Mini Review

A review of the bubble technique and other methods for confirming nasogastric tube position in anesthetized patients

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Anesthetized patients may have difficulty with the placement and verification of nasogastric tube, which may make insertion more difficult. We recently compared the bubble technique to the conventional method for confirming nasogastric tube insertion in patients under anesthesia and observed that the bubble technique had a greater confirmation rate than the conventional technique. The purpose of this article is to discuss the different techniques for confirming the nasogastric tube's position in the anaesthetized patient, with a special emphasis on the Bubble approach.

Key Words: *Nasogastric tube; Anesthesia; Bubble technique*

INTRODUCTION

Inserting and confirming a Naso Gastric Tube (NGT) in anaesthetized patients may be difficult, [1,2]. Repeated efforts following a failure are often ineffective. If misaligned, the NGT is more prone to kinking at the same location. The NGT most often impinges on piriform sinuses and arytenoid cartilage [3].

Though introducing an NGT is a relatively safe procedure, improper placement may result in severe and even deadly consequences. Multiple studies have shown that NG tubes can be commonly misplaced [4]. Placing the NGT accidentally in the respiratory tract may result in bronchoaspiration, pneumothorax, subcutaneous emphysema, pulmonary haemorrhage, empyema, and bronchopleural fistula [5]. These complications may emerge with the insertion or advancement of an NGT into the gastrointestinal system, including sinusitis, nasal septal erosion, epistaxis, and esophageal perforation [6]. Other uncommon complications associated with NGT include intracranial positioning, [7] mediastinitis, pneumomediastinum, and internal jugular vein perforation [8,9]. As a result, it is necessary to verify the proper positioning of NGT.

LITERATURE REVIEW

Numerous techniques have been proposed with different degrees of effectiveness for NGT insertion. In routine practice, blind nasal insertion is performed while maintaining external laryngeal manipulation or under direct vision using a laryngoscope, followed by instrumentation using Magill's forceps. Several traditional methods, including auscultations, gastric aspirate pH determination, and visual examination, are used to ensure that the nasogastric tube is adequately placed [10]. Calorimetric carbon dioxide indicators, X-ray, ultrasound, fluoroscopy, and magnet tracking are other techniques for verifying NGT location [10]. The literature also contains reports of the combination of several methods. For example, pulling the cricoid cartilage outward and rightward while maintaining moderate neck flexion is a simple and effective technique for NGT placement in unconscious intubated patients [10]. However, in the operation theatre, many of the times, NGT has to be inserted intraoperatively, where the abdomen is draped, and the majority of the methods listed above are not feasible.

Prasad et al. described the bubble technique as a novel approach for NGT insertion [11]. They reported this method as applying jelly to the proximal end of the NGT before insertion. Once the NGT passes the gastroesophageal junction and enters the stomach, the stomach's gas is expected to create a bubble at the NGT's proximal end. Additionally, they highlighted that when the NGT is twisted in the oral cavity, no bubbles appear; bubbles form repeatedly when placed intratracheally, and one or two bubbles appear when placed intragastrically. They placed over one hundred NGTs successfully utilizing this method during general anesthesia. We recently compared this approach to the traditional method on 249 individuals and found it beneficial [12].

DISCUSSION

We performed a parallel group randomized controlled trial on subjects aged 20 to 70 years who were scheduled for surgeries under general anaesthesia with neuromuscular blocking drugs, tracheal intubation, and required a nasogastric tube. In the control group, a lubricated NGT containing 2% lidocaine was inserted into the chosen nostril as a standard method, with the head remaining in the neutral position. The distal end of NGT in the bubble method group was lubricated with lidocaine jelly containing 2% lidocaine, and the proximal end was similarly lubricated with the similar jelly to fill its channel by 0.5 cm to 1.0 cm. Once the NGT tip passes the gastroesophageal junction and enters the stomach, a single bubble was anticipated to develop from the jelly owing to the presence of gas in the stomach at the NGT's proximal end. A blinded investigator outside of the operating room who was unaware of the group assignment verified the NGT position using fluoroscopy. If bubbles formed at the proximal end of NGT however no NGT was visible by fluoroscopy in the intervention group, it was considered as a false positive. If no bubble developed at the proximal end yet NGT was detected using fluoroscopy, the result was classified as a false negative.

We randomly assigned 249 patients to one of two groups: 125 to the Bubble group and 124 to the Control group. The confirmation rate for the bubble approach was 76.8 percent (95 percent Confidence Interval (CI): 68.7-83.3), which was considerably higher than the rate for the traditional method, which was 59.7 percent (95 percent CI: 50.9-67.9) (p 0.001). While compared with fluoroscopy, the bubble method had a sensitivity of 92.3 percent (95 percent Confidence Interval (CI): 85.6-96.1), a specificity of 81.0 percent (CI: 60.0-92.3), a positive predictive value of 96.0 percent (CI: 90.2-98.4), and a moderate negative predictive value of 68.0 percent (CI: 48.4-82.8).

We observed the bubble method for NGT insertion to be easy and effective, with no significant side effects [12]. Although Prasad et al. reported this method in 2011, it was not explored in the literature. This approach is applicable during the operating period, when the abdomen is draped, and the majority of the other techniques are impractical. When NGT is administered incorrectly, it may produce little or no symptoms, especially in individuals at high risk, like those who are not conscious or intubated, or who without a gag or swallowing reflex. Fluoroscopy or chest radiography is the gold standard method for verifying the nasogastric tube is in the right

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positions. We utilized the bubble method to insert the nasogastric tube and verified its location using fluoroscopy. In Table 1, we summarized the various techniques for NGT confirmation, their advantages and disadvantages, and related literature.

Newer other techniques for confirmation of the location of NGT

The video laryngoscope, successful tracheal intubation equipment, was utilized to assist NGT insertion and was superior to the blind method [20]. This gadget may improve the precision with which problems associated with NGT implantation are diagnosed [21]. Kavakli et al. discovered that using a video laryngoscope to help with NG tube insertion increased success rates and decreased kinking in sedated and intubated adult patients compared to using a traditional method. In these patients, using a video laryngoscope during nasogastric tube placement reduces mucosal bleeding.

TABLE 1

Different techniques for confirming the nasogastric tube's position in anesthetized patients

Methods Name	Technique	Advantage	Disadvantages	Literature
Insufflation and Auscultation	The NGT is used to insufflate air, whereas epigastrium is auscultated.	Simple, feasible, inexpensive	Bronchial "rumbling" sounds may be confused with epigastrium sounds, making this technique unreliable.	Metheny et al. discovered that the auscultation technique correctly placed the NG in just 34.4 percent of patients [13]. Likewise, Seguin et al. revealed that the insufflation and auscultation technique had a greater sensitivity (96%) but a lower specificity (17%) [14].
Gastric aspirate pH	Ph value between 1 and 5 corresponds to the NGT's tip location in the stomach.	Easy to perform	Not feasible within the operating room, as sometimes, no gastric contents are aspirated through the NGT.	Muslu et al. showed that the pH meter's specificity was 100 percent (95 percent confidence interval (CI) 16.6–100 percent), while its sensitivity was 76.5 percent (95 percent CI 58.8–89.2 percent) [15]. Seguin et al. observed that measuring the pH of stomach fluid had a sensitivity of 49% and a specificity of 74% for determining the NGT location [14].
Calorimetric carbon dioxide indicators	It utilizes colorimetric paper devices, which is designed to show an easily discernible shift in color within seconds after the detection of carbon dioxide	It may be used effectively to differentiate the insertion of a respiratory tube from that of a GI tube.	It does not, however, differentiate between gastric and duodenal insertions.	Erzincanli et al. determined that the colorimetric capnometry technique had a sensitivity of 100 % and a specificity of 66.7 % in identifying the proper positioning of the nasogastric tube [16].
Ultrasound	Neck and subxiphoid ultrasound	Non-invasive No radiation exposure	Requires competence in verifying the location of the NGT, which is not generally available in the operating room.	Yldrm et al. compared neck and subxiphoid ultrasonography to chest radiographs for evaluation of nasogastric tube placement in 49 patients. 4 They reported that neck ultrasonography had a sensitivity of 91.5 percent and a positive predictive value of 100 percent. The sensitivity of subxiphoid ultrasonography was 78.72 percent [4].
X-Ray and Fluoroscopy	Normal NGT descends in the thorax in the midline, bisects the carina in the midline, and crosses the diaphragm in the midline, with its tip located below the diaphragm.	Gold standard method Most Accurate	X-ray exposure	Chen et al. demonstrated that fluoroscopic guided placement of NGT is a promising option for patients with complicated anatomies associated with advanced head and neck cancer [17].
Bubble technique	A jelly is administered to the proximal end of the NGT prior to insertion. The stomach's gas is intended to create a bubble at the NGT's proximal end.	Can be utilized intraoperatively, while the abdomen is draped.	No significant side effect	Sharma et al. observed that the Bubble method had a sensitivity of 92.3 percent and a positive predictive value of 96.0 percent [12].
Manometer pressure guided	NGT motion is guided by manometer pressure measurements and its location is confirmed by using a fiberscope	Non-observer dependent	Evaluated only in mechanically ventilated patients	Chen et al. examined 40 adult mechanically ventilated patients and found that the NGT placement was more successful on the first effort in the manometry group than those in the control group (100 percent vs. 70%; p = 0.02) [18].
Magnet tracking system	A sensor array external to the computer keep an eye on the position of a tiny magnet fixed to the end of an NGT.	Assess the NGT's position with certainty. More accurate	Expensive Needs significant user training. Difficult for anaesthetized patients within in the operating room	Bercik et al. showed that magnet tracking was 100 % accurate in their study [19].

Sharifnia et al. randomly assigned 100 adult patients undergoing abdominal surgery under general anesthesia to receive the NGT using a wire rope guide with chin lift (wire group) or by a head flexion method (control group) [22]. They discovered that the wire group had a 98 percent success rate on the first attempt, whereas the control group had a 74 percent success rate (P =.001). The median time needed for NGT insertion was substantially lower in the wire group (35.3 4.8 vs. 61.5 6.2 seconds, P =.001). The wire

group had a substantially reduced frequency of kinking/coiling, bleeding, and moderate injuries. They found that using a rope wire guide to place the NGT correctly in intubated patients is less time-consuming and has a high success rate on the first attempt.

Ruananukun et al. randomly assigned 80 adult patients requiring intraoperative nasogastric tube insertion to either the gastric biopsy forceps aided method (stylet group) or the traditional blind procedure (control group) [23]. The stylet group achieved 92.5 percent of initial attempts, compared to 65 percent in the control group (P = 0.013). Overall, the stylet group had a better success rate (100 percent versus 85 percent; P = 0.026). The stylet group needed less time to insert the nasogastric tube (24.85 9.62 vs. 62.4 59.38 seconds; P = 0.002). They concluded that using gastric biopsy forceps to assist with nasogastric tube insertion resulted in a higher success rate and shorter insertion time.

Behera et al. have presented a new technique for confirming the Naso Gastric tube (NGT) location and tip localization in sedated and intubated adult patients utilizing flexible video bronchoscopy [24]. The scope used was 65 cm in length and can therefore follow the NGT to the pyloric canal. They insufflated 2 L/min of oxygen via the working channel of scope to prevent the tip from fogging, which also aids in opening the esophagus during endoscopy. Suctioning repeatedly prevented gastric distension caused by oxygen insufflation. The entire course of the NGT may be observed in the esophagus and stomach.

Hirano et al. investigated the efficacy of utilizing biologically transparent light to identify the proper location of the nasogastric tube in 102 patients undergoing general surgery [25]. After general anesthesia, a nasogastric tube with a biologically transparent lighting catheter was implanted in all patients. The presence of physiologically transparent light in the epigastric region, with or without finger pressure, showed that the tube had been introduced successfully into the stomach. The tube location was determined using an X-ray inspection, which was then compared to the results of the biologically transparent lighting method. X-ray examination verified the location of the nasogastric tube in the stomach. They found that physiologically transparent lighting is an effective and safe method for identifying the proper location of the nasogastric tube in surgical patients under general anesthesia, with a sensitivity and specificity of 77.4 percent and 100 percent, respectively.

CONCLUSION

Significant advancements in the area of NGT placement confirmation have been made throughout the years. However, the optimal method has not been found yet. Therefore, we examined the bubble technique for nasogastric tube insertion in anesthetized patients and observed that the bubble technique had a greater confirmation rate than the conventional technique. Further studies should be conducted to develop an optimal technique to confirm the NGT placement that is accurate, cheap, and simple to use.

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