PS-18

rTMS as an Novel treatment to alleviate Holmes' Tremor after Post-Stroke Olivary Nucleus Hypertrophy- A Case Study

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Purpose

Hypertrophic olivary degeneration(HOD) is hypertrophic change of the inferior olivary nucleus which typically results from focal lesions interrupting dentato-rubro-olivary pathway(DROP). Clinically HOD presents oculopalatal tremor or Palato-pharyngo-laryngeal myoclonus, and may aggravate dysphagia. Dentate nucleus in DROP is also a part of dentato-rubro-thalamo-cortical pathway, or cerebello-thalamo-cerebral(CTC) pathway. Dysruption of either pathway could result in movement disorder or tremor in stroke patients.

Our hypothesis is that stimulation to the M1 cortex could induce neuroplastic changes in the cerebello-thalamo-cortical or dentate-rubro-olivary pathways.

Materials

The subject of this case report is a 57-year-old male who developed quadriplegia and dysphagia after bilateral pontine hemorrhage 7 months ago from admission. He was admitted for protracted dysphagia recovery despite improvement in arousal. Bilateral HOD was found in MRI image. Also, Swallowing assessment with the Fiberoptic swallowing study(FEES) showed diffuse tremor of pharyngeal wall and both arytenoids with severe secretion aspiration.

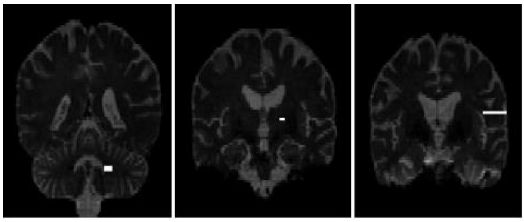
Methods

Transcranial magnetic stimulation-evoked motor responses were recorded in mylohyoid before and after the TMS sessions via a pair of bipolar patch electrodes. The TMS coil was placed 10-11cm laterally and 2cm posteriorly of the vertex and a hot spot search was performed in this area to get the largest motor evoked potentials(MEPs). Resting motor threshold was defined as the minimum stimulation intensity which resulted in MEPs of at least 20uV in 50% of the trials.

rTMS was applied every weekday for 6 days. A session of stimulation consisted of 5Hz stimulation for 20 minutes(for a total of 1200 pulses each day) given over the provisional mylohyoidal cortical area of both hemispheres. The intensity of stimulation was set to 90% of the resting motor threshold for the abductor pollicis brevis muscle of the comparatively less affected hemisphere(left). No complication was observed during the procedure.

Results

FEES performed past 5 weeks of rTMS therapy showed a decrease of pharyngeal wall tremor. Diffusor tensor image was acquired before and 3 days after the completion of the stimulation sessions. By analyzing each ROIs in the both CTC and DROP(Fig.1), FA values from frontal operculum and ventral thalamus increased at both hemispheres(Table 1). By contrast, little or mixed interval changes of FA values was found in bilateral dentate, red nuclei and central tegmental tract ROIs.



(A) (B) (C)

Fig.1 Locations of ROIs that constitute DROP or CTC pathway.

(A) left dentate nucleus
(B) left ventrolateral nucleus of thalamus
(C) left motor cortex of frontal operculum

	Right hemisphere	Left hemisphere
Frontal operculum	0.31 → 0.43 ▲	0.35 → 0.49 ▲
Ventral thalamus	0.46 → 0.49 ▲	0.51 → 0.71 ▲
Dentate nucleus	0.46 → 0.48 ▲	0.50 → 0.46 ▼
Red Nucleus	0.42 → 0.34 ▼	0.41 → 0.54 ▲
Central tegmental tract	0.27 → 0.53 ▲	0.63 → 0.41 ▼

Table.1 The effects of rTMS on FA values of ROIs that constitute cerebello-thalamo-cortical and dentato-rubro-olivary pathways.

Conclusion

The present case report reports improvement of tremor of pharyngeal wall and arytenoids after rTMS therapy on M1. This might be the one of cases that supports that rTMS on motor cortex might be the therapy for palato-pharyngo-larnyngeal tremor and secondary dysphagia.
It is suggested that a unilateral M1 stimulation or cerebellar stimulation for other HOD cases could be employed to compare the therapeutic effect of bilateral M1 stimulation.

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