Case Report

Dual-port technique in navigation-guided endoscopic resection for intraparenchymal brain tumor

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Abstract

Background: In navigation-guided endoscopic surgery performed via a single port, the interference of surgical instruments often disturbs the resection and hemostasis.

Case Description: With regard to this, we designed a dual-port technique for navigation-guided endoscopic surgery in a 62-year-old man, with intraparenchymal anaplastic astrocytoma. Two transparent sheaths with Nelaton tubes were inserted in the front of the target lesion via an infinity-shaped burr hole, under the control of the navigation system. The lesion was removed partially using a rigid endoscope and several surgical tools through the bilateral ports. Using the new method, it was convenient to perform hemostasis with bipolar coagulation and aspiration, without any interference from the surgical instruments during the surgery.

Conclusion: The offered dual-port technique may be included in surgery planning for elderly patients or patients in particular conditions, with intraparenchymal brain tumors.

Key Words: High-grade glioma, navigation, neuroendoscopy

INTRODUCTION

Biopsy for diagnosis of intraparenchymal tumors of the central nervous system can be performed by various methods, including needle biopsy, using a stereotactic frame, frameless biopsy with image-guided stereotactic techniques, and open biopsy via a small craniotomy. These methods have advantages and disadvantages in sampling accuracy, approach to deep lesions, and sample volume. In stereotactic biopsy especially, sampling error and the small amount of the sample tissue are the most likely reasons for a relatively low diagnostic yield, although stereotactic biopsy is minimally invasive, with a potentially low complication risk. Even in a frameless biopsy, using a navigation system, there is a potential target registration error.

In recent times, navigation-guided endoscopic surgery has been used for the biopsy or resection of intraparenchymal brain tumors. In tumor biopsy, the new method has some advantages over other biopsy procedures, including direct visualization of the lesion, larger sample volume without risk of bleeding, lesser invasiveness, and easy application in both shallow and deep lesions. Furthermore, if the operator challenges the intensive...
removal of the lesion, single-port endoscopic surgery has a disadvantage of the operator’s handling, due to the interference of surgical instruments, which often disturbs the easy resection and hemostasis procedures. Therefore, we developed a new dual-port technique in navigation-guided endoscopic biopsy, to obtain lesser invasiveness and a larger sample volume than in a single port technique, for a patient with an intraparenchymal high-grade glioma. In this article, we describe the details of the dual-port technique.

CASE REPORT

A 62-year-old man was admitted to our hospital with a 10-month history of motor aphasia. He had a past history of bifrontal oligodendroglioma and underwent right frontal lobectomy in another hospital, followed by bifrontal radiation therapy 30 years before the admission. Additionally, he had a lacuna infarction in the left frontal lobe six years before the admission. On admission, he had mild motor aphasia, with 90% Karnofsky Index of Performance Status (KPS). Magnetic resonance (MR) imaging revealed a heterogeneously enhanced mass lesion, 2.8 cm in maximum diameter, in the left frontal lobe. After careful informed consent and discussion of alternatives, the patient selected partial removal using navigation-guided endoscopic technique to prevent the deterioration of his higher functions, rather than the conventional microsurgical removal.

For navigation-guided endoscopic biopsy, the patient’s head was fixed with a Mayfield frame under general anesthesia. Two transparent sheaths with diameters of 6.8 mm (Neuroport®, mini size; Olympus Corp., Tokyo) with Nelaton tubes (Fr 18) as alternative inner tubes were inserted into the front of the target lesion via an infinity-shaped burr hole, under control of the navigation system (StealthStation®, Medtronic, Inc., Minneapolis, MN) [Figure 1]. The front of the lesion was observed with a rigid endoscope (EndoArm®; Olympus Corp. Tokyo, Japan) through the left port, and the lesion was removed partially, using one or two surgical tools, through the bilateral ports [Figure 2].

Partial removal, with 40% removal rate, using the technique described earlier for navigation-guided endoscopic surgery, with photodynamic diagnosis (PDD) and intraoperative pathological diagnosis (IPD), was performed. During the surgery, convenient hemostasis using bipolar coagulation and aspiration, without any interference from the surgical instruments, was easy to perform. MR imaging revealed partial resection of the mass lesion after the surgery [Figure 3]. The patient had no advanced complications, and was discharged from our hospital one week after the surgery. The histological diagnosis was anaplastic astrocytoma.

DISCUSSION

In this article, we have described our first experience of using a dual-port technique in navigation-guided endoscopic resection for an intraparenchymal brain tumor, although for ventricular colloid cysts or for shunt replacement the dual-port technique has been reported previously. Especially in colloid cysts, the operator can achieve a safe and complete resection by using this method. In the previous cases, operators used the dual-
The possible disadvantage of the dual-port technique could be that the brain damage caused by this method may be larger near the sheath tracts than in a single-port technique. However, the sum of squares of two fine ports (2 x 0.36 cm²) is smaller than that of a single regular port (0.79 cm²). Moreover, even when using the regular port, the actual severe complication rate is not higher than that of the needle biopsy. Moreover, the bur-hole size in this new method (2.8 cm²) is also similar to that in the single port method (about 2.2 cm²). Operators should also care about the small cortical region between the two ports in this new method. We must ensure the safety of this method, including the influence of dual-port insertion on the surrounding brain, via large-scale studies, in the future.

In conclusion, evaluating the first experience of using the new method in the described case, we conclude that the new dual-port technique in navigation-guided endoscopic resection may be considered as an alternative when planning surgery in elderly patients or patients in particular conditions, with intraparenchymal brain tumors.

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