

## Difficult airway in children with trisomy 18: incidence, outcomes, and complications in a single center retrospective observational study

Wenyu Bai, Thomas Klumpner, Xinyi Zhao, Graciela Mentz, Glenn Green, Lori Q. Riegger, Shobha Malviya, Sydney E.S. Brown  
Department of Anesthesiology, Division of Pediatric Anesthesiology, University of Michigan, Ann Arbor, MI

### Introduction

- Trisomy 18 (Edwards syndrome)- genetic condition characterized by multi-organ anomalies at birth
- Survival has improved- now patients receive a variety of life-sustaining surgical procedures
- Micrognathia/retrognathia, restricted mouth opening lead to potential difficult airway
- Limited studies on airway management including difficult facemask (DF) and difficult intubation (DI)

### Method

- Retrospective single center study
- ~ Patients identified using ICD codes and chart review
- ~ Age <18-years
- ~ Receiving general anesthesia
- ~ Dates of study period: 01.2010 to 06.2021
- Collected data on:
  - Patient characteristics (comorbidities, orofacial anatomy, demographics, weight, procedure type)
  - Airway management (use of facemask, LMA, and tracheal intubation), and the difficulty of each intervention
- DF: inadequate or impossible mask ventilation despite airway adjuvants and additional personnel
- DI included: Grade  $\geq 3$  view with direct laryngoscopy (DL),  $\geq 3$  attempts, airway achieved by escalating to an advanced airway device including video laryngoscope (VL), fiberoptic scope (FOS), and rigid bronchoscope
- Airway intervention related complications included cardiac arrest, CPR, vasoactive medication administration, aspiration, airway or lung injury, and hypoxemia
- Univariable statistics (e.g., means, proportions)
- Standardized differences (SD) to compare patient characteristics across easy and difficult tracheal intubations

**Table1. Characteristics of easy and difficult tracheal intubation (n=145)**

Measures	Full Sample (n=145)		Easy Intubation (n=85)		Difficult Intubation <sup>1</sup> (n=60)		SD <sup>2</sup>
	N	Percentage (%)	N	Percentage (%)	N	Percentage (%)	
<b>Age group</b>							
Newborn – < 1 year	65	44.8	32	37.6	33	55.0	0.67
Toddler (1-3 year)	38	26.2	21	24.7	17	28.3	
Preschool (4-5 year)	9	6.2	4	4.7	5	8.3	
School age (6-12 year)	29	20.0	24	28.2	5	8.3	
Teens (13-18 year)	4	2.8	4	4.7	0	0.0	
<b>Weight</b>							
≤ 10 Kg	87	60.0	40	47.1	47	78.3	0.77
> 10 Kg	53	36.6	43	50.6	10	16.7	
Missing	5	3.4	2	2.4	3	5.0	
<b>Preoperative Comorbidities</b>							
Prematurity	15	10.3	8	9.4	7	11.7	0.07
Congenital heart disease	113	77.9	67	78.8	46	76.7	0.05
Sleep apnoea	76	52.4	43	50.6	33	55.0	0.09
Gastroenterology tube feeding	56	38.6	34	40.0	22	36.7	0.07
<b>Procedure Type</b>							
Craniofacial	5	3.4	2	2.4	3	5.0	0.85
Pediatric general and urology	24	16.6	17	20.0	7	11.7	
Otolaryngology	50	34.5	23	27.1	27	45.0	
Cardiac	25	17.2	10	11.8	15	25.0	
Radiology	11	7.6	11	12.9	0	0.0	
Orthopaedic	16	11.0	13	15.3	3	5.0	
Others	14	9.7	9	10.6	5	8.3	
<b>Orofacial Features</b>							
None	73	50.3	53	62.4	20	33.3	0.61
At least one feature	72	49.7	32	37.6	40	66.7	0.61
Micrognathia	56	38.6	24	28.2	32	53.3	0.53
Retrognathia	45	31.0	25	29.4	20	33.3	0.09
Restricted mouth opening	16	11.0	6	7.1	10	16.7	0.30
Multiple features	45	31.0	23	27.1	22	36.7	0.21
<b>Eventual Device Used to Intubate</b>							
DL	87	60.0	76	89.4	11	18.3	2.22
VL	32	22.1	3	3.5	29	48.3	
FOS	7	4.8	0	0.0	7	11.7	
Otolaryngology airway devices <sup>3</sup>	17	11.7	4	4.7	13	21.7	
Combined (FOS+LMA, FOS+VL)	2	1.4	0	0.0	2	3.3	0.26
<b>Intubation Attempts</b>							
1	110	75.9	77	90.6	33	55.0	0.99
2	18	12.4	8	9.4	10	16.7	
≥3	17	11.7	0	0.0	17	28.3	

### References:

1. Nelson KE, et al. JAMA. 2016;316(4):420-8., 2. Birmingham EE, et al. Paediatr Anaesth. 2021;31(4):419-28., 3. Fiadjoe JE, et al. Lancet Respir Med. 2016;4(1):37

### Results

- The dataset contained 165 anesthetics: 145 intubations, 17 mask, 3 LMA among 48 children
- Incidence of DF and DI: 2.9% and 41.4% respectively

### DI (n=60)

- ~ More than half occurred in children < 1 year old
- ~ ¾ in children with weight ≤ 10kg
- ~ 2/3 with at least one orofacial anomaly
- ~ most common (45%) in otolaryngology procedure
- ~ Nearly 50% ultimately secured by VL
- ~ 15% by FOI
- ~ 1/5 by otolaryngology airway devices
- ~ <20% by DL

### Airway intervention related Complications:

- ~ Hypoxemia in 45.5% anesthetics, 19% severe
- ~ 11 Critical cardiopulmonary events needing treatment with vasoactive medications (epinephrine, phenylephrine, atropine and ephedrine), including 1 with CPR

### Discussion

- **DF and DI were common**
- Risk factors included patient age < 1 year, weight ≤10 kg, otolaryngology procedures, micro or retrognathia, and restricted mouth opening
- VL and FOS more successful compared with DL
- Rescue often required by otolaryngologist
- Elective intubation should be performed in settings where advanced airway device and staff skilled in its use are available
- Prepare to treat airway intervention related complications
- Limitations: retrospective study; unique local otolaryngology resource; genetic variants of trisomy 18 not identified