Brain Injury – Monitoring & Prognostication, Oral Abstract:

Using non-invasive techniques to explore personalized cerebral perfusion targets in critically ill patients

Lee K.F.H., Wood M.D., Maslove D.M., Muscedere, J.M., Boyd J.G.
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Cerebral perfusion is regulated by cerebral autoregulation.

1. Normally, cerebral blood flow (CBF) is not correlated with blood pressure (BP).

2. Positive correlations between CBP and BP reflect CA dysfunction.

- Lower limit of autoregulation (LLA)
- Upper limit of autoregulation (ULA)
Cerebral perfusion is regulated by cerebral autoregulation

1. Normally, cerebral blood flow (CBF) is not correlated with blood pressure (BP)
2. Positive correlations between CBP and BP reflect CA dysfunction

How can we non-invasively assess cerebral autoregulation?

1. **Mean arterial pressure (MAP)** measured via radial artery
2. **Cerebral blood flow** measured by proxy via brain tissue oximetry (near-infrared spectroscopy, NIRS)

Dahan et al. 2016 Anesthesiology

www.foresight.com
MAP vs rSO2: the ‘rolling’ correlation analysis

Cerebral Oximetry Index (COx)

Dysfunctional cerebral autoregulation is associated with delirium in critically ill adults

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SAGE
- Strategy employed by ICM+ software (Czosnyka and colleagues, Cambridge UK)
- Cerebral oximetry index (COx) binned as a function of MAP
- Nadir of U-shaped curve fitted to the data is proposed to represent optimal MAP
Personalized cerebral perfusion targets?

A

MAP\textsubscript{OPT-A}

Cumul. time (min)

60 80 100 120

MAP (bins)

0 100 200 300

COx

60 80 100 120

0.0 0.5 1.0

-1.0 -0.5 0.0

-0.5
Personalized cerebral perfusion targets?

A

(I) Cumul. time (min)

(II) Cumul. time (min)

(III) Cumul. time (min)

(IV) Cumul. time (min)

MAP (mmHg)

MAP (mmHg)

MAP (mmHg)

MAP (mmHg)

‘safe’

‘safe’

‘safe’

‘safe’

COx (bins)

COx (bins)

COx (bins)

COx (bins)
Summary

• Cerebral autoregulation (CA) can be measured non-invasively using NIRS, using the cerebral oximetry index (COx)

• Cumulative duration of CA dysfunction (positive COx) is associated with the development of delirium in the ICU

• MAP binned as a function of COx may help identify putative targets to optimize cerebral perfusion for individual patients

• Future work is needed to further develop this procedure for real-time management of cerebral perfusion in critical illness
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