LETTERS TO THE EDITOR

Regarding "Cost-effectiveness analysis of elective endovascular repair compared with open surgical repair of abdominal aortic aneurysms for patients at a high surgical risk: A 1-year patient-level analysis conducted in Ontario, Canada"

A 1-year economic evaluation study comparing endovascular aneurysm repair (EVAR) with open surgical repair (OSR) for the management of abdominal aortic aneurysms (AAAs) in patients at a high surgical risk supported that EVAR may be a cost-effective therapeutic option for high-risk patients undergoing elective AAA repair (total average 1-year costs: $34,146 vs. $34,170, respectively; P = not significant).[1] Compared with OSR, EVAR was associated with lower initial hospitalization costs ($31,181 vs. $28,139, respectively; P = not significant) but significantly higher follow-up medical expenses at 1 year ($2,171 vs. $5,172, respectively, $P < .05$).[1]

A possible limitation that may lead to the support of incorrect and/or biased conclusions is the duration of this study (1 year).[1] This may already be suspected from the comparison of the 1-year follow-up medical expenses; although the initial hospitalization expenses were not significantly different for the 2 procedures, EVAR had considerably higher 1-year follow-up costs.[1]

The cost-effectiveness of EVAR may be hampered by the development of long-term complications (e.g. endoleaks, stent migrations, graft-limb thromboses, and graft stenoses).[2] An extensive systematic review and comparative assessment of the 2 procedures for the elective repair of AAAs showed that a large percentage of the complications following EVAR occurs after the first year.[2] For example, although the incidence of type I endoleaks at 1 year was 3.5% (range, 0-14%; 13 studies [n = 2,544 patients]), the same incidence rose to 6.7% (range, 0%-21.5%) beyond the first year (18 studies [n = 7,848 patients]).[2] Similar results were reported for stent migration rates; although the 1-year stent migration rate was <1% (3 studies [n = 1,599 patients]), 4.4% of the patients demonstrated stent migration >1 year following EVAR (range, 1.7%-18.9%; 8 studies [n = 7,027 patients)].[2] Finally, whereas the 1-year incidence of graft-limb thrombosis was 2.5% (range, 0%-11%; 11 studies [n = 1,657 patients]), this incidence increased to 3.8% (range, 1.9%-6.1%; 8 studies [n = 6,602 patients]) after the first year.[2]

Another issue which increases the long-term costs of EVAR is the need for long-term (if not life-long) surveillance.[3] A study comparing the follow-up costs of patients undergoing EVAR vs. OSR for elective AAA repair showed that not only is EVAR more expensive at the 1-year follow-up ($17,640 vs. $14,122, respectively; $P < .001$), but also that this cost discrepancy increases with a longer follow-up period (average follow-up cost per year: $999 vs. $55, respectively; $P < .001$).[3]

In high-risk patients undergoing elective AAA repair, EVAR is probably associated with improved mortality rates compared with OSR (1-year all-cause mortality rates: 7.1% vs. 17.3%, respectively; $P = .04$).[1] However, there is compelling evidence[2-4] suggesting that, after taking into consideration the need for long-term surveillance, EVAR may not be as cost-effective as OSR for the management of patients undergoing elective AAA repair, including those individuals at a high surgical risk.

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Reply

In this 1-year Canadian study among high-risk patients, the 1-year medical costs were similar between endovascular aneurysm repair (EVAR) and open surgical repair (OSR) ($33,311 vs $33,352, respectively) while the 1-year mortality rates were significantly lower in EVAR patients (7.1% vs 17.3%). Based on bootstrap techniques to deal with sampling uncertainty, the probability of EVAR being cost-effective was 0.76 and 0.9 if society was willing to spend $50,000 per life year gained (LYG) or $100,000/LYG, respectively.[1]

In a sensitivity analysis, we extrapolated the 1-year mortality rate observed in our trial to a 5-year time horizon. We assumed long-term routine follow-up costs to EVAR only and several re-intervention rates (5%, 10%, and 20%) in EVAR patients to reflect an increased risk of long-term complications following EVAR. We also used different assumptions regarding mortality convergence. In the least favorable scenario (convergence of mortality rate at 2 years and re-intervention rate of 20%), the incremental cost-effectiveness ratio of EVAR compared with OSR in high-risk patients was $14,968/LYG and $38,720/QALY. Based on these results, we concluded that "EVAR may be a cost-effective strategy in high-risk patients." Our conclusion also stated that "longer term data are needed to decrease the uncertainty associated with the results".[1]

We agree with Dr Paraskevas that it is very important to model the long-term costs and consequences associated with EVAR and OSR. We recognize, as outlined in the discussion, that our extrapolations to a 5-year time horizon did not fully take into account the development and management of long-term comorbidities and differences in quality of life. However, we believe that our assumptions were conservative and favored OSR (eg, no follow-up cost or need for re-intervention in OSR patients).

To evaluate the long-term cost-effectiveness of EVAR and OSR in Canada, the authors recently developed a 10-year Markov model based on a systematic literature review and Canadian cost data. Based on commonly cited threshold, EVAR was not found to be cost-effective compared with OSR.[2] However, this study, like other previous economic studies, was based on data from a mixed population of low- and high-risk patients. As such, these findings may not be generalizable to high-risk patients.

We also recently published a review aimed at evaluating trends over time in EVAR vs OSR. Included in this review were 84 comparative studies (57,645 patients) of which six were randomized trials and 78 were nonrandomized trials. Eight nonrandomized comparative studies specifically examined only high-risk pa-

tients (N = 684 patients). When compared with all patients (N = 75 studies), high-risk patients had lower odds ratio (EVAR/OSR) of cardiac, pulmonary, and renal problems. Lower rates of type I endoleak or conversion were also observed in high-risk patients.[3] Other results indicated that EVAR outcomes had improved over time as previously reported by Frank et al.[4]

We continue collecting data on these high-risk patients to evaluate the midterm outcomes associated with EVAR and OSR, which will confirm if EVAR is cost-effective in high-risk patients based on longer-term data.

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Regarding "Symptomatic acute occlusion of the internal carotid artery: Reappraisal of urgent vascular reconstruction based on current stroke imaging"

Weis-Müller et al reported a single-center experience with surgical revascularization of acute extracranial internal carotid artery (ICA) occlusion in the acute stage.[1] In the Discussion section, they cited our previous article[2] and stated "Nowadays interventional teams are also dealing with acute ICA occlusion. The largest series was actually presented by a Taiwanese group, who treated 30 patients with acute cervical ICA occlusion by using endovascular techniques." After comparing with our results, they concluded that it is better to treat cervical ICA occlusion surgically. We think that there are a number of issues that need to be clarified.

Firstly, our series included endovascular recanalization attempts only in patients with either recurrent neurologic deficit or objective ipsilateral hemisphere ischemia after ICA occlusion documentation. Mean duration from occlusion documentation to the procedure was 179 ± 254 days (ranging from 56 to 1309 days).[2] Therefore, the ICA occlusions were "chronic", instead of "acute" in our report.

Secondly, as the authors mentioned, the success of surgery in acute carotid occlusion depends on the duration of the occlusion. Their success rate in recanalizing ICA occlusion was 86% in patients with occlusion duration less than 72 hours. In contrast, Paty et al[3] reported a low success rate of only 34% in 90 ICA occlusions within 14 days from symptom onset. Therefore, the role of surgery for ICA occlusion should be limited in the very acute stage. Our report, on the other hand, demonstrated an acceptable success rate of 73% in endovascular recanalization for chronic ICA occlusion, in which setting surgery has been proven ineffective.[4] With the advance of device and skill, endovascular recanalization for ICA occlusion, in both acute and chronic stage, may become the treatment of choice in the future.

Irrespective of these issues, Weis-Müller et al are to be acknowledged for applying diffusion/perfusion mismatch in selecting patients who may potentially benefit from urgent revascularization. We believe that using imaging modalities to identify viability/ischemia is crucial in clinical judgment for patients with ICA occlusion, in both acute[1] and chronic[2] stages, and further studies are mandatory to prove this concept.

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Reply

We thank Dr Kao very much for his interesting comment. Indeed, his series of 30 chronic carotid occlusions reopened by endovascular technique[1] cannot be compared with our series of 35 acute carotid occlusions reopened surgically.[2] After reading his article, we misinterpreted his series of carotid occlusions "acute" because time interval elapsed after carotid occlusion was not defined precisely. In the section "patient selection," he wrote: "the most recent cerebral infarction, if documented, should be at least 2 weeks before intervention." We concluded that his strategy is to wait 2 weeks after symptomatic carotid occlusion before starting with his intervention. Now we understand that his indication for intervention is different from ours. His intention is to treat recurrent neurological symptoms caused by chronic carotid occlusion. On the contrary, we want to reopen acutely occluded carotid arteries to safe brain from enlarging infarction and to prevent neurologic disturbances caused by carotid occlusion. Until recently, it was not generally accepted that reopening a chronically occluded internal carotid artery (ICA) is a safe way of enhancing cerebral perfusion, but his results show that endovascular technique may change the dogma. However, our approach is designed to take care for the acute stroke patient as early as possible after acute ICA occlusion in order to prevent the patient from chronic occlusion and further sequelae.