Interventional Management of Head and Neck Emergencies: Carotid Blowout

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Abstract

Keywords

- ▶ carotid blowout syndrome
- ▶ carotid artery sacrifice
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- ▶ interventional radiology

Involvement of the carotid artery by malignant processes of the head and neck with compromise of vessel integrity and rupture—“carotid blowout syndrome” (CBS)—is one of the most devastating complications of malignancy. Most often, it is associated with squamous cell cancer and almost always in patients who have undergone prior radiation therapy. CBS is classified as threatened, impending, or acute. Bleeding into the oral cavity or from areas of skin breakdown is a frightening experience for patients and their families and often a terminal event. Prognosis is poor with up to 50% mortality and morbidity, and surgical options are limited and risky. Endovascular management with vessel sacrifice or stent placement has become the principle treatment option in this patient population, though still associated with procedural complications, often neurologic, that can occur acutely or in a delayed fashion. This article reviews techniques and outcomes associated with endovascular treatment of CBS.

Objectives: Upon completion of this article, the reader will be able to describe the natural history and etiology of carotid blowout syndrome, and the historical and contemporary treatment options.

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Carotid blowout syndrome (CBS) is estimated to occur in 4.3% of patients who have undergone treatment for head and neck cancer.¹ Most commonly, patients have a history of squamous cell cancer and have undergone prior radical neck surgery and radiation therapy. As the carotid artery

receives its blood supply via the vasa vasorum, processes that compromise this supply may lead to weakening of the vessel wall, subsequent dilatation, and possible rupture. Besides radiation and stripping of the carotid artery during surgery, risk factors include mucocutaneous fistula, exposure of the carotid artery to air from skin breakdown, and subsequent drying.^{2,3} CBS has been categorized by Chaloupka et al⁴ as “threatened,” where the carotid artery is exposed to the oral cavity or external environment via skin breakdown or by direct tumor invasion; “impending,” in which sentinel bleeds have occurred but have been controlled by conservative management; or “acute,” where there is active bleeding. Surgical management with vessel ligation and/or bypass is associated with high rates of morbidity and mortality likely related to the technical difficulty of dealing with anatomy altered by prior surgery and radiation resulting in tissues that are fragile and heal poorly.² Since the initial descriptions in the mid-1990s, endovascular management has become the mainstay treatment options for CBS.^{4,5} Endovascular management can be deconstructive, where the vessel is sacrificed, or reconstructive, where the vessel is left patent by the placement of covered stents.

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Patient Management

Intervention is, for the most part, reserved for category II or III patients. If patients are stable and time permits, a contrast-enhanced computed tomogram of the neck from the thoracic inlet to the circle of Willis can be helpful in planning the approach, by assessing for likely vessels involved and collateral circulation. Patients are seen first by the ENT service to determine if a conservative approach may be an option. If this is felt not likely to succeed, patients are brought urgently to the angiography suite. Patients may or may not have a protected airway (tracheostomy, endotracheal tube), but the authors do not routinely intubate patients for the procedure as they find monitoring the patients' neurological status during the intervention to be very helpful, particularly if a vessel sacrifice is being considered.

External Carotid Source

In the authors' experience, external carotid involvement is usually the result of tumor invasion of the branch vessel. Angiographic findings vary from irregular caliber vessels to pseudoaneurysm formation to abrupt vessel truncation. These patients are best managed by vessel sacrifice with coil embolization (►Fig. 1).

Internal Carotid Source

As expected, internal carotid artery (ICA) involvement is more complex to treat. Angiographic findings include vessel encasement, focal vascular invasion, and frank extravasation (►Fig. 2). Treatment options for CBS involving the ICA can be classified into vessel deconstruction and reconstruction.

Figure 1 A 52-year-old man with history of squamous cell cancer of the oropharynx diagnosed 7 months previously, with completion of chemotherapy and radiation therapy 3 months ago. He presents with massive oral bleeding, hypotension, and transfusion requirement. (A) Axial contrast-enhanced CT image of the neck shows large mass encasing the left carotid artery with linear high density consistent with extravasation (arrow); note the absence of jugular vein that had been sacrificed. (B) Lateral projection digital subtraction arteriogram (DSA) of left common carotid demonstrates contrast extravasation from truncated lingual artery (black arrow). (C) Microcatheter in lingual artery. (D) Embolization with platinum microcoils (arrows) (Hilal Embolization Microcoil, Cook Incorporated, Bloomington, IN) was performed. Lateral DSA of left common carotid shows the absence of extravasation and occlusion of lingual artery. Patient was alive and well 2 years later with no further bleeding.

Figure 2 A 52-year-old man with history of squamous cancer of the tonsil, with chemoradiation therapy 5 months previously, presents with multiple episodes of hemoptysis. (A) Lateral digital subtraction arteriogram of the right common carotid artery shows invasion of the carotid bifurcation anteriorly (black arrow). (B) Temporary occlusion balloon (white arrow) (Fogarty Edwards Lifesciences, Irvine, CA) and stasis of contrast above the balloon. (C) After the patient clinically passed the test balloon occlusion, coil (Embolization Coil, Cook Incorporated, Bloomington, IN) sacrifice of the external, internal, and common carotid arteries was performed. Residual contrast is noted in the common carotid artery (arrow). There was no further bleeding at 15-month follow-up.

Parent vessel occlusion (PVO) or carotid artery sacrifice with coil or balloon-occluding devices⁶ has been practiced for many years with a high degree of technical success but with a significant risk of transient or permanent neurologic injury. Some authors advocate a balloon test occlusion (BTO) prior to definitively sacrificing the vessel.⁷ In certain patients, BTO may be bypassed due to the emergency of the clinical situation.

Because of the risk of brain ischemia following PVO, some investigators have proposed the use of covered stents in patients who fail BTO or are felt to have limited collateral flow based on incompleteness of the circle of Willis (→Fig. 3) or involvement of the contralateral carotid artery. Covered stents represent a vessel reconstruction option, and at least in theory a more elegant treatment option. Moreover, with increased availability and smaller delivery systems, covered stents are an increasingly attractive alternative for CBS. Initial reports suggested a high early success with low procedural complication rates.⁸ More recently, longer term results have been less encouraging, with stents occluding (either incidentally or with neurologic events), stent infection, and brain abscess formation.^{9–11}

Definitive consensus for the optimal treatment for CBS is lacking, as there are no large randomized trials or prospective studies. As such the reader should be cautioned that most observations are from small retrospective series. One such series of 15 CBSs in 14 patients suggests an algorithm with PVO as first-line treatment, but using BTO if the clinical situation permits.⁷ Covered stents would be reserved for those who fail BTO. This is based on the observation that 83% (5 out of 6) of patients who passed BTO and were treated with PVO had favorable outcomes, defined as survival at the time of data collection. The sixth patient had recurrent CBS at 29 months and expired. Conversely, in the same study, of those patients who did not have a BTO prior to PVO, 80% (4 out

of 5) had an unfavorable outcome. A separate recent study of 10 patients treated with covered stents showed 100% immediate hemostasis.¹² However, as mentioned above, long-term outcomes were limited due to infection and thrombosis, and recurrent CBS secondary to stent infection was seen in 30% of

Figure 3 A 49-year-old woman with cancer of the oropharynx and prior chemoradiation presents with massive hemoptysis requiring 8 units of packed red blood cells. Bleeding from the right oropharynx was controlled by manual compression of the right carotid artery, until (A) temporary occlusion balloon (star) (Fogarty Edwards Lifesciences, Irvine, CA) was placed in the common carotid artery. Lateral DSA through the lumen of the occlusion balloon demonstrates extravasation from common carotid artery (black arrow). (B) Following placement of covered stent (Wallgraft Endoprosthesis, Boston Scientific, Natick, MA) (black arrows), bleeding was controlled. Note the absence of anterior cerebral artery (double arrow), felt to place patient at increased risk for brain ischemia with vessel sacrifice. Patient had no further bleeding and no neurologic events; however, the stent was found to be occluded at routine staging computed tomography of the neck.

treated patients. An additional patient (10%) suffered a stroke due to stent thrombosis. Only 20% (2 out of 10) of the patients were asymptomatic and living at the time of data collection, with the remaining 4 patients having expired unrelated to CBS.¹² If a covered stent is placed, indefinite antibiotic administration is recommended, as the covered stent may be exposed to oral flora. In addition, long-term antiplatelet therapy is required, which may exacerbate hemorrhage.

In summary, CBS is a devastating complication of head and neck cancer. Endovascular management is highly successful and is associated with reasonable risk. Lesions involving the external carotid or its branches are best managed with microcatheter access and coil embolization. An ICA source is more challenging because of the risks of neurological deficits. PVO is still the preferred method of management of these lesions, although placement of covered stents is an option in patients who are not candidates for PVO but may be associated with a high degree of stent failure or delayed neurological event.

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