

Neonatal & Paediatric RBC Components

NHO conference 19th Nov 2010

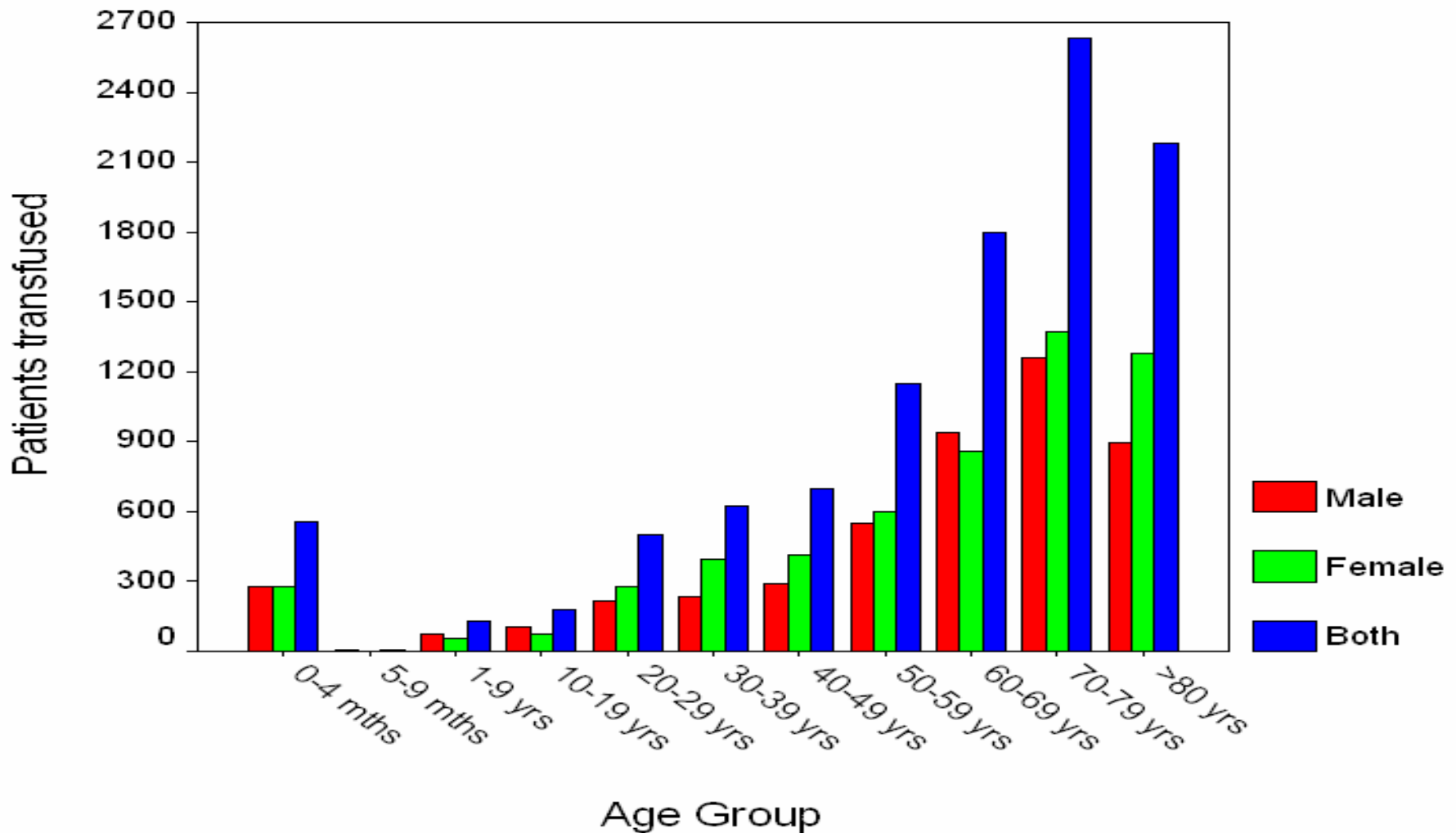
Gresham Hotel

J O' Riordan

Issues in RBC Neonatal Transfusion

- **Volume 10-20 mls/kg or >**
- **Freshness - < 5, 7, 10, 35 day**
- **Rate**
- **Anticoagulant – CPD or Sag-M**
- **Donor exposure –limited & to what extent**
- **CMV status - universal or selective**
- **Irradiation - universal or selective**
- **Leucoreduction**
- **Transfusion transmitted diseases**

Red cells use by age representing 58 % of national RBC usage (2001 Blood Utilisation Survey)



Profile of neonatal recipients of one viremic donor

Donation year	HCV test	Recipients			
		1	2	3	4
Quad Pack					
•	Anti-HCV	-	-	+	+
	HCV RNA	-	-	-	+
•		D*			
1987	Anti-HCV	+			
	HCV RNA	-			
1990	Anti-HCV	D*	+	+	+
	HCV RNA		-	+	+
1990	Anti-HCV	-x2#	+		
	HCV RNA	-	+		
1991	Anti-HCV	+	+		
	HCV RNA	-	+		

- = negative, + = positive. *Deceased. #This baby received two top-up transfusions from donor . O’Riordan et al Trans Med 1998;8:303-308

Neonatal RBC Components

- Small vol top-up transfusion
Red cells AS (Pedipack -full shelf life)
- IUT
Red cells, plasma reduced (5 days)
- Exchange and massive transfusion neonate
Red cells, plasma reduced (5 days)
- Large vol surgical use (cardiac surgery)
Red Cells AS (5 days)

THE PREMATURE INFANT

Foreshortening
3rd Trimester
Transfer Iron



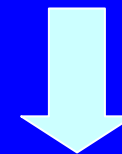
GESTATION



PRE- TERM



SICK
PRETERM
BABY



Inadequate
EPO production

In-Utero
production of
EPO



NICU,
phlebotomy
Anaemia of
Prematurity



Anaemia of Prematurity

- Physiologic anaemia of infancy
- 10-12 weeks Hb 9.0g/dl

- Anaemia of prematurity
- 4-6 weeks Hb 8.0g/dl infants 1.0-1.5kg
7.0g/dl infants < 1.0 kg
- Phlebotomy losses
- Shortened RBC survival 40-60 days

BUG guidelines

- **Each Neonatal Dept develop own guidelines**
- **Clinicians who follow guidelines give fewer transfusions**
- **Degree of prematurity : majority infants > 1500g will not require transfusion**
- **Most < 1000g –assign pedipack**
- **Degree of illness (e.g. respiratory support)**
- **The post natal age**

BUG Suggested RBC Guidelines

Hb 12-13.0g/dl severe cardiopulmonary disease

Hb 10.0-11.0g/dl moderate cardiopulmonary disease

Hb 8.0 –10.0g/dl symptomatic anaemia

Hb 7.0-8g/dl late anaemia, stable patient

Hb 10.0g/dl major surgery

**Do not recommend routine RBC replacement for
phlebotomy losses**

RBC for small vol transfusion

(Red Cells, LD in Additive Solution,
splits 1-5) Pedipack (56830-4)

- ABO compatible with mother & infant & infants RhD (or RhD neg) IBTS O Pos or O Neg
- IAT compatible with maternal plasma (if available) or neonates' plasma for 1st Tx (& subsequent Txs if atypical maternal antibodies present)
- SAG-M 35 days
- HCT 0.5-0.7
- Vol 10-20 mls/kg over 2-4 hrs
- Dedicated single unit to one infant (Pedipack)
- Irradiate if appropriate

RBC for small vol transfusion

(Red Cells, LD in Additive Solution,
splits 1-5) Pedipack

Preterm infant

- Assign a relatively fresh pedipack (5-7 days)
- Protocols designed so that freshest blood is transfused to youngest i.e the VLBW infant ages with the unit

Neonatal Transfusion: Audit BUG 2007 Recommendations

Small volume RBC-'top-up' transfusion:

Written guidelines

- Audit, stratified by birth weight
- Audit donor exposure
- Audit phlebotomy losses (NICORE)

Platelet transfusion-written guidelines

- Audit usage and donor exposure

FFP/SD-Plasma

- Audit usage to guidelines

Donor exposure among transfused infants 2005/6

- Details on 291 infants tx pedipacks

No. of Donor Exposure in Tx Infants

• Pedis	1	2	3	4	5+/->
• Total	203	62	21	11	4
• % TXs	70	21	7	4	1.4

RBC for Intrauterine Transfusion

Red cells, LD,CPD for IUT (30018)

- O, Rh D-negative, K neg or lacking implicated RBC antigen eg anti-c - RhD pos, c -neg
- IAT- Cross-match compatible with maternal serum & neg for relevant antigen(s)
- HCT : up to 0.70-0.85
- CPD
- < 5 days old
- CMV neg
- Irradiated & transfuse within 24 hrs of irradiation
- HbS negative
- Not to be transfused straight from 4° storage

After birth all RBCs & platelets must be irradiated

N.B follow-up (8 weeks) hyporegenerative anaemia often require top-up
Tx

Exchange Transfusion

Red cells, Plasma Reduced CPD,LD
5 days (54350)

- **O, D-negative, lacking implicated RBC antigen or ABO/RH type-specific, lacking implicated RBC antigen**
- **Cross-match compatible with maternal serum**
- **HCT : UK 0.50-0.55, AABB 0.4-0.5**
- **CPD or reconstitute**
- **< 5 days old**
- **CMV neg/reduced risk**
- **Irradiated & transfuse within 24 hrs**
- **HbS negative**
- **Not to be transfused straight from 4° storage**

Possible Complications of Exchange Transfusion

Hyperglycaemia

Hyperkalaemia/hypokalaemia

Hypocalcaemia

Hypovolaemia/polycythaemia

Hypothermia

Thrombocytopenia

Coagulation factor deficiency

Haemolysis

GvHD (previous IUT)

Apnoea

Bradycardia

Cyanosis

Vasospasm

Thrombosis

NEC

Air embolism

Exchange Transfusion-a lighter Approach

15 year retrospective review Jackson et al 1997

- **N = 106 patients**
- **81 healthy –hyperbilirubinaemia**
- **25 ill**
- **mortality – 2 (2%)**
- **Risk of bilirubin encephalopathy v Severe complications 12%**

Tertiary referral to NICU with full monitoring & resuscitation capabilities

Red cells, Plasma Reduced, cPD LD
5 days, 54350 (massive transfusion of
newborn)

- Acute life-threatening haemorrhage in the newborn

Acute feto-maternal transfusion

Twin-twin transfusion

Bleeding from vasa praevia or birth injury

Hyperkalaemia

2 weeks of age

- **Cardiopulmonary bypass surgery**
- **32 day-old packed RBC**
- **60 mls -cardiac arrest –serum K 8.9⁺ mmol/l**
- **Plasma K⁺ pack 60 mmol/l- Hall et al Transfusion 1993**

29 week hydropic preterm – creatinine 196 mmol/l

- **Multiple top –ups from 7/8 day old As RBCs**
- **Arrested K ⁺8.1 mmol/l**
- **K ⁺19.6 donor unit- Podlosky et al Abstr. Transfusion Med 1996**

Hyperkalaemia-induced cardiac arrest -62 day old baby

- **Rapid infusion 120 mls of irradiated (48 hrs prev) 6 day old blood through central line**

Red Cells, LD in Additive Solution

5 days (54481)

- Large volume surgical use
Cardiac surgery

Mou SS et al. Fresh whole blood versus reconstituted blood for pump priming in heart surgery in infants. N Engl J Med 2004

Bond et al Use of SAG-M RBC in large volume transfusion associated with cardiac surgery in neonates and infants: a retrospective audit
Transfusion Medicine 2010

Fatal Transfusion-Associated Graft-v-Host Disease in Infants During the First Year of Life

Underlying Medical Condition	Number Reported
Primary immunodeficiency disease	27
Related blood donor	26
Intrauterine and exchange transfusion	5
Exchange transfusion only	9
Aplastic Anaemia	1
No generally acknowledged risk factor	5
Total	73

Strauss R. Transfusion 2000;40;1528-1540

Irradiation

- IUT
- Top-up or exchange transfusion after IUT
- Exchange tx
- First- or second-degree relative or HLA- matched donor
- Proven or *suspected* immunodeficiency
 - All severe T lymphocyte immunodeficiency syndromes
- Platelets transfused in utero
- Platelets or RBCs after birth if fetus received either RBCs or platelets
- No need to irradiate RBC for infants undergoing cardiac surgery (unless clinical or laboratory features suggest co-existing T lymphocyte immunodeficiency syndrome)

HLA matched platelets

Granulocytes

Universal Irradiation of Pedipacks?

- **Low risk**
- **Leucodepletion**
- **SHOT Report (1996-7) TA-GVHD in 32 weeks multiply transfused**
 - HLA haplotype shared with one donor & rare severe combined immunodeficiency**
- **NHO –Report (2004) – 2 infants with severe immunodeficiency did not get irradiated blood**
- **HLA haplotype sharing more common in Ireland**
- **Irradiation almost doubles K^+ ; shelf-life 14 days (BCSH)**
- **US blood banks –irradiate just before transfusion**

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Red Cells AS (5 days)

Effect of Leucodepletion on TA-GVHD

- **Universal leucodepletion Nov 1999 UK & IBTS**
- **Removes 3-4 logs total leucocytes**
- **3.5 log₁₀ removal CD3 T cells**
- **TA-GVHD: SHOT**

1996-1999	12 cases
2000-2003	1 case