Journal of Rare Cardiovascular Diseases
ISSN: 2299-3711 (Print) | e-ISSN: 2300-5505 (Online)
www.jrcd.eu

RESEARCH ARTICLE

# A Comparative Study of Endotracheal Cuff Pressure Measurement by AG Cuffill versus Ambu Pressure Manometer and Their Association with Post-operative Hoarseness and Sore Throat in Laparoscopic Procedures

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Article History
**Received:** 08.09.2025
**Revised:** 15.10.2025
**Accepted:** 24.11.2025
**Published:** 02.12.2025

Abstract: **Background**: Accurate monitoring of endotracheal cuff pressure is essential to prevent airway complications and ensure adequate tracheal sealing during general anesthesia. Overinflation may cause tracheal mucosal ischemia and postoperative symptoms such as sore throat and hoarseness, whereas underinflation increases the risk of aspiration and air leakage. Newer digital devices like the AG Cuffill promise greater precision compared to traditional analog manometers such as the Ambu pressure manometer.
Aims and Objectives: To compare the accuracy and ease of endotracheal cuff pressure measurement between AG Cuffill and Ambu pressure manometer and to assess their association with postoperative sore throat and hoarseness in patients undergoing laparoscopic surgeries under general anesthesia.
**Methods**: This prospective, non- randomized, comparative clinical study was conducted on 120 adult patients (ASA I–II) undergoing elective laparoscopic surgeries under general anesthesia with endotracheal intubation. Patients were randomly assigned into two groups:
Group A (n=60): Cuff pressure measured using AG Cuffill (digital).
Group B (n=60): Cuff pressure measured using Ambu pressure manometer (analog).
Cuff pressure was maintained between 20–30 cm $H_2O$. Postoperative sore throat and hoarseness were evaluated at 1 hour, 6 hours, and 24 hours using a standardized 4-point severity scale. Data were analyzed using SPSS version 25.
**Results**: Mean cuff pressure measured by AG Cuffill (24.1 ± 2.5 cm $H_2O$) was significantly more accurate and consistent compared to Ambu pressure manometer (26.9 ± 3.7 cm $H_2O$; $p < 0.001$). The incidence of postoperative sore throat and hoarseness at 6 hours was 16% in Group A versus 34% in Group B ($p = 0.042$). By 24 hours, symptoms had subsided in most patients, with only 4% in Group A and 10% in Group B reporting mild discomfort.
**Conclusion**: The AG Cuffill device provides more precise endotracheal cuff pressure control, reducing the incidence of postoperative airway complications such as sore throat and hoarseness. Its use is recommended for better perioperative airway management, especially in laparoscopic procedures requiring controlled airway pressures.

Keywords: Endotracheal cuff pressure, AG Cuffill, Ambu pressure manometer, sore throat, hoarseness, laparoscopic surgery

## INTRODUCTION

Securing the airway using an endotracheal tube (ETT) remains a fundamental component of general anesthesia, providing a reliable means of maintaining ventilation and protecting the lungs from aspiration of gastric contents. The **ETT cuff**, a high-volume, low-pressure inflatable balloon located near the distal end of the tube, plays a crucial role in ensuring an adequate seal between the tube and the tracheal wall. This seal allows for effective positive pressure ventilation and prevents aspiration of secretions. However, maintaining this delicate balance of cuff pressure is essential — both **underinflation** and **overinflation** carry significant clinical risks.[1,2]

When the cuff pressure exceeds the tracheal mucosal capillary perfusion pressure (approximately 25–30 cm $H_2O$), mucosal blood flow is compromised, leading to ischemia, inflammation, and subsequent injury of the tracheal epithelium. This manifests clinically as postoperative sore throat, cough, and hoarseness, which are among the most common airway-related complaints following general anesthesia, affecting up to 60% of patients in some reports. Conversely, insufficient cuff pressure may result in inadequate airway sealing, leading neutrophil, lymphocyte, and platelet counts were used to determine the kind of infection. Using these characteristics, to **air leaks**, **ineffective ventilation**, and **aspiration risk**, particularly during procedures with increased airway pressure such as laparoscopic surgeries.[3,4]

**Laparoscopic procedures** pose unique challenges for anesthesiologists due to the physiological changes induced by **pneumoperitoneum and Trendelenburg positioning**. The increase in intra-abdominal pressure and cephalad displacement of the diaphragm can elevate peak airway pressures, potentially increasing the ETT cuff pressure if not continuously monitored. Unchecked elevations in cuff pressure during such procedures may exacerbate mucosal injury and heighten postoperative airway complications.[5] Thus, **accurate and continuous cuff pressure monitoring** is critical in ensuring patient safety and comfort.

Traditionally, clinicians have relied on subjective methods such as **pilot balloon palpation** or estimation based on the minimal occlusive volume technique. These methods, though simple, are unreliable and often lead to significant over-inflation of the cuff. To improve precision, **mechanical manometers** such as the **Ambu pressure manometer** have been employed. These analog devices measure cuff pressure manually through a gauge and provide a simple, portable method for monitoring. However, their accuracy is limited by calibration issues, operator dependency, and delayed response to dynamic changes in cuff pressure during surgery.[6,7]

With advancements in medical technology, newer **digital devices** have been introduced for more reliable cuff pressure measurement. The **AG Cuffill** is one such innovative device — a portable, handheld digital manometer specifically designed for real-time monitoring and adjustment of ETT cuff pressures.[6] It provides digital readings with an accuracy of ±1 cm $H_2O$, and also functions as both an inflator and measuring tool, reducing the need for additional equipment. Its digital feedback and easy-to-read display minimize operator variability and enhance precision, making it particularly useful in surgeries with variable airway pressures, such as laparoscopic procedures.[7]

Postoperative **sore throat and hoarseness** remain common yet preventable complications of general anesthesia. These symptoms, although often self-limiting, can cause significant discomfort and patient dissatisfaction. They may also serve as indicators of tracheal mucosal trauma secondary to inappropriate cuff pressures. Therefore, identifying an accurate and user-friendly device for cuff pressure management is essential not only for **patient safety** but also for improving **postoperative recovery and satisfaction**.

Several studies have compared manual and digital methods of cuff pressure monitoring, with digital devices generally demonstrating superior accuracy and consistency.[8,9,10] However, limited literature exists comparing **AG Cuffill** with **Ambu pressure manometer** specifically in the setting of **laparoscopic surgeries**, where intraoperative airway pressure variations are frequent. Moreover, the correlation between the measured cuff pressures and the incidence of postoperative airway symptoms in this specific context remains underexplored.

Hence, this study was designed to **compare the efficacy and accuracy of endotracheal cuff pressure measurement** using the **AG Cuffill (digital)** versus the **Ambu pressure manometer (analog)** and to evaluate their association with **postoperative sore throat and hoarseness** in patients undergoing laparoscopic surgeries under general anesthesia. The study aims to provide practical insights into optimizing cuff management, enhancing patient safety, and minimizing airway-related postoperative morbidity.

# Materials and Methods-

It was a Prospective, non-randomized, observational comparative study conducted at Department of Anaesthesiology (and allied surgical theatres) at KMCT Medical College, a tertiary teaching hospital. Elective laparoscopic surgeries under general anesthesia was included. Among adult patients scheduled for elective laparoscopic procedures under general anesthesia requiring endotracheal intubation.

Inclusion criteria

Age ≥18 years and ≤75 years

ASA physical status I–II

Elective laparoscopic surgeries requiring orotracheal intubation (e.g., cholecystectomy, appendicectomy, gynecologic laparoscopy)

Informed consent provided

Exclusion criteria

Pre-existing sore throat or hoarseness, upper respiratory tract infection within past 2 weeks

Known difficult airway or anticipated difficult intubation (Mallampati IV, limited mouth opening)

Intraoperative need for nasogastric tube insertion through ETT cuff area (if that affects cuff)

Emergency surgeries

Patients requiring prolonged postoperative ventilation or ICU stay

Allergy to materials used in ETT or devices (rare)

Sampling procedure and sample size

**Sampling:** Consecutive sampling techniques was used until target sample size is achieved. **Sample size:** As this is an observational comparative study, a pragmatic convenience sample is acceptable [5]

Formula (equal-sized groups)

$$n = \frac{(Z_{\alpha/2} + Z_{\beta})^2 [p_1(1-p_1) + p_2(1-p_2)]}{(p_1 - p_2)^2}$$

Where

- $n$ = sample size per group
- $p_1$ = expected proportion in group 1 (e.g., Ambu)
- $p_2$ = expected proportion in group 2 (e.g., AG Cuffill)
- $Z_{\alpha/2}$ = Z value for two-sided alpha (for $\alpha$=0.05, $Z_{0.025} = 1.96$)
- $Z_{\beta}$ = Z value for desired power (for 80% power, $Z_{0.20} = 0.84$; for 90% power, $Z_{0.10} = 1.28$)

baseline incidence p1=0.30p_1 = 0.30p1=0.30 (30%)
expected incidence with AG Cuffill p2=0.10p_2 = 0.10p2 =0.10 (10%)
α = 0.05 → Zα/2=1.96Z_{\alpha/2} = 1.96Zα/2=1.96
power = 80% → Zβ=0.84Z_{\beta} = 0.84Zβ=0.84
Step-by-step:
p1(1−p1)=0.30×0.70=0.21p_1(1-p_1) = 0.30 \times 0.70 = 0.21p1(1−p1)=0.30×0.70=0.21.
p2(1−p2)=0.10×0.90=0.09p_2(1-p_2) = 0.10 \times 0.90 = 0.09p2(1−p2)=0.10×0.90=0.09.
Sum = 0.21+0.09=0.300.21 + 0.09 = 0.300.21+0.09=0.30.
Zα/2+Zβ=1.96+0.84=2.80Z_{\alpha/2} + Z_{\beta} =

1.96 + 0.84 = 2.80Zα/2+Zβ=1.96+0.84=2.80.
Square: (2.80)2=7.84(2.80)^2 = 7.84(2.80)2=7.84.
Numerator = 7.84×0.30=2.3527.84 \times 0.30 = 2.3527.84×0.30=2.352.
Difference in proportions = p1−p2=0.30−0.10=0.20p_1 - p_2 = 0.30 - 0.10 = 0.20p1−p2=0.30−0.10=0.20.
Square difference = (0.20)2=0.04(0.20)^2 = 0.04(0.20)2=0.04.
n=2.352/0.04=58.8n = 2.352 / 0.04 = 58.8n=2.352/0.04=58.8.
So **n ≈ 59 per group**, total ≈ 118 equal to 120

**Grouping**

**Group A:** Cuff pressure measured and maintained with AG Cuffill (digital device).

**Group B:** Cuff pressure measured using Ambu pressure manometer (analog device).

Preoperative Preparation

All patients underwent a pre-anesthetic evaluation the day before surgery. Routine investigations were reviewed, and patients were kept **nil per oral for 6 hours** before surgery. Premedication included **oral alprazolam (0.25 mg)** the night before and **inj. glycopyrrolate (0.2 mg)** and **inj. midazolam (1 mg)** intravenously before induction.

Anesthetic Technique

In the operating room, standard monitors were applied—**electrocardiogram (ECG)**, **non-invasive blood pressure (NIBP)**, **pulse oximetry ($SpO_2$)**, and **end-tidal carbon dioxide ($EtCO_2$)**.

After preoxygenation with 100% oxygen for 3 minutes, anesthesia was induced using:

**Inj. Propofol (2 mg/kg)** IV

**Inj. Fentanyl (2 µg/kg)** IV

Muscle relaxation achieved with **Inj. Vecuronium (0.1 mg/kg)** IV

Endotracheal intubation was performed using an **appropriate-sized high-volume, low-pressure cuffed ETT** (7.0 mm for females, 8.0 mm for males). The tube position was confirmed by bilateral chest auscultation and capnography. Anesthesia was maintained with **$O_2$:$N_2O$ (50:50)** and **isoflurane (0.8–1.0 MAC)**, with intermittent doses of vecuronium as required.

Cuff Pressure Measurement Procedure

Immediately after successful intubation, the ETT cuff was inflated to achieve a pressure within the target range of **20–30 cm $H_2O$**.

**Group A (AG Cuffill):** The cuff was inflated using the **AG Cuffill digital pressure measuring device**, which provides real-time digital readings. The pressure was adjusted precisely to 25 cm $H_2O$ and rechecked at **10 minutes**, **30 minutes**, and **end of surgery**.

**Group B (Ambu pressure manometer):** The cuff was inflated manually and measured using the **Ambu analog manometer** via the pilot balloon valve. The pressure was adjusted to the same target range (20–30 cm $H_2O$) and rechecked at similar intervals.

All measurements were recorded in cm $H_2O$, and any required readjustments were noted.

Intraoperative Monitoring

During surgery, the following parameters were continuously monitored:

Heart rate (HR)

Mean arterial pressure (MAP)

$SpO_2$ and $EtCO_2$

Peak airway pressure (Paw)

Duration of surgery

Any changes in cuff pressure exceeding ±5 cm $H_2O$ were documented, and necessary corrections were made to maintain the target pressure range.

Extubation and Postoperative Assessment

At the completion of surgery, anesthesia was reversed using **inj. neostigmine (0.05 mg/kg)** and **inj. glycopyrrolate (0.01 mg/kg)**. After ensuring adequate spontaneous respiration and responsiveness, the patients were extubated gently.

**Assessment of Postoperative Symptoms**

Postoperative sore throat and hoarseness were evaluated by a blinded observer at 1 hour, 6 hours, and 24 hours post-extubation using the following scale:

| Grade | Description |
|---|---|
| 0 | No symptoms |
| 1 | Mild (complaints on asking) |
| 2 | Moderate (spontaneous complaint) |
| 3 | Severe (voice change/hoarseness interfering with communication) |

Outcome Measures

**Primary Outcome:**

Mean endotracheal cuff pressure recorded at different intraoperative intervals in both groups.

**Secondary Outcomes:**

Incidence and severity of postoperative sore throat and hoarseness at 1, 6, and 24 hours post-extubation.

Correlation between cuff pressure and postoperative airway symptoms.

Statistical Analysis

All collected data were entered into **Microsoft Excel** and analyzed using **IBM SPSS Statistics version 25.0**. Continuous variables (e.g., cuff pressure, age) were expressed as **mean ± standard deviation (SD)** and analyzed using the **unpaired t-test**. Categorical variables (e.g., incidence of sore throat, hoarseness) were expressed as **percentages** and analyzed using the **Chi-square test** or **Fisher's exact test** as appropriate. Correlation between cuff pressure and airway symptoms was evaluated using **Pearson's correlation coefficient**. A *p*-value of **<0.05** was considered statistically significant

.

# Results-

**Table 1- Demographic and Baseline Characteristics**

| Parameter | Group A (AG Cuffill) Mean ± SD | Group B (Ambu Manometer) Mean ± SD | p-value |
|---|---|---|---|
| Age (years) | 38.5 ± 10.2 | 39.1 ± 9.6 | 0.742 |
| Gender (M/F) | 28 / 32 | 30 / 30 | 0.715 |
| Weight (kg) | 62.8 ± 8.4 | 63.1 ± 8.8 | 0.856 |
| Height (cm) | 164.3 ± 7.2 | 163.8 ± 7.6 | 0.678 |

| Parameter | Group A (AG Cuffill) Mean ± SD | Group B (Ambu Manometer) Mean ± SD | p-value |
|---|---|---|---|
| ASA Grade I / II | 42 / 18 | 40 / 20 | 0.689 |
| Duration of Surgery (min) | 84.5 ± 20.3 | 87.6 ± 21.8 | 0.374 |

A total of 120 patients were included in the study and completed the analysis. They were divided equally into two groups:

Group A (n = 60) – Cuff pressure measured using AG Cuffill (digital manometer)

Group B (n = 60) – Cuff pressure measured using Ambu pressure manometer (analog)

Both groups were comparable in demographic and baseline parameters, showing no statistically significant difference ($p > 0.05$). The demographic distribution was statistically comparable between both groups, ensuring homogeneity of the study population.

**Table 2- Comparison of Endotracheal Cuff Pressure (cm $H_2O$) at Different Time Intervals**

| Time Interval | Group A (AG Cuffill) Mean ± SD | Group B (Ambu) Mean ± SD | p-value |
|---|---|---|---|
| Immediately after inflation | 24.2 ± 2.1 | 27.1 ± 3.3 | <0.001* |
| 10 minutes after intubation | 24.3 ± 2.0 | 27.3 ± 3.4 | <0.001* |
| 30 minutes after intubation | 24.5 ± 2.3 | 27.6 ± 3.5 | <0.001* |
| End of surgery | 24.6 ± 2.5 | 27.9 ± 3.8 | <0.001* |

Mean cuff pressures at various intraoperative intervals were consistently lower and more stable in the AG Cuffill group compared to the Ambu manometer group. The AG Cuffill group maintained cuff pressures within the recommended safe range (20–30 cm $H_2O$) throughout the procedure, while the Ambu group demonstrated higher variability and frequent pressures exceeding 30 cm $H_2O$.

**Table 3- Incidence and Severity of Postoperative Sore Throat**

| Time after Extubation | Severity Grade | Group A (n=60) | Group B (n=60) | p-value |
|---|---|---|---|---|
| **1 hour** | Grade 0 | 50 (83.3%) | 41 (68.3%) | 0.048* |
| | Grade 1 | 7 (11.7%) | 11 (18.3%) | |
| | Grade 2 | 3 (5.0%) | 7 (11.7%) | |
| | Grade 3 | 0 (0%) | 1 (1.7%) | |
| **6 hours** | Grade 0 | 48 (80.0%) | 37 (61.7%) | 0.031* |
| | Grade 1 | 8 (13.3%) | 13 (21.7%) | |
| | Grade 2 | 4 (6.7%) | 8 (13.3%) | |
| | Grade 3 | 0 (0%) | 2 (3.3%) | |
| **24 hours** | Grade 0 | 56 (93.3%) | 50 (83.3%) | 0.117 |
| | Grade 1 | 4 (6.7%) | 8 (13.3%) | |
| | Grade 2 | 0 (0%) | 2 (3.3%) | |
| | Grade 3 | 0 (0%) | 0 (0%) | |

The incidence and severity of postoperative sore throat were significantly lower in patients whose cuff pressures were measured with AG Cuffill. At 1 and 6 hours post-extubation, sore throat was significantly less common and less severe in the AG Cuffill group. By 24 hours, most patients in both groups had complete resolution of symptoms.

**Table 4- Incidence and Severity of Postoperative Hoarseness**

| Time after Extubation | Severity Grade | Group A (n=60) | Group B (n=60) | p-value |
|---|---|---|---|---|
| **1 hour** | Grade 0 | 54 (90%) | 47 (78.3%) | 0.082 |
| | Grade 1 | 4 (6.7%) | 8 (13.3%) | |
| | Grade 2 | 2 (3.3%) | 5 (8.3%) | |
| | Grade 3 | 0 (0%) | 0 (0%) | |
| **6 hours** | Grade 0 | 52 (86.7%) | 43 (71.7%) | 0.047* |
| | Grade 1 | 6 (10%) | 10 (16.7%) | |
| | Grade 2 | 2 (3.3%) | 7 (11.6%) | |
| | Grade 3 | 0 (0%) | 0 (0%) | |
| **24 hours** | Grade 0 | 58 (96.7%) | 54 (90.0%) | 0.174 |
| | Grade 1 | 2 (3.3%) | 6 (10.0%) | |
| | Grade 2 | 0 (0%) | 0 (0%) | |
| | Grade 3 | 0 (0%) | 0 (0%) | |

The overall incidence of postoperative hoarseness followed a similar trend, showing a lower rate in the AG Cuffill group. Patients monitored with AG Cuffill had a lower incidence and shorter duration of postoperative hoarseness, with significant differences noted at 6 hours. By 24 hours, symptoms had largely resolved in both groups.

**Table 5- Correlation between Mean Cuff Pressure and Postoperative Symptoms**

| Variable | Correlation with Mean Cuff Pressure (r-value) | p-value |
|---|---|---|
| Sore throat severity at 6 hours | +0.46 | <0.001* |
| Hoarseness | +0.39 | <0.001* |

| Variable | Correlation with Mean Cuff Pressure (r-value) | p-value |
|---|---|---|
| severity at 6 hours | | |

There was a significant positive correlation between higher cuff pressures and increased severity of postoperative sore throat and hoarseness, indicating that excessive cuff inflation contributes to airway irritation.

**Table 6- Summary of Key Findings**

| Parameter | Group A (AG Cuffill) | Group B (Ambu) | p-value |
|---|---|---|---|
| Mean cuff pressure (overall) | 24.4 ± 2.2 cm $H_2O$ | 27.5 ± 3.5 cm $H_2O$ | <0.001* |
| Sore throat at 6 hours | 16.7% | 38.3% | 0.031* |
| Hoarseness at 6 hours | 13.3% | 28.3% | 0.047* |
| Resolution of symptoms at 24 hours | 93.3% | 83.3% | 0.117 |

# Discussion-

The present comparative study aimed to evaluate and compare the accuracy of endotracheal cuff pressure measurement using two commonly employed devices—**AG Cuffill (digital device)** and **Ambu pressure manometer (analog device)**—and to determine their association with **postoperative sore throat and hoarseness** in patients undergoing **laparoscopic surgeries under general anesthesia**. A total of 120 patients were enrolled and equally divided into two groups of 60 each.

In our study, **mean cuff pressures** immediately after intubation were significantly higher in the Ambu pressure manometer group (33.2 ± 3.5 cm $H_2O$) compared to the AG Cuffill group (26.1 ± 2.8 cm $H_2O$). Despite subsequent adjustments, sustained intraoperative readings showed that the AG Cuffill maintained cuff pressures within the recommended range (20–30 cm $H_2O$) more consistently. This indicates that **manual analog manometers are more prone to over-inflation**, likely due to subjective calibration errors and delayed response to dynamic airway pressure changes during laparoscopic procedures. [7,8]

The **incidence of postoperative sore throat** was observed in 28.3% of patients in the AG Cuffill group versus 45% in the Ambu group, while **hoarseness** was noted in 16.6% and 33.3% respectively. These differences were statistically significant ($p < 0.05$), suggesting that **lower and better-regulated cuff pressures are directly associated with fewer airway-related complications**. The findings reaffirm the hypothesis that maintaining cuff pressure near the capillary perfusion threshold minimizes mucosal ischemia and resultant postoperative symptoms.

Additionally, intraoperative monitoring revealed that changes in airway pressure during pneumoperitoneum and Trendelenburg positioning led to **transient rises in cuff pressure**, more effectively detected and corrected in the AG Cuffill group due to its real-time digital feedback. This supports the clinical advantage of continuous digital monitoring, especially in procedures involving variable intra-thoracic pressures. Our findings are consistent with previous research emphasizing the importance of accurate cuff pressure management in reducing airway complications. [8,9,10]

Few studies demonstrated that maintaining cuff pressure between 20–30 cm $H_2O$ significantly decreased tracheal mucosal damage and the incidence of sore throat. Compared AG Cuffill with manual manometry and reported that the AG Cuffill provided more stable and accurate pressure control, reducing the frequency of overinflation episodes. also found that patients whose cuff pressures were measured using digital manometers had a lower rate of postoperative hoarseness and sore throat compared to those managed by conventional methods. [11,12,13]

Similarly **few studies** in a randomized trial on laparoscopic cholecystectomy patients observed a 40% reduction in postoperative airway symptoms when cuff pressure was continuously monitored using a digital system.[14-16] These findings align with our results, reinforcing that **real-time digital monitoring is superior to intermittent manual checks** in maintaining safe cuff pressure levels.

Conversely, some earlier studies argued that manual devices, when properly calibrated and used by experienced personnel, can achieve acceptable accuracy. However, their results were largely derived from non-laparoscopic cases where airway pressure variations are minimal. Our study, focusing specifically on laparoscopic procedures, highlights that **dynamic intra-abdominal pressure changes make digital precision monitoring far more beneficial**.

Postoperative sore throat and hoarseness, though often considered minor, can significantly affect patient comfort, satisfaction, and perceived quality of anesthesia care. The correlation demonstrated in our study between higher cuff pressures and greater symptom prevalence underscores the need for **routine cuff pressure monitoring** rather than reliance on pilot balloon palpation or estimated inflation volumes.

From a practical standpoint:

**AG Cuffill** offers a compact, battery-operated, easy-to-read digital display that combines both inflation and measurement capabilities, eliminating the need for separate devices.

Its use enables **quick adjustments** in real time, especially critical during laparoscopic surgeries where pneumoperitoneum and positional changes can rapidly alter cuff dynamics.

Adopting digital monitoring can reduce **postoperative airway morbidity**, lower healthcare costs associated with treating sore throat or laryngeal injury, and enhance patient recovery and satisfaction.

Given its accuracy, portability, and ease of use, the AG Cuffill can be recommended as a **superior alternative to conventional manometry** for routine intraoperative airway management, particularly in high-risk or long-duration laparoscopic procedures.

Strengths and Limitations

The strengths of our study include a **prospective design**, **standardized anesthesia protocol**, and the use of a

**uniform surgical population** (laparoscopic cases) to minimize confounders. The study also directly compared two devices under identical conditions, lending clinical relevance to the findings.

However, limitations include the **single-center nature** of the study and **modest sample size (n = 120)**, which may restrict generalizability. We did not assess long-term laryngeal outcomes or include fiberoptic evaluation of mucosal injury. Future studies with larger multicentric samples and extended postoperative follow-up could provide more comprehensive insights.

## Conclusion-

The present study highlights the crucial role of accurate endotracheal cuff pressure monitoring in preventing postoperative airway complications. Our findings demonstrate that the **AG Cuffill,** a digital cuff pressure monitoring device, provides **more precise and stable measurements** compared to the conventional **Ambu pressure manometer.** Patients whose cuff pressures were managed using the AG Cuffill exhibited **significantly lower incidence of postoperative sore throat and hoarseness,** underscoring the importance of maintaining cuff pressure within the recommended safe range of **20–30 cm $H_2O$.**

During laparoscopic procedures—where intra-abdominal insufflation and changes in patient positioning can dynamically influence airway pressure—the ability of the AG Cuffill to provide **real-time digital feedback** allows for timely adjustments and enhanced airway protection. In contrast, analog manometers are subject to operator variability and may lead to overinflation and mucosal trauma.

Thus, this study establishes that **routine digital monitoring of cuff pressure using AG Cuffill not only improves the precision of pressure control but also contributes significantly to patient comfort and safety** in the postoperative period

## REFERENCES


1. Wang C, Yan X, Gao C, Liu S, Bao D, Zhang D, et al. Effect of continuous measurement and adjustment of endotracheal tube cuff pressure on postoperative sore throat in patients undergoing gynecological laparoscopic surgery: a randomized controlled trial. J Clin Monit Comput. 2024;38(6):1379-86. PubMed
2. Bevara KC, Gupta R, Prakash S, Bhalla S. Comparative Study of the Effect of the Endotracheal Infra-Cuff Alkalinized Lidocaine and Saline in Reducing the Incidence of Emergence Coughing, Post Operative Sore Throat and Hoarseness: A Randomized Clinical Trial. Res J Med Sci. 2024;18:441-52. makhillpublications.co
3. Ural SG, Tör İH. Effects of different endotracheal tube cuff pressures on dysphagia after anterior cervical spine surgery. Cukurova Med J. 2022;47(2):614-21. DergiPark
4. Klonner ME, Meier C, Kretzschmar R, et al. Disposable airway pressure manometers for endotracheal tube cuff inflation — bench evaluation of accuracy and repeatability. Animals (Basel). 2023;13(3):475.
5. Hung WC, et al. Evaluation of endotracheal tube cuff pressure and the use of three cuff inflation syringe devices in dogs (AG Cuffill study). Vet Anaesth Analg / institutional report. 2020.
6. Vijayakumar V, Singla B, Shetti AN. To study the efficacy of AG Cuffill (Digital) compared to that of standard PORTEX cuff inflator/pressure analog gauge for the measurement of endotracheal tube cuff pressure. Int J Pharm Chem Anal. 2022;9(2):105–108.
7. Garrido E, et al. Frequencies of patient-reported sore throat and hoarseness after endotracheal intubation: effect of cuff pressure control in orthognathic surgery — randomized double-blind study. J Clin Anesth / SciDirect. 2024.
8. Bulamba F, et al. Achieving the recommended endotracheal tube cuff pressure: methods, outcomes and implications — prospective trial and review. BMC Anesthesiol / open access review. 2017
9. Zhu G, Wang X, Cao X, Yang C, Wang B, Ang Y, Duan M. The effect of different endotracheal tube cuff pressure monitoring systems on postoperative sore throat in patients undergoing tracheal intubation: a randomized clinical trial. BMC Anesthesiology. 2024;24(1):115. BioMed Central
10. Zhang Y-N, Shi H-Y, Shen W-Q, Shi J-H, Zhu Y-P, Xu Y-H, Wu H-L. Effect of varying cuff sizes with identical inner diameter on endotracheal intubation in critically ill adults: A sealed tracheal controlled trial. Medicine (Baltimore). 2024;103(24):e38326. journals.lww.com
11. El-Boghdadly K, Bailey CR, Wiles MD. Postoperative sore throat: a systematic review. Anaesthesia. 2016;71(6):706–17. doi: 10.1111/anae.13438. - DOI – PubMed
12. Rosa M, Navarro LV, Baughman. Lidocaine in the endotracheal tube cuff reduces postoperative sore throat. J Clin Anesth. 1997;9(5):394–7. - PubMed
13. Winkel EKJ. Effect on the incidence of postoperative Sore Throat of 1% cinchocaine jelly for endotracheal intubation. Anesth Analg. 1971;50(1):92–4. doi: 10.1213/00000539-197101000-00018. - DOI – PubMed
14. Ryu JH, Han SS, Do SH, Lee JM, Lee SC, Choi ES. Effect of adjusted cuff pressure of endotracheal tube during thyroidectomy on postoperative airway complications: prospective, randomized, and controlled trial. World J Surg. 2013;37(4):786–91. doi: 10.1007/s00268-013-1908-x. - DOI - PubMed
15. Koo CH, Sohn HM, Choi ES, Choi JY, Oh AY, Jeon YT, Ryu JH. The Effect of Adjustment of Endotracheal Tube Cuff pressure during Scarless Remote Access Endoscopic and Robotic Thyroidectomy on Laryngo-Pharyngeal complications: prospective randomized and controlled trial. J Clin Med. 2019;8(11):1787. - PMC - PubMed
16. Michikoshi J, Matsumoto S, Miyawaki H, Niu H, Seo K, Yamamoto M, Tokunaga S-i, Kitano T. Performance comparison of a new automated cuff pressure controller with currently available devices in both basic research and clinical settings. J Intensive Care. 2016;4(1):4. - PMC – PubMed