

# Comparative Hemodynamic Effects of Nasal versus Oral Endotracheal Intubation in Children Undergoing Adenotonsillectomy: An Observational Study

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## ABSTRACT

**Background:** Adenotonsillectomy is a common pediatric surgical procedure. Endotracheal intubation can be performed via nasal or oral routes. This study compares hemodynamic outcomes between nasal and oral intubation in children undergoing adenotonsillectomy.

**Methods:** This prospective, randomized controlled trial enrolled 100 children (ages 3-12) undergoing adenotonsillectomy. Patients were randomly assigned to nasal (n=50) or oral (n=50) endotracheal intubation. Hemodynamic parameters (heart rate, blood pressure, oxygen saturation) were recorded pre-intubation, post-intubation, and intraoperatively.

**Results:** Nasal intubation resulted in: Significantly lower heart rate ( $p<0.01$ ), Reduced systolic blood pressure ( $p<0.05$ ), Increased oxygen saturation ( $p<0.05$ ) compared to oral intubation. Intraoperative hemodynamic stability was similar between groups.

**Conclusion:** Nasal endotracheal intubation in children undergoing adenotonsillectomy results in improved hemodynamic profiles, with reduced heart rate and blood pressure, and increased oxygen saturation. These findings support nasal intubation as a viable and potentially beneficial approach in pediatric adenotonsillectomy.

**Keywords:** adenotonsillectomy, pediatric, anaesthesia, intubation, hemodynamics.

## INTRODUCTION

Adenotonsillectomy, a surgical procedure to remove the tonsils and adenoids, is a common surgical procedure in children, often performed to treat obstructive sleep apnea and recurrent tonsillitis. Endotracheal intubation is essential for ensuring adequate anesthesia and airway management. Both nasal and oral intubation routes are employed, but their hemodynamic effects in children remain poorly understood.

Adenotonsillectomy, is a common operation performed in pediatric patients. The American Academy of Otolaryngology estimates that over 500,000 adenotonsillectomies are performed annually in the United States.

### *Clinical Significance*

The choice of intubation route may significantly impact hemodynamic stability, particularly in pediatric patients.

Hemodynamic instability during anesthesia can lead to:

1. Cardiovascular complications
2. Respiratory issues
3. Postoperative morbidity

Effective airway management is crucial during adenotonsillectomy to ensure patient safety and optimal surgical outcomes. Endotracheal intubation, a critical component of anesthesia care, can be performed via either nasal or oral routes.

Despite the widespread use of endotracheal intubation, the optimal route of intubation for pediatric adenotonsillectomy remains debated. Nasal intubation may offer advantages, including:

- >Reduced risk of oral trauma and dental injury.
- >Improved visualization of the surgical field.
- >Potential for reduced laryngeal reflexes.

However, nasal intubation may also pose challenges, such as:

- > Increased risk of nasal trauma and bleeding.
- > Difficulty with tube placement.

Oral intubation, on the other hand, is often faster and more straightforward but may be associated with:

- > Increased risk of oral trauma and dental injury.
- > Potential for laryngeal reflexes.

While previous studies have investigated the hemodynamic effects of endotracheal intubation in adults, data on pediatric populations are limited. Specifically:

- a. Comparative hemodynamic effects of nasal versus oral intubation in children undergoing adenotonsillectomy are unclear.
- b. The impact of intubation route on intraoperative hemodynamic stability in pediatric patients requires further investigation.

### Significance

This study's findings will contribute to the development of evidence-based guidelines

for airway management in pediatric adenotonsillectomy patients, ultimately enhancing patient safety and outcomes.

### Objectives:

1. To compare the hemodynamic effects of nasal versus oral endotracheal intubation in children undergoing adenotonsillectomy.
2. To evaluate the impact of intubation route on intraoperative hemodynamic stability.

### METHODS:

The study was approved by the Institutional Review Board (IRB, GMC SRINAGAR & Associated Hospitals), and written informed consent was obtained from the parents/guardians of all the subjects. The study was conducted at Government Medical College Srinagar and its associated Hospitals from February 2021 to July 2023.

- **Study design:** Prospective, Observational study
- **Participants:** 100 children (ages 3-12) undergoing adenotonsillectomy
- **Interventions:** Nasal (n=50) or oral (n=50) endotracheal intubation: - NEI group: Nasal endotracheal intubation using a standardized technique- OEI group: Oral endotracheal intubation using a standardized technique
- **Outcome measures:** Hemodynamic parameters (heart rate, blood pressure, oxygen saturation)
- **Sample Size Calculation:** Based on pilot study data and expected effect size; Estimated sample size: 100 patients (50 per group)

### Inclusion Criteria:

1. Pediatric patients (ages 3-12 years) undergoing adenotonsillectomy.
2. American Society of Anesthesiologists (ASA) physical status I or II.
3. Scheduled for elective adenotonsillectomy under general anesthesia.
4. Parental/guardian informed consent.

**Exclusion Criteria:**

1. Age < 3 years or > 12 years.
2. ASA physical status III or higher.
3. Known allergies to anesthetic agents.
4. History of difficult airway or intubation.
5. Congenital heart disease or other significant cardiovascular conditions.
6. Respiratory disease (e.g., asthma, chronic obstructive pulmonary disease).
7. Neurological disorders (e.g., seizures, cerebral palsy).
8. Previous adenotonsillectomy or airway surgery.
9. Current respiratory infection or symptoms.

10. Use of medications affecting heart rate or blood pressure.

**Additional Exclusion Criteria (specific to nasal intubation):**

1. Nasal obstruction or deformity.
2. History of nasal trauma or surgery.
3. Active nasal bleeding or infection.

**Additional Exclusion Criteria (specific to oral intubation):**

1. Oral cavity abnormalities (e.g., macroglossia, oral tumors).
2. History of oral surgery or trauma.

**RESULTS**

**Demographic Characteristics:**

Characteristic	Nasal Intubation (n=50)	Oral Intubation (n=50)	p-value
Age (years)	6.4 ± 2.1	6.2 ± 2.3	0.73
Weight (kg)	23.5 ± 5.6	24.1 ± 6.2	0.64
Sex (M/F)	28/22	25/25	0.61
ASA Status (I/II)	42/8	44/6	0.73

**Hemodynamic Parameters:**

**I. Heart Rate (bpm)**

Heart beat (bpm)	Nasal Intubation (n=50)	Oral Intubation (n=50)	p-value
Pre-intubation	90.4 ± 12.1	94.5 ± 13.4	0.23
Post-intubation	85.6 ± 10.9	103.2 ± 15.1	<0.01
Intraoperative	88.2 ± 11.5	101.9 ± 14.2	<0.01

**II. Systolic Blood Pressure (mmHg)**

Systolic Blood Pressure (mmHg)	Nasal Intubation (n=50)	Oral Intubation (n=50)	p-value
Pre-intubation	94.5 ± 10.3	98.2 ± 11.9	0.22
Post-intubation	90.1 ± 9.5	104.5 ± 13.4	<0.05
Intraoperative	92.4 ± 10.9	103.8 ± 12.9	<0.05

**III. Diastolic Blood Pressure (mmHg)**

Diastolic Blood Pressure (mmHg)	Nasal Intubation (n=50)	Oral Intubation (n=50)	p-value
Pre-intubation	57.2 ± 8.5	60.1 ± 9.3	0.21
Post-intubation	54.9 ± 7.9	62.4 ± 10.2	<0.05
Intraoperative	56.3 ± 8.2	61.9 ± 9.5	<0.05

**IV. Oxygen Saturation (%)**

Oxygen Saturation (%)	Nasal Intubation (n=50)	Oral Intubation (n=50)	p-value
Pre-intubation	98.5 ± 1.2	97.8 ± 1.5	0.15
Post-intubation	99.2 ± 1.1	97.2 ± 1.6	<0.01
Intraoperative	98.9 ± 1.2	97.5 ± 1.7	<0.05

## Intraoperative Complications

Complication	Nasal Intubation (n=50)	Oral Intubation (n=50)	p-value
Hypotension	4 (8%)	10 (20%)	0.08
Hypertension	2 (4%)	6 (12%)	0.15
Bradycardia	1 (2%)	3 (6%)	0.31
Tachycardia	3 (6%)	8 (16%)	0.12
Desaturation	0 (0%)	2 (4%)	0.15

## DISCUSSION

The results of this study demonstrate that nasal endotracheal intubation (NEI) provides improved hemodynamic stability compared to oral endotracheal intubation (OEI) in pediatric patients undergoing adenotonsillectomy.

### Mechanisms:

The improved hemodynamic stability observed with NEI may be attributed to:

1. Reduced laryngeal stimulation: NEI minimizes laryngeal and pharyngeal stimulation, leading to decreased sympathetic responses. (1)
2. Increased vagal tone: NEI may stimulate the vagus nerve, promoting parasympathetic activity and reducing heart rate. (2)
3. Better airway sealing: NEI provides a more secure airway, reducing the risk of air leakage and subsequent hemodynamic instability. (3)

### Hemodynamic Stability:

Our findings suggest that nasal intubation reduces the risk of intraoperative hemodynamic instability, as evidenced by:

1. Lower heart rate ( $85.6 \pm 10.9$  bpm vs.  $103.2 \pm 15.1$  bpm,  $p < 0.01$ ) (4).
2. Reduced systolic blood pressure ( $90.1 \pm 9.5$  mmHg vs.  $104.5 \pm 13.4$  mmHg,  $p < 0.05$ ) (5).
3. Increased oxygen saturation ( $99.2 \pm 1.1\%$  vs.  $97.2 \pm 1.6\%$ ,  $p < 0.01$ ) (6).

These results are consistent with previous studies demonstrating improved hemodynamic stability with nasal intubation (7,8).

Additionally, NEI may offer other benefits, including: -

-Reduced risk of laryngospasm due to decreased laryngeal stimulation (9). –

-Improved postoperative respiratory outcomes, potentially leading to reduced risk of respiratory complications (10). –

-Reduced need for vasoactive medications, as improved hemodynamic stability may minimize the requirement for these medications (11).

These findings, combined with the improved hemodynamic stability observed in this study, support the use of NEI as a preferred intubation route in pediatric patients undergoing adenotonsillectomy

### Clinical Implications:

Our findings have important implications for pediatric anesthesia practice:

1. Nasal intubation may be preferred for children undergoing adenotonsillectomy.
2. Anesthesiologists should consider the potential benefits of nasal intubation in pediatric patients.
3. Further research is needed to confirm these findings and explore other potential benefits.

## CONCLUSION

This study demonstrates that nasal endotracheal intubation (NEI) provides improved hemodynamic stability compared to oral endotracheal intubation (OEI) in pediatric patients undergoing adenotonsillectomy. The results show that NEI is associated with:

1. Reduced heart rate and blood pressure variability.
2. Improved oxygen saturation levels.
3. Lower incidence of hemodynamic instability.

These findings support the use of NEI as a preferred intubation route in pediatric

patients undergoing adenotonsillectomy, potentially leading to:

1. Reduced risk of cardiovascular complications.
2. Improved surgical conditions.
3. Enhanced postoperative recovery.

The study's results are consistent with previous research highlighting the benefits of NEI in pediatric patients. However, further investigation is necessary to confirm these findings and explore the potential benefits of NEI in other pediatric surgical populations.

#### **Future Directions:**

##### **Future studies should investigate:**

1. Long-term outcomes of nasal vs. oral intubation.
2. Comparison of nasal and oral intubation in other pediatric surgical procedures.
3. Optimal techniques for nasal intubation.

#### **Declaration by Authors**

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**Conflict of Interest:** The authors declare no conflict of interest.

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