

EFFECT OF ANEMIA OF PREMATURITY AND ITS TREATMENT ON HEMODYNAMICS OF PRETERM INFANTS

Mohamed Alaa Eldin Hassan Thabet, Ahmed Adel Hassan El Beheiry, Marwa Mohamed Farag Mohamed, Amany Abdel Hamed Tolba El Sebaee
Department of Pediatrics, Department of Alexandria University, Faculty of Medicine, Alexandria University, Egypt

INTRODUCTION

Anemia, described as low hemoglobin (Hb) or hematocrit (HCT) levels. The causes are multifactorial and include an immature hematopoietic system resulting in poor iron stores, decreased red blood cell (RBC) lifespan, low erythropoietin levels, and frequent blood sampling. Anemia is often poorly tolerated, resulting in tachycardia, desaturation, apneic events, and poor feeding, and growth. When untreated, severe anemia may adversely affect organ function due to increase their cardiac output. Though uncommon, this increases the risk of the development of left ventricular dysfunction and lead to inadequate oxygen supply, possibly resulting in anemic tissue hypoxia and injury. Anemia may also result in alterations in cerebral oxygenation and an increased risk for cerebral injury. Existing data raise concerns about the impact of anemia on both short- and long-term neurodevelopmental outcome (NDO). The underlying mechanisms for neurodevelopmental sequelae are multifactorial and incompletely understood, but known causative factors include cerebral hypoxia, ischemia, oxidative injury, and fluctuations in cerebral perfusion. It has been estimated that more than 90% of extremely low-birth-weight infants receive one or more RBC transfusions during their NICU stay. Transfusion thresholds remain controversial as RBC transfusions are associated with increased risk for ischemia-reperfusion damage or oxidative injury potentially resulting in transfusion-associated necrotizing enterocolitis, bronchopulmonary dysplasia and retinopathy of prematurity. Several studies comparing high (liberal) and low (restrictive) Hb or Hct thresholds for RBC transfusion have been published but controversies about when to transfuse anemic preterm infants still remain. More research needs to be done to find superior indicators of perfusion and oxygenation to possibly use as transfusion markers. Hemodynamic measurements by Doppler study has the potential to provide criteria for Packed cell transfusion.

Aim of the work

The aim of this work to study the hemodynamic changes accompanying anemia of prematurity in neonates with gestational age ≤ 32 weeks and the effect of its treatment on hemodynamics.

METHODS

The study was done to evaluate the hemodynamic changes provoked by anemia of prematurity and transfusion of packed red blood cells (RBCs) in neonatal intensive care units in Alexandria University Maternity Hospital.

This study was conducted on 72 preterm infants. All patients were divided into 2 groups:

Nonanemic inpatient premature infants (36 infants) (Hematocrit $>30\%$) will be compared with **Pretransfusional anemic** (Hematocrit $<30\%$) inpatient according to clinical and hemodynamic measures premature infants (36 infants). Anemic premature infants will be assessed before and 24 hours after the transfusion of pRBCs.

RESULTS

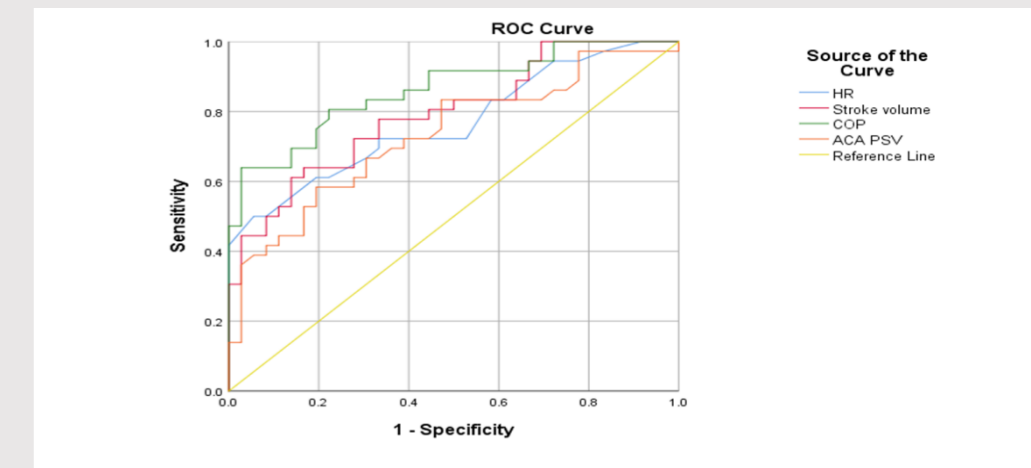
Heart rate(HR), Stroke volume(SV), Left ventricular output(LVOP) and Peak systolic velocity(PSV) in Anterior cerebral artery (ACA) were found to be significantly higher in the anemic group.

SV, LVOP, PSV in ACA, PSV, and RI (Resistive index) in RA(Renal artery), were found to be significantly higher before transfusion as shown in table (1).

Table (1) Comparison between the anemic infants before and after packed transfusion s as regard HR ,SV ,LVOP and ACA velocity:

	Cases(n=36)	Test of sig.	P
HR (beat/min) Min. – Max.	130 – 186	t= -4.548	<0.001*
Mean \pm SD.	160.4 \pm 15.1		
Median (IQR)	162.5 (145 – 170)		
Stroke volume(ml/kg)			
Min. – Max.	1.1 – 3.8	U= 436.5	0.017*
Mean \pm SD.	2.51 \pm 0.76		
Median (IQR)	2.75 (1.85 – 3.1)		
LVOP (ml/kg/min)			
Min. – Max.	199 – 570	U= 178.5	<0.001*
Mean \pm SD.	328.59 \pm 87.01		
Median (IQR)	315 (263.9 – 377.35)		
ACA			
PSV (cm/s)			
Min. – Max.	22.3 – 76	U= 347.5	0.001*
Mean \pm SD.	45.91 \pm 12.16		
Median (IQR)	45.15 (35.9 – 53.15)		
EDV (cm/s)			
Min. – Max.	3 – 23	U= 566.5	0.358
Mean \pm SD.	8.43 \pm 4.4		
Median (IQR)	6.85 (5.7 – 10.4)		
RI			
Min. – Max.	0.67 – 0.94	t= -0.894	0.375
Mean \pm SD.	0.82 \pm 0.07		
Median (IQR)	0.82 (0.79 – 0.88)		

In order to determine the predictive values of HR, stroke volume, COP and ACA PSV for anemia, ROC curve analysis was utilized and our results showed that COP was the best discriminator at a cutoff ≥ 260.2 for anemia as it has AUC of 0.862, Sensitivity and Specificity 80.6% and 77.8% respectively as shown in figure (1).



Figure(1) ROC curve analysis

CONCLUSION

Anemia is a common comorbidity in preterm infants in the neonatal intensive care unit (NICU). AOP is not completely preventable due to decreased erythropoietic activity. The decision to transfuse is frequently based on clinical signs and standard guidelines. Hemodynamic measurements are not common in transfusion practice. Doppler study can provide one of the objective criteria for packed cell transfusion in these infants. HR, stroke volume, COP and ACA PSV were found to be reliable markers for anemia and COP show the best preference.