital fees, brain supplements before and after the operation, as well as rehabilitation is expensive. Other expenses such as food for patient and family, transportation, telephone bills also contribute. This causes budget cuts, in time as well as money; which explains that after the diagnosis of brain tumor is made, both the patient and their family are affected, as well as changes in friendship, roles and rules in the family, and their environment.[17] In this patient, the cause of his suicidal tendencies could have been caused by both biological and psychological factors. The patient's suicidal tendency disappeared after the removal of his cerebellar tumor, which was presumed to be because of his physical improvements that had an effect on his psyche. However, his suicidal tendency needs to be monitored in future follow-ups.

Comprehensive management

Malignant brain tumors usually cause suffering for the patient and their families, and usually cause the patient's death within several years. The effort to cure the tumor is often toxic and painful. As a result, the patient's quality of life is decreased. Better understanding of the emotional distress experienced by such patients could bring about a more effective intervention, which better enables the patient and their family to weather the disease and have a better quality of life.[12]

The management of secondary personality changes should be focused on the underlying disease. The use of lithium, carbamazepine, and valproic acid to control the labile affect and impulsivity is recommended. Aggression can be controlled using lithium, anticonvulsive medication,

or a combination of both. Apathy and inertia could be improved using psychostimulants. The patient's cognition and verbal skills are usually preserved, which makes them excellent candidates for psychotherapy such as cognitive rehabilitation therapy and problem-solving therapy. The family must be involved in the therapeutical process, with a focus on education and understanding of the behavioral changes. Brain tumor patients also benefit from pastoral or psychotherapy sessions, which help in existential and spiritual matters.[12,15]

CONCLUSION

Neuroscience team approach for the management of brain tumor patients, must not be overlooked. The role of the family in the management of such patients, as well as in obtaining a complete picture of the disease, should be emphasized. Surgical and nonsurgical management strategies, as well as pharmacological and psychological treatments, must all be utilized for these patients. The end result of these therapies is comprehensive care for brain tumor patients, and the improvement of their quality of life.

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Commentary

Since the publication of Phineas Gage[1,2] and the pioneering work of Luria,[2] we are well aware of the importance of the frontal lobe as the CEO of the brain. The acceptance of the medical community of the importance of the frontal lobe is ironic, since 20 years ago it was considered the silent area of the brain and frontal lobotomy for some times contribute to the lack of understanding between neurosurgeons, psychiatrists, and the public. Fortunately as the case is reported by the authors immediately arouse suspicion in the treatment team that a frontal lobe syndrome was an important finding evident in this patient.

While the authors have an excellent review of the frontal lobe syndrome and its importance in neurosurgical intervention,[3,4] the syndrome of cerebella pontine and its behavioral manifestations are relative new (past decade) and should make the neurosurgical team aware of its symptomatology and differential diagnosis[5-7] and we are grateful to the authors for their contribution.

The most important lesson to take home from this article is that currently we cannot conceive a neurosurgical clinical team without the participation of neuropsychiatry, neurology, neurosurgery neuropsychology rehabilitation, and imaging,[8] and that is "food for the thought" for the administrators who do not hesitate in calling neurosciences institute when one discipline or one noted specialist is the main attraction for the patient rather than a cohesive multidisciplinary team.

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