

A Comparison of the Effects of Preoperative Administration of Omeprazole and Ranitidine on Gastric Volume and pH in Patients Undergoing Elective Surgeries under General Anaesthesia

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Abstract

Background: Proton-pump inhibitors and histamine-2-receptor blockers act by reducing gastric volume and increasing gastric pH. These help to mitigate the effects of aspiration. However, the better of the two agents has not been established. **Aim:** This prospective randomised, double-blind study was undertaken to compare the effects of omeprazole and ranitidine. **Patients, Materials and Methods:** One hundred and sixty American Society of Anaesthesiologist I and II adults scheduled for surgery under general anaesthesia were divided into two groups: Group R received 50 mg ranitidine and Group O 20 mg omeprazole. The drugs were given intravenously 2 h before the induction of anaesthesia. Gastric content was aspirated after induction and before extubation. The gastric volume and pH were measured and analysed. **Results:** The mean postintubation and preextubation gastric volumes were greater in Group R, whereas Group O exhibited an elevated mean postintubation and a significantly higher preextubation gastric pH. **Conclusions:** The effect of omeprazole is superior to that of ranitidine as regards increasing gastric pH and reducing volume.

Keywords: Gastric pH, gastric volume, omeprazole, ranitidine

INTRODUCTION

Despite advances in anaesthesia, aspiration still occurs. The results of the Royal College of Anaesthetists 4th National Audit Project showed that aspiration was responsible for 50% of airway-related deaths during anaesthesia in the UK.^[1] In a study done in Nigeria, aspiration accounted for 1.9% of airway-related critical incidents.^[2]

Patients scheduled for surgical procedures under the general anaesthesia technique are at increased risk for/of aspiration. The incidence of aspiration has been shown to be 1 in 350,000.^[1] Aspiration may occur because some of the drugs used in induction depress protective reflexes.^[3] The effect of aspiration depends on the volume, acidity, and particles in the aspirate.^[3,4]

It is thus imperative to prevent aspiration. Preventive measures include preoperative fasting and the use of pharmacological

agents such as proton-pump inhibitors (PPIs) and histamine-2 receptor blockers (H2RBs). These drugs alter the gastric volume, pH, or both. Ranitidine and omeprazole are examples of the two classes of drugs. There have been conflicting results on which agent is more effective.^[5-9] Assessing the effectiveness of these drugs in our local environment will guide decision-making in clinical practice. This study compares the effectiveness of preoperative intravenous (IV) doses of ranitidine and omeprazole on gastric pH and volume.

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PATIENTS, MATERIALS AND METHODS

This was a prospective, randomised, double-blinded study. After obtaining institutional ethical clearance and informed consent, NHREC/05/01/200B-FWA0002458-IRB00002323, 160 patients were recruited. Inclusion criteria were adults aged 20–50 years, scheduled for elective surgery under general anaesthesia with the American Society of Anaesthesiologists (ASA) physical status I and II. Exclusion criteria included refusal by the patient, allergy to study drugs, ASA physical status III and above, and patients on medication that alter gastric volume or pH, such as antacids. Patients were also excluded from the study if they had upper gastrointestinal tract disease, intestinal obstruction, features predictive of difficult intubation, and comorbidities such as diabetes mellitus, obesity, or head injury.

The sample size was calculated using the formula for comparing two independent groups' mean in an experimental study. Attrition value was up to 10% in the unanticipated event of vomiting or patient requiring suctioning intraoperatively. Using power as 80%, the sample size was calculated to be 160. A systematic random sampling method was used to choose patients for the study. Distribution into the treatment groups was achieved by envelope randomisation. The envelopes were sealed.

Two hours before the scheduled surgery, patients in Group R received IV ranitidine 50 mg, whereas 20 mg IV omeprazole was administered to patients in Group O. A predetermined length of an 18 Fr gauge salem sump orogastric tube (Argyle Sherwood Medical, Tullamore, Ireland) was passed into the stomach after intubation. Gastric contents were aspirated in the supine and lateral positions using a graduated 50 ml syringe. Gastric pH was immediately checked with a calibrated Hanna precision pH meter (Model 213, Hanna instrument, Woonsocket, Rhode Island, United States of America). Before extubation, the same procedure was repeated.

The data were recorded in a predesigned form and analysed with IBM® Statistical Package and Service Solutions® software IBM SPSS version 24 Armonk NY USA (R 2016). Categorical variables were presented as frequencies, whereas continuous variables were presented as means and standard deviations. The difference in the mean values of the postintubation and preextubation gastric volumes (PiGV and PeGV, respectively) and the change in the postintubation and preextubation gastric pH (PiGpH and PeGpH) were analysed

with the independent samples *t*-test. A $P < 0.05$ was considered statistically significant. Results were presented as tables and charts.

RESULTS

One-hundred and sixty patients participated in this study, with eighty patients in each group. All the participants completed the study. Analysis of the results revealed as follows: the mean age was 43.59 years (standard deviation [SD] = 6.43). The mean preoperative fasting duration of the participants in Group R was 12.71 h (SD = 1.26), whereas that of Group O was 12.96 (SD = 1.23), $P = 0.526$.

Gastric aspirate which was obtained following intubation, showed that the mean volume (PiGV) for Group R was 12.00 ± 4.84 mL. In Group O, it was found to be 10.44 ± 2.82 , $P = 0.293$. Subsequently, the acidity was tested. The mean PiGpH for Group R gave a value of 4.68 ± 0.63 . For Group O, the value was found to be 4.78 ± 0.040 , $P = 0.433$.

As regards the mean PeGV, the following were the findings: the volume for Group R was 9.16 ± 2.10 mL, whereas that for Group O was 6.66 ± 2.32 mL, $P = 0.014$.

Analysis of the aspirated gastric juice for PeGpH showed that, in Group R, gastric acidity was 5.99 ± 0.75 , whereas that for Group O was 6.72 ± 0.64 , $P = 0.010$.

DISCUSSION

This study looked at the effect of a single preoperative dose of IV ranitidine and omeprazole in reducing gastric volume and increasing gastric pH.

Salem sump orogastric tube was used in this study, unlike Levin or Ryle's tube used in other studies.^[6,10] Studies have shown that the volume of gastric contents aspirated blindly through a salem sump orogastric tube closely approximates that obtained through dye dilution methods.^[11,12]

This study demonstrated that omeprazole administration produces lower gastric volume compared with ranitidine. However, the difference was not significant. This finding is in agreement with that of Gouda *et al.*^[13] Their study showed a similar reduction in preoperative gastric volume and pH in patients who received 60 mg of oral omeprazole and 150 mg of oral ranitidine.

Goel *et al.* also compared the effects of IV pantoprazole and ranitidine.^[11] They recorded a PiGV of 10.97 ml in the

	Group R	Group O	P	SD (R)	SD (O)	95% CI	SE
Preoperative fasting duration (h)	12.71	12.96	0.526	1.26	1.23	-0.55–1.05	0.40
PiGV (mL)	12.00±4.84	10.44±2.82	0.293	4.84	2.82	-3.7–1.01	1.17
PeGV (mL)	9.16±2.10	6.66±2.32	0.014	2.10	2.32	-3.84–1.07	0.68
PiGpH	4.68±0.63	4.78±0.040	0.433	0.63	0.40	-0.22–0.39	0.15
PeGpH	5.99±0.75	6.72±0.64	0.010	0.75	0.64	0.28–1.12	0.21

CI: Confidence interval, SD: Standard deviation, SE: Standard error, PiGV: Postintubation volumes, PeGV: Preextubation volumes, PiGpH: Postintubation gastric pH, PeGpH: Preextubation gastric pH

ranitidine group and 11.92 mL in the pantoprazole group. Their findings are different from ours.

Memiş *et al.* compared IV doses of pantoprazole and ranitidine on 90 ASA I and II patients scheduled for elective surgery.^[14] They concluded that both drugs reduced both gastric volume and pH. However, the difference was not statistically significant.

Gangurde and Missal found that ranitidine was more effective than omeprazole in increasing gastric pH. However, the gastric volume was increased in the ranitidine group, as was found in this study.^[5] This may be as a result of the large dose of ranitidine used: 300 mg against 40 mg of omeprazole. Furthermore, Amit *et al.* documented that 50 mg IV ranitidine significantly decreased preoperative gastric volume than 20 mg IV rabeprazole: 15.16 mL versus 18.68 mL.^[6]

Aspiration can occur at extubation. Therefore, there is a need to assess PeGV.

In this study, omeprazole significantly reduced the PEGV preextubation compared to ranitidine. It has been noted that a single dose of omeprazole irreversibly inhibits up to 90% of gastric acid secretion.^[15] In contrast, ranitidine inhibits about 70% of gastric acid production.^[15] This may explain the greater effect of omeprazole reflected in a lower PEGV. This observation has been confirmed by Padmaja *et al.*^[7] They demonstrated a significant reduction in the PEGV in patients on IV rabeprazole compared to ranitidine. However, in contrast to this study, which found no significant difference in the PIGV, Padmaja *et al.* also noted a significantly lower PIGV despite having a much smaller sample size (60 vs. 160).^[7]

In this study, gastric pH did not differ significantly in the postintubation phase but increased significantly in Group O compared to Group R in the preextubation stage. Gouda *et al.* similarly documented a better pH profile for PPI compared to H2RBs.^[13] Padmaja *et al.* also had similar findings.^[7] However, both PiGpH and PeGpH were elevated significantly in their work.

Gurkaran *et al.* had similar results to the findings in this study.^[8] Puri *et al.* also found a more significant effect on gastric pH and volume with 20 mg of oral omeprazole than with 300 mg of ranitidine.^[16]

However, Bhattacharyya *et al.* found a significantly higher gastric pH in patients that received oral ranitidine 150 mg compared to 40 mg of oral pantoprazole.^[10] This significant difference was found at 1-h and 2-h postinduction.

Amit *et al.* also found a similar gastric pH in patients who received IV rabeprazole and ranitidine: 6.68 versus 6.12.^[6] These values are closer to the PeGpH in patients who received omeprazole and ranitidine, respectively, in this study. Ahmed *et al.* did not show any superiority of one agent over the other in their oral PPIs and ranitidine study.^[9]

No subject in either group in the study met the high-risk criteria for aspiration, which is defined as a gastric volume of >25 mL

and a gastric pH of <2.5.^[11] This finding further buttresses the efficacy of both medications in improving the gastric milieu during general anaesthesia.

CONCLUSIONS

Both IV omeprazole and ranitidine effectively reduce gastric volume and increase gastric pH to safe levels. However, omeprazole has a more statistically significant effect.

Limitations

One of the limitations of the study is the unavailability of a gastroscopist; this would have aided aspiration under direct vision. Furthermore, prolonged fasting in these patients may have negatively influenced fluid and electrolyte balance. Estimation of electrolyte values may have been useful.

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Conflicts of interest

There are no conflicts of interest.

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