

## CASE REPORT

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# REPAIR OF CAROTID BLOW-OUT USING A CAROTID SHEATH IN A PATIENT WITH RECURRENT THYROID CANCER

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### ABSTRACT

The patient had thyroid cancer and underwent subtotal thyroidectomy. Local recurrence occurred on both sides 5 years and 6 months later. The sterno-hyoid muscle and sterno-thyroid muscle were severed and the tumor around the cricoid cartilage was removed. The tumor extended into the space between the right common carotid artery and internal jugular vein and was located under the right common carotid artery and vagus nerve on the lateral side. The carotid sheath was peeled off of the carotid artery quite easily. The right common carotid artery ruptured abruptly at the distal side during this procedure.

The right common carotid artery had two layers, which were very fragile, so the direct suture or repair with a graft was impossible. The carotid artery could not be trapped with ligation because the cerebral vascular supply was not examined preoperatively. This portion was repaired using the remaining carotid sheath. However, re-bleeding occurred at the proximal portion of the previous laceration spontaneously. Fibrin glue with oxidized cellulose was initially used to seal the second small hole in this lesion. The second ruptured section was repaired using the remaining sterno-thyroid and sterno-hyoid muscles. The proximal portion of the right common carotid artery was reinforced with the harvested external jugular vein.

These procedures resulted in hemostasis. Three-dimensional CT angiography showed irregular stenosis just after the operation, but it recovered 11 days later. No cerebral infarction occurred after the operation and the patient's general condition was good.

Key Words: Carotid blow-out, Carotid sheath, Fibrin glue, Thyroid cancer, Papillary carcinoma

### INTRODUCTION

Carotid blow-out syndrome is the most feared complication in head and neck surgery.<sup>1)</sup> The syndrome occurs in 3% to 4% of all head and neck cancer patients and is easy to happen following fistula formation, bad wound healing and tumor recurrence.<sup>2,3)</sup> Carotid blow-out syndrome presents an average of 2.7 years after the initial diagnosis of cancer, usually occurs proximal to the carotid bifurcation, and is bilateral in 2% of cases.<sup>3)</sup>

Carotid blow-out syndrome occurred in a patient undergoing reoperation for recurrent thyroid cancer, and was repaired using the remaining carotid sheath, sterno-thyroid muscle, sterno-hyoid muscle and the harvested external jugular vein. This report presents this case with a discussion of the surgical technique.

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## CASE REPORT

The patient was a 41-year-old male. He had thyroid cancer and had been treated with subtotal thyroidectomy. The pathological diagnosis was papillary carcinoma. Local recurrence occurred on both sides 5 years and 6 months later, and the re-operation was done by an otolaryngologist (Fig. 1). The sterno-hyoid muscle and sterno-thyroid muscle was severed and the tumor around the cricoid cartilage was removed. The crico-thyroid muscle was also removed. The tumor extended into the space between the right common carotid artery and internal jugular vein. The recurrent tumor was also located under the right common carotid artery and vagus nerve on the lateral side.

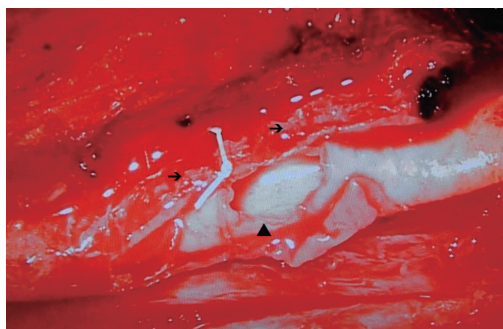
The carotid sheath of the right common carotid artery was hard and had no elasticity. The carotid sheath was peeled off of the carotid artery quite easily. The outer membrane of the carotid artery remained untouched. The right common carotid artery ruptured abruptly at the distal side during this procedure. Therefore, a neurosurgeon was consulted.

The right common carotid artery had two layers, which were very fragile, so the direct suture or repair with a graft was impossible. The carotid artery could not be trapped with ligation because the cerebral vascular supply was not examined preoperatively. The carotid sheath was sutured to the carotid artery on the distal and proximal end of the lacerated portion (Fig. 2A). Thereafter, the lacerated portion was covered with the remaining carotid sheath surrounding the carotid artery (Fig. 2B). Fibrin glue was used to seal the space between the carotid artery and carotid sheath. The surrounding carotid sheath was then doubly sutured around the carotid artery. These procedures resulted in hemostasis.

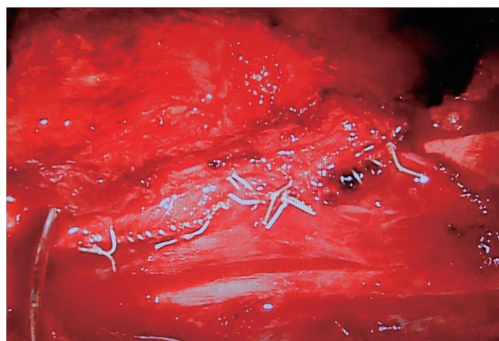


**Fig. 1** Preoperative examinations. Enhanced cervical CT scan showed the recurred thyroid cancer in juxta-carotid regions of both sides. The tumor on the right side (white arrowhead) attached to the right common carotid artery (white arrow).

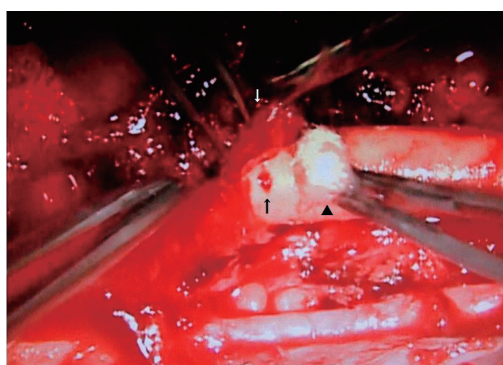
## REPAIR OF CAROTID BLOW-OUT



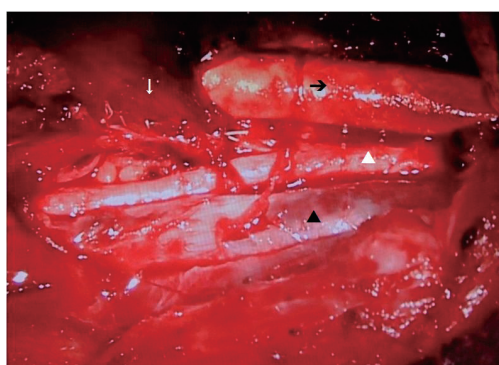
**Fig. 2A:** The carotid sheath (arrows) was sutured to the right common carotid artery at the distal end of the lacerated portion (arrowhead).



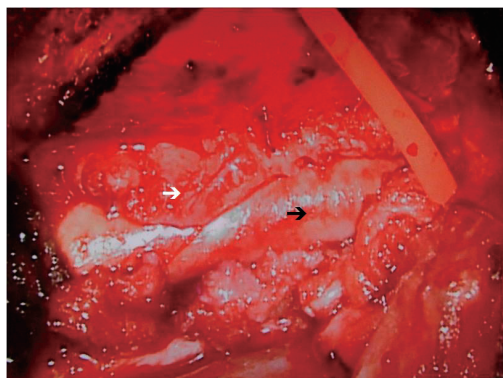
**Fig. 2B:** The lacerated portion was covered with the remaining carotid sheath surrounding the right common carotid artery.



**Fig. 2C:** Re-bleeding occurred at the proximal portion (black arrow) of the previous laceration. Fibrin glue with oxidized cellulose (arrow head) was initially used to seal the second small hole (black arrow) in this lesion. The ruptured section was then covered with the remaining sterno-thyroid muscle (white arrow) as the first layer.



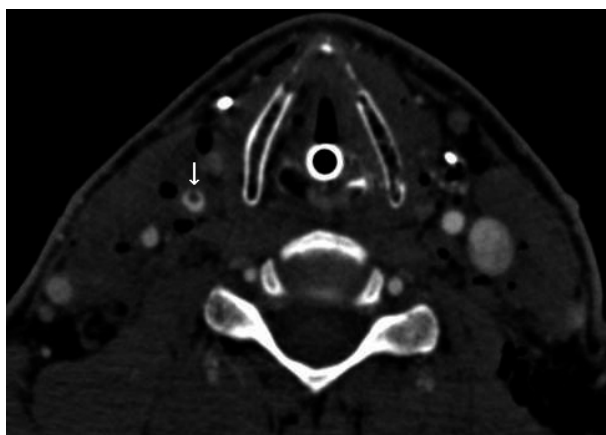
**Fig. 2D:** The ruptured section was then covered with the remaining sterno-hyoid muscle (white arrow) as the second layer. Black arrow shows the right common carotid artery. White arrowhead indicates the right vagus nerve. Black arrowhead shows the right internal jugular vein.



**Fig. 2E:** The proximal portion of right common carotid artery (black arrow) was covered with the harvested external jugular vein (white arrow).

**Fig. 2** Intraoperative view

However, re-bleeding occurred spontaneously at the proximal portion of the previous laceration during the dissection of the opposite side. Fibrin glue with oxidized cellulose was initially used to seal the second small hole in this lesion (Fig. 2C). The ruptured section was then covered with the remaining sterno-thyroid muscle as the first layer and the sterno-hyoid muscle as the second layer (Fig. 2C, D). These procedures resulted in hemostasis. The proximal portion of the right common carotid artery was covered with the harvested external jugular vein because there were no vascularized tissues surrounding this artery (Fig. 2E). Finally, the repaired right common carotid artery was widely covered with the sternomastoid muscle. Blood pressure was



**Fig. 3** Axial view of the enhanced CT scan just after operation. The carotid sheath used for the repairment was partially pushed into the arterial cavity (white arrow).



**Fig. 4** Right carotid angiography 5 days after operation. The irregularity of the wall still remained after the repair (black arrow).



strictly controlled after the operation, and no anti-platelet drugs were administered.

Three-dimensional CT angiography showed irregular stenosis in the right common carotid artery just after the re-operation (Fig. 3). Digital subtraction angiography also showed irregular stenosis in the right common carotid artery 5 days after the re-operation (Fig. 4). However, the stenosis was found to recover on magnetic resonance angiography 11 days later. No cerebral infarction occurred after the operation and the patient's general condition was good. The pathological specimen revealed the papillary carcinoma which showed prominent invasion of the nervous system. The patient is in good condition without neurological complication, and recurrence of the tumor 22 months after the operation.

## DISCUSSION

Thyroid cancer frequently invades the recurrent laryngeal nerve, strap muscles and trachea, and it is followed by invasion of the esophagus, internal jugular vein and carotid artery.<sup>4)</sup> Surgical resection is the primary treatment for locally advanced thyroid cancer, and the carotid sheath invaded by a tumor must be excised with the thyroid tumor.<sup>5)</sup> During this procedure, the adventitia that encircles the carotid artery and jugular vein can easily be damaged.

Carotid blow-out syndrome patients present with sentinel bleeding, but 60% of patients will develop a life-threatening hemorrhage requiring emergent intervention.<sup>3)</sup> The incidence is higher due to the lack of supporting healthy tissues if there is a history of radical neck dissection.<sup>3,6)</sup> Other risk factors for carotid blow-out syndrome include radiotherapy, flap necrosis, mucocutaneous fistula, wound infection, and recurrent tumor invasion.<sup>3)</sup> A sevenfold increased incidence of carotid blow-out syndrome is found after radiotherapy.<sup>3)</sup> Injury to the vasa vasorum and necrotizing vasculitis in all three layers is an important factor in the development of radiation-induced vasculopathy of large arteries.<sup>7,8)</sup> Bacterial inflammation can also cause thrombosis of the vasa vasorum and arterial wall injury.<sup>3)</sup> The carotid rupture in the current case was related to the previous radical neck dissection followed by the recurrent tumor invasion.

Over 90% of patients with carotid blow-out syndrome are treated with endovascular therapy (embolization 56%, stenting 36%), and surgical ligation (7%) is rarely indicated.<sup>3)</sup> Carotid artery embolization has a 15% to 20% neurologic morbidity rate and a lower incidence of associated mortality.<sup>3)</sup> Endovascular embolization can also help predict cerebrovascular complications with temporary balloon occlusion and collateral cerebral blood flow analysis.<sup>3)</sup> Stent-grafts may be useful in the treatment of carotid blow-out syndrome and show a high procedural success rate in selected cases.<sup>9)</sup> However, stent placement has a higher risk of recurrent carotid blow-out syndrome (44%) than embolization therapy (10%).<sup>3)</sup>

Emergency ligation of the carotid artery causes neurological casualties in 30% of the patients.<sup>2)</sup> Other studies of carotid blow-out syndrome treated with surgical ligation report an average mortality rate of 40% and an average morbidity rate of 60%.<sup>3)</sup> Although trapping with ligation was considered in the current case, trapping of the right common carotid artery was not done, because the cerebral vascular supply was not assessed preoperatively. Instead, reconstruction was done with the remaining carotid sheath and muscle flaps. Fibrin glue was used to seal the space between the carotid artery and the surrounding covering flap. We thought that it was important to seal the ruptured portion in multiple layers using vital, vascularized tissue. Thus, the reconstruction was reinforced by covering the common carotid artery with the harvested external jugular vein and sternocleidomastoid muscle.<sup>1)</sup> This surgical technique was an emergency measure following the sudden rupture of the common carotid artery. We finally managed to control hemorrhaging without occluding the common carotid artery. Given the large diameter of

the common carotid artery, obstruction could be avoided even after the thrombus was formed around the repaired sites. This procedure can be one option when an unexpected rupture of the carotid artery occurs.

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