Your Brain Without Oxygen

Insights into the Cerebral Response to Hypoxia from functional MRI

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Regional hypoxic vulnerability

Challenges:
- Can’t study normal physiological response once brain is already damaged
- Need a “safe” model of global cerebral hypoxia
Sustained Hypoxia at High Altitude Barcroft Lab

- Advanced fMRI techniques developed at CFMRI to quantify:
  - Cerebral blood flow
  - Cerebral \( O_2 \) metabolism
  - Tissue oxygenation
  - Parenchymal swelling
  - Diffusion
Brain Changes at “recreational” altitudes

- CO₂ is an important modulator of blood flow
- CO₂ is also an important modulator of O₂ metabolism

Smith JAP 2013;114:11-18
Hypoxic for 6 hrs (85% SaO₂)

Does +5% CO₂ (as in ischemia) cause regional differences in ΔCMRO₂?

Insular Cortex
-8%

Basal Ganglia
+4%

Occipital Cortex
-20%

Post. Cingulate Cortex
-14%

CO₂ sensitivity appears to be important in regional hypoxia vulnerability
Current Grants:
• Regional CBF / CMRO₂ sensitivity to CO₂ in hypoxic vulnerability
• Hemodynamic and Metabolic Coupling in Migraine

CBF / CMRO₂ / PtiO₂ in Migraine

• Global hypoperfusion and hypometabolism during migraine headache
• Reversed by sumatriptan therapy (5-HT agonist)