Challenges of blood requirement for paediatric ECMO life support

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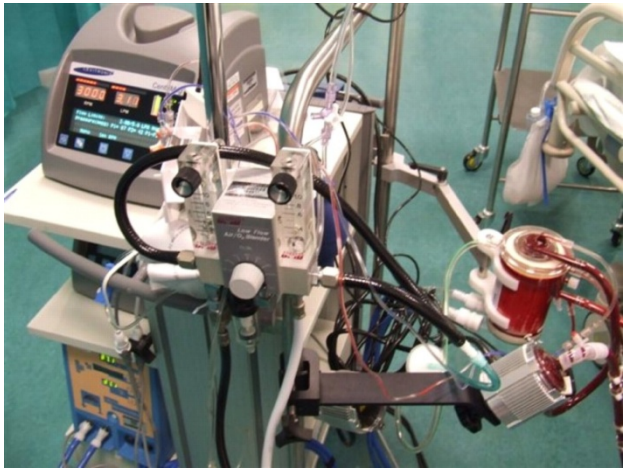
Extracorporeal Membrane Oxygenation (ECMO)

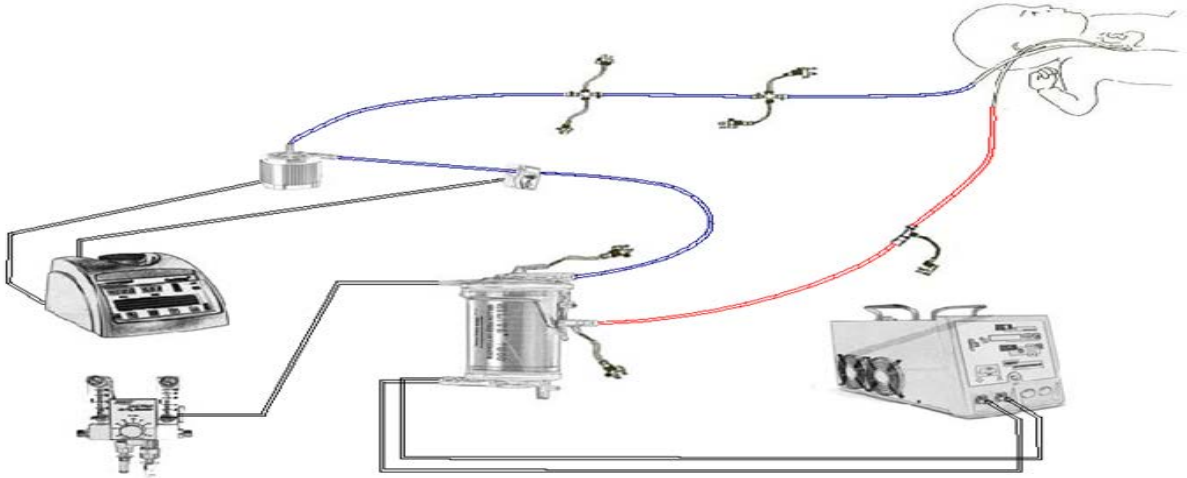
- What is ECMO?
- Why do we need blood products?
- How to reduce blood product administration?

What is Extracorporeal Membrane Oxygenation ECMO?

- Modified cardiopulmonary bypass machine which provides long-term (wks to months) physiological lung and / or heart support.



What is ECMO?



Indications for ECMO

- Patient selection key
- Severe respiratory and cardiac failure despite maximal conventional therapy
- No contraindications
- Potentially reversible lesion

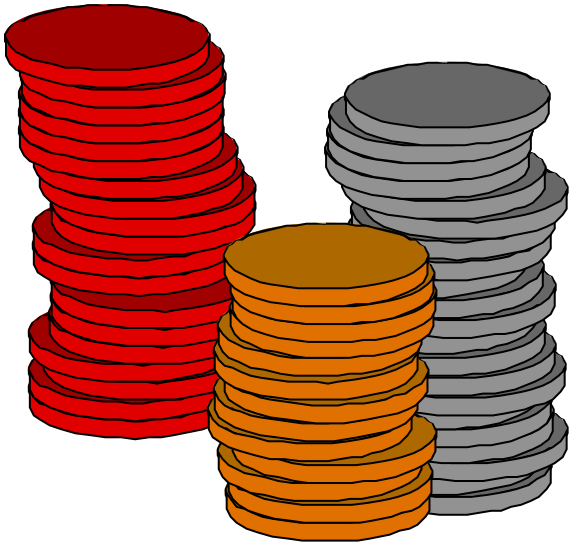
Aims of ECMO

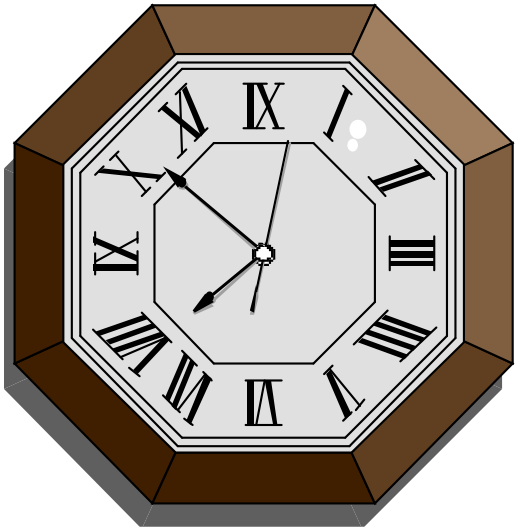
- **Provide <u>extracorporeal</u> RESPIRATORY <u>support</u>**
  - To oxygenate the blood, remove CO_2
  - provide 'lung rest': prevent O_2 toxicity & baro/volutrauma

1. **Provide <u>extracorporeal</u> CIRCULATORY <u>support</u>**
   - Deliver adequate oxygenation to vital organs
   - All maximal 'heart rest' & recovery

Aims of ECMO

- **A supportive therapy which buys time**





to allow damaged organs to recover

Major Problems on ECMO

- **Circuit complications**
- **Sepsis**
- **Failure to recover**
- **Bleeding – heparinised circuit**
  - **patient condition – DIC or post op cardiac surgery**
  - **extracorporeal circuit – activation of coagulation and fibrinolytic pathways**

Blood and Blood Products are Vital for ECMO

- **Oxygenation**
  - maintain optimal haemoglobin between 100 – 120 g/L

- **Safe ECMO - prevent bleeding**
  - maintain platelets and blood coagulation parameters to reduce bleeding risk

- **Treatment of bleeding**
  - can require massive blood, platelet and blood product transfusion

The Challenge of Blood Requirement for Paediatric ECMO

- Monitoring and management of coagulation on ECMO remains a challenge
- Blood and blood products are an expensive and precious resource
- Review of management of coagulation currently underway (ELSO)
- Alder Hey review of our ECMO transfusion practice

Alder Hey ECMO Transfusion Practice Development

Patients receiving ECMO, often require multiple transfusions of blood products, which carries associated risks.

Frequently reviewed Transfusion practice in terms of:

1. Blood product parameters and triggers for administration of blood products.
2. Developed a bleeding protocol, for management of bleeding on ECMO.
3. Change in clinical practice, to attempt to rationalise blood product usage.

Blood Product Parameters

- Parameters developed to limit blood product exposure.

	Non – Bleeding Patient
Haemoglobin	100-120 g/L
Platelets	>50 x 10^9/L
Fibrinogen	>0.75 g/L

Bleeding Protocol

- Adopt Bleeding parameters

	Bleeding Patient
Activated Clotting Time (ACT)	140-160 seconds
Platelets	>150 $X10^9$
Fibrinogen	>1.5 g/L

(Fibrinogen concentrate if >15kgs)

- If requiring >40mls/kg of fluid boluses to maintain ECMO Flow – swap from HAS/Gelofusine to FFP
- Consider Tranexamic Acid
- Consider Surgical re-exploration
- Consider stopping Heparin

Changes in Clinical Practice

- Implementation of new guidelines and Protocols within the ECMO Specialist Nursing Team
- Hospital Transfusion Department changed its practice to reduce donor exposure to patients receiving ECMO.
- Achieved by dividing one donor adult red cell unit into 6 paediatric packs. Where possible, Fresh Frozen Plasma (FFP) and Cryoprecipitate (Cryoppt) units were also divided into paediatric units, to limit donor exposure.
- Good working relationship between PICU and the Transfusion Department

Alder Hey Children's NHS
NHS Foundation Trust

A Review of Blood Product Usage in Children Receiving Extracorporeal Membrane Oxygenation (ECMO) in a Tertiary Paediatric Intensive Care Unit

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Inspired by Children

Review of Blood Product Usage

January 2015

Objective:

- To establish blood and blood product usage in the patients receiving ECMO.
- To assess if changes to practice have impacted on the amount of blood products administered, and in turn donor exposure and costs for ECMO patients.

Methodology:

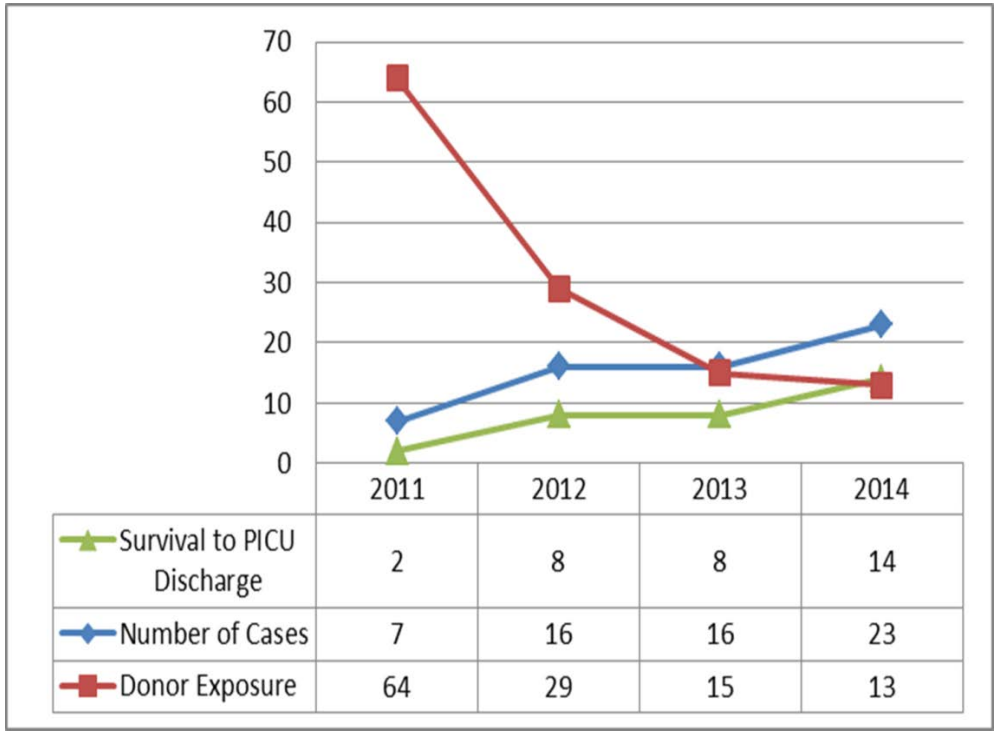
A retrospective case note and chart review of blood and blood products administered to all patients receiving ECMO within our unit, from April 2011 to January 2015. Donor exposure and costs were calculated accordingly.

Results

	2011	2012	2013	2014	P Value
Number of Cases	7	16	16	23	
Length of ECMO (hrs)	172 (16 – 354)	101 (4 – 934)	127 (28 – 1033)	96 (19 – 767) *	
Median volume of Red Cells per ECMO run (mls)	2480	1160	640	520	
Median volume of FFP per ECMO run (mls)	840	320	200	300	
Median volume of Cryoppt per ECMO run (mls)	200	200	140	140	
Median volume of Platelets per ECMO run (mls)	1420	380	260	240	
Donor Exposure	64 (8 - 82)	29 (3 – 169)	15 (6 – 96)	13 (3 – 84) *	0.033
Survival to PICU Discharge	2/7	8/16	8/16	14/23	0.453
Cost of Blood Products (GBP)	£11,625.21 (£734 - £14,726)	£4,827.63 (£1705 - £27,326)	£2,092.17 (£991 - £15,507)	£1,922.50 (£267 - £15,205) *	

* Denotes median (range)

Donor Exposure



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Summary

- Significantly reduced donor exposure to patients receiving ECMO.
- Reduction in blood and blood product usage, with a significant reduction in costs.
- Potentially reduced risk to patients, without increasing mortality.

ECMO Team

A team approach is key to successful ECMO

Transfusion and Haematology Services are vital members of the ECMO Team

Special thanks to the Alder Hey Haematology and Transfusion Teams