

is mandated. We feel that aneurysm repair should not be undertaken in centres performing less than 50 cases per year, and ideally than annual caseload should approach 150.

Conflict of Interest/Funding

None.

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Part Two: The Case Against Centralisation of Abdominal Aortic Aneurysm Surgery in Higher Volume Centers

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Introduction

At first glance this might not seem like much of a debate. Over the last decade or so, proponents of centralisation of abdominal aortic aneurysm (AAA) surgery have amassed volumes of literature in support of their position, with much of this literature originating from the esteemed St. George's Vascular Institute.^{1–5} Their arguments are persuasive with their convincing evidence of a volume–outcome relationship with AAA surgery. This relationship is so intuitive to most surgeons, and so carefully demonstrated by the centralisation proponents, that it is become an almost indisputable motherhood type principle. That's all well and good when the debate remains an academic one, but when such centralisation strategies are implemented a closer and more practically relevant analysis is necessary. On further scrutiny this volume–outcome relationship is not as clear cut and persuasive as it might be at first glance.

Biases on both sides of the argument are obvious and pervasive. Not surprisingly, centralisation supporters tend to work at higher volume centres with favourable outcomes while those resisting centralisation efforts often work at lower volume centres, often with favourable outcomes. Centralisation of AAA surgery has occurred in several international jurisdictions with either a planned and data driven approach,⁶ or an unplanned approach by exclusion.⁷ In either instance the practical challenges of a centralisation strategy have outlined the complexity of the situation, rather than the simplicity of a simple volume–outcome relationship. So, before blindly following our colleagues who would advocate centralisation of AAA surgery, let's take a closer look at some of the intricacies, challenges, and possibly some negative effects that such a strategy would necessitate.

Volume–Outcome Relationship

When superficially examined this volume–outcome relationship with elective aneurysm surgery is simple, intuitive, and makes good common sense. We would hope that more experience results in better results, and it generally does.

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So why don't we move all aneurysm cases to those surgeons and centres already performing a lot of repairs and with even higher case volumes we'd expect even better results? Well, let's take a second look, it might not be as simple as that. In fact, two recent systematic reviews have questioned the existence, or at least the strength of such a relationship partially because of methodological challenges.^{8,9}

First of all, whose case volumes are we talking about? Conflicting studies claim that it's either the surgeon's experience,^{10,11} or the hospital's case volumes¹⁻³ that are the most important in driving improved outcomes. So which one is it? Is it either, or both? What about a busy surgeon with large aneurysm case load in a low volume hospital, or a low volume surgeon in a busy high volume regional hospital? What outcomes can a patient expect then? Secondly, what defines a high or low volume hospital or surgeon? Some investigators, including the St. George's group have advocated a specific threshold volume of elective repairs (30 per year),² while others have not.⁸ Is a simple case volume requirement all that is necessary to lower mortality rates?

Even such staunch volume—outcome proponents as the surgeons from St. George's have admitted that there may be more to the story. They now suggest that decisions regarding centralisation should not be based exclusively on case volume thresholds, but on quality of care indices.⁴ Although higher case volumes may be related to improved outcomes, a causal relationship may not exist. It might be the addition of other quality of care indices that increased case volumes permit that actually result in better patient outcomes. For example, in an analysis of in-hospital mortality following elective aneurysm repair in California hospitals, the contribution of case volumes and other quality of care indices was explored.¹² A 51% reduction in mortality was observed in hospitals that implemented a policy of perioperative beta-blocker usage while there was no improvement in mortality with hospitals meeting a case volume threshold. There are other instances and examples where the achievement of quality of care indices was more successful in improving patient outcomes than performing a certain number of aneurysm repairs.¹³

So upon further review, a quality of care—outcome relationship probably will be more causal than any volume—outcome relationship. Any positive volume—outcome relationship likely reflects certain best practices and quality of care standards that come with experience, while negative volume—outcome relationships reflect that these practices aren't guaranteed in higher volume settings, nor are they limited to the busiest hospitals and surgeons.

Urgent Aneurysm Care

With centralisation of aneurysm surgery more patients with ruptured AAA's will require transfer to regional centres. These regional centres will need to be sufficiently resourced to meet these increasing demands for emergency surgery, both from the human resource and the infrastructure standpoint. In some areas this increased demand might be difficult to accommodate, including the United Kingdom (U.K.) where at one point 25% of tertiary academic centres declined urgent referrals if there was no intensive

care unit bed.¹⁴ This infrastructure and resource discrepancy will require attention prior to even contemplating any formal centralisation process.

The volume—outcome relationship with ruptured aneurysms has been explored, but not to the same extent as with elective cases. Conflicting evidence exists that either supports^{1,10} or refutes^{2,15} the existence of this relationship with ruptured aneurysms. In fact two of these conflicting papers were penned by the St. George's group. A meta-analysis revealed an association between higher volumes and lower mortality rates following ruptured aneurysm repair,¹ while an analysis of Hospital Episode Statistics² failed to show such an association. What are we to think?

Regardless, let's assume that increased case volumes might result in improved outcomes with ruptured aneurysms. There still is a price to pay for centralisation. Ruptured aneurysms pose a time sensitive, life threatening problem that requires expedient attention. The clock is ticking and any delay in treatment can result in sudden death. Three recent North American studies have reviewed the effect of patient transfer on the chance of survival in patients with ruptured aneurysms.¹⁶⁻¹⁸ All three concluded that although transfer delayed definitive surgical repair, it did not adversely affect a patient's chance of survival. One of these studies was from our centre¹⁷ and on first review these papers may offer support for centralisation of ruptured aneurysm services. However, these reviews included only those patients who survived transfer to the treating facility. The patients were preselected to exclude those unstable patients who died prior, or during transfer. Who's to know whether any of those patients would have survived if offered repair at their local hospital? A similar concern was expressed in the U.K. when in one study less than half of all patients with ruptured aneurysms were transferred to a regional vascular unit, and only a minority of nontransferred patients received an attempt at surgery at their local hospital.¹⁹ As a result, the authors were correctly concerned that centralisation of vascular services could lead to inappropriately low operative and survival rates in patients who are not transferred to regional vascular units.¹⁹

So, with ruptured aneurysms centralisation of surgical care might not be the answer. Patients that survive transfer and subsequent repair are likely those that would have survived repair at their local hospital, and those who don't survive transfer may have survived if treated at their initial institution. However, although very important, the actual aneurysm repair is only one component of the patient's treatment. Expert anesthesia and intensive care (therapy) unit (ICU/ITU) attention is also necessary to ensure survival. Perhaps a strategy of urgent surgical repair at the local hospitals followed by transfer to higher volume regional units for ICU/ITU care would reflect the need for timely surgical attention and expert, and expensive, postoperative care. This strategy has not been widely or formally evaluated to date.

Patient Preference

One of the primary arguments in favour of centralisation is based on the negative correlation between case volume and the risk of perioperative mortality. Although, to surgeons, it's logical that patients would prefer a lower risk of

mortality, this may not always be the case. Patient decision making can involve a number of factors, and surgeons' dependence on mortality risk in making decisions can border on the paternalistic. From the patient's perspective there may be benefits to local care including convenience, proximity to personal support systems and continuity of care with familiar physicians that could outweigh the promise of lower perioperative mortality.²⁰ This area of investigation is underexplored, but in one of the few relevant studies, 45% of American patients would prefer local surgery for their pancreatic cancer even if the mortality risk was double that of a regional centre.²¹

With aneurysm surgery the conclusions of such studies are mixed, and probably reflect the questions being asked. On the one hand, 92% of patients were willing to travel at least an hour to have their aneurysm surgery at a centre promising lower mortality rates and the possibility of endovascular repair.²² However, in another study from the U.K. many patients were found to prefer local care and would accept the higher mortality rates that such a decision could incur.²³ One explanation for the different results rests in the patient population being assessed. It's not surprising that a mainly urban population in a large metropolitan area, such as London, U.K., might accept a travel distance for care when it represents an hour tube ride,²² whereas a similar travel time in a rural environment would require more effort.²³ The latter situation more accurately represents what North American patients face as they more commonly travel greater distances, across a larger geographic area, for tertiary and quaternary surgical care, compared to their European counterparts.

Regardless, by restricting the centralisation argument to purely physician designated outcome measures, we fail to consider other, just as important in some instances, socio-economic patient specific factors. Without a doubt these will have different implications for rural and urban populations and for patients in different jurisdictions, but should be considered none the less, prior to blindly adopting a centralisation strategy. After all, our patients are the ones who inevitably benefit, or suffer, from such health policy decisions.

Health Care Delivery

Although the current debate includes AAA surgery, the impact of centralisation on the provision of general vascular surgery care needs to be considered. Abdominal aortic aneurysm repair, whether it is open or endovascular, remains the defining procedure of our specialty and the staple of vascular surgeons' practice. In many countries, any hospital that during a centralisation initiative loses its ability to perform AAA repairs would likely lose the bulk of its vascular surgery coverage as vascular surgeons would shift their practices to the centres designated to provide aneurysm care.^{24,25} Carefully coordinated outreach programs can maintain some premise of vascular surgery services at these service depleted hospitals, but coverage will be primarily on an outpatient clinic basis during daytime hours.²⁴

It is unclear whether a centralisation strategy would result in financial or budgetary benefits. It's predicted that, at best, there could be modest financial benefits with centralisation with higher quality service provided at a similar cost-per-case.^{24,25} Even with a successfully coordinated centralisation strategy for AAA surgery patient benefit might be disparate and inversely related to the distance from the hospital. This principal of "distance decay" describes the under utilisation of health services by patients living in remote and rural areas.²⁶ Although unavoidable to a certain extent, several strategies have been suggested to minimize the negative effects of centralisation on these patients, including enhancement of outreach programs, information technology, rural transport systems and equitable funding strategies.²⁶ Such strategies will be necessary such that all patients benefit from centralisation to differing degrees, or at least aren't harmed.

Conclusions

I don't doubt that a volume–outcome relationship does exist in some instances involving aneurysm care. However, case volumes don't necessarily equate with care quality in as simple a linear fashion as we might hope. Therefore, it is too simplistic for important health care delivery decisions, such as centralisation, to depend solely on case volumes, whether it be at the surgeon or the hospital level. Patient outcomes and other quality of care indices should drive such decisions and also serve to assess their effects, and need for revision, on an ongoing basis.

Of course, any service consolidation decision will have ramifications in specific clinical scenarios, i.e. ruptured aneurysms, and with certain patient populations, i.e. rural patients, that will require further exploration. These discussions should include health care providers and policy makers, in addition to patients. After all, they are the ones who will benefit, or suffer, as a result of these decisions.

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EDITORS’ COMMENT

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Our debaters have examined the volume-outcome relationship with abdominal aortic aneurysm repair (AAA) and both sides of the centralization of care argument. Several unanswered questions warrant further exploration.

What is the role of an individual surgeon’s annual caseload? Following a review of the literature, Henebiens et al.¹ failed to demonstrate a hospital volume threshold for safely performing open AAA repair. A possible explanation is that the majority of publications analyzing volume-outcome relationships for complex procedures (ie, AAA repair) have focused on annual hospital case volumes and not individual surgeons’ annual caseload. A meta-analysis by Young et al.² did suggest an association between high surgeon caseload and decreased mortality for elective open AAA repair but the potential intrinsic role of hospital volume in this relationship was not analyzed. The Finnvasc study group³ did observe a correlation between surgeon experience and mortality rate with elective AAA repairs. However, there was no association between hospital volume and mortality in elective or ruptured AAA operations. A recent paper from McPhee et al.⁴ addressed this issue and demonstrated again that considering case-volume, the main factor driving the mortality

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