# Assessment of Cerebrovascular Autoregulation Using Regional Cerebral Blood Flow in Severe Traumatic Brain Injury

Ryan David Tackla MD; Jason Hinzman PhD; Mark Magner MD; Norberto O. Andaluz MD; Jed Hartings PhD
Department of Neurosurgery, University of Cincinnati (UC) College of Medicine, Neurotrauma Center at UC Neuroscience Institute, 231 Albert Sabin Way, Cincinnati, OH 45267, USA

## Introduction

Impairment of cerebrovascular autoregulation is a risk factor for ischemic damage following severe brain injury. Autoregulation can be assessed indirectly using intracranial pressure monitoring as a surrogate of cerebral blood volume, but this measure may not be applicable to patients following decompressive craniectomy. Here, we describe assessment of autoregulation using regional cerebral blood flow (rCBF).

## Methods

In 7 patients with severe brain trauma who underwent surgical decompression, a Hemedex® rCBF probe was placed intraoperatively in peri-lesional tissue. Autoregulation was assessed as a moving Pearson correlation between CPP and rCBF (rCBFx).

## Conclusions

rCBF-based autoregulation assessment is feasible and could be used to guide CPP management strategies to optimize autoregulation and perfusion. Autoregulatory impairment and CPPopt vary considerably between patients; rCBF monitoring could help guide CPP targeting decisions.

## Results

Composite data showed relatively constant perfusion over a wide CPP range (50–90 mmHg) and a U-shaped autoregulation curve with maximal autoregulation (CPPopt) at 55–60 mmHg. All rCBF values fell below the ischemic threshold (<18 ml/100 g/min) when CPPs were <50 mmHg compared with 11 % ischemia when CPPs >50 mmHg ($P < 0.05$). We examined the percent time during which both autoregulation was intact and rCBF exceeded the ischemic threshold. In the composite data, this variable was maximal in the CPP range of 75–80 mmHg (CPPideal). In individual patients, the range of CPPs with intact autoregulation varied widely. Individual CPPopt values ranged between 60 and 100 mmHg and CPPideal ranged between 65 and 105 mmHg.

## Learning Objectives

By the conclusion of this session, participants should be able to: 1) Describe the importance of autoregulation-directed therapy as it relates to improvement in TBI outcomes, 2) Discuss the current techniques capable of continuously monitoring autoregulation, and their limitations, in the intensive care setting, 3) Identify a novel rCBF monitor-based index of autoregulation which is both feasible and could be used to guide CPP management strategies to optimize both autoregulation and perfusion

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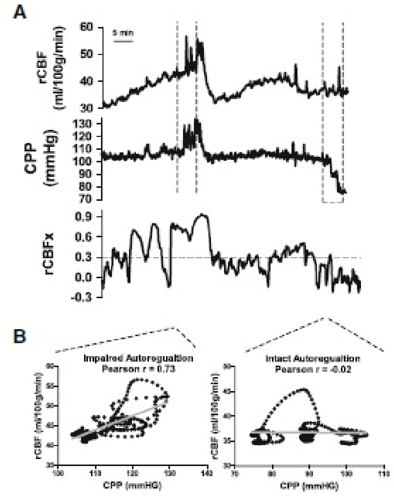
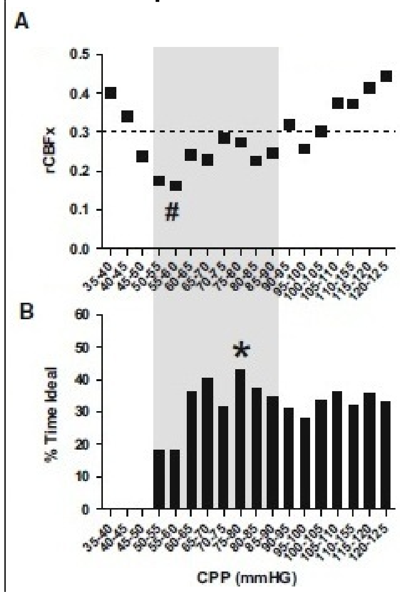
## Assessment of focal cerebrovascular autoregulation




a Smoothed graphs (8 second average) of regional cerebral blood flow (rCBF), cerebral perfusion pressure (CPP), and the calculated rCBFx. b Pearson correlations between rCBF and CPP in the two 5-minute periods delineated by dashed lines depict periods of impaired (Pearson correlation coefficient >0.3) and intact (Pearson correlation coefficient <0.3) autoregulation

## Dependence of autoregulation and % Time Ideal on perfusion pressure




a The average rCBFx for each 5-mmHg CPP bin. Based on the composite data, the CPP with the lowest autoregulation index (CPPopt) is 55–60 mmHg (indicated by #). b The percent time that autoregulation was intact and perfusion was above the ischemic threshold (>18 ml/100 g/min) as a function of CPP (% Time Ideal). The CPP with the highest % Time Ideal is 75–80 mmHg (CPP ideal indicated by *) for the composite data. Note that CPPideal is greater than CPPopt