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Neurovascular Diseases may Predispose for Postoperative Delirium

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Introduction

Socioeconomics of patients with and without wooziness were looked at between the two gatherings by a free examples t-test for consistent, ordinarily dispersed information, a Mann-Whitney U test for constant slanted information, and a chi-square for correlation of straight out information. The relationship of MRI highlights with postoperative daze was contemplated with strategic relapse examinations with change for age, sex, concentrate on focus and sort of a medical procedure. Mind volumes, WMH volumes and cortical infarct volumes were moreover adapted to intracranial volume. In summary, we found an association between preoperative cortical brain infarcts and occurrence of postoperative delirium, although this did not reach statistical significance. Furthermore, we detected a trend for an association of a more complex shape of WMH with occurrence of postoperative delirium. No associations were found between preoperative WMH volume, presence of lacunar infarcts, global brain volumes and postoperative delirium.

Description

Previous studies on the association between preoperative global brain volume and postoperative delirium have shown conflicting results. Some small studies showed an association between reduced preoperative brain volumes and postoperative however, most studies did not find this association. Our findings are therefore in accordance with most previous studies. The total brain volume in patients with a delirium in our study was slightly lower than in patients without a delirium however, the effect size was very small, and comparable to previous negative findings in the SAGES study that had a similar design as the BioCog study. WMH volume is a key imaging marker of cerebral small vessel disease. In previous studies on the relation between WMH and postoperative delirium, most studies showed an association trend between WMH volume and postoperative delirium. However, the largest previous study has concluded that there was no significant association between WMH volume and postoperative delirium or delirium severity. Our study is the largest study to date to assess this relation, and although WMH volume was higher in patients who developed postoperative delirium, this difference did not reach statistical significance. Based on our results the effect size of a possible association between WMH volume and occurrence of a postoperative delirium is probably smaller than previously expected [1].

WMH shape features are novel markers for cerebral small vessel disease, in which a more rough or complex shape of periventricular and confluent lesions, and a more elongated shape of deep lesions potentially represents a more severe manifestation of cerebral small vessel disease. WMH shape features have shown the ability to distinguish patients with different diseases, showing that a more complex shape of lesions was related to a more severe disease type, such as type diabetes mellitus and frailty. Our study is the first to assess preoperative WMH shape features in relation to postoperative delirium. Although our study showed no significant between-group differences in these features, a trend was found for the association between a lower convexity of periventricular and confluent lesions and postoperative delirium. This finding indicates that periventricular and confluent WMH might be more complex in patients who will develop postoperative delirium. A lower convexity has previously shown to be related to frailty in a cross-sectional study from the same study cohort. Future studies should be performed to elucidate the exact role of WMH shape in relation to adverse postoperative events [2].

Previous studies on cerebral hemodynamics have shown that during a delirium episode, cerebral perfusion was disrupted. Furthermore, evaluation of cerebral hemodynamics has shown the ability to detect neurodegeneration such as Alzheimer's disease at an early stage. As dementia is an important predisposing factor for delirium, altered hemodynamics might already be present before surgery in patients who are at risk for delirium. One retrospective study showed that cerebral blood flow abnormalities on CT scans in patients with cardiac surgery were related to postoperative adverse neurologic outcomes, of which only a small percentage was postoperative delirium. Only one previous study reported on the relationship between preoperative perfusion as measured with arterial spin labeling MRI and postoperative delirium, and showed no association. The lack of associations in our larger cohort are in line with this previous study. These findings may indicate that impaired cerebral perfusion may not predispose elderly for postoperative delirium, or that any relationship between cerebral hemodynamics and POD is more complex [3].

Brain infarcts can be divided into lacunar, subcortical and cortical brain infarcts. These infarcts reflect different disease processes, as lacunar brain infarcts are regarded as a feature of cerebral small vessel disease, whereas cortical brain infarcts are a feature of large vessel disease. Previous studies on the relation between cerebral infarcts and postoperative delirium have not distinguished between lacunar and cortical infarcts. These studies have shown an association between multiple brain infarcts and postoperative delirium in patients after cardiac surgery. We did not find an association between lacunar infarcts and postoperative delirium. However, we did detect an association between cortical infarcts and delirium, although this did not reach statistical significance. Our findings contribute to previous findings by indicating that the previously observed association could be driven by the presence of cortical brain infarcts. Possibly, patients with large vessel disease are more at risk for perioperative events resulting in postoperative delirium, such as perioperative micro-embolism due to a higher preoperative cardiovascular burden. Another explanation may be that patients with larger cortical brain infarcts have a lower brain reserve. A lower brain reserve could increase the vulnerability for precipitating risk factors for delirium in the perioperative period [4].

Limitations of our study may be the extensive work up study protocol for all participants, possibly introducing a selection of patients who were less vulnerable compared to patients who declined participation. This could have underestimated the observed associations between preoperative MRI features and postoperative delirium. Another limitation could be that we had to exclude patients with head motion artifacts, especially for the perfusion MRI. This reduced our power to detect between group differences, and possibly led to exclusion of vulnerable patients who were not able to lie still in the MRI scanner. However, there were no differences in the frequency of delirium in the group included in our perfusion analysis compared to the excluded group. A limitation could be that for some of the brain MRI feature not all scans could

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be used, which could have underestimated the found results for some of these features. Another limitation could be that we used two different types of MRI scanners, introducing a potential between center differences. However, we used an image analysis pipeline that is robust for center differences, and adjusted for study center in all analyses. Unfortunately, we did not collect data whether participants with cortical infarcts were symptomatic from their lesions. Further, due to the relatively small number of patients with cortical infarcts in combination with the large variation in lesion location, we had insufficient statistical power to perform analyses on the effect of lesion location [5].

Conclusion

In conclusion, we have shown that structural brain MRI features may only be minor predisposing factors for postoperative delirium, which is in contrast to a number of previous studies. Our study suggests that only patients with preoperative cortical brain infarcts and patients with a more complex white matter hyper intensity shape may have a predisposition for developing delirium after major surgery. Strengths of our study are that it is the largest prospective study on preoperative brain volumes, perfusion and infarcts in relation to postoperative delirium to date, with state-of-the-art imaging and analysis techniques. This is the first study on WMH shape analysis and delirium. These WMH shape markers were not analyzed in the total study group, because these were not validated for between-center applications. Furthermore, our study included a heterogeneous group of patients who were scheduled for different types of major surgery from two study centers, increasing the generalizability of our results.

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