Application of new specific biomarkers for organ damage after open and endovascular thoracoabdominal aortic aneurysm surgery as model for more accurate perioperative patients' surveillance

Impact of the research results:

Aortic aneurysms are most often degenerative aneurymatic changes of the aortic wall involving all three layers, the intima, media and adventitia. Thoracoabdominal aortic aneurysms (TAAA) involve the thoracic and the abdominal part of the aorta. Despite the fact, that the disease is slowly progressive, with an average annual growth rate between 3-5 mm, the related morbidity and mortality of the disease is of relevance, especially as the mortality in case of aneurysm rupture is dramatically high. The development of endovascular techniques has increased patients' safety and improved the outcome after surgery for aortic pathologies such as thoracic aortic aneurysm and infrarenal aortic aneurysm, which can be treated by endovascular approach in the multitude of cases. Yet, in case of more complex aneurysms involving the thoracoabdominal aorta or the juxtarenal aorta, morbidity and mortality rates remain on a relevant level, even in experienced vascular surgical departments with appropriate expertise to treat these complex cases. Even if the surgical therapy, regardless if performed by open or endovascular means, was uneventful, the impact of the surgical approach and certain specific requirements have a relevant and potentially negative impact on patients' outcome. In fields of endovascular repair, the length of covered aortic segment may lead to dysregulated activation of endothelium-related inflammation reaction. If TAAA repair is performed by open repair, the aortic cross clamping, the distal aortic and selective organ perfusion using heart lung machine and the systematic anticoagulation are requirements, which are well known risk factors for adverse outcome, which is partially related to the ischemia-reperfusion damage as well as the related inflammation cascade. The described perioperative changes, which are induced by a dysregulated activation of the inflammation system of unknown origin, may accordingly lead to an unpredictable and adverse course after initially successful surgical treatment.

It was my motivation to improve the understanding of these pathophysiological processes enabling an earlier detection and by that a timelier treatment in critical ill patents. According to my profession as a vascular surgeon who is dealing with complex aortic aneurysm patients on a daily basis in the operation room and in the intensive care unit, the clinical assessment of patients pre- peri- and postoperatively is of genuine interest. Based on the previously described high risk of complications, especially in the first postoperative days, a fast and more appropriate surveillance of critical ill patients would be favorable. Physician are trained to use different, clinically established biomarkers which could improve patients' assessment. Biomarkers are signal and effector molecules in the human body of different origin, which could be used as indicators for adverse events such as organ failure, chronic and acute processes such as bacterial infection and reduced general condition. Applying this "early warning system", physicians dealing with critical ill patients may be able to recognize and to treat patients more timely, potentially leading to improved outcome for our patients.

In fields of open and endovascular TAAA repair, although an urgent clinical need is existent, the usage of specific biomarkers for organ damage and poor general condition hasn't been established so far. In my doctoral thesis the assessment of biomarkers focusing on organ-specific and general outcome in patients undergoing open and endovascular TAAA repair, I would like to help improving patients' outcome after undergoing major vascular surgery. Furthermore, the findings of my research in this particular fields could be transferred to other surgical disciplines, facilitating comparable studies in the future. Based on the results of my thesis, several biomarkers could be used to establish a more appropriate postoperative assessment of patients undergoing major surgery such as open and endovascular TAAA repair. Especially early detection of postoperative acute kidney injury is of utmost importance as it may lead to a timelier treatment, which may be related to better outcome for the patients.