



The origin of the elephant trunk

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Keywords: Elephant trunk procedure; mega aortic syndrome; hybrid repair of thoraco-abdominal aneurysms



Submitted Feb 14, 2025. Accepted for publication Jun 02, 2025. Published online Aug 01, 2025.

doi: 10.21037/acs-2025-eket-0035

View this article at: <https://dx.doi.org/10.21037/acs-2025-eket-0035>

At the beginning of the 1980s, the aortic arch and thoraco-abdominal aorta were considered *terra incognita* in the field of cardiovascular surgery. The discovery of this surgical field necessitated the development of novel, largely untested procedures. The specific challenges encompassed brain protection in the event of circulatory interruption, sealing of the vascular prosthesis material under conditions of extracorporeal circulation, and the avoidance of paraplegia during operations on the thoraco-abdominal aorta. The initial significant reproducible accomplishments were attained during this period by E. Stanley Crawford and associates at the Methodist Hospital in Houston. Their findings have since garnered significant attention from the broader cardiovascular research community (1,2).

In the nascent Department of Cardiovascular Surgery at the Hannover Medical School, the publications of the Crawford group were met with admiration and profound interest. Hans Borst, the director, had been acquainted with E. Stanley Crawford since their days at Harvard Medical School, where Crawford was a senior resident in the surgical clinic. During a cardiovascular congress in Athens, where Crawford spoke about his major aortic operations, the two reconnected and arranged to meet in Crawford's hotel room. It was there that I provided the necessary tobacco products for entertainment. A visit was arranged at the Methodist Hospital in Houston, and the participants attended on different dates.

In addition to the admirable surgical skills, we considered the high level of expertise in cardiac and vascular surgery to be indispensable for this operation. Unknown to us at the time, but of crucial importance for the success of the operation, was the Hemonetics Cell Saver, which we

imported after our return from the United States. Of course, we wanted to perform such operations in Hanover as soon as possible.

As the senior physician in vascular surgery at the time, I was presented with a middle-aged patient in good physical condition, a non-smoker, with a challenging process noted on the chest X-ray. Fluoroscopy showed a pulsating tumor that probably corresponded to a thoracic aortic aneurysm. Computed tomography or digital subtraction angiography were not yet available for further diagnostics. Conventional transarterial angiography showed multiple aneurysms affecting the entire aorta, starting in the ascending aorta, over the aortic arch, into the descending aorta and the abdominal cavity. There was no aortic valve insufficiency, and the aorta was normally narrowed at the isthmus and at the level of the renal arteries.

With these findings, I went to see Hans Borst the next day. With the enthusiasm of a young surgeon, I told him that I had now found the case of all cases. Given that the patient was symptom-free despite the extent of the findings, Hans Borst was cautious—but he did not want to refuse an operation either. We decided to think about a strategy that could simplify the procedure. There was no doubt that we would have to perform the aortic replacement in three stages. In particular, the re-exposure of the distal aortic arch anastomosis via the standard thoracotomy in the fifth intercostal space did not seem to be without risk. Hans Borst had the decisive idea after he had already gone to bed. The next morning, I met him on the vascular surgery ward, where he presented his plan to some senior staff in my presence. He also had a catchy name: elephant trunk procedure. I remain convinced that this catchy title is a key

factor in the procedure's popularity today.

The “Elephant Trunk” refers to a component of the vascular prosthesis that is approximately 10 centimetres in length and is inserted into the distal aortic orifice with the intention of facilitating connection during the subsequent procedure. The distal anastomosis, which is used to seal the current aortic replacement, is performed side-to-side at the customary location.

Technically, its innovation lay in the fact that, in a step-by-step procedure, the next prosthesis could be connected without clamps in the previously operated area. A bold cut in the underlying aneurysm is enough to immediately grasp and clamp off the unsecured elephant trunk. In case of doubt, the Cell Saver protects against major blood loss. We planned everything very carefully and ultimately carried out the procedure in three stages. Before the subsequent procedure, we were able to radiologically localize the position of each elephant trunk using Hemoclips attached to the edge of the prosthesis.

In the second step of the procedure, the descending aorta was replaced, and an additional trunk was brought in far enough below the aortic hiatus. This allowed for the anastomosing of the replacement of the abdominal aorta below the diaphragm. This also meant that an incision of the diaphragm could be avoided. The step-by-step approach to the thoracic-abdominal aneurysm of Crawford type II extension likely also prevented the development of paraplegia, as the one-stage operation of a type II aneurysm is considered particularly risky in this respect (3). In the step-by-step approach, the aortic replacement in the first step corresponded to the replacement of an aneurysm of Crawford type I extension, and a type IV in the second step. According to the findings of larger studies, the presence of the latter extensions does not appear to be associated with an elevated risk of paraplegia (4).

The effectiveness of the step-by-step approach, which incorporates the “elephant trunk” technique, in thoracoabdominal aneurysm surgery, particularly in conjunction with stent prostheses, in preventing paraplegia is becoming increasingly evident (5). I firmly believe that the “Elephant Trunk” technique still has great potential in this respect and can help to effectively prevent one of the worst consequences of well-intentioned prophylactic surgery—a conclusion that would be in line with the opinion of Hans Borst.

First published as *How to do it* in the journal of the *German Society for Thoracic, Cardiac and Vascular Surgery*,

edited by Borst, the procedure initially attracted little attention (6). It was only when E. Stanley Crawford and colleagues explicitly mentioned the elephant trunk in the title of one of their publications a few years later that it began to be cited with increasing frequency—a trend that continues to this day (7).

Acknowledgments

None.

Footnote

Funding: None.

Conflicts of Interest: The author has no conflicts of interest to declare.

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References

1. Crawford ES, Saleh SA, Schuessler JS. Treatment of aneurysm of transverse aortic arch. *J Thorac Cardiovasc Surg* 1979;78:383-93.
2. Crawford ES, Snyder DM, Cho GC, et al. Progress in treatment of thoracoabdominal and abdominal aortic aneurysms involving celiac, superior mesenteric, and renal arteries. *Ann Surg* 1978;188:404-22.
3. Estrera AL, Miller CC 3rd, Huynh TT, et al. Neurologic outcome after thoracic and thoracoabdominal aortic aneurysm repair. *Ann Thorac Surg* 2001;72:1225-31.
4. Etz CD, Zoli S, Mueller CS, et al. Staged repair significantly reduces paraplegia rate after extensive thoracoabdominal aortic aneurysm repair. *J Thorac Cardiovasc Surg* 2010;139:1464-72.
5. Pellenc Q, Roussel A, Senemaud J, et al. Staged hybrid repair of type II thoracoabdominal aneurysms. *J Vasc Surg* 2021;74:20-7.

6. Borst HG, Walterbusch G, Schaps D. Extensive aortic replacement using "elephant trunk" prosthesis. *Thorac Cardiovasc Surg* 1983;31:37-40.
7. Crawford ES, Coselli JS, Svensson LG, et al. Diffuse

aneurysmal disease (chronic aortic dissection, Marfan, and mega aorta syndromes) and multiple aneurysm. Treatment by subtotal and total aortic replacement emphasizing the elephant trunk operation. *Ann Surg* 1990;211:521-37.

Cite this article as: Walterbusch G. The origin of the elephant trunk. *Ann Cardiothorac Surg* 2025;14(5):377-379. doi: 10.21037/acs-2025-evet-0035