Neurodevelopmental Outcomes of Extremely Preterm Infants Undergoing Trans-Catheter Closure of the Patent Ductus Arteriosus

NICHD
NEONATAL RESEARCH NETWORK

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Introduction

- Transcatheter patent ductus arteriosus (PDA) closure has become an increasingly common treatment strategy for preterm infants.
- There is a paucity of data on neurodevelopmental outcomes in extremely preterm infants who undergo transcatheter PDA closure.

Objective

- To evaluate neurodevelopmental impairment (NDI) of extremely preterm infants with PDA treated with transcatheter PDA closure compared to surgical ligation and only medical treatment.

Methods

- Retrospective cohort study of infants born at <27 weeks' gestation at NICHD NRN sites between 1/1/2016 and 12/31/2019.
- Comparisons were made between infants who underwent transcatheter closure, PDA ligations and only PDA medical treatment.
- Primary outcome was severe NDI or death at 2 years.
- Severe NDI, defined as >=1 of the following: gross motor function level 4 or 5, motor and/or cognitive composite score <70 on Bayley-III, bilateral blindness, or deafness.
- Multivariable logistic regression analysis was performed for the outcome of severe NDI or death adjusting for the propensity scores of PDA treatment strategy, NRN center, birth year, gestational age and age at procedural closure.

Results

Study Cohort

- A total of 1493 infants.
- Catheter closure and surgical ligation were performed on 99 and 280 infants, respectively.
- 1114 infants only received medical treatment.
- Characteristics of the groups are presented in Table 1.
- Median age at catheter closure was significantly greater than age at ligation (62 vs. 32 days, $p < 0.01$).

Neurodevelopmental Outcomes Between the Groups

(Table 2)

- Severe NDI or death
  - 49% of infants with catheter closure
  - 39% with surgical ligation
  - 46% with medical treatment only
- There was no statistically significant difference in odds of severe NDI or death between the groups (unadjusted odds).
- Higher proportion of deaths in the medical treatment only group.

Multivariable logistic regression analysis (Table 3)

- No difference in odds of severe NDI or death between catheter closure and surgical ligation groups.
- Both procedural groups had similar odds of severe NDI or death compared to medical treatment only group.

Table 1. Characteristics of the study cohort. Mean (SD) or n(%)

Characteristic	Catheter Closure (N=99)	Surgical Ligation (N=280)	Medication only (N=1114)	P Value
Gestational age (weeks)	24.9 (1.1)	24.7 (1.1)	24.9 (1.2)	0.02
Birth Weight (grams)	701 (134)	688 (150)	712 (162)	0.23
Male	36 (36)	136 (49)	561 (50)	0.03
Antenatal Steroids	90 (91)	262 (94)	1045 (94)	0.51
IVH	47 (47)	109 (39)	464 (42)	0.32
PVL	16 (16)	23 (8)	57 (5)	<0.01
Age at PDA closure	63 (27)	33 (17)		<0.01

Table 2. Neurodevelopmental Outcomes. Mean (SD) or n (%)

Outcome	Catheter Closure (N=99)	Surgical Ligation (N=280)	Medication only (N=1114)	P Value
Severe NDI or Death	40 (49)	85 (39)	407 (46)	0.18
Severe NDI	37 (47)	67 (34)	190 (28)	<0.01
Death	3 (3)	18 (6)	217 (20)	<0.01

Results

Table 3. Multivariable logistic regression analysis of death or severe neurodevelopmental impairment

Severe NDI or Death	Adjusted Odds Ratio (95% CI)
TCPC vs Surgical ligation	0.87 (0.30-2.48)
TCPC vs Medical treatment only	1.16 (0.64-2.11)
Surgical ligation vs Medical treatment only	0.89 (0.61-1.29)

Conclusions

- Transcatheter PDA closure had similar odds severe NDI or death compared to only medical treatment and surgical ligation.
- These findings need to be evaluated in large prospective studies as the management practices around transcatheter PDA closure evolves.

Limitations

- Survival bias (additional analysis planned).
- Confounding by contraindication.
- Shunt burden was different between the two procedural closure groups.
- Details of hemodynamic measures, duration of PDA exposure, and timing of diagnosis or medical treatment were not available.

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