TRANS-ATLANTIC DEBATE

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Debate: Whether an endovascular-first strategy is the optimal approach for treating acute mesenteric ischemia

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Acute mesenteric ischemia continues to be a life-threatening insult in often-elderly patients with many comorbidities. Recognition and correct diagnosis can be an issue leading to delays in therapy that result in loss of bowel or life, or both. The basic surgical principals in treating acute mesenteric ischemia have long been early recognition, resuscitation, urgent revascularization, resection of necrotic bowel, and reassessment with second-look laparotomies. Endovascular techniques now offer a less invasive alternative, but whether an endovascular-first or open surgery-first approach is preferred in most patients is unclear. Our discussants will attempt to clarify these issues. (J Vasc Surg 2015;62:767-72.)

PART I: AN ENDOVASCULAR-FIRST STRATEGY IS THE OPTIMAL APPROACH FOR TREATING ACUTE MESENTERIC ISCHEMIA—PRO

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This debate is to be as evidence based as possible. The first point to establish, however, is that there have been no randomized controlled trials comparing an endovascular-first vs an open surgery-first strategy for the treatment of acute mesenteric ischemia (AMI) as we have for ruptured aortic aneurysm repair.[1] Given that AMI is relatively uncommon and usually presents as an emergency, there probably never will be a randomized controlled trial to study this issue. However, according to the Grading of Recommendations Assessment, Development and Evaluation (GRADE) Guidelines,[2] data from observational studies can be valuable, provided certain criteria are met, including that the risk of bias must be minimized, data should be consistent, and confounding factors need to be controlled for.

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Most published reports are single-center series, with all the methodologic problems related to that type of study design, in particular, publication bias. A recent example is from Kuopio University Hospital in Finland, which reported a 5-year consecutive series of patients with AMI. During this time they applied an endovascular-first strategy, which was feasible in 88% of cases.[3] Mortality was a commendable 32%, and in half of the cases where endovascular therapy (EVT) failed, surgical bypass was ultimately successful. These survival rates compare favorably with the experience of my opponents in this debate (in another single-center series), who reported 30-day mortality rates of 62% after the treatment of acute arterial thrombosis and 59% after arterial embolism, where a policy of open surgery-first was the primary treatment strategy.[4]

One important group of patients with AMI is those who develop acute-upon-chronic ischemia. In another publication from Dr Endean's group on the treatment of chronic mesenteric ischemia patients, they report high mortality rates in patients in whom a vein graft was used as the bypass conduit of 16% vs 5% amongst those who had a prosthetic graft ($P = .039$).[5] Patients in whom a vein graft was used underwent emergency surgery more often (16% vs 4%; $P = .012$) and had a contaminated surgical site more often (30% vs 7%; $P = .001$). The authors concluded that the inferior results after venous bypass might have been prevented had the revascularization taken place more expeditiously. A venous mesenteric bypass is known to be more prone to kinking and occlusion. Interestingly, however, the authors did not mention a natural alternative in this situation, which would be antegrade or retrograde[6] stenting of the superior mesenteric artery (SMA).

Of greater practical interest than single-center series is the analysis of population-based outcomes, which generally

avoid the problem of publication bias. Swedvasc, the Swedish National Registry for Vascular Surgery, was founded in 1987 and captures >90% of all vascular surgical procedures in a country with 9.5 million inhabitants. Swedvasc has published two reports on outcomes after revascularizations of the SMA for AMI for the periods 1987 to 1998[7] and 1999 to 2006.[8] Overall, total surgical activity increased fourfold from 1999 to 2006, while the number of endovascular revascularizations increased sixfold. Complete case records were analyzed in 60 and 163 patients from the two periods, respectively.[7,8] Overall mortality decreased from the first period to the second, but this decrease was only observed in patients treated by EVT. Thirty-day and 1-year mortality rates were 42% versus 28% ($P = .03$) and 58% versus 39% ($P = .02$) for open and endovascular surgery, respectively. Long-term survival was also better after EVT than after open surgery ($P = .02$).

Could this difference be explained solely by differences in case-mix? Probably not, because the number of bowel resections performed at the time of revascularization was similar for the two cohorts, and a multivariate analysis showed primary EVT was independently associated with survival (odds ratio, 3.7; 95% confidence interval, 1.2-11.6; $P = .025$). As was also observed in Kuopio, Finland, one of the main reasons why a policy of primary EVT first was successful was that most patients with a failed EVT underwent a successful open revascularization.

Further analyses of the Swedvasc Registry are ongoing, but data from the latest period (2009-2015) are not yet available. It has been noted, however, that from 2009 onwards, more than half of all arterial procedures for AMI were endovascular, and that an endovascular-first strategy seems to be more advantageous for patients with SMA thrombosis than for patients with embolic occlusions. Swedvasc observed no significant difference in mortality after embolic occlusions (37% vs 33%), whereas the mortality rate was significantly higher after open than after EVT for thrombotic occlusions (56% vs 23%).[9]

In another large population-based registry reporting from the National Inpatient Sample in the United States, a similar time trend and similar differences in results were reported by our North American colleagues.[10] The National Inpatient Sample database includes 20% of inpatient hospital episodes from ~1000 United States hospitals and is considered to have high-quality data. Among 679 AMI patients treated between 2005 and 2009, 514 (76%) underwent open and 165 (24%) underwent EVT. The proportion of AMI patients who underwent endovascular repair increased from 12% in 2005 to 30% in 2009. Mortality was 39% after open compared with 25% after endovascular revascularization ($P = .006$). Amongst survivors, the proportion of patients who needed total parenteral nutrition was also significantly higher after open repair than after EVT (24% vs 14%; $P = .025$).

Although level I evidence is lacking, observational data like these are quite compelling, but why might an EVT-first strategy be preferable in patients with AMI? There are several possible explanations:

First, it may be a better damage control strategy to opt for EVT first (usually under local anesthesia) than opting for an emergency laparotomy under general anesthesia. Avoiding prolonged general anesthesia in these frail patients may be an important part of damage control, as has been observed in patients undergoing ruptured AAA repair.[11]

Second, EVT invariably involves a completion angiogram to ensure that the revascularization has been completed to the best possible standard. The necessity for adjunctive procedures, such as percutaneous transluminal angioplasty or thrombolysis, as a consequence of the completion angiography is not uncommon. Completion angiography could, of course, be performed also after open surgery, but an analysis of the contemporary Swedish experience showed it had not been performed in a single patient.[8]

Third, EVT is, of course, a minimally invasive procedure, which may explain higher success rates when treating elderly, frail patients with small marginal physiological reserves.

Paradoxically, it seems to be a greater challenge to get AMI patients treated (in the first place) than to debate about what is the "ideal" revascularization strategy. With modern multislice computed tomography imaging technology, the ability to diagnose acute SMA occlusion should not be difficult, but the diagnosis has to be suspected first. In the United States study, 4665 of 23,744 patients presenting with AMI underwent some form of treatment, but only 679 patients underwent an open or endovascular revascularization, constituting only 3% of the entire cohort and 15% of those treated.[10]

We know that ~70% of the patients with acute SMA occlusion will require revascularization to survive[12] and that the remaining 30% can be saved by bowel resection only, yet only a very small proportion of AMI patients will receive this live-saving treatment. There are no parallel data from Sweden or any other European country, but revascularization strategies appear to vary >10-fold between centers with high and low surgical activity, despite similar populations, suggesting that a similar problem exists in Europe (unpublished data).

Venous thrombosis is the cause of ischemia in approximately one in seven patients with AMI, and possibly one in four according to my opponent's experience.[4] Primary treatment with heparin, followed by catheter-directed thrombolysis if the clinical picture does not improve, is the treatment of choice despite the lack of comparative data. Quoting my opponent, who wrote, "There are anecdotal reports of venous thrombectomy, but this has not shown improved outcome and is generally not recommended."[4]

In our experience, the best route for thrombolysis is transjugular and through a transjugular intrahepatic portosystemic shunt, improving outflow.[13,14] Furthermore, in AMI after aortic dissection, thoracic endovascular aortic repair and adjunct endovascular methods are the preferred methods of revascularization, which is undisputable.[15]