Effects Of Different Concentrations Of Intraoperative Supplemental Oxygen On Post-Operative Nausea And Vomiting (PONV) In Patients Under Going Modified Radical Mastectomy

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Citation

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Abstract

Postoperative Nausea and Vomiting (PONV) is a most common postoperative complication. Although regarded as a minor and often inevitable complication of anaesthesia and surgery it may delay discharge and necessitate hospital admission. It is an important cause of morbidity after anaesthesia. This study is aimed to know the effects of different concentrations of oxygen used intra-operatively on PONV in patients undergoing modified radical mastectomy.

In a randomized and blinded study sixty patients receiving standardized general anaesthetic technique were randomly assigned to three groups, 20 patients in each. Group A receiving 30% oxygen intraoperatively. group B receiving 50% and group C receiving 80% oxygen respectively. The incidence of PONV and adverse events were recorded postoperatively up to 24 hrs. The incidence of PONV over 24 hrs after modified radical mastectomy showed no significant difference between all the three groups ($p<0.05$, one way ANOVA and chi square test). There was no significant difference in rescue antiemetics required between all groups.

Conclusion: Intraperative high concentration of oxygen administration did not prevent PONV over the 24-hrs follow up period in patients undergoing modified radical mastectomy performed under general anaesthesia.

INTRODUCTION

Postoperative nausea and vomiting (PONV) is one of the most common adverse events after anaesthesia. There have been attempts to identify risk factors for PONV, both patient dependent and patient independent[1,2,3]. Despite these analyses, the true underlying risk of PONV in individual patient remains often unpredictable[4].

There is no “gold standard” antiemetic prevention. Incidence of postoperative nausea and vomiting remains 20% to 70%, despite introduction of new antiemetic medications, short acting opioids and anaesthetics[5,6,7]. The incidence depends on numerous non-anaesthetic factors, including the operative procedure, duration of surgery, age, gender, obesity, anxiety, gastroparesis, and history of motion sickness or previous postoperative nausea[8]. Breast surgery is associated with relatively high incidence of PONV (60%) [9, 10]. The exact cause of the high incidence of PONV in breast surgery is unknown. Supplemental perioperative oxygen reduces postoperative nausea and vomiting in patients undergoing colon resection and laparoscopy during emergency transport of patients following trauma. The exact mechanism of prevention of PONV by oxygen is not known so far. CTZ (chemoreceptor trigger zone) is sensitive to dopamine as well as serotonin. A purposed hypothesis of such effects is the fact that hyperoxia decreases dopamine release by the carotid bodies and decreases release of serotonin by ameliorating intestinal ischaemia[11, 12,13].

We conducted a prospective, randomized, comparative blind study to know effects of different concentrations of intra

operative oxygen on PONV in patients undergoing modified radical mastectomy.

MATERIALS AND METHODS

After ethics committee approval and written informed consent from the subjects, a prospective randomized study was conducted in 60 female patients of ASA physical status I and II with carcinoma breast scheduled for modified radical mastectomy (MRM). Patients with history of motion sickness, gastritis, lower esophageal sphincter disorder, and patients on antiemetic therapy were excluded from the study. Patients were randomly divided into 3 groups; 20 patients in each. A randomization list was prepared according to a list of randomized number in a computer spread sheet resulting in a list of 20 assigned patient in each group receiving 30%, 50%, and 80% oxygen intraoperatively.

Group A – 20 patients receiving 30% oxygen intra operatively"
Group B – 20 patients receiving 50% oxygen intra operatively
Group C – 20 patients receiving 80% oxygen intra operatively.

All patients were premedicated with oral diazepam 0.1mg /kg on the night before surgery and 90 minutes before the procedure. Intramuscular injection of pethidine at a dose of 1mg/kg, glycopyrrolate 0.2mg was administered 45 minutes before surgery. General anaesthesia was induced with intravenous injection of thiopentone sodium 5mg/kg body weight. Tracheal intubation was facilitated by vecuronium bromide. In the three groups oxygen was supplemented at a concentration of 30%, 50% and80% respectively. Anaesthesia was maintained with oxygen and air, isoflurane, vecuronium bromide and pethidine. Hemodynamic variables (blood pressure and pulse rate) were maintained within 20% of preinduction values by adjusting isoflurane concentration. Residual neuromuscular blockade was reversed with neostigmine 50-70 µgm^{-} kg and glycopyrrolate 8-10 µgm $^{-}$kg body weight. All patients were transferred to the post anaesthesia care unit after extubation. All patients were observed for any untoward events. Oxygen was supplemented through venti mask if oxygen saturation was less than 95%. PONV in the first 24 hrs was graded using a numeric rank scale$_{11}$ PONV score:

0 = No nausea/vomiting
1 = Nausea alone
2 = Vomiting once
3 = Vomiting twice or more times in 30 minute interval.

All episodes of PONV were recorded with in the first 24 hrs after anaesthesia (0-2, 2-6, 6-24hrs) in post anaesthesia care unit by direct questioning by attending anaesthetist or by spontaneous complaint by the patients. Ondansetron 4mg intravenously was administered as a rescue antiemetic to patients who had a PONV score ≥ 2. Statistical analysis of data among the groups was performed by one-way analysis of variance (ANOVA) and Chi-Square Tests. P value <0.05 was considered as statistical significant.

RESULTS

There were no significant differences between the groups with regard to age, weight, ASA physical status, and duration of anaesthesia, intraoperative & postoperative analgesic requirements. (Table 1.)

Figure 1

Table 1: Patient's Demographics and underlying factors

Parameters	Group A	Group B	Group C	P Value
Age (yr)	43.50±9.2	43.95±11.47	45.13±10.63	0.352
Wt (kg)	50.65±12.6	54.90±9.3	54.6±13.77	0.462
Duration Of Anaesthesia (Minutes)	142.50±22.27	150.70±29.5	147.9±28.79	0.592
Intra Op Analgesic (Pethidine, mg)	48.00±14.36	48.50±9.88	47.50±10.6	0.965
NDMR (mg)	14.00±1.654	14.90±2.57	13.90±3.55	0.442

Data expressed as mean± standard deviation
P value <0.05 is significant

During the first 24 hrs in the postoperative period the incidence of PONV was 35% in group A, 45% in group B and 30% in group C (Table 2). Incidence of only nausea was 15% in group A, 25% in group B and 5 % in group C. This difference is not statistically significant.

There was no statistically significant difference in the incidence of PONV among all the three groups at all time intervals (Table 2).

Figure 2

Table 2: Incidence of PONV during first 24 hr

Parameter	Group 1	Group 2	Group 3	'p' Value
PONV; 0-2hr	6 (30%)	4 (20%)	2 (10%)	0.286
2-6hr	7 (35%)	8 (40%)	6 (30%)	0.802
6-24hr	4 (20%)	7 (35%)	3 (15%)	0.297
Overall (0-24hr)	7 (35%)	9 (45%)	6 (30%)	0.605
Rescue Antiemetic 0-2hr	4 (20%)	0	1 (5%)	0.06
2-6hr	4 (20%)	3 (15%)	5 (25%)	0.73
6-24hr	1 (5%)	4 (20%)	2 (10%)	0.32
Overall (0-24hr)	4 (20%)	4 (20%)	5 (25%)	0.906
Incidence of nausea	3 (15%)	5 (25%)	1 (5%)	0.208

Rescue antiemetic treatment was required in four patients of group A and four patients of group B and five patients of

group C within 24 hrs. There is no statistically significant difference in all the three groups (p value 0.906). (Table 2.)

DISCUSSION

Postoperative nausea vomiting is not only an unpleasant sensation for patients but it may increase the risk of aspiration pneumonia because recovery of normal airway reflexes is often delayed in postoperative events. It is a leading cause of delayed discharge from the hospital. Breast surgery is associated with a relatively higher incidence in different studies[9, 10]. The etiology of PONV following breast surgery performed under general anaesthesia is complex and is dependant on a variety of factors which include age, sex, obesity, history of mountain sickness or previous PONV, operative procedure, anaesthetic technique and postoperative pain.

The complex act of vomiting involves coordination of the respiratory, gastrointestinal, and abdominal musculature and is controlled by the emetic center. Stimuli from several areas within the central nervous system can affect the emetic center [14, 15]. These include afferents from the pharynx, gastrointestinal tract and mediastinum, as well as afferents from the higher cortical centers (including the visual center and the vestibular portion of the eighth cranial nerve) and the chemoreceptor trigger zone (CTZ) in the area prostrema. The area prostrema of the brain is rich in dopamine, opioid, and serotonin or 5-hydroxytryptamine (5HT3) receptors [14]. Four major neurotransmitter systems appears to play important roles in mediating the emetic response viz. dopaminergic, histaminic (H1), cholinergic, muscarinic and 5HT3. Higher concentration of oxygen supplementation was thought to be an inhibitor of 5HT3 release by decreasing intestinal ischeamia and inhibiting dopamine release [12].

In this study supplemental perioperative 80% oxygen could not reduce postoperative nausea vomiting as compared with 30% and 50% oxygen in patients undergoing breast surgeries performed under general anaesthesia. We found only a brief beneficial effect on the incidence of PONV in the 80% oxygen group, but statistically it was not significant.

Our findings are in accordance with those of two studies by Purhonen et al [16, 17]. They found that supplemental oxygen does not reduces the incidence of post operative nausea and vomiting after ambulatory gynecologic laparoscopy (55% after 80% oxygen and 62% after routine 30% oxygen over all incidence) and in women undergoing breast surgeries (no difference in over all incidence of PONV in 30% & 50% oxygen groups).Our findings are not matched with those of previous studies of Greif and Goll et al[11, 12]. In the Grief et al study the overall incidence of post operative nausea or vomiting in the first 24 hrs post operatively was 30% in the patients assigned to 30% oxygen, but only 17% in those given 80% oxygen after colorectal surgery. Goll et all [12] reported a reduction in PONV by a factor of two in patients given 80% rather than 30% inspired oxygen during surgery and for 2 hrs post operatively in gynaecology laparoscopy patients.

The mechanism by which oxygen administration reduces the incidence of these post operative sequelae remains unknown but may be related to subtle intestinal ischemia. The tissue at greater risk of intraoperative injury in this study may be intestine.

Intestinal tissue is highly metabolically active and has a notoriously poor tolerance for even brief periods of hypoxia or ischemia, surgical stress, elevation of intra abdominal pressures, retractor positioning, and intestinal mobilization[18]. All these factors cause inadequate tissue perfusion. Release of 5- hydroxy tryptamine from the intestine as a consequence of ischemia is one of the most potent known triggers of nausea and vomiting. Hence mechanism involved in decreased PONV may be due to the fact that hyperoxia decreases release of 5-hydroxytryptamine and dopamine release by the carotid bodies [19]. CTZ (chemoreceptor trigger zone) is sensitive to dopamine as well as serotonin [20]. Thus hyperoxia per se may reduce nausea and vomiting mediated by dopamine.

Alxander Kober et al [13] found that supplemental oxygen during ambulance transport reduced nausea scores by 50% and decreased vomiting four fold, these data are thus consistent with previous hypothesis that supplemental oxygen reduces release of emetogenic neurotransmitters dopamine from carotid bodies.

Large concentration of oxygen during surgery may cause undesirable side effect such as increased risk of surgical fires, atelectasis and awareness. Ozan Acka et al reported that administration of 80% oxygen in the perioperative period does not worsen lung function [21]. In our study none of the patients had clinically significant complications related to 80% intraoperative oxygen.

CONCLUSIONS

Efficacy of supplemental higher concentration of oxygen

intraoperatively in prevention of PONV in patients under going modified radical mastectomy is questionable though it has been proved beneficial in intestinal surgery. Further more studies in larger groups are indicated to determine whether there is a place for supplemental oxygen in the management of PONV or not in patients under going modified radical mastectomy.

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