Operative Airway Evaluation for Chronically Intubated Infants with Extubation Failures Associated with High Downsizing Rates

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Introduction

- Long-term intubation and large endotracheal tube (ETT) sizes in infants may predispose the airway to iatrogenic laryngotracheal injury and extubation failure[1,2].
- The Neonatal Resuscitation Program (NRP) released weight-based ETT sizing recommendations in 2021[3].

Weight (g)	ETT size (mm)
<1000	2.5
1000 – 2000	3.0
>2000	3.5

- Infants with 3.0mm and 3.5mm ETT required downsizing, and 0.5mm smaller ETT sizes were associated with fewer adverse events[4].

Methods

- Retrospective review at tertiary level children's hospital (Nov 2021 to Dec 2024)
- Infants ≤6 months undergoing first operative airway evaluation due to extubation failure
- Chronic intubation defined as > 2 weeks
- Collected demographic and patient data, operative data, and clinical outcomes

Table 1. Demographic data

Mean Corrected Age (months)	1.4 ± 1.6 (IQR 0.4 – 2.0)
Sex	
Male n (%)	52 (55%)
Female n (%)	43 (45%)
Race	
White n (%)	67 (96%)
African American/Black n (%)	21 (22%)
Latinx n (%)	2 (2%)
Asian n (%)	5 (5%)
Premature n (%)	61 (64%)
Mean gestational age (weeks)	31.6 ± 5.9 (IQR 26 – 37)
Bronchopulmonary Dysplasia	47 (49%)
Major Cardiac Abnormality	30 (32%)
Major Neurologic Disorder	12 (13%)
Trisomy 21 n (%)	7 (7%)
Major medical comorbidity n (%)	23 (24%)
Mean duration of intubation (days)	55.3 ± 48.8 days

Results

- Infants with 3.5 ETT at operative evaluation required downsizing more frequently than infants with 3.0 ETT (59% vs. 13%, p<0.01)
- Downsized patients (3.5 to 3.0 ETT) trended higher extubation rates vs. those who weren't downsized (50% vs 29%, p=0.21).
- Gestation <28 weeks had lower extubation success rates (24%, p=0.01) and higher tracheostomy rates (65%, p=0.01)
- Infants with major neurologic conditions had lower extubation success rates (8%, p=0.02)
- Infants weighing >4kg had higher downsizing rates (43%, p=0.07) and lower extubation success rates (29%, p=0.08).
- BPD and airway malacia were not significantly associated with downsize, extubation, or tracheostomy rates.

Results

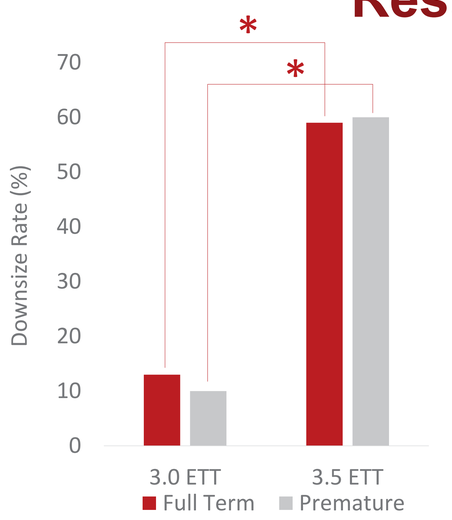

Figure 1. Infants with 3.5 ETT had higher downsizing rates than 3.0 ETT in full term (13% vs. 59%, p<0.01).

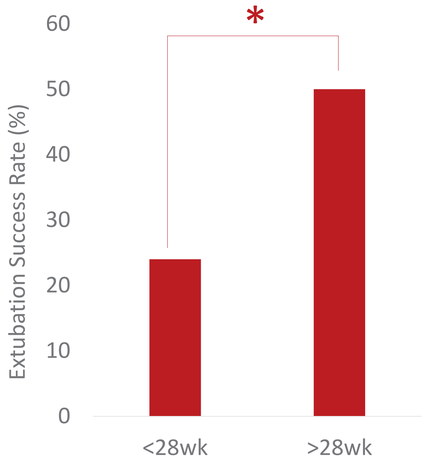

Figure 2. Infants <28 wks had lower extubation success vs. infants ≥28 wks (24% vs. 50%, p<0.05).

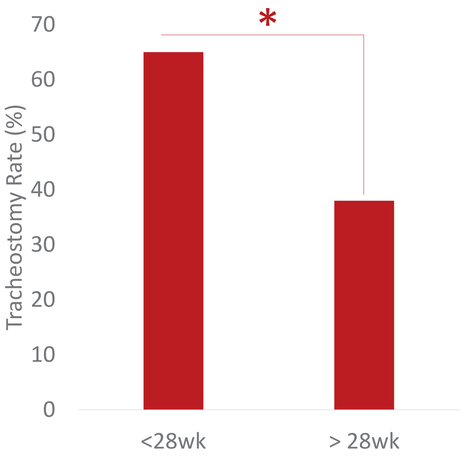

Figure 3. Infants <28wks gestation had higher tracheostomy rates vs. ≥28wks gestation (65% vs. 38%, p<0.05)

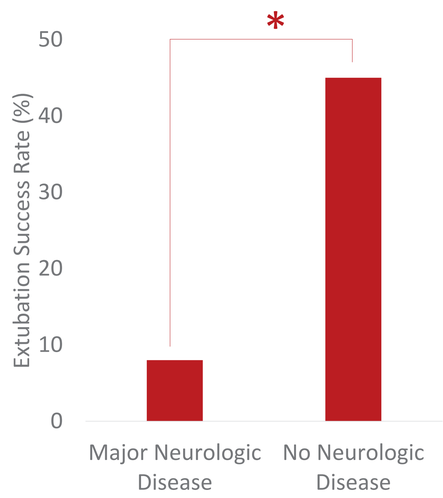

Figure 4. Infants with major neurologic disease had lower extubation success than infants with no neurologic disease (8% vs.45%, p<0.05).

*denotes statistical significance (p<0.05); NS = not significant

Discussion

- Prevalence of subglottic stenosis (SGS) is 2-11%[8-9].
- Post-intubation SGS is attributed to risk factors such as duration of intubation, traumatic intubation, gestational age, and size of endotracheal tube[5-7].
- Gestation <28 weeks and neurologic comorbidity were strongly linked to extubation failure and tracheostomy
- Airway malacia and BPD do not appear to predict outcomes
- Limitations: retrospective, small cohort, inability to distinguish congenital vs. acquired SGS

Conclusions

- Smaller ETT (-0.5mm) reduces the need for downsizing and trends toward higher extubation success
- Weight-based ETT sizing may overestimate airway caliber for long-term ventilation
- Extreme prematurity and neurologic comorbidity drive airway outcomes, not airway malacia
- We recommend incorporating pediatric otolaryngologist input into ETT sizing recommendations

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