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# Effect of Intravenous Esomeprazolesodium Andintravenous Pantoprazole on Gastric Ph in Adultsundergoing Elective General Anesthesia

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**Abstract**

*Introduction*: General anaesthesia predisposes a patient to regurgitation andaspiration of gastric substances into otherwise healthy lungs leading to fatal acidaspiration syndrome. Historically, the syndrome most commonly described as aspiration pneumonitis or Mendelson's syndrome, 1 was reported in 1946 in patientswho aspirated while receiving general anaesthesia during obstetrical procedure. Everypracticing anaesthesiologist thus has a key concern to this preventable devastatingclinical condition which causes progressivelung damage due to the acidic solution. *Methods:* This is a prospective, controlled, randomised, single blinded studyconducted in 60 patients of American Society of Anaesthesiologists grade I and IIposted for elective surgery under general anaesthesia. The patients enrolled in thestudy were randomly assigned to two groups having 30 patients in each. Group Preceived i.v pantoprazole 40mg, Group E received i.v esomeprazole 40 mg a nightprevious to surgery. The observer was totally blind about the groups or drugs given tothe patients. On the day of surgery, after induction of anaesthesia gastric juice wasobtained via nasogastric tube and was checked for pH using pH meter. *Results:* Mean pH of group P was 5.15± 0.68 which is significantly lower thangroup E, who received i.v esomeprazole sodium with mean pH of 6.6±0.67, ($P<0.001$), as shown by two-tailed independent T test. *Conclusion:* From the observations and analysis of the present study, it can beinferred that esomeprazole sodium 40 mg i.v is more effective than pantoprazole 40mg i.v to raise the gastric pH for prevention of aspiration pneumonitis.

**Keywords:** Aspiration Pneumonitis; Esomeprazolesodium; Pantoprazole; Gastric pH.

## Introduction

The condition of aspiration pneumonitis and its dreaded sequelae are wellknown to the anaesthesiologists. And though it is not absolutely preventable, but byadopting some precautions or preventive measures, the chance of aspiration or if it occurs, its squeal can be brought down to an absolute minimum [1]. Ever since the historic documentation by Mendelson, 1 acid aspiration syndrome has been a major concern for every anaesthesiologist because of morbidity and mortality associated with it [2]. According to the literatures, the incidence of aspiration pneumonitis contributed by general anaesthesia in surgical population is only one in 9, 209 [3].

There are literatures reporting this incidence to be one in 3,000 operations under general anaesthesia which accounts for 10 to 30 percent of all deaths associated with anaesthesia [3]. Its severity is a function of both the pH and the volume of thegastric juice aspirated. Use of $H_2$ inhibitors and/or proton pump inhibitors (PPI) maybe useful in high-risk patients (obese, diabetics, American Society of Anaesthesiologists (ASA) physical status IV and V,

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emergency procedures, inadequate starvation, pregnancy, ileus,oesophagealdysfunction or surgery) [4].

Various workers have worked out several dose regimens and schedules withdifferent therapeutic agents preoperatively , all with a view to prevent or bring down the risk or sequale of aspiration pneumonitis to an absolute minimum [22]. Gastric acidity may be at greatest peak following overnight fasting andlater in the day when the patient comes to the operation theatre for elective surgery and anaesthesia, the greater is the likelihood of acidic juice being present in the stomach due to anxiety and hencethe danger of aspiration [5].

Gastric acid volume more than 25ml and pH less than 2.5 is more importantrisk factor than gastric volume for pulmonary damage in acid aspiration pneumonitis and have been used as guidelines for predicting the greatest risk of aspiration. Many pharmacological agents have been used for prevention of acidaspiration syndrome, but $H_2$ receptor blockers were most commonly used.

**Methodology**

Adult patients posted for elective surgeries under general anesthesia in JSS Medical College and Hospital, Mysore.

*Inclusion Criteria*

1. Patients of ASA grade I and II.
2. Age group > 20 yrs of age of both sex.
3. Mallampatti classification 1 and 2 patients.
4. Elective surgeries under general anesthesia.

*Exclusion Criteria*

1. Patients having upper gastrointestinal disorder.
2. Morbidly obese patients having BMI > 40kg $m^{-2}$
3. Patients allergic to study drugs.
4. Patients with anticipated difficult intubation.
5. Patients undergoing emergency surgeries.
6. Patients receiving medications known to affect secretory and or motor functions of the stomach.

*Sampling Technique*

With simple random sampling technique, 60 patients were selected who fulfil the inclusion criteria and exclusion criteria and divided them into two groups of 30 each.

Group P: received intravenous pantoprazole 40 mg i.v.

Group E: received intravenous esomeprazole 40 mg i.v.

All participants were examined preoperatively. Informed written consent was obtained from the participants prior to the study during the preanesthetic evaluation. Complete preanesthetic evaluation was performed in each patient including detailed history, physical examination and preoperative investigations.

A complete history was taken regarding ailment for which the patient was admitted-past illness especially relevant to gastro-enterology, cardiovascular, respiratory, hepatic, excretory and endocrine system, previous operation if any. If the patient gave any history of operation in the past done under general anesthesia, they were asked in detail about preoperative medication, period of fasting preceding surgery or any vomiting perioperatively. On the day preceding the surgery at 10 p.m, the participantsweregiven the concerned drugs. Group P patients received i.v pantoprazole 40mg and group E received i.v esomeprazole 40mg .

**Results**

This prospective, parallel group, controlled, randomised, single-blinded study was conducted at JSS Medical College and Hospital, Mysore involving 60 patients divided into two groups. In group P (n=30), participants received i.v pantoprazole 40mg and in group E (n=30) participants received i.v esomeprazole 40mg. Demographic characteristics of the participants in the two groups were comparable. The body weights among groups were also comparable. There was no statistically significant difference in age (P=0.768) and body weight (P=0.687) between the groups by one way ANOVA test.

Among 30 patients in group P 13 (43.31%) patients were in ASA grade I, and 17(56%) patients were in ASA grade II. Among 30 patients in group E 11 (36.7%) patients were in ASA grade I, and 19 (63.3%) patients were in ASA grade II.

This was not statistically significant (P=0.598) as shown by Pearson's correlation coefficient test.

Mean pH of group P was 5.15±0.68 which is significantly lower than group E, who received i.v esomeprazole with mean pH of 6.6±0.67, (P<0.001), as shown by two-tailed independent T test.

**Table 1:** Age distribution of the patients

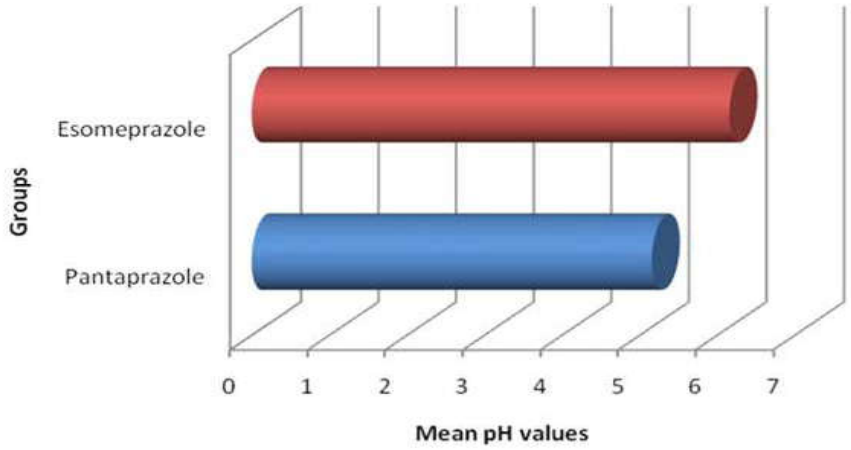
| Ages | Pantaprazole | Group Esomeprazole | Total |
|---|---|---|---|
| 20-30y | 5 | 6 | 11 |
| | 16.7% | 20.0% | 18.3% |
| 31-40y | 3 | 3 | 6 |
| | 10.0% | 10.0% | 10.0% |
| 41-50y | 7 | 8 | 15 |
| | 23.3% | 26.7% | 25.0% |
| 51-60y | 14 | 10 | 24 |
| | 46.7% | 33.3% | 40.0% |
| 61-70y | 1 | 3 | 4 |
| | 3.3% | 10.0% | 6.7% |
| Total | 30 | 30 | 60 |
| | 100.0% | 100.0% | 100.0% |

**Table 2:** ASA grade distribution of the patients

| ASA | Pantaprazole | Group Esomeprazole | Total |
|---|---|---|---|
| G 1 | 13 | 11 | 24 |
| | 43.3% | 36.7% | 40.0% |
| G 2 | 17 | 19 | 36 |
| | 56.7% | 63.3% | 60.0% |
| Total | 30 | 30 | 60 |
| | 100.0% | 100.0% | 100.0% |

**Table 3:** pHobserved in group P and group E

| | Group | N | Mean |
|---|---|---|---|
| PH | Pantaprazole | 30 | 5.1570 |
| | Esomeprazole | 30 | 6.1610 |
| ( P = 0.046 ) | | | |




**Graph 1:** pHobserved in group P and group E

## Discussion

Regurgitation, vomiting and aspiration may occur quite unexpectedly in association with anaesthesia and may have serious sequelae. Aspiration/ regurgitation was ranked fifth and comprised over 5 per cent of a large collection of incidents that arose during general Anaesthesia. While attention has usually focused on aspiration as the major consequences of regurgitation and vomiting, other sequeale such as laryngospasm, desaturation and bronchospasm are also important. These problems are encountered by all practicing anaesthetists and present as emergencies requiring instant recognition and a rapid appropriate response. Aspiration of

gastric contents (Mendelson's syndrome) was first described by Mendelson in 1946 in obstetric cases Esomeprazole is the last of the five proton pump inhibitors (omeprazole, lansoprazole, pantoprazole and rabeprazole) available in the market for clinical use. Proton pump inhibitors act by irreversibly blocking the hydrogen/potassium adenosine triphosphatase enzyme system (the H+/K+ ATPase, or more commonly just gastric proton pump) of the gastric parietal cell. The proton pump is the terminal stage in gastric acid secretion, being directly responsible for secreting H+ ions into the gastric lumen, making it an ideal target for inhibiting acid secretion.

The results presented from this study show that esomeprazole 40mg i.v is more potent than pantoprazole 40mg i.v. when administered to male and female volunteers. This was demonstrated by esomeprazole i.v providing intragastric pH > 6 and a significantly higher mean intragastric median pH than pantoprazole i.v. This concurs with the results of a previous study where esomeprazole 40mg was administered orally and pantoprazole 40mg i.v. It is also in agreement with resultsfrom a previous comparative study examining intragastric pH following oral administration of standard doses of the two drugs.

Gastric acid volume more than 25ml and pH less than 2.5 is more important risk factor than gastric volume for pulmonary damage in acid aspiration pneumonitis and have been used as guidelines for predicting the greatest risk of aspiration. I.V esomeorazole 40mg provides a mean pH > 6 and mean gastric fluid volume < 5ml at steady state than standard doses of all other PPIs.

A number of studies have been performed, which examined intragastric pH following oral administration of esomeprazole 40mg. The amount of time with intragastric pH >4, over the 24-h period on day 5 of dosing, ranged from 14 to 16 hours. Although the majority of these studies were performed in patients with symptoms of GERD and despite the inevitable variability between study populations, the value of 13 hours with pH > 6 observed in this current study is consistent with those observed for the previous studies, despite the different route of administration. It is worth noting, however, that in these previous studies examining oral esomeprazole treatment, individuals were permitted breakfast on treatment days, where as in the current study, no breakfast was permitted. As eating breakfast will temporarily increase the gastric pH, this may explain why the time with pH > 6 observed in the present study is at the lower end of the previously documented range.

In a recent study by Raeder et al., the proportion of patients who vomited during the first 24 h after surgery was lower with esomeprazole than with placebo (38% vs. 49%; not significant), and the mean amount of vomit was significantly lower (52 vs. 86 g; $P< 0.05$). These findings lend weight to the use of esomeprazole in patients with an increased risk of pulmonary aspiration. In conclusion, this trialshowed that esomeprazole administered as a single i.v. dose of 40 mg significantly decreased net gastric secretion [6].

The similar efficacy of esomeprazole 40 mg i.v. observed in this study with that in previous studies following oral administration is clinically relevant, as it allows switching between administration routes while maintaining the level of acid control [7,8].

This is in agreement with a direct comparison of esomeprazole administered orally or as a 30-min i.v. infusion, also carried out in healthy volunteers. Versatility in the route of administration has many benefits, including making it possible to continue using esomeprazole 40 mg in patients who are hospitalized, while already receiving esomeprazole therapy. It will also allow hospitalized patients who develop acid related upper GI complications and are already receiving other forms of i.v. medication, to be treated effectively with esomeprazole 40 mg i.v.

For many hospitalized patients requiring i.v. PPI therapy, such as those in an intensive care unit requiring prevention of stress ulcers or those with gastrointestinal bleeding, a higher intragastric pH than pH 4 is desirable [9]. A secondary analysis of the data showed that on both days 1 and 5, the total time with pH > 5 and 6 was increased with esomeprazole compared with pantoprazole. It should be noted that patients such as those described above would require continuous PPI infusion to treat their conditions, rather than the once-daily infusion reported in the present study.

## Conclusion

In conclusion the purpose of this study was to evaluate pantoprazole 40 mg i.v and esomeprazole sodium 40 mg i.v in terms of the ability to raise the gastric pH and decrease the volume of gastric juice. Both the drugs under study proved to be effective in raising the gastric pH to well above 2.5. If we consider the lowest critical pH to be 2.5 then both the drugs

were effective in raising the pH to safe level but esomeprazole sodium (pH > 6) increases gastric pH more than pantoprazole (pH > 5 )

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