Transfusion of irradiated and stored red blood cells to neonates

Haematologica 2007; 88:(6)e82

Irradiation of cellular blood components is the only measure for preventing transfusion-associated GvHD. The patients at risk and the indications for irradiation are increasing in recent years. Many transfusion centers lack irradiators and must obtain irradiated components from outside suppliers which complicates the timely and practical provision of transfusion to the patient.

Storage of irradiated (4000 rad) CPDA-1 RBCs for 35 days has been shown to have little or no effect on RBC ATP, 2,3 DPG, methemoglobin, pH, glucose comsumption and plasma hemoglobin.[1] Furthermore, 24-h post-transfusion red cell recovery was only slightly decreased after transfusion of irradiated (3000 rad) AS-1 RBC stored for 42 days.[2] The major concern about transfusion of irradiated stored RBCs to neonates is the potassium (K^+) load of the product.[3] Clinical data on the safety of γ-radiated and stored RBCs for transfusion in newborns are lacking. We determined the hematocrit and K^+ concentration in the supernatants of 32 consecutive irradiated saline-adenine-glucose-mannitol (SAG-M) RBC units which were obtained from the Sectorial Blood Bank. The RBCs were irradiated with 2500 rad between day 0 and 7 post-collection . We determined hematocrit and K^+ levels in aliquots collected from the bag on days 0, 2, 7, 14 and 21 after irradiation. RBCs had a mean hematocrit of 58.8% (SD 3.17) and the mean K^+ concentration in the supernatant on the day of irradiation was 7.95 mmol/L (SD 2.58). This concentration rose progressively during storage, as shown in Figure 1. The mean K^+ concentration in the supernatant plasma of the units stored for 21 days was 62.23 mmol/L. This concentration is lower than the 80-100 mmol/L accepted as the maximum to be infused through a peripheral vein. The total amount of K+ administered in a transfusion of RBCs irradiated and stored for 21 days is 0.38 mmol/Kg. This represents only a 10-20 % of daily K^+ requirements of a neonate (2-3 mmol/kg/day) and are transfused usually in 2 hours. The infusion rate of 0.19 mmol/Kg/hour is well below the recommended safe K^+ infusion rate of 0.25 to 1 mmol/Kg/hour. We reviewed the clinical charts of 10 newborns who received irradiated RBCs that had been stored for at least 10 days, administered at a standard dose of 15 ml/kg in 1-2 hours and who had K^+ determinations performed before and after transfusion. The K^+ determinations were performed a median of 3.15 hours before (range: 2.05 to 3.30) and 3.37 hours after transfusion (range: 2.07 to 6). Age, weight, diagnosis, days from irradiation to transfusion, and K^+ concentration pre and post-transfusion are shown in Table 1. There were not statistically significant differences in K^+ levels before (median 3.55 mmol/L) and after (median 3.7 mmol/L) transfusion (Z=-1.232, p= 0.218). The patients did not experience any clinical adverse effect during transfusion. In conclusion, as far as K^+ is concerned, the transfusion of irradiated and stored RBCs to neonates at 15 mL/kg in 1-2 hours appears to be safe.

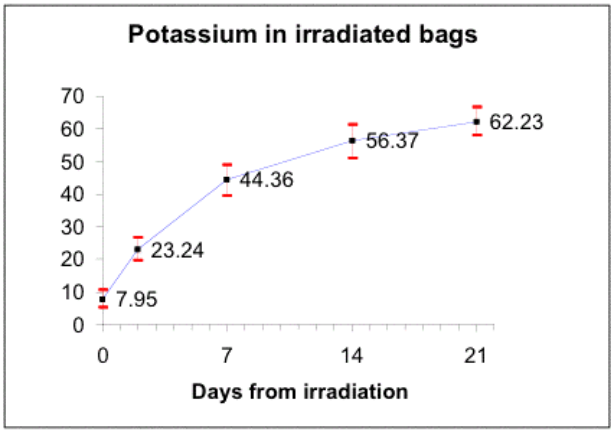

Figure 1. K^+ concentration (mean ± standard deviation) in supernatant of irradiated RBCs stored for up to 21 days

Table 1. Changes in blood K^+ concentration after transfusion of irradiated and stored RBCs.

Case	Age (days)	Weight (kg)	Diagnosis	Days from irradiation	K^+ pre (mmol/L)	K^+ post (mmol/L)
1	13	3	Great arteries transposition	16	3,1	3,2
2	7	3,6	Bronchopulmonary dysplasia	15	3,7	3
3	2	3,7	Perinatal asphyxia	19	3,4	3,5
4	14	2,6	Diaphragmatic hernia	14	4,1	4,2
5	27	4,5	Pneumococcal sepsis	17	3,6	3,9
6	4	0,6	Extreme prematurity	20	3,2	3,5
7	8	1	Extreme prematurity	12	5,1	4,5
8	15	4	Perinatal asphyxia	15	4,6	4,8
9	11	4	Skull fracture	20	3,6	3,3
10	25	4	Pulmonary atresia	23	3,5	3,9

I. Martín, I. Alcorta, L. Baixeras, J. Zárate, F. Martínez
Servei d'Hematologia, Hospital Universitari Sant Joan de Déu, Esplugues (Barcelona), Spain. Universitat de Barcelona, Spain

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