

Reconstruction for Bilateral Internal Jugular Vein Perfusion Disruption

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ABSTRACT

When resecting the internal jugular veins bilaterally in surgery for head and neck cancer, it is necessary to perform neck dissection in two stages or to reconstruct the internal jugular veins in one stage. Reconstruction of the internal jugular vein using grafting or direct anastomosis to the external jugular vein have both been reported. We report the case of a 53-year-old man with accidental injury to the left internal jugular vein after resection of the right internal jugular vein for supraglottic cancer. The left internal jugular vein was damaged near the inflow of the subclavian vein, making vein grafting difficult. Therefore, internal jugular venous return was reestablished by end-to-side anastomosis of the left internal jugular vein to the left external jugular vein system. In this surgical procedure, by incising the internal jugular vein obliquely, it was not necessary to match the calibers of the internal jugular vein and the external jugular vein system, and a smooth hemodynamic body was reconstructed. In addition, we were able to reconstruct the internal jugular vein while preserving blood flow in the external jugular vein system. End-to-side anastomosis of the internal jugular vein to the external jugular system is an option for internal jugular vein reconstruction.

Key words cervicoplasty; jugular vein; microsurgery; neck dissection; plastic surgery procedures

When blood flow to the internal jugular veins (IJV) is disrupted by bilateral neck dissection, intracranial pressure increases due to venous insufficiency, along with the associated risk of complications such as blindness and cerebral infarction.^{1, 2} We experienced a case, in which, the contralateral IJV was accidentally damaged during unilateral IJV resection, resulting in

intraoperative bilateral bulbar conjunctival edema immediately after the incident. Emergency reconstruction of the IJV was performed by anastomosis of the IJV with the communicating vein of the external jugular vein (EJV), with return of perfusion and improvement of the patient's symptoms. We report the details of the operation and the patient's postoperative course.

PATIENT REPORT

A 53-year-old man visited the nearest hospital with a chief complaint of hoarseness of voice, and a raised lesion with ulceration on the supraglottis was discovered. He was referred to the Department of Otolaryngology and Head and Neck Surgery at our hospital. Biopsy of the tumor revealed squamous cell carcinoma, and hence chemotherapy was introduced with combination therapy with docetaxel, fluorouracil and nedaplatin. However, since adverse events such as fever and neutropenia were observed early on, it was decided to perform surgical treatment after completing one course of chemotherapy. Since preoperative MRI showed tumor invasion of the right IJV and supraclavicular lymph node metastasis, combined resection of the right IJV, right sternocleidomastoid muscle (SCM), and right EJV was planned. The left IJV was to be preserved.

Total laryngectomy and bilateral neck dissection was performed by an otolaryngological, head and neck surgeon. The right neck was dissected at the I-IV cervical level, and the right IJV, EJV and SCM were resected as planned. During left neck dissection (C II to IV level), however, the left IJV was injured near the side of subclavian vein inflow (Fig. 1). Since it was difficult to repair the left IJV, it was ligated for hemostasis. Observation of the face, bilateral palpebral conjunctiva, and bulbar conjunctiva revealed marked edema (Fig. 2), with no changes in vital signs.

Since the left IJV was ligated at its base, it was difficult to anastomose the IJV directly because the cut end was near the inflow of the subclavian vein. Hence, we decided to perform an end-to-side anastomosis of the left IJV to the communicating vein of the left EJV, since the communicating vein connecting the left EJV and the anterior jugular vein was more developed than

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Abbreviations: AN, accessory nerve; EJV, external jugular vein; IJV, internal jugular vein; SCM, sternocleidomastoid muscle

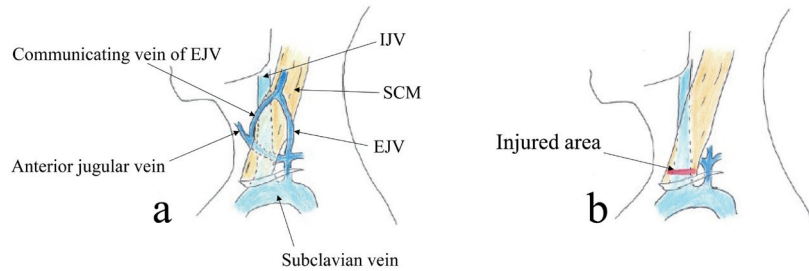


Fig. 1 . Course of the blood vessels. (a) Original course. (b) Injured area of the IJV.

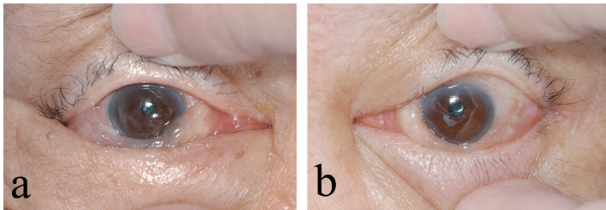


Fig. 2 . Appearance of the eyes before IJV reconstruction. (a) Right. (b) Left. Remarkable edema of the bulbar conjunctiva was observed.

the left EJV. The vessel diameter of the IJV was 12 mm, and the diameter of the communicating vein of the EJV was 5 mm. After releasing the ligature of the left IJV and removing the thrombus, the stump of the left IJV was cut obliquely and end-to-side anastomosis to the communicating vein of the left EJV was performed. After continuous suturing of the posterior surface of the vessel with 9-0 nylon, interrupted suture with 9-0 nylon

was performed on the anterior surface (Fig. 3). Release of the clamp resulted in return of blood flow through the IJV, which was also confirmed by the presence of a patency test. Subsequently, edema of the face and bilateral conjunctiva rapidly disappeared (Fig. 4).

Postoperatively, the patient's vital signs were stable, and there was no facial or conjunctival edema.

On the sixth postoperative day, the patient developed fever and right neck swelling. With a diagnosis of surgical infection, the surgical wound was reopened and pharyngeal leak and abscess formation were observed. Emergency debridement and right pectoralis major musculocutaneous flap to close the pharyngeal leak and protect the neck vessels from infection were performed under general anesthesia.

At the time of surgery, integrity of the anastomosis of the left IJV and left EJV communicating vein was confirmed, and adequate venous return was observed with the patency test (An angled forceps is used to hold the vessel distal to the anastomosis. Another forceps is

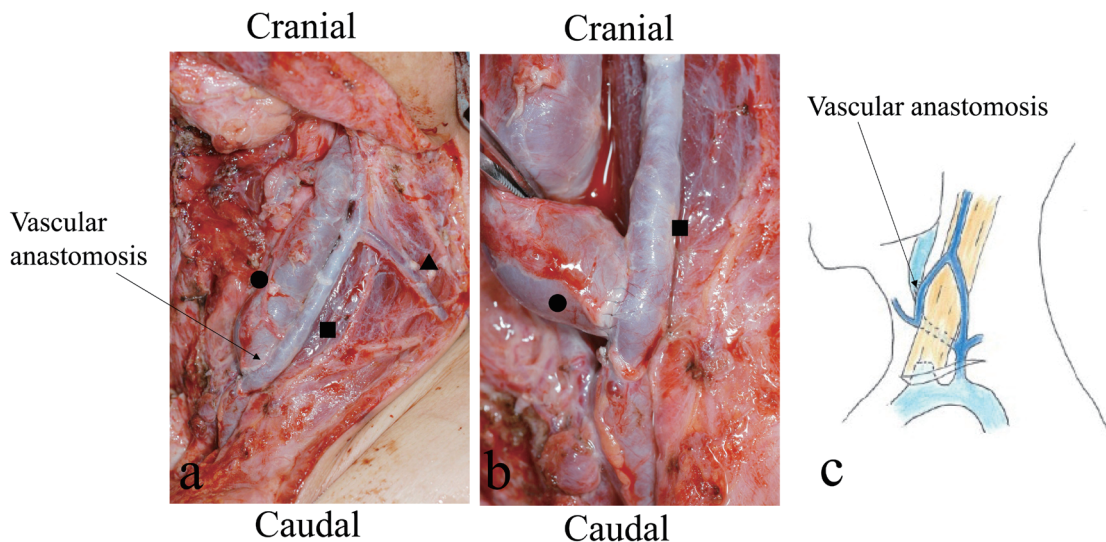


Fig. 3 . Intraoperative vascular anastomosis. (a) Course of the blood vessels (IJV, communicating vein of EJV and EJV). (b) Enlarged image of the end-to-side anastomosis. (c) Overall picture. ●IJV ■communicating vein of EJV ▲EJV.

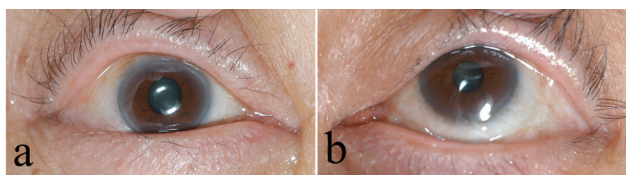


Fig. 4 . Appearance of the eyes on the day after surgery. (a) Right. (b) Left. The conjunctival edema had resolved.

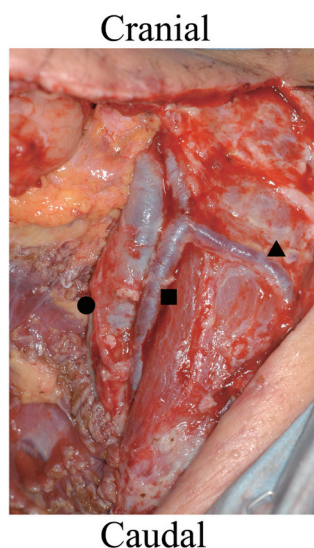


Fig. 5 . Anastomotic vessels at the time of wound re-opening on postoperative day 6. Adequate flow in all the vessels (IJV, communicating vein of EJV and EJV) was observed. ●IJV ■communicating vein of EJV ▲EJV.

then used to gently occlude the vessel distal to this. The forceps is moved in a distal direction. Upon release of the angled forceps, the vessel will fill up with blood.³) (Fig. 5).

Contrast-enhanced CTs at 14 days and 11 months after the initial surgery confirmed that blood flow was well maintained in the left IJV, left EJV, and communicating vein of the left EJV (Fig. 6).

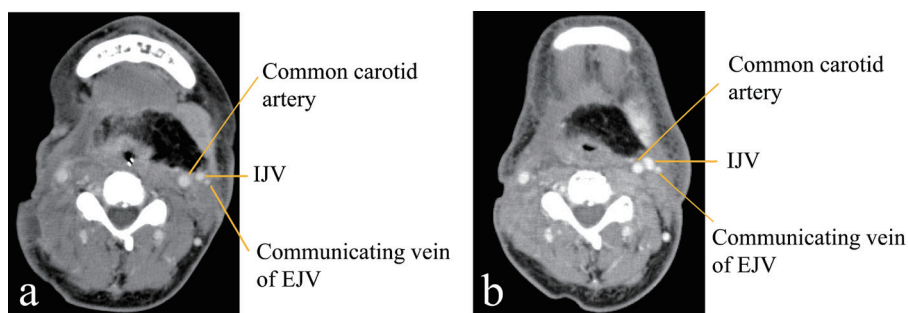


Fig. 6 . Postoperative contrast-enhanced CT. (a) Fourteen days after initial surgery. (b) Eleven months after initial surgery.

DISCUSSION

Neck dissection in the treatment of head and neck cancer was popularized by Martin H.⁴ Combined resection of the IJV, SCM and accessory nerve (AN) is called radical neck dissection, and has increased the effectiveness of control of cervical lymph node metastasis.⁵ Since subsequent, clinical studies have shown that the IJV, SCM and AN do not necessarily need to be resected, modified neck dissection, which preserves these structures, and selective neck dissection, which reduces the extent of dissection, have become mainstream.⁶ However, if bilateral internal jugular vein resection is required due to tumor invasion, the consequent disruption of venous return and increased intracranial pressure can lead to fatal complications.^{7, 8} Complications of perfusion failure in the IJV, including blindness, syndrome of inappropriate antidiuretic hormone secretion airway obstruction, cerebral infarction and even death have been reported.^{1, 2} To avoid these complications, a two-stage neck dissection or simultaneous reconstruction of the IJV is recommended.¹ We found reports of unilateral IJV reconstruction but no reports of bilateral IJV reconstruction. The veins used to reconstruct the IJV include the great saphenous vein, EJV and artificial blood vessels.^{9, 10} When using the EJV, methods such as end-to-end anastomosis of the remaining EJV and grafting of the EJV have been reported.¹¹ In this case, the left IJV was injured near the clavicle, and it was necessary to remove the clavicle for reconstruction using the above methods, so the above reconstruction methods were not selected. We could not find any previous reports of end to side anastomosis of the IJV to the EJV system with successful preservation of blood flow in the EJV system, as in the present case. In this case, the left IJV, which we had planned to preserve during bilateral neck dissection, was injured near the subclavian vein, immediately leading to edema of the face and bulbar conjunctiva. If the IJV had not been reconstructed, it could have led to serious complications. In addition, since edema of the bulbar conjunctiva improved immediately after IJV

reconstruction, we believe that reconstruction of IJV blood flow was essential.

Since there is usually a difference in caliber between the IJV and EJV systems, it is necessary to adjust the caliber using techniques such as tapering¹²⁻¹⁴ when performing end-to-end anastomosis, although this is not necessary for end-to-side anastomosis. By cutting the stump of the IJV obliquely, it is possible to restore smooth blood flow and avoid the risk of anastomotic thrombosis without consideration of the difference in vessel diameter.

The EJV is formed by the confluence of the posterior branch of the retromandibular vein and the posterior auricular vein, and the retromandibular vein is formed by merging of the maxillary and superficial temporal veins.¹⁵ The EJV is involved in cerebral blood flow, since the maxillary vein is fed by the pterygoid plexus, which communicates with the cavernous sinus.¹⁵ Furthermore, since it has been reported that about 20% of EJV blood flow consists of blood that is returned from the brain,¹⁶ preserving the EJV system is useful for maintaining intracranial venous return.

It has also been reported that preserving the EJV system in head and neck cancer surgery reduces edema, pain, and discomfort in the neck immediately after surgery.¹⁷ In this case, since the right EJV was resected concurrently, preservation of the left EJV was considered important for ensuring the adequacy of venous return from the face and neck.

The EJV system is rarely included in the resection area of lymph node dissection, and even if the IJV is accidentally damaged, anastomosis to the EJV system can maintain cerebral venous circulation. This method, in which end-to-side anastomosis of the IJV to the EJV system is performed while maintaining blood flow in the EJV system, might be one of the options for maintenance of venous return not only from the cranial region, but also from the face and neck.

The EJV sometimes flow into the trunk of the IJV,¹⁸ in which case this method cannot be used. For head and neck reconstruction, the cephalic vein is used in cases there is a paucity of veins in the neck or to salvage a failing free flap,¹⁹ and it may also used for IJV reconstruction when EJV system cannot be used.

The authors declare no conflict interest.

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