

Technical Notes & Surgical Techniques

Emergency high-flow bypass for the management of ruptured postirradiated internal carotid artery pseudoaneurysms in nasopharyngeal carcinoma patients



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ABSTRACT

Rupture of a postirradiated internal carotid artery (ICA) pseudoaneurysm in patients with nasopharyngeal carcinoma (NPC) is a rare yet life-threatening emergency. In contrast to pseudoaneurysms found in patients with other head and neck malignancies, those identified in NPC patients have a propensity to occur in the petrous segment of the ICA, which pose a serious challenge to clinical physicians. Over the past few decades, endovascular treatment with covered stents has widely been adopted as the treatment of choice for patients at risk of brain ischemia after occluding the parent vessel of the pseudoaneurysm. Although recent series have demonstrated that immediate hemostasis can be achieved in most of the patients undergoing covered stent placement, a high incidence of delayed complications has been reported, including delayed cerebral ischemia, in-stent thrombosis, and septic thromboembolism.

We present two NPC patients with a postirradiated pseudoaneurysm involving the petrous segment of the internal carotid artery. As direct parent vessel occlusion was infeasible, we established an emergency high-flow extracranial-intracranial (EC-IC) bypass followed by endovascular parent vessel occlusion. Both of the patients were followed-up for more than 24 months without neurological deficit or rebleeding. We suggest that EC-IC bypass with parent vessel occlusion should be considered as a practical and durable treatment option for patients with postirradiated ICA pseudoaneurysms who cannot tolerate direct carotid occlusion.

1. Introduction

Rupture of a pseudoaneurysm of the carotid artery and its branches is a rare but devastating complication of radiotherapy treatment in patients with head and neck malignancy, including nasopharyngeal carcinoma (NPC). Surgical ligation of the parent vessel, once considered the treatment of choice in the past, has largely been replaced by endovascular treatment due to significant morbidity and mortality [1]. Deconstructive endovascular management, using detachable coils and embolization materials to occlude the parent vessel, has shown promising results for patients without significant risk of brain ischemia [2, 3], while reconstructive management with covered stents is reserved for patients who are considered at high risk of developing brain ischemia after parent vessel occlusion [4–6]. However, reconstructive management has its risks. Recent studies have demonstrated high rates

of recurrent bleeding and undesirable delayed complications related to stent-grafts, such as delayed occlusion of stent-grafts and septic thrombosis [4, 7, 8]. As a result, we opted to perform an extracranial-intracranial (EC-IC) bypass with parent vessel occlusion, which is considered an effective treatment for patients with complex internal carotid artery (ICA) aneurysms [9–11]. We here report 2 cases of ruptured postirradiated ICA aneurysm successfully treated with an emergency EC-IC high-flow bypass and embolization of the ICA.

2. Case reports

2.1. Case 1

A 55-year-old man with a past history of NPC was treated with radiotherapy in 1996. He remained well until he presented with an

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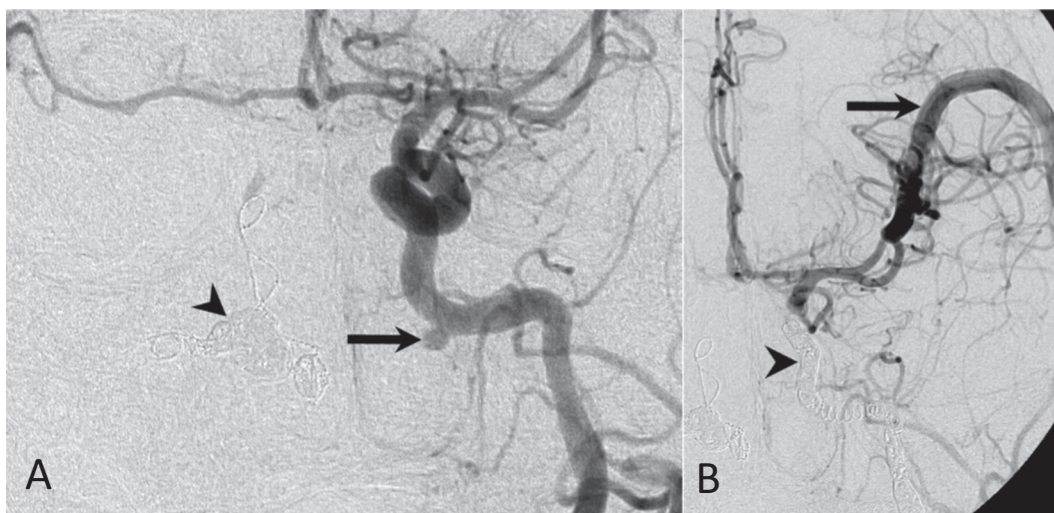


Fig. 1. (A) Preoperative digital subtraction angiography (DSA) demonstrated a pseudoaneurysm in the petrous segment of the left internal carotid artery (ICA) (arrow) and occlusion of the contralateral ICA (arrowhead). (B) DSA obtained after trapping of the parent artery revealed the patent bypass graft (arrow) and complete obliteration of the left ICA (arrowhead).

episode of massive epistaxis in 2010. Emergency conventional angiography revealed a pseudoaneurysm in the right ICA; the patient underwent endovascular occlusion of the right ICA with detachable coils and the bleeding was controlled. Five years later, a necrotic mass lesion was found in the nasopharynx on head and neck magnetic resonance (MR) imaging during a regular check-up. The patient underwent endoscopic biopsy to sample the nasopharynx, and a few hours after the biopsy, he developed profuse oronasal bleeding and desaturation. After stabilizing the patient, contrast-enhanced computed tomography (CT) demonstrated an ill-defined necrotic mass over the nasopharynx with skull base erosion and left distal cervical ICA encasement. Conventional angiography revealed occlusion of the right ICA and a pseudoaneurysm in the petrous segment of the left ICA (Fig. 1A). As the patient was at high risk of developing cerebral ischemia after occlusion of the left ICA, we established a high-flow bypass with a great saphenous vein graft between the left external carotid artery (ECA) and the M3 portion of the left middle cerebral artery (MCA). The patient was rushed to the angiography suite for permanent embolization of the left ICA immediately after the operation (Fig. 1B). A CT perfusion scan performed the next day revealed complete obliteration of the left ICA and good patency of the venous graft. The postoperative course was uneventful. The patient remained neurologically intact and was discharged 2 weeks after the surgery. The patient was asymptomatic 30 months after the operation.

2.2. Case 2

A 68-year-old man with a past history of NPC was treated with concurrent chemoradiotherapy 30 years ago. He was admitted to the hospital due to massive epistaxis with hemorrhagic shock requiring resuscitation. CT angiography demonstrated a pseudoaneurysm in the petrous segment of the left ICA (Fig. 2A), a hypoplastic anterior communicating artery, and bilateral hypoplastic posterior communicating arteries (Fig. 2B and C). To minimize the risk of ischemic stroke, we decided to perform a high-flow bypass followed by embolization of the left ICA.

A high-flow bypass with a radial artery graft was established between the left superior thyroid artery and the M2 portion of the left MCA successfully. The patient was sent to the angiography suite directly from the operating room for endovascular occlusion of the left ICA (Fig. 2D and E). He remained neurologically intact and was discharged on the 7th postoperative day. CT perfusion 3 months after the operation revealed a patent bypass graft with symmetric perfusion

(Fig. 2F). The patient remained neurologically well during a 24-month follow-up.

3. Discussion

Radiotherapy has been the mainstay of treatment for nasopharyngeal carcinoma [12]. Despite its excellent treatment results, radiotherapy can lead to several delayed complications affecting structures adjacent to the nasopharynx [13, 14]. Rupture of pseudoaneurysms in NPC patients is a well-recognized complication with a high mortality rate. The incidence of postirradiated pseudoaneurysms in NPC patients remains undetermined, and only a few case series have been published [13, 15–18]. The initial presenting symptom is usually sudden onset of profuse oronasal bleeding, and in severe cases, hemodynamic instability and airway compromise. Unlike pseudoaneurysms identified in patients with other head and neck malignancies [2, 4, 19], those found in NPC patients have a propensity to occur in the petrous segment of the ICA [15, 18], possibly because it is exposed to more radiation than other carotid territories during radiotherapy. Recent series have shown that two-thirds of pseudoaneurysms were identified in the petrous segment of the ICA [15], while lesions of other segments of the ICA or branches of the common carotid artery (CCA) and external carotid artery (ECA) have been reported less frequently [18].

Endovascular management has emerged as the treatment of choice for ruptured postirradiated pseudoaneurysms over the past few decades [1, 19, 20]. Parent vessel occlusion with detachable coils and liquid embolization material (deconstructive management) is the preferred treatment for patients with adequate cerebral collateral circulation [2–4], while covered stents (reconstructive management) have been adopted by many centers to treat patients who are at high risk of brain ischemia after carotid occlusion [5, 6].

Although covered stent placement has been shown to achieve immediate hemostasis in 100% of patients in several studies, a high incidence of short-term and delayed complications has recently been emphasized. Chang et al. [4] reported a series of 96 patients with acute or ongoing bleeding after irradiation for head and neck cancer, of whom 18 patients underwent covered stent placement. Immediate hemostasis was obtained in all patients, but technical complications developed in 9 of the 18 patients (50%), including delayed occlusion of the stent-graft, marginal stenosis, and delayed septic thrombosis. In addition, patients treated with stent-grafts appeared to have a significantly higher rate of rebleeding than patients treated with

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