Original Article

Indian Journal of Anaesthesia and Analgesia
Volume 4 Number 2, April - June 2017 (Part–1)
DOI: http://dx.doi.org/10.21088/ijaa.2349.8471.4217.26

Effect of Intravenous Esomeprazole Sodium and Intravenous Pantoprazole on Gastric pH in Adults Undergoing Elective General Anaesthesia

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Abstract

Background: General anesthesia predisposes a patient to regurgitation and aspiration of gastric substances into otherwise healthy lungs leading to fatal acid aspiration syndrome. Historically, this syndrome most commonly described as aspiration pneumonitis or Mendelson's syndrome, was reported in 1946 in patients who aspirated while receiving general anesthesia during obstetrical procedure. Every practicing anesthesiologist thus has a key concern to this preventable devastating clinical condition which causes progressive lung damage due to the acidic solution. *Objective:* To assess the effect of single intravenous dose of esomeprazole sodium 40 mg and pantoprazole 40 mg administered a night before elective surgery and anesthesia in reducing intragastric pH and volume of gastric juice. *Methods:* This is a prospective, controlled, randomized, single blinded study conducted in 60 patients of American Society of Anesthesiologists grade I and II posted for elective surgery under general anesthesia. The patients enrolled in the study were randomly assigned to two groups having 30 patients in each. Group P received ivy pantoprazole 40 mg; Group E received iv esomeprazole 40 mg a night previous to surgery. The observer was totally blind about the groups or drugs given to the patients. On the day of surgery, after induction of anesthesia gastric juice was obtained 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 than group E, who received ivy esomeprazole sodium with mean pH of 6.6±0.67, ($P<0.001$), as shown by two-tailed independent T test.

Among the group P the mean gastric aspirate volume was 9.56±2.52 ml, and in group E mean gastric aspirate volume was 5.66±2.36 ml, which was statistically lower in group E as compared to group P. *Conclusions:* From the observations and analysis of the present study, it can be inferred that esomeprazole sodium 40 mg i.v is more effective than pantoprazole 40 mg iv to raise the gastric pH for prevention of aspiration pneumonitis.

Keywords: Aspiration Pneumonitis; Esomeprazole Sodium; Pantoprazole; Gastric pH.

Introduction

Aspiration pneumonitis and its fatal complications are very familiar to the anaesthesiologist. Though it cannot be completely preventable some measures can be taken to prevent the incidence of aspiration and its complications and can be reduced to its minimum [16]. After documentation done by Mendelson [1], prevention of aspiration remains the most important aim of all the anaesthesiologist today to prevent lung damage caused by acidic solution [5].

Some literatures reveal that the incidence of aspiration pneumonitis was about 1in 3000 operations which were done under general anaesthesia and also accounts for 10 to 30 percent of death due to this anaesthesia [3]. Its severity depends on pH and volume of gastric juice aspirated. With the use of H_2 inhibitors and proton pump inhibitors the risk of aspiration can be reduced in high risk patients such as obese, diabetes, ASA physical status ÉV

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Received on 10.01.2017
Accepted on 14.01.2017

and V, emergency procedures, pregnancy, esophageal dysfunction [16]. Many studies were conducted with different therapeutic agents and with different dose regimens to reduce the risk of aspiration pneumonitis to an absolute minimum [16].

Gasrtric acid volume and pH were taken as a important guidelines for predicting the greatest risk of aspiration. A gastric acid volume greater than 25ml and pH less than 2.5 were considered important risk factors for causing lung damage in acid aspiration pneumonitis [2]. Many drugs were used for prevention of acid aspiration syndrome. But commonly used were H_2receptor blockers.

By taking into account the efficacy of proton pump inhibitors this study was conducted to know the effects of two proton pump inhibitors esomeprazole sodium and pantoprazole which were given intravenously to increase pH and to bring down the gastric acid secretion.

Objectives of the Study

1. To assess the effect of single intravenous dose of esomeprazole sodium 40 mg administered a night before elective surgery and anesthesia in reducing intra- gastric pH and volume of gastric acid.
2. To compare the effects of intravenous esomeprazole sodium 40 mg with intravenous pantoprazole 40 mg.

Materials and Methods

After the approval by the institutional ethical committee, the study was done at Adhichunchanagiri Institute of Medical Sciences, Bellur from November 2015 to August 2016.

Source of Data

Adult patients posted for elective surgeries under general anesthesia in Adhichunchanagiri Institute of Medical Sciences, Bellur.

Inclusion Criteria

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

Exclusion Criteria

1. Patients having upper gastro intestinal disorder.
2. Morbidly obese patients having BMI>40kgm-2
3. Patients allergic to study drugs.
4. Patients with anticipated difficult intubation.
5. Patients undergoing emergency surgeries.

Study Design

Prospective, controlled, randomized, single blinded study.

Sampling Technique

The patients of the study were allotted randomly into two groups having 30 patients in each group.

Group P: received pantoprazole 40 mg i.v.

Group E: received esomeprazole 40 mg i.v.

Parameters Studied

- pH of the gastric fluid – using pH meter.
- Volume of the gastric fluid –volume is measured with graduated syringe.

Patient Preparation

A detailed and complete preanaesthetic checkup was done on each patient which include there detailed history, physical examination and preoperative investigations. Written informed consent was taken from the patients before the study during preanaesthetic evaluation. A detailed history was taken with respect to patients past illness related to cardiovascular, respiratory, excretory, endocrine system and about previous operations. On previous day of the surgery at 10pm, the patients were given the assigned drugs. Group P patients received iv pantoprazole 40mg and group E received iv esomeprazole 40mg.

Anesthesia Technique

All patients were identified and taken into the operation theatre, an intravenous line was established and secured, and fluids were administered at body temperature. The monitors pulse oximetry, NIBP, ECG and $EtCO_2$ were connected and basal vitals noted. All patients were preoxygenated for about 3minutes and were given fentanyl 2µgkg^{-1} injection. Induction was done with propofol 2mgkg^{-1}

iv. After giving suxamethonium 2mgkg^{-1} tracheal intubation was facilitated. Anaesthesia was maintained with nitrous oxide and oxygen at 2:1ratio and vecuronium 0.1mgkg^{-1} or atracurium 0.5mgkg^{-1}. After intubation a nasogastric tube of 14 or 16G sizes was placed in the stomach. Placement of nasogastric tube in the stomach was confirmed by introduction of 15ml of air and by auscultation over the epigastrium.After 30minutes of induction gastric juice sample was aspirated and the sample was transferred to a clear test tube to be analysed by pH strip and confirmed by pH meter.

Results

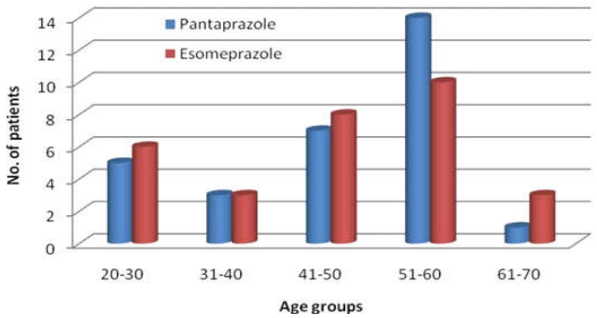
A prospective, controlled, randomized, single blinded study was done at Adhichunchanagiri Institute of Medical Sciences, Bellur involving 60 patients divided into two groups. In group P (n=30), participants received. Iv pantoprazole 40 mg and in group E (n=30) participants received. Iv esomeprazole 40mg. Demographic characteristics were comparable between two groups of the participants. Statistical significant difference was not present with respect to age (P=0.768) and body weight (P=0.687) between the groups by one way ANOVA test.

Table 1: Age distribution of the patients.

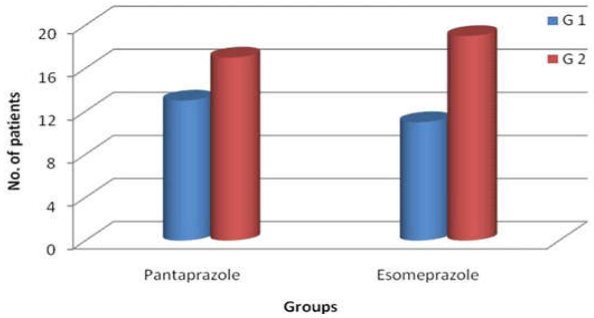
Ages	Group		Total
	Pantoprazole	Esomeprazole	
20-30y	5 16.7%	6 20.0%	11 18.3%
31-40y	3 10.0%	3 10.0%	6 10.0%
41-50y	7 23.3%	8 26.7%	15 25.0%
51-60y	14 46.7%	10 33.3%	24 40.0%
61-70y	1 3.3%	3 10.0%	4 6.7%
Total	30 100.0%	30 100.0%	60 100.0%

Table 2: ASA grade distribution of the patients

ASA	Group		Total
	Pantoprazole	Esomeprazole	
G1	13 43.3%	11 36.7%	24 40.0%
G2	17 56.7%	19 63.3%	36 60.0%
Total	30 100.0%	30 100.0%	60 100.0%



Graph 1: Age distribution of the patients.



Graph 2: ASA grade distribution of the patients

Table 3: pH observed in group P and group E

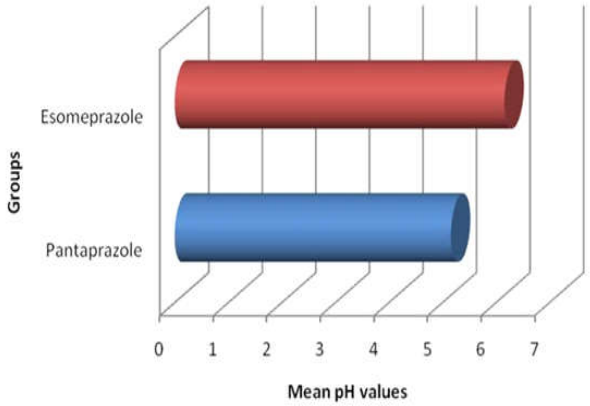
	Group	N	Mean
PH	Pantoprazole	30	5.1570
	Esomeprazole	30	6.1610

(P =0.046)

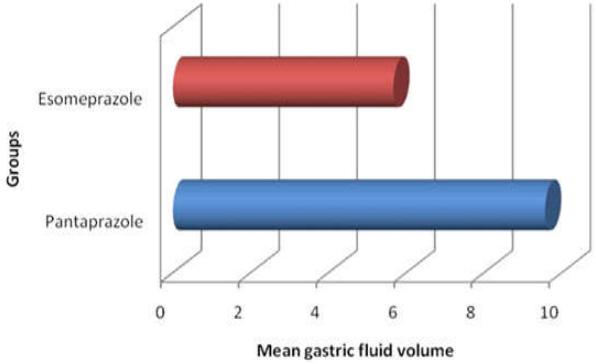
Table 4: Volume of gastric juice in group P and group E

Gastric Juice	N	Mean in ml
Pantoprazole	30	9.5667
Esomeprazole	30	5.6667

(P<0.0001)



Graph 3: pH observed in group P and group E.



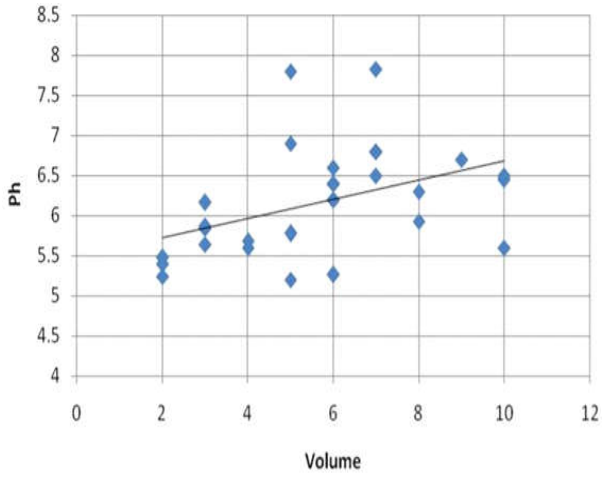
Graph 4: Volume of gastric juice in group P and group E.

Among 30 patients in group P 13 (43.31%) patients were in ASA gradeI, and 17(56%) patients were in ASA grade II. Among 30 patients in group E 11(36.7%) patients were in ASA gradeI, and 19 (63.3%) patients were in ASA grade II. There was no statistical significance (P=0.598) as shown by pearson's correlation co-efficient test.

Table 5: Correlation of gastric juice volume and pH

		P^H	Gastric Juice
PH	PearsonCorrelation	1	-.259(*)
Gastric Juice	PearsonCorrelation	-.259(*)	1

N=60,*Correlation at 0.05(2-tailed):...



Graph 5: Correlation of p^H and volume of gastric juice

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

Among the group P the mean gastric aspirate volume was 9.56±2.52ml, and in group E mean gastric aspirate volume was 5.66±2.36ml, which was statistically lower in group E as compared to group P.

While correlating pH value with gastric juice volume it was found that as the pH decreases the gastric juice volume increases by two tailed Pearson's correlation Co efficient t-test, it is statistically significant (P=0.046, which is P <0.05).

Discussion

Aspiration, regurgitation can occur circumstantially with general anaesthesia and can cause serious sequelae. Along with aspiration other complications like laryngospasm, bronchospasm and desaturation can also occur. Mendelson's syndrome was known since 1946, where there was aspiration of stomach contents into the lungs during obstetrical anaesthesia was described by Mendelson.

Prevention of aspiration remains the most important aim of all the anaesthesiologist today to prevent lung damage caused by acidic solution Esomeprazole is a 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.

From the results of this study it was shown that esomeprazole 40mg iv is more potent than pantoprazole 40mg iv. This was shown by esomeprazole iv providing intragastric pH >6 a higher mean intragastric pH than pantoprazole iv. This is in accordance to previous study where esomeprazole 40mg was given orally and pantoprazole 40mg iv [8]. 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. IV esomeprazole 40 mg provides a mean pH >6 and mean gastric fluidvolume <5ml.

Many studies which were conducted on oral administration of esomeprazole 40mg showed the time with intragastric pH> 4 over the 24hr period ranged from 14 to 16 hours. In our study the pH >6 was observed for about 13 hours which is comparable with that of previous studies although the drug was given by different route.

A recent study conducted by Raeder et al showed patients vomited with in 24hrs of surgery were comparatively less with esomeprazole than with placebo group (38% vs 49%). Then the volume of vomit was also significantly lower (52g vs 86g P < 0.05) in esomeprazole group. These findings have made the use of esomeprazole in patients having a higher risk of pulmonary aspiration. The above study showed that esomeprazole 40mg iv will reduce gastric secretion significantly.This study is in correlation with other studies where oral esomeprazole was used.

For many patients who are in intensive care unit who require higher intragastric pH which is pH > 4 for prevention of stress ulcers or those with gastrointestinal bleeding esomeprazole is superior to pantoprazole and can be used as infusion to treat these conditions, rather than once daily dose as reported in the present study.

Conclusion

In conclusion esomeprazole sodium (pH>6) increases gastric pH more than pantoprazole (pH>5). Esomeprazole reduced the volume of gastric juice to <6ml and pantoprazole <10ml. considering the cost effectiveness, esomeprazole is much effective than the pantoprazole. From the observations and analysis of the present study it can be inferred that esomeprazole sodium 40mg iv is more effective than pantoprazole 40mg iv to raise the gastric pH and to lower the volume of gastric juice for prevention of aspiration pneumonitis.

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