

Investigation of Usefulness of the Embolization Method for Tumor Hemorrhage in the Head and Neck Causing Formation of a Pseudoaneurysm in a Blood Vessel Feeding the Central Nervous System

Akira YAMAMOTO, Shigeki IMAI, Masayuki GYOTEN,
Tsutomu TAMADA, Yasumasa KAJIHARA, Takeshi AKISADA*
and Tamotsu HARADA*

*Department of Diagnostic Radiology, Kawasaki Medical School,
Kurashiki, 701-0192 Japan*

**Department of Otolaryngology, Kawasaki Medical School,
Kurashiki 701-0192, Japan*

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ABSTRACT. We performed endovascular treatment on four cases of head and neck malignant tumor in which a pseudoaneurysm had formed in a blood vessel feeding the central nervous system and had caused intractable arterial hemorrhage. The procedure was successfully performed in all of the patients, and hemostasis was achieved. Postoperative systolic blood pressure increased by 40.5 mmHg on average, and all of the patients recovered from hypovolemic shock, including cardiac arrest. This method is more useful than other current methods if the operators have sufficient knowledge and experience, and judge emergency cases calmly and accurately. It may become the first choice for most cases of tumor hemorrhage in the head and neck in the future.

Key words : endovascular treatment — head and neck tumor — tumor bleeding

For the treatment for advanced malignant tumors and postoperative recurrent tumors in the head and neck, radiotherapy and chemotherapy are mainly performed.^{1,2)} However, arterial hemorrhage from tumors sometimes occurs after therapy.¹⁻³⁾ We have encountered tumor hemorrhage from a large blood vessel in a pseudoaneurysm of a necrotized tumor formed by tumor remission.^{3,4)} Such hemorrhage forms a complex fistula in many cases, and compression hemostasis is difficult in most cases. Surgical hemostasis is also difficult in many cases because of adhesion and inflammation of the surrounding tissue formed by previous surgery or radiotherapy. In four of nine such cases, a pseudoaneurysm formed in a blood vessel feeding the central nervous system, a difficult situation to the treat. In these four cases, we performed endovascular treatment, in which the isolation and the packing method was applied to the distal side over the proximal side of the pseudoaneurysm. Here, we report on the usefulness of this method.

MATERIALS AND METHODS

During the last four years, nine patients who underwent radiotherapy and chemotherapy for malignant tumors in the head and neck at Kawasaki Medical School Hospital developed intractable arterial hemorrhage, for which compression and surgical hemostasis were difficult. In four patients, a pseudoaneurysm formed in a blood vessel feeding the central nervous system, which is difficult to treat. We used the isolation and packing method through endovascular treatment in these four patients and investigated its usefulness. The patients were two males and two females aged 41-65 years, who had squamous cell carcinoma (SCC) 2 of the nasopharynx and oropharynx, facial malignant fibrotic histiocytoma (MFH), and an anaplastic tumor of the thyroid gland, respectively. All of the patients developed hypovolemic shock, and one patient had cardiac arrest (Table 1).

Angiography was performed in all four patients to identify the bleeding blood vessel. The internal carotid artery was bleeding in three patients, and the common carotid artery in one patient. A pseudoaneurysm had formed in all of the cases.

These blood vessels feed the central nervous system and, basically, the Matas test is performed before operation, excluding emergency cases. In two negative cases and one emergency case, the isolation and packing method was applied. The distal side blood vessel of the pseudoaneurysm was embolized with a coil, and the pseudoaneurysm was embolized with a coil and gelfoam, followed by coil embolization toward the proximal side blood vessel. In one Matas test-positive patient, a covered stent was used for hemostasis.

TABLE 1. Clinical findings of bleeding in 4 patients with head and neck malignancy

| Case | Age (y.o.) /Sex | Sites (tumor) | Previous treatment | Blood pressure | Hypovolemic shock |
|------|--------------------|-------------------------------------|-----------------------|-------------------|----------------------|
| ① | 58/M | Nasopharynx (SCC) | RT Chemo | Cardiac arrest | (+) |
| ② | 41/F | Face (MFH) | Ope, RT Chemo | 80/50 | (+) |
| ③ | 65/F | Thyroid gland (anaplastic tumor) | Ope, RT Chemo | 82/54 | (+) |
| ④ | 58/M | Oropharynx (SCC) | RT Chemo | 86/42 | (+) |

SCC, squamous cell carcinoma ; MFH, malignant fibrotic histiocytoma
RT, radiation therapy ; Chemo, chemotherapy ; Ope, operation

RESULTS

The bleeding blood vessel was identified, and hemostasis was successful in all of the patients. Massive hemorrhage occurred due to elevation of pressure in the aneurysm during distal side embolization of the pseudoaneurysm in one patient, but bleeding was stopped by a calm and rapid embolization technique. Postoperative systolic blood pressure increased by 40.5 mmHg on average, and all of the patients successfully recovered from hypovolemic shock, including cardiac arrest, in the early phase. Three

TABLE 2. Results of various IVR materials for control of bleeding in 4 patients with head and neck malignancy

| Case | Ruture sites | IVR materials | Blood pressure post IVR | Complications | Rebleeding |
|------|-------------------------|------------------------|-------------------------|---------------|------------|
| ① | Rt. internal carotid a. | Metallic coils Gelfoam | 110/60 | None | None |
| ② | Lt. internal carotid a. | IDC Micro coils | 90/60 | None | (+) |
| ③ | Rt. common carotid a. | Covered stent | 110/84 | None | None |
| ④ | Lt. internal carotid a. | Metallic coils Gelfoam | 106/72 | None | None |

IVR, interventional radiology

patients with nasopharyngeal tamponage for compression hemostasis were relieved and became capable of ingesting food. Although postoperative complications such as fever and facial pain transiently occurred, no severe complications, such as central and peripheral neuropathy, skin necrosis, or visual loss, were noted (Table 2).

All of the patients died due to advancement and metastasis of the tumor after embolization, but hemorrhage did not recur in any of the patients, and tumor hemorrhage was not the direct cause of death in any of the patients.

DISCUSSION

For progressive malignant tumors and postoperative recurrent tumors in the head and neck, radiotherapy and chemotherapy are selected in many cases.^{1,2)} However, we often encounter patients who develop intractable arterial bleeding from the tumor even though the tumor has remitted and has been necrotized by therapy. In many such cases, previous radiotherapy and surgery have caused severe tissue adhesion, and infection often occurs, making surgical hemostasis difficult.^{3,4)} In such patient as case 1, moreover, compression hemostasis is difficult when a complex fistula forms or hemorrhage occurs in the oral cavity, nasal cavity, or laryngopharynx (Fig 1). Endovascular treatment the bleeding blood vessel can be identified regardless of these problems, and selective application of hemostasis to the bleeding blood vessel can be performed. Since tumors have a complex vascular construction, it is ideal to embolize in the peripheral region to prevent recurrent hemorrhage due to developed collateral vessels. In this regard, hemostasis by endovascular treatment is very useful.

As a characteristic of tumor hemorrhage after radiotherapy and chemotherapy, vascular injury made by tumor invasion in the blood vessel connects to the intratumor region necrotized by radiotherapy and chemotherapy and causes bleeding, forming a pseudoaneurysm in the necrotized region in many cases (Fig 2a).

Since the wall of a pseudoaneurysm is fragile, basically, the isolation method, in which the pseudoaneurysm is retained, and the distal side and proximal side blood vessels of the pseudoaneurysm are embolized is

considered appropriate.^{5,6)} However, in bleeding from malignant tumors in the head and neck after radiotherapy and chemotherapy, in which the necrotized region of the tumor becomes a pseudoaneurysm in many cases, the complex vascular construction of tumors is likely to cause re-bleeding due to developed collateral circulation. Risk of re-bleeding due to rupture of the pseudoaneurysm with an embolization-induced increase in the blood pressure of the residual tumor blood vessels is also a concern.

The mortality of arterial hemorrhage in the head and neck is very high. The mortality from surgical ligation and the incidence of recurrent bleeding and severe complications, have been reported to be 9-64% and 16-84%, respectively.^{7,8)} The mortality from recurrent bleeding may be higher. To reduce the incidence of recurrent bleeding, we perform the isolation and packing method including embolization of pseudoaneurysms. Although good outcomes have been obtained with embolization using the isolation method or the balloon occlusion in previous reports,⁹⁻¹¹⁾ these hemostasis methods create a condition similar to that after surgical ligation and retain the pseudoaneurysm, with which there is a high risk for recurrent bleeding. We experienced a patient who underwent endovascular treatment of an abdominal pseudoaneurysm and had re-bleeding from developed collateral vessels. In this regard, the isolation and packing method may reduce the risk of re-bleeding compared with other therapeutic methods. No bleeding recurred in the four patients we investigated.

There are various embolizing substances used for hemostasis. For the external carotid arterial region, to some extent peripheral embolization is not problematic, and gelfoam and PVA are used. According to previous reports, PVA alone or PVA with a coil have been used in many cases. We embolize the peripheral side with gelfoam, which is technically easy to

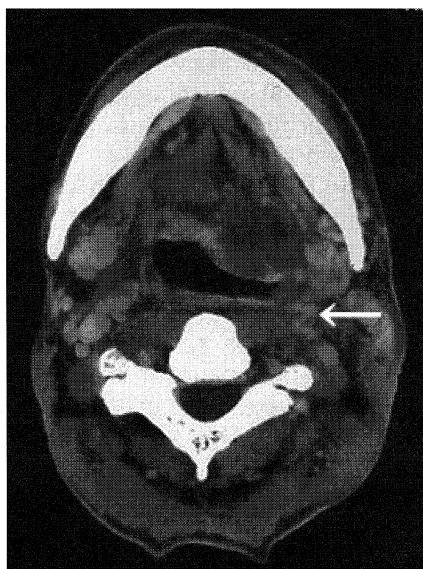


Fig 1. (Case 1, 58-year-old man) CT shows an internal carotid artery injury made by tumor invasion.

use and low-priced, and additionally embolize the proximal side with a coil, to which no objection may be raised.¹²⁻¹⁴⁾

In bleeding from a blood vessel feeding the central nervous system, there is a risk of cerebral ischemia-induced central neuropathy as a complication. Therefore, the embolizing substances used for this are markedly different from those for the external carotid arterial region. Since the unilateral internal carotid artery is completely embolized, the preoperative Matas test is essential if time permits.

In previous reports, balloon occlusion has achieved a good outcome in many cases.⁹⁻¹¹⁾ However, we perform the isolation and packing method, in which the region between the distal and the proximal side including the pseudoaneurysm, is embolized.

With the actual technique, we embolize the distal blood vessel of the pseudoaneurysm with a coil until the blood flow is completely blocked, and then the pseudoaneurysm and the proximal side blood vessel are embolized with a coil and gelfoam (Fig 2a, b, c). PVA and NBCA may be used for embolization of aneurysms.

The closest attention should be paid to avoiding elevation of pressure in the pseudoaneurysm during distal embolization, and massive hemorrhage caused by injuring the fragile aneurysm wall during embolization of the pseudoaneurysm. We encountered a patient in whom massive hemorrhage from the pseudoaneurysm occurred after distal embolization (Fig 2b), but bleeding was stopped calmly and promptly by immediate embolization of the

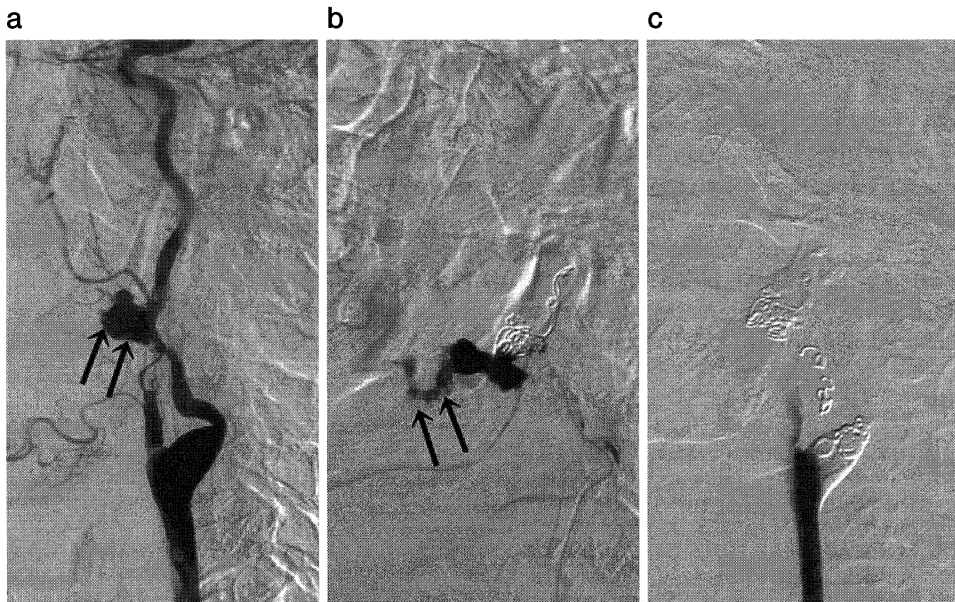


Fig 2. (Case 1, 58-year-old man)

- a: Carotid arteriography shows a large internal carotid pseudoaneurysm (arrow).
- b: Carotid arteriography after distal coil embolization shows massive hemorrhage (arrow) from the pseudoaneurysm.
- c: Carotid arteriography after isolation and packing embolization shows no flow within the carotid system.

pseudoaneurysm and the proximal side (Fig 2c).

Deviation of the coil and gelfoam toward the periphery due to mis-selection of the coil causes severe complications. The incidence of complications of embolization for hemorrhage in the head and neck have been reported to be 1.9%,¹⁶⁾ which is not high, but the closest attention should be paid. Coils that can be detached after indwelling in an appropriate region, such IDC and GDC coils, have recently been developed, and risks due to medical instruments have been decreased. However, knowledge and experience of operators for selection of appropriate coils for the vascular diameters are necessary and important. Moreover, massive hemorrhage is likely to occur due to elevation of pressure in the pseudoaneurysm during distal embolization, and therefore, the operator requires a calm and accurate technique.

A Matas test-positive emergency case of common carotid arterial hemorrhage occurred in one of the patients, and bleeding was successfully stopped by indwelling a covered stent, but this may be controversial because a high incidence of complications of narrowing and obstruction of indwelled blood vessels and cerebral embolism has been reported.^{17,18)} Fortunately, no bleeding recurred in this patient, nor were there complications such as neuropathy.

The mortality from arterial hemorrhage of malignant tumors in the head and neck is high, particularly in patients after radiotherapy or surgery, who are frequently accompanied by bleeding from sites to which application of compression hemostasis is difficult, and by adhesion and inflammation in the surrounding tissue to which surgical hemostasis is difficult to apply. Not only for cases in which surgical or compression hemostasis is difficult but also in other cases, endovascular treatment is very useful and should be the first choice. The isolation and packing method is has the advantages of a low risk of re-bleeding and of being low-invasive compared to surgical and compression hemostasis. Complications due to the endovascular procedure are disadvantages, but the incidence depends on the operators.

Although it is not possible to determine based on this study alone, this method is more useful than other current methods if the operators have sufficient knowledge and experience, and judge emergency cases calmly and accurately, and it may become the first choice for most cases of tumor hemorrhage in the head and neck in the future.

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