WHEN THE HEART INTERFERES WITH THE BRAIN: EFFECTS OF CARDIAC SURGERY ON HIGHER COGNITIVE FUNCTIONS

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INTRODUCTION

Cardiac surgery improves cardiovascular outcomes but poses risks of neurological complications, notably perioperative stroke (3–9%, mostly ischemic) and Postoperative Cognitive Dysfunction (POCD), affecting up to 80% of patients. Lesion network mapping links focal brain lesions to functional networks, providing insights into the neural basis of POCD.

AIM

To systematically analyze the topography of cerebral lesions associated with cardiac surgery, to compare them with lesions from a representative stroke cohort, and to investigate whether cardiac surgery-related lesions exhibit distinct patterns of functional disconnection.

MATERIALS AND METHODS

Neuroimaging analysis

- **Lesion Topography**

20 cases: 12 MRI and 8 CT images.
Patients' scan images map lesions brain atlas, the MNI152 2mm. Tracing was made by hand using FSLeyes software.

To compare the topographic distribution of cardiac surgery-associated lesions with stroke, we used the publicly available ATLAS dataset (Anatomical Tracings of Lesions After Stroke).

- **Lesion Network Mapping**

We used the Funcon tool from the BCBtoolkit, to estimate functional connectivity alterations.
To compare functional disconnection patterns we performed a permutation-based inference.

Statistical Analyses

Lesion volumes were tested for normality (Shapiro–Wilk) and compared using Mann–Whitney U or t-tests as appropriate.

RESULT

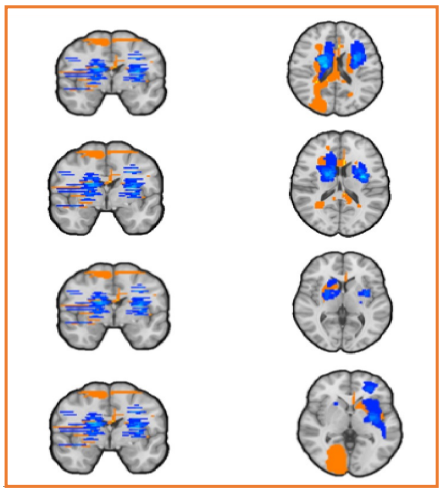

Figure 1. Overlap maps of brain lesions in cases associated with cardiac surgery (orange) and in controls not associated with cardiac surgery (blue).

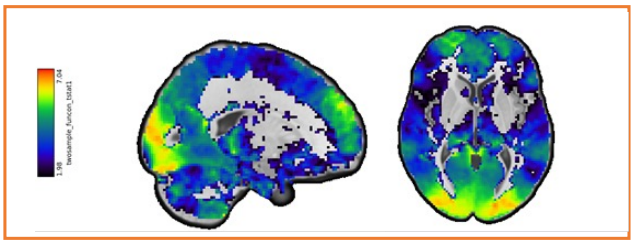

Figure 2. Functional connectivity analysis. Statistical brain maps of voxels with significantly higher probabilities of disconnection in cases than in stroke controls (sagittal and axial slice).

CONCLUSION

Our findings suggest that cardiac surgery associated ischemia may lead to significant disruptions in the functional connectivity between brain regions involved in higher-order cognitive processes.
Specifically, the occipital lobe, the pulvinar, and the medial frontal cortex appear particularly vulnerable to postoperative disconnection phenomena.