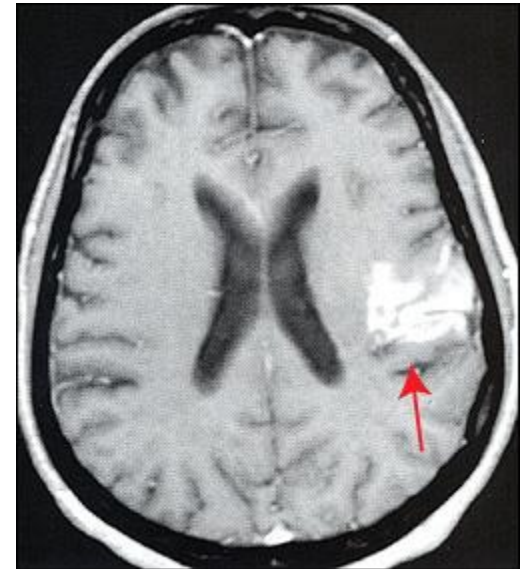


Improving Collateral Circulation During Focal Ischemia

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What Is Stroke?

- Two major types
 - Ischemic stroke (occlusion of a major artery going to the brain—majority of stroke)
 - Hemorrhagic stroke (bleeding on or inside the brain caused by the breakage of an aneurysm, vessel dissection, etc.)
- Usually related to preexisting conditions
 - Hypertension, prior head injury, embolism
- In focal ischemic stroke, the pial circulation provides collateral blood flow to the core and penumbra regions.

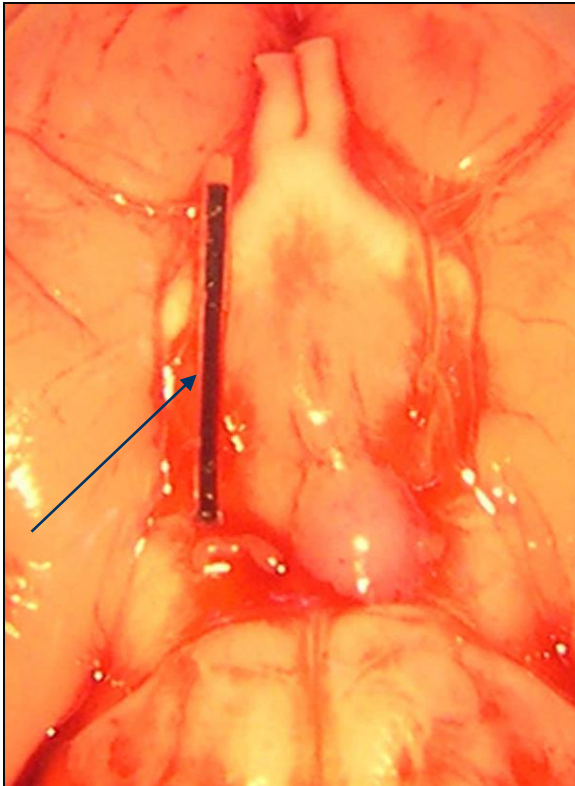


MRI of a stroke in the left hemisphere of the brain

Research Questions

- How do focal ischemia and reperfusion affect cerebral circulatory responses?
- What may contribute to the recovery of brain perfusion during and after ischemia?

Lab Objectives



A silicon-coated suture occludes the MCA by filling the ICA.

- Observe the effects of induced focal stroke on rats
 - Male, female, hypertensive/aged (risk factors for stroke)
 - Use either a suture or a thrombin clot to occlude the MCA
- Enhance collateral blood flow using vasodilators, including:
 - Adenosine/adenosine kinase inhibitor
 - Nitric oxide/phosphodiesterase inhibitor
 - Carbon dioxide/hypercapnia

Methods

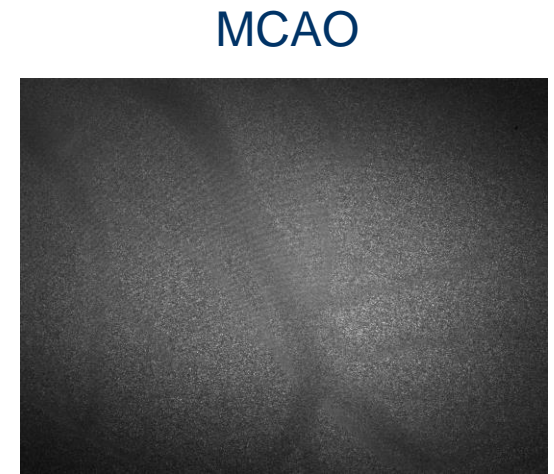
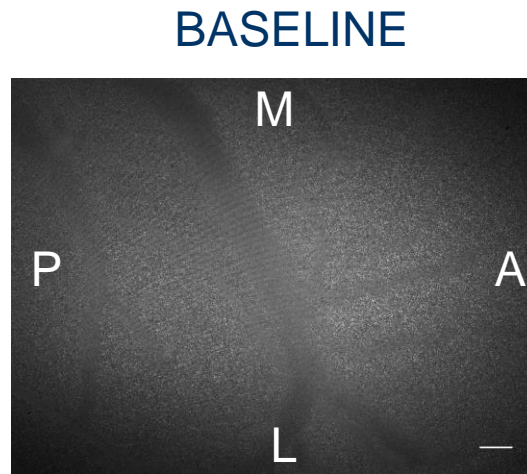
- Anesthetized using isoflurane gas
- Cannulation of femoral artery for BP monitoring; tracheal intubation
- Creation of cranial window
- MCAO using suture or clot
- Topical administration of vasodilator/IV application of AKI
- Monitoring of blood flow/dilation
 - LDF
 - Laser Speckle Imaging
 - Vessel diameter measurement



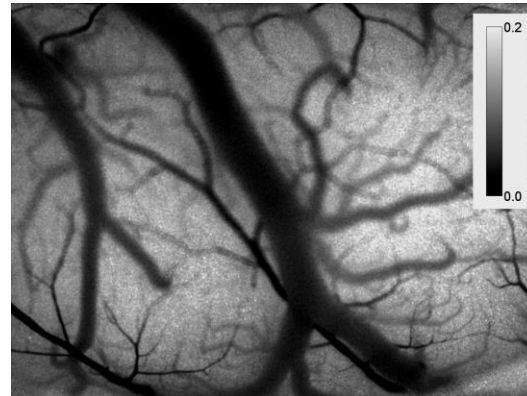
Processed Laser Speckle contrast image

Results

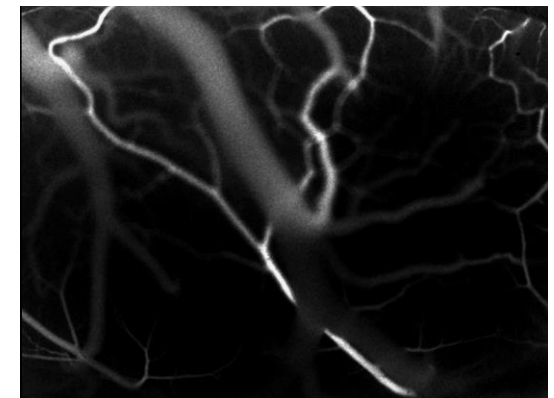
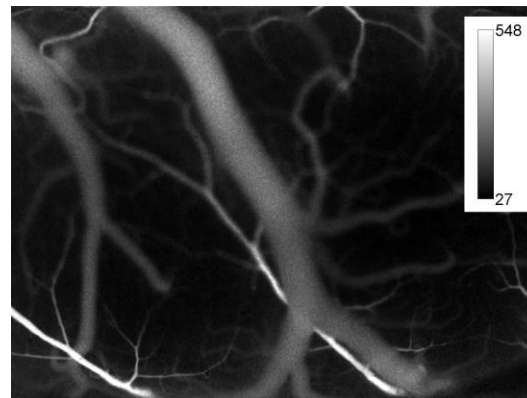
RAW IMAGE



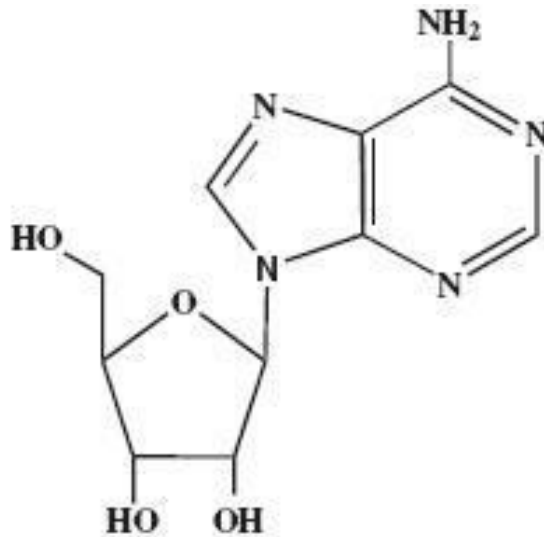
LASER SPECKLE
CONTRAST



CEREBRAL
BLOOD FLOW



Adenosine



An adenosine molecule

- Breakdown product of ATP
 - Adenine (purine) and ribose sugar
 - Lack of O₂, glucose to core of stroke; cellular respiration cannot occur
 - ATP breaks down to Adenosine and 3 P_i
- Adenosine acts as a potent vasodilator of collaterals, but is quickly broken down by adenosine kinase.
 - Adenosine kinase inhibitor

Conclusion

- Primary results are encouraging
 - Adenosine/AKI administration attenuates ischemic damage
- Future studies
 - Phenylephrine
- Development of collateral flow-enhancing drugs with minimal side effects

References

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Thanks to:

- Dr. Al Ngai, PhD (Principal Investigator)
- Peter Chong (Research Assistant)
- Kathy Chin (Research Assistant)
- Sean Kim (Undergrad, UW)
- Samuel Kim (Undergrad, Emory University)