

CLINICAL TECHNIQUES AND TECHNOLOGY

Arterial microanastomoses on the reverse flow of the internal carotid artery reverse flow: an extreme solution in free-flap revascularisation. How we do it

Microanastomosi arteriosa su flusso retrogrado dell'arteria carotide interna: una soluzione estrema nella rivascolarizzazione dei lembi liberi

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SUMMARY

Microvascular free tissue transfer in head and neck reconstruction requires suitable recipient vessels, which are frequently compromised by prior surgery, radiotherapy, or size of the tumour. A surgical description of an arterial free flap pedicle anastomosis on the reverse internal carotid arterial flow in a vessel-depleted neck is presented. A 66-year-old male with a relapse of hypopharyngeal squamous cell carcinoma previously treated with both surgical and radiation therapy for carcinoma of the tongue and the larynx was successfully reconstructed using a free forearm flap with reverse internal carotid arterial flow. The involvement of the carotid glomus and prior surgery excluded the other vessels as recipients. The forearm free flap survived without any complications. This procedure can be considered an alternative rescue technique for salvage reconstruction in a vessel-depleted neck.

KEY WORDS: Head and neck cancer • Free-flap • Microanastomoses • Carotid artery • Reverse flow

RIASSUNTO

La ricostruzione con lembi liberi richiede la presenza di vasi riceventi che spesso possono essere compromessi da precedenti interventi chirurgici, radioterapia o dalle dimensioni del tumore. In questo articolo abbiamo riportato la tecnica chirurgica da noi utilizzata per la realizzazione di una microanastomosi effettuata sul segmento distale dell'arteria carotide interna sfruttando il suo flusso retrogrado effettuata in un collo privo di altri vasi utilizzabili. Un paziente di 66 anni con recidiva di carcinoma squamocellulare dell'ipofaringe, precedentemente trattato con chirurgia e radioterapia per un carcinoma squamocellulare della lingua e della laringe, è stato ricostruito con successo con un lembo libero di avambraccio rivascolarizzato con il flusso retrogrado dell'a. carotide interna. Il coinvolgimento del glomo carotideo ed il precedente trattamento chirurgico avevano impedito l'utilizzo di altri vasi del collo. Il lembo di avambraccio non ha riportato complicanze nel post-operatorio. Questa procedura può essere considerata un'alternativa estrema per consentire la ricostruzione nei casi in cui i vasi del collo risultino inadeguati e/o assenti.

PAROLE CHIAVE: Tumori testa e collo • Lembo libero • Microanastomosi • Arteria carotide • Flusso retrogrado

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Introduction

To date, microvascular free-tissue transfer represents a reliable technique for reconstruction of defects following surgical treatment of head and neck cancer. Free tissue transfers have a high overall success rate, ranging between 91% and 99% of cases¹, and are generally performed with good functional and aesthetic outcomes, even considering donor-site morbidity^{2,3}. However, the procedure requires specific surgical skills, especially for management of the vascular pedicle. In particular, identification and preparation of recipient vessels and microsurgical vascular anas-

tomoses are crucial steps in the field of reconstructive surgery^{4,5}. Meticulous attention to these points should be paid to avoid dangerous and life-threatening complications, and improve the overall success rate.

In fact, the management of vascular pedicles can be a troublesome aspect, especially in pre-irradiated graft beds, on the basis of vascular fibrosis and endothelial thickening. In addition to this, surgeons faced with free-flap reconstruction have to be trained, to modify *in itinere* during a radial forearm flap set up for reconstruction following resection of a relapsing hypopharyngeal tumor in an irradiated patient.

Clinical techniques and technology

A microvascular transfer of the radial forearm was planned to reconstruct the digestive tract in a 66-year-old man with a relapsing hypopharyngeal squamous cell carcinoma (SCC). The patient's relevant history began 14 years before when he underwent a partial glossectomy with bilateral functional neck dissection for an undifferentiated SCC, followed by post-operative radiotherapy. In July 2010, a total laryngectomy was performed for the development of an undifferentiated SCC in the left pyriform sinus, extending to the homolateral larynx.

The patient was also affected by arterial hypertension and chronic obstructive pulmonary disease.

For the tumour recurrence in the residual hypopharyngeal lateral left wall (Fig. 1), also considering his previous irradiation history, surgery was therefore planned. An en bloc tumour resection englobing the proximal portion of the involved common carotid artery at the level of the carotid artery bifurcation (previously undetected to the pre-operative radiologic assessment) was performed, and a right fascio-cutaneous radial forearm flap was set up and tubulised for reconstructive purposes (Figs. 1, 2).

Due to the lack of appropriate arterial flow on the arteries tributary to both the ipsilateral and contralateral external carotid artery, the reversed flow in the distal portion of the left internal carotid artery was used for arterial microanastomoses. Venous microanastomosis was performed

between the right tyreo-linguo-facial venous trunk and the cephalic donor vein.

A left pectoral muscle flap was then transposed to protect the residual carotid artery, and a cutaneous Tiersch graft taken from the anterolateral left thigh was used to cover the residual donor site defect.

Discussion

To date, microsurgical reconstruction of the head and neck after oncological surgery based on free flaps is, in experienced hands, an effective and successful technique⁶. The most common used recipient vessels for arterial microanastomoses are the branches of the external carotid artery, such as the facial, superior thyroid, and lingual arteries. However, it is generally accepted that each artery having, once resected, any pulsatile and adequate flow at its distal end can be used as a recipient vessel⁷.

However, in managing head and neck reconstruction, surgeons must be ready to modify *in itinere* their reconstructive strategy on the basis of unexpected anatomic extension of the disease (e.g. vascular involvement) or impairment of vascular structures suitable for microanastomoses due to unsuspected flow obstruction or reduced vascular flow (e.g. related to atheromatous disease, post-attinic atherosclerosis, or, less frequently, to intimal injury after the positioning of intra-arterial infusion catheter). In addition to these, some technical difficulties may arise, in-

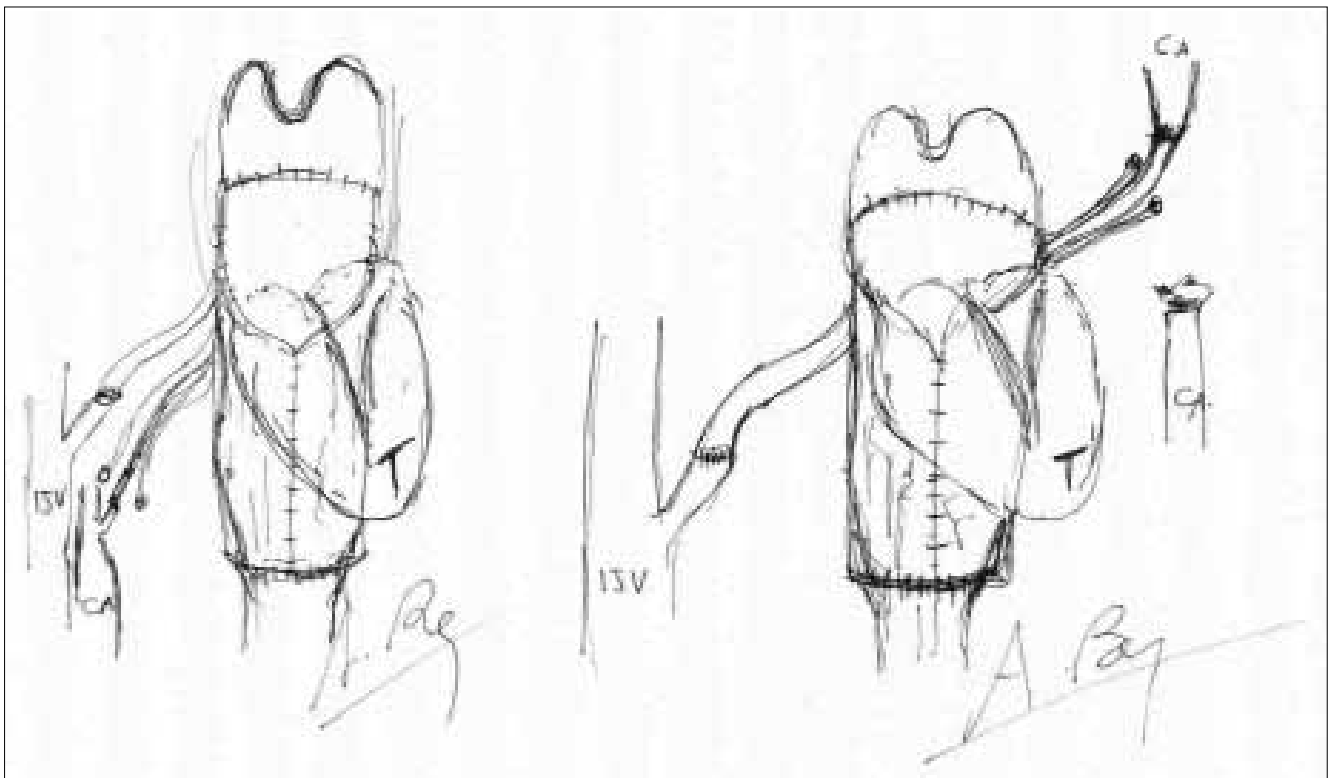


Fig. 1. Ablation.



Fig. 2. Reconstruction.
T: tongue; IJV: internal jugular vein, C: carotid artery.

cluding troublesome pedicle management due to limited pedicle length, reduced vessel caliber or kinking of the pedicle^{8,9}. In order to overcome these pitfalls, some authors¹⁰ have suggested that interposition of venous grafts can be used to reach an adequate pedicle length. However, it must be pointed out that surgical strategies using fragile and thin-walled vessels such as graft veins may predispose to intravascular thrombosis.

Therefore, under unexpected and unfavourable conditions, aside from other less effective reconstructive techniques such as delayed locoregional flaps¹¹, the use of reverse arterial flow can be considered as an extreme surgical choice. In fact, Neligan and co-workers described 28 cases of superior thyroid and facial artery reverse flow used for free flap revascularisation with good clinical outcomes⁸. These positive results may be related to adequate

arterial flow, corresponding to 57-76% of systemic arterial pressure as documented by clinical and physiopathologic studies⁹. In addition to this, Batchelor⁷ stated that the distal flow of an extracranial reverse flow vessel would be enhanced by recruitment of its peripheral capillary branches resulting in overflow leading to an adequate flap blood supply. At any rate, it may be speculated that the above mentioned conditions related to extracranial reverse flow recipients would be valid in case of intracranial vessels, thus leading to a successful outcome such in this case. However, to our knowledge, no previous descriptions of arterial microanastomoses performed on the reverse flow of the internal carotid artery have been reported.

With regards to the donor site, forearm free flaps should be considered as the preferred choice compared to perforator flaps in such difficult situations, on the basis of

their long and well-caliber pedicles^{12,13}. Indeed, in our patient, the forearm flap allowed us to reach the distal portion of the inner carotid artery and use its reverse flow for revascularisation. Moreover, the large size of the radial artery used achieved a good matching with the most of the secondary arterial neck branches and even with the internal carotid artery. In addition to this, a long pedicle is useful when contralateral arterial supply management is required, as in our report, due to impaired patency of the ipsilateral arterial.

In conclusion, microvascular surgery in vessel-depleted necks is a challenge and somewhat troublesome aspect. The case presented herein suggests the feasibility of internal carotid artery reflow for free flap revascularisation when no other safer or easier technical options are possible.

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