Incidence and predictive factors for vocal cord palsy after aortic arch surgery in pediatric patients

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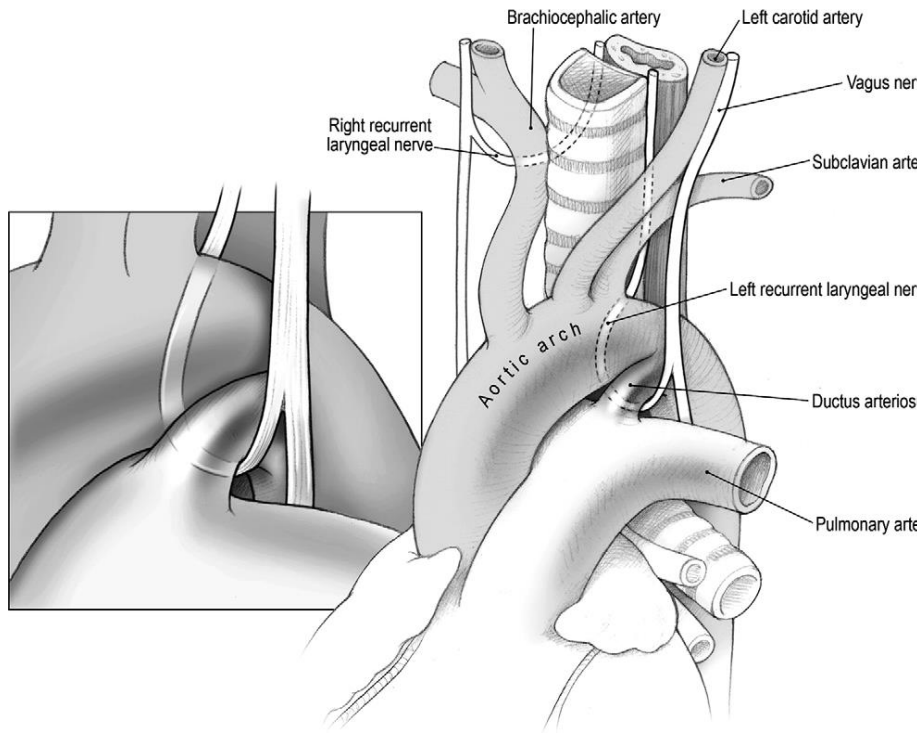
Background

- *Pediatric patients* with **post-cardiac surgery vocal cord palsy (VCP)** typically present with stridor, weak cry and sometimes aspiration

- **Aortic arch surgery** is known to be particularly *susceptible* to VCP from damage to the **recurrent laryngeal nerve**

- Some patients manage to recover, but others have permanent vocal cord palsy, **<u>requiring further interventions.</u>**

- **Therefore, we retrospectively reviewed the** incidence, risk factors, and recovery rate of VCP after aortic arch surgery at our institution



Truong, M. T., et al. (2016). "Pediatric vocal fold paralysis after cardiac surgery: Rate of recove and sequelae." <u>Otolaryngology–Head and Neck Surgery</u> **137**(5): 780-784.

Methods

- Retrospective medical chart review of **pediatric (≤18 years)** aortic arch surgery patients from ***Jan 2020 till Dec 2023***

- Since 2020, patients with *suspicious symptoms* ***(stridor, weak cry, aspiration tendency)*** were routinely referred for laryngoscopy exam by pediatric otolaryngology department

Outcomes

- **Incidence and recovery rate vocal cord palsy (VCP)**

- **Analyzed the *perioperative variables* that may influence VCP**

Baseline Characteristics

TABLE 1. Baseline characteristics (n=61)	
Age at surgery (days)	28 (14.5-109.00)
Weight at surgery (kg)	3.49 (2.98-5.05)
Sex	
Male	32 (52.5%)
Female	29 (47.5%)
Prematurity	14 (23%)
Ventricular physiology	
Single Ventricle	13 (21.3%)
Biventricular	48 (78.7%)
Genetic syndromes	11 (18%)
CHARGE syndrome	3
Turner syndrome	1
Edwards syndrome	1
Noonan syndrome	1
Others	5

Categorical data presented as number (%) and continuous data presented as median (interquartile range)

VCP characteristics

Incidence of VF Palsy	12 (19.7%)
Lt	11
Rt	1
Surgery types	
Coartoplasty	7
IAA repair	5
Norwood	0
Vascular ring	0
Median follow up (months)	4 (0.5-9)

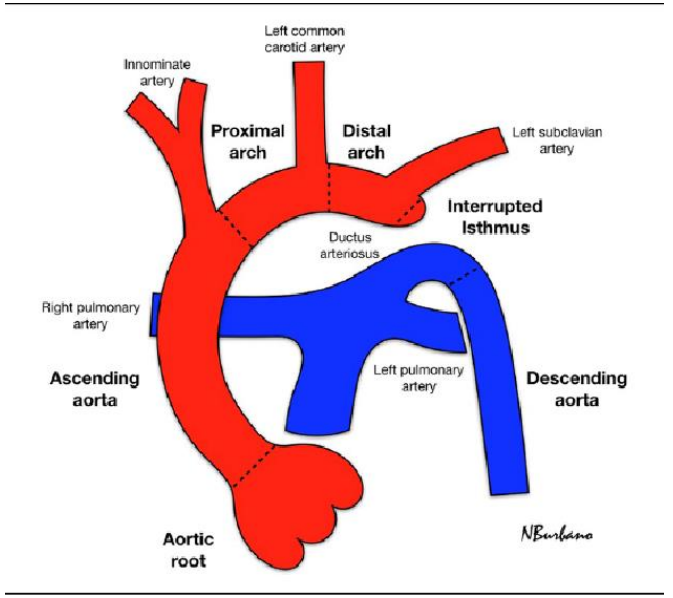
- Total of 12 vocal cord palsy of 61 (19.7%)
- Lt VCP -11
- Rt VCP -1 (Right sided aortic arch)

Surgery Characteristics

	VCP-	VCP+	P-value
Coartoplasty (n=41)	34 (83%)	7 (17%)	0.51
Norwood type Procedure (n=11)	11 (100%)	0 (0%)	0.1
IAA repiar (n=7)	**2 (28.6%)**	**5 (71.4%)**	**0.002**
Vascular ring (n=2)	2 (100%)	0 (0%)	1

- Values are presented as n (%). P values in bold indicates statistically significant. *The P values were calculated from 4 separate cross-classification tables comparing VCD (yes/no) by each procedure group (yes/no), with the Fisher exact test used to test the null hypothesis of independence

- 7 out of 41 CoA repair had VCP
- None of the Norwood patients (n=11) had VCP
- 5 out 7 IAA repair had VCP (p=0.002)
- All 7 cases of IAA were **Type A**



Perioperative variables

TABLE 2 Perioperative variables on VF palsy

	VCP-	VCP+	P-value
PICU stay (days)	8.5 (6-15)	8 (7-12.5)	0.827
Intubation (hrs)	170 (80-465)	119 (88-176)	0.336
# of intubation performed	1 (1-2.50)	2 (1-2)	0.225
Hospital stay (days)	32 (15-113)	32(23.5-40)	0.574
CPB time (min)	164.5 (111.5-207.5)	174.5(155-203)	0.368
ACC (min)	48 (21.5-67.5)	62(43-68.5)	0.182
Regional perfusion (min)	25 (15.5-36)	27.5(22-28.5)	0.729
age (days)	42.5 (15.5-120)	16.5(14-30)	0.173
weight (kg)	3.74 (2.82-5.4)	3.24 (3.015-3.745)	0.743
Preop Intubation			
no	31 (83.8%)	18 (75%)	0.513
yes	6 (16.2%)	6 (25%)	
Incision type			
Median sternotomy	37 (77.1%)	11 (22.9%)	0.432
Thoracotomy	12 (92.3%)	1 (7.7%)	
Prematurity			0.71
no	33 (76.7%)	10 (23.3%)	
yes	12(85.7%)	2(14.3%)	
Syndrome			0.712
no	36 (78.3%)	10 (21.7%)	
yes	13 (86.7%)	2 (13.3%)	
Redo op			
no	37 (75.5%)	12 (100%)	0.1
yes	12 (24.5%)	0	
TEE utilization			0.101
no	11(100%)	0 (0%)	
yes	38 (76%)	12 (24%)	
Cardioplegic arrest			
no	15 (88.2%)	2 (11.8%)	0.481
yes	34 (77.3%)	10 (22.7%)	
Ventricular physiology			
Single Ventricular	13 (100%)	0 (0%)	0.054
Biventricular	36 (75%)	12 (25%)	

Univariate analysis

Trend for biventricular to have more VCP (p=0.054)

Non-Norwood operations

TABLE 6. Perioperative variables on VF palsy- non-Norwood patients

	VCP-	VCP+	P-value
PICU stay (days)	8.00 (3.00 -11.25)	8.00 (7.00-14.25)	0.5
Intubation (hrs)	116.00 (25.00-247.00)	119 (88-176)	0.803
# of intubation performed	1.00 (1.00 - 1.00)	2 (1-2)	**0.002**
Hospital stay (days)	24.00 (13.75 -56.00)	32.00 (23.25-41.00)	0.426
CPB time (min)	136.50 (17.25 - 170.25)	174.50 (149.00 - 207.00)	**0.014**
ACC (min)	35.00 (18.00 - 58.50)	62.00 (41.00-68.75)	**0.045**
Regional perfusion (min)	21.00 (0.00 - 27.25)	27.50 (22-28.75)	0.082
age (days)	23.50 (14.00 -113.00)	16.50 (14.00-30.50)	0.363
weight (kg)	3.00 (3.00 -6.00)	3.00 (3.00-4.00)	0.758
Preop Intubation			
no	30 (83.3%)	8 (57.1%)	0.071
yes	6 (16.7%)	6 (42.9%)	
Incision type			0.147
Median sternotomy	26 (68.4%)	11 (91.7%)	
Thoracotomy	12 (31.6%)	1(8.3%)	
Prematurity			0.461
no	23 (67.6%)	10 (83.3%)	
yes	11 (32.4%)	2(16.7%)	
Syndrome			
no	28 (73.7%)	10 (83.3%)	0.705
yes	10 (26.3%)	2 (16.7%)	
Redo op			
no	36 (94.7%)	12 (100%)	1
yes	2 (5.3%)	0 (0%)	
TEE utilization			
no	11 (28.9%)	0 (0%)	**0.046**
yes	27 (69.2%)	12 (100%)	
Cardioplegic arrest			0.181
no	15 (39.5%)	2 (16.7%)	
yes	23 (60.5%)	10 (83.3%)	

Univariate analysis

- Number of intubation performed (p=0.002)

- CPB time (p= 0.014)

- ACC time (p=0.045)

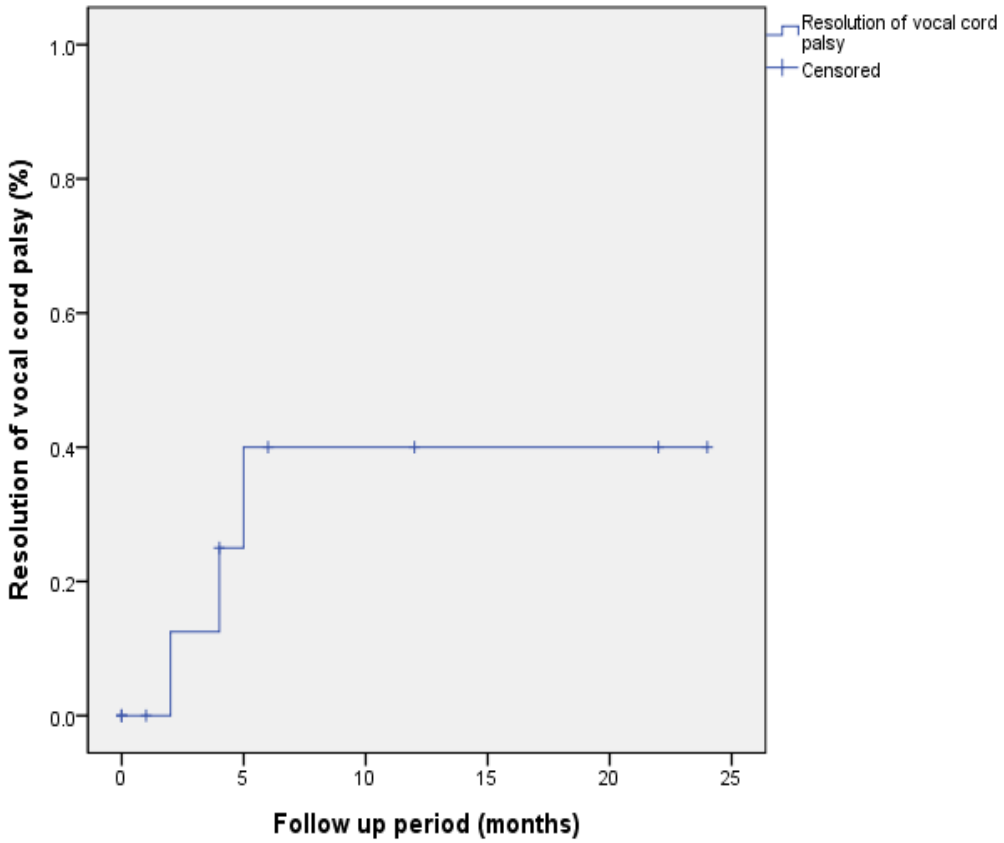
-TEE utilization (p=0.046)

Multivariate analysis

- Number of intubation performed

(OR 4.914, CI 1.311-18.421, p=0.018)

Follow up data on VCP



- **3 patients** (25%) had shown recovery after *mean follow up of 3.7 months*

- 4 patients did no further laryngoscopy
  - -1 patient referred for Sw. Otx.
  - -2 patients: symptoms improved
  - -1 patient persistent Sx.

- **3 patients** had **persistent palsy** after a year of ENT follow up (mean f/u of 19 months)

- **2 patients** still under follow up with persistent palsy (mean f/u of 5 months)

Patient	Sex	Age (days)	Diagnosis	Operation	F/U(months)	Recovery confirmed
1	F	13	CoA with diffuse arch hypoplasia VSD, ASD, PDA	Coarctoplasty VSD patch closure, ASD primary closure PDA division	4	+
2	F	14	CoA with diffuse arch hypoplasia AVSD (no primum ASD, inlet VSD, mitral valve cleft) PDA	Coarctoplasty AVSD repair (inlet VSD patch closure) PDA division, ASD primary closure	0	-
3	F	16	Coarctation of aorta with arch hypoplasia VSD ASD PDA TR	Coarctoplasty VSD patch closure ASD primary closure, PDA division TV repair	4	-
4	M	18	CoA with hypoplastic aortic arch (right aortic arch) Complete TGA, ASD, PDA	Coarctoplasty Pulmonary artery internal banding Atrial septectomy	5	+
5	M	29	Coarctation of aorta VSD ASD PDA	Coarctoplasty VSD closure ASD primary closure PDA division	22	-
6	M	31	CoA, Hypoplastic aortic arch VSD ASD PDA	Coarctoplasty PDA division VSD patch closure ASD primary closure	6	-
7	M	3124	Coarctation of aorta with cervical aortic arch	Coarctoplasty	1	-
8	M	8	Interrupted aortic arch (type A) with large PDA VSD, ASD	Interrupted aortic arch repair PDA division VSD patch closure ASD primary closure LPA patch angioplasty	0	-
9	F	14	Berry syndrome 1. IAA (type A) with arch hypoplasia 2. AP window (distal type) : RPA from asending aorta 3. PDA	IAA repair AP window division & RPA detachment from aorta PDA division	0	-
10	F	16	IAA (type A) AP window (type II) ASD PDA Severe pulmonary hypertension	IAA repair AP window repair ASD primary closure PDA division	24	-
11	M	17	IAA (type A) TGA with VSD ASD & PFO (restrictive) PDA (large)	IAA repair PA internal banding (4mm) PDA division Atrial septectomy	2	+
12	M	150	Berry syndrome 1. IAA (type A) , 2. AP window (distal type): RPA from ascending aorta 3. PDA	IAA repair AP window repair	12	-

Conclusion

- Our data on pediatric aortic arch surgery shows **type A IAA repair** has higher incidence of developing VCP.

- For non-Norwood arch operations, **total number of intubation** performed is a ***risk factor*** for higher incidence of VCP

Thank you

References

- Truong, M. T., et al. (2016). "Pediatric vocal fold paralysis after cardiac surgery: Rate of recovery and sequelae." Otolaryngology–Head and Neck Surgery **137**(5): 780-784.
- Kenny, L., et al. (2022). "Vocal cord dysfunction after pediatric cardiac surgery: A prospective implementation study." JTCVS Open 11: 398-411.