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Elective repair of abdominal aortic aneurysm: the evidence is in but the jury may still be out.

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We would like to congratulate Antoniou *et al.* for their timely overview and metaanalysis, comparing long-term outcomes of the randomised trials of open surgery repair (OSR) versus endovascular aneurysm repair (EVAR). The strengths of this review are the inclusion of long-term results from OVER trial, published so recently, and early results from a small, but previously unidentified, Chinese randomised trial. (1,2)

As with previous reviews and meta-analyses, the authors again found that the survival and other advantages of EVAR are mainly short-term and that beyond 4 years these advantages have faded. In the longer-term, aneurysm-related mortality, reinterventions, secondary rupture and subsequent death occur more often in EVAR patients. (1,3–5) However, over full follow-up to 12 years or more, overall survival was similar between the randomised groups, a consistent finding across the 3 trials (DREAM, EVAR-1 and OVER) with long-term follow up. In trials of elective procedures, disease-specific mortality is probably of greater importance than all-cause mortality. (6) For up to 4 years, aneurysm-related mortality was lower in the EVAR groups but after this time, particularly after 8 years aneurysm-related mortality was higher in the EVAR groups versus the open repair groups, a finding which has highlighted issues about both the durability of EVAR and post-EVAR surveillance.

The analyses of secondary outcomes such as secondary aneurysm rupture and re-interventions are not complete, with data either not available or not extracted from all trials with long-term follow up and no hazard ratios are presented for the long-term rates of reinterventions and secondary aneurysm rupture. Therefore, the data presented for these results might be misleading. (7) Added to this, neither patients nor clinicians were blinded to the treatment allocation. Therefore, patients in the EVAR groups, and their treating clinicians, could become more nervous about the long-term durability of their endograft and seek the reassurance of surveillance more often and more regularly than those in the OSR groups, which could introduce bias into the reintervention rate. Indeed, the EVAR-1 trial provided some evidence for the more intensive long-term follow-up of EVAR patients.

Two important issues were not addressed. First can these results can be applied to women. Even though women were under-represented in these included studies (far less than the overall proportion of women among patients undergoing AAA repair, ~16%), a sub-group analysis by sex and would have been welcome and provided important new information. Second, the health economic outcomes, including quality of life, were not addressed in the meta-analyses. Although meta-analysis of randomised trials provides the highest level of clinical evidence, the included studies are from an early phase of the EVAR era. It is often argued that the longer learning experience, improve endograft technology with more conformable devices and the evolution of hybrid suites with much improved intra-operative imaging would have altered the results of the trials, providing better durability for EVAR. Outside randomised trials, comprehensive 10-year follow up of patients is unusual but this is what is needed to confirm such arguments. We also should remember that advances in anaesthesia, intensive care, minilaparotomy and enhanced recovery programmes could have improved the early outcomes of open repair. Other changes in clinical practice since the trials were conducted include common disregard of instructions for use for EVAR procedures, surveillance programmes based of risk stratification after EVAR and less interventional management of type 2 endoleaks. (8,9) Modelling studies are needed to assess the impact of these factors on health economic outcomes.

Finally, the meta-analysis focuses on outcomes selected by clinicians. Patient-centred care demands that the outcomes valued by patients are assessed. Patient-preferred outcomes are likely to include factors such as discharge directly back home, time to resumption of normal activities, quality of life etc. There has been no attempt to synthesise the quality of life data across the trials. In the future, with better educated patients, patient preferences will increasingly influence the selection of treatment options.

The evidence is in, peri-operative and early outcomes are better with EVAR but long-term outcomes are not and may even be worse. Proof, that with the ever-evolving changes in clinical practice, long-term aneurysm-related mortality, re-intervention rates and other outcomes are similar (or better) after EVAR versus OSR remains a challenge for the years ahead. Whilst most of the vascular surgical community think that verdict is clearly in favour of EVAR, the jury, which includes health service providers, may still be undecided.

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