

EFFECT OF RANITIDINE ON GASTRIC pH AND VOLUME IN WOMEN UNDERGOING ELECTIVE CAESAREAN SECTION

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SUMMARY

The pH and volume of the gastric fluid was analyzed, using blind gastric aspiration, in 40 patients undergoing elective caesarean section. Group-I consisted of those twenty patients who received 150 mg ranitidine at night and then in the morning of surgery. Group-II was given no medication. Intragastric pH and volume were measured, immediately after induction of anaesthesia and again on completion of surgery. In group-I, the volume aspirated was 17 ± 3.91 and the pH was 4.33 ± 1.03 . In group-II, the volume aspirated was 31.75 ± 11.42 and the pH was 2.29 ± 0.31 . There is significant difference in the volume and pH of the two groups. Hence this study shows that ranitidine is very effective in reducing the acidity and volume of gastric fluid in all those women undergoing elective caesarean section.

INTRODUCTION

Ranitidine is a H₂-receptor antagonist which has the ability to control both gastric pH and volume when given to pregnant women during labour.^{1,2}

Gastric acidity increases in all pregnant women and most maternal deaths attributed to general anaesthesia for caesarean section are related either to difficulty in tracheal intubation or pneumonitis resulting from aspiration of acid gastric contents, commonly known as "Mendelson syndrome".³

The use of extra-dural or sub-dural anaesthesia obviates these risks, however regional anaesthesia is not suitable for all patients and general anaesthesia will always have a role in obstetrics. Precaution therefore must be taken to control the volume and pH of gastric contents in all those patients who may require caesarean section.

All authorities agree that aspiration of gastric fluid with a pH of 2.5 or less considerably increases the risk of acid aspiration syndrome and all agree that if pH is greater than 3.5, there is virtually no risk. Between these two values the degree of associated risk is dependent upon the volume of the material aspirated. It has been shown that even 25 ml of gastric fluid with a pH less than 2.5 can cause acid aspiration syndrome.^{4,5}

The aim of this study therefore is to control both pH and volume of gastric fluid with a drug which can effectively raise the pH to safer level and decrease the gastric juice volume, thus decreasing the maternal morbidity and mortality associated with general anaesthesia in women undergoing elective caesarean section.

MATERIAL AND METHODS

Forty cases of elective caesarean section were selected for this study during a six

months period in the department of anaesthesiology and Intensive care, Post-graduate Medical Institute, Lady Reading hospital, Peshawar. They were divided into two groups of twenty each. The first group received 150 mg ranitidine orally in the evening before surgery i.e (2200 hours) and then in the morning of surgery i.e (0600 hours). This group was termed as MEDICATED group. The second group which was given no medicine, was named as UN-MEDICATED group. No other pre-medication was given to any of the patient. All the women were healthy with uncomplicated pregnancies. Exclusion criteria included obese patients, any history of acid related gastro-intestinal tract disorders, drug allergy or abuse. Laboratory investigation included routine pre-operative full blood count, urea , sugar, ECG and X-Ray chest.

All women were transported to operation theatre in the lateral tilt position, placed in the same position on operation theatre table and monitored with ECG, non-invasive blood pressure and pulse oximetry.

Pre-oxygenation done for 2-3 minutes. anaesthesia induced with thiopentone 5 mg/kg body weight while cricoid pressure was being applied. Suxamethonium 1.5 mg/kg was given, after loss of eye lash reflex to facilitate tracheal intubation. Anaesthesia maintained with 50% nitrous oxide in oxygen, supplemented with 0.5% halothane until delivery of the baby when nitrous oxide was increased to 70% in oxygen. Muscle relaxation continued with 0.5 mg/kg atracurium. Morphine 0.1 mg/kg given at the delivery of the baby. Halothane discontinued at skin closure. 100 % of oxygen administered at the end of surgery. Atropine 1 mg and neostigmine 2.5 mg were given to reverse residual neuro-muscular blockade.

Gastric aspiration was performed after induction of anaesthesia and again on completion of anaesthesia , before reversal. A wide bore orogastric tube was inserted after tracheal intubation and correct position

in the stomach was checked by auscultation of injected air. A 50 ml syringe was used for aspiration of gastric fluid. Attempts were made to maximize the returned volume by repeated aspiration while the tube was slowly withdrawn a little and then re-inserted. This procedure is shown to give better results than intermittent suction or continuous mechanical suction. Aspiration was also performed at the end of surgery. Volumes were measured directly from the 50 ml syringe which was graduated in one ml markings. Measurements of the pH were

TABLE - I
SHOWING THE RESULTS OF GASTRIC JUICE pH AFTER TAKING RANITIDINE.

No. of patients	Percentage (%)	pH
12	60%	4-4.5
3	15%	6-7
5	25%	3-3.5

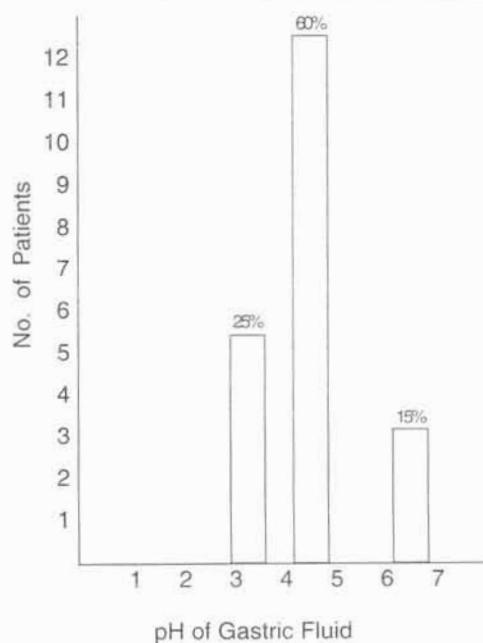


Fig. No. 1 Showing the relationship between number of patients and pH of gastric fluid in Medicated Patients.

made within one hour using a pH meter in the central pathology laboratory of Post-graduate Medical Institute Lady. Reading Hospital. Each sample was checked twice for pH measurement. The volumes and pH of the gastric aspirate were recorded and statistical analysis done at the end of study^{16,17}.

RESULTS

Forty patients were included in this study, divided into two groups termed as **MEDICATED** and **UN-MEDICATED** group. In the medicated group 12 patients had a pH in range of 4 - 4.5, 3 patients had a pH in range of 6-7 and 5 patients had a pH in range of 3 - 3.5 (Table No. I). The mean pH, as calculated in this group was 4.33 ± 1.03 (mean \pm SD). This relationship between the number of patients and gastric fluid pH is shown in figure No. 1.

The volume in the medicated group as shown in table No. II, 15 patients had volume in the range of 15- 20 ml, 3 patients had volume in the range of 20 - 25 ml and 2 patients had volume in the range of 5 - 10 ml. So Mean volume in this group as calculated was 17 ± 3.91 (mean \pm SD). This relationship between the number of patients and the volume of gastric fluid is shown in figure No.2.

In the **Un-Medicated Group**, 10 patients had a pH in the range of 1.95 - 2.00, 4 patients had a pH in the range of 2 - 2.8 and 6 patients had a pH in the range of 2.5 - 3.00 (Table No. III). The Mean pH in UN-MEDICATED GROUP group, as calculated was 2.29 ± 0.31 (Mean \pm SD). This relationship between the number of patients and gastric pH is shown in figure No.3.

The volume in **Un-Medicated Group**, as shown in table No. IV, 12 patients had volume in the range of 30 - 40 ml, 2 patients had volume in the range of 50 - 60 ml and 6 patients had volume in the range of 15 - 20 ml. The mean volume calculated was 31.75 ± 11.42 (Mean \pm SD). The

TABLE - II
SHOWING THE RESULTS OF GASTRIC JUICE AFTER TAKING RANITIDINE.

No. of patients	Percentage (%)	Volume
15	75%	15-20 m
3	15%	20-25 m
2	10%	5-10 m

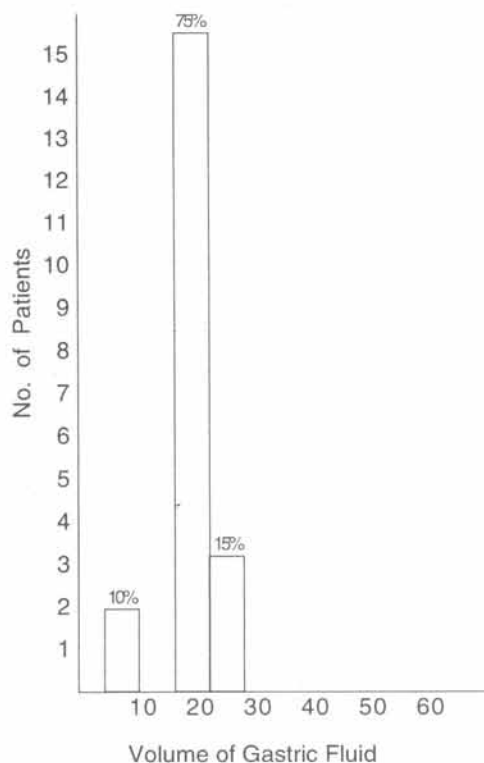


Fig. No. 2 Showing the relationship between number of patients and Volume of gastric fluid in Medicated Patients.

relationship between the number of patients and gastric volume in un-medicated group is shown in figure No.4. Table No. V shows the comparison of the pH and volume of the two groups.

DISCUSSION

Aspiration pneumonitis secondary to gastric contents regurgitation and aspiration

TABLE – III
SHOWING THE RESULTS OF GASTRIC
pH WITHOUT ANY PREMEDICATION.

No. of patients	Percentage (%)	pH
10	50%	1.95–2
4	20%	2–2.8
6	30%	2.5–3

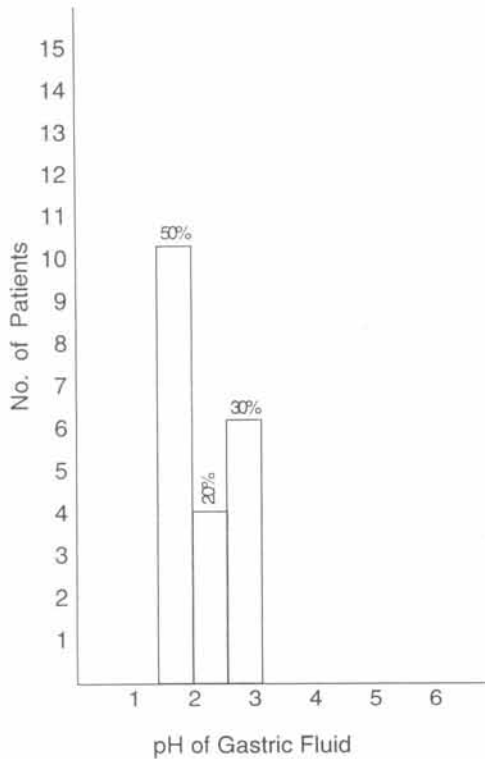


Fig. No. 3 Showing the relationship between number of patients and pH of gastric fluid in Un-Medicated Patients.

is a recognized complication of anaesthesia, especially in obstetrical anaesthesia. This syndrome has also been shown in animal studies to be associated with gastric volume > 25 ml and a gastric pH < 2.5. Therefore multiple agents have been used in humans to decrease gastric acidity and gastric volume in an attempt to decrease hypothetically the incidence of aspiration and severity of pneumonitis if aspiration does occur. These

TABLE – IV
SHOWING THE RESULTS OF VOLUME
OF GASTRIC FLUID IN
UN-MEDICATED PATIENTS.

No. of patients	Percentage (%)	Volume
12	60%	30–40 m
6	30%	15–20 m
2	10%	50–60 m

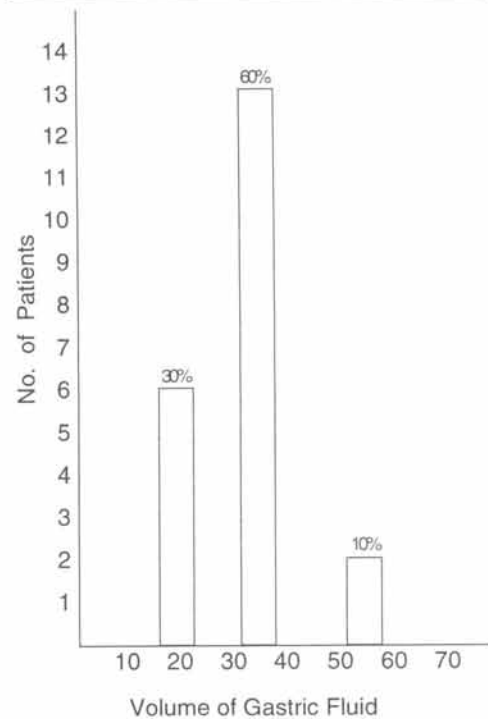


Fig. No. 4 Showing the relationship between number of patients and Volume of gastric fluid in Un-Medicated Patients.

agents included particulate antacids, non-particulate antacids, anticholinergics, dopaminergic inhibitors (metoclopramide) and H2 receptor antagonist. All of them have got their own merits and demerits. Particulate antacids have fallen out of favour following the reports that these drugs can cause an acute lung injury, not different from aspiration of solid food particles. Sodium citrate, a non-particulate antacid is a very

TABLE - V
COMPARISON OF THE PH
AND VOLUME OF THE TWO GROUPS
SHOWN AS MEAN \pm SD.

Group	pH	Volume (ml)
Medicated	4.33 \pm 1.03	17 \pm 3.91
Un-medicated	2.29 \pm 0.31	31.75 \pm 11.42

useful drug with a rapid onset of action but it has two drawbacks, its short duration of action and increase in gastric volume caused by it, when 30 ml of 0.3 M solution is used.⁶

The use of prokinetic drugs metoclopramide, domperidone and cisapride have been advocated by some workers as they invariably lead to increase in gastric emptying rate in patients with normal gastric motility. These are, however, not effective against the decrease in barrier pressure caused by opioids administration and after the reversal of neuromuscular blockade with neostigmine and atropine. This limits their use at the time of extubation. There is however strong arguments for combining these agents with H₂-receptor antagonists.⁷

Much importance has been given to the use of H₂ receptor antagonist these days. Cimetidine, with over all good safety record has been implicated in causing multiple side effects, with the most significant being hypotension, cardiac arrhythmias, central nervous system depression, broncho-constriction and drug interactions with theophylline, warfarine and phenytoin^{12,15}.

Famotidine, although has got less side effect than cimetidine, is expensive. In this study ranitidine has been used because it is longer acting than cimetidine, free from drug interaction and has got fewer side effects.

This study has demonstrated that the use of ranitidine, an H₂ receptor antagonist, in dosage of 150 mg in the evening and then

150 mg in the morning orally, has significantly reduced the acidity and volume of gastric contents to a safer level i.e the mean pH was 4.33 \pm 1.03 (mean \pm SD) and mean volume 17 \pm 3.91 (mean \pm SD).

The results of this study can be compared to the study by Stevin A. Dubin and his colleagues,⁷ who compared the effects of oral famotidine and ranitidine on gastric volume and pH in their study and they found that one pre op evening dose of ranitidine 150 mg has raised the pH to 4.3 \pm 2.1 and reduced the volume to 17.9 \pm 11.7 which is quite comparable to our study in which the mean pH was 4.33 \pm 1.03 (mean \pm SD) and mean volume was 17 \pm 3.91 (mean \pm SD). Similarly in another study by R.D. Colman and his colleagues,⁸ the use of oral ranitidine 150 mg at night, followed by 50 mg ranitidine intra-muscularly, 90 minute before operation, in women undergoing elective caesarean section resulted in gastric content within the "safe limits" as defined by Roberts and Shirley.^{13,14}

In the second group of this study i.e un-medicated, our results shows a mean pH of 2.29 \pm 0.31 and volume of 31.75 \pm 11.42. This study can be compared to that by Faure et al^{9,10} which shows a mean volume of 46 \pm 19.9 and a pH of 2.45 \pm 2 (mean \pm SD). Similarly Roberts and Shirley⁴ found a mean volume of 59 ml (Range 5-400ml) and a pH of 3.55 \pm 1.8 in obstetric patient. Robert and Shirley thus defined the greater risk patients i.e those who have gastric volume > 25 ml or more than 0.4 ml/kg body weight and pH less than 2.5 are at a greater risk of developing aspiration pneumonitis.

In our study the mean pH calculated in the un-medicated group was 2.29 \pm 0.31 and mean volume was 31.75 \pm 11.42, which can be compared to western studies where about 55% patient had volume more than 40 ml.

So in this study it has been shown that there is significant difference in the gastric

pH and volume when patient had taken H2 receptor antagonist as compared to those patient who had taken no medication and thus they are at a definite risk. This risk would further increase in obese patients and those who have got some acid related gastro-intestinal tract disorders. Antacid prophylaxis is only a part of the prevention of acid aspiration. Much reliance is also placed on the use of cricoid pressure as part of the rapid sequence induction, however even in trained hands, cricoid pressure is not infallible and it is important to ensure that if regurgitation occurs despite cricoid pressure, aspiration of gastric contents does not lead to acid pneumonitis and this aim is achieved with the use of H2 receptor antagonist in all those patient who may require caesarean section.

CONCLUSION

From the study carried out, we have reached at the following conclusion that obstetric patient have got a high gastric volume and low gastric pH. This is shown in our study that un-medicated patients have got a mean volume of 31.75 ± 11.42 (mean \pm SD) and a mean pH of 2.29 ± 0.3 (mean \pm SD). These patients are thus at a considerable risk of developing aspiration pneumonitis if proper precaution are not taken. The use of ranitidine in this study has shown that it has reduced the acidity and volume of gastric contents, bringing these values within the safer level, thus decreasing the morbidity and mortality in obstetric patient if regurgitation does occur. Much importance has been given to the use of H2 receptor antagonist these days, as they can effectively control both gastric volume and pH and apart from obstetric patient these are used in all obese patient and also those patient who are at a greater risk of regurgitation and aspiration.

REFERENCES

1. Roberts RB, Shirley MA. Antacid therapy in obstetrics. *Anaesthesiology*, 1980; 53: 83.
2. Ewart MC, Yau G, Gin T, Kotur CF. A comparison of the effects of omeprazole and Ranitidine on gastric secretion in women undergoing elective caesarean section. *Br J Anaesthesia* 45: 527.
3. Mendelson CL. The Aspiration of stomach contents into the lungs during obstetric anaesthesia *American Journal of Obstetrics and gynaecology* 1946; 52: 191.
4. Roberts R.B, Shirley C. A Reducing the risk of acid aspiration during caesarean section. *Anaesthesia and Analg* 1974; 63: 665.
5. Lim SK, Elegbo EO. The use of single dose of sodium citrate as a prophylaxis against acid aspiration syndrome in patients undergoing caesarean section *Med J Malaya* 46: 349(A).
6. Solanki DR, Suresh M, Ethridge HC. The effect of intravenous cimetidine and metaclopramide on gastric volume and pH. *Anaesth. Analg*, 1984; 63: 599.
7. Dubin SA, Silverstein PI, Wakefield ML, Jense HG. Comparison of the effects of oral famotidine and ranitidine on gastric volume and pH. *Anaesth. Anal*, 1989; 69 : 680.
8. Colman RD, Frank M, Loughman BA. Use of LM Ranitidine for prophylaxis of aspiration pneumonitis in obstetrics. *Br J Anaesthesia* 1988; 61: 720.
9. Faure EAM, Lim HS, Block BS. Sodium bicarbonate buffers gastric acid during surgery in Obstetrics and gynaecology. *Anesthesiology* 1987; 67: 274.
10. Manchikanti L, Kraus JW, Edds SP. Cimetidine and related drugs in anaesthesia. *Anaesth analg* 1982 ; 61 : 595.
11. Newson AJ. The effectiveness and duration of pre-operative antacid therapy. *Anaesth Intensive Care* 1977; 5: 214.
12. Pickering BG, Palahmuik RJ, Cumming M. Cimetidine; premedication in elective caesarean section: a comparison of cimetidine and magnesium trisilicate mixture regimens. *Br J Obst Gynae*, 1980; 87: 565.
13. Guay J, Santerra L, Gaudreault P, Goult B, Dupur C. Effect of oral cimetidine and

- ranitidine on gastric pH and residual volume in children. *Anaesthesiology*, 1989; 71: 547.
14. Goersky GV, Finlay A, Bissonette B, Shaffer EA. Efficacy, duration and absorption of a paediatric oral liquid preparation of ranitidine hydrochloride. *Can J Anaesth* 1992; 39:791.
 15. Lam AM, Grace DM, Phil D, Penny FJ, Vezina WC. Prophylactic intravenous cimetidine reduce the risk of acid aspiration in morbidly obese patients. *Anaesthesiology*, 1986; 65: 684.
 16. Salem MR, Wong AY, Mani M, Bennet EJ, Toyoma T. Premedication drugs and gastric juice pH and volume in paediatric patients. *Anaesthesiology* 1976; 44:216.
 17. Zafar Ali. Gastric Juice analysis in patients undergoing caesarean section. *Journal of Anaesthesiology* 1990; 4: 7.