How to choose right inotrope for newborn?

Dr Sachin Shah
MD, DM
Fellowship in Neonatology (Australia)
Fellowship in Pediatric Critical Care (Canada)

Director,
Intensive care services
Surya Mother and Child Superspeciality Hospital, Pune
Dr Sachin S Shah
MD (Pediatrics), DM (Neonatology)
Fellowship in Neonatology (Australia)
Fellowship in Pediatric critical care (Canada)

• Director, Intensive care services, Surya Mother and Child Superspeciality Hospital, Pune
• Over 20 years of experience after graduation. Worked for 6 years in Australia and Canada, out of which 3 years were spent in Hospital for sick children, Toronto which is one of the most advanced Pediatric hospitals in the world.
• Over 25 publications in indexed journal.
• Reviewer for Cochrane collaboration
• PG teacher – Fellowship in Neonatology
• Areas of interest – clinical epidemiology, ventilation, hemodynamic monitoring, etc
What do we currently know?

- Nothing
How do we choose therapy?

- Depending on clinical findings
- Depending on BP
- Depending on Echo

Evidence supporting these therapies
Shock

- Not synonymous with hypotension
- CRT – adapted from term infants, ≤ 2 secs
- HR
- Colour - Off colour
- CVO2
- Lactate
- Functional Echocardiography
Definition of Hypotension

- Statistically low BP
- Unsafe BP
- Operational/Target BP > GA in weeks

BAPM. Arch Dis Child 1992;67:868
Target BP

- Mean BP > 30 OR > GA in weeks
Functional Echo

- Assessment of CO/ function
- Permits assessment of response to the therapeutic interventions
- SVC flow provides shunt independent assessment of flow to upper body
Functional Echo

- Low SVC flow – adverse outcome
- PPV of low SVC flow for adverse outcome is low
- Therapy aimed as preventing low flow has not been shown to be beneficial

Dempsey EM. Clin Perinatol 2009;36:75-85
Functional Echo

• Diagnosis of PDA
Current therapies

- Volume
- Vasoactive drugs
  - Dopamine
  - Dobutamine
  - Milrinone
  - Adrenaline
  - Vasopressin
- Steroids
Volume

- Most preterms with hypotension are normovolemic
- Rapid fluid boluses are associated with IVH
- Liberal fluids increase risk of CLD
- Most do not respond to volume

Dempsey EM. Clin Perinatol 2009;36:75-85
Volume

- Useful only in hypovolemic shock – abruption, placenta previa, feto-maternal transfusion
- NS, RL preferred to Colloids
- 10 ml/kg over 30-60 mins
- Occ. O negative blood may be used in severe anemia

Evans N. Arch Dis Child Fetal Neonatal Ed 2006;91:213
Reasons for using vasoactive drugs

- Optimising end organ/tissue perfusion
- Optimising cardiac output
- Optimising BP
Common conditions needing vasoactive drugs

- Septic shock
- Hypovolemic shock
- Cardiogenic shock – PDA
- PPHN
Shock in preterm infants

- Treatment must be tailored to etiology and pathophysiology of shock
- Etiology is difficult to determine usually: Hypovolemia, Myocardial dysfunction, Abnormal vasoregulation
Shock in preterm infants

• Response to inotropes is unpredictable
• B receptor maturation lags behind that of alpha receptors.
• Alpha receptor actions predominate
Shock in first 24 hours

- Low SVC flow during 6-12 hours, normalises by 24 hours
- Due to cord clamping, SVR increases and CO drops

NeoReviews Vol.5 No.3 March 2004 e109
First 24 hours

- Pressure and flow based approach
- Targeted Echo at 6 hours and 12 hours or if hypotensive
- Treat if SVC flow < 50ml/kg/min OR RVO < 150 ml/kg/min, even if MBP is normal
First 24 hours

- **First Line** - Dobutamine (10-20 ug/kg/min)
  
  Will increase BP in most babies
  
  Useful in improving low SBF in the first 24 hours.

- **2nd line** – Dopamine (5-10 ug/kg/min) if BP is low

- **3rd line** – adrenaline (0.05-0.1 ug/kg/min)
After 24 hours

• More likely that SBF will be normal or high
• 1st line – Dopa (5ug/kg/min)
• 2nd line – Adrenaline (0.05-0.1 ug/kg/min)
• 3rd line – hydrocortisone 1-2mg/kg
Inotrope resistance

- Two facets to inotrope resistance
- Low SBF
- Vasodilatory hemodynamics due to poor vasomotor tone
  - Adrenaline and Hydrocortisone are increasingly used in this situation
  - Milrinone is being used for low SBF state
Clinical evidence
Dopamine v/s Dobutamine

- 5 RCTs, 209 infants < 37 weeks with hypotension
- Dopamine more effective in treating hypotension.
- Dobutamine more effective in improving CO and SVC flow
- No difference in mortality, PVL, IVH

Subhedar et al. The Cochrane library 2011;issue 3.
Milrinone

- Double blind RCT in VLBW infants
- Milrinone did not prevent Low SVC flow state
- No adverse effects noted

Milrinone

- Used in PPHN
- Decreases PVR without significant effect on BP

Steroids

- Hydrocortisone improves BP and tissue perfusion
- Long term effects not known
- Whether clinical outcomes are improved is not known

Steroids

- Subset of patients who might benefit from hydrocortisone need to be identified
- ? Refractory shock
- ? Infants with low cortisol levels
Steroids

- Do not use simultaneously with indomethacin
- Dexamethasone not recommended
Vasopressin

• Small neonatal studies
• Sepsis
• Low-dose AVP (0.0002–0.0007 U/kg/min) appears to decrease catecholamine requirement without associated hyponatremia.

Vasopressin in PPHN

- Selective pulmonary vasodilatory effects of low dose
- Post op Cardiac neonates
- A case series in 10 neonates with PPHN found that low-dose AVP improved BP, UO and OI while reducing the requirement for inhaled nitric oxide.

Preterms with hypotension and PDA

- Single observational study
- 17 infants < 32 weeks with PDA and hypotension
- Dopamine < 10ug/kg/min
- Increases PVR and decreases shunting
- Increases SBP and systemic blood flow

Septic Shock

- Dopamine preferred
- Adrenaline

- Myocardial dysfunction happens relatively late.
Other Interventions

- Maintain Euglycemia
- Maintain Normocalcemia (monitor iCa and substitute if low)
- Avoid overventilation
Nursing issues in fine tuning inotropes

- Purge till the solution drips from the end of ext tubing.
- Do not mix inotropes
- The most important inotrope is connected most distally (nearer to the patient)
Nursing issues

- Keep new syringes loaded when the pumps gives alarm of nearly empty.
- Use pumps with battery backup.
- Do not flush the inotrope lumen.
- Do not use the inotrope lumen for sampling.
Conclusions

• Judicious understanding about physiology is important.
• Reason for using the inotrope should be identified. Remember that one size does not fit all.
• Vasoactive drugs have to be titrated at the bedside against predetermined endpoints.
• Always think of Cardiac output
• Frequent assessments needed
• Comprehensive assessment and not single organ approach
THANK YOU !!!!!