

Optical Probe Development for Blood Flow Monitoring during Cardiopulmonary Resuscitations

Group 1: Giselle Matlis, Eric Obenschain, Nathan Ona, Rena Mathew, Nadim Amin

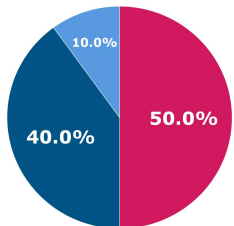
Advisors: Dr. Wesley Baker¹, Dr. Tiffany Ko¹, and Dr. Kurtulus Izzetoglu²

¹ Division of Neurology, Children's Hospital of Philadelphia, ² School of Biomedical Engineering, Science & Health Systems, Drexel University



1. Need and Objective

Provide Brain Perfusion Monitoring during CPR



CHOP Cardiac Arrest Outcomes

Around 150 cases annually

- Did Not Survive
- Survived with Impaired Neurology
- Survived with Neurology Intact

Clinical Need

- Persistently **poor neurological outcomes** from cardiac arrest*
- Insufficient brain perfusion monitoring****

Objective

Develop an **optical probe** to measure **carotid artery blood flow (BF)** during in-hospital pediatric CPR.

Key Requirements

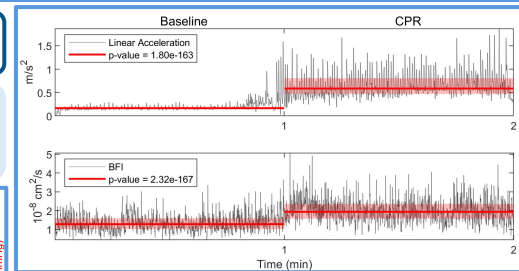
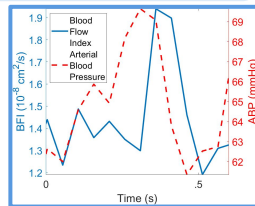
- Maintain photon counts (50k - 400k counts/second) for adequate signal-to-noise ratio
- Show statistical significance (p -value < 0.001) between baseline motion and CPR motion measurements

3. Testing/Results

Optical Signal and Acceleration Correlate with Motion

Prototype optical signal **measures BF** while accelerometer **tracks motion**.

With adequate signal-to-noise ratio, **blood flow index (BFI)** captures arterial pulsatility when there is **no motion (baseline)**.



Median
Interquartile Range
*Linear acceleration and BFI during baseline and CPR are **significantly different** (p -value < 0.001)

2. Solution

Noninvasive Carotid Artery Blood Flow Monitor

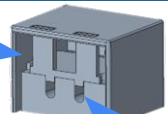
4. Conclusion

Novel Measurement Tool to Aid in Pre-Clinical CPR Research

Accelerometer
Measures motion



3D Printed Housing
Holds Embedded sensors and optic ends



Deployed on the neck

CPR Emergency Monitor
Monitor perfusion to the brain



Contact Sensor
Ensure proper contact

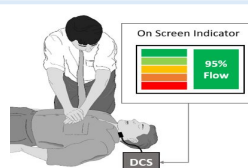


DCS Optics
Diffuse correlation spectroscopy (DCS) measures BF through a light and detector

Significance

- Novel pre-clinical measurement to study effects of chest compressions
- Provide surrogate for cerebral perfusion during CPR

Next generation device with on screen indication of carotid BF



Prototype in use during pre-clinical CPR study

Potential Impact

Future generations of our device may supply real-time measurements of perfusion to guide rescuer compression mechanics.