



REVISTA BRASILEIRA DE ANESTESIOLOGIA

Publicação Oficial da Sociedade Brasileira de Anestesiologia
www.sba.com.br



SCIENTIFIC ARTICLE

Comparison of different methods of nasogastric tube insertion in anesthetized and intubated patients



Ali Sait Kavakli*, Nilgun Kavrut Ozturk, Arzu Karaveli, Asuman Arslan Onuk, Lutfi Ozyurek, Kerem Inanoglu

Antalya Training and Research Hospital, Department of Anesthesiology and Reanimation, Antalya, Turkey

Received 2 February 2016; accepted 7 August 2016
Available online 2 September 2016

KEYWORDS

Intubation,
nasogastric;
Endotracheal tube
assisted;
Video laryngoscope;
Success rate

Abstract

Background: Nasogastric tube insertion may be difficult in anesthetized and intubated patients with head in the neutral position. Several techniques are available for the successful insertion of nasogastric tube. The primary aim of this study was to investigate the difference in the first attempt success rate of different techniques for insertion of nasogastric tube. Secondary aim was to investigate the difference of the duration of insertion using the selected technique, complications during insertion such as kinking and mucosal bleeding.

Material and methods: 200 adult patients, who received general anesthesia for elective abdominal surgeries that required nasogastric tube insertion, were randomized into four groups: Conventional group (Group C), head in the lateral position group (Group L), endotracheal tube assisted group (Group ET) and McGrath video laryngoscope group (Group MG). Success rates, duration of insertion and complications were noted.

Results: Success rates of nasogastric tube insertion in first attempt and overall were lower in Group C than Group ET and Group MG. Mean duration and total time for successful insertion of NG tube in first attempt were significantly longer in Group ET. Kinking was higher in Group C. Mucosal bleeding was statistically lower in Group MG.

Conclusion: Use of video laryngoscope and endotracheal tube assistance during NG tube insertion compared with conventional technique increase the success rate and reduce the kinking in anesthetized and intubated adult patients. Use of video laryngoscope during nasogastric tube insertion compared to other techniques reduces the mucosal bleeding in anesthetized and intubated adult patients.

© 2016 Sociedade Brasileira de Anestesiologia. Published by Elsevier Editora Ltda. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

* Corresponding author.

E-mail: alisaitkavakli@hotmail.com (A.S. Kavakli).

PALAVRAS-CHAVE

Intubação,
nasogástrica;
Intubação traqueal
assistida;
Videolaringoscópio;
Taxa de sucesso

Comparaç o de diferentes m todos de inserç o de sonda nasog strica em pacientes anestesiados e intubados

Resumo

Justificativa: A inserç o de sonda nasog strica (NG) pode ser dif cil em pacientes anestesiados e intubados com a cabe a em posiç o neutra. H  v rias t cnicas para a inserç o bem-sucedida de sonda NG. O objetivo prim rio deste estudo foi investigar a diferen a da taxa de sucesso na primeira tentativa de diferentes t cnicas para inserç o de sonda NG. O objetivo secund rio foi investigar a diferen a do tempo de inserç o com o uso da t cnica selecionada e as complicaç es durante a inserç o (dobradura da sonda e sangramento da mucosa).

Material e m todos: 200 pacientes adultos que receberam anestesia geral para cirurgias abdominais eletivas que exigiam inserç o de sonda NG foram randomicamente distribu dos em quatro grupos: grupo convencional (Grupo C), grupo com a cabe a posicionada lateralmente (Grupo L), grupo com assist ncia de tubo traqueal (Grupo TE) e grupo com videolaringosc pio McGrath (Grupo MG). As taxas de sucesso, os tempos de inserç o e as complicaç es foram registrados.

Resultados: As taxas de sucesso de inserç o da sonda NG na primeira tentativa e em geral foram menores no Grupo C que nos grupos TE e MG. As duraç es e os tempos totais de inserç o bem-sucedida da sonda NG na primeira tentativa foram significativamente maiores no Grupo TE. Dobradura foi maior no Grupo C. Sangramento da mucosa foi estatisticamente menor no Grupo MG.

Conclus o: O uso de videolaringosc pio e de TE durante a inserç o de sonda NG comparado ao uso da t cnica convencional aumentou a taxa de sucesso e reduziu a dobradura da sonda em pacientes adultos anestesiados e intubados. O uso de videolaringosc pio durante a inserç o de sonda NG em comparaç o com outras t cnicas reduz o sangramento da mucosa em pacientes adultos anestesiados e intubados.

  2016 Sociedade Brasileira de Anestesiologia. Publicado por Elsevier Editora Ltda. Este   um artigo Open Access sob uma licen a CC BY-NC-ND (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

Introduction

Insertion of nasogastric (NG) tube is frequently performed procedure for laparoscopic or major abdominal surgeries. This procedure may be sometimes difficult for anesthesiologists. In anesthetized and intubated patients, the gastric tube may become coiled in oral cavity due to inability to swallow and presence of an inflated cuff in the proximal trachea. Furthermore, flexible structure of the NG tube may be cause to coiling and unsuccessful placement. Non-opposing lateral eyes like opening near the tip may provoke kinking of NG tube.¹ Many studies have been reported lower success rates on the first attempt and more complications with the head in the neutral position.²⁻⁵

Previous studies have been described the different techniques for facilitation of NGT insertion such as the use of intubation stylet,¹ endotracheal tube-assisted technique,⁶ endoscopic technique,⁷ the use of frozen NG tube,⁸ use of 'peel-away' split tracheal tube,⁹ angiography catheter guided technique,¹⁰ esophageal guidewire-assisted technique.¹¹ Effective devices used in tracheal intubation such as Glidescope,¹² King Vision,¹³ Pentax-AWS¹⁴ video laryngoscopes have been reported to facilitate the NG tube insertion.

We hypothesized that use of different techniques for NG tube insertion could increase the rate of successful insertion compared with the conventional technique in

anesthetized and intubated patients undergoing abdominal surgery. Therefore, we compared conventional technique, head in the lateral position, endotracheal tube assisted technique and use of McGrath MAC video laryngoscope for NG insertion to determine the success rate, duration for insertion, and incidence of complications, such as bleeding and kinking.

Methods

This study was prepared through the application of the guidelines of "The Declaration of Helsinki", evaluated and approved by the ethics committee of the Training and Research Hospital, Antalya, Turkey, Approval Number 64/14, and it was also entered into the Clinicaltrials.gov clinical trials registry (n  NCT02557204). All patients gave their written informed consent to take part of the study.

The primary aim of this study was to investigate the difference in the first attempt success rate of different techniques for insertion of NG tube. Secondary aim was to investigate the difference of the duration of insertion using the selected technique, complications during insertion such as kinking and mucosal bleeding.

Two hundred adult patients, who received general anesthesia for elective abdominal surgeries that required NG tube insertion, were randomly divided into four groups

by computer-generated randomization: conventional group (Group C), head in the lateral position group (Group L), endotracheal tube (ET) assisted group (Group ET) and McGrath video laryngoscope group (Group MG).

Patients with a history of coagulopathy, nasal stenosis, upper respiratory tract anomalies, esophageal varix, esophageal hiatus hernia, base of skull fracture, loose teeth, Cormack and Lehane and/or Mallampati scores of 3 or 4 were excluded.

On patient's arrival to the operating room, a peripheral venous catheter was established. Standard monitoring was included non-invasive blood pressure, five-lead electrocardiography and pulse oximetry. In all patients, general anesthesia was induced with intravenous propofol $2 \text{ mg} \cdot \text{kg}^{-1}$, fentanyl $2 \mu\text{g} \cdot \text{kg}^{-1}$, rocuronium $0.6 \text{ mg} \cdot \text{kg}^{-1}$. All patients were tracheally intubated, with a 7.5 mm internal diameter endotracheal tube in females and an 8.0 mm internal diameter endotracheal tube in males. Anesthesia was maintained with 5–6% desflurane and nitrous oxide 60% in oxygen, with positive pressure ventilation in a circle system.

All NG tube insertions were performed by the same three anesthesiologists who blinded to study experienced in the techniques. The authors did not perform NG tube insertion to avoid operator bias. A Fr. 16, 121 cm NG tube (Bicakcilar, Istanbul, Turkey) was used in all cases.

In Group C, the NG tube was inserted gently through a selected nostril while the head maintained in the neutral position without any maneuvers or instrument.

In Group L, the patient's head was turned to the right lateral position. NG tube was inserted through the selected nostril without any maneuvers of the neck.

In Group ET, the NG tube was inserted through selected nostril. Patient's mouth was opened with two fingers and about 80 cm of NG tube was taken out from the mouth. For preparing of split ET, an ET which has 7.5 mm internal diameter tube was carefully cutted lengthways (from distal to proximal end) with sterile scissors and lubricated both inner and outer surface. NG tube was inserted into the splitted ET. ET was advanced blindly through the oral cavity to a depth approximately 18 cm without using laryngoscope while ET had NG tube inside it. And then NG tube was advanced approximately 65 cm ($\pm 5 \text{ cm}$). NG tube was freed from the cut of the ET when the successful insertion was verified. And it was pulled out through the nostril until the required length (Fig. 1).

In Group MG, McGrath MAC video laryngoscope (Aircraft Medical Ltd, Edinburgh, UK) was inserted intraorally when the pyriform sinus or esophagus was viewed; NG tube was inserted transnasally and advanced into esophagus under direct vision (Fig. 2).

In all procedures, successful insertion was confirmed by hearing the gurgling sounds of auscultation over the epigastrium when injecting 10 mL of air via the NG tube. All patients were examined by direct laryngoscopy in terms of oral mucosal bleeding after nasotracheal tube placement.

The duration of insertion time was measured with a stopwatch by an anesthetic nurse. Duration of insertion time was defined as the start when the NG tube was inserted through the nostril and as the end when the successful insertion was confirmed in first attempt. If the first attempt failed; the NG tube was fully withdrawn, cleaned, lubricated (Dispogel, Dispofarma, Ankara, Turkey) and the procedure



Figure 1 Endotracheal tube assisted technique.

were repeated using the same technique. If two attempts for insertion were unsuccessful; the selected technique was considered as a failure. NG tube was inserted with the assistance of a laryngoscope and Magill forceps under direct vision in all failed procedures. When more than one attempt was required, NG tube insertion times for each attempt were summed, but times between attempts which included cleaning and relubricating of NG tube were neglected.

Success rate of the selected technique (first attempt, second attempt and overall), duration of insertion for selected technique, complications such as kinking and mucosal bleeding were noted.

Power analysis was performed to evaluate the success rates of different techniques in the first attempt of insertion of NG tube. A pilot study with 15 patients per group was performed to calculate the estimated sample size.



Figure 2 Use of McGrath MAC video laryngoscope.

Table 1 Patients' characteristics (values are mean \pm SD or number with percentage).

	Group C (n=50)	Group L (n=50)	Group ET (n=50)	Group MG (n=50)	p-Value
Age	54.3 \pm 11.2	52.2 \pm 10.7	55.7 \pm 9.9	50.9 \pm 11.3	0.726
<i>Gender</i>					
Male	28 (56%)	26 (52%)	25 (50%)	27 (54%)	0.544
Female	22 (44%)	24 (48%)	25 (50%)	23 (46%)	0.623
BMI (kg.m ⁻²)	24.1 \pm 3.3	24.4 \pm 2.9	23.7 \pm 4.1	23.9 \pm 2.8	0.584
Height (cm)	162.9 \pm 6.7	161.2 \pm 5.9	163.4 \pm 6.2	162.6 \pm 5.1	0.695
<i>Preoperative ASA status</i>					
ASA 1	29 (58%)	28 (56%)	29 (58%)	31 (62%)	0.644
ASA 2	17 (34%)	17 (34%)	16 (32%)	15 (30%)	0.826
ASA 3	4 (8%)	5 (10%)	5 (10%)	4 (8%)	0.794
<i>Mallampati scores</i>					
MP 1	30 (60%)	28 (56%)	31 (62%)	33 (66%)	0.462
MP 2	20 (40%)	22 (44%)	19 (38%)	17 (34%)	0.371

BMI, body mass index; ASA, American Society of Anesthesiologists; MP, mallampati.

Consequently, a minimum of 44 patients for each group was required for an approximate 30% improvement (from base rate of 55% to 85%) in success rate of NG tube insertion using these techniques ($\alpha=0.05$ and $\beta=0.2$). Hence, 50 patients per group were included to replace any dropouts.

Statistical analysis was performed using SPSS version 21 statistical software (SPSS Inc., Chicago, IL, USA). All numerical data were tested for normal distribution by Kolmogorov–Smirnov test. Categorical data were analyzed using Pearson Chi-square or Fisher exact test. Continuous data were analyzed using ANOVA or Kruskal–Wallis test. All data are expressed as mean \pm standard deviation (SD) for continuous data and numbers (percentage) for categorical data. *p*-Value less than 0.05 were considered statistically significant.

Results

Two hundred patients were enrolled in the study. There was no difference in age, gender, body mass index, height, American Society of Anesthesiologists (ASA) physical status and mallampati scores in all four groups (Table 1).

Success rate of NG insertion in first attempt was lower in Group C than Group ET and Group MG. Similarly, overall success rate was lower in Group C compared with Group ET and Group MG. There was no statistical difference between Group L, Group ET and Group MG in terms of success rates (Table 2).

Mean duration for successful insertion of NG tube in first attempt was significantly longer in Group ET than other groups. Total time for successful insertion of NG tube was significantly longer in Group C compared to Group L and Group MG. Total time for successful insertion of NG tube was similar in Group L and Group MG (Table 3).

A few complications were noted: kinking and mucosal bleeding. Kinking was higher in Group C. Mucosal bleeding was statistically lower in Group MG compared to other groups (Table 4).

Life-threatening complications arising from NG tube insertion such as esophageal or stomach perforation, severe bleeding was not observed.

Discussion

Our study shows that, NG insertion using conventional technique is cause to lower success rate and more complications.

There are studies available in the literature comparing different techniques for NG insertion.

In study by Mohariri and colleagues¹² prospectively compared conventional technique and using GlideScope video laryngoscope for NG tube insertion in 80 patients; success rate in first attempt was 57.5% in conventional group and 85% in Glidescope group. These findings were similar to our study. Overall success rate was higher in conventional group than our study (95% and 56%, respectively). This difference may be due to limited with two attempts for every technique

Table 2 Success rates of nasogastric tube insertion (values are number with percentage).

	Group C (n=50)	Group L (n=50)	Group ET (n=50)	Group MG (n=50)
First attempt	27 (54%)	39 (78%)	50 (100%) ^a	46 (92%) ^b
Second attempt	6 (12%)	5 (10%)	0 (0%)	3 (6%)
Overall success	33 (66%)	44 (88%)	50 (100%) ^c	49 (98%) ^d

^a *p*=0.001 ET vs. C.

^b *p*=0.028 MG vs. C.

^c *p*=0.038 ET vs. C.

^d *p*=0.044 MG vs. C.

Table 3 Comparison of duration for nasogastric tube insertion (values are mean \pm SD).

	Group C (n = 50)	Group L (n = 50)	Group ET (n = 50)	Group MG (n = 50)
Mean duration for successful first attempt (s)	27.3 \pm 3.8	21.4 \pm 5.3 ^a	82.3 \pm 7.9 ^b	24.6 \pm 2.3 ^c
Total time for successful insertion (s)	62.5 \pm 15.3	43.4 \pm 7.8 ^d	82.3 \pm 7.9 ^e	42.4 \pm 4.2 ^f

^a $p=0.001$ ET vs. L.^b $p=0.001$ ET vs. C.^c $p=0.001$ ET vs. MG.^d $p=0.047$ L vs. C.^e $p=0.021$ ET vs. C and $p=0.001$ ET vs. L.^f $p=0.038$ MG vs. C and $p=0.001$ ET vs. MG.**Table 4** Complications (values are number with percentage).

	Group C (n = 50)	Group L (n = 50)	Group ET (n = 50)	Group MG (n = 50)
Kinking	10 (20%)	3 (6%) ^a	0 (0%) ^b	1 (2%) ^c
Mucosal bleeding	10 (20%) ^d	9 (18%) ^e	10 (20%) ^f	1 (2%)

^a $p=0.039$ C vs. L.^b $p=0.001$ C vs. ET.^c $p=0.020$ C vs. MG.^d $p=0.020$ C vs. MG.^e $p=0.041$ L vs. MG.^f $p=0.020$ ET vs. MG.

in our study. Because; they had reached this ratio after third attempt.

In study by Okabe and colleagues¹³ which was performed in 60 patients by using King Vision video laryngoscope compared to the conventional technique; overall success rate was 90% in conventional group and 100% in King Vision group. Unlike our study, they were considered to be a failed attempt if the time required for insertion was 5 min or more. The longer attempt period may cause to high success rate in the conventional group.

In both studies, high success rate with the use of video laryngoscope demonstrated the effectiveness of the NG tube insertion under direct vision.

If the patient's head turns to laterally; tip of the tube may follow the lateral border of the pharynx and the tube may advance through the esophagus without coiling in the laryngopharynx.² Disadvantage of this technique is being unsafe for patients with unstable cervical spine and head injuries. Bong and colleagues² reported that success rate in first attempt was 80% in the head in the lateral position and 40% in the head in the neutral position. They reported that head in the lateral position technique avoided some of complexity and time-consuming measures of failed NG tube insertion. In our study, success rates in first attempt and overall were higher in head in lateral position than neutral group. But there were no significant difference.

Rigidity of the NG tube may affect success rate. Warming and softening of NG tube during the insertion may affect the pass of NG tube. An ET guidance can be used to increase tube rigidity.¹⁵ Kwon and colleagues⁶ reported efficacy of NG insertion in a study performed in 56 patients. In their study, success rate in first attempt (100%) and overall (100%) was similar to ET group in our study. Appukutty and Shroff reported a similar result after second attempt as 92%.⁵

Trauma can be observed along the tract from the nares to esophagus during NG insertion and it can cause to bleeding.

Blind insertion can increase the risk.¹⁶ Kinking and coiling of the NG tube is described as the most common complication during NG insertion with conventional technique in the previous studies.^{1,5,6,11,17,18} NG tube is mostly impacted in the pyriform sinuses and arytenoid cartilage.¹⁹ These results comply with our findings. In our study, kinking was the most common complication in Group C compared to other groups.

Direct vision can decrease duration of NG insertion and trauma-related complications in anesthetized patients.^{20,21} In our study, in Group MG, complications were lower than the other groups.

Our study has some limitations. The main limitation of this study; the anesthesiologists who performed the NG insertion knew the technique used for NG tube insertion. Therefore, NG insertions were performed by three anesthesiologists who were blinded to the study to avoid potential investigator evaluation bias. Another limitation was verification of the NG tube placement. Confirming the NG insertion by auscultation method may not be reliable all the time.²² But we preferred this method because it was easy to apply and used as a routine.

Potential criticism is why we did not use Magill forceps for NG insertion in ET group. Because; in ET group, mucosal bleeding was more than other groups. Using the Magill forceps under direct visualization by laryngoscopy has increased the risk of upper airway trauma.²³ This situation could affect the results of our study.

Conclusions

Based on our results, use of video laryngoscope and endotracheal tube assisted NG tube insertion compared to conventional technique increase the first attempt success rate and reduce the kinking in anesthetized and intubated adult patients. Use of video laryngoscope for NG tube

insertion compared to endotracheal tube assisted technique reduces the duration of insertion. Use of video laryngoscope during NG tube insertion compared to other techniques reduces mucosal bleeding in anesthetized and intubated adult patients. Further studies with higher sample sizes and patients with difficult airways should be done to confirm the conclusions of our study.

Funding

Departmental resources were used for the study.

Conflicts of interest

The authors declare no conflicts of interest.

References

1. Tsai YF, Luo CF, Illias A, et al. Nasogastric tube insertion in anesthetized and intubated patients: a new and reliable method. *BMC Gastroenterol.* 2012;12:99.
2. Bong CL, Macachor JD, Hwang NC. Insertion of the nasogastric tube made easy. *Anesthesiology.* 2004;101:266.
3. Mahajan R, Gupta R. Another method to assist nasogastric tube insertion. *Can J Anaesth.* 2005;52:652–3.
4. Kayo R, Kajita I, Cho S, et al. A study on insertion of a nasogastric tube in intubated patients. *Masui.* 2005;54:1034–6.
5. Appukutty J, Shroff PP. Nasogastric tube insertion using different techniques in anesthetized patients: a prospective, randomized study. *Anesth Analg.* 2009;109:832–5.
6. Kwon OS, Cho GC, Jo CH, et al. Endotracheal tube-assisted orogastric tube insertion in intubated patients in an ED. *Am J Emerg Med.* 2015;33:177–80.
7. Bostan AG. A novel endoscopic technique for failed nasogastric tube placement. *Otolaryngol Head Neck Surg.* 2015;153:685–7.
8. Chun DH, Kim NY, Shin YS, et al. A randomized, clinical trial of frozen versus standard nasogastric tube placement. *World J Surg.* 2009;33:1789–92.
9. Dobson AP. Nasogastric tube insertion-another technique. *Anaesthesia.* 2006;61:1127.
10. Ghatak T, Samanta S, Baronia AK. A new technique to insert nasogastric tube in an unconscious intubated patient. *N Am J Med Sci.* 2013;5:68–70.
11. Kirtania J, Ghose T, Garai D, et al. Esophageal guidewire-assisted nasogastric tube insertion in anesthetized and intubated patients: a prospective randomized controlled study. *Anesth Analg.* 2012;114:343–8.
12. Moharari RS, Fallah AH, Khajavi MR, et al. The GlideScope facilitates nasogastric tube insertion: a randomized clinical trial. *Anesth Analg.* 2010;110:115–8.
13. Okabe T, Goto G, Hori Y, et al. Gastric tube insertion under direct vision using the King Vision™ video laryngoscope: a randomized, prospective, clinical trial. *BMC Anesthesiol.* 2014;14:82.
14. Ikeno S, Nagano M, Tanaka S, et al. Gastric tube insertion under visual control with the use of the Pentax-AWS. *J Anesth.* 2011;25:475–6.
15. Sprague DH, Carter SR. An alternate method for nasogastric tube insertion. *Anesthesiology.* 1980;53:436.
16. Halloran O, Grecu B, Sinha A. Methods and complications of nasoenteral intubation. *JPEN J Parenter Enteral Nutr.* 2011;35:61–6.
17. Illias AM, Hui YL, Lin CC, et al. A comparison of nasogastric tube insertion techniques without using other instruments in anesthetized and intubated patients. *Ann Saudi Med.* 2013;33:476–81.
18. Mandal MC, Dolai S, Ghosh S, et al. Comparison of four techniques of nasogastric tube insertion in anaesthetised, intubated patients: a randomized controlled trial. *Indian J Anaesth.* 2014;58:714–8.
19. Parris WC. Reverse Sellick maneuver. *Anesth Analg.* 1989;68:423.
20. Gombar S, Khanna AK, Gombar KK. Insertion of a nasogastric tube under direct vision: another atraumatic approach to an age-old issue. *Acta Anaesthesiol Scand.* 2007;51:962–3.
21. Jones A, Diddee R, Bonner S. Insertion of a nasogastric tube under direct vision. *Anaesthesia.* 2006;61:305.
22. Milsom SA, Sweeting JA, Sheahan H, et al. Naso-enteric tube placement: a review of methods to confirm tip location, global applicability and requirements. *World J Surg.* 2015;39:2243–52.
23. Weber S. Traumatic complications of airway management. *Anesthesiol Clin N Am.* 2002;20:503–12.