Premature neonates with severe congenital heart diseases: Post operative course and outcome after early cardiac surgery.


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INTRODUCTION
• Prematurity and low weight are documented risk factors of morbidity and mortality following cardiac surgery.
• However, most of studies include all neonates born with a weight less than 2500g (low birth weight), without any consideration for gestational age.
• The premature condition is a critical period, with significant vulnerability to hemodynamic changes.
• This study evaluates early and late outcome of preterm newborns undergoing early cardiac surgery under cardiopulmonary bypass (CPB).

MATERIAL AND METHODS
Retrospective study, 2000-20013
Population:
• 28 consecutive premature (GA<37 week’s gestation) neonates included 10 (35.7%) with genetic aberrations or significant associated congenital anomalies.
• Major congenital heart disease (at least 2 defects and/or 1 defect resulting in death within the 1st month of life).
• Preoperative status: suspected early-onset infection (n=13), mechanical ventilation (n=19), prostaglandin infusion (n=21), Rashkind procedure (n=11).
• All, except 3 with single ventricle physiology, underwent cardiac surgery with CPB in the preterm period (<37 week’s gestation) for anatomical repair.
• Follow-up: phone contact to referring cardiologists.

RESULTS
EARLY OUTCOME
Overall mortality : 43 % (95% CL : 0.25 – 0.62)
Anatomy and mortality :
Group | N | Death
--- | --- | ---
Coarctation of aorta with ventricular septal defect | 2 | 1
Aortic stenosis | 3 | 0
Transposition of great arteries | 9 | 1
Simple Complex with coarctation | 8 | 1
1 | 0
Total anomalous pulmonary venous return | 5 | 4
Single ventricle anomalies | | |
Hypoplastic left heart syndrome | 2 | 2
Tricuspid atresia and pulmonary stenosis | 3 | 0
Interrupted aortic arch | | |
With ventricular septal defect | 2 | 1
With tricusus arteriosus | 1 | 1
With aorticpulmonary window | | |
TOTAL | 28 | 12

Mortality and risk factors :
| Mean ± SD | Total | Alive | Death | p |
--- | --- | --- | --- | ---
Birth weight (g) | 2238 ± 510 | 2145 ± 378 | 2003 ± 581 | 0.032 |
Gestational age (SA) | 34.3 ± 1.2 | 34.6 ± 1.1 | 33.9 ± 1.3 | 0.17 |
Weight at surgery (g) | 2289 ± 478 | 2434 ±436 | 2057 ± 464 | 0.037 |
Cardiopulmonary bypass (min) | 120 ± 47 | 106 ± 47 | 134 ± 43 | 0.12 |
Aortic cross-clamp time (min) | 60 ± 31 | 64 ± 32 | 53 ± 30 | 0.40 |

Median (Range) :
| Total | Alive | Death | p |
--- | --- | --- | ---
Age at surgery (d) | 9.5 (2-33) | 9.0 (2-20) | 11.5 (1-33) | 0.23 |
Delayed sternal closure (d) | 3.0 (0-34) | 0.5 (0-5) | 4.0 (0-34) | 0.027 |
Mechanical ventilation (d) | 6.5 (1.75) | 6.0 (2-40) | 12.0 (1-75) | 0.46 |
Inotropic support (d) | 7.0 (1-34) | 7.0 (0-12) | 9.0 (1-34) | 0.41 |
Hospital length of stay (d) | 29.5 (8-143) | 27.5 (12-74) | 29.5 (8-143) | 0.98 |

Complications :
• Cardiac events : myocardial infarction (n=1), coronary artery fistula (n=1)
• Pulmonary : bronchopulmonary dysplasia (n=8), tracheostomy (n=2), vocal cords paralysis (n=2), diaphragmatic paralysis (n=1), pulmonary hypertension (n=3, lobectomy=1)
• Miscellaneous : gastrostomy with Nissen fundoplication (n=1), failure to thrive (n=3), detachment of the retina (n=1), delayed acquisition with deafness (n=1)

EARLY mortality : n=2 pts
Cause of death | N (time after surgery, d)
--- | ---
Hypovolemic shock with massive bleeding | 3 (perop, 1, 10)
Failure of ECMO weaning | 2 (2, 8)
Obstruction of Blalock | 1 (1)
Massive intraventricular hemorrhage | 1 (17)

LATE OUTCOME
Follow-up duration : 153 ± 52 months.
Survival rate : At 1 month = 75% (95%CL 59-91) At 1 and 5 year = 57% (95%CL 39-75)
Cardiac reinterventions : 8 pts (38%) 5 pts had at least 2 reoperations at a mean delay of 2.8 ± 1.3 months

Complications :
Cardiac events :
• myoccardial infarction (n=1)
• coronary artery fistula (n=1)
• bronchopulmonary dysplasia (n=8)
• tracheostomy (n=2)
• vocal cords paralysis (n=2)
• diaphragmatic paralysis (n=1)
• pulmonary hypertension (n=3, lobectomy=1)
• Miscellaneous:
• gastrostomy with Nissen fundoplication (n=1)
• failure to thrive (n=3)
• detachment of the retina (n=1)
• Delayed acquisition with deafness (n=1)

Functional status : 9 pts (32%) were asymptomatic at follow-up termination

CONCLUSION
• One-stage biventricular repair of severe congenital heart defects in preterm neonates is feasible, though mortality remains high.
• Prematurity severity was not a risk factor, thus arguing for early surgery.
• Only small weight influenced outcome, possibly due to the technical complexity of surgery in the premature.
• Post operative complications may be related to hemodynamic instability in the perioperative period. However, for these premature infants, only restoration of physiological hemodynamics could allow organ maturation and subsequent survival.
• Mortality was mainly confined to the first year. Despite reinterventions, late mortality is low with favorable condition at last follow-up.