Pediatric obstructive sleep apnea: A prospective observational study of respiratory events in the immediate recovery period after adenotonsillectomy

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Background

- Postoperative respiratory adverse events after adenotonsillectomy (AT) for pediatric obstructive sleep apnea (OSA) commonly occur[1]
- These events have also rarely resulted in severe injury[2]
- *Respiratory depression difficult to objectively identify in children*
- Data from immediate postoperative recovery period may predict risk of overnight respiratory events[3]
- Aim: **Measure incidence and identify predictors of respiratory depression and airway obstruction** in the post-anesthesia care unit (PACU) after AT using a *noninvasive respiratory volume monitor (RVM)*

Methods

- **Prospective observational cohort study**
- **Primary outcome: Airway obstruction and respiratory depression in the PACU**
  - Measured using noninvasive RVM (ExSpiron®1Xi)
  - Defined as minute ventilation < 40% predicted for at least 2 minutes.
- **Secondary outcomes: mild and severe clinical respiratory events in the PACU**
  - Measured by continuous observation
- Applied and synced RVM to invasive minute ventilation measurements after intubation
- Stepwise Poisson regression to identify predictors of the number of primary outcome events without collinearity

Table 1. Baseline characteristics and primary and secondary outcome measurements of 60 children undergoing adenotonsillectomy for obstructive sleep apnea

Baseline characteristics	n (%) or median (IQR)
Age, years	4 (2, 8)
BMI z score	1.8 (0.5, 2.4)
Sex, female	27 (45)
Race	
White	12 (20)
Black	16 (27)
Hispanic	32 (53)
Reason for admission	
Age < 3 years	13 (22)
Obesity	17 (28)
Severe obstructive sleep apnea	13 (22)
2+ reasons	17 (28)
*Severe obstructive sleep apnea	28 (47)
†Apnea-hypopnea index	12.8 (6.0, 29.0)
Comorbid conditions	
Obesity	11 (18)
‡Other	18 (30)
2+ conditions	20 (33)
Preoperative oral morphine equivalent, mg/kg	0.0 (0.0, 0.10)
Intraoperative oral morphine equivalent, mg/kg	0.3 (0.2, 0.4)
Postoperative oral morphine equivalent, mg/kg	0.1 (0.0, 0.2)
Extubated deep	42 (70)
Outcome	
Respiratory depression/airway obstruction	39 (65)
Number of events	2 (0, 4)
Events/hour of monitoring time	1.3 (0, 2.8)
¥Mild clinical respiratory events	21 (40)
^Severe clinical respiratory events	1 (2)

*Greater than or equal to 10 apneas or hypopneas per hour
†Median apnea-hypopnea index in those children with preoperative polysmnogram, n=27
‡Other conditions include Trisomy 21, asthma, seasonal allergies, prematurity, seizure disorder, and autism
¥Airway obstruction or hypoxemia requiring oxygen supplementation, nasopharyngeal/oropharyngeal airway placement, stimulation, repositioning, or suctioning
^Airway obstruction or hypoxemia requiring mask ventilation, noninvasive positive airway pressure, reintubation, or intensive care unit transfer

Table 2. Results of stepwise Poisson regression analysis for predicting the number of episodes of airway obstruction or respiratory depression in the recovery room following adenotonsillectomy in children with obstructive sleep apnea

	Estimate	95% CI	P value
BMI Z score			
<-1	3.9	1.5, 10.2	<0.01
-1 to 0	0.5	0.2, 1.1	0.08
0 to 1	Reference		
1 to 2	2.0	1.2, 3.5	<0.01
>2	1.0	0.6, 1.9	0.89
Reason for admission			
Age	1.5	0.8, 3.1	0.24
Severe OSA	0.5	0.2, 1.2	0.12
2+ reasons	1.3	0.8, 2.1	0.27
Obesity	Reference		
ASA PS Score			
II	Reference		
III	0.6	0.4, 0.9	0.01
Comorbidity			
None	Reference		
Obesity	1.2	0.6, 2.5	0.55
*Other	1.4	0.8, 2.5	0.27
2+ conditions	2.0	1.1, 3.5	0.02
Extubated			
Deep	1.5	1, 2.3	0.07
Awake	Reference		

Twenty-six variables were included in the initial model.
McFadden's R squared of the final model = 0.256.
*Other conditions include Trisomy 21, asthma, seasonal allergies, prematurity, seizure disorder, and autism

Results

- *RVM monitoring* identified **39 children** (65%) with respiratory depression or airway obstruction
- Only **22 children** (36%) had a *recognized* clinical respiratory event

Conclusion

- Increased episodes of airway obstruction and respiratory depression: BMI Z score < -1 or between 1 and 2 and having at least 2 comorbidities.
- **Airway obstruction/respiratory depression following AT occur more frequently than clinically recognized**
- Postoperative disposition often determined by clinical monitoring for adverse respiratory events
- Standard monitoring may be inadequate
- **Integrating respiratory physiological variables may help determine patient disposition after AT**
- Future studies should determine suitability of RVM parameters as predictive biomarkers of respiratory events

References

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