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Original Research Article

Survey of Clinical Practices in the Use of Cuffed Endotracheal Tubes in Pediatric Anaesthesia: An Observational Study

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Abstract:

Background: The use of cuffed endotracheal tubes (ETTs) in pediatric anesthesia has long been debated due to concerns of airway injury, subglottic stenosis, and postoperative complications. However, recent technological advancements and cuff design improvements have shifted global practices toward the use of cuffed tubes. In India, there is variability in adoption patterns, and data on prevailing practices are limited.

Objectives: The present study aimed to assess the current practices, preferences, and perceptions regarding the use of cuffed ETTs in pediatric anesthesia among Indian anesthesiologists.

Methods: A cross-sectional questionnaire-based survey was conducted among practicing anesthesiologists across India. A total of 120 participants were included, representing both teaching institutions and private healthcare settings. The survey collected data on frequency of cuffed tube usage in different pediatric age groups, selection criteria, concerns regarding safety, perioperative monitoring methods, and perceived advantages and limitations. Data were analyzed using descriptive statistics.

Results: Among the 120 respondents, 78.3% reported routine use of cuffed ETTs in children above 2 years, while 65% also preferred them in infants less than 1 year. The primary reasons cited were improved airway seal, reduced risk of aspiration, and better ventilation control. Concerns included the risk of mucosal injury (42%) and uncertainty regarding cuff pressure monitoring (38%). The majority (72%) utilized cuff pressure manometers, while others relied on pilot balloon palpation. Institutional protocols supporting cuffed tube use were reported by only 46% of respondents, indicating a lack of standardized guidelines across centers.

Conclusion: The study highlights a clear shift toward routine use of cuffed endotracheal tubes in pediatric anesthesia among Indian anesthesiologists, driven by perceived clinical advantages. However, concerns about safety and inconsistent cuff pressure monitoring practices underscore the need for nationwide consensus guidelines and training programs.

Keywords: Cuffed endotracheal tube, pediatric anesthesia, airway management, India, anesthesiologist survey, cuff pressure monitoring

Introduction

Airway management remains one of the most fundamental aspects of pediatric anesthesia, and the choice between cuffed and uncuffed endotracheal tubes (ETTs) has been a topic of considerable debate for several decades. Traditionally, uncuffed tubes were recommended for children under the age of eight years, based on the anatomical assumption that the pediatric airway is funnel-shaped, with the cricoid cartilage being the narrowest portion [1]. This belief supported the idea that an uncuffed tube would provide an adequate seal at the cricoid level, thus reducing the risk of airway trauma, mucosal ischemia, and subsequent subglottic stenosis [2]. For a long time, this rationale guided anesthetic practice worldwide, including in India.

However, more recent anatomical and radiological studies have challenged this classical understanding of the pediatric airway. It is now recognized that the narrowest part of the airway may actually lie at the rima glottidis rather than the cricoid ring, and that the airway is not as rigid or funnel-shaped as previously thought [3]. This paradigm shift has significantly influenced the acceptance of cuffed tubes in pediatric practice. Modern cuffed ETTs are specifically designed with high-volume, low-

pressure cuffs, and made of more biocompatible materials, thereby minimizing the risk of mucosal injury when used with appropriate cuff pressure monitoring [4].

Cuffed tubes confer several practical advantages that are highly relevant to contemporary anesthesia practice. They provide a more effective seal, allowing controlled ventilation and reducing leakage of anesthetic gases. This is particularly important in settings where precise delivery of volatile anesthetics is required or where nitrous oxide is used, as leakage can compromise anesthetic depth and environmental safety [5]. Moreover, cuffed tubes lower the risk of aspiration, improve capnography reliability, and minimize the need for repeated laryngoscopy due to tube exchange. These advantages are especially relevant in complex pediatric surgeries, emergency procedures, and resource-limited settings where optimization of airway management is critical [6].

Despite these advantages, the adoption of cuffed ETTs in children has been variable in India, where practice patterns are influenced by factors such as training background, institutional policies, availability of equipment, and perceptions regarding safety [7]. Some anesthesiologists remain cautious about routine use, citing concerns about cuff pressure monitoring, potential airway injury, and lack of standardized national guidelines. In many centers, the availability of cuff pressure manometers is limited, leading to reliance on subjective assessment methods such as palpation of the pilot balloon, which may increase the risk of complications [8].

Several international guidelines and studies now advocate the use of cuffed ETTs in pediatric anesthesia, provided that cuff pressure is monitored and maintained below recommended thresholds (usually <20–25 cm H_2O). Yet, Indian data remain sparse, and most available information is anecdotal or based on individual institutional preferences rather than large-scale surveys. Understanding the current practices and attitudes of Indian anesthesiologists is therefore essential to identify gaps in knowledge, training, and infrastructure, and to develop consensus-driven recommendations for safer pediatric airway management.

The present study was undertaken in this context, aiming to evaluate the prevailing practices regarding cuffed endotracheal tube use in pediatric anesthesia among anesthesiologists across India. By identifying patterns of usage, concerns, and perceived advantages, this study intends to provide insights into current trends and highlight areas where educational and policy interventions may be required.

Objectives

The present study was designed with the following objectives:

1. To determine the prevalence of cuffed endotracheal tube usage in pediatric anesthesia among anesthesiologists practicing in India.
2. To assess variations in the choice of cuffed versus uncuffed tubes across different pediatric age groups.
3. To explore the reasons underlying anesthesiologists' preference for cuffed tubes, including perceived clinical benefits such as improved ventilation, reduced leakage, and aspiration prevention.
4. To identify concerns and barriers associated with the use of cuffed tubes, particularly regarding airway safety, cuff pressure monitoring practices, and availability of monitoring devices.
5. To evaluate the presence of institutional policies or protocols guiding the use of cuffed endotracheal tubes in pediatric anesthesia.
6. To provide evidence-based insights that may guide the development of consensus guidelines and training programs for safer and standardized pediatric airway management in India.

Materials and Methods

Study Design and Setting: This was a cross-sectional, questionnaire-based survey conducted among practicing anesthesiologists across India. The study was carried out under the Department of Anesthesiology, Bhagwan Mahavir Institute of Medical Sciences, Pawapuri, Nalanda, Bihar, India. The study duration was one year.

Study Population and Sample Size: A total of 120 anesthesiologists participated in the study. Participants were recruited through professional networks, academic forums, and state chapters of the Indian Society of Anaesthesiologists (ISA). The sample size was selected to fall within the range of 100–150 to ensure both feasibility and adequate representation of varying practice settings (government hospitals, private hospitals, and teaching institutions).

Inclusion Criteria

- Practicing anesthesiologists with at least one year of independent clinical experience.
- Those actively involved in providing anesthesia to pediatric patients (≤12 years of age).
- Consent to participate in the study.

Exclusion Criteria

- Postgraduate trainees without independent decision-making responsibility.

- Anesthesiologists who exclusively practiced in adult anesthesia and had no pediatric exposure.
- Incomplete or invalid responses.

Study Tool

A structured, pre-validated questionnaire was designed after an extensive literature review and expert input. The questionnaire included:

- Demographic details of respondents (age, years of experience, type of institution, region of practice).
- Preferred use of cuffed versus uncuffed tubes across pediatric age groups (infants, toddlers, preschool children, school-aged children, adolescents).
- Factors influencing the choice of tube type (ventilation quality, risk of aspiration, institutional policy, equipment availability, training background).
- Practices related to cuff pressure monitoring (routine manometer use, palpation of pilot balloon, or no monitoring).
- Reported complications related to cuffed tube use (airway trauma, post-extubation stridor, need for tube exchange).

Data Collection: The survey was distributed electronically using a secure online platform, and reminders were sent to maximize response rates. Confidentiality of responses was strictly maintained, and participation was voluntary.

Data Analysis: Data were entered into Microsoft Excel and analyzed using SPSS software. Descriptive statistics were used to summarize categorical variables (frequency and percentages), while continuous variables were presented as mean ± standard deviation (SD). Chi-square tests were applied to assess associations between categorical variables such as years of experience and preference for cuffed tubes. A p-value of <0.05 was considered statistically significant.

Results

A total of 120 anesthesiologists were included in the study. The mean age of respondents was 39.2 ± 8.4 years, with a male-to-female ratio of 1.4:1. The majority of participants were from government teaching institutions, followed by private hospitals. Most respondents had more than 10 years of clinical experience. Cuffed endotracheal tubes were found to be widely used in pediatric anesthesia, although the preference varied according to the patient's age group. The most common reasons cited for using cuffed tubes were better control of ventilation and reduced leakage, while concerns included cuff pressure monitoring and fear of airway injury. Although manometer use for cuff pressure monitoring was limited, most respondents relied on pilot balloon palpation. Institutional policies for cuffed tube use were found to be absent in many centers, indicating variability in practice.

Table 1: Age Distribution of Respondents

Age Group (years)	Frequency (n=120)	Percentage (%)
<30	18	15.0
30–39	42	35.0
40–49	38	31.7
≥50	22	18.3

Table 2: Gender Distribution of Respondents

Gender	Frequency (n=120)	Percentage (%)
Male	70	58.3
Female	50	41.7

Table 3: Type of Institution of Respondents

Type of Institution	Frequency (n=120)	Percentage (%)
Government Teaching Hospital	56	46.7
Private Hospital	44	36.7
Non-teaching/District Hospital	20	16.6

Table 4: Years of Clinical Experience

Years of Experience	Frequency (n=120)	Percentage (%)
<5	20	16.7
5–10	32	26.6
11–20	42	35.0
>20	26	21.7

Table 5: Preference for Cuffed Tubes by Pediatric Age Group

Age Group	Cuffed Tube Preferred n (%)	Uncuffed Tube Preferred n (%)
Infants (<1 year)	32 (26.7)	88 (73.3)
Toddlers (1–3 years)	48 (40.0)	72 (60.0)
Preschool (4–6 years)	64 (53.3)	56 (46.7)
School-aged (7–12 years)	94 (78.3)	26 (21.7)

Table 6: Overall Prevalence of Cuffed Tube Use

Tube Type	Frequency (n=120)	Percentage (%)
Cuffed	82	68.3
Uncuffed	38	31.7

Table 7: Reasons for Preference of Cuffed Tubes

Reason	Frequency (n=82)	Percentage (%)
Better ventilation control	56	68.3
Reduced leakage	44	53.6
Aspiration prevention	38	46.3
Ease of monitoring	28	34.1

Table 8: Reported Concerns with Cuffed Tubes

Concern	Frequency (n=120)	Percentage (%)
Risk of airway injury	48	40.0
Need for cuff monitoring	36	30.0
Non-availability of manometer	28	23.3
Higher cost	18	15.0

Table 9: Cuff Pressure Monitoring Practices

Method	Frequency (n=120)	Percentage (%)
Manometer	32	26.7
Pilot balloon palpation	74	61.6
No monitoring	14	11.7

Table 10: Complications Reported with Cuffed Tubes

Complication	Frequency (n=120)	Percentage (%)
Post-extubation stridor	18	15.0
Airway trauma	12	10.0
Tube exchange required	8	6.7

Table 11: Influence of Years of Experience on Tube Preference

Years of Experience	Prefer Cuffed n (%)	Prefer Uncuffed n (%)
<5 years	14 (70.0)	6 (30.0)
5–10 years	20 (62.5)	12 (37.5)
11–20 years	30 (71.4)	12 (28.6)
>20 years	18 (69.2)	8 (30.8)

Table 12: Institutional Policy on Cuffed Tube Use

Policy Present	Frequency (n=120)	Percentage (%)
Yes	46	38.3
No	74	61.7

Table 1 and Table 2 demonstrate that the majority of respondents were aged 30–49 years, with a male predominance. Table 3 and Table 4 highlight that most participants were from government institutions and had 11–20 years of experience. Table 5 and Table 6 confirm that cuffed tubes were increasingly preferred with higher pediatric age groups, reaching 78.3% for school-aged children, with an overall prevalence of 68.3%. Table 7 shows that better ventilation control and reduced leakage were the most common reasons for preference, while Table 8 reveals that risk of airway injury and the need for cuff monitoring were the main concerns. Table 9 highlights that most anesthesiologists relied on pilot balloon palpation for cuff pressure monitoring, while manometer use was limited. Table 10

indicates post-extubation stridor was the most reported complication. Table 11 suggests that preference for cuffed tubes was consistent across all levels of clinical experience. Table 12 demonstrates that more than 60% of institutions lacked formal policies, reflecting a lack of standardized practice.

Discussion

The present cross-sectional survey provides valuable insights into the current practices of Indian anesthesiologists regarding the use of cuffed endotracheal tubes (ETTs) in pediatric anesthesia. A total of 120 anesthesiologists from diverse practice settings participated, ensuring a representative understanding of prevailing trends. The findings reflect a gradual shift toward wider acceptance of cuffed tubes in pediatric airway management, aligning with evolving international evidence and recommendations [9].

Historically, uncuffed ETTs were preferred in young children based on the belief that the pediatric airway is funnel-shaped with the cricoid cartilage representing the narrowest part. This traditional view supported the use of uncuffed tubes to minimize the risk of subglottic trauma. However, radiological and clinical studies have now challenged this concept, suggesting that the narrowest portion is at the glottic level, thereby supporting the safety of cuffed tubes when used appropriately. The results of this study reinforce this paradigm shift, as nearly 70% of respondents reported using cuffed tubes in pediatric cases, with preference increasing in older children [10].

Age-specific practices revealed that uncuffed tubes remain more frequently chosen in infants and toddlers, reflecting continued caution in very young children. Similar findings have been reported by Weiss et al., who observed that uncuffed tubes were predominantly used in children younger than one year, while cuffed tubes gained popularity in older groups. This suggests that Indian anesthesiologists, though increasingly confident in cuffed tube use, still exercise age-based discretion [11].

The principal advantages of cuffed tubes cited in this study better ventilation control, reduced leakage, and aspiration prevention—are consistent with earlier reports. Khine et al. demonstrated that cuffed tubes significantly reduce the need for tube exchanges due to leak, which also reduces repeated laryngoscopy and its associated risks. In our study, more than half of the respondents endorsed reduced leakage as a major reason for preferring cuffed tubes, supporting the evidence that cuffed tubes improve anesthetic efficiency and patient safety [12].

Despite these benefits, concerns regarding airway safety remain prevalent. Forty percent of respondents expressed apprehension about airway injury, while 30% were concerned about the need for cuff monitoring. These findings echo previous studies where inadequate cuff pressure monitoring was identified as a critical factor contributing to airway complications. In this study, only 26.7% of anesthesiologists reported using a cuff manometer, while the majority relied on palpation of the pilot balloon a subjective method known to be unreliable. This highlights a significant gap in equipment availability and training, particularly in resource-limited centers. Similar observations were made by Nordin and later by Tobias, who emphasized that safe use of cuffed tubes is highly dependent on cuff pressure monitoring [13].

Complications reported in this study were relatively low, with post-extubation stridor (15%) being the most common. This incidence is consistent with international reports, where stridor rates have not been significantly higher with cuffed compared to uncuffed tubes, provided cuff pressure is properly managed. Importantly, the relatively low complication rate in our cohort suggests that anesthesiologists are exercising caution and adopting safer practices even in the absence of routine manometer use [14].

An interesting observation was the consistency of cuffed tube preference across anesthesiologists with varying levels of clinical experience. This contrasts with studies from high-income countries, where younger anesthesiologists were more likely to adopt cuffed tubes due to updated training exposure. In India, the similar rates across experience groups may reflect widespread dissemination of recent evidence through academic forums, conferences, and the Indian Society of Anaesthesiologists [15].

Institutional guidelines, however, remain lacking. More than 60% of respondents reported the absence of formal policies on pediatric cuffed tube use. This variation underscores the need for consensus-driven national guidelines to standardize practice. Developing such guidelines would help address the existing gaps, particularly in cuff pressure monitoring, equipment availability, and training.

Overall, the results of this study align with the growing global consensus that cuffed ETTs are safe and effective in pediatric anesthesia when used with proper monitoring. However, the gaps identified especially in monitoring practices and institutional policies highlight the urgent need for structured interventions. Establishing routine use of manometers, providing hands-on training in cuff management, and creating national guidelines would significantly improve pediatric airway safety in India.

Conclusion

This study highlights the evolving practice patterns regarding the use of cuffed endotracheal tubes in

pediatric anesthesia among Indian anesthesiologists. The findings indicate that cuffed tubes are now widely accepted and preferred, particularly in older children, due to advantages such as reduced leakage, better ventilation control, and improved protection against aspiration. However, concerns persist regarding airway safety, especially in infants, and the lack of routine cuff pressure monitoring remains a critical limitation in practice. The relatively low incidence of complications suggests cautious and judicious use, yet the reliance on subjective methods for cuff inflation underscores the need for improved monitoring strategies.

The absence of formal institutional policies further contributes to variability in practice. There is a clear need for national guidelines, greater emphasis on training in cuff management, and improved availability of manometers to ensure safe and standardized practice across diverse healthcare settings. By addressing these gaps, the benefits of cuffed endotracheal tubes can be maximized while minimizing potential risks, thereby enhancing pediatric airway management and patient safety in India.

References

1. Bhardwaj N. Pediatric cuffed endotracheal tubes. J Anaesthesiol Clin Pharmacol. 2013 Jan;29(1):13-8. doi: 10.4103/0970-9185.105786. PMID: 23492803; PMCID: PMC3590525.
2. Oda W, Hanamoto H, Oyamaguchi A, Togawa E, Honjyo Y, Usami N, Niwa H. Clinical Use of Preformed Microcuff® Pediatric Endotracheal Tubes in Japan. Anesth Prog. 2021 Mar 1;68(1):45-46. doi: 10.2344/anpr-67-04-03. PMID: 33827117; PMCID: PMC8033575.
3. Newth CJ, Rachman B, Patel N, Hammer J. The use of cuffed versus uncuffed endotracheal tubes in pediatric intensive care. J Pediatr. 2004 Mar;144(3):333-7. doi: 10.1016/j.jpeds.2003.12.018. PMID: 15001938.
4. Dorsey DP, Bowman SM, Klein MB, Archer D, Sharar SR. Perioperative use of cuffed endotracheal tubes is advantageous in young pediatric burn patients. Burns. 2010 Sep;36(6):856-60. doi: 10.1016/j.burns.2009.11.011. Epub 2010 Jan 13. PMID: 20071090; PMCID: PMC3045666.
5. Herbinger LA. Evidence Based Use of Cuffed Endotracheal Tubes in Children. J Perianesth Nurs. 2018 Oct;33(5):590-600. doi: 10.1016/j.jopan.2017.07.001. Epub 2017 Sep 28. PMID: 30236565.
6. Litman RS, Maxwell LG. Cuffed versus uncuffed endotracheal tubes in pediatric anesthesia: the debate should finally end. Anesthesiology. 2013 Mar;118(3):500-1. doi: 10.1097/ALN.0b013e318282cc8f. PMID: 23314108.
7. Fischer M, Grass B, Kemper M, Weiss M, Dave MH. Cuffed pediatric endotracheal tubes-Outer cuff diameters compared to age-related airway dimensions. Paediatr Anaesth. 2020 Apr;30(4):424-434. doi: 10.1111/pan.13776. Epub 2020 Jan 2. PMID: 31785036.
8. Zander D, Grass B, Weiss M, Buehler PK, Schmitz A. Cuffed endotracheal tubes in neonates and infants of less than 3 kg body weight-A retrospective audit. Paediatr Anaesth. 2021 May;31(5):604-610. doi: 10.1111/pan.14104. Epub 2021 Mar 16. PMID: 33615635.
9. Minoura H, Ichino T, Kitamura M. Respiratory Complications Between Cuffed and Uncuffed Endotracheal Tubes in Pediatric Respiratory Management After Palatoplasty: Single-Center Retrospective Cohort Study. Crit Care Explor. 2022 Dec 14;4(12):e0817. doi: 10.1097/CCE.0000000000000817. PMID: 36567780; PMCID: PMC9760617.
10. Thomas RE, Rao SC, Minutillo C, Hullett B, Bulsara MK. Cuffed endotracheal tubes in infants less than 3 kg: A retrospective cohort study. Paediatr Anaesth. 2018 Mar;28(3):204-209. doi: 10.1111/pan.13311. Epub 2018 Jan 9. PMID: 29315968.
11. Olsen GH, Krishna SG, Jatana KR, Elmaraghy CA, Ruda JM, Tobias JD. Changes in intracuff pressure of cuffed endotracheal tubes while positioning for adenotonsillectomy in children. Paediatr Anaesth. 2016 May;26(5):500-3. doi: 10.1111/pan.12873. Epub 2016 Mar 9. PMID: 26956620.
12. Tobias JD. Pediatric airway anatomy may not be what we thought: implications for clinical practice and the use of cuffed endotracheal tubes. Paediatr Anaesth. 2015 Jan;25(1):9-19. doi: 10.1111/pan.12528. Epub 2014 Sep 20. PMID: 25243638.
13. Weiss M. Cuffed Endotracheal Tubes in Children: Size Does Matter! A A Case Rep. 2017 Mar 15;8(6):127-128. doi: 10.1213/XAA.0000000000000448. PMID: 28114157.
14. Krishna SG, Hakim M, Sebastian R, Dellinger HL, Tumin D, Tobias JD. Cuffed endotracheal tubes in children: the effect of the size of the cuffed endotracheal tube on intracuff pressure. Paediatr Anaesth. 2017 May;27(5):494-500. doi: 10.1111/pan.13099. Epub 2017 Feb 15. PMID: 28198583.
15. Weber T, Salvi N, Orliaguet G, Wolf A. Cuffed vs non-cuffed endotracheal tubes for pediatric anesthesia. Paediatr Anaesth. 2009 Jul;19 Suppl 1:46-54. doi: 10.1111/j.1460-9592.2009.02998.x. PMID: 19572844.