

## Perioperative Respiratory Complications in Children Undergoing General Anaesthesia: A Prospective Observational Study

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### Abstract

**Background:** Perioperative respiratory complications remain among the most frequent adverse events in pediatric anaesthesia and are an important cause of morbidity, prolonged recovery, and unplanned escalation of care. **Objectives:** To determine the incidence and pattern of perioperative respiratory complications in children undergoing surgery under general anaesthesia and to identify associated clinical and procedural risk factors. **Methods:** This prospective observational study was conducted in the Department of Anaesthesiology at Government Medical College, Khammam, Telangana, from August 2025 to January 2026. One hundred consecutive children undergoing surgery under general anaesthesia were enrolled and followed from induction until discharge from the post-anaesthesia care unit. Demographic details, recent upper respiratory tract infection, passive smoke exposure, ASA physical status, type of surgery, airway device, and duration of anaesthesia were recorded. Respiratory complications occurring intraoperatively and postoperatively were documented and analyzed. **Results:** The mean age of participants was  $4.8 \pm 3.7$  years; 58.0% were males. Overall, 30.0% of children developed at least one perioperative respiratory complication. Intraoperative events occurred in 18.0%, and postoperative events occurred in 20.0%; 8.0% experienced complications during both periods. Oxygen desaturation was the commonest intraoperative event, while prolonged oxygen requirement and airway obstruction predominated postoperatively. Complications were significantly more frequent in children younger than 5 years, those with recent upper respiratory tract infection, passive smoke exposure, endotracheal intubation, and airway-related ENT surgery. **Conclusion:** Perioperative respiratory complications were common in this cohort and were predominantly associated with identifiable high-risk clinical and airway factors. Focused preoperative screening, careful airway planning, and closer perioperative surveillance in vulnerable children can help reduce adverse respiratory outcomes.

**Keywords:** children; general anaesthesia; perioperative complications; respiratory adverse events; pediatric anaesthesia; upper respiratory tract infection



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### INTRODUCTION

Pediatric anaesthesia has become considerably safer over the last few decades, yet respiratory events continue to account for a large proportion of perioperative morbidity in children [1]. The pediatric airway is anatomically narrow, highly compliant, and more prone to dynamic obstruction, while oxygen reserve is lower and metabolic demand is higher than in adults. These physiological characteristics make children particularly vulnerable to desaturation, laryngospasm, bronchospasm, breath-holding, excessive secretions, postoperative airway obstruction, and stridor during the perioperative period [4]. Even when most of these events are transient and reversible, they can interrupt surgery, delay recovery, necessitate unplanned interventions, and in severe cases lead to intensive care admission or cardiorespiratory compromise [4].

The reported incidence of perioperative respiratory adverse events in children varies across studies because of differences in patient selection, case mix, event definitions, and anaesthetic practices. Earlier elective surgery data demonstrated that respiratory complications are common even in routine pediatric cases. Large prospective work has shown that risk increases substantially in the presence of young age, active or recent upper respiratory tract infection, passive smoke exposure, airway surgery, tracheal intubation, and higher ASA physical status [4]. Multicentre European data have further underlined the burden of perioperative severe critical events, with respiratory complications forming the dominant subgroup. These observations indicate that respiratory risk in children is not random; rather, it is strongly influenced by identifiable host, surgical, and anaesthetic factors.

Upper respiratory tract infection remains one of the most debated perioperative problems in pediatric anaesthesia. Children commonly experience recurrent viral infections, and the decision to proceed with surgery often requires balancing operative urgency against increased respiratory vulnerability [2,3]. Published evidence shows that children with recent or active upper respiratory tract infection have a higher likelihood of coughing, breath-holding, desaturation, laryngospasm, and bronchospasm, especially when endotracheal tubes are used [2,5]. Contemporary risk stratification tools, including the COLDS score, have been developed to support structured preoperative assessment in such settings [7,8]. Likewise, studies comparing airway devices suggest that supraglottic airway use can reduce some respiratory complications relative to tracheal intubation in selected children [5,6].

Despite the availability of international evidence, local prospective data from Indian tertiary teaching hospitals remain limited, and respiratory risk profiles can differ according to referral patterns, case severity, environmental exposures, and perioperative workflow. Institution-specific data are useful for recognizing modifiable risk factors, improving planning, and strengthening perioperative vigilance. Therefore, the present study was undertaken at Government Medical College, Khammam, Telangana, to evaluate perioperative respiratory complications in children undergoing general anaesthesia. The objectives of the study were to determine the incidence and pattern of perioperative respiratory complications and to assess their association with selected demographic, clinical, surgical, and airway-related factors.

## **MATERIALS AND METHODS**

### **Study design and setting**

This hospital-based prospective observational study was conducted in the Department of Anaesthesiology, Government Medical College, Khammam, Telangana, over a six-month period from August 2025 to January 2026. The study was designed to document perioperative respiratory complications in children undergoing surgery under general anaesthesia and to examine their association with preoperative and intraoperative risk factors under real-world clinical conditions.

### **Study population**

The study included 100 consecutive pediatric patients aged up to 12 years who underwent surgical procedures under general anaesthesia during the study period. Children scheduled for elective as well as time-sensitive procedures were considered for inclusion when perioperative follow-up from induction of anaesthesia to discharge from the post-anaesthesia care unit was feasible. Children in whom complete perioperative observation was not possible or whose records were incomplete were excluded. All eligible participants were enrolled consecutively to minimize selection bias.

### **Preoperative assessment**

Pre-anaesthetic evaluation was performed in all children. Demographic characteristics, age, sex, ASA physical status, history of recent upper respiratory tract infection, and passive smoke exposure were documented. A recent upper respiratory tract infection was considered present when the child had a history of symptoms such as cough, rhinorrhoea, nasal congestion, fever, or sore throat within the preceding two weeks, based on available clinical records and caregiver history [2,3,10,14]. The nature of the surgical procedure, including airway-related ENT and non-airway surgery, was also recorded because type of surgery influences respiratory risk [4].

### **Intraoperative and postoperative observations**

Anaesthesia was administered according to institutional practice under the supervision of consultant anaesthesiologists. The airway device used for each child was documented as endotracheal tube, laryngeal mask airway, or face mask. Duration of anaesthesia was categorized as less than 60 minutes, 60 to 120 minutes, or more than 120 minutes. Standard intraoperative monitoring was employed, including pulse oximetry, electrocardiography, non-invasive blood pressure monitoring, and capnography where indicated. The occurrence of respiratory complications was prospectively noted during induction, maintenance, emergence, and recovery.

### **Outcome measures and analysis**

The primary outcome was the occurrence of any perioperative respiratory complication. Respiratory complications were defined in accordance with commonly reported pediatric anaesthesia events in the literature [1,4,10,12]. Intraoperative complications included oxygen desaturation, coughing or breath-holding, laryngospasm, bronchospasm, and excessive airway secretions. Postoperative complications included prolonged oxygen requirement for more than 30 minutes, airway obstruction, cough, desaturation, stridor, and bronchospasm. Children experiencing more than one event were recorded under each relevant category, while overall incidence reflected the number of children with at least one complication. Continuous variables are presented as mean  $\pm$  standard deviation, and categorical variables as frequency and percentage. Associations between selected risk factors and perioperative respiratory complications were assessed using appropriate tests for categorical data, and a p value of less than 0.05 was considered statistically significant.

### **Ethical considerations**

The study was conducted after approval from the Institutional Ethics Committee of Government Medical College, Khammam. Written informed consent was obtained from parents or legal guardians before enrolment, and assent was considered where age appropriate. Confidentiality of patient information was maintained throughout the study.

## RESULTS

A total of 100 children undergoing surgery under general anaesthesia were enrolled during the study period. All recruited participants completed perioperative follow-up and were included in the final analysis. The mean age of the study population was  $4.8 \pm 3.7$  years. Most children belonged to the age group of 1-5 years [40.0%], followed by 6-10 years [25.0%], infants aged less than 1 year [20.0%], and 11-12 years [15.0%]. Males constituted 58.0% of the study population, while females accounted for 42.0%. A majority of children were classified as ASA physical status I [72.0%], followed by ASA II [24.0%] and ASA III [4.0%]. Recent upper respiratory tract infection was noted in 16.0% of children, and passive smoke exposure was present in 29.0%. Endotracheal intubation was used in 62.0% of cases, laryngeal mask airway in 26.0%, and face mask anaesthesia in 12.0% of cases. The baseline perioperative characteristics are shown in Table 1.

**Table 1. Baseline characteristics of the study population [N = 100]**

| Variable                                 | Category              | n  | % / Mean $\pm$ SD |
|------------------------------------------|-----------------------|----|-------------------|
| Age [years]                              | Mean $\pm$ SD         |    | $4.8 \pm 3.7$     |
| Age group [years]                        | <1                    | 20 | 20.0              |
|                                          | 1–5                   | 40 | 40.0              |
|                                          | 6–10                  | 25 | 25.0              |
|                                          | 11–12                 | 15 | 15.0              |
| Sex                                      | Male                  | 58 | 58.0              |
|                                          | Female                | 42 | 42.0              |
| ASA status                               | I                     | 72 | 72.0              |
|                                          | II                    | 24 | 24.0              |
|                                          | III                   | 4  | 4.0               |
| Recent upper respiratory tract infection | Yes                   | 16 | 16.0              |
|                                          | No                    | 84 | 84.0              |
| Passive smoke exposure                   | Yes                   | 29 | 29.0              |
|                                          | No                    | 71 | 71.0              |
| Type of surgery                          | Airway-related ENT    | 18 | 18.0              |
|                                          | Other ENT             | 12 | 12.0              |
|                                          | General surgery       | 24 | 24.0              |
|                                          | Orthopaedic           | 20 | 20.0              |
|                                          | Urology               | 14 | 14.0              |
|                                          | Others                | 12 | 12.0              |
| Airway device                            | Endotracheal tube     | 62 | 62.0              |
|                                          | Laryngeal mask airway | 26 | 26.0              |
|                                          | Face mask             | 12 | 12.0              |

| Variable                | Category   | n  | % / Mean $\pm$ SD |
|-------------------------|------------|----|-------------------|
| Duration of anaesthesia | <60 min    | 46 | 46.0              |
|                         | 60–120 min | 38 | 38.0              |
|                         | >120 min   | 16 | 16.0              |

Overall, 30 children developed at least one perioperative respiratory complication, giving an incidence of 30.0%. Intraoperative respiratory complications occurred in 18.0% of children, whereas postoperative respiratory complications in the post-anaesthesia care unit were observed in 20.0%. Eight children experienced complications during both periods. The overall distribution of perioperative respiratory complications is presented in Table 2.

**Table 2. Incidence of perioperative respiratory complications [N = 100]**

| Complication category                               | n  | %    |
|-----------------------------------------------------|----|------|
| Any perioperative respiratory complication          | 30 | 30.0 |
| Intraoperative respiratory complication             | 18 | 18.0 |
| Postoperative respiratory complication              | 20 | 20.0 |
| Both intraoperative and postoperative complications | 8  | 8.0  |

Among intraoperative events, oxygen desaturation was the most common complication and was observed in 8.0% of children, followed by coughing or breath-holding in 6.0%, laryngospasm in 5.0%, excessive airway secretions in 4.0%, and bronchospasm in 3.0%. In the postoperative period, prolonged oxygen requirement for more than 30 minutes was seen in 8.0% of children, airway obstruction in 7.0%, cough in 6.0%, oxygen desaturation in 5.0%, stridor in 3.0%, and bronchospasm in 2.0%. Some children experienced more than one respiratory event. The pattern of specific respiratory complications is shown in Table 3.

**Table 3. Pattern of specific perioperative respiratory complications**

| Respiratory complication                   | n | %   |
|--------------------------------------------|---|-----|
| Intraoperative desaturation                | 8 | 8.0 |
| Intraoperative coughing/breath-holding     | 6 | 6.0 |
| Intraoperative laryngospasm                | 5 | 5.0 |
| Intraoperative excessive secretions        | 4 | 4.0 |
| Intraoperative bronchospasm                | 3 | 3.0 |
| Postoperative prolonged oxygen requirement | 8 | 8.0 |
| Postoperative airway obstruction           | 7 | 7.0 |
| Postoperative cough                        | 6 | 6.0 |
| Postoperative desaturation                 | 5 | 5.0 |
| Postoperative stridor                      | 3 | 3.0 |
| Postoperative bronchospasm                 | 2 | 2.0 |

Perioperative respiratory complications were more frequent in younger children and in those with recognized airway risk factors. Complications were recorded in 24 of 60 children aged less than 5 years compared with 6 of 40 children aged 5 years or older [40.0% vs 15.0%,  $p = 0.008$ ]. Children with a recent upper respiratory tract infection had a markedly higher rate of complications than those without such history [62.5% vs 23.8%,  $p = 0.002$ ]. Likewise, passive smoke exposure, use of an endotracheal tube, and airway-related ENT procedures were significantly associated with a higher incidence of respiratory complications. These associations are detailed in Table 4.

**Table 4. Factors associated with perioperative respiratory complications**

| Variable                                 | Category                        | Complications n/N | %    | p value |
|------------------------------------------|---------------------------------|-------------------|------|---------|
| Age                                      | <5 years                        | 24/60             | 40.0 | 0.008   |
|                                          | ≥5 years                        | 6/40              | 15.0 |         |
| Recent upper respiratory tract infection | Yes                             | 10/16             | 62.5 | 0.002   |
|                                          | No                              | 20/84             | 23.8 |         |
| Passive smoke exposure                   | Yes                             | 14/29             | 48.3 | 0.011   |
|                                          | No                              | 16/71             | 22.5 |         |
| Airway device                            | Endotracheal tube               | 24/62             | 38.7 | 0.015   |
|                                          | Laryngeal mask airway/Face mask | 6/38              | 15.8 |         |
| Type of surgery                          | Airway-related ENT              | 10/18             | 55.6 | 0.009   |
|                                          | Non-airway surgery              | 20/82             | 24.4 |         |

Most respiratory events were mild to moderate in severity and responded promptly to standard measures such as airway repositioning, suctioning, administration of 100% oxygen, and brief positive pressure ventilation. Nebulized bronchodilators were required in 4 children, and 1 child required re-intubation and unplanned intensive care monitoring for persistent bronchospasm. No mortality was recorded in the study cohort.

## DISCUSSION

The present prospective observational study found that 30.0% of children undergoing surgery under general anaesthesia experienced at least one perioperative respiratory complication. This finding confirms that respiratory events remain a substantial component of pediatric perioperative morbidity despite advances in monitoring and airway management [13]. The observed incidence is higher than the 26.2% reported in the Ethiopian prospective study by Wudineh et al. [12] and is broadly consistent with the approximately 30% risk described in children with upper respiratory tract infection who were allowed to proceed with anaesthesia in the French national cohort [9]. Differences across studies are expected because respiratory event rates depend on age distribution, case mix, airway surgery burden, event definitions, and the threshold used for perioperative reporting [10].

In the present study, oxygen desaturation emerged as the leading intraoperative event, while prolonged oxygen requirement and airway obstruction predominated in the postoperative period. This pattern is clinically plausible and agrees with the literature showing that desaturation, cough, laryngospasm, bronchospasm, and airway obstruction constitute the most frequent respiratory complications in pediatric anaesthesia [10,12,14]. The fact that postoperative complications slightly exceeded intraoperative events also deserves attention, because respiratory vulnerability often persists into emergence and recovery when airway reflexes, secretions, pain, and residual anaesthetic effects interact [13].

A major finding of this study was the strong association between respiratory complications and younger age. Children younger than 5 years had significantly more events than older children, which is consistent with earlier reports identifying infancy and early childhood as periods of heightened respiratory risk [2,4,6,12]. Smaller airway caliber, limited respiratory reserve, and increased airway reactivity probably contribute to this vulnerability. Recent upper respiratory tract infection was another important determinant, with complication rates more than doubling in affected children. This mirrors a substantial body of evidence demonstrating that current or recent upper respiratory symptoms increase perioperative coughing, desaturation, laryngospasm, and bronchospasm [10,14]. Passive smoke exposure also showed a significant association in the present cohort, supporting prior data that household smoke exposure amplifies airway irritability and perioperative respiratory risk [12].

Airway management had a clear influence on outcomes. Children managed with endotracheal intubation showed a significantly higher complication rate than those managed with laryngeal mask airway or face mask. This agrees with classical randomized data and later meta-analytic findings that tracheal intubation is associated with greater airway stimulation and a higher burden of respiratory adverse events in susceptible children [11]. Similarly, airway-related ENT

surgery carried a substantially higher rate of complications, in line with multicentre evidence that procedures involving the upper airway impose additional respiratory stress [12,13].

The clinical implication of these findings is that respiratory risk in pediatric anaesthesia is predictable to a meaningful extent. Careful preoperative screening for recent infection, smoke exposure, age-related vulnerability, and procedure type, combined with judicious airway device selection and closer recovery surveillance, can improve perioperative safety. The present study adds locally relevant prospective evidence from a tertiary teaching hospital and supports structured risk stratification in routine pediatric anaesthesia practice.

### Limitations

This study was conducted at a single tertiary care center with a relatively modest sample size, which limits external generalizability. The observational design identifies associations but does not establish causation. Detailed stratification by anaesthetic drugs, provider experience, and individual surgical subtypes was not performed. Multivariable modeling was also not undertaken because of the sample size and event distribution. These factors should be considered while interpreting the findings.

### CONCLUSION

Perioperative respiratory complications were common among children undergoing general anaesthesia in this prospective cohort, affecting nearly one-third of patients. Oxygen desaturation, postoperative oxygen requirement, and airway obstruction were the predominant events, and most were managed successfully with prompt standard measures. Younger age, recent upper respiratory tract infection, passive smoke exposure, endotracheal intubation, and airway-related ENT surgery were significant risk factors. These findings emphasize the importance of meticulous preoperative assessment, identification of modifiable exposures, individualized airway planning, and close intraoperative and postoperative surveillance. Integrating structured respiratory risk assessment into routine pediatric anaesthesia practice can strengthen perioperative safety and help reduce avoidable respiratory morbidity in tertiary care settings, especially in similar tertiary hospitals.

### REFERENCES

1. Mamie C, Habre W, Delhumeau C, Barazzzone Argiroffo C, Morabia A. Incidence and risk factors of perioperative respiratory adverse events in children undergoing elective surgery. *Paediatr Anaesth.* 2004;14(3):218-224. doi:10.1111/j.1460-9592.2004.01169.x.
2. Tait AR, Malviya S, Voepel-Lewis T, Munro HM, Seiwert M, Pandit UA. Risk factors for perioperative adverse respiratory events in children with upper respiratory tract infections. *Anesthesiology.* 2001;95(2):299-306. doi:10.1097/0000542-200108000-00084
3. Parnis SJ, Barker DS, Van Der Walt JH. Clinical predictors of anaesthetic complications in children with respiratory tract infections. *Paediatr Anaesth.* 2001;11(1):29-40. doi:10.1046/j.1460-9592.2001.00607.x.
4. von Ungern-Sternberg BS, Boda K, Chambers NA, Rebmann C, Johnson C, Sly PD, et al. Risk assessment for respiratory complications in paediatric anaesthesia: a prospective cohort study. *Lancet.* 2010;376(9743):773-783. doi:10.1016/S0140-6736(10)61193-2.
5. Tait AR, Pandit UA, Voepel-Lewis T, Munro HM, Malviya S. Use of the laryngeal mask airway in children with upper respiratory tract infections: a comparison with endotracheal intubation. *Anesth Analg.* 1998;86(4):706-711. doi:10.1097/0000539-199804000-00006.
6. Drake-Brockman TFE, Ramgolam A, Zhang G, Hall GL, von Ungern-Sternberg BS. The effect of endotracheal tubes versus laryngeal mask airways on perioperative respiratory adverse events in infants: a randomised controlled trial. *Lancet.* 2017;389(10070):701-708. doi:10.1016/S0140-6736(16)31719-6.
7. Subramanyam R, Yeramaneeni S, Hossain MM, Anneken AM, Varughese AM. Perioperative respiratory adverse events in pediatric ambulatory anesthesia: development and validation of a risk prediction tool. *Anesth Analg.* 2016;122(5):1578-1585. doi:10.1213/ANE.0000000000001216.
8. Lee LK, Bernardo MKL, Grogan TR, Elashoff DA, Ren WHP. Perioperative respiratory adverse event risk assessment in children with upper respiratory tract infection: validation of the COLDS score. *Paediatr Anaesth.* 2018;28(11):1007-1014. doi:10.1111/pan.13491.
9. Michel F, Vacher T, Julien-Marsollier F, Dadure C, Aubineau JV, Lejus C, et al. Peri-operative respiratory adverse events in children with upper respiratory tract infections allowed to proceed with anaesthesia: a French national cohort study. *Eur J Anaesthesiol.* 2018;35(12):919-928. doi:10.1097/EJA.0000000000000875.
10. Regli A, Becke K, von Ungern-Sternberg BS. An update on the perioperative management of children with upper respiratory tract infections. *Curr Opin Anaesthesiol.* 2017;30(3):362-367. doi:10.1097/ACO.0000000000000460.
11. de Carvalho ALR, Vital RB, de Lira CCS, Magro IB, Sato PTS, Lima LHN, et al. Laryngeal mask airway versus other airway devices for anesthesia in children with an upper respiratory tract infection: a systematic review and meta-analysis of respiratory complications. *Anesth Analg.* 2018;127(4):941-950. doi:10.1213/ANE.0000000000003674.

12. Wudineh DM, Berhe YW, Chekol WB, Adane H, Workie MM. Perioperative respiratory adverse events among pediatric surgical patients in university hospitals in Northwest Ethiopia: a prospective observational study. *Front Pediatr.* 2022;10:827663. doi:10.3389/fped.2022.827663.
13. Habre W, Disma N, Virag K, Becke K, Hansen TG, Jöhr M, et al. Incidence of severe critical events in paediatric anaesthesia (APRICOT): a prospective multicentre observational study in 261 hospitals in Europe. *Lancet Respir Med.* 2017;5(5):412-425. doi:10.1016/S2213-2600(17)30116-9.
14. Stepanovic B, Regli A, Becke-Jakob K, von Ungern-Sternberg BS. Preoperative preparation of children with upper respiratory tract infection: a focussed narrative review. *Br J Anaesth.* 2024;133(6):1212-1221. doi:10.1016/j.bja.2024.07.035.