PERIOPERATIVE NEUROCOGNITIVE DISORDER: MRI CHANGES IN THE BRAIN AFTER SURGERY

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Perioperative Neurocognitive Disorder (PND)

- Formerly known as Postoperative Cognitive Decline (POCD)

- Decrease in cognitive ability after surgery with testable decreases in memory, executive function, and motor coordination in 20-40% of immediate postoperative patients

- Patients usually recover within a month, though there are cases lasting much longer
Perioperative Neurocognitive Disorder (PND)

■ This is a syndrome, not a disease with one single etiology
  - It’s more like a fever than influenza

■ Occurs more frequently in patients 60 years of age and older

■ Occurs more frequently in patients undergoing cardiac surgery
Why it matters

- Associated with early exit from the workforce, decreased quality of life, and premature mortality

- Our society is getting older, and an increasing number of the elderly undergo surgery every year

- Not well studied and as such there’s a lot of room for improvement
Purpose and methods of this study

- Pilot study to explore the effects of cardiac surgery on various MRI scans of the brain before and after surgery

- Four patients MRI scans at one week prior, one week after, and three months after cardiac surgery

- MRI sequences used:
  - Fluid-attenuated inversion recovery (FLAIR)
  - Magnetization-prepared 180 degrees radio-frequency pulses and rapid gradient-echo (MP RAGE)
  - Sampling perfection with application-optimized contrasts using different flip-angle evolution (SPACE)
Mechanical damage

DAMPs

CNS

Cytokines

BBB

Macrophages

TNF
HMGB1
IL-1

α7nAChR agonists

nAChR

Cellular response

TLRs

nAChR

Hippocampal Signal Changes

- Hippocampal mask applied for regional analysis
- Constant mask in MNI space, inverse transformation applied to determine area in subject space
This is a comparison of the average hippocampal pixel Z-score as compared to white matter.

MRI Signals are not reliable for comparison between scans.

A probability map was used to determine the 500 most likely pixels to be white matter. The average and standard deviation of these pixels was used to determine a Z-score for the hippocampus.

To determine statistical significance of the changes in hippocampal signal, we will need an N of about 26 individuals.

- Alpha of 0.05 and beta of 0.20, using SPSS and G-power.
Summary

- Promising, though not statistically significant, trends that could provide some insight into PND
- Imaging “pipeline” in place to analyze incoming study participants
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Questions?