The Acute Effect of Packed Red Blood Cell Transfusion on the Partial Pressure of Carbon Dioxide and Oxygen in Mechanically Ventilated Children After the Norwood Operation

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Background
- The Norwood operation is the first of three cardiac surgeries to establish proper circulation in patients with single ventricle physiology
- Many infants undergo packed red blood cell (pRBC) transfusion following cardiac surgery to increase oxygen content and delivery
- Optimal transfusion thresholds have not been well-defined in children following cardiac surgery
- pRBC transfusions have been independently associated with morbidity and mortality in both pediatric and adult patients
- We examined the effects of pRBC transfusion on children with single ventricle physiology after the Norwood operation

Methods
- Retrospective chart review was conducted to gather data on patients eligible for the study
- The following measurements were collected for patients at baseline and following pRBC transfusion:
  - Arterial pH
  - PaCO2
  - PaO2
  - Arterial bicarbonate (HCO3)
  - Arterial Lactate
  - FiO2
  - Minute Ventilation
  - Hemoglobin
- For patients who had multiple arterial blood gases drawn, values closest to the pRBC transfusion were used
- SPSS Version 23.0 was used to complete statistical analysis with a p-value of p<0.05 considered significant

Results
- A total of 33 patients were included in the final analysis
- Significant changes following pRBC transfusion were observed for:
  - Hemoglobin increased by 3.25 (p<0.01)
  - Arterial pH (p=0.20)
  - PaCO2 (p=0.70)
  - PaO2 (p=0.44)
  - Arterial lactate decreased by 1.02 (p=0.03)
  - PaO2/FiO2 ratio decreased by 15.00 (p=0.04)

Conclusions and Future Applications
- Overall, we see some improvement in oxygen delivery following pRBC transfusion
- While the paO2 did not change significantly following pRBC transfusion, the significant reduction in arterial lactate suggests greater delivery of oxygen to the tissue
- pRBC transfusions may have some benefits for patients following the Norwood operation by increasing the hemoglobin levels significantly
- The benefits of pRBC transfusion must be weighed against the possible negative effects including increased length of hospital stay, prolonged mechanism ventilation, and increased incidence of postoperative complications

References

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