Indocyanine green videoangiography for cerebellar hemangioblastoma

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see also Indocyanine green videoangiography for hemangioblastoma.

Ryba et al. reported a case of multiple hemangioblastomas involving two radiologically silent lesions only detected intraoperatively by Indocyanine green fluorescence. A 26-year-old woman presented with a cystic cerebellar tumor on the tentorial surface of the left cerebellar hemisphere on MRI. A left paramedian suboccipital approach was performed to remove the mural nodule with the aid of ICG injection. The first injection applied just prior to removing the nodule, highlighted the tumor and vessels. After resection, two new lesions, invisible on the preoperative MRI, surprisingly enhanced on fluorescent imaging 35 minutes after the ICG bolus. Both silent lesions were removed. Histological analysis of all three lesions revealed they were positive for HB. The main goal of this report is to hypothesize possible explanations about the mechanism that led to the behavior of the two silent lesions. Intraoperative ICG video angiography was useful to understand the 3D angioarchitecture and HB flow patterns to perform a safe and complete resection in this case. Understanding the HB ultrastructure and pathophysiological mechanisms, in conjunction with the properties of ICG, may expand potential applications for their diagnosis and future treatments [1)].

Murai et al. in 2011, reported three patients with cerebellar hemangioblastomas presenting with symptoms of vertigo and/or headaches and diagnosed on the basis of preoperative magnetic resonance imaging (MRI) and angiography findings. Preoperative embolization of the tumor feeding artery was not performed in any of the patients. None of the patients underwent any procedure prior to ICGVAG that would affect the ICG findings, such as perilesional hemostatic coagulation or ablation. In each patient, it was possible to judge the approximate location of the tumor in relation to the brain surface and to distinguish the feeding and draining vessels. Following resection of the tumor, ICGVAG images confirmed that the mural nodule had been eliminated. None of the patients required blood transfusion, either during or after the surgery. For each patient, the lesion was pathologically confirmed as HB, postoperative contrast-enhanced MRI confirmed the absence of residual tumor, and diffusion-weighted MRI revealed no ischemic changes.

Differentiation of feeding and draining vessels in the region of the lesion is particularly important for successful surgical removal of HB. In the present three patients, ICGVAG findings enabled easy vascular differentiation and were also useful for confirming that there was no residual tumor. Indocyanin green videoangiography was concluded to be useful for safe resection of HB. [2)].

For hypervascular posterior fossa tumors, preoperative image assessment is important. Furthermore, the use of ICG during surgery is advantageous for surgical strategies where the feeding arteries and draining veins exist superficially in the operative field and are therefore easier to en bloc resection. However, it is actually rather difficult in practice. Therefore, Shinya et al. proposed a surgical strategy for visualizing hypervascular tumors of the posterior fossa utilizing indocyanine green (ICG) [3)].

They reported 2 cases:

Case 1 involved a 48-year-old male with a history of von Hippel-Lindau disease. Magnetic resonance imaging (MRI) revealed a solid tumor measuring 3.0 cm in diameter in the right cerebellopontine angle. They performed surgery because the tumor was pressing against the brainstem. Surgery was performed via the posterior subtemporal transtentorial approach in order to visualize the feeding artery and draining vein intraoperatively. The vessels were confirmed by ICG and the tumor was removed en bloc.

Case 2 involved a 30-year-old woman. Signs of increased intracranial pressure were noted, and an MRI revealed a solid tumor 3.5 cm in diameter in the left cerebellar hemisphere. Surgery was performed via the midline suboccipital approach. Similarly, they confirmed the vessels using ICG and the tumor was removed en bloc.

For hypervascular tumors of the posterior fossa, preoperative image assessment is important. Furthermore, the use of ICG during surgery is advantageous for surgical strategies where the feeding arteries and draining veins exist superficially in the operative field and are therefore easier to remove en bloc. [4)].

From January 2009 to February 2012, nine consecutive patients (seven men, two women) who underwent surgery for hemangioblastomas using intraoperative ICG-VA were included in this study. Surgery was performed on four cystic cerebellar lesions with mural nodules, two solid tumors (one in the cerebellar hemisphere and one in the medulla oblongata), one spinal tumor and multiple tumors in two patients with von Hippel-Lindau disease. Of the nine patients, three were treated for recurrent tumor. The ICG-induced fluorescence images of hemangioblastomas with variable presentation were evaluated.

All tumors could be completely removed en bloc. Blood flow in the tumor and tumor-related vessels at the brain surface were clearly detected by ICG-VA in all cases, except one recurrent tumor where postoperative adhesive scar tissue obstructed ICG-induced fluorescence resulting in poor delineation of the blood flow patterns and tumor margins. ICG-VA was also helpful for detecting the multiple small mural nodules within the cyst or the tumors buried under thin gliotic neural tissue despite reduced fluorescence.

Intraoperative ICG-VA is a safe and easy modality for confirming the vascular flow patterns in hemangioblastomas. In addition, ICG-VA provided useful information for intracystic small lesions or

lesions concealed under thin brain tissue in order to accomplish total resection of these tumors [5].

Case reports

Two patients who had received a total resection of cerebellar hemangioblastoma developed cerebrospinal fluid dissemination during a long-term follow-up period.

The patients were two women aged 45 and 57 years. In the cerebellar hemisphere, one patient had cystic hemangioblastoma of mural nodule type and the other had a solid type. Both the patients successfully underwent total resection by craniotomy. They presented no mutations in the von Hippel-Lindau disease (VHL) gene or lesions in the other organs. One patient developed local recurrence 38 months after the initial surgery and received stereotactic radiosurgery. Three spinal cord tumors developed 91 months later, and the tumors were disseminated to the entire cerebrospinal cavity 107 months later. The other patient developed hydrocephalus 53 months after the initial surgery with tumor tissues disseminated in the intracranial subarachnoid space. The conditions of the two patients gradually aggravated despite treatment with ventriculoperitoneal shunt and irradiation to the whole brain and whole spinal cord.

Cerebrospinal fluid dissemination of cerebellar hemangioblastoma was found dominantly in non-VHL patients. The diagnosis was made 10 years after the initial surgery. Irradiation therapy was performed, but the patients died about 2 years after the diagnosis was given. Molecularly targeted therapies including vascular proliferation suppression have been attempted lately, but no effective therapy has been established. Early diagnosis of dissemination as well as a combination of aggressive excision and stereotactic radiosurgery are considered to be appropriate for current interventions [6].

References

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