Device discordancy: Lost cords, quick-fix seekers, quality, and ethics

Lars G. Svensson, MD, PhD

Our modern world is so accustomed to instant gratification and efficiency with the accompanying expectations of little effort or pain that people will often choose the easy path at the cost of a poorer outcome over the long term. There are many examples of these choices by both consumers and patients, particularly when they are not fully informed, including use of catheter-based devices rather than open procedures.

In this issue of the Journal, Flores and colleagues1 present their experience with combined open aortic arch repair and descending thoracic aortic stenting in the hopes of avoiding a second procedure, either open or endovascular, to treat patients more speedily. The results are sobering. First, their circulatory arrest times must have been prolonged, thus risking greater brain injury to the patients. Second, postoperative spinal cord injury occurred at an unacceptably high percentage of 24%. The finding of an increased complication rate of spinal cord injury is not new. For example, acute aortic dissection repair with replacement of the entire aortic arch (a questionable procedure except in rare cases) and stenting of the descending aorta has resulted in a similarly high rate of lost spinal cord function.2-7 Furthermore, in our early experience with the modified inverted elephant trunk insertion method in 84 patients,8 we noted that too long of an elephant trunk graft in the descending aorta resulted in complete paraplegia in 1 patient and paraparesis in 2 patients. This led to our recommendation that an elephant trunk graft should be no longer than 10 to 15 cm.

Why then is stenting or a long elephant trunk graft a problem? The obvious answer is that the intercostal arteries are occluded by the graft material, and the cord becomes dependent on collateral circulation.9 Second, it is likely that pump-related nonpulsatile hypotension and perioperative hypotension are inadequate for sufficient perfusion of the spinal cord in many patients who are dependent on their collateral arteries.9,10 In addition, it is worth noting that the squeezing of atheroma, somewhat akin to the texture of toothpaste, into intercostal arteries by stents could likely cause embolic obstruction of the blood supply. Whether these factors completely explain the high risk of paralysis when stenting is combined with cardiopulmonary bypass cannot be determined from this study.

In our review of 832 descending aortic open repairs,11 paralysis occurred mostly in those patients who underwent replacement of either the entire descending aorta or the distal third or in those patients who had previously undergone abdominal aortic replacements. In 132 patients with descending aortic repairs, Borst and colleagues12 found paralysis was higher in patients with replacement below T8. Similarly, others13-16 noted a higher paralysis rate with distal descending aorta replacements.

It appears that these hard lessons are now being relearned for descending aortic stenting. The Stanford group17 reported in 2004 that the risk of paralysis increased with either distal descending aortic stents or combined descending aortic stents in patients with previous aortic abdominal replacements. In our experience with descending aortic...
and thoracoabdominal stenting, we have also noted that distal 
descending stents are associated with increased paralysis. Of 
particular concern is that if the hypogastric arteries are not 
patent, then the risk is considerably increased, probably be-
cause the cruciate and iliolumbar blood supply to the cord is 
interfered with. Also of concern is the rate of paralysis in 16 
patients in whom we have performed thoracoabdominal type II 
and III aortic stenting procedures where the intercostal and 
lumbar arteries have also been occluded. In these latter pa-

tients, the paralysis rate was 12.5%. The same applies to our 
series of 22 patients who had second-stage endovascular stent-
ing of elephant trunk grafts, with 3 (13.6%) patients experi-
encing transient paraparesis.

The greater risk with occlusion of arteries between T7 and 
L2 is clearly related to the importance of adequate blood 
supply to the spinal cord in this particular segment, including, 
among others, the largest of the radicular arteries, the arteria 
radicularis magna, also know as the artery of Adamkiewicz. 
Thus the poor findings by Flores and colleagues, including an 
increased risk of paralysis in patients with either previous 
abdominal aortic replacements or stents below T7, should not 
come as an unexpected disappointment. Indeed, for stents 
below T7, an astounding 62.5% had loss of cord function.

The 3% to 13% risk of paralysis with descending aortic 
stents (not inserted through the arch) is no better than the 
3.8% risk reported by us10 for descending and thoracoab-
dominal repairs or the 3% to 5% for descending repairs 
reported by several different groups, including mortality 
rates of 3% to 5%. Therefore these must be the 
standards, or better, that should be met for elective descend-

ing endovascular stents. Clearly, particularly for distal de-
scending aortic stents, whether the problems of occluding 
terminal and lumbar arteries with stents will ever be 
overcome still requires considerable research. Potentially 
bypassing the intercostal and lumbar arteries by means of open 
procedures detracts from the aims of stenting procedures 
that do not require the chest to be opened.

Of further concern, patients with stents require yearly fol-

low-up with CT scans and concurrent radiation for a lifetime 

because of the risks of various types of endovascular leaks, 
stent fractures, or graft migrations. In a sense, one disease 
process has been replaced by another. There is also no reason 
to suspect that thoracic stent grafts will perform any better than 
adominant stent grafts, and similarly, on the basis of previous 
reports and extrapolations from the Stanford data, a 50% 
five-year event-free survival after thoracic stent replacement 
can be expected. Thus before the endovascular procedures, 

patients need to be fully informed that they will require a 

life of careful follow-up and that in those patients who 
have a life expectancy of more than 5 to 10 years, it is likely 
they will require multiple repeat procedures. Indeed, in an 
independent audit of stented patients in France, 45% of 

patients had an event in the first year, excluding deaths.

Certainly some of the subgroups of descending aortic 

stenting have been shown to do well with thoracic aortic 
stent grafting in comparison with open procedures, such as 
traumatic ruptures of the aorta, saccular aneurysms, 
penetrating ulcers, second-stage elephant trunk procedures 
in high-risk patients, ischemic complications related to 
distal dissection, ruptures, and localized aneu-


rysts. Nonetheless, the natural history of medial degenerative 

aneurysms is such that the aorta increases in both size and 

length, and hence it is logical to conclude that over time, 
stent grafts will likely have problems until we have devel-

oped more securely anchored and advanced material grafts.

Therefore as practicing surgeons we are faced with dis-

cordance between what we know as far as quality of out-

come and a patient’s desire for less pain. Our ethical dilem-

mas are as follows: Should we bend to the seekers of “quick 

fixes”? How involved should we be with companies de-

veloping and promoting new devices? Can we afford to lower 

our academic standards and not perform prospective ran-

domized studies, despite pressures to not do them? How are 

we going to maintain our ethical values yet deal with the 

developing “turf” wars over thoracic aortic stenting?

How we answer these questions will influence how 

we approach the burgeoning “percutaneous” transfemoral-

based valve and other device-related procedures. Every 

practicing surgeon accustomed to a 1% mortality rate and 

1% stroke rate for coronary artery bypass or valve surgery 

with excellent long-term outcome of patients will have to 

confront these ethical dilemmas and the issues involved 

with the survival of cardiovascular and vascular surgery.

The high risk of stroke with transcatheter devices will also 

need to be lowered (Stanford First Generation 10%, 

Medtronic Valor High Risk 8%, and Cribier PVT 7.1%).

References

1. Flores J, Kunihiara T, Shiyii N, Yoshimoto K, Matuszaki K, Yasuda K. 

Extensive deployment of the stented elephant trunk is associated with 
2006;131:336-42.

elephant trunk procedure combined with ascending aorta and arch 
replacement for acute type A aortic dissection. Eur J Cardiothorac 

Cerebrospinal dysfunction after endovascular stent-grafting via a me-
dian sternotomy: the frozen elephant trunk procedure. Ann Thorac 

Open stent-grafting for aortic arch aneurysm is associated with in-

5. Kato M, Kuratani T, Kaneko M, Kyo S, Ohnishi K. The results of total 
arch graft implantation with open stent-graft placement for type A 

et al. Hybrid endograft for one-step treatment of multisegment disease 

frozen elephant trunk technique for the treatment of extensive thoracic