Frontal language area

Saito et al. previously revealed that identification of the frontal language area (FLA) can be difficult in patients with dominant frontal glioma involving the pars triangularis (PT).

A study added new cases and performed additional analyses. They noticed a new finding that the presence of extension to the pars orbitalis (POr) was associated with negative response to the FLA. The aim of the present study was to evaluate the impact of PT involvement with extension to the POr on the failure to identify the FLA. From 2000 to 2017, awake craniotomy was performed on 470 patients. Of these patients, the present study included 148 consecutive patients with frontal glioma on the dominant side. We evaluated whether tumors involved the PT or extended to the POr. Thirty one of 148 patients showed involvement of the PT, and we examined the detailed characteristics of these 31 patients. The rate of negative response for the FLA was 61% in patients with involvement of the PT. In 31 patients with frontal glioma involving the PT, univariate analyses showed significant correlation between extension to the POr and failure to identify the FLA ($P = 0.0070$). Similarly, multivariate analysis showed only extension to the POr correlated significantly with failure to identify the FLA ($P = 0.0129$). We found new evidence that extension to the POr which impacts connectivity between the PT and POr correlated significantly with negative response to the FLA of patients with dominant frontal glioma.Identification of language areas using functional brain mapping is sometimes impossible using current methods but essential to preserve language function in patients with gliomas located within or near the frontal language area (FLA). However, the factors that influence the failure to detect language areas have not been elucidated [1)].

A study evaluated the difficulty in identifying the FLA in dominant-side frontal gliomas that involve the pars triangularis (PT) to determine the factors that influenced failed positive language mapping.

Awake craniotomy was performed on 301 patients from April 2000 to October 2013 at Tokyo Women's Medical University. Recurrent cases were excluded, and patients were also excluded if motor mapping indicated their glioma was in or around the motor area on the dominant or nondominant side. Eighty-two consecutive cases of primary frontal glioma on the dominant side were analyzed for the present study. MRI was used for all patients to evaluate whether tumors involved the PT and to perform language functional mapping with a bipolar electrical stimulator. Eighteen of 82 patients (mean age 39 ± 13 years) had tumors that showed involvement of the PT, and the detailed characteristics of these 18 patients were examined.

The FLA could not be identified with intraoperative brain mapping in 14 (17%) of 82 patients; 11 (79%) of these 14 patients had a tumor involving the PT. The negative response rate in language mapping was only 5% in patients without involvement of the PT, whereas this rate was 61% in patients with involvement of the PT. Univariate analyses showed no significant correlation between identification of the FLA and sex, age, histology, or WHO grade. However, failure to identify the FLA was significantly correlated with involvement of the PT ($p < 0.0001$). Similarly, multivariate analyses with the logistic regression model showed that only involvement of the PT was significantly correlated with failure to identify the FLA ($p < 0.0001$). In 18 patients whose tumors involved the PT, only 1 patient had mild preoperative dysphasia. One week after surgery, language function worsened in 4 (22%) of 18 patients. Six months after surgery, 1 (5.6%) of 18 patients had a persistent mild speech deficit. The mean extent of resection was 90% ± 7.1%. Conclusions Identification of the FLA can be difficult in patients with frontal gliomas on the dominant side that involve the PT, but the positive mapping rate of the FLA was 95% in patients without involvement of the PT. These findings are useful for establishing a positive mapping strategy for patients undergoing awake craniotomy for the treatment of frontal gliomas on the dominant side. Thoroughly positive language mapping with

subcortical electrical stimulation should be performed in patients without involvement of the PT. More careful continuous neurological monitoring combined with subcortical electrical stimulation is needed when removing dominant-side frontal gliomas that involve the PT [2].

In three patients stimulation of the frontal speech area resulted in one or more of the following symptoms: speech arrest, writing arrest, or impaired rapid alternating movements of the tongue, fingers or toes. Speech arrest could be altered at individual points either with or without impairment of rapid movements or writing, but writing was not impaired without concomitant difficulties with either speech or rapid finger movements. Our data suggest that the frontal speech area may function to integrate complex motor functions, some speech related and others not. We also confirm previous conclusions that Exner's writing centre is not separate from Broca's area and that the writing defect in Broca's aphasia can occur without involvement of the motor strip [3].

1)
Saito T, Muragaki Y, Tamura M, Maruyama T, Nitta M, Tsuzuki S, Kawamata T. Impact of connectivity between the pars triangularis and orbitalis on identifying the frontal language area in patients with dominant frontal gliomas. Neurosurg Rev. 2018 Nov 10. doi: 10.1007/s10143-018-1052-z. [Epub ahead of print] PubMed PMID: 30415305.
2)
Saito T, Muragaki Y, Maruyama T, Tamura M, Nitta M, Tsuzuki S, Konishi Y, Kamata K, Kinno R, Sakai KL, Iseki H, Kawamata T. Difficulty in identification of the frontal language area in patients with dominant frontal gliomas that involve the pars triangularis. J Neurosurg. 2016 Jan 22:1-9. [Epub ahead of print] PubMed PMID: 26799301.
3)
Lesser RP, Lueders H, Dinner DS, Hahn J, Cohen L. The location of speech and writing functions in the frontal language area. Results of extraoperative cortical stimulation. Brain. 1984 Mar;107 (Pt 1):275-91. PubMed PMID: 6697159.