

# Sacrificing the internal carotid artery in infiltrating neck tumours: a study of four clinical cases

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**Abstract.** Tumour infiltration of the carotid arteries, especially the common carotid artery (CCA) and the internal carotid artery (ICA), is a great challenge in maxillofacial surgery. Cases in which the malignant tumour and/or lymph node is stuck to the carotid artery, especially the ICA, have previously been considered inoperable. Four such cases, two with recurrent metastatic nodal neck masses encasing the ICA, one with aggressive fibromatosis, and one with a carotid body tumour, are described herein. Successful resection of the mass along with the ICA was performed in all cases after a positive balloon occlusion test. All patients made an uneventful recovery with no signs or symptoms of any neurological deficits. In addition, all of the patients were free of disease for the whole postoperative period of 18 months.

**Key words:** internal carotid artery; metastatic tumour; balloon occlusion test.

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The carotid arteries (common carotid artery (CCA) and/or internal carotid artery (ICA)) are invaded in 5–10% of cervical lymph node metastases of head and neck squamous cell carcinoma in patients with advanced regional disease.<sup>1</sup> Such cases in which the malignant tumour and/or lymph node is stuck to the carotid artery, especially the ICA, have previously been considered inoperable. If surgery is performed, the choice of treatment for such cases is dissection, resection, or reconstruction of the invaded carotid artery.<sup>1</sup>

En bloc resection of the carotid artery together with the infiltrating tumour allows better regional control of the disease, and the 5-year disease-free survival rate is almost 22%.<sup>2,3</sup> The main complication associated with en bloc resection of the carotid artery is the development of a cerebral stroke due to the sudden change in the blood circulation to one of the brain hemispheres. It has been found that when the carotid artery is removed but not reconstructed, the risk of developing a stroke is almost 30%. However, proper

reconstruction of the carotid artery reduces this risk to less than 3%.<sup>3,4</sup>

In contrast, carotid artery dissection (CAD) is not associated with a stroke risk. The carotid sheath and the arterial wall usually act as a barrier to invasion by squamous cell carcinoma, but advanced lesions of the neck may present with direct invasion or encasement of the artery, especially after primary treatment with radiotherapy.<sup>1</sup> However, when massive cancer invasion of the carotid artery is present, for instance if the tumour invades the vessel

(over the carotid adventitia), CAD cannot be performed.<sup>2</sup> Thus, in such cases, en bloc resection of the artery is necessary for proper surgical management of the cancer.

Grafting the carotid artery after resection is another treatment choice and it decreases the risk of cerebral complications. However, this procedure carries the risk of life-threatening haemorrhage, thromboembolic events, and pseudoaneurysm formation.<sup>5,6</sup> The decision on whether to resect or reconstruct the carotid artery with a graft is controversial and based on the extent of the malignancy, the simultaneous entrance into the upper aerodigestive tract, and the effects of irradiation. The age of the patient and the presence of contralateral carotid disease should also be considered.

Several imaging signs are useful for predicting a massive invasion of cancer into the carotid artery. These include deformation of the artery (which becomes oval), encasement of more than 180 degrees, and segmental obliteration of the fat between the adenopathy and the carotid artery.<sup>7,8</sup> The relationship between the neoplasm and cervical vessels may be demonstrated on computed tomography (CT) views, although this is a less effective imaging modality in diagnosing the involvement of the CCA and ICA than ultrasonography or magnetic resonance imaging (MRI). Also, it is important to estimate the length of the free stump of the distal part of the ICA to ensure that it is sufficient to allow full excision of the tumour mass.<sup>9</sup>

The balloon occlusion test for the resected carotid artery has been used to predict whether the patient will be able to tolerate either temporary or permanent occlusion of the ICA. The complication rate of ICA occlusion is lowered when the balloon occlusion test is positive.<sup>10</sup>

Compared to other procedures such as radiochemotherapy or CAD alone, en bloc resection of the carotid artery allows better regional control of the cancer. Nevertheless, the global survival rate at 5 years is identical for CAD and en bloc resection.<sup>1</sup>

The cases of four patients with malignant and locally aggressive tumours invading the carotid vessels, who were treated successfully through sacrifice of the ICA (en bloc resection without reconstruction), are presented herein. These patients were treated during the period November 2012 to March 2014.

## Patients and methods

Multi-slice computed tomography angiography (CTA) was performed for all four

patients in order to assess the extent of the tumour and to determine the length of the ICA free of disease, as measured from the skull base down. Tumour invasion of the skull base was considered a contraindication to resection.

It was considered too difficult to apply an interposition graft in all patients with suspected tumour involvement of the ICA close to the skull base; these patients underwent angiography and clinical evaluations by means of an ICA balloon occlusion test. Although no patient had a negative balloon occlusion test, it was planned to refer such patients for chemoradiotherapy according to the institutional protocol. Informed consent was obtained from all patients.

The patients were all followed up for a minimum period of 18 months. Ultrasound examination of the neck was performed at 3-month intervals and positron emission tomography (PET)-CT at 6-month intervals.

### Case 1

A 45-year-old male presented with an enlarged lymph node in the right side of the neck that was fixed to the surrounding structures, as well as invading the overlying skin. The patient had a history of resected malignant tumour of the tongue with supraomohyoid neck dissection 18 months earlier. Multi-slice CTA of the neck was performed, which revealed a mass with irregular borders invading the

right carotid sheath, with a free distal stump measured from the skull base of about 40 mm in length (Fig. 1a). The balloon occlusion test was done by a neurosurgeon and the outcome was positive.

Resection of the mass along with the right CCA and the overlying skin was done (Fig. 1b). The composite defect was restored using a pectoralis major myocutaneous flap (Fig. 1c). The patient made an uneventful recovery and did not show any signs of cerebrovascular effects. No signs or symptoms of recurrence were seen during the 18 months after surgery. Unfortunately the patient died 2 years after surgery due to ischaemic heart disease.

### Case 2

A 58-year-old male presented with a mass in the right side of the neck that was fixed to the surrounding structures (Fig. 2a). The patient had a history of laryngeal carcinoma, which had been treated by ablative laser 12 months before presentation. Multi-slice CTA of the neck was done, which revealed a mass with irregular borders encroaching on the right carotid sheath, with a free distal stump measured from the skull base of about 40 mm in length (Fig. 2b). The balloon occlusion test was positive.

The patient underwent resection of the mass along with the right CCA (Fig. 2c and d). He made an uneventful recovery and

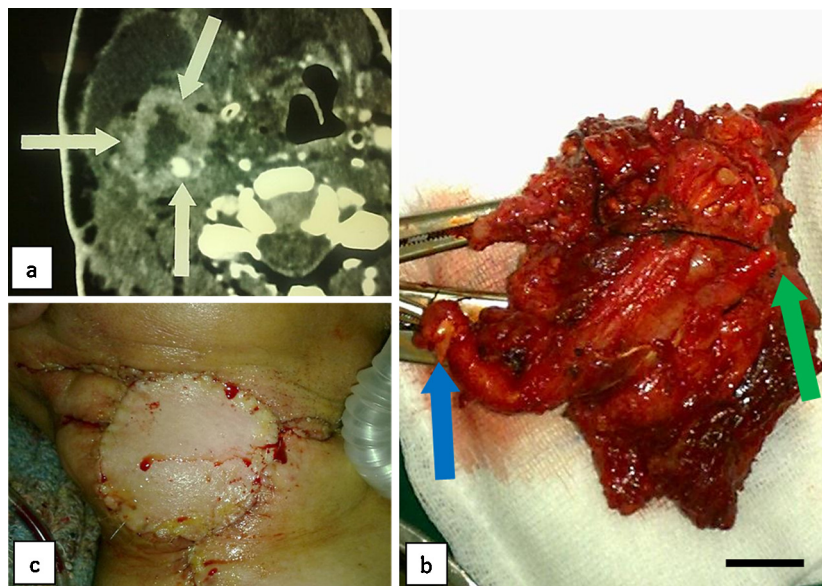


Fig. 1. Images of case 1: (a) CTA of the neck showing the metastatic tumour involving the right CCA (arrows); (b) the resected mass along with the right CCA and ICA (scale bar = 2 cm); (c) restoration of the neck composite defect using a pectoralis major myocutaneous flap. (CTA, computed tomography angiogram; CCA, common carotid artery; ICA, internal carotid artery.)

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