With EVAR And TEVAR Does The Choice Of Graft Affect Arterial Stiffness And Post-Implantation Syndrome: Is There Any Clinical Significance?

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Introduction:
The evolution in the endovascular area has influenced the management of aortic pathologies. Since Parodi and coworkers performed the 1st endovascular abdominal aortic aneurysm repair (EVAR) in early 1990, substantial progress has been made in treating patients with abdominal aortic aneurysms (AAAs). Endovascular aortic repair of AAA is widely accepted as a safe, effective and less invasive treatment alternative to open surgical AAA repair. Thoracic endovascular aortic repair (TEVAR) for descending thoracic aortic aneurysms was first reported by Michael Dake in 1994. The operative mortality and morbidity benefits of TEVAR, as documented in numerous trials and registries have led to widespread acceptance of this less invasive modality for the management of thoracic aortic aneurysms.

Arterial Stiffness and type of Endograft:
Although endovascular techniques for the repair of aortic pathologies have emerged as an effective alternative treatment modality to conventional open repair, limited data exists concerning the mechanical changes induced by endograft implantation. It can be assumed that the alterations of aortic mechanical properties can have a direct impact on heart output.

Arterial stiffness is an independent marker of all-cause mortality and cardiovascular morbidity and mortality. Pulse wave velocity (PWV) is a valid, clinically feasible, and reproducible measure of arterial stiffening. In a recently reported prospective study we assessed changes in PWV in patients undergoing EVAR. Patients with AAA appeared to have significantly elevated PWV levels compared to controls, while stent-graft implantation was related to PWV increase. An important regulator of arterial compliance following endografting is the engineering characteristics of stentgrafts. In a following prospective study we evaluated the effects of different types of endografts on PWV in patients undergoing EVAR. One hundred eighteen consecutive men with AAA undergoing elective EVAR were enrolled in the study. Our study revealed that the endograft type was an independent predictor of PWV change in the AAA group. The presence of AAA was positively associated with arterial stiffness, while endograft implantation was associated with increased pulse wave velocity. The latter effect was independently associated with the endograft type (woven more than PTFE).

Preliminary data of an ongoing trial in our Department suggests that stent-graft implantation in thoracic aorta leads to PWV increase. The haemodynamic effects of different endografts are under investigation.

Clinical implications of altered arterial stiffness after EVAR and TEVAR:
The influence that different aortic repair modalities exert on central hemodynamics depends widely on the site of intervention. It can be assumed that the hemodynamic impact exerted by a vascular prosthesis in the descending aorta may be more severe
than implanting the endograft in the abdominal aorta. The long-term impact of these mechanical changes on cardiovascular outcomes requires further investigation.

Notably, a non-significant tendency of cardiovascular deaths was apparent in EVAR trial in the endovascular group during the 24-month interval. Although cardiovascular mortality was primarily due to the poor general health status of those patients or the required secondary interventions, a harmful effect of even slight alterations in aortic stiffness induced by endografts should be considered. A matter of investigation could be whether this subtle hemodynamic impact represents an increased risk factor for patients with already impaired cardiac compensatory mechanisms.

Post-implantation syndrome and type of Endograft:
Postimplantation syndrome (PIS) is a systemic inflammatory response frequently observed after endovascular treatment of abdominal (EVAR) and thoracic aortic aneurysms (TEVAR). The main features of PIS include fever, leukocytosis, elevated C-reactive protein and coagulation disturbances. This systemic inflammatory reaction is also associated with increased serum levels of cytokines, such as interleukin IL-6, IL-8, IL-1 and, tumor necrosis factor-alpha (TNF-a). Mechanisms that have been proposed to explain this systemic inflammatory reaction include injury to the vascular endothelium and manipulation of the introducer catheters and sheaths inside the aneurysmal thrombus during the endovascular procedure, resulting in white cell activation and the release of various cytokines.

In addition, endograft type appears to influence the inflammatory response following EVAR. Results of a recently reported study from our Institution support the hypothesis that implantation of stent grafts based on woven polyester are associated with a stronger inflammatory response compared to PTFE stent grafts. Voûte et al. confirmed the same hypothesis reporting that PIS occurred almost exclusively in the first 3 days after woven polyester endograft implantation and the first 2 days after PTFE endograft implantation.

Preliminary data of an ongoing prospective trial in our Department, evaluating the inflammatory response and renal function after elective thoracic endovascular aortic repair suggest that endograft implantation in patients with TAAs may propagate the inflammatory response during the early postoperative period. On the contrary, renal function does not seem to be deteriorated and influenced by the inflammatory response.

Clinical implications of PIS after EVAR and TEVAR:
The clinical manifestation of PIS includes fever, and lumbar back pain. This biological response following EVAR is not always spontaneously attenuated and could lead to the development of SIRS even several days after the operation. This issue raises concerns of postoperative morbidity, especially in patients at high risk, including the elderly with several comorbidities. Although previous studies have reported that PIS may result in severe complications such as pulmonary dysfunction, cardiovascular events and renal insufficiency leading to prolonged hospitalization, in our experience in 88 patients apart from a transient pyrexia and the discomfort to the patient, PIS was not associated with perioperative adverse clinical events showing a benign course. However, close surveillance of patients developing an excessive inflammation response postoperatively is suggested.
Apart from the discomfort to the patient a theoretical concern could be that the post-implantation syndrome may be associated with late complications such as endoleaks, stent graft migration and aneurysm rupture. The intramural thrombus, which remains in situ after EVAR, has previously been reported to be a source of proteases and speculated to be involved in development of late complications after EVAR. However no one of these hypotheses has been confirmed.

**Conclusions:**
Increased arterial stiffness observed after EVAR and TEVAR represents a concern. The long-term impact of these mechanical changes on cardiovascular outcomes and the potential differential effects of different endografts on central haemodynamics require further investigation. The clinical impact of the PIS has been diminished during the last years. We suggest a close surveillance of patients -especially high risk, including the elderly with several comorbidities - developing an excessive inflammation response postoperatively.

**References:**

