The use of single dose of sodium citrate as a prophylaxis against acid aspiration syndrome in obstetric patients undergoing caesarian section

S. K. Lim, MBBS, M. MED. *Lecturer*

E. O. Elegbe, MBBS, D. A., FFARCSI *Professor*

Department of Anaesthesiology, Faculty of Medicine, Universiti Kebangsaan Malaysia, Jalan Raja Muda, 50300 Kuala Lumpur

Summary

The effectiveness of sodium citarate as a prophylaxis against acid aspiration syndrome was studied in 3 groups of obstetric patients. Group I was the control group which consisted of 20 patients in established labour who were not likely to require caesarian section. No antacid had been given to these patients. Group II consisted of 20 patients who underwent elective caesarian section, while Group III consisted of another 20 patients who underwent emergency caesarian section. Group II and III were given 30ml of 0.3M sodium citrate as soon as they arrived in the operation theatre. The gastric content was aspirated after the induction of anaesthesia and at the end of surgery just before extubation. The volume was measured and a sample sent for pH analysis. Sodium citrate was found to increase the gastric pH significantly in both Group II and III patients when compared with Group I patients who underwent emergency caesarian section. We conclude that 30ml of 0.3M sodium citrate is effective in increasing gastric pH though it tends to be associated with an increase in gastric volume.

Key words: Obstetric anaesthesia, caesarian section, sodium citrate as prophylaxis against acid aspiration.

Introduction

Pulmonary aspiration of ε astric content (Mendelson syndrome) in obstetric patients continues to be one of the commonest causes of maternal morbidity and mortality¹. The severity and the extent of pulmonary damage is related to the pH² and the volume³ of material aspirated. It is generally agreed that a pH of less than 2.5 is a critical level for producing severe pulmonary damage. It is also suggested by Roberts and Shirley³ that a gastric content of more than 25ml. is a threat to pregnant patients should aspiration occur.

Many preventive measures have been advocated to alter the gastric pH and volume to a safe level. These include emptying the stomach mechanically and pharmacologically(metoclorpromide); neutralisation of gastric contents by antacids or H₂ receptor antagonists. In the Maternity Hospital Kuala Lumpur, a single dose of mist. magnesium trisilicate (MMT) was used to neutralise the gastric content for patients going for Caesarian Section (LSCS) until 1984 when it was replaced by 0.3M sodium citrate. A study by Tan⁴ in this hospital in 1984 showed that a single dose of mist. magnesium trisilicate(15 ml) given before general anaesthesia for LSCS decreased the number of patients at risk (pH less than 2.5) from 53% (without MMT) to 20% (with MMT). However in view of the reports

that aspiration of MMT neutralized gastric content could still give rise to chemical pneumonitis^{5,6,} the author proposed the use of sodium citrate as a safer alternative since this has been shown to cause much less pulmonary damage when aspirated⁷. With the availability of 0.3M sodium citrate in this hospital in 1985, it has been given to all patients coming for LSCS just prior to induction of anaesthesia. Since no study has been reported in this hospital on the effectiveness of sodium citrate in neutralizing the gastric content, we have undertaken this study to evaluate its effectiveness in neutralizing the gastric content of patients scheduled for elective and emergency LSCS.

Materials and methods

3 groups, each made up of 20 obstetric patients were studied after approval was obtained from the Ethical Research Committee.

Group I

This was the Control Group consisting of patients of ASA 1 or 2 who were in established labour. No antacid had been given. A Ryle's tube was inserted after patients' consent had been obtained and a sample of the gastric juice was aspirated and sent for pH analysis.

Group II

This consisted of patients scheduled for elective LSCS under general anaesthesia.

Group III

This consisted of patients who required emergency LSCS under general anaesthesia.

For groups II and III, no premedication was given. As soon as the patient arrived in the operation theatre, 30 ml. of 0.3 M sodium citrate was given orally. All patients had a rapid sequence induction with pre-oxygenation, thiopentone, cricoid pressur, suxamethonium, and intubation. Anaesthesia was maintained with 50% nitrous oxide in oxygen, 0.5% halothane, and a non-depolarising muscle relaxant. After delivery of the baby, intravenous pethidine lmg/kg was given and anaesthesia maintained with 67% nitrous oxide in oxygen.

Following intubation, a Ryle's tube was passed into the stomach and gastric content aspirated. Attempts were made to empty the stomach as much as possible by repeated aspiration while adjusting the position of the Ryle's tube. Volume of the aspirate was measured and a sample sent for pH analysis. After completion of the surgery, just before extubation, the gastric content was again aspirated, the volume measured and a sample sent for pH analysis.

The pH of the gastric content was measured by Corning pH meter. Results were analysed using Student's t-test and Chi-square test. A p value of < 0.05 was considered as significant.

Results

The patients' characteristics are summarised in Table 1. There was no significant difference between the 3 groups with regards to their age and weight.

There was also no significant difference between the elective and emergency group with regards to the fasting interval and medication - aspiration interval as shown in Table 2.

The mean pH of gastric aspirate of the patients in Group II and Group III compared with that of Group I at induction and just before extubation are as shown in Table 3. Sodium citrate significantly raised

| (Control) | (Elective) | Emergency) |
|------------|-------------|-----------------------|
| 20 | 20 | 20 |
| 28.8 (5.6) | 27.6 (5.5) | 28.3 (4.4) |
| 60.4 (8.3) | 62.9 (11.1) | 62.0 (11.2) |
| | 28.8 (5.6) | 28.8 (5.6) 27.6 (5.5) |

| | Table I |
|----------------------------|---------------------------------|
| Patients' characteristics. | Values expressed in mean (S.D.) |

Table II Fasting interval & medication-gastric aspiration interval in elective and emergency LSCS patients

| | Elective (n = 20) (Group II) | Emergency (n = 20) (Group III) |
|---|---------------------------------|-----------------------------------|
| Fasting interval (hours) | 10.2 (2.6) | 8.7 (4.6) |
| Medication-aspirate interval (minutes) | | |
| 1st aspirate | 19.8 (10.5) | 15.4 (5.9) |
| 2nd aspirate | 56.7 (14.1) | 49.7 (12.4) |

the pH of gastric aspirate of patients in Group II and Group III. In Group I, 75% of the patients had a gastric pH of less than 2.5 while in Group II, all patients had gastric pH more than 2.5 at both induction and just before extubation, and in the Group III only one patient had pH less than 2.5 just before extubation (Table 4).

Figures 1 and 2 show the distribution of the gastric pH of Group II and Group III patients at induction when compared with Group I patients.

The volume of gastric aspirate at induction and just before extubation for Group II and Group III patients who underwent LSCS are shown in Table 5. The volume of gastric aspirate tend to be larger in patients undergoing emergency LSCS (Group III) than in the elective group (Group II), though the difference was not statistically significant. Group III patients had a wider range of volume of gastric aspirate than Group II patients (Table 5). Six patients (30%) in Group II and nine patients (45%) in Group III had a volume of gastric aspirate of greater than 25ml. at induction. Just before extubation there were six patients in Group III and none in Group II with a volume of gastric aspirate of greater than 25ml (Table 4).

 Table III

 Gastric pH of LSCS patients at induction and extubation compared with control group.

| Group I (control) | | Group II (Elective) | Group III (Emergency) |
|----------------------|------------|------------------------|--------------------------|
| | Induction | + 5.46 (4.1 – 7.08) | #5.36 (2.65 – 6.53) |
| 2.47 (1.2 – 6.26) | Extubation | + 5.38 (3.64 – 7.04) | #5.22 (2.01 – 6.86) |

Values expressed in mean (range)

+ significant between Group II and Group I at p < 0.05# significant between Group III and Group I at p < 0.05

| Table IV |
|--|
| No of LSCS patients at "risk" (pH < 2.5, Volume > 25ml.) |

| | Group II (elective) (n = 20) | Group III (emegency) (n = 20) |
|----------------------|---------------------------------|----------------------------------|
| Induction | | |
| pH < 2.5 | 0 | 0 |
| \dot{V} ol > 25ml. | 6 (30%) | 9 (45%) |
| Extubation | | |
| pH < 2.5 | 0 | 0 |
| Ŷol > 25ml. | 0 | 6 (30%) |

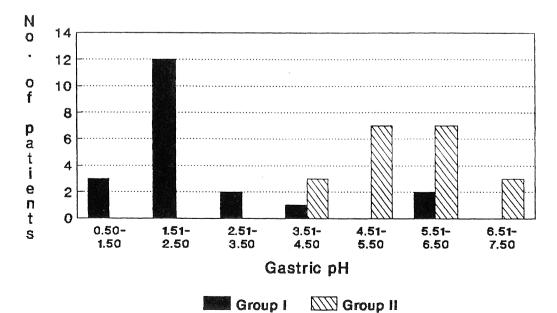
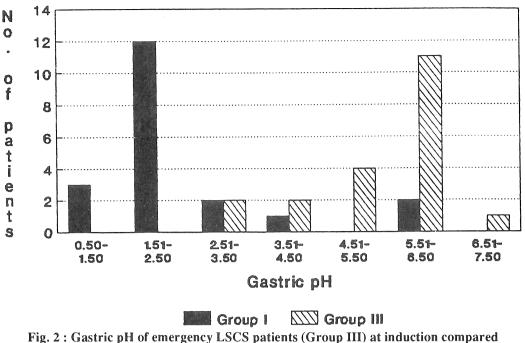


Fig. 1 : Gastric pH of elective LSCS patients (Group II) at induction compared with control group (Group I)



ergency LSCS patients (Group III) at i with control group (Group I)

itil control group (Group 1)

| Table V | | |
|--|--|--|
| Volume of gastric aspirate in LSCS patients. | | |
| Values expressed in mean ml. (range) | | |

| | Group II (Elective) (n = 20) | Group III (Emergency) (n = 20) |
|------------|---------------------------------|-----------------------------------|
| Induction | 21.3 (1-65) | 26.8 (2-126) |
| Extubation | 10.3 (3 – 21) | 17.4 (2 - 90) |
| Total | 31.6 (5 – 71) | 44.2 (5.5 – 130) |

Discussion

Obstetric patients undergoing LSCS are most susceptible to hazards of aspiration during induction of anaesthesia just before intubation and during emergence form anaesthesia just after extubation. It is generally accepted that a pH of less than 2.5 and a gastric volume of more that 25 ml. expose the patients to the risk of severe pulmonary damage should aspiration occur^{8,9}. This present study showed that 30 ml. of 0.3M sodium citrate given just before the induction of anaesthesia for elective and emergency LSCS was effective in raising the gastric pH above the critical level of 2.5 in almost all patients and maintained at this level throughout the duration of the surgery. This is in agreement with the studies done by Gibbs et al¹⁰, Abboud et al¹¹, and Dewan et al¹². In the study by Tan⁴, where 15ml of MMT was given to obstetric patients just prior to the induction of anaesthesia for emergency LSCS, 20% of

the patients had a gastric pH of less than 2.5. The range of pH in his patients was 1.3-8.6 while in the present study the range of pH in patients who were given sodium citrate was much narrower. This seems to suggest the possibility of inadequate mixing of MMT with the gastric juice in Tan's patients, giving rise to pockets of unneutralized gastric content. Sodium citrate was more consistent in raising the gastric pH in both the elective and emergency situations. We also noted that there was no significant variation in the gastric pH between the 2 samples collected from each patient. This seems to support the fact that sodium citrate, being a clear antacid, mixes more evenly with the gastric juice than MMT, as no attempts were made to mix the antacid with the gastric content by rotation or side movement of our patients as described by Holdsworth and co-workers (1980)¹³.

The largest volume of gastric aspirate recorded in this study was 126 ml. which was obtained from a patient at induction who underwent emergency LSCS, while in the elective group the largest volume was 65 ml. The larger volume of gastric aspirate in the emergency group is most likely due to the delayed gastric emptying which occurs during labour and which may be increased by any narcotic analgesic which had been given. Even just before extubation 30% of this group of patients still had a gastric aspirate of more than 25 ml. Our method of aspiration of the gastric content however, does not ensure the complete retrieval of all the gastric content, it is likely that larger volumes were present. This indicates that there is still arisk of pulmonary aspiration, and all obstetric patients requiring LCSC should still be regarded as having a "full stomach".

In conclusion, a single dose of 30ml. of 0.3M sodium citrate given just before the induction of anaesthesia is effective in neutralizing the acidic gastric content of patients undergoing elective and emergency LSCS. However because it tends to increase the gastric volume especially in patients undergoing emergency LSCS, aspiration of the gastric content can still occur. Therefore the usual prophylactic maneuvers e.g. rapid sequence induction, cricoid pressure and endotrachael intubation must be employed and vigilance on the part of the anaesthetist cannot be substituted.

The use of H_2 receptor antagonists may be of use in such situations as they have been shown to increase gastric pH and reduce gastric volume¹⁴.

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