Effect of blood pressure management during aortic coarctation repair on tissue oxygen saturation measured by near-infrared spectroscopy

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Background
This study compares the effects of three commonly used blood pressure regulating agents on tissue oxygen saturation of the brain and peripheral tissues, during aortic coarctation repair in children, with the use of near-infrared spectroscopy. Based on the reported adverse effect of sodium nitroprusside (SNP) on tissue oxygen saturation, we wanted to explore the hypothesis that the alteration in tissue oxygen saturation occurring with SNP would not be present with sevoflurane and nitroglycerin (NTG).

Results
• There were no significant differences between treatment groups for rs_O2.
• Treatment with SNP resulted in a significantly larger and faster decrease of S_O2 and Sm_O2 compared to NTG (Table and Fig 1).
• Linear regression analysis showed a lower dependence between mean arterial pressure and rs_O2 for NTG (Fig 2).

Methods
• 30 children with isolated aortic coarctation were randomized to sevoflurane, SNP or NTG for blood pressure control during aortic cross-clamping.
• Bilateral regional cerebral oxygen saturation (rS_O2), renal oxygen saturation (S_O2) and muscle oxygen saturation (Sm_O2) were continuously recorded (INVOS 5100, Somanetics Corporation, Troy, MI).
• Changes in tissue oxygen saturation, rate of decay and area under the curve (AUC) were compared between treatment groups. Relationships between changes in tissue oxygen saturation and changes in blood pressure were evaluated by correlation and linear regression analysis.

<table>
<thead>
<tr>
<th></th>
<th>Sevo group</th>
<th>SNP group</th>
<th>NTG group</th>
<th>p-value between groups</th>
</tr>
</thead>
<tbody>
<tr>
<td>Max change in S_O2 (%)</td>
<td>-43 19</td>
<td>-59 13*</td>
<td>-33 22</td>
<td>0.028</td>
</tr>
<tr>
<td>Max change in S_m_O2 (%)</td>
<td>-55 19</td>
<td>-64 17*</td>
<td>-34 25</td>
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<tr>
<td>Decay rate S_O2 (%/min)</td>
<td>-5.6 3.1</td>
<td>-7.7 2.7*</td>
<td>-3.9 3.0</td>
<td>0.034</td>
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<tr>
<td>Decay rate S_m_O2 (%/min)</td>
<td>-6.2 2.4</td>
<td>-9.3 3.7*</td>
<td>-3.9 2.7</td>
<td>0.003</td>
</tr>
</tbody>
</table>

* p<0.05 from NTG

Fig 1. Area under the curve (AUC) for tissue oxygen saturation during aortic cross-clamping, indicating a significantly larger decrease in renal and muscle saturation in the SNP group compared to the NTG group (* p<0.05 from NTG).

Fig 2. Linear regression plot showing lower dependence between right cerebral oxygen saturation and MAP in the NTG group.

Conclusion
This study confirms the hypothesis that SNP promotes impaired peripheral tissue oxygenation.

Our data suggest that nitroglycerin might be preferable to sodium nitroprusside for blood pressure control during procedures involving aortic cross-clamping.