J Korean Med Sci 2005; 20: 232-5
ISSN 1011-8934

Effects of Preoperative Anxiety on Gastric Fluid Acidity and Volume

The aim of this study was to evaluate the effect of preoperative anxiety on the gastric pH and volume. We studied 96 female patients aged 16-60 yr who underwent elective gynecological surgery. We classified the subjects into 2 groups, those presenting preoperative anxiety scores using visual analogue scale (VAS, 0-10) less than 5 (L-group, n=59), and those with 5 and more (H-group, n=37). Immediately after tracheal intubation, gastric contents were aspirated using a 14-F multiorifice nasogastric tube. The gastric acidity and volume of the two groups were not statistically different. Mean pH were 3.0±1.8 and 3.0±2.0 in each group (L-group and H-group) and mean gastric volume (mL) were 15.3±11.7 and 11.8±11.8, respectively. Nine (15.3%) patients in the L-group were considered to be 'at risk i.e. gastric pH <2.5 and volume >25 mL' and one patient (2.7%) in the H-group (p <0.05). The mean serum gastrin concentrations in both groups were similar (21.6±9.8 vs. 20.2±11.0 pg/mL). The pH and volume of preoperative gastric contents were not correlated with the preoperative anxiety. The results suggest that a low level of preoperative anxiety can be considered a risk factor for aspiration pneumonitis.

Key Words : *Preoperative Care; Anxiety; Gastric Acid*

Jeong-Yeon Hong, Jong In Oh

Department of Anesthesiology, Samsung Cheil Hospital, Sungkyunkwan University, School of Medicine, Seoul, Korea

Received : 6 May 2004
Accepted : 4 August 2004

Address for correspondence
Jeong-Yeon Hong, M.D.
Department of Anesthesiology, Samsung Cheil Hospital, 1-19 Mukjeong-dong, Jung-gu, Seoul 100-380, Korea
Tel : +82.2-2000-7826, Fax : +82.2-2000-7785
E-mail : jenyhongg@hanmail.net

INTRODUCTION

Preoperative anxiety or stress have been thought to delay gastric emptying and increase gastric acidity and is therefore considered one of risk factors related with aspiration pneumonitis. In large series of Olsson et al. (1), it was reported that pain and anxiety were able to be important mechanisms of decreasing intestinal motility especially in emergency surgical cases. Similarly, outpatients tend to have increased gastric fluid, presumably because of anxiety (2). Cote et al. (3) found that more anxious children had a higher gastric acid content, although the difference was of questionable clinical significance. More recently, clinical studies using various methods, however, have failed to confirm any correlation between anxiety and gastric function (4-6).

The purpose of this study was to clarify whether anxiety affects the preoperative actual acidity and volume of gastric fluid with several contributing factors such as sex, age, fasting time, hypoglycemic status controlled in female patients undergoing elective gynecologic surgery under general anesthesia.

MATERIALS AND METHODS

After obtaining an approval from the Committee of Ethics on Human Study in our hospital and an informed consent from each patient, we studied ASA physical status I-II 96 female patients aged between 16 and 60 yr who underwent elective gynecological surgery under general anesthesia. Patients with a history of any gastrointestinal disorder, or who were receiving antacids or H_2 receptor blockers, or any other medication, which would interfere with gastrointestinal function, were excluded from the study. No one had history of hypertension, diabetes, pregnancy, or obesity. All patients fasted after midnight. No premedication was administered. A power analysis was performed to determine the sufficient sample size required to establish a significant difference in the gastric variables and in the percentage of patients at risk for aspiration pneumonia based on the results of a preliminary study, using an α-value of 0.05, and power of 0.8. The calculated sample size was 96.

Before induction of anesthesia, patients were asked to complete the visual analogue scale with regard to the level of anxiety (range 0=no anxiety at all, to 10=extremely anxious) in the preoperative preparing unit. The patient's data including vital signs, oral fasting time, and medical and surgical history were collected from interview and the medical records. Immediately after tracheal intubation using 100-120 mg of propofol and 0.5 mg/kg of rocuronium, a 14-F multiorifice nasogastric tube (Levin tube, Yushin Medical, Shiheung, Korea) was inserted upto 60 cm from the incisor. Proper position of the nasogastric tube was verified by auscultation over the epigastrium by injecting 10 mL of air. Subsequently, the gastric

fluid was aspirated gently to a syringe using mild negative pressure. This maneuver was repeated in both slightly left- and rightward tilted positions and in Trendelenburg and reverse Trendelenburg position to ensure maximum emptying of the stomach. After the aspiration of gastric content, nasogastric tube was removed. A standard general anesthesia with enflurane in nitrous oxide, oxygen, and rocuronium was provided for the surgery.

The volume of gastric fluid and pH were measured using a metered cylinder and a pH meter twice (model-920A, Orion Research Inc., Beverly, MA, U.S.A.). Blood concentration of glucose was measured at the same time by using a blood glucose meter (SureStep, Lifescan Inc., Milpitas, CA, U.S.A.). Blood samples taken from the arm opposite to the intravenous infusion were collected and centrifuged; the serum was separated and stored at -70℃. Double Antibody Gastrin Method is a radioimmunoassay technique for gastrin designed for the quantitative measurement of gastrin in serum, which utilizes labeled synthetic iodinated human gastrin (SHG I-17) (7).

Visual analogue scale (VAS) of preoperative anxiety was 3.82±2.1 and the range was from 0 to 8.5. We classified the subjects into 2 groups, those presenting VAS less than 5 (low-anxiety group, L-group), and remains (high-anxiety group, H-group). These groups consisted of 59 and 37 patients, respectively.

Statistical analysis was performed by paired t-test with Bonferroni correction for demographic data. The Mann-Whitney U-test and chi-square test were used to analyze the anxiety scores, gastric pH and volume of the gastric fluid, serum gastrin concentrations, and the number of patients at risk for aspiration pneumonitis (gastric pH <2.5 and volume >25 mL) in order to compare both groups. Spearman's correlation coefficient was used to measure the association between anxiety and gastric residues. A *p*-value of less than 0.05 was considered significant.

Table 1. Demographic data and preoperative values

	L-group (n=59)	H-group (n=37)
Age (yr)	39.9±10.0	39.6±9.8
Weight (kg)	58.3±9.7	59.4±8.5
Height (cm)	158.3±5.1	159.7±4.4
Fasting time (hr)	17.0±4.0	17.1±3.8
Blood glucose (mg/dL)	93.8±6.6	92.0±8.6
SBP (mmHg)	126.4±20.7	129.7±15.1
DBP (mmHg)	75.9±13.5	74.8±11.0
HR (/min)	77.9±13.4	80.6±14.8
Diagnosis		
Myoma	38	25
Adenomyosis	12	6
Endometriosis	6	5
Ovarian cyst	3	1

Data are mean±SD or number of patients.
SBP, systolic blood pressure; DBP, diastolic blood pressure; HR, heart rate. Values are not significantly different between the two groups.

RESULTS

The two groups were comparable with regard to age, weight, height, diagnosis, fasting time, and preoperative blood glucose level. Preoperative heart rate, systolic and diastolic blood pressures were similar in the both groups (Table 1).

The preoperative anxiety score (VAS) of L-group was 2.4±1.4, and that of H-group was 6.0±0.9. The mean gastric acidity and volume of the two groups were not statistically different: pH of L-group, 3.0±1.8 (range: 1.3-7.3), pH of H-group, 3.0±2.0 (range: 1.3-7.8), volume of L-group, 15.3±11.7 mL (range: 0-50), and volume of H-group, 11.8±11.8 mL (range: 0-70). There were 9 (15.3%) patients considered to be 'at risk: gastric pH <2.5 and volume >25 mL' in the L-group, and 1 (2.7%) in the H-group (p<0.05, Fig. 1). The mean serum gastrin concentration in the L-group was 21.6±9.8 pg/mL, and that in the H-group was 20.2±11.0 pg/mL (p=NS). The pH and volume of preoperative gastric contents were not significantly associated with the preoperative anxiety (Fig. 2).

During the insertion of nasogastric tube, there were no epistaxes, vomiting, ventilatory problem, or other serious complications.

DISCUSSION

The main finding of this study was that there are no differences in preoperative gastric pH and volume between the two groups, but there are more patients 'at risk' for aspiration pneumonitis in the low anxiety group. These are inconsistent with previous general knowledge and our expectations. Several authors reported that preoperative anxiety did not prolong gastric emptying nor had influence gastric acidity and vol-

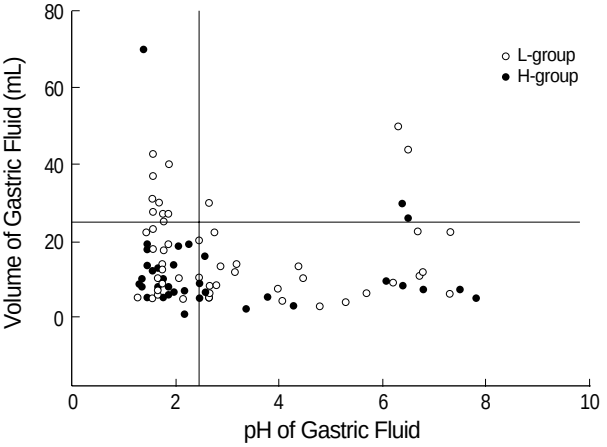

Fig. 1. Gastric pH and volume of gynecologic patients in low anxiety group (L-group, n=59) and high anxiety group (H-group, n=37). There were 9 (15.2%) patients considered to be 'at risk: pH <2.5 and volume >25 mL' in the L-group, and 1 (2.7%) in the H-group (p<0.05). Lines are drawn at pH=2.5 and volume=25 mL.

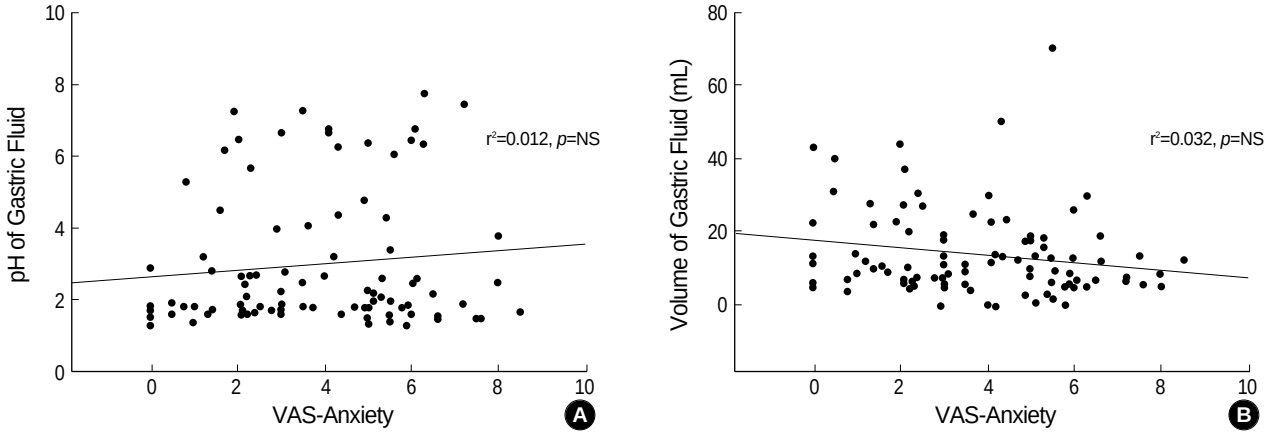

Fig. 2. Relationship between preoperative anxiety and gastric fluid. The pH (A) and volume (B) of preoperative gastric contents were not significantly associated with preoperative anxiety.

umes in adults and children (3-5, 8, 9). Haavik et al. (6) evaluated the relationship between oral premedication, preoperative anxiety, and gastric contents in patients having elective surgery. Gastric volume and pH did not correlate with the type of premedication or the level of anxiety. Kawana et al. (9) observed that a smaller gastric fluid volume in highly anxious pediatric patients compared to children with low anxiety level. They suggested some possible explanations. In a highly anxious state, the cephalic phase of gastric secretion would be suppressed. In addition, the increased sympathetic tone disturbs gastric secretion through the adrenergic neurons in the splanchnic nerve. In our results, however, we could not detect any differences in serum gastrin concentration which has been known as a major hormone regulating secretion of gastric juice. Interestingly, we also observed that the number of 'patients at risk: gastric pH <2.5 and volume >25 mL' was much greater in less anxious patients. The smaller gastric volume of highly anxious patients was consistent with the report of Kawana et al. (9). Therefore, perhaps gastric motility, not gastric secretion, was altered by neural or endocrine mechanisms in the anxious patients. Traditionally, the β-adrenergic system has been shown to exert an inhibitory action on gastric emptying in normal circumstances; isoprenaline decreases and propranolol increases stomach emptying (10, 11). In contrast, Christensen and Stadil (12) reported that corticosteroids and adrenaline, in physiological concentrations, increase the acidity of gastric secretions. We did not measure hormones including epinephrine, norepinephrine, or any other stress hormones. Although our results did not support any association between the level of preoperative anxiety and gastric volume and pH, preoperative anxiety seems to decrease the risk of aspiration pneumonitis. Further studies are necessary to clarify neurogenic and endocrine regulatory mechanisms of anxiety on preoperative gastric function.

Since gastric secretion and movements are controlled by a very complicated mechanism and gastric residuals are affected by many factors, a well controlled study design is difficult to create. We tried to minimize other influencing factors for gastric secretion and emptying such as sex, age, fasting time, preoperative blood glucose concentration, and premedication.

We have some limitations of study design. No attempt was made to take account of the phase of menstrual cycle or circadian variation because the effect of both has been shown not to apply to gastric emptying of liquids (13, 14). The patients in the present study fasted much longer than the recommended period. This may be due to environmental factors including unpredictable delay of the operation, or protocol violation by the patient such as skipping the previous evening meal due to preoperative anxiety and tension. The technique of gastric aspiration cannot guarantee complete gastric emptying, and volumes recorded reflect only the maximum gastric aspirate obtained at the time, with every effort made to increase yield by manipulation of the tube. Dye absorption technique and fiberoptic gastroscopy are more reliable than blind aspiration (15), but are more complicated, time consuming, and clinically limited methods.

We evaluated the patients' anxiety in terms of VAS based on the study of Kindler et al. (16). They reported that the VAS allows effective measurement of preoperative anxiety and detection of patients' anesthetic concerns.

We conclude from the current data that there are no significant differences of preoperative gastric pH and volumes between high and low anxious patients. However, the number of patients 'at risk' for aspiration pneumonitis was much more in low anxious patients. The results suggest that a low level of preoperative anxiety can be considered a risk factor in connection with aspiration pneumonitis.

REFERENCES

1. Olsson GL, Hallen B, Hambraeus-Jonzon K. *Aspiration during anaesthesia: a computer-aided study of 185,358 anaesthetics. Acta Anaesthesiol Scand 1986; 30: 84-92.*

2. Ong BY, Palahniuk RJ, Cumming M. *Gastric volume and pH in outpatients. Can Anaesth Soc J 1978; 25: 36-9.*
3. Cote CJ, Goudsouzian NG, Liu LM, Dedrick DF, Szyfelbein SK. *Assessment of risk factors related to the acid aspiration syndrome in pediatric patients: gastric pH and residual volume. Anesthesiology 1982; 56: 70-2.*
4. Nygren J, Thorell A, Jacobsson H, Larsson S, Schnell PO, Hylen L, Ljunggvist O. *Preoperative gastric emptying: effects of anxiety and oral carbohydrate administration. Ann Surg 1995; 222: 728-34.*
5. Lydon A, McGinley J, Cooke T, Duggan PF, Shorten GD. *Effect of anxiety on the rate of gastric emptying of liquids. Br J Anaesth 1998; 81: 522-5.*
6. Haavik PE, Soreide E, Hofstad B, Steen PA. *Does preoperative anxiety influence gastric fluid volume and acidity? Anesth Analg 1992; 75: 91-4.*
7. Lindstedt G, Olbe L, Kilander AF, Armbrecht U, Jagenburg R, Runsteen D, Lundberg PA. *Analytical and clinical evaluation of a radioimmunoassay for gastrin. Clin Chem 1985; 31: 76-82.*
8. Simpson KH, Stakes AF. *Effect of anxiety on gastric emptying in preoperative patients. Br J Anaesth 1987; 59: 540-4.*
9. Kawana S, Uzuki M, Nakae Y, Namiki A. *Preoperative anxiety and volume and acidity of gastric fluid in children. Paediatr Anaesth 2000; 10: 17-21.*
10. Rees MR, Barber D, Clark RA, Holdsworth CD, Howlett PJ. *Effect of beta adrenergic drugs and beta blocking agents on gastric emptying in man. Gut 1978; 19: A435.*
11. Clark RA, Holdsworth CD, Rees MR, Howlett PJ. *The effect on paracetamol absorption of stimulation and blockade of beta-adrenoceptors. Br J Clin Pharmacol 1980; 10: 555-9.*
12. Christensen KC, Stadil F. *Effect of epinephrine and norepinephrine on gastrin release and gastric secretion of acid in man. Scand J Gastroenterol (Suppl) 1976; 37: 87-92.*
13. Gill RC, Murphy PD, Hooper HR, Bowes KL, Kingma YJ. *Effect of the menstrual cycle on gastric emptying. Digestion 1987; 36: 168-74.*
14. Goo RH, Moore JG, Greenberg E, Alazraki NP. *Circadian variations in gastric emptying of meals in humans. Gastroenterology 1987; 93: 515-8.*
15. Taylor WJ, Champion MC, Barry AW, Hurtig JB. *Measuring gastric contents during general anaesthesia: evaluation of blind gastric aspiration. Can J Anaesth 1989; 36: 51-4.*
16. Kindler CH, Harms C, Amsler F, Ihde-Scholl T, Scheidegger D. *The visual analog scale allows effective measurement of preoperative anxiety and detection of patients' anesthetic concerns. Anesth Analg 2000; 90: 706-12.*