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CASE REPORT

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A novel acute phase rehabilitation approach: Vibration therapy in insular glioma patients

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Abstract

Acute phase rehabilitation has beneficial effects on functional results, activities of daily living, mobility and cognition in glioma patient. Two insular glioma patients had acute phase rehabilitation were presented in this study. The Karnofsky Performance Scale, The Stroke Rehabilitation Assesment of Movement Scale, the Berg Balance Scale, and the Functional Independence Measure were used to assess patients. While Case 1 was treated with Neurodevelopmental Therapy (Bobath approach) (12 sessions), Case 2 was treated with cervical vibration in addition to Neurodevelopmental Therapy (15 sessions). Besides observing positive developments in the balance and functional levels of the two cases after treatment, there was more improvement in the balance parameter of Case 2. As a result of the study, cervical vibration application in addition to the rehabilitation program of patients with insular tumor could be useful in terms of balance development.

Keywords: Brain, tumor, vibration, rehabilitation

Introduction

The insular glioma comprises of up to 25% of all low grade gliomas and 10% of all high grade gliomas in recent epidemiological study. The insular glioma patients have primarily motor and somatosensorial problems in addition to vestibular, visuel, emotional and cognitive problems because the insular cortex has connections with primary and secondary somatosensory areas, auditory and visual association cortex, hippocampus [1]. Additionally, because the insular cortex is surrounded by the medial cerebral artery and perforated lateral branches, the insular cortex has a very complex anatomy and the functional significance is very high. Insular gliomas often result in diffuse damage across neighbouring regions including the internal capsule and basal ganglia, because of neighbourhood to medial cerebral arter [2].

General treatment approaches for brain tumors include surgical treatment, chemotherapy, radiotherapy and rehabilitation, which is also valid for patients with insular glioma [3]. Studies have shown that patients achieve functional gains after acute rehabilitation approaches in patients with brain tumors [4,5].

One of these studies indicated that functional levels of patients with brain tumor were increased by treatment with neurodevelopmental therapy (NDT, Brunnstrom and Bobath approach) and proprioceptive neuromuscular facilitation techniques [4].

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Vibration, which is included in rehabilitation interventions, is applied with various forms (local or whole body) and contributes to improvement of vestibular system and proprioception sense in the field of rehabilitation. It has been reported that vibration improves balance and proprioception in many neurological disorders such as hemiplegia, multiple sclerosis and Parkinson's disease [6]. Vibration application causes stimulation of the peripheral proprioceptors and it is transported to ganglion spinale towards fasciculus gracilis and cuneatus pathways. Axons, ascend within the posterior funiculus, make the second synapse in the nucleus gracilis and cuneatus at the levels of the medulla oblongata. After the fibers from the both sides cross over in decussatio lemnisci medialis, the axons forming the lemniscus medialis then synapse with the third neurons in the ventral posterolateral nucleus of thalamus. Finally, the axons of these neurons pass through the crus posterior of the capsula interna, reaching the cortex and terminating synapses with the neurons in Brodmann's 3,1,2 areas in the gyrus postcentralis. In summary, peripherally vibration application provides stimulation of funiculus posterior, internal capsule and sensorial cortex [7].

As a result of the literature, the studies about the efficacy of physiotherapy in patients with brain tumors are very limited and any study has been reported about investigating the efficacy of the vibration therapy after surgical treatment in insular glioma patients. This study was carried out to investigate the effect of postoperative rehabilitation program on balance and functional outcomes in two similar cases with insular glioma, considering that tumor tissue in the insular cortex causes somatosensorial, motor and vestibular problems.

Case Report

Case 1

52-year-old female patient was operated five years ago for left insular glioblastoma. The patient was treated with the postoperative radiotherapy and concomitant temozolomide followed by the adjuvant temozolomide for 18 months. She did not participate to any rehabilitation program. Three years after she had completed her chemotherapy, she complained about increased weakness on her right side and the patient was hospitalized for the re-resection due to the recurrence of her malignancy. At her admission, she was nearly hemiplegic. After the surgical treatment, physiotherapy and rehabilitation program (PTR) started on the 3rd day after surgery. 12 PTR sessions was performed during her hospital stay and she was discharged with an individualized home-exercise program.

Case 2

69-year-old male patient was admitted with complaints of numbness at the right side. On his medical history, he was operated for his left insular glioblastoma six months ago and received postoperative radiotherapy with concomittant temozolomide and 4 cycles of adjuvant temozolomide administration thereafter. He had not received any rehabilitation programme within six months. The tumor recurred in 6 months and he underwent second surgery. In his preoperative neurological examination; the patient had right hemiparesis and hypoesthesia. After the second surgery, PTR started on the 1st day after surgery and the patient had 15 PTR sessions and was discharged with a home-exercise program.

Assessment

Karnofsky Performance Scale, Stroke Rehabilitation Assessment of Movement (STREAM), Functional Independence Measurements and Berg Balance Scale were used to assess functional level, quality and quantity of movement, activities of daily living and balance, respectively [8,9]. All assessments were performed before treatment and before discharge.

Treatment

According to the findings, Neurodevelopmental Bobath Treatment approach was applied in the rehabilitation program of the two cases in order to minimize motor-sensory impairments and to provide normal movement experience and functional independency. In the treatment program, trunk control exercises were predominantly performed because body control was important for achieving dynamic stabilization in the different regions of body and reducing abnormalities in other body parts. Pulmonary rehabilitation took an important place of the treatment program for two patients. For intense sensory input, underfoot deep friction massage, joint mobilization and pelvic mobilization were applied. In the sitting and standing positions, load transferring and functional reaching exercises were also included in the treatment program.

Local vibration was applied with the portable local vibration device (Vibrasens; Techno Concept, France) to the paravertebral muscles by using the probe 7 centimeter at the frequency range of 60-80 Hz for 60 seconds in addition to the rehabilitation program only for Case 2.

Results

When the patients were re-assessed before discharge, a 10% improvement in Karnofsky Performance Scale scores was observed in both cases. Both cases often needed another person for performing their personal activities before the initation of the treatment. After the treatment program, their need for the assistance from another person decreased significantly and they needed occasional assistance from another person for their daily personal activities.

Analysing STREAM scores, the percentage of recovery of Case 2 was higher than of Case 1. While Case 2 was able to perform sitting and standing activities with help and deviations before treatment, he was able to perform motion pattern normally and independently after treatment. Although some improvements in the quality were observed in Case 1, these improvements did not reflect to the test score.

When Functional Independence Measurements scores were analysed, it was found that there were 8.73% improvement in Case 1 and 11.9% improvement in Case 2. This difference was due to the higher capacity of independence in transfer activities in Case 2.

As a result of Berg Balance Scale, there was a significant improvement 26.7% in balance of Case 2, while an increase of 16.07% was observed in Case 1. Because Case 2 was able to stand while feet were placed together, turn around himself 360 degrees and place alternate leg on footstool independently after treatment (Table 1).

Table 1. Before and after treatment assessment results of Case 1 and Case **2**

	CASE 1			CASE 2		
	B.T.	A.T	Recovery Percentage *	B.T	A.T	Recovery Percentage *
KPS (0-100)	50	60	10	50	60	10
STREAM (0-70)	35	36	1.4	40	45	7.14
FIM (0-126)	65	76	8.73	69	84	11.9
BBS (0-56)	24	33	16.07	27	42	26.7

KPS: Karnofsky Performance Scale, STREAM: The Stroke Rehabilitation Assessment of Movement Scale, FIM: Functional Independence Scale, BBS: Berg Balance Scale, B.T.: Before Treatment, A.T.: After Treatment, *The percentage of recovery was calculated by proportioning the difference between B.T.-A.T. to the maximum score of the test

Discussion

As a result of the study, we found that activities of daily living and functional levels improved and balance and mobility increased in both of Case 1 and Case 2. However, we have observed more improvement in balance parameters of Case 2. We thought that this difference could be due to intense localization of muscle fibers and mechanoreceptors in the cervical region and close association between cervical region and the vestibular system.

While vibration sense ascends along the posterior funiculus, passes through the internal capsule, therefore vibration sense is affected in insular glioma patients. When the proprioceptors in cervical region are stimulated, we stimulated all of the vibration pathways and somatosensorial cortex [10]. It could be said that including vibration application to the rehabilitation program can support the treatment of the patients positively. Because vibration also causes a response called "tonic vibration reflex" which provides the activation of the muscle spindle and muscle fibers through alpha

motor neurons and increase the efficiency of the polysynaptic pathways. This application can be used in terms of improving proprioception sense [11].

Vibration application is also used for various purposes such as improving neuromuscular activity, regulating muscle tone, increasing balance in the rehabilitation of patients with hemiplegia, multiple sclerosis and spinal cord injury [6]. The clinical studies showed that vibration provides improvement in balance and proprioception, decrease neuropathic pain and spasticity [12,13].

Vibration application can cause some cardiovascular reactions, headache and even epileptic seizures, when the frequency overlapped with the resonance frequency which is body's own vibration frequency. Therefore, vibration must be applied carefully hypertensive patients [14]. In our study, the intracranial pressure of Case 2 was not affected, so it could be said that vibration is a safe method when applicated carefully even in intracranial tumor patients.

Conclusion

Physiotherapists working in the field of neurological rehabilitation focus on the trunk and limb movements in the physiotherapy program; meanswhile the cervical region is neglected, generally. At the end of the study, it has been concluded that the inclusion of the vibration therapy into the PTR programs of neurological patients could be beneficial because of intense proprioceptors in the cervical region and be stimulating all of the vibration tractus. The results of the current study needed to be supported with studies have more cases and high quality.

Competing interests
The authors declare that they have no competing interest.

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