Young RBC Subpopulation Reduce the Hb-Oxygen Affinity of Cord Blood from Preterm Neonates

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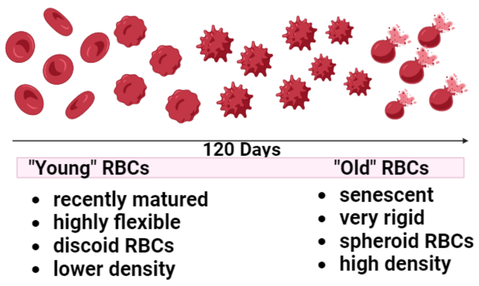
INTRODUCTION

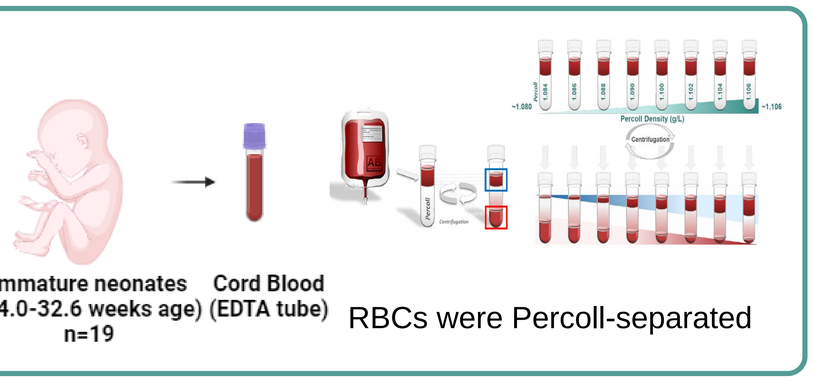
- Adult packed RBCs (pRBC) bind oxygen differently than that from premature infants.
- The p50 measures the oxygen pressure at which hemoglobin is 50% saturated with oxygen.
- Hb-O_2 affinity of young (Y-RBCs) and old RBCs (O-RBCs) is different.

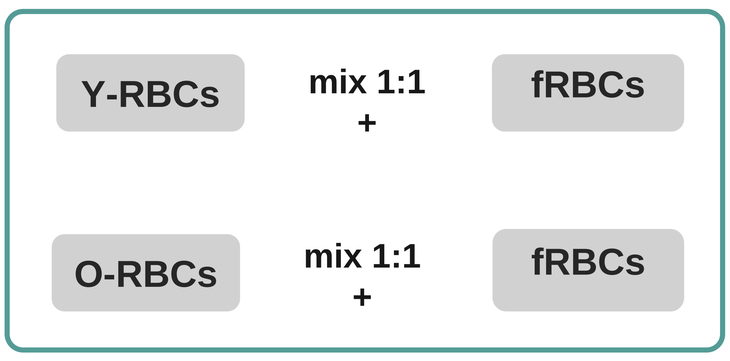


Objective:

To characterize changes in fetal RBCs (fRBCs) hemoglobin-oxygen affinity following mixing with "young" RBCs and "old" RBCs.

METHODS





Hemox Analyzer
(p50)

Coulter
(RBC indices)

RESULTS

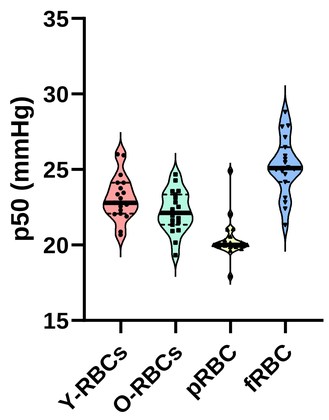


Figure 1 p50 comparison in packed RBC (pRBC) and fRBC shows a significant difference. p50 in fRBC is significantly higher compared to pRBC. ($p < 0.0001$).There was also a difference in p50 between fRBC mixed with Y-RBC (23.34 ± 1.17 mmHg), and fRBC mixed with O-RBC (22.36 ± 1.21 mmHg) ($p < 0.0001$)

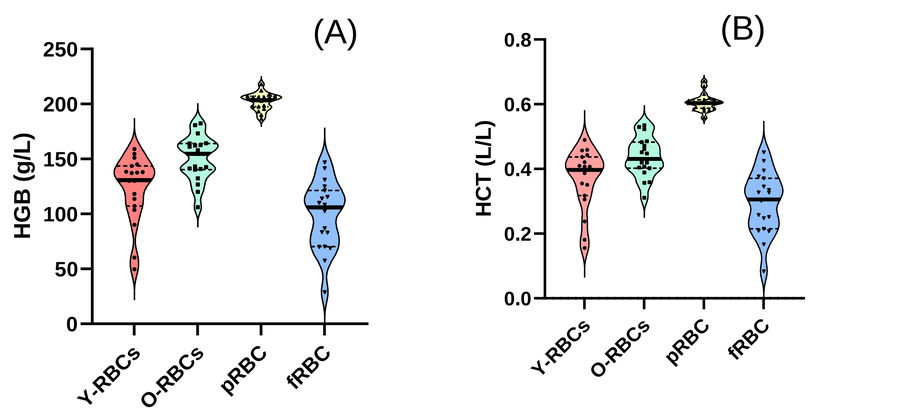


Figure 3 HGB and HCT comparisons in different subpopulations showed significant differences. The fRBC group had a lower HGB count compared to pRBC. Additionally, fRBC mixed with Y-RBCs had a lower RBC count than O-RBCs ($P<0.0001$) (Figure 3A).The fRBC group had a lower HCT to pRBC. Additionally, fRBC mixed with Y-RBCs had a lower HCT than O-RBCs ($P<0.0001$) (Figure 3B).

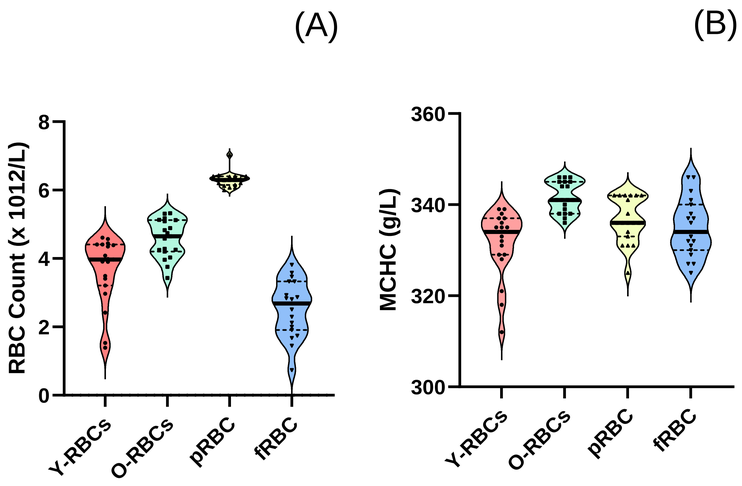


Figure 2 MCHC and RBC Count comparisons in different subpopulations showed significant differences. MCHC values were as follows: fRBC (334.94 ± 6.29 g/L), fRBC mixed with Y-RBC (331.47 ± 7.37 g/L), and fRBC mixed with O-RBC (341.63 ± 3.38 g/L) ($P < 0.0001$) (Figure 2A). The fRBC group had a lower RBC count compared to pRBC. Additionally, fRBC mixed with Y-RBCs had a lower RBC count than O-RBCs ($P<0.0001$) (Figure 2B).

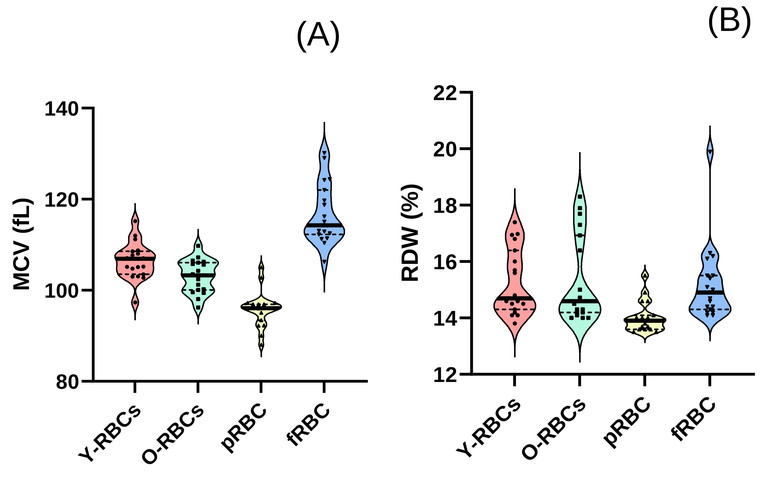


Figure 4 MCV and RDW difference between fRBC, pRBC, Y-RBC and O-RBC mixing with fRBC. The fRBC group exhibited, significantly lower MCV than pRBC. Also, fRBC mixing with Y-RBCs had a lower RBC count compared to O-RBCs ($P<0.0001$) (Figure 4A). There was no significant difference in the RDW between fetal red blood cells (fRBC), fRBC mixed with Y-RBC, and fRBC mixed with O-RBC. (Figure 4B)

CONCLUSIONS

- Addition of **O-RBCs** to cord blood from preterm infants significantly **increases hemoglobin-oxygen** affinity.
- **O-RBCs** may briefly reduce tissue oxygen delivery, as they shift the ODC curve leftward, increasing oxygen affinity and **decreasing oxygen release.**
- Y-RBCs share closer physiological properties (p50, HGB, HCT, MCHC, MCV) with fRBCs.

Implication:

Y-RBCs could offer significant advantages for precision transfusions for premature babies.

ACKNOWLEDGEMENTS

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