EVALUATION OF PRE-OPERATIVE ANTACID FOR ELECTIVE CAESARIAN SECTION

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SYNOPSIS

The value of pre-operative antacid administration for elective caesarian section was clearly demonstrated by comparing the pH and volume of gastric contents in 50 patients treated with 10 ml Mist Magnesium Trisilicate with that of 50 controls. In the treated group, only one patient had a gastric pH below 2.5 while in the control group 27 patients had gastric pH below 2.5. There was no significant difference in the volume of the gastric aspirate between the two groups.

INTRODUCTION

Pulmonary acid aspiration syndrome persists even in our modern era to be a major cause of anaesthetic associated maternal mortality and morbidity in obstetric patients. More than half of all anaesthetic deaths in the United Kingdom resulted from aspiration of vomitus (Edwards et al, 1956; Report on confidential enquiries into maternal deaths in England and Wales, (1967 - 1969). In Singapore, 5 out of 7 cases of acid aspiration syndrome reported by Ambiavagar et al (1967) were associated with obstetric anaesthesia.

A historic milestone in modern obstetric anaesthesia was reached in 1966 when Taylor and Pryse-Davies introduced the regime of pre-operative antacid administration for the prevention of acid aspiration syndrome. This prophylactic measure has in recent years gained widespread acceptance even in non-obstetric anaesthetic practice (Crawford, 1970; Hutchinson & Newson, 1975; Peskett, 1973; Tay & Chiu, 1978). Routine pre-operative antacid prophylaxis for patients undergoing emergency caesarian section was introduced at Kandang Kerbau Hospital in 1972. Its prophylactic value against pulmonary acid aspiration is evinced by the subsequent absence of anaesthetic death from acid aspiration although sporadic cases of non-fulminant Mendelson's Syndrome have been seen. Recently Tay et al established the effective

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prophylactic antacid dose for patients undergoing emergency caesarian section. In this study, we undertook to assess the gastric acidity and volume content of patients undergoing elective caesarian section with and without the prophylactic use of antacids.

MATERIALS AND METHODS

One hundred healthy female patients between ages of 17 and 41 years presenting for elective caesarian section were studied. The first 50 patients were not given any pre-operative antacid whilst the subsequent 50 patients each received 10 ml of Mist magnesium trisilicate B.P.C. (containing magnesium trisilicate, magnesium carbonate and sodium bicarbonate). Pre-medication consisted of intravenous atropine 0.6 mg immediately prior to induction. A standardised technique of endotracheal general anaesthesia with muscle relaxants and controlled ventilation was employed. Following induction and tracheal intubation, a Ryle's tube (14 - 18 fg) was inserted per oral into the stomach and the gastric contents aspirated. The volume of aspirate was noted and the pH estimated by means of Merck's colourfast indicator paper with 0.5 pH gradations. Aspiration of gastric contents was repeated just prior to reversal of anaesthesia and the volume and pH of the contents recorded.

The mean age, weight and time interval from last meal to induction of anaesthesia of patients in the two study groups are listed in Table I; the differences between the two study groups are not statistically significant.

RESULTS

GROUP UNTREATED WITH ANTACID: The total volume of gastric contents aspirated ranged from 1.0 to 79.0 ml with a mean of 18.9 ml. The pH of the first gastric sample varied from 1.0 to 8.0 with a mean of 2.5, whilst that of the second sample varied from 1.0 to 9.0 with a mean of 3.2. Gastric aspiration was possible on both occasions in 34 patients. In these patients the difference between the pH of the two gastric aspirates was found by the paired 't' test to be statistically highly significant ($p < 0.001$). Twenty-seven patients had a pH of < 2.5 at induction, whilst 20 patients had a similar pH of < 2.5 just prior to reversal. There were nine patients with a pH consistently less than 2.5 and gastric aspirates exceeding 0.4 ml/kg body weight. Should a pH of 3.5 or less be accepted as the critical pH for man (Taylor, 1975a), then the gastric acidity of 31 patients at induction, and 22 patients just prior to reversal could have resulted in Mendelson's syndrome had aspiration occurred. Ten of these patients had a pH that was consistently 3.5 or less, and gastric aspirates exceeding 0.4 ml/kg body weight.

GROUP TREATED WITH 10 ML ANTACID: The mean total volume of gastric aspirate was 23.4 ml with a range from 3.0 to 77.0 ml. The mean pH of the first gastric sample was 8.0 with a range from 1.5 to 9.0, whilst that of the second sample was 8.2 with a range from 3.0 to 9.0. Gastric aspiration was possible on both occasions in 47 patients. In these patients the difference between the pH of the two samples was found by the paired 't' test to be statistically

TABLE 1: Patient Characteristics of Study Groups

Patient characteristics	Untreated patients	Patients treated with 10 ml antacid
Age:		
Range (years)	17 - 41	20 - 40
Mean ± SD	30.7 ± 5.1	29.7 ± 4.8
Weight:		
Range (kg)	41 - 80	35 - 85
Mean ± SD	57.6 ± 9.7	57.3 ± 10.1
Duration of pre-operative starvation:		
Range (hrs)	12.7 - 19.3	12.5 - 20.0
Mean ± SD	14.9 ± 1.7	15.0 ± 1.7

significant ($p < 0.05$). Only one patient was potentially at risk of pulmonary acid aspiration syndrome. Her gastric pH at induction was 1.5 and the volume aspirated at induction was 25 ml, just 1 ml short of the critical volume of 0.4 ml/kg body weight. The pH of the second gastric sampling was 3.5. Should a pH of 3.5 or less be accepted as the critical pH for Mendelson's syndrome in man, then this woman would have been at risk for the acidity of her gastric aspirate both at induction and prior to reversal was 3.5, and the total gastric volume aspirated exceeded 0.4 ml/kg body weight.

COMPARISON OF GASTRIC VOLUMES ASPIRATED BETWEEN ELECTIVE AND EMERGENCY CAESARIAN PATIENTS

The mean gastric volume of both treated and untreated patients undergoing elective caesarian section were compared with the mean gastric volume in another series (Tay et al) in which 50 patients, of comparable age, weight and duration of pre-operative fasting, underwent emergency caesarian section after prophylactic administration of 10 ml of Mist magnesium trisilicate B.P.C. This comparison was made to determine if there was any statistical difference between the mean gastric volume of patients who were already in labour and those who were electively operated upon.

Whilst there was no statistical difference between the mean gastric volumes of untreated and treated elective caesarian section patients ($p > 0.05$), there was a statistically highly significant difference ($p < 0.001$) between the mean gastric volume of emergency caesarian section patients and the mean gastric volumes of both treated and untreated caesarian section patients.

Table II summarises the results of this study.

TABLE II: pH and Volume of Gastric Contents of both Untreated Patients and Patients Treated with 10 ml Antacid

	Untreated patients	Patients treated with 10 ml antacid	Statistical significance
Volume:			
Range (ml)	1 - 79	3 - 77	t = 1.48
Mean ± SD	18.9 ± 16.1	23.4 ± 13.9	p 0.05
pH:			
(a) At induction:			
Range	1.0 - 8.0 (n = 41)	1.5 - 9.0 (n = 47)	t = 17.67
Mean ± SD	2.48 ± 1.64	7.97 ± 1.27	p 0.001
(b) Prior reversal:			
Range	1.0 - 9.0 (n = 43)	3.0 - 9.0 (n = 50)	t = 16.08
Mean ± SD	3.22 ± 1.88	8.22 ± 1.06	p 0.001
No. of patients with pH 2.5:			
(a) At induction	27	1	X^2 = 31.0 p 0.001
(b) Prior reversal	20	0	X^2 = 22.56 p 0.001
No. of patients with pH consistently 2.5 and total gastric vol. 0.4ml/kg body weight	9	0	X^2 = 7.81 p 0.01
No. of patients with pH 3.5:			
(a) At induction	31	1	X^2 = 38.65 p 0.001
(b) Prior reversal	22	1	X^2 = 22.59 p 0.001
No. of patients with pH consistently 3.5 and total gastric vol. 0.4ml/kg body weight	10	1	X^2 = 6.54 p 0.05

DISCUSSION

In 1946, Mendelson demonstrated that gastric acidity was the critical factor determining the occurrence of pulmonary acid aspiration syndrome. Subsequent experimental studies showed that the condition could be produced if the gastric aspirate had a pH below 2.5 (Teabeaut, 1952) and a volume exceeding 0.4 ml per kg body weight (Roberts and Shirley, 1974). These figures have traditionally been extrapolated to represent critical values in man (Roberts and Shirley, 1974; Bannister and Sattilaro, 1962; Vandam, 1965). However, Taylor's report in 1975 of a patient who developed pulmonary acid aspiration following inhalation of gastric contents of pH 3.5 suggests that the critical pH in man is probably closer to 3.5 than the widely accepted pH of 2.5.

Out study reveals that when a pH of less than 2.5 and aspirated volume exceeding 0.4 ml per kg body weight are regarded as values critical to the development of acid aspiration syndrome, then 18% of untreated patients were at risk of Mendelson's syndrome. If, as is suggested by Taylor's case report, the critical pH in man is taken to be 3.5 or less, then 20% of untreated patients and only 2% of the treated patients were in danger of acid aspiration syndrome. There was no statistical difference between the mean gastric volume of untreated and treated patients undergoing elective caesarian section. However, there was a highly statistically significant difference ($p < 0.001$) between the mean gastric volume of emergency caesarian section patients and the mean gastric volumes of untreated and antacid treated patients undergoing elective caesarian section. This difference is probably due to delay gastric emptying associated with the onset of labour. Our finding that the pH of the second gastric sample was higher than that of the first sample in both treated and untreated elective caesarian section groups could possibly be due to the depressant effect of anticholinergic premedicant and general anaesthesia (Christensen and Skovsted, 1975; Newson, 1977).

Whilst pre-operative antacid may markedly reduce the risk of acid induced pulmonary complications, it does not prevent the development of pulmonary pathology consequent to the aspiration of either pathogenic bacteria or particulate matter (Bartlett and Gorbach, 1975). Antacid incompetence and complacency should never be allowed to creep in from a false sense of security after pre-operative antacid prophylaxis.

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REFERENCES

1. Ambiavagar, M., Chan, O.L., Pais, F.W., and D'bras, Beg: "The acid aspiration syndrome", SMJ, 8. 35, 1967
2. Bannister, W.K., and Sattilaro, A.J: "Vomiting and aspiration during anaesthesia", Anaesthesiology, 23, 251, 1962.
3. Bartlett, J.G., and Gorbach, S.L: "The triple threat of aspiration pneumonia", Chest, 68. 561, 1975.
4. Christensen, V., and Skovsted, P: "Effects of general anaesthetics on the pH of gastric contests in man during surgery", Acta. Anaesth. Scand., 19. 49, 1975.
5. Crawford, J.S: "The anaesthetist's contribution to maternal mortality", Brit. J. Anaesth., 42. 70, 1970.
6. Edwards, G., Morton, H.J.V., Pask, E.A., et al: "Deaths associated with anesthesia : a report of 1000 cases", Anaesthesia, 20. 194, 1956.
7. Hutchinson, B.R., and Newson, A.J: "Preoperative neutralization of gastric acidity", Anaesth. Intens. Care, 3. 198, 1975
8. Mendelson, C.L: "The aspiration of stomach contents into the lungs during obstetric anaesthesia", Amer. J. Obstet. Gynec., 52. 191, 1946.
9. Newson, A.J: "The effectiveness and duration of pre-operative antacid therapy", Anaesth. Intens. Care, 5. 214, 1977.
10. Peskett, W.G.H: "Antacid before obstetric anaesthesia", Anaesthesia, 28. 509, 1973.
11. Report on confidential enquiries into maternal deaths in England & Wales, 1967 - 1969.
12. Roberts, R.B., and Shirley, M.A: "Reducing the risk of acid aspiration during caesarian section", Anaesth. Analg. Curr. Res., 53. 859, 1974.
13. Tay, H.S., and Chiu, H.H: "Risk of acid aspiration in laparoscopy", (to be published).
14. Tay, H.S., Chiu, H.H., and Teo, A.C.Y: "Evaluation of pre-operative antacid regime for emergency caesarian section", (to be published).
15. Taylor, G: "Acid pulmonary aspiration syndrome after antacids : case report", Brit. J. Anaesth., 47. 615, 1975a.
16. Taylor, G: "(2) acid pulmonary aspiration (correspondence)", Brit. J. Anaesth., 47, 1230, 1975b.
17. Taylor, G., and Pryse-Davies, J: "The prophylactic use of antacids in the prevention of the acid pulmonary aspiration syndrome (Mendelson's Syndrome)", Lancet, 1. 288, 1966.
18. Teabeaut, J.R: "Aspiration of gastric contents : experimental study", Amer. J. Path., 28. 51, 1952.
19. Vandam, L.D: "Aspiration of gastric contents in the operative period", N. Eng. J. Med., 273. 1206, 1965.