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■ Case Report ■

Development of a contralateral acute subdural hematoma during awake craniotomy for glial tumor in a 12-year-old boy -A case report-

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Contralateral acute subdural hematomas that occur during removal of brain tumors under general anesthesia are extremely rare, and there are no reports of this developing during awake craniotomy for brain tumors. We report a case of a 12-year-old boy who complained of sudden and severe headache and nausea around the completion of removal of a glial tumor of the frontal lobe under awake anesthesia. Postoperative computerized tomography scan revealed the presence of contralateral acute minimal subdural hematoma. We suggest that during craniotomy with awake anesthesia for brain tumors, contralateral acute subdural hematoma may occur, even in the absence of brain bulging or changes in vital signs. Sudden intra-operative headache and nausea should be investigated by immediate postoperative computerized tomography scans to ascertain diagnosis. **(Anesth Pain Med 2011; 6: 157～159)**

Key Words: Awake craniotomy, Contralateral subdural hematoma, Glial tumor.

Acute subdural hematomas (SDHs) that are found postoperatively on the contralateral side of the initial lesion are mostly those that develop after removal of chronic subdural hematoma [1-5]. Contralateral acute SDHs that occur during removal of brain tumors under general anesthesia are extremely rare, and there are no reports of this developing during awake craniotomy for brain tumors. We report a case of a 12-year-old boy who complained of sudden and severe headache and nausea without brain swelling around the completion of removal of a glial tumor of the frontal lobe under awake anesthesia, which was subsequently confirmed by postoperative computerized tomography (CT) scan as a contralateral acute minimal SDH.

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CASE REPORT

A 12-year-old male patient weighing 48 kg was planned for awake craniotomy for removal of a glial tumor located in the posterior aspect of the left inferior frontal gyrus which is also known as Broca's area (Fig. 1). The patient complained of right upper limb weakness and rotation one year prior to the visit to the hospital. There was no significant past medical or surgical history, and the preoperative evaluation, physical examination, and airway assessment were all normal. The patient arrived at the operation room without pre-anesthesia medication. After applying routine monitoring in the operation room, 50 μg of fentanyl was injected intravenously. Under local anesthesia, a 22 gauge catheter was inserted into the radial artery to measure the continuous arterial blood pressure. An 18 gauge catheter was also placed in the saphenous vein at the ankle for fluid infusion and blood transfusions. Local anesthesia was conducted on the fixation site of the headholder with 0.25% bupivacaine mixed with 1 : 200,000 epinephrine. Oxygen was provided via a nasal cannula at 4 L/min, and respiration was monitored by end-tidal CO_2 monitoring (Smart Anesthesia Multi-gas Module, GE Medical Systems, Milwaukee, USA). Midazolam 2 mg was given intravenously, with continuous infusion of remifentanil 0.04－0.07 μg/kg/min and propofol 50－90 μg/kg/min. Fluctuations in blood pressure, heart rate, respiration rate, SpO_2, and end-tidal CO_2 were monitored. Surgery began after local anesthesia with 1.5% lidocaine mixed with 1 : 200,000 epinephrine, and the continuous infusion of

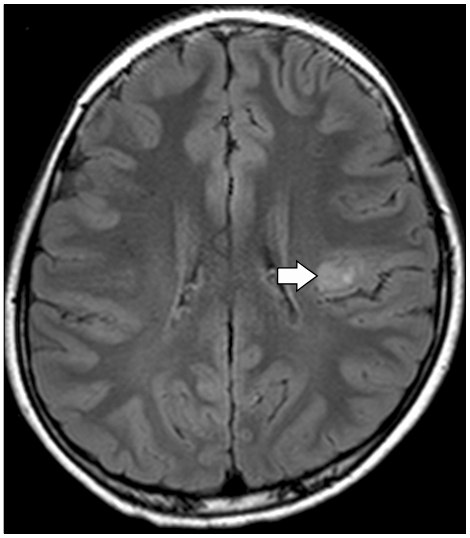

Fig. 1. Preoperative magnetic resonance image demonstrates focal high signal intensity mass like lesion in posterior aspect of left inferior frontal gyrus (white arrow).

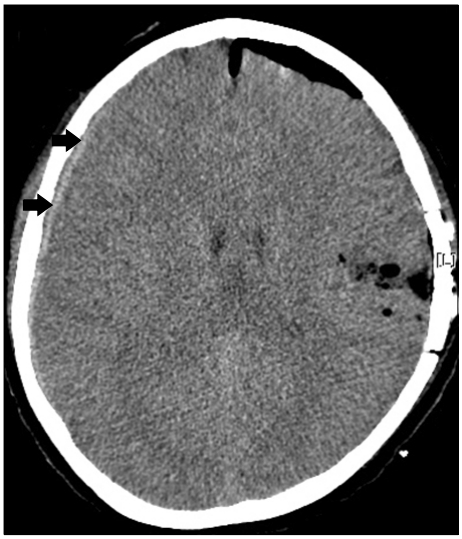

Fig. 2. Immediate postoperative CT scan demonstrates a newly developed right minimal subdural hematoma (black arrows).

remifentanil and propofol volumes were constantly adjusted according to blood pressure, respiratory rate, pain score and sedation score. The patient was stable throughout surgery. After completion of dura mater excision, remifentanil and propofol infusion was discontinued and the patient was fully awakened, which took about three minutes. We continuously monitored motor and speech responses throughout the removal of tumor. The patient tolerated the procedure well without significant complaints and vital signs were all within normal limits.

When the removal of the tumor was almost complete, the patient suddenly began to complain of headache and nausea. Blood pressure at this time was slightly elevated to 130/90 mmHg and the respiratory rate was normal. The patient's mental status was alert and arterial blood gas analysis showed the following normal values; pH 7.37, $PaCO_2$ 34.1 mmHg, PaO_2 225.2 mmHg, and SaO_2 99%. There was no evidence of brain swelling or other abnormal findings. As the procedure was near completion, midazolam 2 mg, pentobarbital 75 mg, remifentanil 0.05 μg/kg/min, and propofol 25 μg/kg/min was administered with mask ventilation to alleviate the severe headache and nausea. The patient's symptoms stabilized immediately. The vital signs and arterial blood gas analysis were within normal limits and the procedure was completed. After completion of the procedure, the patient was still slightly drowsy, but vital signs were within normal limit. CT scan of his brain was performed immediately following the completion of the procedure and revealed a small subdural hematoma located at the contralateral side of the brain tumor (Fig. 2). Only supportive therapy without further interventional surgery was administered as there was no evidence of neurological symptoms or damage, and also because the size of the subdural hematoma did not require surgery. The drowsy mental state on the first postoperative day improved to clear status the next day. Headache and nausea was present intermittently for the first five postoperative days and disappeared completely after the sixth postoperative day. There was no motor or speech impairment evident.

DISCUSSION

SDHs during or after craniotomy may occur in the contralateral side of the surgery, but the mechanisms involved are not clear [1-5]. One possible theory for this phenomenon that has been postulated is the parenchymal shift of the brain which results from the sudden loss of cerebrospinal fluid (CSF) or the removal of an intracranial lesion [2]. Such perioperative parenchymal shift may lead to tearing of the bridging veins which cross the contralateral hemisphere's subdural space, resulting in contralateral SDH. Other possible risk factors that have been suggested as causes of contralateral intracranial hemorrhage are bleeding tendency, brain atrophy, aggressive anti-edema treatment, and excessive CSF drainage [6]. The intraoperative acute SDH that was observed in the above patient may be attributable to parenchymal shift but it is

unclear as this occurrence is extremely rare. This patient did not reveal any abnormalities in the preoperative assessment of past history or laboratory tests, hyperosmolar agents were not administered during surgery, and other procedures such as lumbar puncture for CSF drainage were not performed prior to surgery. Therefore, there seems to be no definite identifiable cause of the contralateral SDH in this patient.

If SDHs occurred during general anesthesia, then it would have been very difficult to detect neurological abnormalities during surgery. Oliver et al. commented that although hypertension and bradycardia that manifest due to increased intracranial pressure may be observed, these are largely nonspecific and usually appear during the last stages, and therefore that localized neurological abnormalities are difficult to detect during surgery [7]. As this patient was awake during surgery, he was able to communicate his headache and nausea symptoms to the medical personnel. If he had been under general anesthesia or sedation, the likelihood of the presence of a SDH would not have been considered, because there were neither any evident changes of vital signs nor brain swelling.

Headache and nausea that occur during awake craniotomy could be related with dura mater or brain vessel traction [8]. However, the sudden and severe manifestation of such symptoms observed in this patient should alert the anesthesiologist of the possibility of an intracranial hemorrhage. If the symptoms are overtly severe, then consultations with the surgeon should be conducted regarding changes in anesthesia method, as co-operation with the patient may be difficult during awake craniotomy. In this particular case, we deferred from laryngeal mask airway insertion or tracheal intubation since the tumor removal was almost complete, there was no change in mental status, and there were neither any evidences of brain swelling nor respiratory problems. However, it is suggested that if mental status change or brain swelling or respiratory changes were detected, then laryngeal mask airway insertion or tracheal intubation would have been necessary.

We report an extremely rare case of sudden headache and nausea during awake craniotomy without evidence of brain swelling, and which was subsequently found to be acute minimal subdural hematoma on the opposite side by postoperative CT. Such clinical manifestations should warn the anesthesiologist and surgeon to the possibility of such a lesion and immediate confirmation should be performed with CT.

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