background noise. We defined the occurrence of delirium as the patient meeting *Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition* criteria for delirium on the first or second postoperative day assessments.

Overall, delirium developed in 7 of 66 patients (10.6%) after the operation. Patients with postoperative delirium were significantly older (58 ± 5 vs 49 ± 11 years) and were characterized by a significantly larger microembolic load at the right MCA compared with controls (741 ± 404 vs 401 ± 341; $t = 2.66$; $p = 0.010$). The microembolic load at the left MCA was almost equal in the two groups (316 ± 351 vs 238 ± 231; $t = 0.888$; $p = 0.378$). Age and right hemisphere microemboli independently predicted development of delirium (Wald coefficients = 3.89 and 5.30, $p < 0.05$, respectively). Analysis showed that the total number of microembolic signals at both MCAs exceeded 900 in 6 of 7 patients (86%) with delirium. In 5 patients, microemboli were registered predominantly at the right MCA, and in 1 patient, microemboli reached mostly the left hemisphere. Only 1 patient with delirium showed a relatively low microembolic load of 300 signals in total. In this patient, delirium was associated with multiple organ insufficiency. Only in 16 of 59 controls (27%) did the microembolic load exceed 900. The group differences were significant ($\chi^2 = 9.68$; $p = 0.002$).

The present data show that cerebral microemboli are associated with delirium after cardiac operations in most patients; however, other pathologic factors may also contribute to the development of delirium.

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Reply

To the Editor:

We thank the authors Bokeriia and colleagues [1] for their interesting comments on our article [2]. The authors reported that a range of studies in cardiac surgery patients showed that intraoperative micro emboli are an important risk factor for cerebral complications, including a postoperative delirium, according to their own data. The authors showed that postoperative delirium in cardiac surgery is associated with high cerebral microembolic load. We agree that this might be a risk factor of delirium after cardiac surgery, but we have found no evidence from the literature to support it.

In our department of cardiac surgery we do not use a transcranial Doppler system for continuous bilateral monitoring of middle cerebral artery blood flow because of a lack of clinical relevance. Therefore, in our study we examined the relationship between patients undergoing cardiac surgery with and without cardiopulmonary bypass (on-pump and off-pump, respectively). In a total of 90 patients who underwent on-pump surgery and 22 patients who underwent off-pump surgery, it is surprising that the univariate analysis showed a significantly higher incidence of delirium in off-pump patients compared with on-pump patients (25.5% vs 4.5%; $p = 0.03$). However, when we restricted this analysis to patients only undergoing coronary artery bypass grafting, we found that in the on-pump group, 3 of 21 patients became delirious (14.3%) compared with 1 of 21 in the off-pump group (4.8%), resulting in a relative risk of 3. Of course, this is not statistically significant due to the low numbers involved. In the multivariate analyses in the whole study group, the significant relation between on-pump and off-pump cardiac surgery and delirium disappeared.

The Octopus Study showed that during off-pump procedures there were no signals registered indicating microembolic load. Nevertheless, no difference in neurologic outcomes was observed between on-pump and off-pump procedures [3, 4].

In an earlier study by Bucerius and colleagues [5], it was observed that the increased use of off-pump cardiac surgery might lead to a lower prevalence of delirium. However, although their study was extremely large (16,184 patients), "only" 1,842 patients underwent off-pump surgery, and the diagnosis of delirium was made by physicians that was not based on the DSM-IV criteria or based on the diagnosis of a psychiatrist.

In Medisch Spectrum Twente, the "no touch technique" is also currently used. This is a surgical strategy aiming to avoid aortic manipulation by using either pedicled or composite arterial grafts (left internal mammary artery-Y grafts) combined with off-pump coronary artery bypass grafting. Even in high-risk patients, this technique results in less neurologic events (6–10). This might also decrease the incidence of delirium. We have analyzed data from 400 patients from our hospital who were operated on with "no-touch" off-pump coronary artery bypass grafting, and we found only 1 patient with a cerebrovascular accident.

However, given the interesting data of Bokeriia and colleagues [1], cerebral micro emboli might be associated with delirium after cardiac surgery and might be a risk factor to add to a risk checklist delirium in cardiac surgery patients when the opportunity to measure these micro emboli exists.

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Is a 1-cm Margin From Major Vessels Adequate for Radiofrequency Ablation of Pulmonary Neoplasms?

To the Editor:

We read with interest the article of Dr Fernando [1], who reviewed the "state of the art" for radiofrequency ablation (RFA) of primary or secondary lung cancer [1]. We particularly appreciated the suggestion to limit lung RFA to the outer two-thirds of the lung parenchyma to avoid proximity to the hilar blood vessels.

Recently an animal study [2] pathologically confirmed that "RFA is effective with an acceptable degree of minimal damage to the normal lung tissue, and can be safely done near the pulmonary vessels." Another study [3] suggests that a 1-cm margin from major blood vessels is safe for RF ablation, as is currently used for RFA in solid organs.

We stress that the compressibility of lung parenchyma is a unique characteristic; therefore, a 1-cm margin may be inadequate in some cases. We illustrate the problem in the figure and legend as follows (Fig 1).

Recently an alert was issued by the United States Food and Drug Administration on mortality observed with the use of RFA for lung lesions [4]. Thus, the compressibility of the lung must be considered in planning and executing RFA of lung lesions near major vessels.

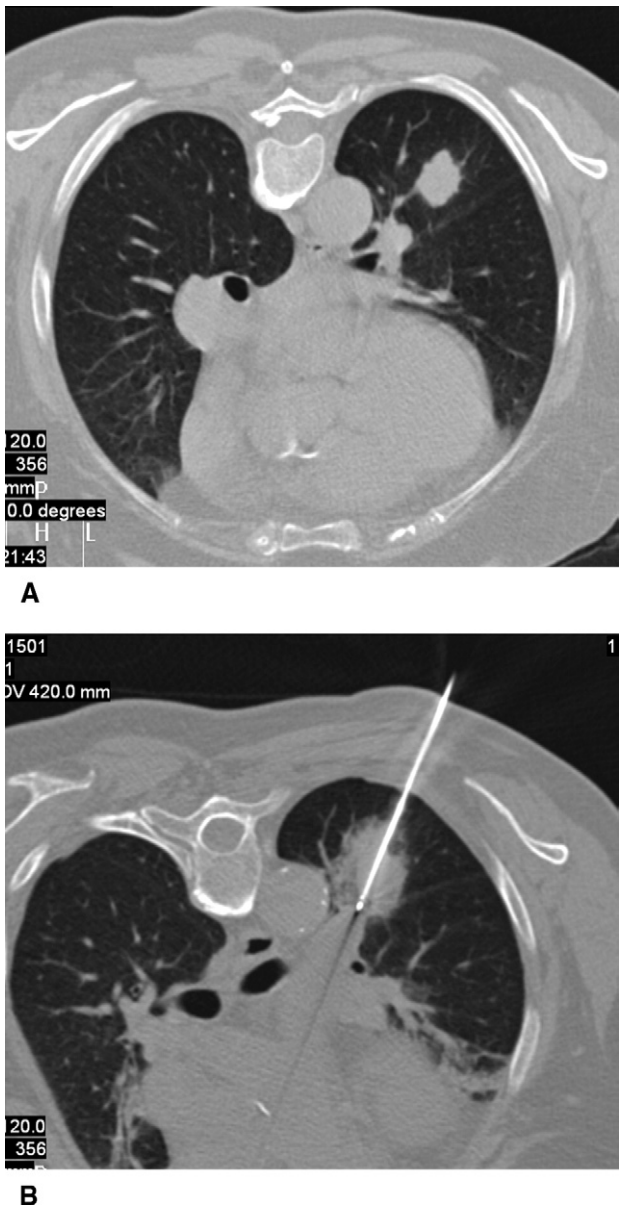

Fig 1. (A) A 66-year-old woman had a pulmonary metastasis from rectal carcinoma, which appeared approximately 1.6 cm away from the large hilar blood vessels. (B) However, insertion of the electrode, following the long axis of the lesion in order to obtain total ablation, compressed the lung parenchyma against a major blood vessel. Fortunately, the patient did not have a complication.

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0003-4975/09/$36.00