

## Prosthetic carotid bypass graft for in-stent restenosis performed for post-endarterectomy recurrent stenosis: technical details

A. SIANI, F. ACCROCCA, L.M. SIANI, R. GABRIELLI, R. ANTONELLI,  
G.A. GIORDANO, G. MARCUCCI

**SUMMARY:** Prosthetic carotid bypass graft for in-stent restenosis performed for post-endarterectomy recurrent stenosis: technical details.

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G. A. GIORDANO, G. MARCUCCI

*Aim. Carotid artery stenting (CAS) is the treatment of choice for recurrent stenosis after carotid endarterectomy (CEA). However a significant incidence of in-stent restenosis could be occurred. Despite classical CEA leads to good results, in selective cases bypass graft may be the best treatment of in-stent restenosis.*

*Case reports. We describe two cases of carotid bypass graft performed to treat a recurrent in-stent stenosis after CAS for post-CEA restenosis. No death and cardiac complication occurred and no cranial nerves impairment was detected.*

*Conclusion. Prosthetic bypass graft is safe and effective in treatment of in-stent recurrent restenosis after CEA restenosis.*

**RIASSUNTO:** Ruolo del bypass carotideo nelle restenosi post-stenting eseguito per restenosi post-endoarterectomia: note tecniche.

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*Introduzione. Lo stenting carotideo (CAS) rappresenta il trattamento di scelta per le restenosi post-endoarterectomia carotidea (CEA). Tuttavia il rischio di una nuova restenosi appare significativo. Nonostante gli ottimi risultati di una redo-CEA, il bypass carotideo sembrerebbe essere il trattamento di prima scelta.*

*Case reports. Riportiamo due casi di bypass carotideo eseguiti per trattare una restenosi intrastent successiva ad una CAS eseguita per trattare una restenosi post CEA. Non si è osservata mortalità e morbilità perioperatorie. Non si sono osservate lesioni dei nervi cranici.*

*Conclusioni. Il bypass carotideo garantisce ottimi risultati per il trattamento di tali lesioni. La morbilità e la mortalità perioperatorie sono sovrapponibili alla CEA*

**KEY WORDS:** Carotid stent - Carotid surgery - In-stent restenosis.  
Stent carotideo - Chirurgia carotidea - Restenosi intra-stent.

### Introduction

Treatment of choice for restenosis after CEA is CAS (1). However a high incidence of in-stent restenosis due to recurrence of hyperplastic process was reported (2). Despite the redo-endovascular treatment could be recommended, in selective cases the surgical conversion by carotid bypass may be preferred (3,4).

We report two cases of carotid bypass graft performed to treat a recurrent in-stent stenosis after CAS for post-CEA restenosis.

### Case reports

#### Case 1

A 75 year-old man presented with severe symptomatic restenosis of the left internal carotid artery (ICA) after eversion CEA performed 2 years before. He underwent CAS (Carotid wallstent, Boston Scientific). The patient had history of hypertension and coronary artery disease. Eight months later symptoms recurred and color-Duplex ultrasounds (US) and angio-CT scan showed a severe residual plaque distally to deployed stent.

#### Case 2

A 68 year-old man presented with severe asymptomatic post eversion CEA restenosis of the left ICA. CAS (Carotid wallstent, Boston Scientific) was performed. His medical history was Hypertension and diabetes. One year later the US and angio-CT scan documented a severe in-stent restenosis.

#### Technique

After orotracheal intubation with remifentanyl conscious sedation a redo cervicotomy along the sternocleidomastoid muscle

with ventrojugular approach to the carotid bifurcation was carried out. The common carotid artery (CCA) and the ICA were controlled in not previous dissected lengths. External carotid artery was controlled far from bulb avoiding laryngeal nerve lesion. After eparinization, ICA was clamped after routinary extensive mobilization of the hypoglossal-vagal confluence, occipital artery ligation and cutting of posterior belly of digastric muscle. Omohyoid muscle was routinary divided. An interposition 6 mm PTFE graft (Propaten, Gore, Flagstaff, Ariz) was performed. After vessels clamping an end to side proximal anastomosis on the CCA was carried out (Fig. 1). Declamping of CCA and graft tension leads to flushing and right length measurement to avoid graft kink/angulations. Distal end-to-end anastomosis was performed after ligation of the ICA above the carotid stent. After flushing the suture was tied and ICA declamped (Fig. 2) The stent was left to avoid carotid dissection.

At one year follow-up no symptoms recurred and no restenosis was observed at US. No cranial nerves impairment was detected.

## Discussion

Despite CAS seems to be the best approach to treat post-CEA restenosis, pre-existent hyperplastic process may be associated with an high incidence of in-stent restenosis (2). Redo-CEA documented further restenosis or occlusion in 20% of cases in contrast with bypass reconstruction, while the combined stroke and death results were the same (5,6). The technical determinants for successful outcomes are:

- 1) anastomosis in carotid arteries disease free;
- 2) proximal end-to side anastomosis executed first;
- 3) accurate measurement of graft length to avoid kinking or tension in the anastomotic site;
- 4) accurate flushing;



Fig. 1 - End-to-side anastomosis is made between PTFE and common carotid artery. Proximal internal carotid artery was ligated distal to the end of the stent.

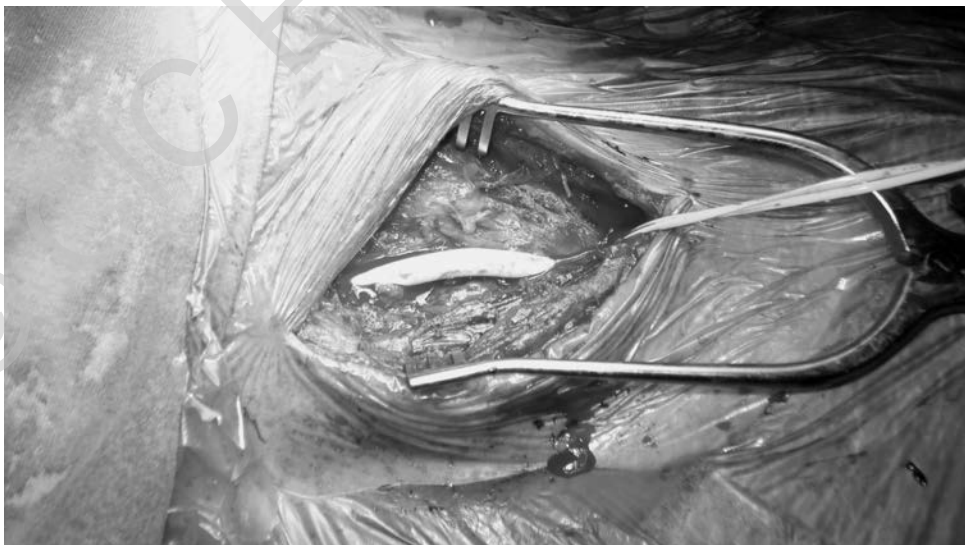


Fig. 2 - End-to-end anastomosis was performed between PTFE and internal carotid artery.

- 5) end-to-end distal anastomosis;
- 6) stent left in place in order to avoid carotid dissection in an area of intense fibrosis.

As suggested by Ricco et al., the ICA can be approached behind the internal jugular vein in cases of high bifurcation or extensive fibrosis and the distal end-to-side anastomosis configuration should be preferred especially in cases of posterior wall thickened artery (7).

Regarding the choice of graft materials, we prefer the use of PTFE. Authologous saphenous vein has been considered the best graft (3), but adequate length, absence

of valves, diameter > 4 mm, healthy vein wall texture and thigh level harvesting are necessary (8). Moreover the risk of aneurismal degeneration, restenosis or occlusion is 14% (9).

## Conclusion

Prosthetic carotid bypass (PCB) with PTFE graft is a safe alternative to CEA for unusual lesions such as recurrent in-stent restenosis after CEA restenosis.

## References

1. Lal KB, Hobson RW 2nd. Management of carotid restenosis. *J Cardiovasc Surg* 2006;47(2):153-60.
2. Chakhtoura EY, Hobson II RW, Goldstein J, Simonian T, Lal KB, Haser PB, Silva MB Jr, Padberg FT Jr, Pappas PJ, Jamil Z. In-stent restenosis after carotid angioplasty-stenting: incidence and management *J Vasc Surg* 2001;33(2):220-6.
3. Coscas R, Rhissassi B, Gruet-Coquet N, Couture T, De Tymowski C, Chiche L, Kieffer E, Koskas F. Open surgery remains a valid option for the treatment of recurrent carotid stenosis. *J Vasc Surg* 2010;51(5):1124-32.
4. Jimenez JC, Moore WS, Lawrence PF, Quinones-Baldrich WJ. Technical strategies for recurrent carotid stenosis following angioplasty and stenting. *Ann Vasc Surg* 2008;22(2):179-84.
5. Gagne PJ, Riles TS, Jacobowitz GR, Lamparello PJ, Giagnola G, Adelman MA, Imparato AM, Mintzer R. Long-term follow-up of patients undergoing reoperation for recurrent carotid artery disease. *J Vasc Surg* 1993;18(6):991-8.
6. Camiade C, Maher A, Ricco JB, Roumy J, Febre G, Marchand C, Neau JP. Carotid bypass with polytetrafluoroethylene grafts: a study of 110 consecutive patients. *J Vasc Surg* 2003;38(5):1031-8.
7. Ricco JB, Marchand C, Neau JP, Marchand E, Cau J, Fébre G. Prosthetic carotid bypass grafts for atherosclerotic lesions: a prospective study of 198 consecutive cases. *Eur J Vasc Endovasc Surg* 2009;37(3):272-8.
8. Roddy SP, Darling RC 3rd, Ozsvath KJ, Mehta M, Chang BB, Paty PS, Kreienberg PB, Shah DM. Choice of material for internal carotid artery bypass grafting: vein or prosthetic? Analysis of 44 procedures. *Cardiovasc Surg* 2002;10(6):540-4.
9. Lauder C, Kelly A, Thompson MM, London NJM, Bell PR, Naylor AR. Early and late outcome after carotid artery bypass grafting with saphenous vein. *J Vasc Surg* 2003;38(5):1025-30.