〔CLINICAL report〕

# A study on nasotracheal intubation to prevent injury to the nasopharyngeal mucous membrane －Comparison of the bougie method and the gastric tube guide method－

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## Abstract

Nasotracheal intubation with general anesthesia is performed for dental treatment and oral surgery. However, nasotracheal intubation causes nasal bleeding and injury to the mucous membrane of the nasopharynx. This report describes the introduction of Nasogastric tubes with the guide intubation (NTGI) method and discusses its usefulness, and further reports a comparison of the clinical usefulness of the NTGI method (our novel method) and the bougie inferior nasal meatus (BINI) method.

The NTGI was performed clinically and the results of 30cases were confirmed by fiberscopy, showing no cases of injury. The proportion of cases with bleeding from the inferior nasal meatus was similar in the NTGI and bougie inferior nasal meatus as nasotracheal intubation (BINI) methods. The NTGI method prevented injury to the pharyngeal mucous membrane at the time of nasotracheal intubation. Therefore, the results indicated that the NTGI method is safe for nasotracheal intubation.

In the present study, the intubation tube was changed to prevent pharyngeal injury. The tube tip was made of a soft material (soft PVC ; polyvinyl chloride) and with an obtuse angle, and the tube shape was changed. Although the intubation procedures were safe because the intubation tube material was soft, there is the possibility of obstruction of the nasal cavity during general anesthesia. Further studies are required to develop tubes for safer tracheal intubation during general anesthesia and when regaining consciousness as well as during intubation.

**Key words** : Nasotracheal intubation, Safe propulsion, Nasogastric tubes as guide intubation (NTGI), Bougie inferior nasal meatus as nasotracheal intubation (BINI)

## Introduction

Nasotracheal intubation with general anesthesia was performed for dental treatment and oral surgery. However, nasotracheal intubation causes nasal bleeding and injury to the mucous membrane of the nasopharynx (Domino et al., 1999), and we have used the bougie inferior nasal meatus as the nasotracheal intubation (BINI) method to expand the inferior nasal meatus before nasotracheal intubation. In July 2003, we experienced a case where a tracheal tube punctured the pharyngeal mucous membrane during nasotracheal intubation, causing injury to the rhinopharyngeal and mesopharyngeal mucous membranes. For promotion of safety during nasotracheal intubation, the nasogastric tube as guide intubation (NTGI) method has been used since September 2003 (Nakanishi et al., 1995). This paper reports a comparison of the clinical usefulness of the NTGI method (our novel method) and the BINI method.

## Methods

1) Nasotracheal intubation

A gastric tube is passed through a tracheal intubation tube 〔soft PVC ; polyvinyl chloride, Satin Soft Hi-Lo™ Tracheal

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Tube, Mallinckrodt, St. Louis, MO], the inside of which is wetted with lidocaine or physiological saline solution.

After induction of anesthesia, a vasoconstrictor solution containing 0.01% tramazoline hydrochloride is administered to the nasal cavity. The inferior nasal meatus is wiped with a unilateral swab with a wooden axis soaked in benzalkonium chloride, and 1 ml of lidocaine jelly (20 mg/ml) is applied for wetting and for surface anesthesia of the inferior nasal meatus.

Laryngoscopy is performed using a laryngoscope, and 4% lidocaine is sprayed into the trachea and larynx. The tip of the intubation tube through which the gastric tube was passed is inserted through the nasal cavity (Fig. 1).

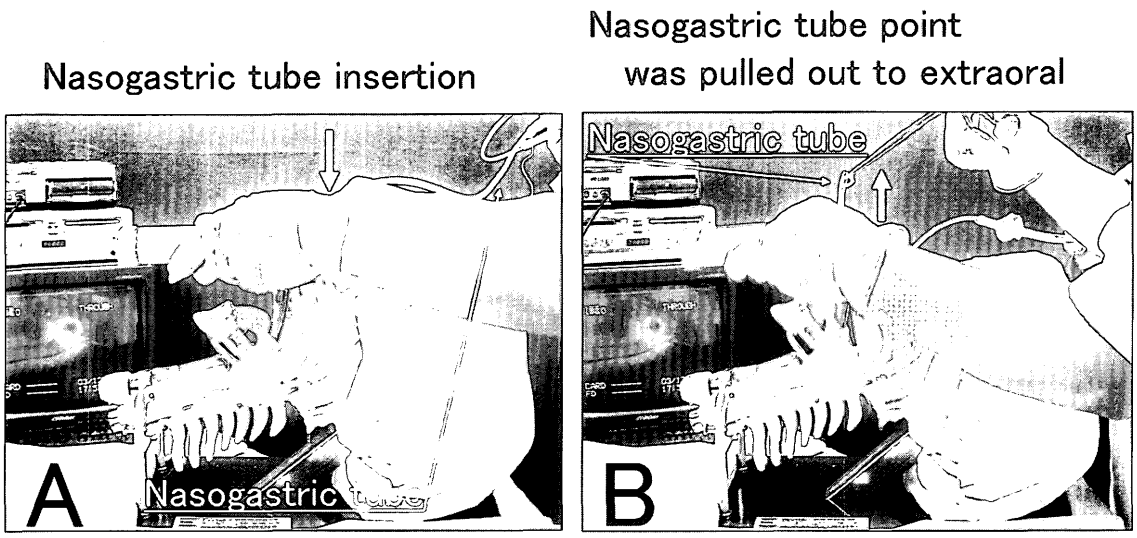


**Fig. 1** Nasogastric tubes as guide intubation (NTGI) – 1

The location of the gastric tube tip in the pharynx is confirmed from the oral side in the open view and the gastric tube tip is pulled out of the oral cavity using Magill's forceps. Then, the intubation tube is inserted into the inferior nasal meatus and turned to the right near the curve of the pharyngeal mucous membrane (Fig. 2).

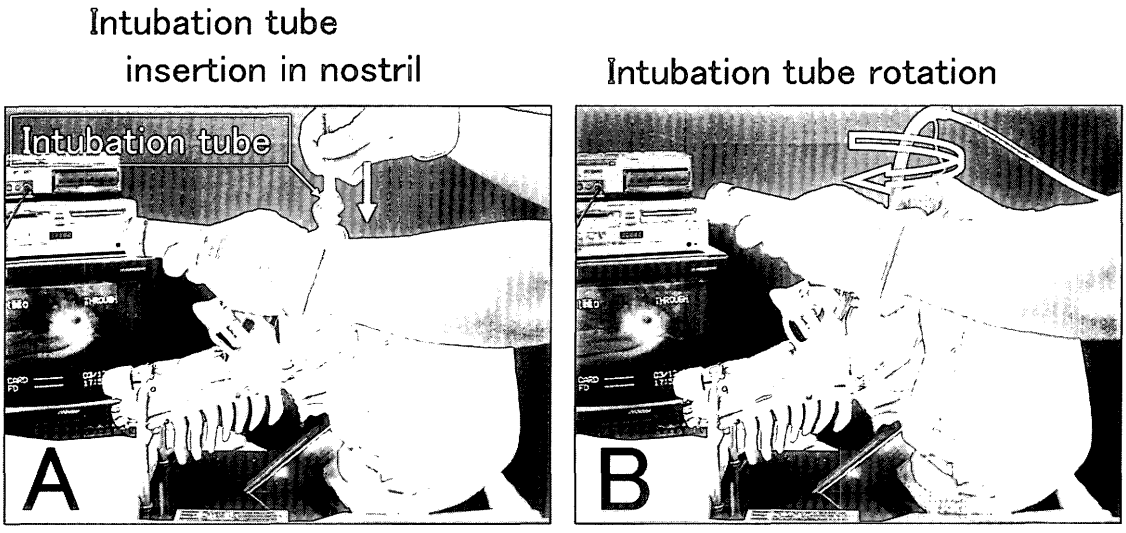


**Fig. 2** Nasogastric tubes as guide intubation (NTGI) – 2

Fuether, the gastric tube is lifted up, as shown Fig. 3–B. Lifting the tube enables the introduction of the intubation tube tip from the rhinopharynx to the mesopharynx without making a forced contact with the pharyngeal mucous membrane. This prevents injury to the pharyngeal mucous membrane. Next, nasal discharge and blood attached to the intubation tube tip can be aspirated by removal of the nasogastric tube (Fig. 3).

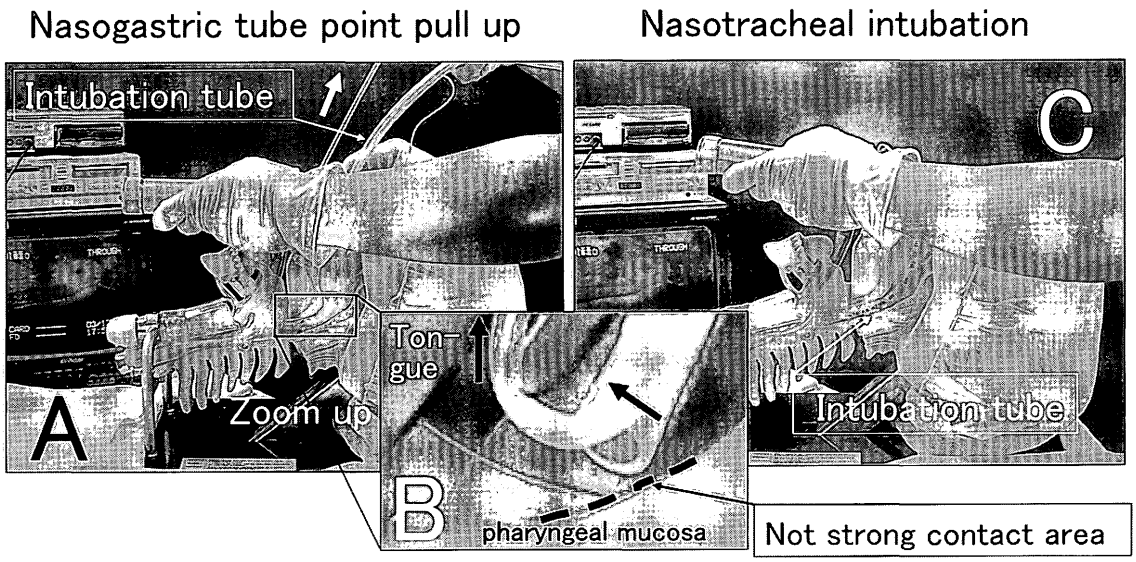


**Fig.3** Nasogastric tubes as guide intubation (NTGI) – 3

The anesthesiologist conducts laryngoscopy and tracheal intubation in the open view of the vocal cord. Tracheal intubation was confirmed at five points and six auscultations were performed to check for tarnishing of the inside of the tube. Secondary confirmation is conducted using a capnometer and determination of the end tidal $CO_2$ level.

An anesthesiologist and an anesthesiology instructor confirm the distance from the intubation tube tip to the tracheal bifurcation site using a fiberscope and photograph. The presence or absence of injury in the larynx and pharynx is then confirmed by fiberscopy and the condition is photographed. In addition, the instructor confirms the position of the intubation tube and presence or absence of injuries by monitoring (Fig. 4).

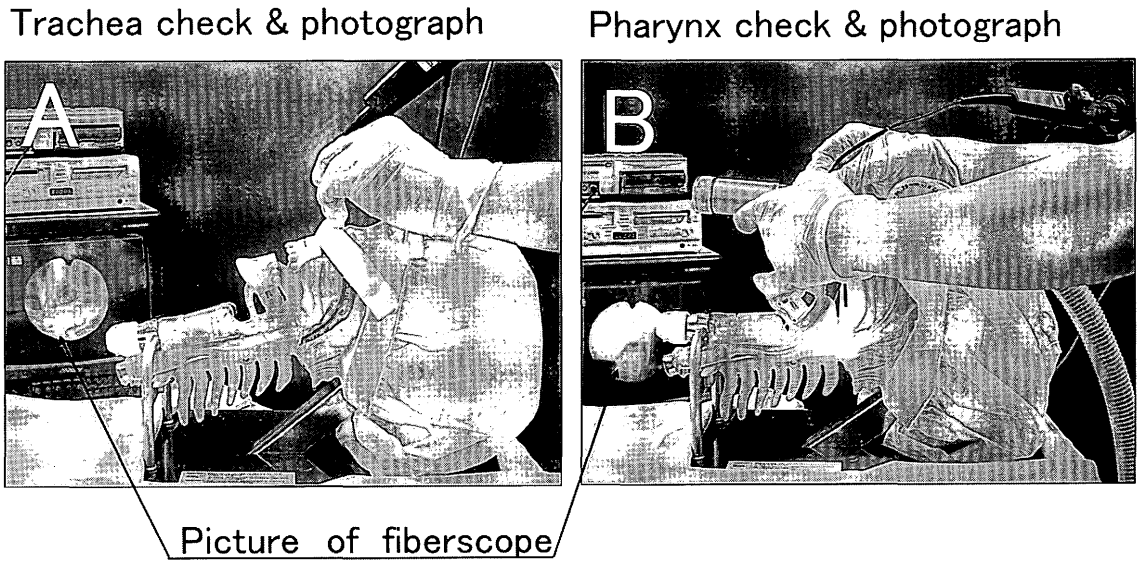


**Fig.4** Nasogastric tubes as guide intubation (NTGI) – 4

2) NTGI comparison with BINI

A reactive comparison between the NTGI and BINI methods in terms of amount of bleeding and intubation time was conducted with 30 cases by the same dental anesthesiologist. Blood loss was measured with respect to four different suctioned levels : no, little (0.1–1.0ml), medium (1.1–5.0ml), and heavy bleeding (>5.1ml). The intubation time was set from the start of the general anesthetic inhalation to the nasotracheal intubation (mean ± SD).

The two groups were compared, and for the statistical analysis, Fisher's exact test was utilized for nasal blood loss volume,

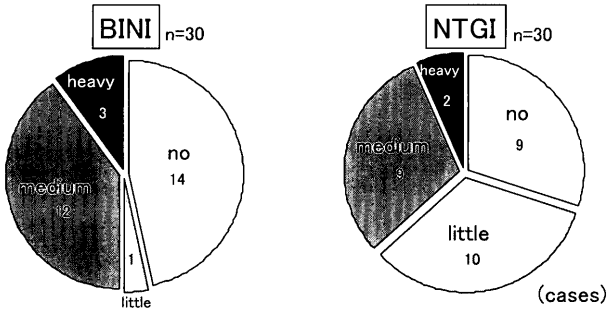


Fig.5 Breakdown of the nasal bleeding level(BINI vs NTGI)
Blood loss was measured with respect to four different suctioned levels : no, little (0.1−1.0 ml), medium (1.1−5.0 ml), and heavy bleeding (>5.1 ml).
BINI : bougie inferior nasal meatus as nasotracheal intubation
NTGI : nasogastric tubes as guide intubation.
No significant difference with Fisher's test (n=30).

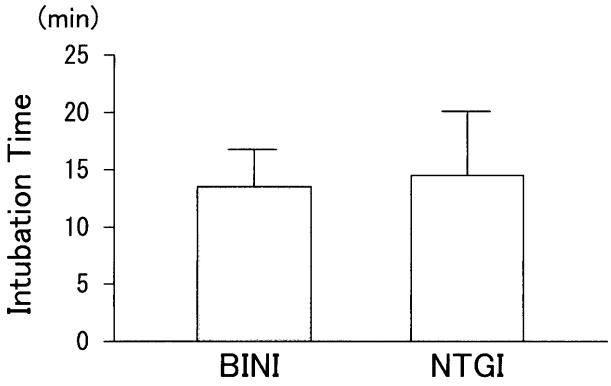


Fig.6 Intubation Time(BINI vs. NTGI)
Intubation time was set from the start of the general anesthetic inhalation to the nasotracheal intubation (mean ± SD).
No significant difference with Mann−Whitney U test (n=30).

and the Mann−Whitney U−test (with Y−stat) was used to compare the intubation time.

## Results

Nasal bleeding due to nasotracheal intubation demonstrated no statistically significant differences between the two groups (Fig. 5).

One case involving a tear of the oropharynx occurred in the BINI group, no oropharynx tear was determined in the NTGI group.

There were no meaningful differences in the intubation time from the start of the general anesthetic inhalation to nasotracheal intubation between the BINI (12.7±7.6min) and NTGI (13.2±3.2min) methods (Fig. 6).

## Discussion

The NTGI method using a gastric tube (Nakanishi et al., 1995 ; Sugiura et al., 1996), or aspiration tube (Sloan, and Van Rooyen, 1994), can prevent large pharyngeal mucosa injuries. As the gastric tube is long, its contact with the pharyngeal mucous membranes, especially the pharyngeal posterior wall, can be reduced by pulling it outside the oral cavity, thus preventing pharyngeal injuries. However, as there have been reports of pharyngeal injury by gastric tubes (Domino et al., 1999), precaution should be exercised. Other nasotracheal intubation methods using fiberscope (Kawamura et al., 2003) or Lightwand (Manabe et al., 2004) have been reported. These will be further examined in future studies.

The results of the present study indicate that pharyngeal mucosa injuries also occur with the NTGI method. There was no significant difference in the amount of bleeding when compared with the BINI method. However, the NTGI method tended to cause micro−bleeding more frequently. This finding was confirmed by a fiberscopy, and nasal bleeding which could not be confirmed macroscopically was recorded as micro−bleeding. As a result, the proportion of micro−bleeding may be higher. However, the NTGI performed in the present study did not cause large injuries and was considered to have provided the promotion of safety during nasotracheal intubation.

There were no differences in the time taken till intubation, as compared with the BINI method. The trachea, larynx, and pharynx were confirmed by fiberscopy.

In the present study, the intubation tube was changed to prevent pharyngeal injury. The tube tip was made of soft material and with an obtuse angle, and the tube shape was changed. Although the intubation procedures were safe because the intubation tube material was soft, there is the possibility of obstruction of the nasal cavity during general anesthesia. Nasotracheal

tubes fabricated from soft materials reduce the extent of tear in the nasal mucous and pharynx mucous membranes. In this study, no complications from tube (PVC : polyvinyl chloride) occlusion or applanation were observed. However, we have previously encountered several cases in which non-PVC type silicon tubes led to applanation in the inferior nasal meatus (a transtracheal aspiration tube, 4 mm in diameter, was unable to pass through the trachea). Further study is required to develop tubes for safer tracheal intubation during surgery and on regaining consciousness as well as during intubation.

## Conclusions

The NTGI protocol was substituted for the BINI method due to the occurrence of tears in the epipharynx and the oropharynx. The NTGI was performed clinically, and 30 cases were verified fiberscopically. A reactive comparison was performed between NTGI and BINI.

No instances of oropharynx tearing were observed in the subjects undergoing NTGI. Blood loss from the inferior meatus in NTGI patients was comparable to that in BINI patients.

The NTGI prevented pharynx mucous membrane tearing as well as blood losses exceeding 5 ml, and these findings confirm the safety and efficacy of the NTGI approach for nasotracheal intubation.

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