INVITED COMMENTARY

Keeping Things Simple, May Not Be So Simple

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When I performed my first carotid endarterectomy (CEA) with retrograde intervention, it seemed so elegant. A simple, hybrid solution for tandem carotid lesions. I was taught to "keep things simple". This applied. In this month's *European Journal of Vascular and Endovascular Surgery*, Meershoek et al. report their experience over 14 years in 16 symptomatic patients undergoing hybrid CEA with proximal intervention.[1] Their results, with no operative stroke, transient ischaemic attack (TIA), or death, are not unusual in the literature. In fact, as they noted, a 2011 meta-analysis reported operative stroke and death in only 1.5%, and promulgated this approach's safety and efficacy.[2] This, in part, steered recent European Society for Vascular Surgery (ESVS) guidelines to recommend that most supra-aortic trunk lesions should be treated retrograde via an open neck.[3] Adding CEA should be straightforward. Is it really that simple? I don't think so.

At Massachusetts General Hospital, our group's enthusiasm for this rarely needed technique has been tempered by growing experience. In 2016, we assessed our 23 patients over 11 years. Thirty day stroke and death (S/D) was 9%! We further studied 62 patients with two other institutions. Results were similar. Operative S/D was 11.3%, with no differences across centres.[4] We recommended careful use of this technique only in symptomatic patients. As Meershoek et al. point out, varied symptomatology, surgeons, centres, and temporal sequencing of procedures in our assessments are problematic and detracting. Regardless, these patients have aggressive atherosclerosis. While there was no neurological morbidity in Meershoek et al.'s patients, cardiac morbidity caused a 12.5% 30 day major adverse cardiovascular event rate. Still not so simple.

I applaud Meershoek et al. for focusing on symptomatic patients, which our recommendations and the ESVS guidelines acknowledge. Recent Vascular Quality Initiative data further investigating CEA with proximal intervention reveal that in 182 symptomatic patients, 30 day S/D was 6%, significantly higher than 2.4% in symptomatic isolated CEA.[5] Regardless of symptomatic status, addition of a proximal intervention increased the S/D risk by 90%. By the way, outcomes of contemporary open surgical reconstruction for combined brachiocephalic and bifurcation disease are not worse! This carries a S/D rate of 5% (Wang LW, Tanious A, Chang DC, Conrad MF, Eagleton MJ, Clouse WD, submitted). It's hard to argue that the hybrid approach is overtly beneficial.

What about long-term considerations? Meershoek et al. admit concern. Of the 16 patients, one late TIA and one stroke were noted, not dissimilar to our experience with a freedom from stroke rate of 84% at five years. One restenosis was identified in the Utrecht's series. Yet, I still worry about restenosis and its implications. This occurred in 34% of our patients with a freedom from restenosis rate of 66% at five years and freedom from re-intervention rate of 81%! Not so simple. Makes one wonder if open revascularisation of tandem lesions in fit patients remains a superior, durable treatment?

What, then, do I make of the report by Meershoek et al.? I believe their description lends further credence; we don't fully understand how safe and efficacious this technique is. Thank goodness we rarely worry about tandem treatment. It's needed in $<$0.8% of CEAs. While I agree patient and lesion selection are paramount, durability remains unknown and thus, clear recognition of who will ultimately benefit is obscure. I also agree that preoperative imaging of the entire arch and carotid/intracranial arterial system is mandatory, cross clamp protection is critical and technical conduct important. This experience illustrates that excellent surgeons, with well thought through plans and insightful selection, can obtain good results, even in the face of symptoms and a difficult population. I still believe when done well in the right patient this approach is appropriate and good treatment. But I don't believe the potential neurologic morbidity is inconsequential. In the end, this hybrid approach to tandem lesions, exciting as it is in keeping things simple, may not be so simple.

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