underwent open AAA repair and 44,376 age-matched and sex-matched controls with up to 20 years of follow-up. The large number of patients and the length of follow-up, as well as the validity of the registries used in the study, guarantee the soundness of the conclusion that AAA patients have a high risk of atherosclerotic events and death.

However, as the authors rightfully remark, the data are limited because the status of comorbidities was unknown. Whereas an AAA patient is more likely to have a heavier atherosclerotic burden than an age-matched and sex-matched control, this is not true for every single AAA patient. Individualization of the risk is important and may not be very difficult because there are several easy and reliable tools to do so, including the ankle-brachial index (ABI) and carotid ultrasound imaging.

In a study performed ~10 years ago, we showed that the presence of carotid stenosis >50% in patients undergoing elective open AAA repair was an independent predictor of long-term death from cardiovascular causes, associated with a 3.6-times increased risk, whereas the presence of echolucent plaques increased the risk by 3.8 times.[2] An ABI <0.9 was also an independent predictor of fatal cardiovascular events, associated with a 2.8-times increased risk.

On the basis of these observations, we suggested that AAA may be divided into two pathologic entities: one with AAA as a local manifestation and one with AAA as part of generalized atherosclerosis. The long-term course differs in these two groups: AAA patients with substantial atherosclerosis are at increased risk of cardiovascular events, whereas it is doubtful whether AAA patients without other evidence of atherosclerosis are at increased risk compared with age-matched and sex-matched controls.

Although the best model that adequately fits the data is sometimes cumbersome, relative risk computation in means of estimating hazards ratios from proportional hazard models should initially account for possible confounders in order to sufficiently warrant adjustment for them in the analysis.[3] In the study by Eldrup et al,[1] unadjusted hazard ratios might have led into misinterpretation of the results, because patients operated on for AAA were not matched for known atherosclerotic factors to the general population, with the exception of previous myocardial infarction and stroke. Moreover, the inclusion of patients with advanced atherosclerotic disease, such as the 351 patients operated on for both peripheral occlusive disease and AAA, may destruct model fitness and deteriorate the clinical appropriateness of the final results.

Pooling data may be a feasible strategy to increase the size of the effect estimate. However, misestimating might negatively affect clinical decision making or policy development. Subgroup analyses can give more unbiased estimates for specific populations and might eventually provide clinicians more insight toward better treatment of patients.

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REFERENCES

1. Eldrup N, Budtz-Lilly J, Laustsen J, Bibby BM, Paaske WP. Long-term incidence of myocardial infarct, stroke, and mortality in patients operated on for abdominal aortic aneurysms. J Vasc Surg 2012;55:311-7.
2. Liapis CD, Kakisis JD, Dimitroulis DA, Daskalopoulos M, Nikolaou A, Kostakis AG. Carotid ultrasound findings as a predictor of long-term survival after abdominal aortic aneurysm repair: a 14-year prospective study. J Vasc Surg 2003;38:1220-5.
3. McNutt LA, Wu C, Xue X, Hafner JP. Estimating the relative risk in cohort studies and clinical trials of common outcomes. Am J Epidemiol 2003;157:940-3.

http://dx.doi.org/10.1016/j.jvs.2012.04.063

Reply

Thank you for the insightful response to our article. We fully agree that the atherosclerotic burden in patients with aortic aneurysm disease is probably not equal. Accordingly, we believe that aneurysm disease is a systemic tissue disorder rather than an atherosclerotic manifestation.[1] The two diseases do, however, share many common risk factors, which perhaps explains the coincident manifestation. It is important to note, however, that no study to date has proven that primary prevention in patients with an asymptomatic reduced ankle-brachial index will benefit from aspirin.[2] It is also becoming more apparent that in patients with asymptomatic carotid plaques, the risk of major vascular events has been significantly reduced after the introduction of antithrombotics, statins, and increased antihypertensive medical treatment.[3]

In substance, we agree that the presence of a reduced ankle-brachial index or a carotid plaque is associated with a higher cardiovascular risk profile. However, no studies have tested whether treatment in patients with abdominal aortic disease is not beneficial in patients without these two disease markers. Recognizing that even after inclusion of the ankle-brachial index in risk stratification models for otherwise healthy people, the discrimination only increases from 60% to 65% in men,[4] with the consequence of then incorrectly holding back prophylactic treatment in up to 35% of the patients stratified.

This is also suggested in our data, where only marginal changes in risk of stroke, myocardial infarct, or all-cause mortality are evidenced if all patients with previous stroke or myocardial infarct are taken out of the analysis.

Finally, we agree that the inclusion of the 356 patients treated for peripheral occlusive disease and aneurysm at the same time could potentially have biased the conclusions. With >2000 myocardial infarcts and 1000 strokes, however, it is unlikely that these 356 patients all should have an event and thereby render a false conclusion.

Until better models exist, we will still argue that all patients with an abdominal aortic aneurysm should receive treatment with both antithrombotics and statins.

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REFERENCES

1. Nordon IM, Hinchliffe RJ, Loftus IM, Thompson MM. Pathophysiology and epidemiology of abdominal aortic aneurysms. Nat Rev Cardiol 2011;8:92-102.
2. Fowkes FG, Price JF, Stewart MC, Butcher I, Leng GC, Pell AC, et al. Aspirin for Asymptomatic Atherosclerosis Trialists. Aspirin for prevention of cardiovascular events in a general population screened for a low ankle brachial index: a randomized controlled trial. JAMA 2010;303:841-8.

3. Naylor AR, Gaines PA, Rothwell PM. Who benefits most from intervention for asymptomatic carotid stenosis: patients or professionals? Eur J Vasc Endovasc Surg 2009;37:625-32.
4. Ankle Brachial Index Collaboration, Fowkes FG, Murray GD, Butcher I, Heald CL, Lee RJ, et al. Ankle brachial index combined with Framingham risk score to predict cardiovascular events and mortality: a meta-analysis. JAMA 2008;300:197-208.

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Regarding "Cost implications of more widespread carotid artery stenting consistent with the American College of Cardiology/American Heart Association guideline"

The recent article by Paraskevas et al[1] brings important attention to the cost implications of more widespread replacement of carotid endarterectomy (CEA) with carotid artery stenting (CAS). They reported charges instead of costs, and charges are difficult to interpret in the Medicare population because cost and payment are not the same as charges. Charges are an indicator of what the hospital would like to be paid, but in the United States, this does not necessarily predict what the hospital will be paid. Also, charges are proportional to cost but are not the same as cost.

Almost simultaneous to the publishing of that article, we published a report comparing costs and payments for carotid endarterectomy (CEA) and carotid stenting (CAS) in asymptomatic Medicare patients.[2] We noted that the cost of CAS was about $5000 higher than the cost for CEA,[2] which is more tangible than a $12,000 difference in charges. The charges and cost are indeed both higher, but then we need to factor in the payments. The difference in Diagnosis-Related Group payment for uncomplicated cases is about $4000 higher for carotid stenting,[2] so that is what the government's incremental cost would be for each Medicare patient converted to CAS.

Because each hospital tends to lose ~$1300 on a CEA and ~$3200 on a stent,[2] the average net increase in loss to the hospitals for each Medicare patient converted from CEA to CAS is $1900. We can thus conclude that if an additional 50,000 patients per year were to be switched from CEA to CAS so that the percentages of CEA and CAS became similar (ie, 50% for CAS and 50% for CEA), the hospitals would lose an additional $95 million each year, despite Medicare making an additional $200 million in payments to the hospitals. These facts further highlight the conclusion of Paraskevas et al[1] that diverting a large number of patients to stenting has a huge economic impact.

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Dr Cloft is the Primary Investigator at an enrolling site for the SAPPHIRE (Stenting and Angioplasty with Protection in Patients and HIghRisk for Endarterectomy) registry sponsored by Cordis Endovascular.

REFERENCES

1. Paraskevas KI, Moore WS, Veith FJ. Cost implications of more widespread carotid artery stenting consistent with the American College of Cardiology/American Heart Association guideline. J Vasc Surg 2012;55:585-7.
2. McDonald RJ, Kallmes DF, Cloft HJ. Comparison of hospitalization costs and Medicare payments for carotid endarterectomy and carotid stenting in asymptomatic patients. AJNR Am J Neuroradiol 2012;33:420-5.

http://dx.doi.org/10.1016/j.jvs.2012.04.069