The Comparison of Gastric pH after Premedication using Ranitidine, Antacids, and Ranitidine-Antacids Combination in Cesarean Section

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Abstract

Background: Pregnant women are at high risk of experiencing gastric fluid aspiration, which is known as Mendelson’s syndrome. The possibility of aspiration increases in an emergency condition. Low pH and high volume of aspirate increase the severity of aspiration. Ranitidine and antacids can increase gastric pH. This study aimed to compare gastric pH after receiving ranitidine, antacids, and ranitidine-antacids combination as premedication in patients undergoing an emergency cesarean section (C-section).

Patients and Methods: This study is a true-experimental design on 27 participants who underwent a C-section at Dr. Saiful Anwar Hospital. The R group received ranitidine 50 mg, the A group received 10 ml of antacids, and the C group received the combination of both. The measurement of gastric pH was carried out on 0, 5, 15, 30, 45, and 60 min after premedication. The data were analyzed using the one-way ANOVA test.

Results: The average change in gastric pH is better seen in the antacids group. The gastric pH increases from 3.19 ± 1.04 to 4.64 ± 1.20 at 60 min after premedication (P > 0.05). Ranitidine administration showed better results at 5, 15, and 30 min after premedication (P > 0.05). The combination of ranitidine and antacids showed better results at 45 and 60 min after premedication (P > 0.05).

Conclusion: There is no significant difference in gastric pH after receiving premedication in patients undergoing a C-section. However, all groups show an increase in gastric pH after receiving premedication. The administration of ranitidine and antacids combination is not better than a single dose of ranitidine or antacids.

Keywords: Antacids, cesarean section, gastric pH, Mendelson syndrome, ranitidine

Introduction

Aspiration is defined as the flow of material from the oral cavity or the gastrointestinal tract to the lungs. The materials such as saliva, nasopharyngeal secrets, bacterial fluid, food, or gastric fluid are often aspirated into the lungs. The aspiration that happens during anesthesia may cause fatal complications. One of the most dangerous aspiration is called Mendelson’s syndrome, occurs when gastric fluid enters the lungs. The aspiration of gastric fluid can trigger an inflammatory response in the lung parenchyma and causes chemical pneumonia. Gastric fluid can directly or indirectly activate inflammatory cell mediators such as phagocyte cells. Phagocyte cells then secrete cytokines, chemokines, or inflammatory macrophage proteins (macrophage inflammatory protein [MIP]-1 β/MIP-2). Cytokines overproduction and chronic inflammation trigger tissue damage.

Pregnant women have a high risk of gastric fluid aspiration due to physiological and anatomical changes in the gastrointestinal system. Aspiration of gastric fluid is dangerous if gastric pH is <2.5 and volume at least 0.3 ml/kg body weight. The gastric pH of almost women who give birth is <2.5. More than 60% of pregnant women have a gastric acid volume of more than 25 ml. The possibility of aspiration increases in the cesarean section (C-section)
in emergency settings because it is assumed that they have a full stomach. According to a study of Mark,[10] aspiration occurred in 3 of 10,000 anesthetics and generally occurred in emergency surgery.

Ranitidine and antacids are drugs that have the ability to increase the acidity of gastric fluid. Ranitidine is classified as an H₂-receptor antagonist (H₂RA).[11] The H₂RA drugs inhibit the binding between histamine and H₂ receptors.[12] Histamine is a compound found in the central nervous system and plays a role in H₂-receptor activation. The activation of H₂ receptors in parietal cells will increase gastric acid secretion.[13] The inhibition of histamine and H₂ receptors binding will reduce gastric acid production and increases the acidity of gastric fluid.

Antacids neutralize gastric acid but increase the gastric fluid production.[14] Antacids are also used to treat duodenal ulcers.[15] Antacids neutralize gastric acid through chemical reactions. Antacids had a more rapid action and shorter duration of effectiveness than H₂RA drugs.[16]

Ranitidine and antacids can be used as premedication before anesthesia. Both drugs have different mechanisms for increasing gastric pH. This study aimed to compare the gastric pH after receiving ranitidine, antacids, and ranitidine-antacids combination as premedication in patients undergoing emergency C-sections.

**Patients and Methods**

This was an experimental study. The participants were 27 pregnant women who underwent emergency C-section at Dr. Saiful Anwar General Hospital, Malang, Indonesia. The inclusion criteria include the age of 20–35 years old, with a body mass index of 19–30 kg/m², and physical status of the American Society of Anesthesiologists I and II. The study protocol was approved by the Health Research Ethical Clearance Committee of Dr. Saiful Anwar General Hospital. All participants provided written informed consent to be included in this study. Patients with eclampsia, history of dyspepsia, consume ranitidine or antacids before surgery, and reported signs of increased intracranial pressure were excluded from the study.

The participants were randomly divided into three groups: Group R received ranitidine 50 mg; Group A received 10 ml of oral antacids; and Group C received both ranitidine 50 mg and 10 ml of oral antacids. Nasogastric tube was inserted to collect the gastric fluid. The measurement of gastric pH was carried out using pH-meter HANNA HI® 991001 before premedication (0 min) and after premedication (5, 15, 30, 45, and 60 min after premedication).

The data were analyzed using the SPSS software version 20 (IBM Corp. Released 2011. IBM SPSS Statistics for Windows, version 20.0. Armonk, NY, USA). Data were analyzed using the one-way ANOVA test. P <0.05 was considered statistically significant.

### Results

The participants of this study were 27 pregnant women who underwent emergency C-section. The characteristics of the participants are displayed in Table 1. The results of the normality test showed that the participants were normally distributed.

The average pH is better seen in the administration of antacids. Before antacids administration, the gastric pH in the antacids group was 3.19 ± 1.04. The administration of antacids increases the gastric pH to 4.64 ± 1.20 at 60 min after the administration [Table 2]. The administration of ranitidine showed better results at 5, 15, and 30 min after premedication compared to other groups [Figure 1]. The antacids group has a higher gastric pH at almost all times of observation, except in the 60th min. The combination of both ranitidine and antacid showed better results at 45 and 60 min after administration [Figure 1].

### Discussion

The possibility of aspiration increases when the patients have a full stomach. The patients have different fasting period because

| Table 1: Characteristics of the participants |
|---------------------------------------------|
| Characteristic | R | A | C | P |
| Number of participants | 10 | 8 | 9 | 0.691 |
| Age (years), n (%) | 20-25 | 4 (40) | 2 (25) | 3 (33.3) | 0.356 |
| | 26-30 | 1 (10) | 2 (25) | 4 (44.4) | |
| | 31-35 | 5 (50) | 4 (50) | 2 (22.2) | |
| BMI (kg/m²), n (%) | 19-23 | 3 (30) | 2 (25) | 2 (22.2) | 0.480 |
| | 24-27 | 6 (60) | 5 (62.5) | 5 (55.5) | |
| | 28-30 | 1 (10) | 1 (12.5) | 2 (22.2) | |
| Fasting period (h), n (%) | 0-6 | 9 (90) | 5 (62.5) | 7 (77.7) | 0.766 |
| | ≥6 | 1 (10) | 3 (37.5) | 2 (22.2) | |

BMI: Body mass index, R: Ranitidine 50 ml, A: Antacids 10 ml, C: Combination of ranitidine 50 ml + antacids 10 ml

Figure 1: Gastric pH of each administration of pH altering premedication
Table 2: The average of gastric pH after premedication

| Groups | 0 min        | 5 min        | 15 min       | 30 min       | 45 min       | 60 min       |
|--------|--------------|--------------|--------------|--------------|--------------|--------------|
| R (mean±SD) | 2.5±0.59     | 2.74±0.58    | 2.99±0.64    | 3.64±0.66    | 4.06±1.03    | 4.73±1.17    |
| A (mean±SD)  | 3.19±1.04    | 3.56±1.0     | 3.83±0.94    | 4.19±1.09    | 4.41±1.16    | 4.64±1.20    |
| C (mean±SD)  | 2.59±0.86    | 3.06±0.92    | 3.29±0.91    | 3.54±0.82    | 3.83±0.99    | 4.40±0.97    |
| Significant | 0.22         | 0.14         | 0.12         | 0.32         | 0.54         | 0.80         |

SD: Standard deviation; R: Ranitidine 50 ml; A: Antacids 10 ml; C: Combination of ranitidine 50 ml + antacids 10 ml

they were in the emergency setting (i.e., not elective surgery) and some patient needs surgery immediately. Nevertheless, the fasting period has been fulfilling the standard.

The present study found no significant difference between each group but was able to show a gastric pH elevation in every group. This result is different from the study conducted by Améndola et al. where a single dose of ranitidine or antacids gave a significant increase in gastric pH. This difference may occur because of the different measurement times of the subject, the dose used, and the drug administration methods. In this study, the measurements were carried out in the 0, 5, 15, 30, 45, and 60 min after the administration of premedication, whereas in the Améndola’s study, the measurements were taken hourly at the first 4 h after ranitidine or antacids administration. Améndola used oral ranitidine 75 mg, whereas this study used 50 mg of intravenous ranitidine.

Ranitidine is an H₂ antagonist. Ranitidine will inhibit histamine H₂-receptors binding. The inhibition of the binding will reduce gastric acid production and increase gastric pH. Améndola’s study showed that ranitidine can increase gastric pH in a sustainable and long term.

The oral administration of antacids increased the acidity of gastric fluid starting from the 5th to the 60th min after premedication. Antacids rapidly increase gastric acidity. Antacids work directly on gastric fluid. Antacids work chemically by neutralizing the hydrochloric acid. The combination of the two premedication agents is expected to provide maximum results. The oral administration of antacids will react directly with gastric acid, whereas the administration of ranitidine is useful as long-term prophylaxis.

This study found that the combination of antacids and ranitidine has better results in the 45th and 60th min compared with other premedication (P > 0.05). The changing of gastric pH in every minute of observation can be used to determine the timing of premedication administration before anesthesia. Based on the study, ranitidine should be given 30 min before anesthesia because the increase in gastric pH is best in the 30th min. In this study, no side effects were found after ranitidine, antacid, and the combination of both, as premedications.

Conclusion

There is no significant difference in gastric pH after the administration of ranitidine, antacids, and ranitidine-antacids combination as premedication in patients undergoing emergency C-section. The combination of ranitidine and antacids is not superior than using single dose of ranitidine or antacids in reducing gastric pH.

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Conflicts of interest

There are no conflicts of interest.

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