

## Effects of Fasting Intervals on Gastric Volume and pH

RIAZ HUSSAIN, TAHIR NAZEER, NASRULLAH KHAN AZIZ, MAQSOOD ALI

### ABSTRACT

**Objective:** To evaluate effect of different intervals of fasting on gastric pH and volume before surgery.

**Methods:-**In this observational study 65 patients of ASA P1 >11 status and age 15 to 50 years of both sex undergoing general anesthesia for elective surgery were studied and time of last fluid/solid intake was noted. After induction of GA a multiorifice orogastric tube (18F) was passed in the stomach and after confirmation gastric fluid was aspirated by 50CC syringe, volume and pH was measured.

**Results:** Patients who had fasted upto 8 hours had gastric fluid volume of  $27.857 \pm 3.058$ CC and pH  $3.929 \pm 0.997$  and patients who had fasted from 8 to 12 hours had gastric fluid volume of  $27.400 \pm 2.980$ CC and gastric pH  $2.914 \pm 0.355$ . Patients who had fasted from 12 hours and above had gastric fluid volume  $27.470 \pm 15.550$ CC and pH  $2.848 \pm 0.284$ .

**Conclusion:** Fasting interval more than 8 hours neither reduce gastric fluid volume nor increase its pH more than 2.5 and prolong fasting interval doesn't guarantee empty stomach and there is no relationship between a prolonged fast and safe gastric environment.

**Keywords:** Gastric pH, Gastric volume, General Anesthesia

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### INTRODUCTION

The purpose of preoperative fasting is to reduce the risk of regurgitation and aspiration of gastric contents during surgery<sup>1</sup>. To achieve this goal, the recommendation on preoperative fasting have varied with time. For elective surgery the order for nil by mouth after midnight or six hours of ingestion of food, although clear fluids may be taken up to two hours before surgery<sup>2</sup>. Therefore, rapid sequence induction with an ETT should be utilized for the anesthetic management in every high risk patients<sup>3</sup>. There are many test and procedures in medicine and specifically in cardiology that require patients to take nothing by mouth for several hours before the procedure<sup>4</sup>. It has been reported that traditional preoperative fast doesn't ensure an empty stomach because of gastric fluid volume and a longer fluid fast doesn't improve the gastric environment<sup>5</sup> but gastric emptying of clear fluids occur within two hours in most patients<sup>6</sup>. Gastric emptying is effected by different factors like obesity<sup>7</sup>, pain<sup>8</sup>, trauma<sup>9</sup>, exercise<sup>10</sup> and systemic diseases. For assessment of gastric volume different rodent models<sup>11</sup> has been used. Similarly in human gastric pH and volume can be assessed with the help of pH paper, Ryles tube and single photon emission computed tomography<sup>12</sup>. Different drugs and remedies are use for fast gastric emptying like metoclopramide<sup>13</sup>, erythromycin<sup>14</sup> and azithromycin<sup>15</sup>. This prospective study attempts to review the effect of different fasting intervals on gastric volume and its pH in our population.

### METHODS

After the approval of study from the hospital ethics committee, 65 patients of ASA I & II status age 10 to 50 years of both sex undergoing general anesthesia for elective surgery were included in the study. Informed consent was taken from all patients. All patients fasted over night for both solids and fluids till the time of surgery. Time of last oral intake was recorded. After induction and intubation a multiorifice orogastric tube (18F) was passed in the stomach and confirmed by injecting few CC of air and listening over the epigastric with stethoscope. Gastric fluid was aspirated gently by 50CC syringe attach to orogastric tube. The suction was facilitated by pressing at three different points at epigastric and also by putting the patients in head up, head down, right lateral and left lateral position. The aspiration was collected in a sterile bowl, volume recorded and pH measured with pH paper. All finding were recorded. Pregnant patients and patients suffering from upper gastrointestinal disease e.g. reflux hiatus or acid peptic disease were excluded. Patients who were administered opioids anticholinergics, H<sup>2</sup> blockers and metoclopramide were also excluded. One way Anova was applied to analyze the data and to test the difference. The p value < 0.05 was considered significant. For sampling of patients proposive non probability technique was used and this was prospective analytical study.

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*Department of Anaesthesia, Services Hospital, Lahore*  
*Correspondence to Dr. Riaz Hussain, Associate Professor*  
*Email: neyazzpk@yahoo.com>*

**RESULTS**

In our study mean age was  $28.1771 \pm 1.213$  and in our study it was found that patients who had fasted up to 8 hours had gastric fluid volume of  $27.857 \pm 3.058$  and pH  $3.929 \pm 0.997$ . Patients who had fasted from 8 to 12 hours had gastric fluid volume of  $27.400 \pm 2.980$ CC and gastric pH  $2.914 \pm 0.355$ . Patients who had fasted from 12 hours and above had gastric fluid volume  $27.470 \pm 15.550$ CC and pH  $2.848 \pm 0.284$ . After analysis none of p values was  $< 0.05$  which should that the difference among the group was statistically insignificant. Similarly no significant correlation was found among fasting duration, gastric volume and pH value.

Graph: Distribution of patients

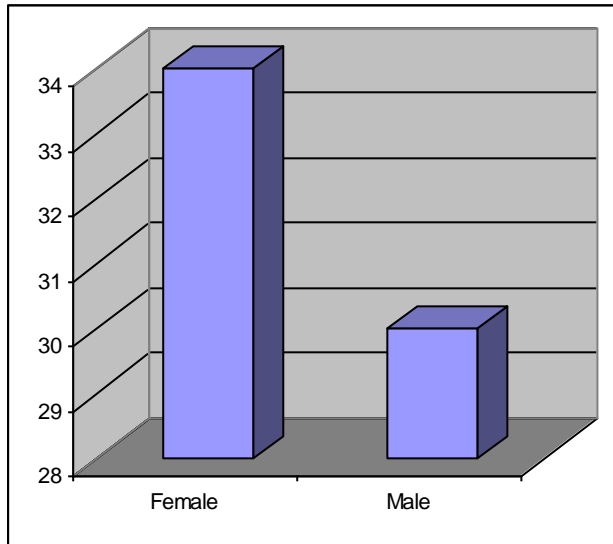


Table 2: Measurements of fasting duration, gastric and pH

<b>Fasting Duration (hr)</b>	
Mean±SEM	$11.015 \pm 0.335$
Median	11
(Min - Max)	( 4 - 17.5 )
<b>Gastric Volume (ml)</b>	
Mean±SEM	$27.477 \pm 1.980$
Median	25
(Min - Max)	( 2 - 70 )
<b>Gastric Ph</b>	
Mean±SEM	$3.00 \pm 0.240$
Median	2
(Min - Max)	( 1 - 8 )

Table 1: Patients characteristics

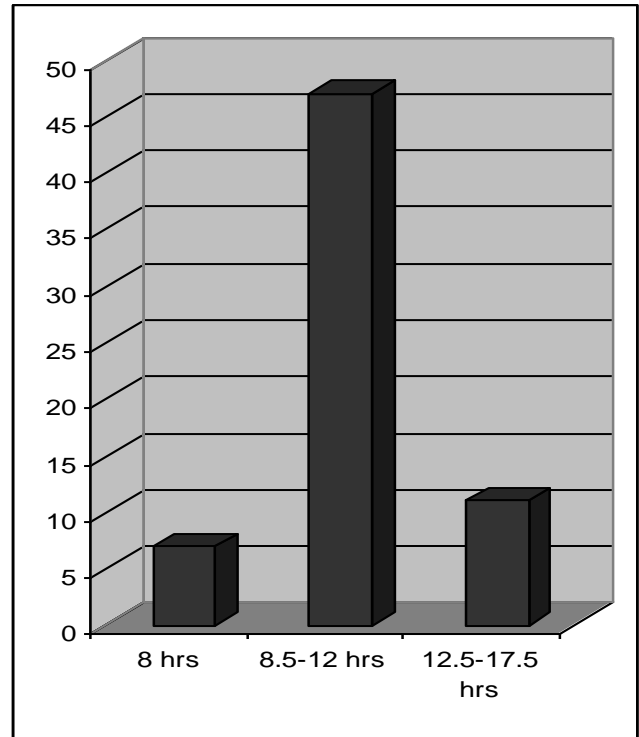
Mean±SEM (age in yrs)	$28.177 \pm 1.213$
Median	26
(Min - Max)	( 15 - 50 )
Mean±SEM (Weight kgs)	$66.646 \pm 1.272$
Median	68
(Min - Max)	(40-85 )

Table 3:

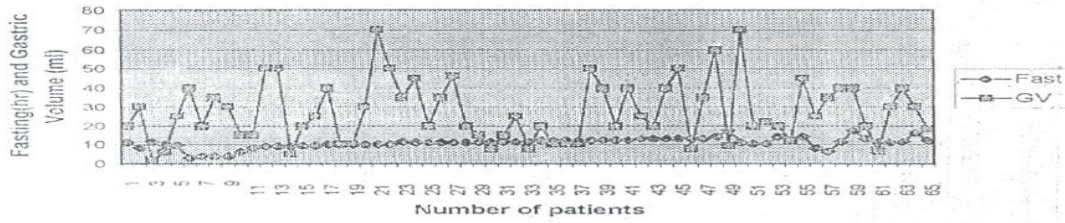
Fasting duration (hrs)	Gastric volume (MLS)	pH ( unit )
Up to 8	$27.857 \pm 3.058$	$3.929 \pm 0.997$
8.5 - 12.0	$27.400 \pm 2.980$	$2.914 \pm 0.355$
12.5 - above	$27.470 \pm 15.550$	$2.848 \pm 0.284$
P value	0.998	0.408

All values are in Mean ± SEM  
 One-way ANOVA is used to test the difference.  
 None of these values are  $< 0.05$  hence difference is insignificant.

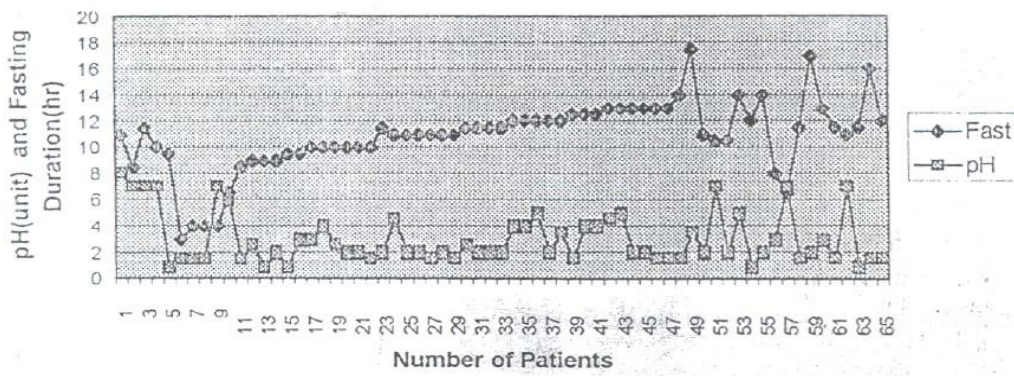
Graph: Distribution of fasting intervals



Correlation of Fasting with Gastric Volume



Correlation of Fasting Duration with Gastric pH



Correlation of Fasting Duration with Gastric Volume and its pH

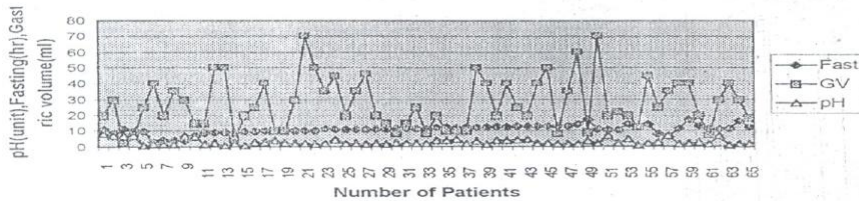


Table 4: Correlation among fasting duration gastric volume and pH value

	FD (r(p-value))	GV (r (p-value))	pH (r (p-value))
Fasting duration (FD)	1.0 (1.0)	---	---
Gastric (GV)Volume	0.035 (0.780)	1.0	---
pH (pH)	-0.149 (0.235)	-0.232 (0.064)	1.0

No significant correlation is found among fasting duration, gastric volume and pH value

Table 5: Incidence of patients with high risk factors

Volume > 25 ml	pH < 2.5	Volume > 25 ml & pH < 2.5
11(17%)	17(27%)	21(33%)

Residual gastric volume greater than 25 ml and pH less than 2.5

## DISCUSSION

Danger of pulmonary aspiration of gastric contents is always of concern to the anesthetist. Results from animal experiments suggest that in human a residual gastric volume of more than 25ml with pH less than 2.5 is potentially lethal. We studied relationship of fasting interval and gastric volume and pH in our population. We found that a prolonged fasting period doesn't guarantee an empty stomach. Our study also showed gastric volume more than 25ml and pH less than 2.5 with prolonged fasting period. Our technique of gastric aspiration is in accordance with the technique used in the study of Hardy et al<sup>16</sup> and Manchikanti et al<sup>17</sup>. Blind gastric aspiration using multiorificed orogastric tube was the method of estimation of gastric fluid volume in our study. In the study of Soreide and colleagues they found that gastric fluid volumes aspirated blindly and that determined by fiber optic gastroscopy were not very different with mean difference of 6ml with blind aspiration. Hence blind gastric aspiration is a fairly reliable method of estimation of gastric fluid volume.

Many studies have been done to compare the effect of prolonged fast and clear fluid 3 hours before induction of anesthesia on gastric volume and pH.

In the study of Miller et al<sup>19</sup> they found no difference in gastric volume and pH between two groups and similarly in the study of Splinter et al<sup>20</sup> they found that the large volume of clear apple juice 2.5 hours before scheduled surgery doesn't have a significant effect on the gastric fluid volume and pH and has additional benefits of improved patient comfort.

Similarly the study of Andrew Hutchison<sup>21</sup> also support our study and they found that there is no statistically significant difference in gastric volume and pH in patients who fasted for eight hours and then those who had clear orange juice and coffee 3 hourly before surgery.

In the stud of Kwailek MA et al<sup>22</sup> they use MRI for assessment of gastric volume and there was no correlation between the volume of preoperative drinking with the volume and pH of gastric content<sup>23</sup> and in the study of Hong JY et al<sup>24</sup> they found that pregnant women have more acidic and greater gastric volume than non pregnant women. Monitoring of residual gastric volume to prevent aspiration is standard practice<sup>25</sup> and nursing care of patients with enteral feeding tubes is common n ICU<sup>26</sup>.

In the study of Metherny NA et al they found that there is no consistent relationship between aspiration and gastric residual volume in critically ill patients<sup>27</sup> and gastric emptying is often delayed in major trauma patients<sup>28</sup>.

So we concluded that fasting interval in elective cases more than 6 hours neither reduce gastric fluid volume nor increase its pH more than 2.5 and prolonged fasting intervals doesn't guarantee empty stomach and there is no relationship between a prolonged fast and safe gastric environment, patients even with prolonged fast should be dealt in seriously to prevent aspiration pneumonitis.

## CONCLUSION

Fasting interval more than 8 hours doesn't reduce gastric volume and in increase in pH more than 2.5 and there is no guarantee of empty stomach and there is no relationship between a prolonged fast and safe gastric environment.

## REFERENCES

1. Brady M, Kinn S, O'Rourkek, Randhawa N, Stuart P. Preoperative fasting for preventing perioperative complications in children. *Cochrane Database syst Rev* 2009; 4: 5285.
2. Aitkenhead AR, Smith G, Rowbotham DJ. Preoperative assessment and premedication. *Textbook of Anesthesia* 2007; 5<sup>th</sup>ed Churchill living stone Elsevier.
3. Zlotrik A, Gruenbaum SE, Rozet I, Zhumadilov A, Shapira Y. Risk of aspiration during anesthesia in patients with congenital insensitivity to pain with anhidrosis: case reports and review of the literature. *J Anesth* 2010; 24: 778-82.
4. Kern M. Should NPO be the rule before the cath? Re-examining pre-procedure routines. *Cath Lab Digest* 2010; 18: 1-10.

5. Crawford MJ, Christian S, Farroio-Gillespie A. Effect of clear liquids on gastric volume and pH and volume in healthy children. *Can J Anaes.* 1991; 38: 8.
6. Rajkumar G, Mehta MK. A comparative study of volume and pH of gastric fluid after ingestion of water and sugar-containing clear fluids in children. *Indian J Anesth* 2007; 51: 117-120.
7. Delgado-Aros S, Camilleri M, Castillo EJ, Cremoni F, Stephens D, Ferber I, Baxter K, Burton D, Zinsmeister AR. Effect of gastric volume or emptying on meal related symptoms after liquid nutrients in obesity: a pharmacologic study. *Clin Gastroenterol Hepatol* 2005; 3: 997-1006.
8. Zlotrik A, Gruenbaum SE, Rozet I, Zhumadilov A, Shapira Y; Risk of aspiration during anesthesia in patients with congenital insensitivity to pain with anhidrosis: case reports and review of literature. *J Anesth* 2010; 24: 778-82.
9. Libert N, Pons-ukkola E, Leclerc T, Clapson P, Debien B, Perez JP. Initial gastric volume nasogastric tube and pneumonia incidence in trauma patients *Critical Care* 2010; 14: 551.
10. Wang Y, Kondo T, Suzukamo Y, Oouchida Y, Izumi S. Vagal nerve regulation is essential for the increase in gastric motility in response to mild exercise. *Tohoku J Exp Med* 2010; 222: 155-63.
11. McConnell EL, Basit AW, Murdan S. Measurements of rat and mouse gastrointestinal pH, fluid and lymphoid tissue and implications for in vivo experiments. *J Pharm Pharmacol* 2008; 60: 63-70.
12. Vasavid P, Chaiwatanarata T, Gonlachanvisit S. The reproducibility of Tc-99m pertechnetate single photon emission computed Tomography (SPECT) for measurement of gastric accommodation in healthy humans: Evaluation of the test results performed at the same time and different time of the day. *J Neurogastroenterol Motil* 2010; 16: 401-6.
13. Burger DM, Wiestner T, Hubler M, Binder H, Keiser M, Arnold S. Effect of anticholinergic (atropine, glycopyrrolate) and prokinetics ( metoclopramide, cisapride) on gastric motility in beagles and Labrador retrievers. *J Vet Med A physiol pathol clin Med* 2006; 53: 97-107.
14. Witte KT, Constable PD. Assessment of the effects of erythromycin, neostigmine and metoclopramide on abomasal motility and emptying rate in calves. *Am J Vet Res* 2005; 66: 545-52.
15. Larson JM, Tavakkoli A, Drane WE, Toskes PP, Mohiree B. Advantages of azithromycin over erythromycin in improving the gastric emptying half time in adult patients with gastroparesis. *J Neurogastroenterol Motil* 2010; 16: 407-13.
16. Hardy JF, Plourde G, Lebrun M, Cote C, Lepage Y. Determining gastric contents during general anesthesia. Evaluation of two methods. *Can J Anesth* 1987; 36: 51-55.
17. Manchikannti L, Collier JA, Marrero TC, Roush JR. Assessment of age-related aspiration risk factors in pediatric, adult and geriatric patients. *Anesth Analg* 1985; 64: 11-17.
18. Soreide E, Soreide JA, Hoist-Larson H and Steen PA. studies of gastric content: comparison of two methods *British J Anesth* 1993; 70: 360-362.
19. Miller M, Nimmo WS; Gastric contents at induction of anesthesia. Is a four hour fast necessary. *BJA* 1983; 55: 1185-1187.
20. Splinter WM, Stewart JA, Muir JG. The effect of pre-operative apple juice on gastric contents, thirst and hunger in children. *Can J Anesth* 1989; 36: 55-58.
21. Hutchison A, Maltaby RJ, Crawford RG. Gastric fluid volume pH in elective in patients; Coffee or orange juice versus overnight fast *Can J Anesth* 1988; 35: 12-15.
22. Kwiatek MA, Fox MR, Steingoetter A, Denne D, Pat A, Kaufman E et al. Effect of clonidine and sumatriptan on postprandial gastric volume response, astral contraction waves and emptying: an MRI study. *Neurogastroenterol Motil* 2009; 21: 928-71.
23. Narutomo K, Sawa M, Shoji F, Akemi S, Shinichi T. Gastric fluid volume and pH in scheduled surgical patients following unrestricted oral fluid intake until two hours before surgery. *Japanese Journal of Anesthesiology* 2005; 54: 14-18.
24. Hong JY, Park JW, Oh JI, Lim WC. Gastric volume and acidity in pregnant and non pregnant women. *Korean J Anesthesiol* 2004; 46: 280-283.
25. Poulard F, Dimet J, Bontemps F, Clements E, Lebert C, Renard B, Reignier J. Impact of not measuring residual gastric volume in mechanically ventilated patients receiving early enteral feeding: A prospective before-after study. *J parenter Enterol Nutr* 2009; 34: 125-130.
26. Williams TA, Leslie GD. Should gastric aspirate be discard or retained when gastric residual volume is removed from gastric tubes. *Aust Crit Care* 2010; 23: 215-7.
27. Metheny NA, Schallom L, Oliver DA, Clouse RE. Gastric residual volume and aspiration in critically ill patients receiving gastric feedings. *AM J Crit Care* 2008; 17: 512-519.
28. Libert N, Ponsukkola E, Leclerc T, Clapson P, Debien B, Perez JP. Initial gastric volume, nasogastric tube and pneumonia incidence in trauma patients. *Critical Care* 2010; 14: 551-58.