ORIGINAL ARTICLE

OROGASTRIC TUBE USE IN PATIENTS UNDERGOING CARDIAC SURGERY, A PILOT STUDY

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Abstract

***Objectives**: This pilot study investigated the potential impact of using orogastric tube (OGT) on the immediate post-operative outcomes in adult patients undergoing coronary artery bypass graft procedures.*

***Design:** A prospective non-blinded randomised study.*

***Setting:** At a single University Hospital.*

***Participants:** Seventy-eight consecutive adult patients that underwent coronary artery bypass graft surgery were included.*

***Interventions:** Thirty-nine patients received an OGT, and thirty-nine patients did not (control group).*

***Measurements:** Primary outcomes included: the incidence of postoperative nausea and vomiting, opiate use for pain, prolonged ventilation, and gastric dilatation on x-ray. Secondary outcomes included: the incidence of major adverse cardiac and cerebral events, major respiratory, gastrointestinal, and renal complications, and total hospital length of stay.*

***Main Results:** There were non-significant trends towards higher incidence of post-operative nausea (n=2/39; 5.1%; p=0.156) and vomiting (n=1/39; 2.6%, p=0.314) in the OGT group compared to the non-OGT group (n = 0). There was a significant increase in opiates use for pain in the OGT group (n = 13/39; 33.3%) compared to the non-OGT group (n = 3/39, 7.7%) (p=0.0054), indicating that OGT may contribute to the development of postoperative pain or discomfort. There was no difference in the incidence of major postoperative outcomes.*

***Conclusions:** In this pilot study, the use of OGT did not impact the immediate postoperative outcomes after coronary artery bypass surgery. However, it was significantly associated with higher use of opiates in these patients.*

***Keywords:** Nasogastric tube; Orogastric tube; Coronary artery bypass graft; Post-operative outcomes; Opiates; Vomiting; Pneumonia*

INTRODUCTION

Nasogastric and orogastric tube use in cardiac surgery patients

Despite that the routine use of nasogastric tube (NGT) is widely accepted in general surgical patients, there does not appear to be sufficient data on its benefits in patients undergoing cardiac surgery. In fact, limited evidence suggested that NGT use does not affect post-operative outcomes, including nausea and vomiting, and that it may even increase postoperative complications such as respiratory infections, pain, and discomfort[1-4]. These complications may be of particular concern in the subgroup of cardiac surgical patients who require prolonged ventilation and extended hospital stay who are at higher risk of developing postoperative adverse effects[5-7]. For instance, pneumonia, one of the most serious post-cardiac surgery complications, has been associated with the prolonged use of NGT in previous reports of patient outcomes[2,3]. In addition, NGT use was reported as being one of the risk factors for nosocomial respiratory infections among hospitalized patients[1]. Other studies have reported that the use of NGT postoperatively may worsen postoperative ileus[8].

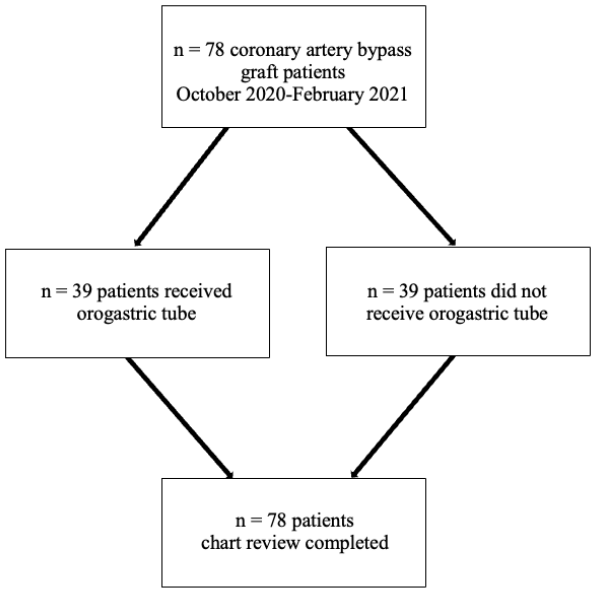

Figure 1

Patient selection flow chart for the study. 78 patients were included in the study, of which 39 received an OGT (study group) and 39 were controls.

Figure created using BioRender
OGT = orogastric tube

Also, prophylactic nasogastric decompression after abdominal surgery was reported to fail at improving hospital length of stay, wound complications (infection, fascial dehiscence, incisional hernia), pulmonary complications (atelectasis, aspiration, pneumonia, fever, pharyngolaryngitis), and abdominal discomfort[9].

Moreover, NGT use has been reported to be associated with nasopharyngeal discomfort and gagging[4], while others have recommended to avoid the use of NGT to prevent interference with peri-operative radiographic imaging[10,11]. While some authors recommended the use of NGT to minimize post-operative nausea and vomiting, a very common problem after cardiac surgery[12,13], these findings did not seem to be reproducible by other groups[14,15]. In fact, it was proposed that NGT does not alleviate gastric distention, and that it may even exacerbate this due to promoting air swallowing[16,17]. Besides these outcomes, NGT may be effectively used for the early administration of essential medications, such as aspirin and anti-epileptic medications, in the immediate postoperative period in intubated patients which can play a key role in improving postoperative outcomes[18].

In a previous review by our group, we highlighted the lack of evidence regarding the potential role of NGT use in cardiac surgical patients[19]. Also, there seems to be a generalized lack of consensus on the most adequate NGT management protocol (such as the timing of insertion/removal, confirmation of the right positioning, and the application of negative suction) in these patients.

There are not specific studies that have exclusively investigated the use of orogastric tube (OGT) (as opposed to NGT) in cardiac surgical patients, though guidelines suggest that OGTs may be favourable over NGTs since OGT use can reduce the risk of nosocomial sinusitis and pneumonia[20]. However, both terms have been used interchangeably in literature despite the inherent difference between the two routes[21,22]. In addition, NGT is typically removed once the patient is extubated thus eliminating a major component of patient discomfort and potential complications that were reported in the context of the prolonged use of NGT.

Therefore, the aim of this pilot study was to explore potential impact of using OGT in patients undergoing isolated coronary artery bypass surgery in terms of postoperative outcomes and whether its use may play a role in enhancing recovery in these patients.

METHODS

Study Design and Data Collection

This is a single-center prospective study that enrolled all consecutive patients who were scheduled for isolated CABG at our institution during the study period. Patients were assigned to receive OGT or not on a fixed 1:1 pattern to achieve a balanced sample size between the two study groups. Neither group received a NGT. Block randomization strategy was followed to create two equal-size groups and to ensure homogeneous baseline characteristics. Patients were included only if they were 18 years or older and underwent an isolated CABG surgery during the study period. Exclusion criteria were emergency procedures, critical preoperative status, and

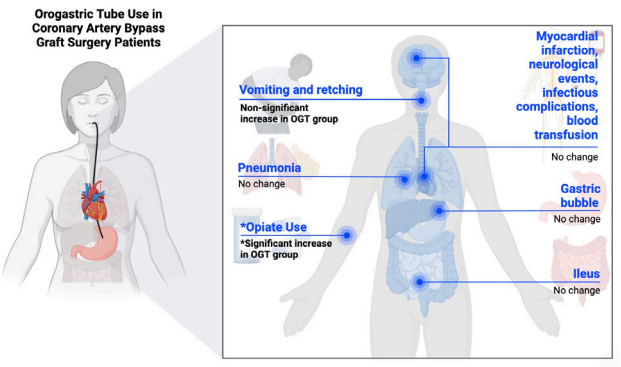

Figure 2

Summary of outcomes in the OGT cohort compared to the non-OGT cohort. Significant increases in opiate use and non-significant increases in vomiting and retching were observed in the group of patients that received an OGT compared to the group that did not. Other outcomes, including pneumonia, ileus, gastric bubble, myocardial infarction, neurological events, infectious complications, and blood transfusion did not have significant differences between the group.

Figure created using BioRender
OGT = orogastric tube

patients who already had a preoperative OGT in situ. A total of 78 patients, 39 in the OGT group and 39 in the no-OGT group (controls), were included in the study. Data outcomes were recorded in a secure electronic datasheet. Patient selection is summarized in Figure 1.

OGT Management Protocol

The study protocol was developed in consensus between cardiac surgery, cardiac anesthesia, and cardiac critical care teams. The OGT was inserted orally in the operating room after the chest was closed and before the patients was transferred to intensive care unit. Placement of OGT in the esophagus was confirmed by direct visual inspection using a laryngoscope in the operating room. After OGT placement, manual suctioning of gastric contents was performed to empty the stomach and the OGT was capped during patient transfer. Upon arrival to intensive care unit, the OGT was manually suctioned then connected to intermittent low-grade negative suction (-40 mmHg). A chest-abdomen X-ray was obtained to confirm OGT placement. All patients underwent transesophageal echocardiography (TOE) examination, and the OGT was inserted after the TOE probe was removed at the end of surgery. Once patients were neurologically and hemodynamically stable with good respiratory mechanics and blood gases, they were extubated. When the patient was ready for extubation, manual suction of OGT was performed prior to removal of the oro-tracheal tube. OGT was removed at the same time of extubation to minimize patient's discomfort. Another chest X-ray was performed the morning following surgery to assess for the pulmonary complications in all patients.

Medication Use

None of the included patients were receiving anti-emetics preoperatively, and intraoperative anti-emetics were not used. The postoperative protocol for the use of anti-emetics included metoclopramide 10mg iv Q 8 hours as requested by the patient and approved by the intensive care unit physician. Risk assessment for post-operative nausea and vomiting was not done routinely.

The same protocol for intraoperative opiate use was applied to all patients, including moderate opioid dose (fentanyl 10-20 mcg/kg or sufentanil 1-2 mcg/kg), inhalational anaesthesia (isoflurane or sevoflurane up to 1.5 MAC), propofol, midazolam and succinylcholine and/or rocuronium. Ono-opioid analgesia use included ketorolac 15-30 mg iv Q 8 hours pro re nata and Acetaminophen 1gm iv Q 6 hours regularly. None of the patients received regional analgesia/blocks.

Post-operative opiates were administered only on a need basis. Patients were assessed and offered opiates if their pain was not well controlled with other non-opiate analgesic agents. Concomitant or prophylactic anti-emetics with opioids were not administered.

Outcome Measures

Data were collected prospectively and all relevant pre-operative, intraoperative, and postoperative outcomes were recorded in an electronic datasheet. Pre-operative and post-operative day-1 chest X-rays were reviewed by two independent reviewers for the presence/size of gastric bubble and/or pulmonary complications and were compared to preoperative chest X-ray. Prolonged ventilation was defined as >24 hours. Adherence to the study protocol was assessed in all participants who received OGT. Data was presented in a descriptive fashion. For comparisons, statistical analysis was performed using the chi-squared test. A p-value cut-off of <0.05 was pre-selected to establish statistical significance. The IBM SPSS Statistics software (Version 29) was used for data analysis.

Ethics Committee Approval and InFORMED CONSENT

This study protocol was approved by our institutional research ethics board (REB) with reference number SURG-555-21, and all procedures were performed in compliance with the relevant guidelines approved by the REB. Consent was obtained from patients before the procedure and the potential benefits/risks of inserting an OGT were explained. All participants provided written informed consent prior to participating.

RESULTS

Patient Demographics

A total of 78 patients were included in our study. Patients who only underwent isolated CABG were included. Patient's demographics and baseline characteristics are shown in Table 1.

Adherence to the study protocol was observed in all patients who received OGT. No procedural complications were reported related to the insertion process and correct OGT placement was confirmed in all participants. The overall outcomes observed between the groups are summarized in Figure 2.

Pre-Operative Variables

There were no statistically significant differences in terms of baseline characteristics between the two groups. The presence of preoperative gastric bubble (indicative of some degree of baseline gastric distension) on chest x-ray was confirmed in 11/39 (28.2%) patients in the OGT group as opposed to 16/39 (41.0%) in the non-OGT group ($p=0.238$). Full patient baseline characteristics for each cohort are summarized in Table 1.

Operative Details

All patients underwent CABG as planned, and there were no statistically significant differences in peri-operative outcomes. Median sternotomy was performed in all 39 OGT patients and in 38/39 (97.4%) non-OGT patients. Cardiopulmonary bypass (CPB) was used in 33/39 (84.6%) of the OGT patients vs. 35/39 (89.7%) of the non-OGT patients. Detailed peri-operative outcomes are outlined in Table 2.

Outcome Differences Between Cohorts

There was a non-significant trend towards increased nausea ($p=0.156$) and vomiting ($p=0.314$) in the OGT group. Also, OGT patients seemed to require more post-operative opiates compared to non- OGT patients ($p=0.0054$). There was no difference in terms of dilated gastric bubble in postoperative

Table 1 **Patient baseline characteristics**

	OGT group, n=39	Non-OGT group, n=39	P values
Age, mean ± SD, y	66.3 ± 9.5	65.5 ± 9.4	NA
Sex, female, n (%)	9 (23.1)	10 (25.6)	0.798
Body mass index, mean	29.2 ± 4.1	27.9 ± 5.7	NA
Obesity, n (%)	18 (46.2)	11 (28.2)	0.102
Smoker, n (%)	6 (15.4)	15 (38.5)	0.022
Ex-Smoker, n (%)	18 (46.2)	10 (25.6)	0.060
Hypertension, n (%)	33 (84.6)	30 (76.9)	0.392
Diabetes, n (%)	18 (46.2)	14 (35.9)	0.358
Chronic obstructive pulmonary disease, n (%)	7 (17.9)	4 (10.3)	0.338
Dyslipidemia, n (%)	26 (66.7)	18 (46.2)	0.070
Peripheral vascular disease, n (%)	3 (7.7)	5 (12.8)	0.461
Carotid artery disease, n (%)	1 (2.6)	1 (2.6)	1.000
Previous transient ischemic attack, n (%)	2 (5.1)	3 (7.7)	0.641
Pre-operative x-ray findings			
Pre-operative gastric bubble, n (%)	11 (28.2)	16 (41.0)	0.238
Medication use			
Acetylsalicylic acid, n (%)	29 (74.4)	25 (64.1)	0.327
Other antiplatelet therapy, n (%)	10 (25.6)	10 (25.6)	1.000
Oral anticoagulants, n (%)	2 (5.1)	7 (17.9)	0.078
Beta blocker, n (%)	16 (41.0)	13 (33.3)	0.485
Amiodarone, n (%)	2 (5.1)	1 (2.6)	0.569
Other antiarrhythmic drugs, n (%)	0	0	NA

*a value of p<0.05 was used to establish statistical significance

Table 2 **Operative details**

	OGT group, n=39	Non-OGT group, n=39	P values
Characteristic	Total/39	Total/39	
Median sternotomy, n (%)	39 (100)	38 (97.4)	0.314
Cardiopulmonary Bypass use, n (%)	33 (84.6)	35 (89.7)	0.504
Cardiac catheterization, n (%)	26 (66.7)	20 (51.3)	0.170
Coronary artery bypass grafting, n (%)	39 (100)	39 (100)	1.000

*a value of p<0.05 was used to establish statistical significance

day-1 chest X-ray between the two groups (p=0.505). Also, there was no difference in prolonged ventilation between the two groups, or in the incidence of postoperative neurological, cardiac, respiratory or renal adverse events between the two groups. Detailed post-operative outcomes for each group are presented in Table 3.

DISCUSSION

There is currently limited evidence on the role of OGT use in the immediate postoperative period after cardiac surgery. It is not clear whether the use of OGT may be helpful by reducing postoperative complications and enhancing recovery in this group of patients.

Adherence to the Study Protocol

One of the main limitations of previous studies was the lack of consistent protocol for the insertion and management of OGT. Therefore, in the current study we established a comprehensive study protocol that was intended to 1) maximise the utility of OGT by applying manual suction of gastric contents at three time points and prn in addition to continuous low-grade negative suction in between 2) minimise the discomfort to patients by inserting the OGT orally thus avoiding nasopharyngeal irritation and 3) to remove the OGT at the same time of extubation to minimize patient's pain and discomfort. The adherence to the study protocol was complete indicating the feasibility of running a wider-scale study.

Postoperative Nausea and Vomiting

Post-operative nausea and vomiting is common after cardiac surgery, and it was reported that increasing the duration of an operation by 30 minutes has can significantly increase the risk of post-operative nausea and vomiting[23]. Post-operative nausea and vomiting can be a source of discomfort to patients and may result in significant complications including myocardial ischemia from increased myocardial oxygen consumption, pulmonary aspiration, electrolyte disturbance, and dehydration[8,14,24]. Whether NGT and OGT affect the incidence of post-operative nausea and vomiting in cardiac surgery patients has been a matter of controversy[14,15,25].

Our findings suggest that the OGT did not alter the rates of post-operative nausea and vomiting by an appreciable amount, with a slight increase in those that had an OGT. This may be explained by upper respiratory tract (i.e., pharynx) irritation from OGT which has previously been reported to be a contributing factor in post-operative nausea and vomiting from NGT[4,26]. Also, diabetes mellitus, a common co-morbidity in our patients, may increase the risk of post-operative nausea and vomiting due to delayed gastric emptying[27]. In addition, the history of tobacco use may affect the incidence of post-operative nausea and vomiting given that smoking may cause gradual desensitization of the chemoreceptor trigger zone[28]. However, we did not find any significant correlation between the history of diabetes or smoking and the incidence of post-operative nausea and vomiting in our patients.

Our findings for OGT are consistent with previous research examining NGT. Burlacu and colleagues (2005) reported that NGT use during coronary revascularization until tracheal extubation did not reduce the incidence and severity of post-operative nausea or the incidence of post-operative vomiting or retching in their patients[14]. Similarly, Hirasaki and colleagues reported that NGT placement did not significantly impact post-operative requirements of antiemetics when measured for 24 hours post-cardiac surgery[15]. In addition, in their randomized controlled trial of 202 cardiac surgery patients, Lavi et al. found no significant impact on nausea, which is also consistent with our findings. However, they reported that there was increased post-operative vomiting in the non-NGT control group (24%) then in the NGT group (10%, $p = 0.007$) 8 hours post cardiac surgery[25]. In this study, the NGT was inserted peri-operatively after anaesthesia and was maintained on gravity suction until extubation when it was removed.

Table 3 **Post-operative outcomes and complications**

	OGT group, n=39	Non-OGT group, n=39	P values
Length of stay, mean ± SD, days	11.8 ± 10.5	9.8 ± 5.2	NA
Death, n (%)	0	0	NA
Nausea, n (%)	2 (5.1)	0	0.156
Vomiting, n (%)	1 (2.6)	0	0.314
Ileus, n (%)	0	0	NA
Gastric Dilation, n (%)	0	0	NA
Stroke and/or TIA, n (%)	0	0	NA
Opiates, n (%)	13 (33.3)	3 (7.7)	0.0054
Thromboembolism, n (%)	0	0	NA
Reopening, n (%)	1 (2.6)	1 (2.6)	NA
Red blood cell Transfusion unit, n (%)	16 (41.0)	14 (35.9)	0.646
Intra-aortic balloon pump, n (%)	1 (2.6)	1 (2.6)	NA
Myocardial Infarction, n (%)	0	0	NA
Any coronary event, n (%)	1 (2.6)	0	0.314
Pneumonia, n (%)	1 (2.6)	0	0.314
Urinary tract infection, n (%)	0	1 (2.6)	0.314
Sepsis, n (%)	0	0	NA
Endocarditis, n (%)	0	0	NA
Prolonged Ventilation, n (%)	1 (2.6)	0	0.314
Post-operative x-ray findings			
Post-operative gastric bubble, n (%)	18 (46.2)	21 (53.8)	0.505

*a value of $p<0.05$ was used to establish statistical significance

Post-Operative Pain and Discomfort

Patient's pain and discomfort are frequently experienced with NGT use and OGT use as reflected by higher need for analgesia in our study. This may be attributed to mechanistic effect of OGT on upper respiratory and digestive tracts, which has previously been reported in NGT[4,26]. Since OGT and NGT both pass through the oropharynx, irritation experienced at this level is common to OGT and NGT, while irritation from the tube above the pharynx is more specific to NGT. In a study using visual analog scale for pain, NGT use was reported to be associated with the highest visual analog scale score in patients undergoing common bedside procedures[29]. Other studies have also linked the NGT use to nasopharyngeal discomfort and gagging, bronchial injury or esophageal perforation, irritative rhinitis, mucosal trauma, and pharyngitis[4,16,30-33]. Also, NGT use was found to be associated with overall pharyngeal irritation to the patient[16,17]. Our findings suggested that OGT use may be associated with increased opioid use presumably due to pain or discomfort. This is important given that post-surgical patients are at increased risk for chronic opioid use due to the acute pain in the immediate post-operative period[34,35].

Post-Operative Respiratory ComplicaTIONS

Prolonged NGT use in cardiac surgery was reportedly associated with increased rates of pneumonia[2,3]. Prior to our study, to our knowledge, associations between OGT and pneumonia had not been published, and we found no significant differences in pneumonia in the OGT versus non-OGT group. NGT was previously reported to promote aspiration through impairing the anatomical integrity of the esophageal sphincter, increasing lower esophageal sphincter relaxation, and desensitization of the pharyngoglottal adduction reflex[36-38]. Also, colonization of pathogenic bacteria, including gram-negative bacteria, is more commonly found in patients with NGT[36]. This may be explained by the interference of NGT with the function of the gastroesophageal sphincter, which may increase the risk of oropharyngeal colonization, bacterial migration, and maxillary sinusitis[3]. A cohort study with 5,158 adult cardiac surgery patients across 10 centers found an increased incidence of pneumonia with prolonged NGT use[2]. Similar results were also reported by a case control study of 135 patients[3].

Post-Operative Gastrointestinal ComPLICATIONS

In our study we used the presence of gastric bubble on chest X-ray as a surrogate for gastric distension. Our study did not demonstrate any significant benefit from the use of OGT in terms of gastric distension. Since OGT and NGT may both cause upper airway irritation, previous findings on NGT this may contribute to our OGT results. Studies reported that NGT can cause irritation which may promote air swallowing thus worsening gastric distention[16,17]. Also, it has been reported that although the NGT may be used for gastric decompression, it may be ineffective in treating ileus and may even exacerbate it, since the irritation causes by the NGT may promote excessive swallowing[8]. These findings are endorsed by the meta-analysis by Cheatham and colleagues that showed that for every patient that requires a NGT to resolve distention, 20 patients can effectively be treated without the use of NGT[39].

Enhanced Recovery After Cardiac SurGERY

Enhanced recovery after surgery (ERAS) protocols are a multidisciplinary model that comprise of evidence-based practice recommendations to improve post-operative outcomes and recovery[40]. NGT and/or OGT use is not considered an element of the cardiac ERAS protocols, which is probably due to the lack of evidence surrounding its use. In a study by Williams and colleagues who implemented an ERAS protocol in cardiac surgery patients for one year, authors included a protocol for early removal of OGT/NGT to minimize any potential negative adverse effects associated with the prolonged use[41]. Our study provides novel information for this line of investigation surrounding OGT use which is relevant to the implementation of ERAS protocols in cardiac surgery.

Study Strengths and Limitations

In the present study, we were able to establish a reproducible and easy-to-follow protocol for the insertion and management of OGT in cardiac surgical patients. This study may be the basis for a larger study with a significantly larger number of enrolled patients. Furthermore, the protocol adherence is a positive result and may show the feasibility of such a study.

However, the most important limitation of our study is the limited number of patients which may have resulted in the inability to synthesize any statistically significant conclusions. Furthermore, we were unable to follow these patients up after hospital discharge for late outcomes. Also, the exact amount of administered opioids in all patients was not recorded. Finally, the interchangeable use of the two terms "OGT" vs. "NGT" may add some ambiguity when interpreting the results of different studies due to the lack of a consistent gastric tube insertion and management protocols.

CONCLUSION

Our study showed that the use of OGT after cardiac surgery did not seem to have significant effect on postoperative clinical outcomes. A large-scale multi-center study is therefore required to establish the impact of routine OGT use and the potential role in enhancing recovery after cardiac surgery.

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