Multicenter Analysis of Utilization of Inhaled Nitric Oxide in Patients Undergoing repair of Truncus Arteriosus

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Disclosures

- None

Background

- Truncus Arteriosus (TA) is typically repaired in the neonatal period

- Postoperative care is sometimes challenged by elevated pulmonary vascular resistance

- Inhaled Nitric Oxide (iNO) is often used in such settings

- Data on the use of iNO following TA repair are sparse

Aims

- Describe iNO use in the postoperative period of patients undergoing repair of TA

- Identify risk factors for its use

- Evaluate relationship between center practice and iNO use

Methods

- Retrospective Cohort Study of infants with TA repair between 2009 and 2016

- 15 participating tertiary care centers in the US

- Exclusion :
    TA with aortic arch obstruction,
     pseudotruncus,
     hemitruncus

Institutions

- Riley Hospital for Children, Indianapolis, IN
- Cleveland Clinic, Cleveland, OH
- Children's Hospital of Michigan, Detroit, MI
- Morgan Stanley Children's Hospital of New York, New York, NY
- North Shore-LIJ Cohen Children's Medical Center, New Hyde Park, NY
- Medical University of South Carolina, Charleston, SC
- Arnold Palmer Hospital for Children, Orlando, FL
- Seattle Children's Hospital, Seattle, WA
- Ann & Robert H. Lurie Children's Hospital of Chicago, IL
- University of Iowa Stead Family Children's Hospital, Iowa City, IA
- Children's National Health System, Washington, DC
- University of Utah Health, Salt Lake City, UT
- Cincinnati Children's Hospital Medical Center, Cincinnati, OH
- University of Michigan C.S. Mott Children's Hospital, Ann Arbor, MI
- American Family Hospital, Madison, WI

Methods

- Bivariate comparison of clinical and operative characteristics between subjects who received iNO and those who did not

- Multivariable mixed logistic regression analysis using backward elimination - to identify independent predictors of iNO use

- ROC analysis examining the relationship between center volume and iNO use was also performed
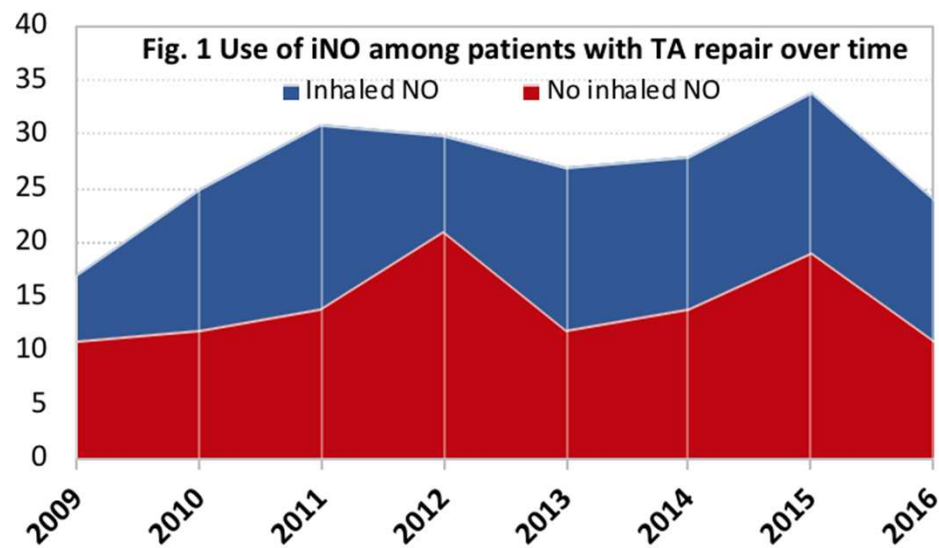
Results

- **216 Patients with TA repair from 15 centers**

- **Collette Edwards Type I -112 (51.9%) , Type II – 90 (41.7%) ,**
  Type III -14 (6.5%)

- **102 (47%) received iNO**

- **Started in the OR in 69 cases (68%), in the ICU in 33 cases (32%)**

- **In the ICU, iNO was initiated on median postoperative day 1 (0,2)**

- **Median duration : 4 d (2,7) ;   Max.dose: 20 ppm (range 10,40)**
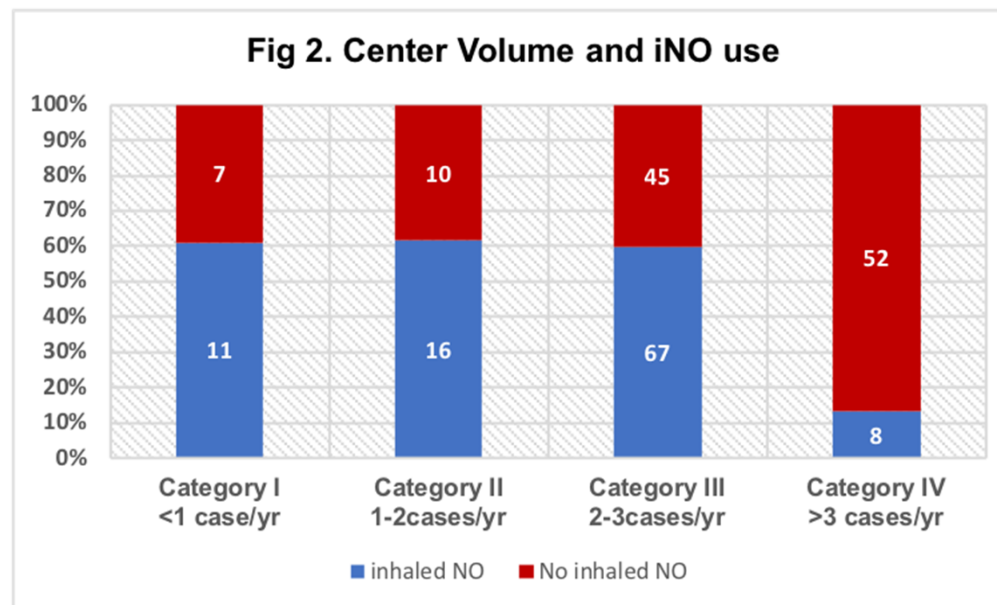
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Results : iNO use over time

Fig. 1 Use of iNO among patients with TA repair over time

Results: Center Volume vs iNO use

Fig 2. Center Volume and iNO use

Results: Baseline Characteristics compared by iNO use

Variable*	All patients (n=216)	No iNO (n=114)	iNO (n=102)	p-value
Age at diagnosis (days)	0.0 (0.0,2.0)	0.0 (0.0,2.0)	0.0 (0.0,1.0)	0.6366
Female	108 (50.0%)	56 (49.1%)	52 (51.0%)	0.7852
Prenatal diagnosis	135 (62.5%)	72 (63.2%)	63 (61.8%)	0.8328
Prematurity (<37 weeks)	42 (19.4%)	21 (18.4%)	21 (20.6%)	0.6879
Diagnosis before discharge	171 (79.2%)	90 (78.9%)	81 (79.4%)	0.9331
Chromosomal anomaly, any	83 (38.4%)	49 (43.0%)	34 (33.3%)	0.1455
DiGeorge/22q.11 deletion	61 (28.2%)	36 (31.6%)	25 (24.5%)	0.2493
Non-cardiac abnormalities	63 (29.2%)	29 (25.4%)	34 (33.3%)	0.2025
Age at first operation (days)	10.0 (7.0,23.0)	8.5 (6.0,16.0)	11.5 (7.0,27.0)	0.0557

*Data represented as median (IQR) or absolute counts (%) as appropriate

Results: Preoperative Clinical Characteristics

Variable	All patients (n=216)	No iNO (n=114)	iNO (n=102)	p-value
Decreased LV Function	24 (11.1%)	7 (6.1%)	17 (16.7%)	**0.0140**
Sev. truncal regurg.	16 (7.4%)	6 (5.3%)	10 (9.8%)	0.2571
Furosemide use (n)	146 (67.6%)	70 (61.4%)	76 (74.5%)	**0.0399**
Shock (n)	21 (9.7%)	9 (7.9%)	12 (11.8%)	0.3378
Mechanical Ventilation (n)	56 (25.9%)	27 (23.7%)	29 (28.4%)	0.4267

Results: Operative characteristics

Variable	All patients (n=216)	No iNO (n=114)	iNO (n=102)	p-value
CPB <150 min (n)	108 (50%)	65 (57.0%)	43 (42.2%)	**0.0292**
DHCA (n)	31 (14.4%)	10 (8.8%)	21 (20.6%)	**0.0134**
MUF use (n)	139 (64.4%)	61 (53.5%)	78 (76.5%)	**0.0004**
RV-PA conduit size (mm/m2)	51.0 (45.5, 56.4)	51.0 (46.2,56.5)	51.1 (45.1,56.3)	0.4888

Results: Predictors of iNO use

Variable	OR	95% CI	p-value
Center Volume (Low vs. High)	8.498	3.70-19.47	<0.0001
MUF use	2.506	1.29-4.84	0.0063
DHCA	2.73	1.11-6.71	0.0280

MUF- Modified Ultrafiltration; DHCA- Deep Hypothermic Circulatory Arrest

Results : Clinical outcomes vs iNO use

Variable	All patients (N=216)	No iNO (n=114)	iNO (n=102)	p-value
PaO2 (mm Hg)				
ICU Admission	84.0 (65.0,135.0)	85.7 (69.0,134.0)	83.0 (61.0,138.0)	0.2221
12h Post	7.0 (10.0-101.0)	75.0 (62.0,95.0)	80.0 (58.0,106.0)	0.2625
VIS				
ICU Admission	9.0 (5.0,12.4)	8.0 (5.0,11.0)	10.0 (7.5,15.0)	**0.0002**
12h Post	8.0 (5.0,15.0)	7.5 (5.0,13.0)	10.0 (6.5,18.5)	0.0055
ECMO	22 (10.2%)	6 (5.3%)	16 (5.7%)	**0.0115**
CPR	26 (12.0%)	8 (7.0%)	18 (17.6%)	**0.0165**

Results : Clinical outcomes vs iNO use

Variable	All patients (N=216)	No iNO (n=114)	iNO (n=102)	p-value
Re-operation	47 (21.9%)	15 (13.2%)	32 (31.7%)	**0.0010**
Mech. vent. hrs	140.2 (86.3,264.6)	108.4 (72.0,167.5)	192.8 (116.0,532.0)	**<0.005**
ICU stay (days)	13.0 (8.0,26.5)	11.0 (7.0, 17.0)	16.5 (10.0,36.0)	**<0.005**
Op.mortality	16 (7.4%)	5 (4.4%)	11 (10.8%)	0.0730
Hospital LOS (d)	23.0 (15.0,43.0)	20.0 (13.0,33.0)	27.5 (18.0, 51.0)	**0.0006**
Overall mortality	29.0 (13.4%)	13 (11.4%)	16 (15.7%)	0.3567

Results: Center vs iNO use

Fig 3. Center as Predictor of iNO use

AUC=0.8136
95% CI (0.76,0.87)
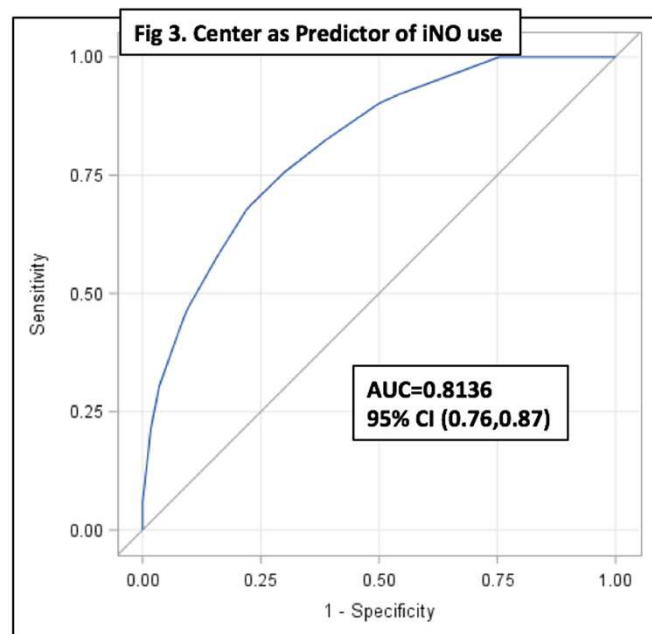
Limitations

- Retrospective analysis

- The temporal relationship between clinical outcomes and iNO administration cannot be ascertained with the data

- Center heterogeneity in each category

- No clear indication of what prompted iNO initiation

Conclusions

- In a contemporary multicenter dataset, nearly half of patients with TA who underwent repair received iNO

- iNO use did not vary significantly over time

- iNO use is highly dependent on individual center practice, with the highest volume centers using iNO less commonly than the other centers

Conclusions

- Modified ultrafiltration and deep hypothermic circulatory arrest were independent predictors of iNO use

- Subjects with iNO use had longer postoperative recovery - reflective of an increased disease burden

- The influence of center practice on iNO use suggests potential for collaborative quality initiatives to determine optimal criteria for utilization of this important but expensive therapy

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In Pediatric Cardiac
Intensive Care