RAPID TWO-STAGE NORWOOD 1 FOR HIGH-RISK HYPOPLASTIC LEFT HEART SYNDROME

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No Disclosures
HLHS – SURGICAL STRATEGIES

NORWOOD 1 OPERATION

HYBRID PROCEDURE
NORWOOD 1: HIGH RISK PATIENTS

Low birth weight
Prematurity
Small ascending aorta
Chromosomal Anomalies
Extra-cardiac Anomalies

“NON-MODIFIABLE”
NORWOOD 1: HIGH RISK PATIENTS

Preoperative Comorbidities
- Older age
- Prolonged Ventilation
- High inotropic support
- Sepsis
- Renal failure
- NEC
- Generalized Oedema (Anasarca)
- Coagulopathy
HYBRID PROCEDURE FOR HIGH RISK HLHS

No CPB
Suboptimal palliation
  • Retrograde aortic arch obstruction
  • Cerebral/Systemic O₂ Delivery
Potential Vascular Injuries with Stent
ALTERNATIVE:
RAPID 2-STAGE NORWOOD 1

Bilateral PA banding (bPAB) + PGE$_1$

Conventional Treatment of Preop Comorbidities (PCM)

Patient Resuscitation

Norwood 1
STUDY HYPOTHESIS

Rapid 2-Stage Norwood 1 with short-term bilateral PA banding can improve the prognosis for high risk patients undergoing the Norwood 1
147 HLHS Patients
Jan 2006 - Nov 2011

17 High Risk Patients

≥4 Preoperative Comorbidities (PCM)

Age > 2 wks (94.1%)
Ventilation > 2 wks (94.1%)
Necrotizing Enterocolitis
Heart Failure
Renal Failure
Hepatic Failure
Sepsis (58.8%)
Coagulopathy
Pulmonary Oedema
Sustained Hypotension
Large Inotropic Requirements
Anasarca (70.6%)
Previous Cardiac Arrest
17 High Risk HLHS Patients

bPAB

Median Age at bPAB
25 days
(13-43 days)
Bilateral PA Banding

SaO₂ 75-85%
Increase in Systemic BP
Echocardiogram
(V > 3.0m/s)
Additional procedures following bPAB

bPAB tightened (1 pt)
Rashkind (3 pts)
Atrial septectomy (1 pt)
Outcomes following bPAB

12 survived
70.6%

5 died
29.4%

Median Number of PCM before bPAB = 6

Median Number of PCM after bPAB = 2

Median Number of PCM before bPAB = 7

Median Number of PCM after bPAB = 8
12 High Risk HLHS Patients post bPAB

Median Interval between bPAB and Norwood 1

8 days (3-68 days)
≤ 2 weeks (66.7%)
≤ 3 weeks (91.6%)
142 Norwood 1
Jan 2006 - Nov 2011

12 High Risk patients
bPAB

Median Number of
PCM = 2

Median Age
38 days

130 Standard
Risk patients

Median Number of
PCM = 2

Median Age
4 days
142 Norwood 1
Jan 2006 - Nov 2011

Early Mortality (30 days) 9.8%

High Risk Group
1 patient 8.3%

Standard Risk Group
13 patients 10%
1-Year Survival after Norwood 1

**Overall Survival 79%**

- **Standard Risk HLHS:** 80%
- **High Risk HLHS:** 67%

*Years after Norwood I*  
*p = 0.277*
LIMITATIONS

Retrospective study.

We did not use any specific algorithm or pathway to decide when bPAB should be employed.

The decision to initiate the Rapid Two-stage Norwood strategy was based on the clinical assessment of the patients on the presence of low cardiac output, persistent acidosis, unbalanced $Q_p/Q_s$ and severe hypoxemia, that did not respond to conventional treatment.
CONCLUSION

Mechanical optimization of the $Q_p/Q_s$ is helpful to reduce the number of PCM and to move high risk patients to a lower risk category.
CONCLUSION

The patients who survive the bPAB and undergo Norwood 1, despite the severity of their initial condition, have early mortality and 1-year survival comparable to the standard risk patients.
Thank You