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VIDEOSCOPIC ASSISTED NASO-TRACHEAL INTUBATION USING MAGILL FORCEPS COMPARED TO CUFF INFLATION METHOD.

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Abstract

Background: Tracheal intubation remains a cornerstone of airway management. Nasotracheal intubation (NTI) offers specific advantages, including reduced need for neck extension, making it particularly useful in patients with cervical spine instability or limited mouth opening. To guide the endotracheal tube (ETT) into the trachea, Magill forceps or gradual cuff inflation may be used. While Magill forceps are effective, they carry risks of mucosal trauma and cuff damage and require adequate mouth-opening

.Objective: To compare the performance of video-assisted NTI using Magill forceps versus the cuff inflation technique in terms of intubation time, number of attempts, and complications

Patients and Methods: This prospective, randomized study was conducted in the intensive care unit of a tertiary hospital. Fifty adult patients requiring NTI were allocated into two equal groups (n=25): one undergoing intubation with Magill forceps, the other using the cuff inflation technique. All procedures were performed under video laryngoscope guidance.

Results: Smooth intubation was achieved in 64% of the Magill group and 48% of the cuff inflation group. Absolute failure occurred in one Magill case and two inflation cases. Bleeding occurred equally in both groups (12%). A second intubation attempt was required in 24% of the Magill group and 32% of the cuff inflation group. Cuff damage occurred in three cases in the Magill group but was not observed in the inflation group. No statistically significant differences were found between groups in primary outcomes ($p > 0.05$). One patient experienced transient hypoxemia (SpO_2 <92%) and was managed with oral intubation. No serious complications were recorded.

Conclusion: Both techniques are feasible and safe when combined. The cuff inflation method offers advantages in patients with limited mouth opening and reduces the risk of ETT cuff damage. However, tip misdirection during inflation can occur and may require additional manipulation.

Keywords: Nasotracheal intubation, Magill forceps, videolaryngoscopy, cuff inflation technique, airway management

Introduction

Securing the airway is a cornerstone of anesthetic practice and emergency care, particularly in critically ill or traumatized patients. Tracheal intubation remains a fundamental technique, yet it poses risks such as hypoxemia, oral trauma, and laryngeal injury, particularly in difficult airway scenarios.[1] Nasotracheal intubation (NTI) is often selected when oral access is limited, such as in cervical spine instability, maxillofacial surgeries, or restricted mouth opening .[2] Traditionally, NTI is performed using direct laryngoscopy with a Macintosh blade and guided by Magill forceps. However, this approach can be time-consuming and traumatic, risking damage to the endotracheal (ET) tube cuff and oropharyngeal structures.[3]

Alternative methods such as blind nasal intubation (BNI) or fiberoptic intubation (FIO) are employed in difficult airways. While FIO remains the gold standard,[4,5] it is resource-intensive and may be less effective in cases of bleeding or heavy secretions .[6] NTI remains relevant in multiple clinical contexts, including ICU settings for prolonged ventilation, where nasal tubes offer better fixation and patient comfort.[7] However, the procedure carries specific risks such as epistaxis, mucosal abrasion, sinusitis, and rare complications like retropharyngeal or pyriform fossa perforation.[8] NTI is contraindicated in patients with skull base fractures or bleeding diatheses. The use of Magill forceps, first described by I.W. Magill in 1920, remains widespread, but concerns persist about mucosal trauma and cuff damage during manipulation .[9,10] Recently, video laryngoscopes (VL) have been increasingly adopted in both routine and difficult airway management. VL improves glottic visualization without requiring alignment of anatomical axes and demonstrates higher success rates,

particularly among novice users.[11] Its utility extends across various patient populations, including obese and pediatric patients, and in out-of-hospital or emergency settings .[12] One challenge with VL is the potential for camera blurring due to secretions, although it generally results in faster intubation with reduced sympathetic stimulation compared to conventional techniques .[13] Cardiovascular responses such as tachycardia may still occur but tend to be less pronounced with VL than with traditional laryngoscopy.

To reduce the trauma associated with Magil Forceps, the cuff inflation (CI) technique has been explored. First described in the 1980s, this method involves partial inflation of the endotracheal tube cuff to elevate the tip toward the glottis, facilitating entry without the use of forceps (14). By minimizing instrumentation, cuff inflation reduces the risk of mucosal injury and may enhance safety during NTI when used with VL (15). External laryngeal manipulation (ELM) is often employed to further optimize the glottic view, although care must be taken to avoid tracheal trauma.[16] Despite its theoretical advantages, the role of VL-assisted NTI using cuff inflation versus Magil Forceps in critical care contexts remains under investigation.

This study aims to compare the videoscopic NTI done by either Magil Forceps or gradual endotracheal tube cuff inflation in regard to the time of the procedure, number of attempts, and any potential difficulties.

Patients and Methods

Study Design and Setting: The study employs a prospective, randomized clinical design, which strengthens the findings by minimizing selection bias and allowing causal inferences. The precise patient selection criteria ensure that the study sample is uniform and relevant to the research question and helps safeguard patient safety. This clinical study was approved by the Iraqi Council of Anesthesia and Critical Care. It was conducted over 12 months (October

1, 2020 – September 30, 2021) at Al-Sadr Teaching Hospital, a tertiary care center. The study included 50 ICU patients aged ≥18 years who required tracheal intubation and were expected to remain intubated for 5–10 days. Patients were selected randomly and assigned to one of two groups (n=25 each): **Group I**: Intubation using video-assisted nasotracheal intubation with **Magill forceps**. **Group II**: Intubation using **cuff inflation** technique with video-assisted guidance.

The sample size we calculated using the Steven K Thompson formula for sample size calculation:

$$\mathbf{n = (N \times Z^2 \times p \times (1 - p)) / ((d^2 \times (N - 1)) + (Z^2 \times p \times (1 - p)))}$$

Where:

n = required sample size

N = total population size

Z = Z-score (e.g., 1.96 for 95% confidence level)

p = estimated proportion (use 0.5 if unknown for maximum variability)

d = margin of error (e.g., 0.05 for ±5%)

Patients were excluded if they met any of the following:

1. SpO_2 <90% despite oxygen therapy
2. History of epistaxis or sinusitis
3. Nasal obstruction (e.g., polyps)
4. Anatomical upper airway abnormalities
5. High aspiration risk
6. Basal skull fracture
7. Anticipated difficult airway
8. Bleeding disorders

Pre-procedure Preparation: All intubations were performed by a single anesthesiologist with over 10 years of experience in airway management using a neutral head position with 30° chest elevation. Nostril selection was based on airflow assessment using cotton occlusion. Premedication included atropine 1 mg IV (or IM in select cases) 30–45 minutes prior. Preoxygenation was achieved using a bag-valve mask with a reservoir for 3 minutes. Xylometazoline 0.05% was instilled (3 drops) in the selected nostril 5 minutes before intubation to reduce mucosal edema and bleeding.

Anesthetic Technique: Sedation included fentanyl 50 μg IV, followed by ketamine 25 mg and titrated propofol until loss of corneal reflexes. Muscle relaxants were not used; any case requiring them was excluded, though no exclusions were necessary.

Intubation Procedure: A polyvinyl chloride (PVC) endotracheal tube (6.5–7 mm ID) was lubricated with lidocaine gel and inserted through the selected nostril. After reaching the supraglottic level (16–19 cm depth), 2% lidocaine (5 mL) was injected through the endotracheal tube for topical anesthesia.

In **Group I**, Magill forceps were used to guide the endotracheal tube into the glottis under video laryngoscope (VL) visualization. In **Group II**, the endotracheal tube cuff was gradually inflated (5 mL increments) to elevate the tip toward the glottic opening. The cuff was deflated after entry into the trachea. In both groups, external laryngeal manipulation (ELM) was applied if necessary. Capnography confirmed tracheal placement.

Timing and Definitions

Intubation time was defined from endotracheal tube tip alignment with glottis to the first capnographic waveform. For group I, this included time to introduce and use the forceps. Initial nasal insertion or VL attempts not requiring reintubation were not classified as failed trials.

Monitoring and Emergency Preparedness: Standard monitoring included ECG, SpO_2, non-invasive blood pressure (NIBP, 2-minute cycling), and capnography. Clinical thresholds for intervention were predefined as follows: $SpO_2 < 92\%$ triggered immediate airway reassessment and oxygenation maneuvers; NIBP < 90/60 mmHg or > 160/100 mmHg prompted pharmacologic intervention; heart rate < 50 bpm or > 120 bpm, or ECG arrhythmias, led to medication adjustment or sedation discontinuation. An emergency cart was prepared with alternative airway tools (e.g., Macintosh laryngoscope, SGA, bougie, fiberoptic bronchoscope) and resuscitation medications.

Statistical Analysis: Data were analyzed using SPSS v22. Variables were classified as scale (continuous) or categorical. Normally distributed data were reported as mean ± SD, and categorical data as frequencies and percentages. A p-value <0.05 was considered statistically significant.

Results

The study involved 50 patients deployed into two groups of equal number (25 each). One group was a subject of inflation method and the other underwent forceps method. Forceps method involved 22 (88%) male patients and 3 (12%) females. Sixteen (64%) male were recruited in the inflation method compared to 9 (36%) female patients. Inferentially, more male patients were involved in the forceps method and the reverse is true for the inflation method. The observed difference in gender distribution was statistically significant (P value <0.05). As in table I

Table I: Gender distribution regarding the video assisted naso-tracheal techniques

Variables			Forceps method	Inflation method	Total
Gender	Male	No.	22	16	38
		Percent	88.0%	64.0%	76.0%
	Female	No.	3	9	12
		Percent	12.0%	36.0%	24.0%
Total		No.	25	25	50
		Percent	100.0%	100.0%	100.0%

Chi squared value = 3.947 **P value** = 0.047

Mean, SD, median as well as lower and upper limits were almost identical in both methods where no significant statistical difference was detected (P value >0.05). These figures are shown in table II

Table II: Period of procedure in relation to the video-assisted naso-tracheal techniques

	Forceps method (sec.)	Inflation method (sec.)	P value*
Mean	15.3	15.6	0.855
SD	6.4	6.1	
Median	14.5	16.0	
Range	6-29	6-26	

*Mann Whitney's test

Both the Magill forceps and cuff inflation methods demonstrated similar performance across key clinical outcomes, with no statistically significant differences. Smooth intubation was more frequent in the forceps group (64% vs. 48%), though not significantly (p = 0.254) . Failure rates, bleeding, and the need for second attempts were comparable between groups. Notably, cuff damage occurred only in the forceps group (12%), suggesting a potential safety advantage for the cuff inflation method, though this difference did not reach statistical significance (p = 0.117). Overall, both techniques appear feasible and safe in ICU settings. Table III

Table III: Difficulties and complications regarding the video-assisted naso-tracheal techniques.

	Forceps method		Inflation method		P value*
	Frequency	Percent**	Frequency	Percent**	
Smoothly successful	16	64%	12	48%	0.254‡
Failure	1	4%	2	8%	0.5*
Bleeding	3	12%	3	12%	0.666*
Second trial	6	24%	8	32%	0.529‡
Cuff damage	3	12%	0	0%	0.117*

Discussion

The findings of this study indicate that both the Magill forceps and cuff inflation techniques are comparable in terms of procedure duration during video-assisted nasotracheal (NTI). The mean intubation times did not differ significantly between the two groups, suggesting that either method may be selected when time efficiency is a primary concern. However, the cuff inflation group showed a slightly higher incidence of repeated attempts, likely attributable to the increased need for coordination between the operator and assistant—a factor less prominent in the Magill forceps group.

When allowing up to three attempts per patient, the overall success rate was 92% (23/25) in the cuff inflation group and 96% (24/25) in the Magill forceps group ($p = 0.529$). Although Magill forceps require additional time for insertion and necessitate wider mouth opening, this is counterbalanced by the time required for gradual cuff inflation and potential for lateral misdirection of the tube tip, which may necessitate repositioning.

Video laryngoscopy (VL) is widely recognized as one of the most significant recent advances in airway management.

Contemporary guidelines recommend VL as a first-line technique for both routine and difficult intubations due to its superior glottic visualization and reduced need for head and neck manipulation .[17,18] The Difficult Airway Society (DAS) 2015 guidelines further emphasize that anesthesiologists should always have immediate access to VL .[19] Its expanding use has positioned VL as a potential alternative to fiberoptic intubation (FIO), particularly in patients with airway bleeding or excessive secretions where FIO may be less effective .[4,6,13]

External laryngeal manipulation (ELM), often accompanied by head rotation, proved highly effective in many cases. Twelve patients were excluded from the study after

successful intubation was achieved using only ELM, with no need for additional instruments. This highlights the continued value of ELM as a primary maneuver to optimize glottic exposure before introducing adjunct techniques. In patients without cervical spine instability, atlantoaxial flexion or extension may further enhance tube guidance. Both the Magill forceps and cuff inflation methods are primarily indicated when such maneuvers fail, particularly in anatomically challenging cases involving a high-positioned larynx.

Nasotracheal intubation remains a valuable technique in ICU and critical care settings due to its unique advantages, including improved tube fixation, better tolerance for prolonged intubation, and enhanced visualization of the glottis. [20]These benefits are especially notable in patients with restricted cervical mobility .[21] However, these advantages must be weighed against potential complications, particularly over extended durations of intubation.

The cuff inflation method provides a simple and minimally traumatic means of redirecting the endotracheal tube tip upward during NTI. Its use reduces the need for additional instrumentation and is especially useful in patients with limited oral access or restricted mouth opening. Studies have demonstrated its effectiveness in head and neck cancer patients with oral apertures as narrow as 2 cm .[22]

First-attempt failures in several cases can likely be attributed to the absence of full muscle relaxation, combined with the typical challenges encountered in ICU patients—such as varying degrees of pre-existing hypoxia. These factors also contribute to the observed variability in intubation times. Although nasal bleeding occurred at an overall rate of 12%—well within reported ranges of 30–55% (23)—this was not the only complication of interest. Mucosal trauma and airway edema are known risks, particularly with

forceful use of Magill forceps or repeated attempts (3, 10). The risk of cuff perforation is also notable with forceps, as seen in our study. While cuff inflation avoids these mechanical traumas, it can lead to the misdirection of the ET tube tip toward the lateral walls, requiring additional maneuvers to correct the trajectory. In both methods, excess manipulation risks airway irritation and procedural delay.

Two cases in the Magill forceps group experienced procedural delays due to the need for incremental sedation to achieve sufficient mouth opening. Such delays would likely not occur with the cuff inflation method, which does not require oral instrumentation.

Conclusion

Both Magill forceps and cuff inflation techniques provide comparable durations and high success rates for video-assisted nasotracheal intubation in ICU patients. Cuff inflation is particularly advantageous in patients with restricted oral access and in reducing the risk of cuff damage. Magill forceps may offer better control in directing the endotracheal tube but at the cost of greater mechanical manipulation. Clinicians should consider individual patient anatomy, procedural complexity, and operator experience when selecting the most appropriate technique.

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Responsibility for statistical analysis 1,2,3,4
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Critical review, 1, 2,3,4

Final approval of the article 1,2,3,4

Each author believes that the manuscript represents honest work and certifies that the article is original, is not under consideration by any other journal, and has not been previously published.

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