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(TEG-PM) correlates well with postoperative chest tube drainage (CTD) in patients undergoing coronary artery bypass grafting (CABG).¹ Furthermore, we applaud Petricevic and colleagues for their keen insights by proposing well-thought-out inclusion criteria that may be used for further research into this topic. In the current economic environment, it is critical that we stratify patients most at risk for bleeding so that resources can be allocated in a cost-efficient manner. A bleeding risk score would be one such intervention. We also agree that the definition of bleeding should be standardized, so that clinicians all speak the same language regarding bleeding. The universal definition for perioperative bleeding proposed by Dyke et al² does offer a reliable grading for bleeding outcome and can be used in future research evaluating bleeding after cardiac surgery.

Our study¹ offers new and unique insight into the use of TEG-PM in identifying patients who are at higher risk of having elevated CTD and requiring platelet transfusion. In our study, although the TEG-PM parameters were used in deciding whether or not surgery should be postponed, there was not a specific numeric cutoff on TEG-PM parameters that led to surgery postponement. Rather, the urgency of the surgery, TEG-PM parameters, and the clinician's judgment were used to determine whether or not surgery should be postponed. As Petricevic and colleagues point out, the subtle "exclusion" of patients whose abnormal TEG-PM caused the surgery to be postponed, makes a correlation with bleeding even harder to demonstrate and suggests that, had these patients been included, a TEG-PM-to-bleeding correlation may have been even stronger. This is an important area for further research and discussion, because excessive bleeding after cardiac surgery remains a complex problem despite many recent advances. We agree that a multicenter prospective study in patients requiring urgent surgery would be another useful application of TEG-PM for risk prediction of bleeding and blood product transfusion.

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Frailty Should Determine Type of Anesthesia in Reducing Postoperative Delirium After Vascular Surgery and Not Vice Versa

To the Editor:

I have read, with great interest, the report by Ellard et al wherein they demonstrated that the risk of postoperative delirium (POD) after vascular surgery is independent of the type of anesthesia and known risk factors such as emergency surgery and beta-blocker use.¹ Although vascular surgery often is interpreted as a major risk factor for the development of POD, few studies focus primarily on this vulnerable patient group. I compliment the authors on providing important data that further contributes to the understanding of POD.

However, I disagree with their conclusion that the presence of risk factors for the development of POD should not influence the choice of the type of anesthesia. This conclusion cannot be drawn based on this retrospective series in which there has been an obvious selection bias. The authors have chosen to exclude open aortic and carotid artery surgery. Recently, we published our results of carotid endarterectomy (CEA) in octogenarians and found a significant difference in POD in favor of patients <80 years of age.² The etiology of POD after CEA appears to have similarities with cardiac surgery patients because of the increased risk of (micro) thromboemboli due to plaque disruption. It should therefore be considered as a high-risk procedure. In addition, the GALA trial showed no difference in outcomes between general and local anesthesia for carotid artery surgery and, thus, both appear safe.³ CEA should, therefore, have been assessed in a study on different anesthetic techniques.

The procedures performed under local anesthesia were, apart from endovascular repair of abdominal aortic aneurysm (EVAR), most likely minor procedures such as embolectomy, wound debridement, or toe amputations. It is unlikely that open femorodistal bypasses were performed using only local anesthesia. Presumably, the lower extremity revascularization group included endovascular procedures such as angioplasty and stent placement. This is a group wherein POD almost never occurs and hospital stay usually is very short.⁴ Amputation surgery, on the other hand, is associated with increased POD incidences, and, with the exception of minor amputations, cannot be performed under local anesthesia. These discrepancies, along with just 6% of patients on whom operative procedures were performed using local anesthesia, make the groups too diverse and inhomogenous to draw a real conclusion.

I fully agree with the authors that the additional administration of sedative medication clouds the beneficial effect of local anesthesia. Medically induced perioperative hypotension is a known risk factor for POD and other postoperative cognitive effects. In addition, the depth of anesthesia seems to play a role; a bispectral index (BIS) between 40 and 60 appears effective in decreasing POD.⁵

The risk of POD after vascular surgery probably is less dependent on the type of anesthesia, but more dependent on frailty and the loss of several domains of function, which leads to a declining reserve capacity for dealing with stressors. Various screening tools for frailty are available, validated, and highly predictive for complications and even POD.^{4,6,7} The degree of frailty should be taken into account in medical decision-making such as type of anesthesia.

In conclusion, the results of this study should be interpreted cautiously. Current evidence would advocate for the use of regional or local anesthesia wherever possible, especially in patients otherwise vulnerable to developing cognitive symptoms.

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Type of Anesthesia and Postoperative Delirium After Vascular Surgery: Reply

To the Editor:

Thank you for this opportunity to respond to the "Letter to the Editor" regarding our manuscript, "Type of Anesthesia and Postoperative Delirium after Vascular Surgery."¹

We appreciate Dr. Pol's interest in our work.

Dr. Pol disagrees with our conclusion that the presence of risk factors for the development of postoperative delirium

(POD) should not influence the choice of the type of anesthesia for patients undergoing vascular surgery.

We would like to emphasize that our conclusion was limited to the type of surgeries that could accommodate either general, regional, or local anesthesia. That was the reason for excluding patients undergoing open aortic and carotid artery surgery. Open aortic surgery was done exclusively under general anesthesia, and most of the patients scheduled for carotid artery surgery underwent stenting procedures without general anesthesia. Clearly, including these patients would have introduced a considerable bias. Furthermore, the general anesthesia versus local anesthesia for carotid surgery (GALA) trial² that was mentioned by Dr. Pol in his comments supported our conclusion that the type of anesthesia (local versus general) did not change the outcome. These findings were further supported by the recent Cochrane review.³

Dr. Pol suggests that there are similarities between carotid artery and cardiac surgery regarding the cerebral embolic phenomenon and the link to development of POD. The etiology of POD is undoubtedly multifactorial. However, the link between microembolic phenomenon and POD is not well supported by the current literature. There is no doubt that cerebral microemboli occur during cardiopulmonary bypass. However, lack of better preservation of cognitive function with off-pump techniques questions the causality link between the embolic phenomenon and POD. On the other hand, there is emerging evidence linking POD with activation of inflammatory pathways during the perioperative period. So, it is possible that patients with limited reserve (frailty indicator) may have an altered inflammatory state resulting in higher prevalence of POD. It certainly is evident with the higher ASA classification scores.

In conclusion, we certainly should combine our efforts in designing multicenter, well-powered, prospective studies to optimize patient risk stratification and reduce POD after vascular surgery.

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