

KNOWLEDGE AND PRACTICE OF INTRAOPERATIVE MANAGEMENT OF ENDOTRACHEAL TUBE CUFF PRESSURE

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ABSTRACT

Background: Endotracheal tube (ETT) cuff pressure management is essential for maintaining airway safety during general anesthesia. Incorrect cuff pressure can lead to serious complications such as tracheal mucosal injury, aspiration, postoperative sore throat, and ventilator-associated pneumonia. Despite clear guidelines recommending objective cuff pressure monitoring, many clinicians still rely on subjective methods. Assessing existing knowledge and practice patterns is vital for improving patient outcomes.

Objective: To evaluate the knowledge, attitude, and practice of anesthetists regarding intraoperative management of endotracheal tube cuff pressure in a tertiary care setting.

Material and Methods: A cross-sectional study was conducted over three months among 65 anesthetists at SIUT. Data were collected using a structured, self-administered questionnaire covering demographics, knowledge, attitude, and practice domains. Responses were analyzed using SPSS version 24. Descriptive statistics were expressed as means, standard deviations, frequencies, and percentages.

Results: Most participants demonstrated good knowledge: 75.4% correctly identified the recommended cuff pressure, and 78.5% recognized the manometer as the gold standard. Attitudes were largely positive, with 76.9% strongly agreeing that correct cuff pressure improves patient safety. However, practical adherence was limited—only 38.5% had ever used a manometer and 70.8% reported unavailability in their centers. Subjective methods such as pilot balloon palpation (46.2%) remained the most common practice.

Conclusion: Although anesthetists showed strong theoretical knowledge and positive attitudes toward ETT cuff pressure monitoring, actual clinical practice was inadequate, largely due to limited availability of manometers and reliance on subjective techniques. Improving access to monitoring devices and enhancing practical training may strengthen patient safety and reduce cuff-related complications.

Keywords: Endotracheal tube, cuff pressure, intraoperative management, anesthetists, knowledge and practice, patient safety.

INTRODUCTION:

Endotracheal intubation is a routinely performed and essential component of general anesthesia,

ensuring airway protection, adequate ventilation, and prevention of aspiration. The endotracheal tube (ETT) cuff provides a necessary seal between

the tube and tracheal wall, minimizing air leakage during positive-pressure ventilation and preventing aspiration of pharyngeal or gastric secretions [1]. However, postoperative airway morbidity related to cuff over- or under-inflation remains common and is strongly associated with improper cuff pressure management. Complications such as postoperative sore throat, tracheal mucosal ischemia, tracheoesophageal fistula, tracheal stenosis, aspiration, and ventilator-associated pneumonia (VAP) may occur when cuff pressures fall outside the recommended range.

Cuff pressure maintenance is therefore recognized as an essential part of airway management, as both ETT and laryngeal mask airway devices require proper inflation to ensure an effective seal without causing tissue damage. Studies demonstrate that subjective assessments, such as palpation of the pilot balloon, correlate poorly with actual cuff pressures.

Multiple reports have documented a high proportion of overinflated cuffs in various clinical environments, highlighting persistent inaccuracies in routine practice.

Although cuff pressure manometers effectively reduce airway-related morbidity, their use is still not routinely implemented in intraoperative settings [5,6].

The gap between recommended airway management practices and actual clinical implementation highlights the importance of evaluating the knowledge and practice of healthcare professionals regarding ETT cuff pressure regulation. Similar studies, including those conducted among anesthetists in the University of KwaZulu-Natal Discipline of

Anaesthesiology and Critical Care, emphasize the need to assess knowledge, attitudes, and current practices related to cuff pressure monitoring.

Therefore, our study aims to assess the level of knowledge and practice regarding intraoperative ETT cuff pressure management among healthcare workers in our institution. Understanding current practices is essential for guiding improvements that enhance patient safety and reduce preventable airway morbidity.

METHODOLOGY:

Duration Of Study: The duration of this study will be three months after approval.

Study Design: It is a cross sectional and prospective study using a structured questionnaire.

Sample Size: A total of 65 anesthetists will be included in this study.

Settings: This study will be carried out in the department of Anaesthesiology in operation theatre and Intensive care units in SIUT.

DATA COLLECTION PROCEDURE:

After getting approval from the institution 65 anesthetists considering inclusive and exclusive criteria will be enrolled. A structured, self-administered questionnaire will be distributed to participants during work hours. Participants will be informed about the purpose and confidentiality of the study. Data will be collected anonymously to reduce bias. The questionnaire will include sections on demographic details, knowledge-based questions, attitude statements using Likert scales, and practice-based multiple-choice questions.

SAMPLE SELECTION CRITERIA:

INCLUSIVE CRITERIA	EXCLUSIVE CRITERIA
Healthcare professionals including only Anesthetists involved in airway management during surgeries. Willing to participate and provide informed consent.	Those who are not actively involved in intraoperative procedures. (non anesthetist). Refusal to consent.

DATA ANALYSIS:

The data will be entered and analyzed by using SPSS version 24.0. Continuous normally distributed variables will be expressed as mean +-

S.D. and now normally as median (IQR). Categorical variables will be reported as frequencies and percentage.

Assess the knowledge, attitude, and practice of anesthetists regarding the intraoperative management of ETT cuff pressure in our hospital.

RESULTS

Demographic Characteristics of Participants

A total of 65 anesthetists participated in the study. The mean age of respondents was 39.54 ± 12.08

years, ranging from 26 to 70 years. The majority were male (58.5%), while 41.5% were female. Most participants were professors (76.9%), followed by specialists (16.9%), consultants (4.6%), and senior lecturers (1.5%). Their professional experience averaged 9.63 ± 9.46 years, with a wide range (2–40 years).

Statistics

Age

N	Valid	65
	Missing	0
Mean		39.54
Median		34.00
Mode		30
Std. Deviation		12.082
Minimum		26
Maximum		70

Gender

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Male	38	58.5	58.5
	Female	27	41.5	100.0
	Total	65	100.0	100.0

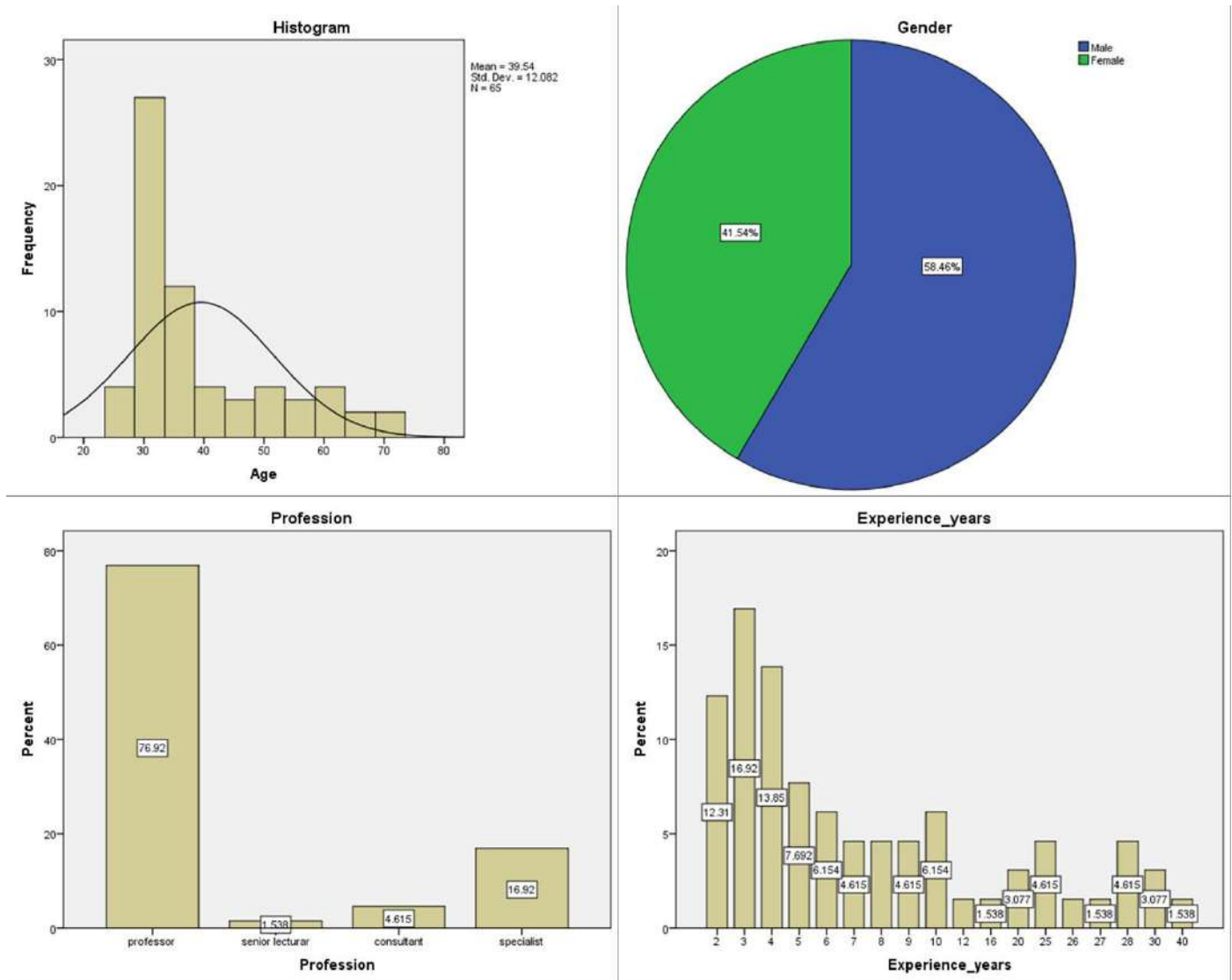
Profession

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid	professor	50	76.9	76.9
	senior lecturar	1	1.5	78.5
	consultant	3	4.6	83.1
	specialist	11	16.9	100.0
	Total	65	100.0	100.0

Statistics

Experience years

N	Valid	65
	Missing	0
Mean		9.63
Median		5.00
Mode		3
Std. Deviation		9.461
Minimum		2
Maximum		40



Knowledge Regarding Intraoperative ETT Cuff Pressure Management

Participants demonstrated generally good knowledge of recommended practices.

- 75.4% correctly identified the recommended cuff pressure (20–30 cmH₂O).
- 78.5% correctly identified the manometer as the gold-standard device.
- 86.2% believed that accurate measurement of cuff pressure is necessary.
- 95.4% recognized that both over-inflation and under-inflation can lead to patient complications.
- 90.8% associated tracheal mucosal ischemia with over-inflated cuffs.
- 98.5% identified leakage and aspiration as consequences of under-inflation.
- 87.7% selected “all the above” as the correct reason for inflating the cuff.

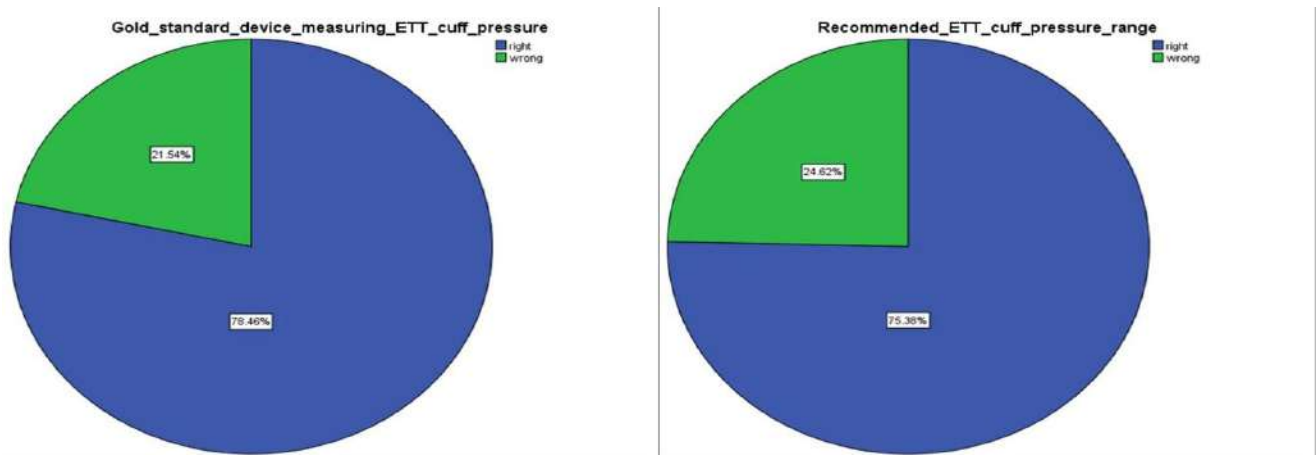
Most respondents believed cuff pressure should be checked once at induction (40%) or every 4 hours (35.4%).

Recommended_ETT_cuff_pressure_range

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid right	49	75.4	75.4	75.4
wrong	16	24.6	24.6	100.0
Total	65	100.0	100.0	

Necessary_to_accurately_measure_cuff_pressure

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid yes	56	86.2	86.2	86.2
no	9	13.8	13.8	100.0
Total	65	100.0	100.0	



Attitude toward ETT Cuff Pressure Management

Overall, attitudes were highly positive:

76.9% strongly agreed that correct cuff pressure is important for patient safety.

58.5% considered regular intraoperative monitoring to be essential.

60% stated they would always use a manometer if available.

53.8% strongly agreed and 43.1% agreed that more training should be provided.

93.8% agreed that monitoring helps prevent tracheal mucosal damage.

Most participants (67.7%) considered cuff-related tracheal injury a very serious issue.

In terms of workload, 38.5% felt monitoring is not burdensome, while only 3.1% found it difficult.

Would_use_a_cuff_manometer_if_available

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid always	39	60.0	60.0	60.0
sometimes	19	29.2	29.2	89.2
rarely	4	6.2	6.2	95.4
never	3	4.6	4.6	100.0
Total	65	100.0	100.0	

Maintaining_correct_cuff_pressure_important_for_safety

	Frequency	Percent	Valid Percent	Cumulative Percent
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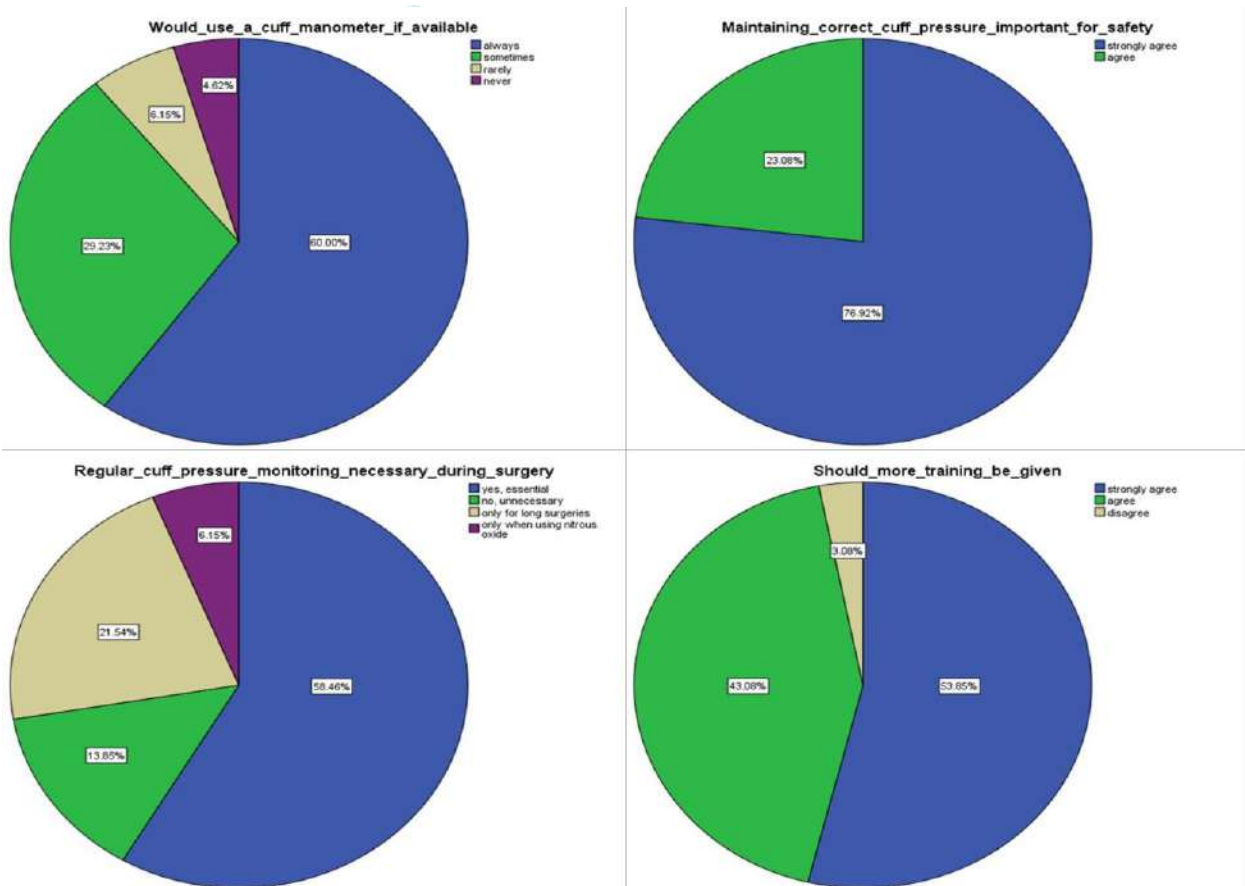
	strongly agree	50	76.9	76.9	76.9
Valid	agree	15	23.1	23.1	100.0
	Total	65	100.0	100.0	

Regular_cuff_pressure_monitoring_necessary_during_surgery

	Frequency	Percent	Valid Percent	Cumulative Percent
yes, essential	38	58.5	58.5	58.5
no, unnecessary	9	13.8	13.8	72.3
Valid only for long surgeries	14	21.5	21.5	93.8
only when using nitrous oxide	4	6.2	6.2	100.0
Total	65	100.0	100.0	

Should_more_training_be_given

	Frequency	Percent	Valid Percent	Cumulative Percent
strongly agree	35	53.8	53.8	53.8
Valid agree	28	43.1	43.1	96.9
disagree	2	3.1	3.1	100.0
Total	65	100.0	100.0	



4. Practice of Intraoperative ETT Cuff Pressure Management

Despite good knowledge and positive attitudes, practical adherence remained suboptimal.

Availability and Use of Manometers

Only 38.5% had ever used a manometer.

70.8% reported no manometer availability in their center.

Only 9.2% reported regular use, while 50.8% reported never using it.

Methods Used for Cuff Inflation

46.2% relied on pilot balloon palpation, an inaccurate subjective method.

24.6% used a fixed volume of air.

21.5% used the minimal leak technique.

Minimal occlusive volume (3.1%) and loss-of-resistance technique (4.6%) were least used.

Monitoring Frequency During Surgery

41.5% checked only after intubation.

23.1% monitored only if problems occurred.

26.2% never monitored during surgery.

Only 9.2% performed hourly monitoring, which is preferred in clinical practice.

Corrective Responses

95.4% would deflate and remeasure if over-inflation is suspected.

63.1% checked cuff pressure immediately after intubation.

53.8% assessed leaks using multiple methods (audible leak, palpation, EtCO₂).

93.8% correctly managed a cuff leak by reinflating the cuff properly.

Factors That Increase Cuff Pressure

61.5% correctly identified that administration of nitrous oxide, coughing, and Trendelenburg position all increase cuff pressure.

Ever_used_tracheal_tube_cuff_manometer

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid yes	25	38.5	38.5	38.5
Valid no	40	61.5	61.5	100.0
Total	65	100.0	100.0	

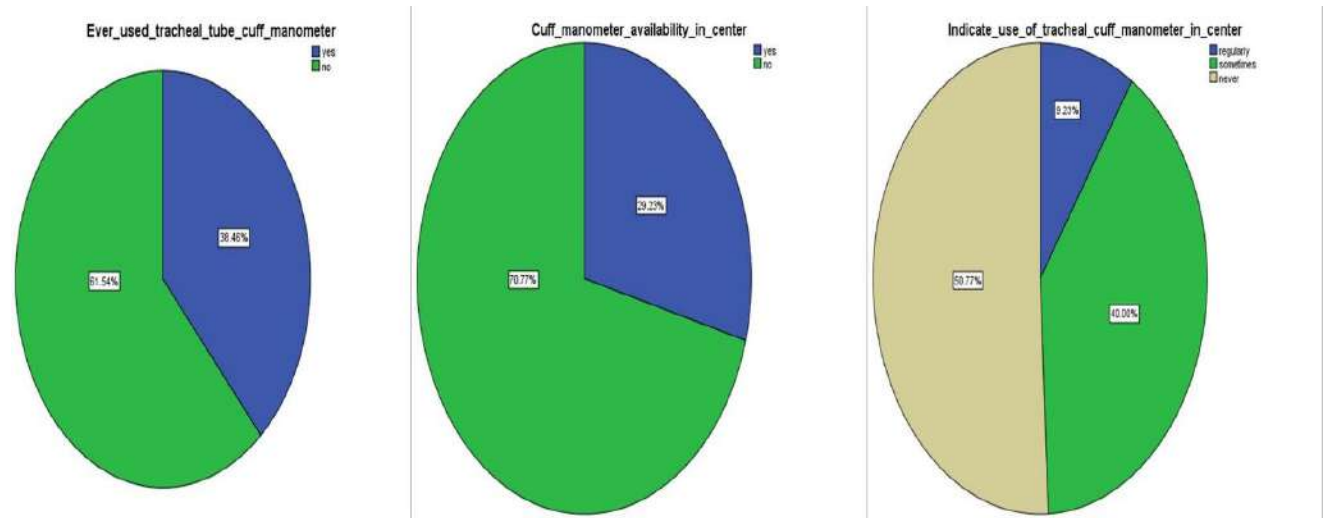
Personal_method_inflating_tracheal_cuff

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid pilot balloon palpation	30	46.2	46.2	46.2
Valid fixed volume of air from syringe	16	24.6	24.6	70.8
Valid minimal leak technique	14	21.5	21.5	92.3
Valid minimal occlusive volume	2	3.1	3.1	95.4
Valid loss of resistance in syringe	3	4.6	4.6	100.0
Total	65	100.0	100.0	

Cuff_manometer_availability_in_center

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid yes	19	29.2	29.2	29.2
Valid no	46	70.8	70.8	100.0

Total	65	100.0	100.0
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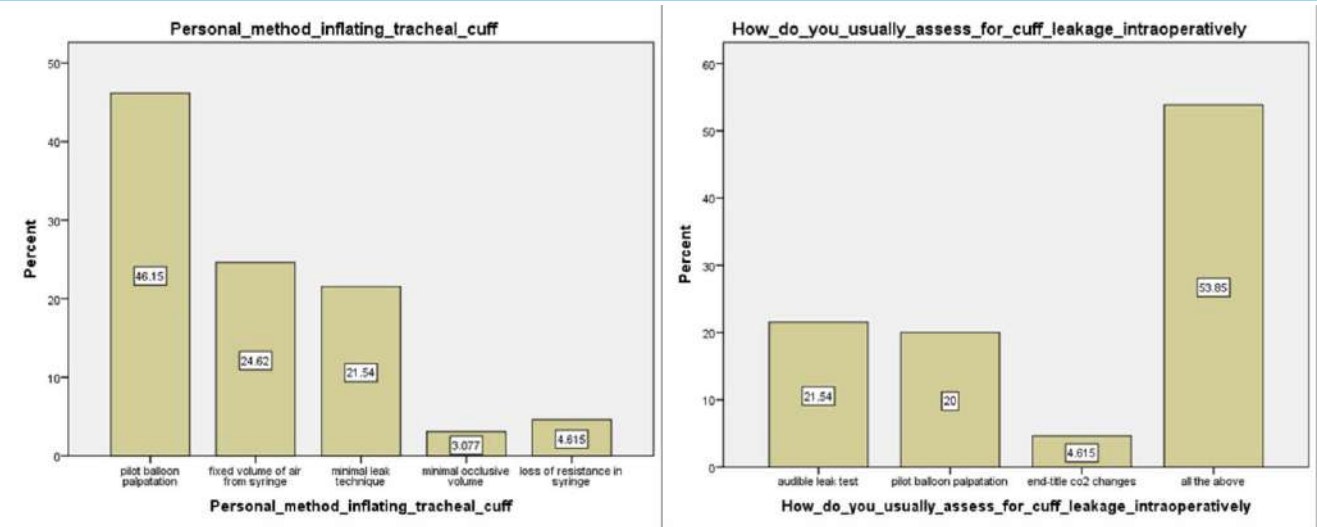


Personal method inflating tracheal cuff

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid pilot balloon palpation	30	46.2	46.2	46.2
Valid fixed volume of air from syringe	16	24.6	24.6	70.8
Valid minimal leak technique	14	21.5	21.5	92.3
Valid minimal occlusive volume	2	3.1	3.1	95.4
Valid loss of resistance in syringe	3	4.6	4.6	100.0
Total	65	100.0	100.0	

How do you usually assess for cuff leakage intraoperatively

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid audible leak test	14	21.5	21.5	21.5
Valid pilot balloon palpation	13	20.0	20.0	41.5
Valid end-titile co2 changes	3	4.6	4.6	46.2
Valid all the above	35	53.8	53.8	100.0
Total	65	100.0	100.0	



Discussion

Clinical practice shows considerable variation in ETT cuff pressure management, with many practitioners still relying on subjective techniques such as minimal occlusive volume and pilot balloon palpation, despite evidence showing their poor accuracy. Study such as the Johannesburg report found high rates of cuff overinflation, with most pressures exceeding recommended limits, suggesting similar trends may exist in our setting. Although cuff manometers are known to reduce airway complications [7], they remain underused, and this gap is further reflected in LMA practices where clinicians often do not check pressures or know correct limits, with predetermined inflation volumes producing dangerously high pressures. Additional risks arise during emergency intubations where cuff pressures are frequently misestimated, and pressures may rise over prolonged intubation [7-8]. Paediatric patients face even higher vulnerability to mucosal injury, yet few practitioners adjust their technique. Knowledge gaps persist regarding safe cuff pressure ranges for both ETTs and LMAs, despite clear evidence that mucosal blood flow is impaired above 30 cmH₂O. Limited training and awareness contribute to these deficiencies, as nearly half of practitioners had never been trained in manometer use. Although postoperative complications remain common and are reduced when pressures are carefully controlled, manometer availability and accessibility remain

major barriers. Overall, the study highlights a significant disconnect between knowledge and practice, emphasizing the need for improved training, equipment availability, and integration of cuff manometry into standard protocols [8].

Conclusion

This study assessed the knowledge, attitudes, and practices of anesthetists regarding intraoperative management of endotracheal tube (ETT) cuff pressure in a tertiary care hospital. Overall, the findings reveal a strong theoretical understanding among anesthetists, with most participants correctly identifying recommended cuff pressure ranges and recognizing manometry as the gold standard for accurate monitoring. Attitudes were similarly positive, as the majority acknowledged the importance of maintaining correct cuff pressure for patient safety and supported the need for additional training.

Despite this encouraging level of knowledge and awareness, a significant gap exists between understanding and clinical practice. Practical adherence to evidence-based guidelines was limited, with less than half of the anesthetists having ever used a cuff manometer and many relying on subjective methods such as pilot balloon palpation. The predominant reason identified for poor practice was limited availability of cuff manometers in most clinical areas. As a result, cuff pressures are seldom monitored objectively, increasing the risk of preventable

complications such as mucosal ischemia, sore throat, tracheal injury, and aspiration.

The study findings underscore the need for system-level improvements to ensure safe airway management. Increasing the availability of cuff manometers, incorporating their use into standard operating protocols, and providing structured training for both junior and senior clinicians are essential steps toward improving patient safety. Bridging the gap between knowledge and practice will require institutional support, continuous education, and reinforcement of evidence-based behaviors in the operating room.

In conclusion, while anesthesiologists demonstrate adequate knowledge and positive attitudes regarding ETT cuff pressure management, practical implementation remains inadequate. Enhancing device availability and promoting consistent, objective monitoring practices are crucial for reducing cuff-related complications and improving perioperative airway safety.

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