



# Comparison of CPDA vs. AS Red Cell Transfusion To Infants on ECMO

Anne F. Eder, MD PhD, Kristine Gray, MT(ASCP), Catherine S. Manno, MD

Department of Pathology and Laboratory Medicine, The Children's Hospital of Philadelphia, Philadelphia, PA



## Introduction

Transfusion protocols for infants on extracorporeal membrane oxygenation (ECMO) were developed in the absence of definitive evidence to guide decisions. Consequently, practices vary among pediatric institutions with respect to the selection of red cell components (*i.e.*, maximum storage time prior to transfusion; preservative/anticoagulant solution) and further modification of the units (*i.e.*, supernatant removal; washing). Two different transfusion protocols evolved at The Children's Hospital of Philadelphia in an effort to balance disparate concerns among groups of specialist physicians. Reflecting primarily theoretical considerations regarding additive solutions (AS), in particular, their mannitol and adenine content, a protocol for infants in the neonatal intensive care unit specifies type O red cells less than 10 days old collected in CPD or CPDA-1 (CPD/A). If only AS units are available the supernatant is removed prior to transfusion. In contrast, cardiologists and anesthesiologists at our institution preferentially requested AS units over CPD/A units, primarily because of the lower concentration of extracellular potassium and decreased risk of attendant cardiac toxicity following massive transfusion. Consequently, infants in the cardiac intensive care unit (CICU) receive primarily ABO/Rh type-specific red cells, collected in AS-1 or AS-3 (AS1/3); some may also receive CPD/A units based on available inventory. Our CICU experience suggests that infants on ECMO tolerate AS1/3 units as well as CPD/A units. To substantiate the comparative safety of transfusing large volumes of AS1/3 units compared to fresh CPD/A units to infants less than four months on ECMO, a retrospective audit of transfusions in the CICU was conducted.

## Methods

Infants in the CICU who received whole unit red cell transfusion on ECMO were selected for retrospective audit. Hemoglobin, sodium, potassium, calcium, glucose and creatinine values were compared before and after the transfusion of CPD/A red cell units or AS1/3 red cell units. Post-transfusion laboratory values were measured within 4 hours of the transfusion. The pre- and post-transfusion mean laboratory values were compared with paired t-tests (one-tailed for hematocrit; two tailed for all other analytes). Pretransfusion laboratory values were subtracted from posttransfusion results to express mean changes in blood chemistry levels, so that a positive value indicates an increase; a negative value, a decrease after transfusion. The mean changes ( ) were then compared with unpaired t-tests.

**Table 1. Red Cell Transfusions Audited**

CPD or CPDA Transfusions				AS-1 or AS-3 Transfusions			
Tx	Patient	Age	Indication for ECMO	Tx	Patient	Age	Indication for ECMO
1	A	2 m	Tetralogy of Fallot/ARDS	1	A	2 m	Tetralogy of Fallot/ARDS
2	B	2 d	Bridge to heart transplant	2	B	2d	Bridge to heart transplant
3	C	3 d	Transposition of the great arteries	3	B		
4	C			4	E	3m	Bridge to lung transplant
5	D	2d	Cardiac arrest, congenital heart disease	5	E		
6	D			6	F	5d	Transposition of the great arteries, double outlet right ventricle sp surgery

**Table 2. Laboratory Values with Transfusion**

	CPD/A			AS1/3		
	Pre	Post	p	Pre	Post	p
Hct, %	38.5	41.9	0.04	33.8	36.6	0.02
Na, mmol/L	139	138	0.66	136	136	0.74
K, mmol/L	4.4	3.7	0.08	4.4	4.2	0.10
GLC, mg/dL	154	137	0.31	97	131	0.19
Ca, mg/dL	8.7	8.7	0.87	9.3	8.6	0.13
Crt, mg/dL	0.6	0.6	1.00	0.4	0.4	1.00

**Table 3. Comparison of Changes in Laboratory Values After CPD/A vs. AS1/3 Transfusion**

	CPD/A (Δ)	AS1/3 (Δ)	p
Hct, %	3.4	2.8	0.37
Na, mmol/L	-0.7	-0.5	0.93
K, mmol/L	-0.7	-0.2	0.14
GLC, mg/dL	-17	34	0.08
Ca, mg/dL	0.05	-0.7	0.08
Crt, mg/dL	0	0	0.20

## Results

Four infants received 6 CPD/A units; four infants received 6 AS1/3 units (*Table 1*). Hematocrit was significantly increased after transfusion of CPD/A ( $p=0.04$ ) or AS1/3 ( $p=0.02$ ) units, with mean differences of 3.4% after CPD/A and 2.8% after AS1/3 transfusions ( $p$ , NS)(*Table 2,3*). No other statistically significant differences between pre- and post-transfusion laboratory values were observed (*Table 2*).

Mean differences in serum chemistry values ( ) following CPD/A or AS1/3 transfusion were compared (*Table 3*). These changes observed in laboratory values following transfusion of CPD/A or AS1/3 units were not statistically or clinically significant. No adverse reactions to blood transfusion were reported.

## Conclusions

Transfusion of AS1/3 units appears to be tolerated as well as CPD/A units by infants on ECMO, suggesting removal of AS supernatant or washing is unnecessary. The data support less reliance on CPD/A units for infants, an important consideration in light of the decreasing availability and greater expense of these units compared to AS units. The data also support simplification of transfusion protocols at our institution, eliminating the need for a separate inventory of CPD/A units or further manipulation of red cell units for infants on ECMO.