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Neuromarkers of Preoperative Inflammation and Development of Postoperative Delirium Following Cardiac Surgery

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Delirium is a temporary neuropsychiatric disorder defined by an acute or fluctuating disruption in attention and cognitive processes. The incidence approaches 50% for major surgery and may signal a greater postoperative risk of cognitive and functional decline. The underlying mechanisms and individualized preoperative risk markers for delirium remain unclear.

To further our understanding of this disorder, pre-operative MRI was utilized to assess NII markers that may demonstrate associations with the incidence and severity of delirium after surgery. We hypothesized that higher inflammatory markers in specific white matter regions (e.g., corpus callosum, cingulum, internal capsule) will relate to an increased probability of developing postoperative delirium.

Six patients were recruited at Barnes-Jewish Hospital as part of an ongoing investigation (NCT03110185) to evaluate the relationship between postoperative delirium and markers of distributed patterns of correlated brain activity. Inclusion criteria included age ≥ 60, English-speaking, and scheduled cardiac surgery requiring cardiopulmonary bypass. Preoperative imaging was conducted within one week of surgery on a 3T Siemens Skyra scanner. Delirium determination relied on the Confusion Assessment Method (CAM). Patients were evaluated with the CAM on three consecutive days within the first eight days after surgery. Diffusion data were processed using custom scripts for motion, group registration, and tract-based spatial statistics. NII-derived metrics of anisotropy and diffusivity were used to examine white matter integrity and markers of neuroinflammation.

Two patients developed delirium. Group maps will be generated to assess differences among patients with and without delirium. We expect this approach will highlight brain regions that may predispose individuals to delirium via markers of cellular inflammation. This will also provide preliminary support toward the use of NII as sensitive neuroimaging modality for the development of postoperative delirium.