

PUMP INDUCED HAEMOLYSIS:

A COMPARISON OF SHORT TERM VENTRICULAR ASSIST DEVICES

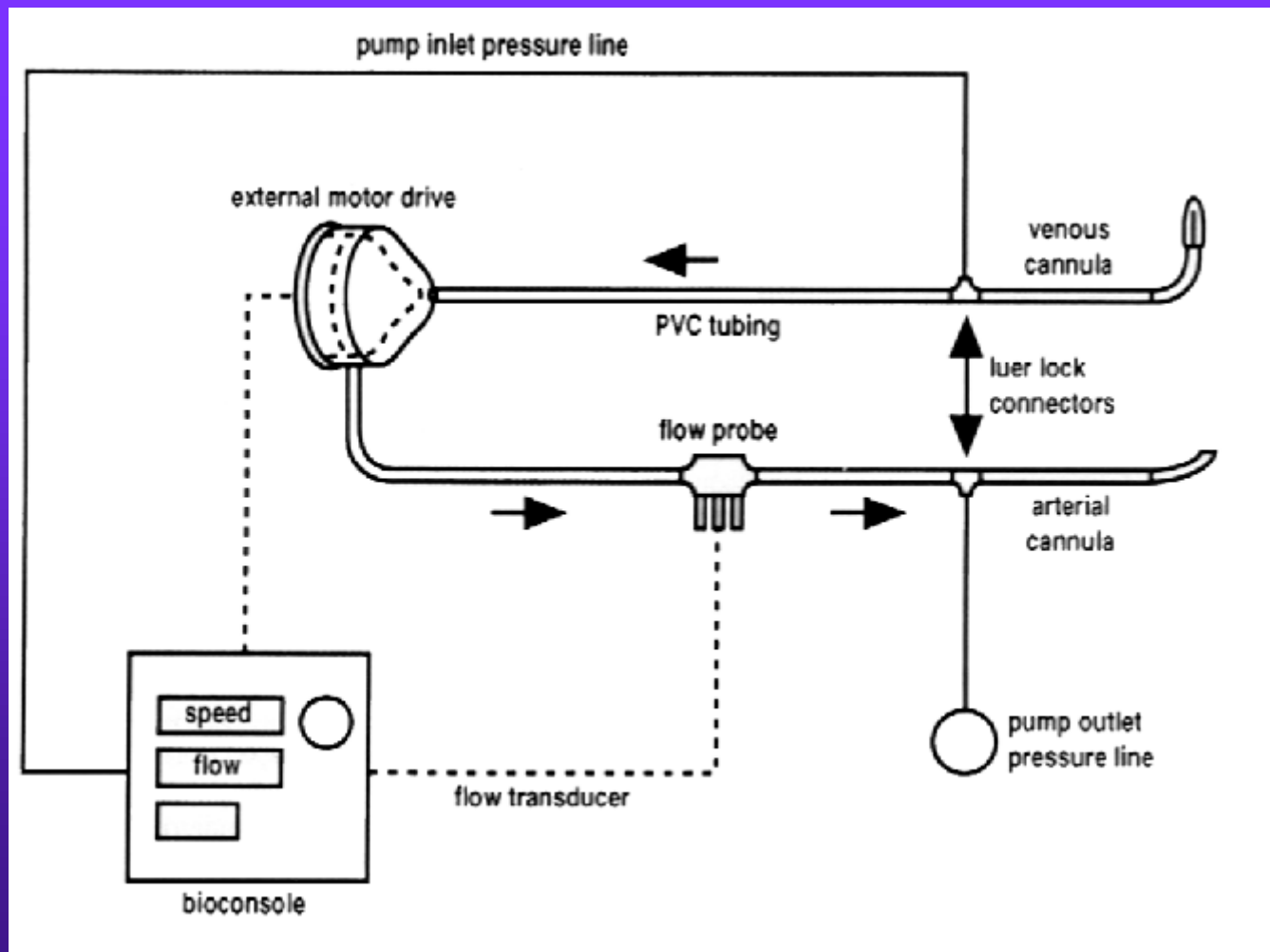
Introduction

- DeBakey - first successful use of a Ventricular Assist Device (VAD) in 1971
- New VAD systems suitable for patients down to 20kg
- Q: Can a child with complex congenital heart disease requiring univentricular support be supported without an oxygenator?

Indications & Contraindications

- Postoperative support - palliative & reparative procedures
- Refractory low Cardiac Output
- Multiorgan failure, neurological impairment, prolonged cardiac arrest
- A child accepted for heart surgery is a candidate for VAD

Royal Children's Hospital VAD circuit



VAD Outcomes

- 1989 - 2000 supported 75 patients using VAD
- 1.2% of CPB cases
- Median age 3 months, weight 4.6 kg
- 49 weaned (69%)
- 32 discharged (43%)
- Median support time 75 hours (1 - 428)

Haemolysis & the Centrifugal Pump

- Haemolysis = release of free Haemoglobin into plasma
- Renal damage, tissue ischemia
- Upper limit 0.6 mg/l
- Pump head change out
 - air embolism
 - circuit contamination
 - no patient support
 - additional costs

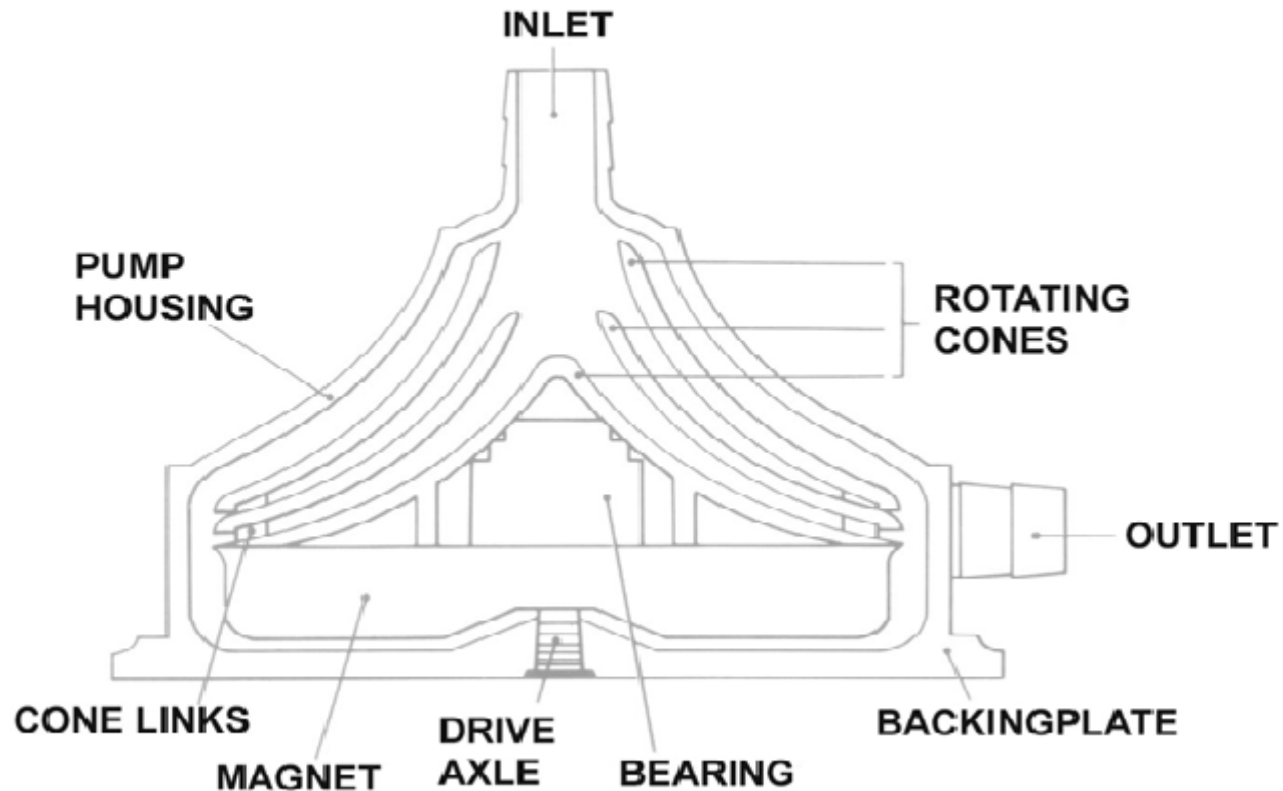
Haemolysis & the Centrifugal Pump

- Known contributors to haemolysis
 - mechanical trauma
 - areas of high shear stress
 - surface contact & exposure time
 - friction heat produced on bearings and seals

Biomedicus Bio-Pump

- Clinical use for over 20 years
- “Standard” for centrifugal pumps
- Familiar to the perfusion community
- Rotating cones
- Drive axle bearing and flexible seal

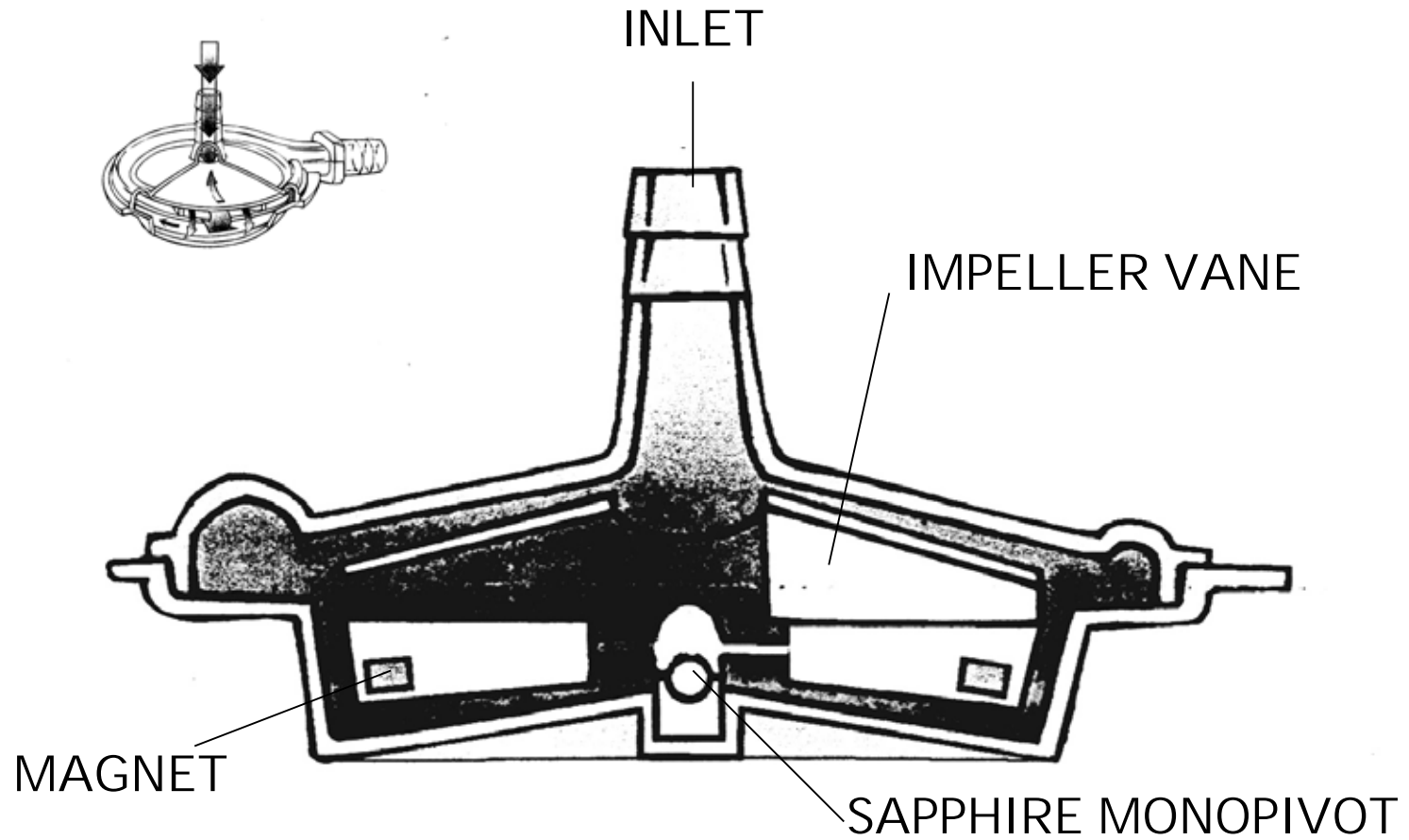
Biomedicus Bio-Pump



Jostra RotaFlow

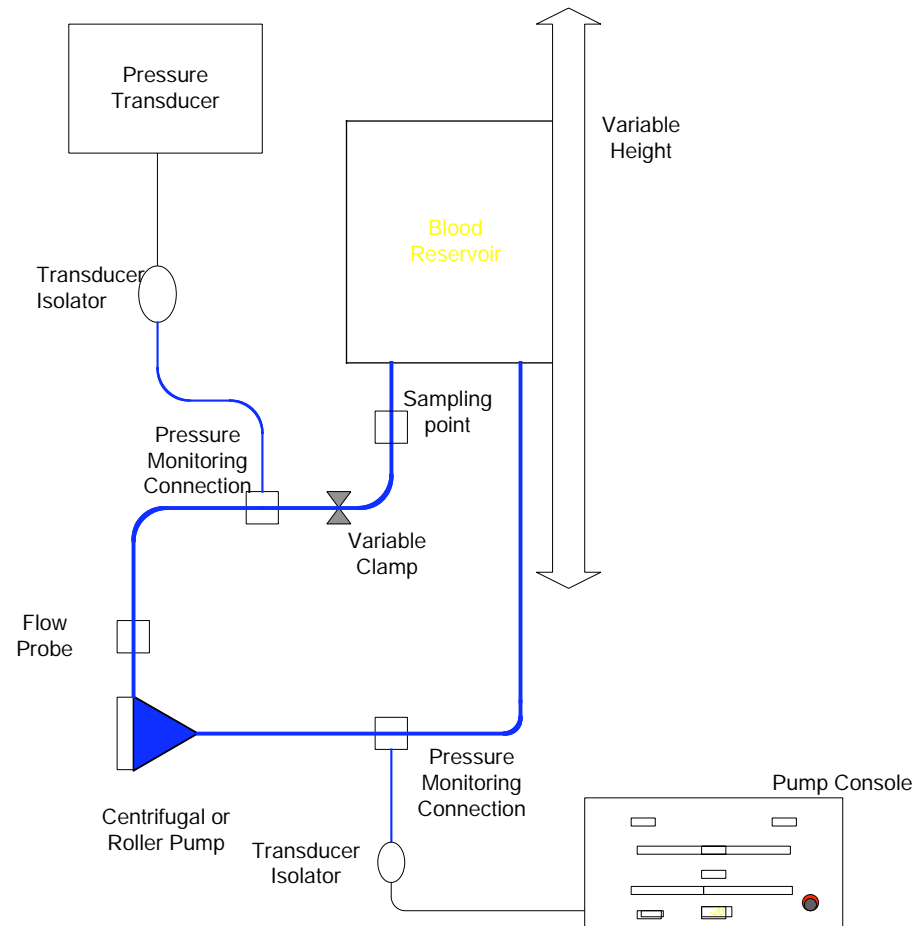
- New generation shrouded impeller pump
- Magnetically stabilized rotor on a monopivot
- Low friction, fewer dead zones
- DEKRA approval for 4 days usage

Jostra RotaFlow

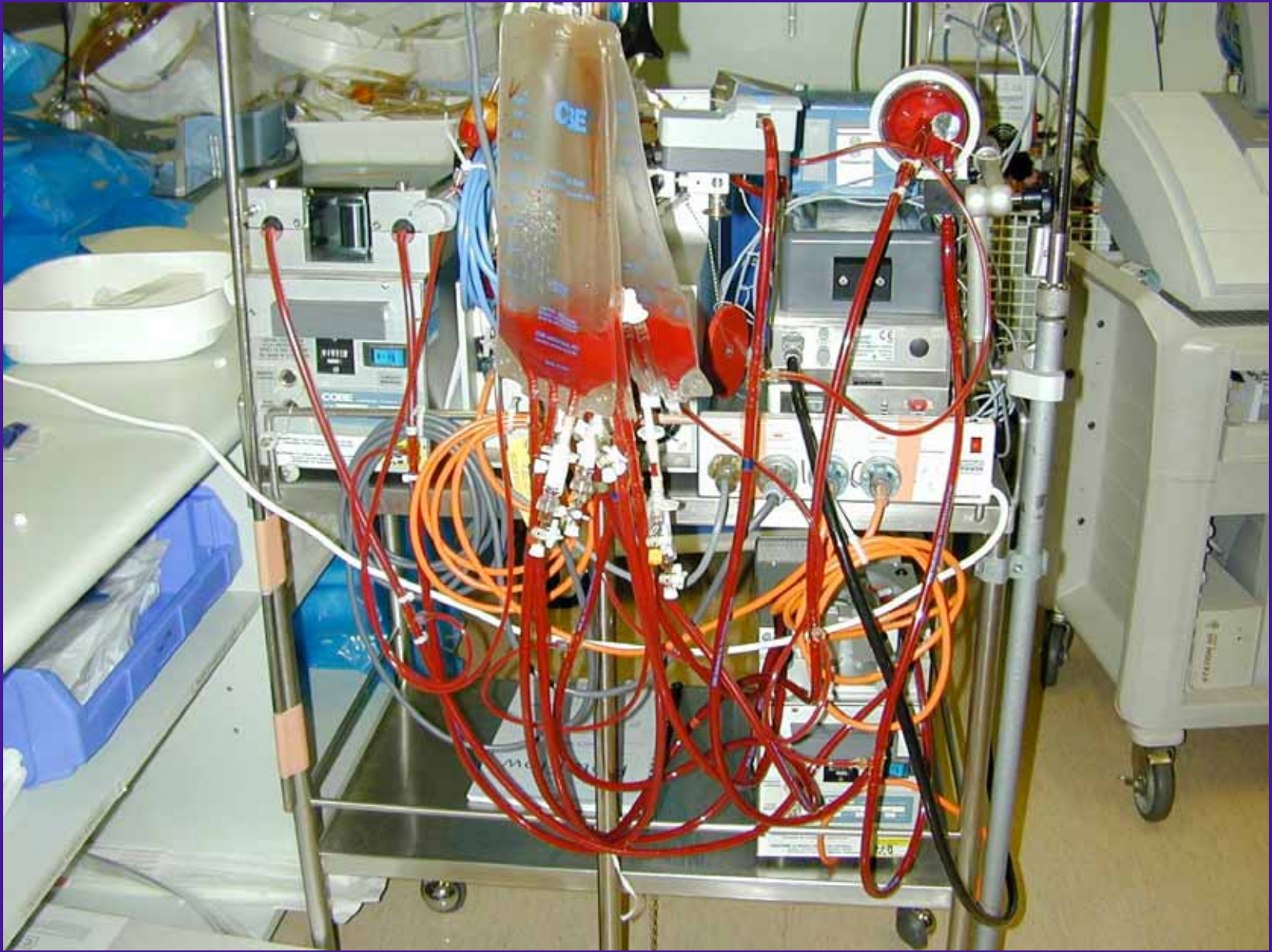


In-vitro Bench Test

Test Circuit



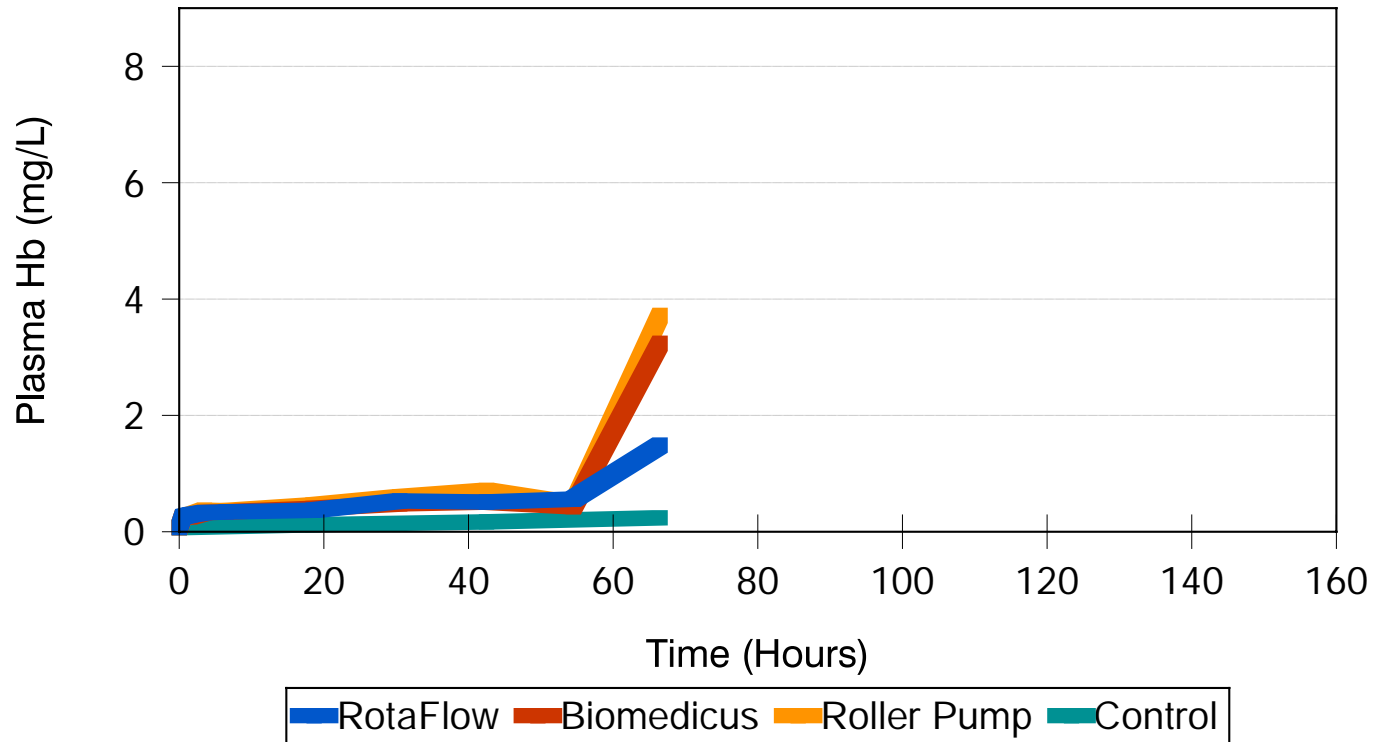




Week 1

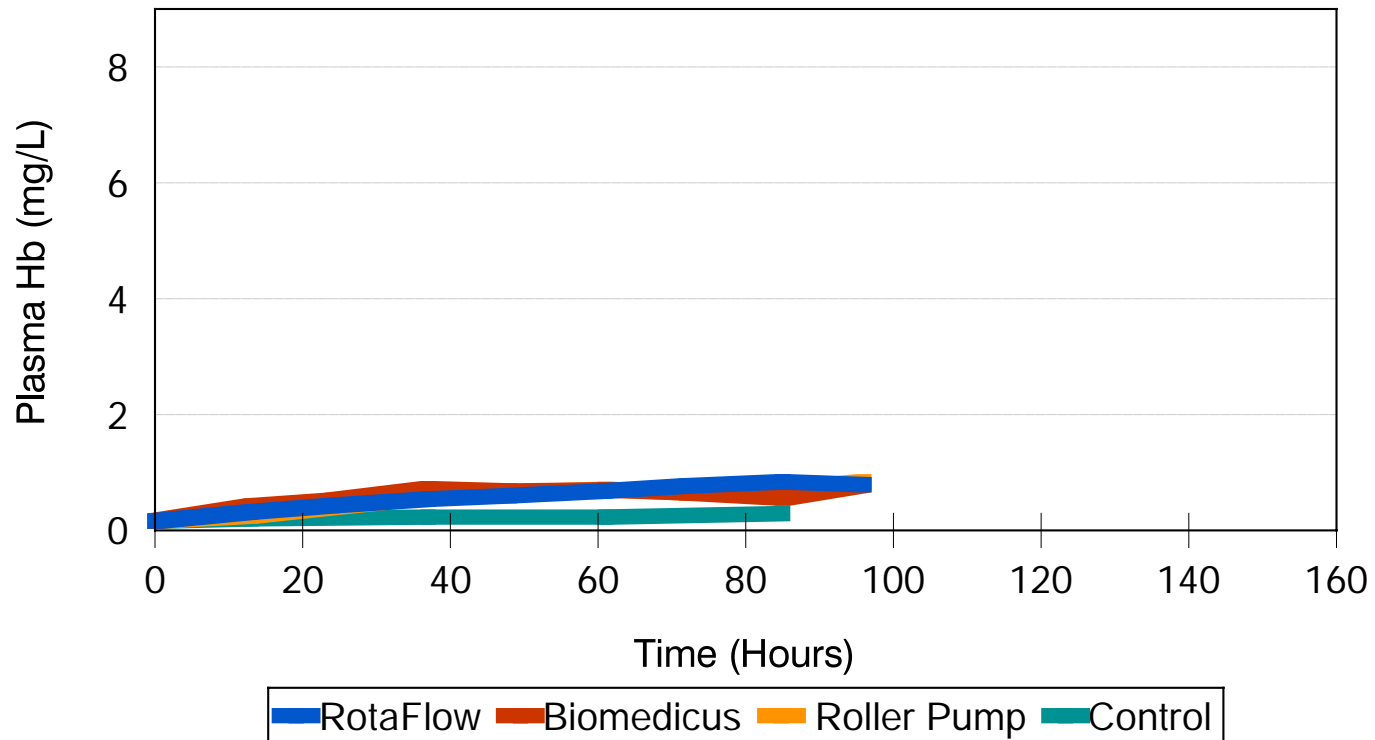
Plasma Free Haemoglobin

Week 1



Week 2

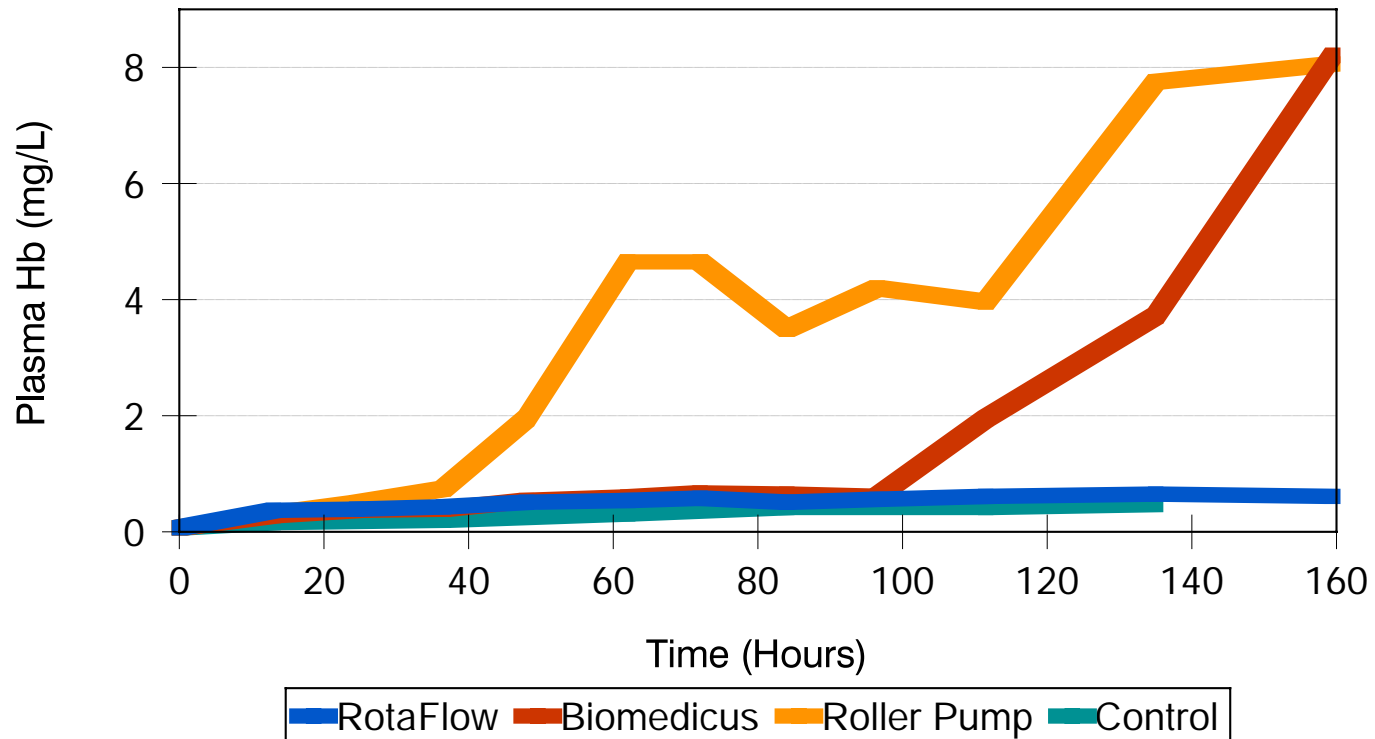
Plasma Free Haemoglobin Week 2



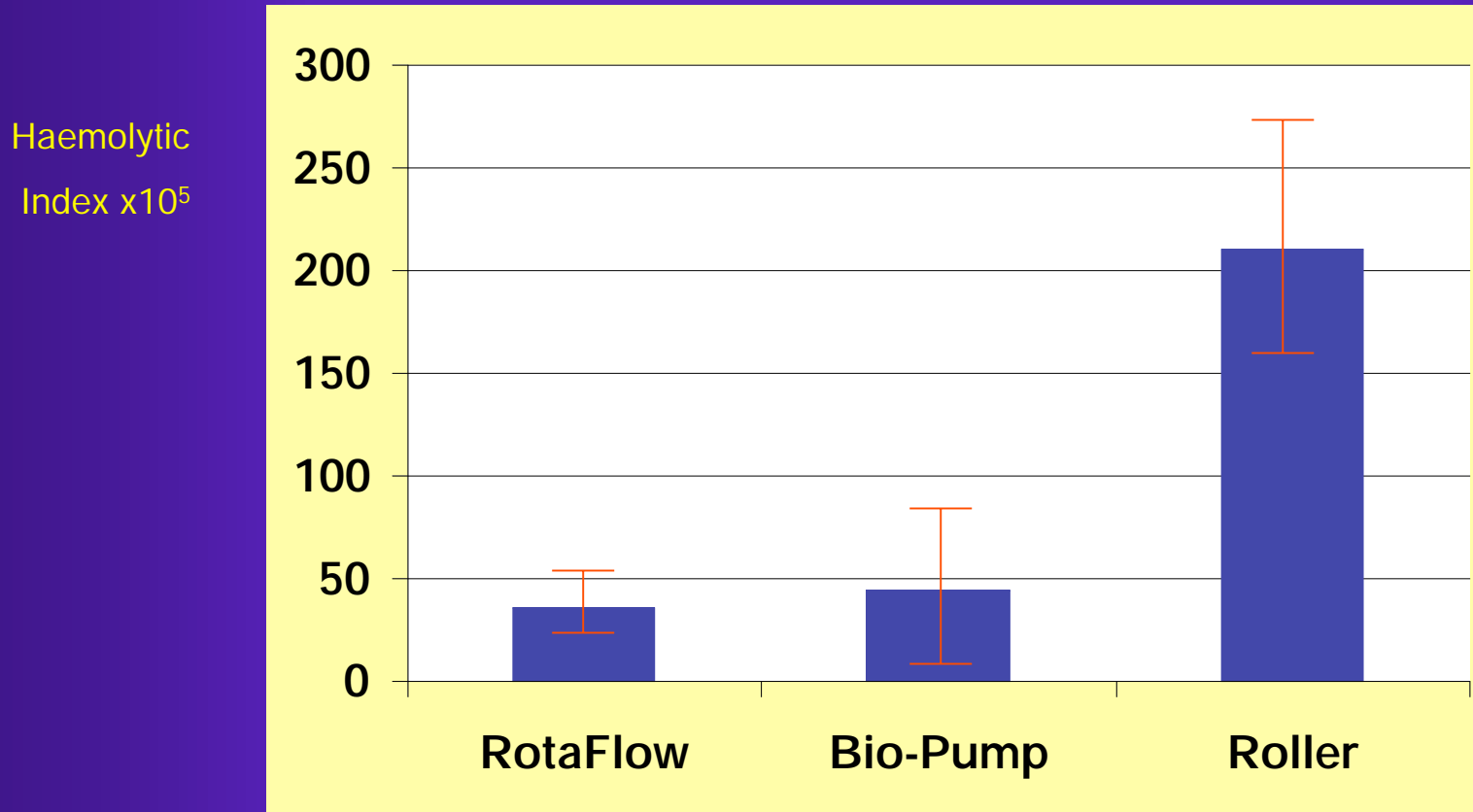
Week 3

Plasma Free Haemoglobin

Week 3



Haemolytic Index 95% Confidence Interval



Discussion

- Week 3 produced meaningful result
- RotaFlow produced lower incidence of haemolysis
- Further studies required
- Coagulation status important

Conclusion

- RotaFlow has theoretical design advantages
- Potential to be less haemolytic in clinical setting
- Retrospective trial comparing VAD results from patients supported by Bio-Cone Vs RotaFlow
- 6 hour FDA approval Vs 4 day DEKRA approval