Modeling Encephalomyosynangiosis After an Ischemic Stroke

Vraj Patel, Daylin Gameotea Turro, Rajkumar Verma

Department of Neuroscience UConn Health Farmington, CT 06032 University of Connecticut Storrs, CT 06269

Abstract

- Ischemic strokes make up 87% of all stroke causing potential long-term disabilities for patients
- The discovery of a novel treatment is imperative especially because there is no effective treatment for stroke patients.
- The brain's ability to recover and self-heal from an ischemic stroke is limited by discontinuous blood supply to the impacted area
- Encephalomyosynangiosis (EMS) is neurosurgical procedure that promotes angiogenesis in patients with moyamoya disease. This procedure consists of a craniotomy where the temporis muscle that surrounds the skull is grafted onto the ischemic part of the brain.
- We hypothesize that EMS promotes angiogenesis around the infarcted area and creates an enriching environment that allows the brain to quickly recover from an ischemic stroke.

Objective

- Perform a histological assessment using immunofluorescent techniques to identify if EMS promotes angiogenesis after an ischemic stroke

Methods

- Middle Cerebral Artery Occlusion (MCAo) is used to induce ischemic stroke in mice
- As shown in **Figure 1**, MCAo is a surgical procedure that consisted of a tracheostomy where a nylon filament is inserted via the internal carotid artery to block blood flow to MCA.
- The mylon filament is removed after 60 minutes to allow for reperfusion
- EMS is performed (as in **Figure 2)** four hours after MCAo
- Mice were randomized into MCAo only or MCAo+ EMS groups
- Mice were sacrificed at either 30 days or 60 days
- Co-immunostaining was used to visualize blood vessels and their maturity
- Cresyl Violet staining was used to measure atrophy

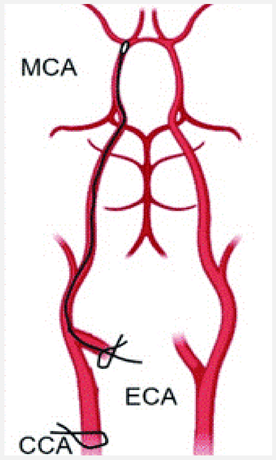


Figure 1. Intraluminal Middle Cerebral Artery Occlusion (MCAo) Diagram

EMS Procedure

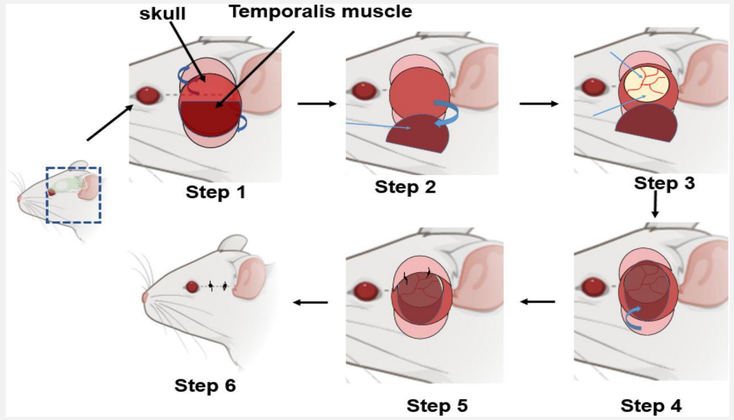
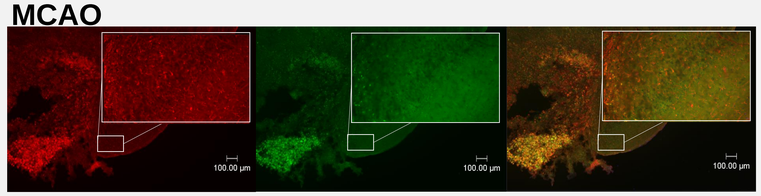


Figure 2. Stepwise EMS procedure after MCAo:

- An incision is made over the middle cerebral artery
- The temporis muscle flap is cut off from the skull and reflected to the side
- A craniotomy is performed, and the dura mater is removed
- The temporis muscle is put back on top of the exposed brain surface
- The temporis muscle is sutured to the dorsal side of the skin
- The skin incision is sutured, and the mouse returned to its cage

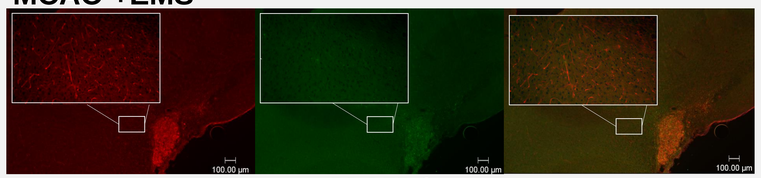
Preliminary Results

MCAO



Tomato Lectin PDGFR β Overlap

MCAO +EMS

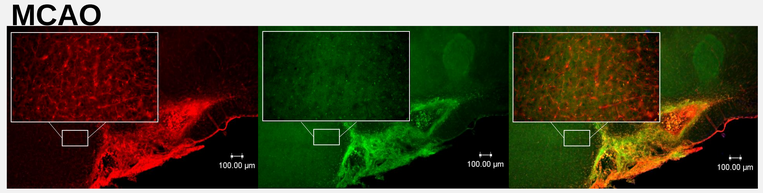


Tomato Lectin PDGFR β Overlap

Figure 3. Co-immunostaining of MCAo only (upper) and EMS +MCAo (bottom)brain tissue after 30 days. This visualization shows low blood vessel density (Tomato lectin) and low blood vessel maturity (PDGRFβ) around the infarcted tissue.

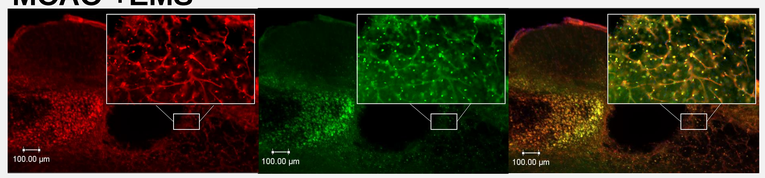
Preliminary Results

MCAO



Tomato Lectin PDGFR β Overlap

MCAO +EMS



Tomato Lectin PDGFR β Overlap

Figure 4. Co-immunostaining of MCAo only (upper) and EMS + MCAo (bottom) brain tissue after 60 days. This visualization shows low blood vessel density (Tomato lectin) and low blood vessel maturity (PDGRFβ) around the infarcted tissue.

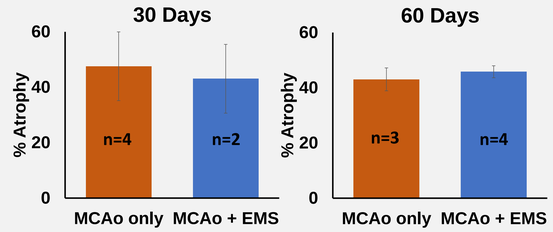


Figure 5. Atrophy determination by CV Staining EMS surgery did not improve stroke mediated atrophy

Conclusion

- EMS after MCAo promotes angiogenesis after stroke at early time point (30 days) however these vessels show maturity after long term recovery (60 days) after stroke. This data suggests that EMS provides an enriching environment for the brain that helps recover from an ischemic stroke faster.

Next Steps

- While we conducted an assessment that visualized increased blood in the brain after EMS, an assessment of blood perfusion will validate if these vessel are functionally viable.

Acknowledgements

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