PRE-OPERATIVE WHITE MATTER ABNORMALITIES PREDICTING POST-OPERATIVE COGNITIVE DECLINE IN HEALTHY OLDER ADULTS

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Introduction

Many studies have demonstrated that cognitive decline can occur after surgery. Mild memory problems, word finding difficulties, general cognitive inefficiency and slowing are among the most common changes. This constellation of symptoms has come to be known as “post-operative cognitive dysfunction” or POCD. The incident rate ranges from 3 to 50% across studies with the highest rates reported after major surgery and in adults over the age of 60 [e.g., 1].

The current study prospectively examined whether specific pre-operative neuroanatomical variables would predict severity and type of cognitive change after non-cardiac surgery among non-demented older adults. White Matter Abnormalities (WMAs), bright areas on FLAIR and T2-weighted MRIs, are usually seen with increasing age and have been linked to chronic hypertension, arteriosclerosis plus low cerebral perfusion. We hypothesized that individuals with more white matter abnormalities (WMA) within the deep regions of the brain, versus more subcortical regions, would exhibit greater decline post-surgery particularly on measures assessing executive function. This hypothesis was based on the theory of reserve, vascular threshold, and the relationship to subcortical-frontal pathways.

Experimental

Total knee replacement surgery patients (n=31) and age-osteoarthritis matched controls (n=15) completed a baseline brain MRI and neuropsychological measures at baseline, acute post-surgery (2-week) and then 3-months later. All pre surgery scans were collected using the Siemens 3T Allegra scanner within the McKnight Brain Institute with MR technician’s assistance. WMA were assessed within the periventricular, subcortical, and deep regions using a semi-automated pixel threshold method in volumetric and FLAIR images.

Results and Discussion

The surgery and nonsurgery groups were comparable in terms of baseline regional WMA severity (all p values >.10). Both groups demonstrated greater WMA in the periventricular region relative to deep and subcortical regions. However, it was only the severity of WMA within the deep brain regions that correlated to post-surgery executive function decline (r = -.42, p=.02). Relationships between baseline WMA and cognitive change variables were not observed for the control group (all r values <.2, ns).

Conclusions

Acute post-operative cognitive decline among healthy older adults, specifically on measures assessing executive function, is at least partially explained by pre-surgical vulnerability within the deep white matter region of the brain. These findings support the concept of vascular brain burden and the threshold theory.

Acknowledgements

We thank Mary Ellen Bentham for her MRI expertise, Ilicia Shugarman, Victor Zhang and Jenny Mace for their medical expertise.

References