# Early and Precise Identification of Neural Tracts Defines Safety Limit of Resection in White Matter in Intrinsic Tumor Patients.

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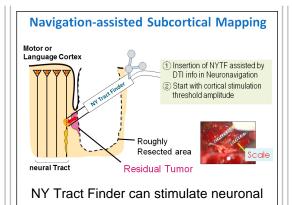## Introduction

Iatrogenic injury to the neural tract during surgery can be a source of significant morbidity. Most cases of cerebral neural tract injury occur in patients with significant risk factors with extensive tumors causing distortion of normal brain structures. A recent technique, Diffusion Tensor Image (DTI), reveals neural pathways preoperatively and helps neurosurgeons to recognize the anatomical relationship of neural pathways and tumors. However insufficient presentations of tractography caused by peritumoral brain edema and DTI shift by intraoperative brain shift are often experienced. These phenomena are unavoidable events. To resolve these problems, update of anatomical information by early and precise identification of neural tract during surgery is necessary to avoid unexpected sequelae.
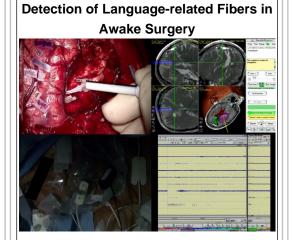
## Methods

We introduce a very simple method which is used in more than 20 major hospitals, including national and prefectural cancer centers, in Japan and China.  This method "Pile Driving Technique" is based on the electrophysiological identification of neural fibers functioning for motor and language. 45 gliomas adjacent to motor or language tract underwent the resection of tumor using this technique.
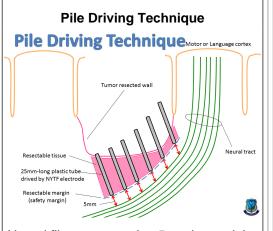
### Navigation-assisted Subcortical Mapping



NY Tract Finder can stimulate neuronal fibers beyond the wall of resection.

## Results

Early and precise identification of neural tract by this technique gives good spatial orientation for surgeons and preserves patients' motor and language functions.
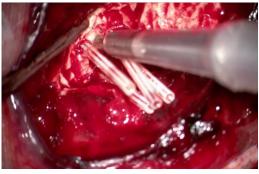
### Detection of Language-related Fibers in Awake Surgery



Electrical Simulation of Frontal Aslant Tract induced Anomia or speech arrest.

### Pile Driving Technique



Neural fibers are running 5mm beyond the tips of tubes.

### Tumor removal adjacent Language fibers



Resection can be performed until the tips of tubes appear.

### Postoperative Motor and Language function

| | | Number of cases |
|---|---|---|
| Intraoperative identification of pyramidal tract | | 41 (100%) |
| Postoperative motor function (one month aft op) | Deterioration | 0 (0%) |
| | No change | 33 (80.5%) |
| | Improvement | 8 (19.5%) |
| Intraoperative identification of language fiber | | 4 (100%) |
| Postoperative language function (one month aft op) | Deterioration | 0 (0%) |
| | No change | 4(100%) |
| | Improvement | 0 (0%) |

## Conclusions

This method enabled the early and precise identification of neural tracts and the preservation of neurological functions by defining safety limit of resection in intrinsic tumor patients.

## References

1. Yamaguchi F, Takahashi H, Teramoto A. Navigation-Assisted Subcortical Mapping: Intraoperative motor tract detection by bipolar needle electrode in combination with Neuro-navigation system. J Neurooncol 93:121–125, 2009

2. Yamaguchi F, Takahashi H, Teramoto A. Intra-operative detection of motor pathway by simple electrode provides safe brain tumor surgery. J Clin Neurosci. 14: 1106-10, 2007

## Learning Objectives

By sharing the knowledge of the rationale of this technique and presenting clinical cases, participants will be able to:
*List the most current and fundamental principles of intraoperative brain mapping in the treatment of intrinsic brain tumors.
*Discuss indications, benefits, and outcomes of Pile driving Technique.
*Assess the latest innovations in brain tumor surgery, especially as they relate to technology for intraoperative brain mapping, will also be emphasized.