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The difficult intraoperative nasogastric tube intubation: A review of the literature and a novel approach

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Abstract

Nasogastric tube intubation of a patient under general anesthesia with an endotracheal tube in place can pose a challenge to the most experienced anesthesiologist. Physiologic and pathologic variations in a patient's functional anatomy can present further difficulty. While numerous techniques to the difficult nasogastric tube intubation have been described, there is no consensus for a standard approach. Therefore, selecting the most appropriate approach requires a working knowledge of the techniques available, mindful consideration of individual patient and clinical factors, and the operator's experience and preference. This article reviews the relevant literature regarding various approaches to the difficult nasogastric tube intubation with descriptions of techniques and results from comparative studies if available. Additionally, we present a novel approach using a retrograde technique for the difficult intraoperative nasogastric tube intubation.

Keywords

Anesthesiology, nasogastric intubation, esophagectomy

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Introduction

Nasogastric tube (NGT) intubation of a patient under general anesthesia with an endotracheal tube in place can pose a challenge to the most experienced anesthesiologist.[1,2] Variations in a patient's functional anatomy, whether physiologic or pathologic, can further complicate an already difficult procedure. In a previous study, Ozer and Benumof[3] demonstrated that the most common sites of resistance for passage of orogastric tube and NGT are the arytenoid cartilages and piriform sinuses. Additionally, NGT intubation has been associated with numerous adverse outcomes such as aspiration pneumonia, nasal mucosal bleeding, intracranial placement, esophageal and other enteric perforation, hypertension, tachycardia, arrhythmia, bronchial placement, pneumothorax, hydrothorax, empyema, and vascular penetration.[2,4–8] To facilitate safe and efficient NGT intubation, numerous techniques have been described in the literature. However, there is no consensus regarding a standard approach, and the decision must account for individual patient and clinical factors and the operator's experience and preference. In this article, we review the literature relevant to NGT intubation, including descriptions of various techniques and results of comparative studies if available. To identify the pertinent medical literature, we reviewed articles published in English from MEDLINE. Our search was conducted using the Medical Subject Headings term "nasogastric intubation" and keywords "head and neck cancer," "esophageal cancer," "esophageal perforation," "surgery," "intraoperative," "complications," and "anesthesia." The relevant findings, descriptions, and results are summarized in Table 1. We also present a novel approach to the difficult NGT intubation with a retrograde technique involving collaboration between the anesthesiologist and surgeon.

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Table 1. Reported techniques for difficult or failed NGT intubation.

Authors	Technique	Outcomes
Ghatak et al.[9]	Mild neck flexion, cricoid cartilage manipulation, and an angiography catheter as a stylet were used to insert an NGT in a single case of an unconscious, intubated 48-year-old male with intracerebral hemorrhage and acute myocardial infarction	This approach facilitated successful NGT insertion after conventional attempts failed
Tsai et al.[6]	The tips of a "Rusch" intubation stylet and NGT are tied together by a slipknot and inserted through the nasal cavity with the patient in intubating position. This technique was compared to conventional NGT insertion in the intubating position for patients scheduled for gastrointestinal or hepatic surgeries requiring intraoperative NGT insertion with general anesthesia and endotracheal tube in place.	1. Overall success rate of NGT intubation was 98.1% (52/53 patients) with versus 64% (32/50) without stylet use ($p < 0.001$) 2. Success rate of first attempt NGT intubation was 94.3% (50/53 patients) with versus 54% (27/50) without stylet use ($p < 0.001$) 3. Success rate of rescue from conventional NGT intubation with stylet use was 94.4% (17/18 patients)
Kirtania et al.[10]	A modified esophageal guidewire is threaded into an NGT as a stylet to facilitate NGT intubation. This assembly is first inserted through the nose and oropharynx in typical fashion, then manual forward displacement of the larynx is performed to aid NGT/guidewire construct transit. The guidewire is retracted from the NGT when the desired position is reached. This technique was compared to the approach of using head flexion and lateral neck pressure to facilitate NGT intubation in patients undergoing abdominal surgery with general anesthesia and tracheal intubation.	1. The use of the esophageal guidewire resulted in a 99.2% (238/240 patients) first intubation attempt success rate compared to 56.7% (136/240) with head flexion and lateral neck pressure alone ($p < 0.001$) 2. The median time for successful NGT intubation was significantly shorter in the guidewire group (55 s) versus the head flexion/lateral neck pressure group (60 s) ($p < 0.001$)
Sudhakar et al.[11]	An orogastric tube is converted to a NGT via a nasally inserted suction catheter. The suction catheter is secured in-continuity to the orogastric tube with suture and retracted through the nose to convert the orogastric tube to a NGT.	Unreported
Upile et al.[12]	Blom-Singer (16 Fr) gel caps are used to combine the distal tips of a nasendoscope and an NGT to permit intubation under direct visualization. This approach was compared to using the nasendoscope to provide direct visualization alone in patients with head and neck cancer who failed conventional NGT intubation attempts.	For failed attempts at conventional NGT intubation, the method of using the gel cap assembly was not found to be better than NGT insertion under direct visualization with the nasendoscope alone
Moharari et al.[13]	The GlideScope is used to facilitate conventional intraoperative NGT intubation by lifting the tongue and tracheal tube to provide improved visualization of the pharynx and esophageal opening. This technique was compared to unassisted conventional NGT intubation in patients undergoing gastrointestinal, gallbladder, and biliary surgery with general anesthesia and endotracheal tube placement.	1. The mean time to successful intubation was 27.7 ± 21 s shorter in the GlideScope group compared to the unassisted group ($p < 0.02$) 2. NGT intubation was successful on the first attempt in 85% (34/40 patients) of the GlideScope group versus 57.5% (23/40) of the unassisted group ($p = 0.007$).
Chun et al.[7]	A silicone NGT is filled with distilled water, frozen, and inserted conventionally. NGT intubation with frozen versus standard NGT was compared in patients undergoing elective general anesthesia and requiring intraoperative NGT intubation.	1. Success rate of NGT intubation was 88% (44/50 patients) in the frozen NGT group versus 58% (29/50) in the control (standard NGT) group ($p = 0.001$) 2. Total time for NGT intubation was shorter in the frozen NGT group (83 seconds) than the control group (120 seconds) ($p = 0.078$)

Table 1. (Continued)

Authors	Technique	Outcomes
Appukutty and Shroff[14]	This study compared the use of a ureteral guidewire as a stylet, a slit endotracheal tube as an introducer, head flexion with application of lateral neck pressure, and the conventional technique for NGT intubation in patients receiving general anesthesia and tracheal intubation for various surgical procedures.	1. Compared to 72% in the control group, the success rate was significantly higher in the ureteral guidewire group; 92% ($p = 0.011$); slit tracheal tube group, 92%, ($p = 0.011$); and in the head flexion with lateral neck pressure group, 92% ($p = 0.004$). 2. Compared to the conventional method, the time required for NGT intubation was significantly longer for the slit tracheal tube group, significantly shorter for the head flexion with lateral neck pressure group, and not significantly different for the ureteral guidewire group.
Mahajan et al.[15]	A ureteric guidewire is modified by adding a Teflon coating to its distal tip. The modified ureteric guidewire is threaded into an NGT as a stylet to provide rigidity and support to facilitate NGT intubation.	This approach was used in 70 patients with successful intubation on the first attempt in 67 patients and the second attempt in 3 patients
Mahajan et al.[16]	An NGT is first passed from the nose and into the mouth. Then, the distal end of a child-size Trachlight™ light wand with stylet in place is lubricated and brought through the distal hole of the NGT. Together, the NGT and light wand are introduced into the esophagus and stomach.	Unreported
Hung and Lee[2]	An NGT is filled with distilled water through aspiration with a feeding syringe and tapped proximally to retain the water. NGT intubation with the water-filled NGT was compared to that with a standard NGT in adult non-trauma patients in an emergency department after tracheal intubation with rapid sequence induction.	The success rate of NGT intubation in the water-fill group was 93.5% (29/31 patients) compared to 65.7% (23/35) in the traditional NGT placement group ($p < 0.01$)
Walker[17]	The placement of a throat pack facilitates conventional NGT insertion through its effects on preventing coiling and impaction as well as helping to turn the NGT posteriorly in the pharynx.	Unreported
Scholtes[18]	After passing an NGT from the nose through the mouth, the distal tip is threaded through the Murphy's eye of a Rusch intubation guide catheter. Together, the NGT and guide catheter are blindly inserted into the esophagus and stomach, and the guide catheter is retracted to leave the NGT in the desired position.	Unreported
Gupta et al.[19]	A facepiece connected to a self-inflating bag is used to create positive pressure in the pharynx in order to open the upper esophageal sphincter to facilitate conventional NGT intubation. This technique was compared to conventional NGT intubation without inflation in patients scheduled for elective surgery undergoing general anesthesia/endotracheal tube placement and requiring intraoperative NGT intubation.	Overall success rate of NGT intubation was 96% (75/78 patients) in the inflation group versus 68% (54/80) in the non-inflation group ($p < 0.001$)
Gombar et al.[1]	Initially, an NGT is introduced through the nasal passage. Gentle laryngoscopy is performed, and the distal tip of the NGT is grasped at the mouth with Magill forceps and pulled until only 3–4 inches of the proximal NGT remains outside the nares. Then, the Magill forceps are used to grip the distal NGT about 2–3 inches from the tip and direct it into the esophagus. The NGT is finally situated and secured in its desired position.	Unreported
Lin et al.[20]	First, an ultrathin (6-mm diameter) endoscope is passed through the nose, nasopharynx, esophagus, and stomach. Then, a guidewire is fed into the stomach through the working channel of the endoscope. The endoscope is withdrawn from the patient, and an NGT is advanced over the guidewire under fluoroscopy. When the NGT is in the desired position, the guidewire is removed. This approach was used in esophageal cancer patients who failed conventional awake NGT intubation due to the presence of obstructing lesions.	Successful NGT intubation in 70/71 procedures (99%) in 40 patients

(Continued)

Table 1. (Continued)

Authors	Technique	Outcomes
Doshi and Anari[21]	The Seldinger technique is employed to facilitate NGT intubation by way of introducing a guide tube over a nasendoscope into the stomach under direct visualization. After positioning into the stomach, the nasendoscope is retracted from the guide tube. Then, the guide tube is used to thread the NGT into the desired position and subsequently removed.	Unreported
Jones et al.[22]	The distal tip of an NGT is secured with suture to a flexible bronchoscope just proximal to its flexible portion. This assembly is directed from the nose to the oral cavity under direct visualization. Then, the suture is cut and the bronchoscope is withdrawn from the mouth. Finally, the NGT is passed into the esophagus and stomach under direct visualization using a laryngoscope and Magill forceps. This approach was described for patients with proven or suspected basal skull fractures.	Unreported
Dutta et al.[23]	Two methods were described to facilitate NGT intubation in patients with a LMA in place: (1) A red rubber endotracheal tube is inserted through the nose, nasopharynx, and hypopharynx. The endotracheal tube cuff was then inflated to displace the LMA cuff forward, thus facilitating conventional NGT insertion. (2) An NGT over an angiographic guidewire is initially inserted through the nose and nasopharynx. Then, a fiberoptic bronchoscope is introduced from the mouth and behind an intubating LMA to guide NGT placement into the hypopharynx and esophagus under direct visualization.	Successful NGT intubation was demonstrated in the two reported cases
Lai et al.[24]	The GlideScope is inserted into the mouth to expose the larynx and pharynx. An NGT is passed from the nose to the oropharynx. Then, the tracheal tube cuff is released and the NGT is advanced into the esophagus and stomach while the chin is lifted.	The authors reported five successful NGT intubations under GlideScope visualization without complications
Yamauchi et al.[25]	The patient is placed on a lumbar supine surgery table and turned to the prone Hall-frame position with the neck rotated 45° to the right. The NGT is then inserted into the nasal cavity and advanced blindly into the stomach. NGT intubation in the prone versus supine position was compared in patients scheduled for elective lumbar supine surgery under general anesthesia with tracheal intubation.	The success rate of NGT intubation within two attempts was 93% (42/45 patients) in the prone position and 33% (15/45) in the supine position ($p < 0.01$). These differing techniques were attempted on the same 45 patients in the supine position first followed by the prone approach.
Reid and Falconer[26]	An NGT is inserted into the nose and pulled from the mouth using Magill forceps. An intubating bougie is attached to the distal end of the NGT and reinserted into the oropharynx, esophagus, and stomach.	Unreported
Mahajan et al.[27]	Conventional NGT intubation with maximum forward neck flexion was compared to the neutral position in patients undergoing surgery requiring general anesthesia and tracheal intubation	Successful first attempt NGT intubation occurred in 80% (24/30 patients) of the flexion group and 50% (15/30) in the neutral position group. After NGT intubation failed twice, additional maneuvers to facilitate NGT insertion were required in three patients in the flexion group compared to nine patients in the neutral group.
Mahajan and Gupta[28]	After introduction into the oropharynx, the orogastric tube or Murphy's eye of a Rusch intubation is directed into the esophagus along the lateral pharyngeal wall using a gloved left index finger	Over a 6-month period, approximately 90 NGT intubations were performed using this method with a success rate of roughly 83%
Kayo et al.[29]	Positioning the head of a patient on a 5-cm-height pillow, regardless of rotating the head or lifting the jaw, is an effective maneuver for NGT intubation	Unreported

Table 1. (Continued)

Authors	Technique	Outcomes
Bong et al.[30]	NGT intubation is facilitated by placing the patient's head in the (right) lateral position instead of the traditional neutral position. These techniques were compared in patients undergoing elective surgery with general anesthesia and tracheal intubation.	1. Successful first pass NGT intubation was performed in 80% (12/15 patients) in the right lateral group versus 40% (6/15) in the neutral group 2. Three or more attempts were required for successful NGT intubation in 20% (3/15 patients) of the right lateral group versus 40% (6/15) in the neutral group
Flegar and Ball[31]	A refrigerated NGT is inserted into the nasal cavity with the concave side approximating the floor of the nasal passage. Then, the NGT is rotated 180° in the oropharynx to bring the tip against the posterior pharyngeal wall. After that, the NGT is passed into the esophagus while the chin is lifted.	Unreported
Kelly and Lee[32]	A nasendoscope is used to assist conventional NGT intubation under direct visualization	This approach permitted the successful placement of over 20 NGT insertions in their series
Ozer and Benumof[3]	Lateral neck pressure compresses the piriform sinuses and moves the arytenoid cartilages medially which facilitates NGT placement. This maneuver was used to rescue failed conventional NGT intubation attempts in patients scheduled for elective surgery requiring general anesthesia and endotracheal intubation.	If the orogastric tube or NGT impacted the piriform sinuses (13/28 first attempt failures) or arytenoid cartilages (7/28), lateral neck pressure resolved 85% (17/20 second attempts) of the impactions
Campbell[33]	The lumen of an NGT is rinsed with chlorhexidine solution and warm water. Then, a gastroscope biopsy forceps is threaded through the NGT and situated within 2 cm of the tip. After that, the assembly is passed from the nose to the oropharynx. At that time, the forceps are stiffened and straightened to reinforce the NGT while the construct is directed posteriorly into the esophagus and stomach. The forceps are removed after the NGT is situated in the desired position by returning them to a floppy state and withdrawing from the patient. This method was used in both conscious and unconscious patients.	Unreported
Shetty et al.[34]	A nasopharyngeal airway is inserted into the pharynx while maintaining a downward projection. After its position is verified, an NGT is inserted through the nasopharyngeal airway and into the esophagus and stomach.	Unreported
Chen and Wang[35]	A nasotracheal tube is used to facilitate NGT intubation without kinking in the nasal cavity	Unreported
Parris[36]	The "reverse Sellick maneuver," or anterior displacement of the cricoid cartilage, is used to facilitate conventional NGT intubation in patients in whom several standard NGT intubation attempts failed	The reported institutional success rate among several anesthesia personnel who performed the maneuver approximately 30 times over 12 months was about 75%–80%
Siegel and Kahn[37]	NGT intubation is facilitated by a nasoesophageally inserted endotracheal tube	Unreported
Lewis[38]	A nasopharyngeal airway is used to facilitate NGT placement	Unreported
Perel et al.[39]	Manual forward displacement of the larynx by manually gripping and lifting the thyroid cartilage was performed to facilitate NGT placement in patients undergoing general anesthesia with tracheal intubation who failed conventional NGT placement. If this rescue maneuver failed, the remainder of the NGT intubations were performed successfully with the use of a finger or laryngoscope with Magill forceps.	In 48 out of 100 anesthetized and intubated patients who failed conventional NGT placement, manual forward displacement of the larynx permitted successful NGT intubation in 33 patients. The remaining 15 patients underwent successful NGT intubations with the aid of a finger or laryngoscope with Magill forceps.

(Continued)

Table 1. (Continued)

Authors	Technique	Outcomes
Huang[40]	First, an NGT is passed from the nose and into the oral cavity. At that point, the NGT is threaded through the side hole of an endotracheal tube. Together, the NGT and endotracheal tube are advanced into the pharynx to guide NGT placement in the esophagus and stomach.	Unreported
Sprague and Carter[41]	An NGT is passed from the nose and into the mouth where a laryngoscope and Magill forceps are used to withdraw the NGT. Then, a slit endotracheal tube is inserted into the mouth and down the esophagus. The NGT is threaded through the slit endotracheal tube into the desired position, and the endotracheal tube is retracted. Once the distal end of the endotracheal tube is in the mouth, the opposite side is slit to complete its removal.	Unreported
Ohn and Wu[42]	After an NGT is passed from the nose and out through the mouth, its tip along with that of an esophageal stethoscope is placed into a pouch made from the tip of a glove. This pouch is then advanced into the esophagus until maximal-intensity heart sounds are heard. At that time, the NGT is separated from the pouch and advanced into the stomach.	Unreported
Mundy[43]	The thyroid cartilage is grasped manually and displaced anteriorly to open the esophagus and facilitate conventional NGT placement	Unreported
Cohen and Fox[44]	First, an NGT is inserted through the nose and mouth where its tip is grasped with Magill forceps under laryngoscopic visualization. The NGT is retracted from the mouth until approximately 3 inches remain from the nares. Then, an esophageal stethoscope is threaded through a slit endotracheal tube and passed either blindly or under laryngoscopic visualization into the esophagus until maximal heart sounds are heard. The esophageal stethoscope is then exchanged for an NGT through the slit endotracheal tube. After the NGT is in the desired position, the slit endotracheal tube is removed from the patient. This technique was demonstrated in patients under general anesthesia.	At the time of writing, the authors reported successful NGT intubation in 118 patients using the described method
Steen[45]	This method is similar to that described by Lundy in 1942. However, a No. 5 Magill tube is used instead of a urethral catheter.	Unreported
Conroy[46]	NGT intubation is facilitated by a nasoesophageally inserted endotracheal tube	Unreported
Lundy[47]	1. If an NGT cannot be passed into the esophagus, a laryngoscope is used to visualize the esophageal opening. Under laryngoscopic visualization, the NGT is grasped with Magill forceps and advanced into the esophagus. 2. An orogastric tube is introduced via an endotracheal tube placed into the esophagus. Then, a urethral catheter is inserted into the nose and extracted from the mouth. The orogastric tube is converted into an NGT by suturing the ends of the urethral catheter and orogastric tube together and pulling both through the nose.	Unreported

NGT: Nasogastric tube; LMA: laryngeal mask airway.

A novel approach to NGT intubation

The patient was a 78-year-old male with a history of multiple head and neck cancers who was emergently transferred to our facility after suffering an iatrogenic esophageal perforation during attempted endoscopic dilation of esophageal strictures. Upon arrival, the patient was immediately brought to the operating room, and induction of general anesthesia and orotracheal intubation were performed without complication. The exploratory laparotomy, partial esophagogastrectomy, and esophagogastrostomy were completed uneventfully. After creating the anastomosis, conventional NGT intubation was attempted by the anesthesiologist, but the pharynx could not be passed, and the NGT extruded from the mouth. At that time, the decision was made by the surgeon to halt additional attempts at NGT intubation to prevent potential injury to repaired esophagus. To proceed, the surgeon opted to use a retrograde approach by passing a Silastic tube through the open stomach, beyond the esophagogastrostomy, into the pharynx, and retrieving it at the mouth. The extruded NGT was secured with suture to the Silastic tube and passed into the correct position in the stomach with coordination between the anesthesiologist and surgeon. From this point, the remainder of the operation was carried through to completion uneventfully. Of note, surgical pathology from the resected distal esophagus and proximal stomach demonstrated extensive involvement of poorly differentiated squamous cell carcinoma extending into the surgical margins and deep muscular layers at the distal esophagus and stomach.

Discussion

Individually, head and neck carcinoma, esophageal cancer, and general anesthesia can contribute to difficult NGT intubation. Consequently, the patient in this case posed a dilemma to the anesthesiologist and surgeon, necessitating a novel approach. Patients with head and neck and esophageal cancers, particularly those who have undergone surgical resection and radiation therapy, present functional and anatomic obstacles to NGT intubation due to the potential presence of tumor, distorted anatomy, and/or soft tissue edema.[20,48] The neuromuscular effects of general anesthesia on relaxing and approximating the soft palate, tongue base, epiglottis, and posterior pharyngeal wall in addition to the presence of a tracheal tube can create further difficulty for NGT intubation.[1] Esophageal perforation has been established as a rare but potentially disastrous complication of NGT intubation, especially in the setting of malignancy.[49,50] The reported risk of esophageal perforation secondary to dilation of malignant strictures is about 10%.[51]

We have reviewed numerous techniques with varying levels of evidence to facilitate successful NGT intubation. Although our patient presented a unique circumstance, our retrograde method offers a safe and viable option. In determining the most appropriate approach to difficult NGT intubation, the risks and benefits of each technique must be considered with respect to the individual patient. Nevertheless, effective communication and a coordinated effort between the members of the health-care team should be made to ensure safe, efficient, and reliable NGT intubation.

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Declaration of conflicting interests

The authors declare that there is no conflict of interest.

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