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The GlideScope with modified Magill forceps facilitates nasogastric tube insertion in anesthetized patients: A randomized clinical study

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Abstract

Objective: Insertion of a nasogastric tube (NGT) in patients who have been intubated with an endotracheal tube while under general anesthesia can cause difficulties and lead to complications, including hemorrhage. A visualization-aided modality was recently used to facilitate NGT insertion. Some studies have focused on the role of modified Magill forceps, which have angles similar to those of the GlideScope blade (Verathon, Bothell, WA, USA).

Methods: Seventy patients were divided into a control group (Group C) and an experimental group (GlideScope and modified Magill forceps, Group M).

Results: The total NGT insertion time was significantly shorter in Group M than C (71.3 ± 22.6 vs. 96.7 ± 57.5 s; mean difference, –25.3 s; 95% confidence interval [CI], 20.8–71.5). There were also significantly fewer mean insertion attempts in Group M than C (1.0 ± 0.0 vs. 2.11 ± 0.93). The success rate for the first attempt in Group C was 37.1%, while that in Group M was 100% (relative risk, 2.7; 95% CI, 1.7–4.1).

Conclusion: The use of the GlideScope with modified Magill forceps for insertion of an NGT in patients who are already intubated and under general anesthesia will shorten the insertion time and improve the success rate.

Keywords

GlideScope, modified Magill forceps, nasogastric tube, general anesthesia, endotracheal tube, first attempt

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Introduction

Insertion of a nasogastric tube (NGT) in patients with an endotracheal tube under general anesthesia can cause difficulties and lead to complications such as hemorrhage.[1] Many attempts have been made to facilitate NGT insertion, but no significant improvements have been seen. These attempts include the use of slit endotracheal tubes, forward displacement of the larynx, use of various forceps, use of a ureteral guidewire as a stylet, head flexion, and lateral neck pressure.[2–5]

Visualization-aided modalities were recently developed to facilitate NGT insertion,[1,6] and studies have been performed to examine the role of modified Magill forceps, which have angles similar to those of the GlideScope blade (Verathon, Bothell, WA, USA) (Figure 1).[7]

The purpose of this study was to investigate whether the GlideScope and modified Magill forceps facilitate NGT insertion in patients under general anesthesia who have undergone endotracheal tube insertion. The primary endpoint was the total insertion time of the NGT, and the secondary endpoint was the success rate of the first attempt.

Methods

Patients

The Hanyang University Guri Hospital Institutional Review Board on Human Subjects Research and Ethics Committee approved the study design. The study was registered by the Clinical Research Information Service (CRIS, KCT0001659, Sang Y Cho, 2015-10-15). Written informed consent was received from all patients before enrollment in the study.

We included patients with an American Society of Anesthesiologists (ASA) class of I, II, or III who required NGT insertion and were scheduled for gastrointestinal, gallbladder, or bile duct surgery. We excluded patients who were expected to

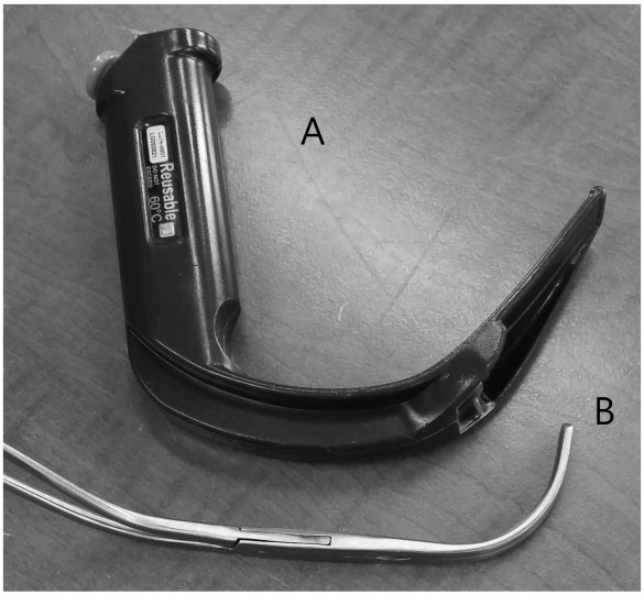

Figure 1. Similar angles between (A) GlideScope and (B) modified Magill forceps.

have intubation difficulties (e.g., had difficulty during a previous surgery, had undergone laryngeal surgery, were currently undergoing laryngeal radiotherapy, were suspected to have esophageal reflux, had loose teeth, had a Cormack–Lehane grade and Mallampati classification of III or IV, had a body mass index of >35 kg/m^2), had a severe deformity of the jaw or laryngopharynx, had an underlying disease of the skull base, had a hemorrhagic disease, or had an esophageal stricture.

Procedure

Before induction of anesthesia, we blocked one side of the nostril and instructed the patients to sneeze through the opposite nostril to check that the nostril was blocked. Midazolam (0.05 mg/kg) and atropine sulfate (0.01 mg/kg) were administered 30 minutes prior to arrival in the operating room. We prepared one opaque envelope for each patient containing computer-generated random passwords and instructed nurses who did not know the study details to open them as soon as the patients entered the operating room. The patients were equally divided into a control group (Group C) and an experimental group (GlideScope and modified Magill forceps, Group M). After their arrival in the operating room, the patients' age, sex, weight, height, body mass index, Mallampati classification, thyromental distance, maximal mouth opening (interincisor distance), and neck circumference (measured at the level of the thyroid cartilage) were recorded. Electrocardiographic parameters, oxygen saturation, noninvasive blood pressure, and end-tidal carbon dioxide were also measured. The depth of anesthesia was measured using a bispectral index (dual-spectroscopy) monitor (A-2000, version 3.3; Aspect Medical Systems Inc., Newton, MA, USA).

We induced anesthesia by administering thiopental sodium (3–5 mg/kg) and remifentanil (1–2 μg/kg) with inhalation of desflurane at 8% volume after denitrification by inhaling oxygen at 8 L/min. Intubation was attempted after the muscle relaxant esmeron (0.6 mg/kg) had been administered and the train-of-four response (from the nerve stimulator attached to the ulnar nerve) was zero.

After intubation, a single anesthesiologist inserted the NGT in both groups. First, in all patients, oropharyngeal suction was performed to remove oral secretions. In Group C, no other assistive devices were required, and the operator inserted the NGT using only the hands. In Group M, the blade of the GlideScope was inserted into the oral cavity to lift the tongue and endotracheal tube and to maximally visualize the esophageal entrance (Figure 2). In both groups, prior to insertion, we measured the NGT to ensure that it would be long enough to reach the stomach; we did this by measuring the tip of the NGT at the patient's xiphoid process and measuring its length to the nostril. In both groups, the NGT was inserted through the nostrils along the floor of the nose to the larynx and then gently inserted while the cuff of the endotracheal tube was loosened and the jaw was gently pulled up slightly. During NGT insertion, the bispectral index was maintained at 40 to 60, and muscle relaxation was confirmed by a nerve stimulator. Successful NGT insertion was defined as insertion in three or fewer attempts, and proper placement was confirmed with a stethoscope; a gurgling sound was heard on auscultation over the epigastrium when injecting 10 mL of air through the NGT or aspirating stomach contents with an enema syringe. The total insertion time was defined as the duration of time from advancement of the NGT into the nostril to confirmation of its successful insertion into the stomach.

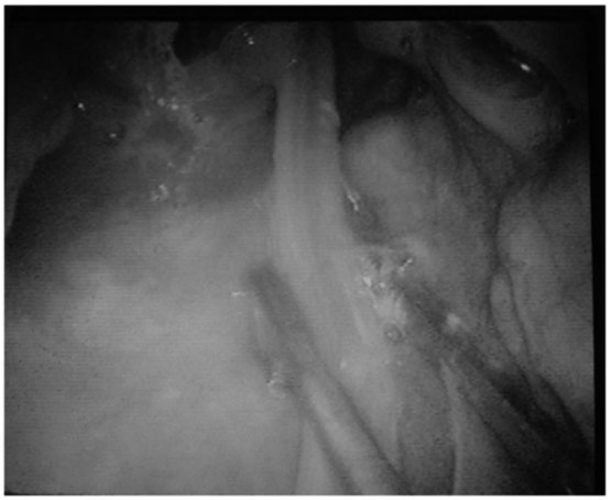

Figure 2. Photograph of nasogastric tube insertion (NGT) insertion in oral cavity. The modified Magill forceps grasping the NGT is shown.

Statistical analysis

We used the mean and standard deviation of the insertion time from a previous study as a reference for estimating our sample numbers: 33 ± 11.4 s. In a two-tailed analysis where $\alpha = 0.05$ and $\beta = 80\%$, 31.3 patients were required to obtain a 20% difference in the mean between the experimental and control groups. In total, 70 patients were required to maintain acceptable statistical power, assuming a 10% dropout rate. Statistical analyses were performed using IBM SPSS Statistics for Windows, Version 20.0 (IBM Corp., Armonk, NY, USA). An unpaired *t*-test was used to compare numerical data between the two groups. The chi-square test or Fisher's exact test (when appropriate) was used for categorical data. When analyzing hemodynamic changes, we used Kruskal-Wallis one-way analysis of variance with a Dunn multiple-comparison test. We considered $p < 0.05$ to be statistically significant.

Results

Seventy patients were enrolled in this study; Groups C and M comprised 35 patients each. No patients were excluded during the study (Figure 3).

There were no significant differences in ASA class, age, height, weight, or body mass index between the two groups (Table 1). There were also no significant differences in the operation time or anesthesia time between the two groups (Table 1).

The total NGT insertion time was significantly shorter in Group M than C (71.3 ± 22.6 vs. 96.7 ± 57.5 s; mean difference, –25.3 s; 95% confidence interval [CI], 20.8-71.5, $p = 0.02$) (Table 2).

There were fewer insertion attempts in Group M than C (1.0 ± 0.0 vs. 2.11 ± 0.93, $p < 0.001$) (Table 2). Successful insertion was achieved at the first attempt in 13 patients, at the second attempt in 5 patients, and at the third attempt in 12 patients; insertion failure occurred in 5 patients in Group C.

The success rate for the first attempt was 37.1% in Group C and 100% in Group M (relative risk, 2.7; 95% CI, 1.7–4.1; $p < 0.001$), which were significantly different (Table 2).

Finally, there was a significant difference in the overall success rate between Groups C and M (74.3% vs. 100%; relative risk, 1.3; 95% CI, 1.1–1.6; $p = 0.002$) (Table 2).

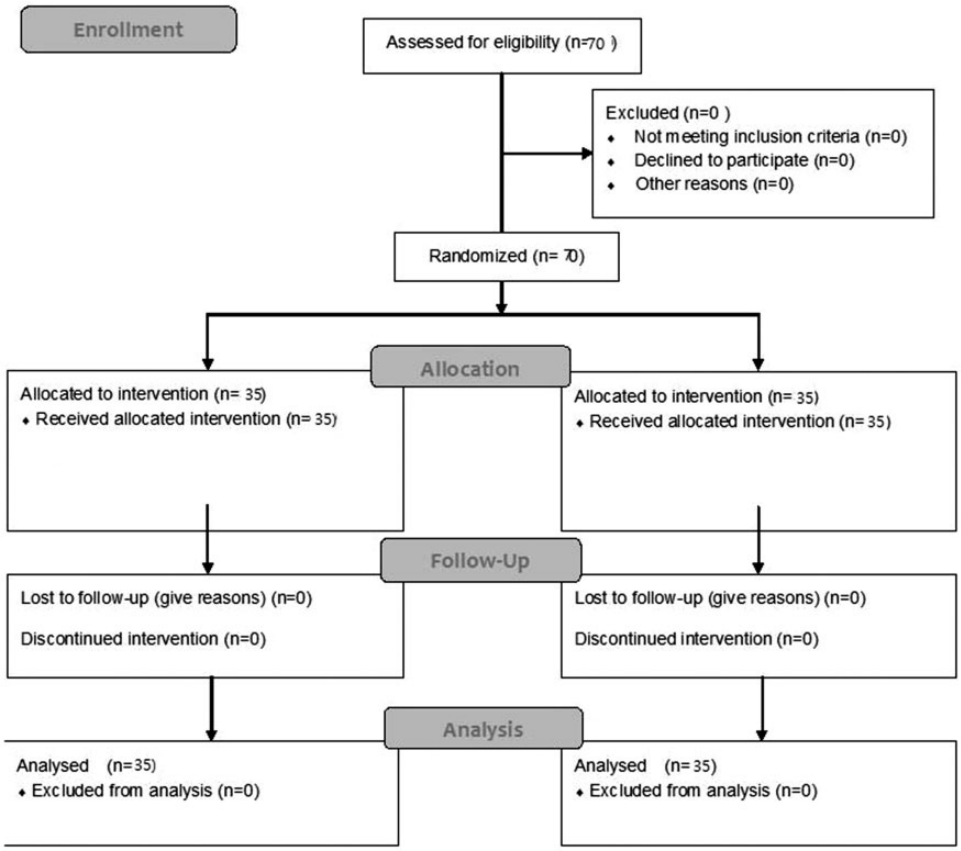

Figure 3. Study flow diagram.

Table 1. Demographic data

	Group C (n = 35)	Group M (n = 35)
ASA classification (I/II/III)	9/25/1	17/16/2
Height (cm)	166.5 ± 8.3	162.8 ± 8.4
Weight (kg)	73.7 ± 14.4	69.5 ± 11.6
Body mass index (kg/m^2)	26.6 ± 4.7	25.8 ± 3.4
Operation time (min)	91.1 ± 39.1	86.0 ± 36.5
Anesthesia time (min)	117.6 ± 47.1	108.6 ± 40.3

Data are presented as n or mean ± standard deviation. Group C, control group; Group M, GlideScope and modified Magill forceps; ASA, American Society of Anesthesiologists.

Discussion

In this study, the use of a GlideScope with modified Magill forceps resulted in a shorter total insertion time, a significant improvement in the first-attempt success rate, and a better overall insertion success rate compared with the conventional method.

For patients who have been intubated and have relaxed muscles, NGT insertion is sometimes very difficult and can cause tissue damage. The main cause of insertion difficulty is usually anatomical; damage can occur to tissues, most notably the piriform sinuses and arytenoid cartilage.[2] Another cause of difficulty is that the NGT is

Table 2. Characteristics of nasogastric tube insertion

	Group C (n = 35)	Group M (n = 35)	Difference in means or relative risk (95% CI)	p-value
Total insertion time (s)	96.7 ± 57.5	71.3 ± 22.6	25.3 (20.8–71.5)	0.02
Insertion attempts	2.11 ± 0.93	1.0 ± 0.0		<0.001
First insertion success rate	13/35 (37.1%)	35/35 (100%)	2.7 (1.7–4.1)	<0.001
Insertion success rate	26/35 (74.3%)	35/35 (100%)	1.3 (1.1–1.6)	0.002

Data are presented as n (%) or mean ± standard deviation unless otherwise indicated.
Group C, control group; Group M, GlideScope and modified Magill forceps; CI, confidence interval.

warmed by the body temperature at the moment of insertion; thus, coiling, knotting, and kinking of the NGT can occur, making insertion more difficult or even impossible. Repeated attempts can cause nasal mucosal damage or even bleeding in the throat.[8] Various solutions to this problem have been assessed. Recent studies have suggested that direct visualization during NGT insertion can be very useful. Direct observation with a bronchoscope alongside NGT insertion into the oral cavity in patients with a suspected basal skull fracture has been reported.[9] The use of direct laryngoscopy and Magill forceps has also been reported for NGT insertion without damage to the uvula or posterior pharyngeal wall.[10] The GlideScope was designed to facilitate difficult intubation by improving the glottic view.[6] In a comparative study of patients under general anesthesia in the operating room, the NGT insertion time was improved, and the complication rate was lower in the GlideScope group than in the control group.[1]

The use of standard Magill forceps in difficult nasal intubations along with indirect laryngoscopy reportedly has a 50% failure rate,[11] and removal of foreign bodies in mannequin glottises using modified forceps with angles similar to those found on an indirect laryngoscope yielded a higher success rate than when using standard Magill forceps.[12] Additionally, nasal intubation using an indirect laryngoscope was reportedly effective when using modified Magill forceps.[7]

In the present study, the NGT insertion time was shorter and the first-attempt success rate and total insertion rate improved when using a GlideScope with modified Magill forceps compared with the control group.

Our study has several limitations. The participating anesthesiologists were not blinded to the assigned groups. A single anesthesiologist inserted all NGTs in this study in an effort to reduce skill bias. This person could not be blinded to both groups, and the potential investigator evaluation bias was therefore increased. In future studies, it would be ideal for multiple anesthesiologists to insert the NGTs and for independent observers to check the duration of the procedure. Additionally, previous studies evaluated how use of the GlideScope facilitates NGT insertion; thus, it seems necessary to compare use of the GlideScope in a control group versus use of the modified Magill forceps in an experimental group.

In conclusion, use of the GlideScope with modified Magill forceps for NGT insertion in patients who are intubated and under general anesthesia will shorten the insertion time and improve the success rate.

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Declaration of conflicting interest

The authors declare that there is no conflict of interest.

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