Gastric Volume and pH in Postpartum Patients

RICHARD BLOUW, M.D.,* JOHN SCATLIFF, M.D.,† DOUGLAS B. CRAIG, M.D.,‡
RICHARD J. PALAHNIUK, M.D.§

The risk of aspiration in parturients has been well recognized since Mendelson first described the syndrome associated with the aspiration of gastric acid.12 Pregnant patients must be considered to have full stomachs because of several factors that increase the risk of gastric retention and regurgitation. The large pregnant uterus presents a mechanical obstruction to the duodenum; progesterone decreases intestinal motility and relaxes the gastroesophageal sphincter mechanism; drugs administered may predispose to gastric retention and regurgitation.3 When, however, does gastric emptying return to normal in the postpartum period? Because this information was not available, we arbitrarily established a rule that no patient was to receive an anesthetic for tubal ligation less than eight hours postpartum. We undertook this study to determine whether, in fact, our patients had emptied their stomachs prior to undergoing anesthesia even eight hours after delivery.

PATIENT SELECTION

Twenty-one patients undergoing abdominal tubal ligation between nine and 42 hours postpartum were compared with 11 patients who had not recently been pregnant and were undergoing elective tubal ligation on the gynecology service. No patient had pre-existing gastrointestinal disease, which might have altered gastric acidity or emptying. All patients were seen pre-operatively and volunteered to participate in the study. Every postpartum patient had received 30 ml of antacid prior to delivery, but no antacid was administered prior to tubal ligation in either group of patients. No postpartum patient had had general anesthesia for delivery.

METHOD

Premedication was not controlled in either group but usually consisted of atropine and a narcotic agent administered intramuscularly 30 minutes to 1 hour preoperatively.

In each case, anesthesia was induced with thiopental, paralysis was achieved with succinylcholine, the trachea was intubated, and anesthesia was maintained with nitrous oxide–oxygen and halothane. Shortly after intubation a small-bore gastric tube was introduced into the stomach and a measured amount (usually 5 ml) of gastric juice was aspirated for pH measurement. Following this, 50 ml of a 1 g/100 ml solution of polyethylene glycol (PEG) were injected into the stomach through the gastric tube. The PEG solution was mixed with the gastric contents by aspiration and reinjection through the tube a minimum of ten times and the gastric content was then aspirated as completely as possible.

The PEG was used as an indicator to measure gastric content by the dilution method. It is a nontoxic, nonabsorbable, water-soluble polymer of molecular weight 3,000–3,700 that can be analyzed with a high degree of accuracy by the turbidimetric method described by Malawer and Powell.4 Knowing the initial concentration (1 g/100 ml) and the final concentration, the volume of gastric fluid diluting the PEG could be calculated. The pH of the gastric juice was measured using an appropriately calibrated pH electrode.

Age, number of hours of fasting, gastric volume and pH were compared in the two groups using Student’s t-test for unpaired data, with P < 0.05 being considered signifi-
The volume of gastric content was correlated with the number of hours of fasting in both control and postpartum groups using regression analysis, as was the gastric volume with the number of hours postpartum in the study group.

**Results (Table 1)**

Mean age of the patients in the two groups were similar. Patients in the study group were an average of 19.5 hours postpartum, with the shortest interval between delivery and tubal ligation being nine hours. All patients in both groups had been fasting for more than eight hours. Although the pH values ranged as high as 5.10 in the control group, and 6.90 in the study group, 75 per cent of values were less than 2.5 in both groups. The mean values in the two groups were similar (control 2.37; study 2.65). The largest volume of gastric fluid detected was 88 ml, in one of the study-group patients, while the largest volume in the control group was 50 ml. Statistical analysis showed no difference between the groups in any of the variables measured. There was no significant correlation between gastric fluid volume and number of hours of fasting in either group, or between number of hours postpartum and gastric volume in the study group.

**Discussion**

We did not show any difference between patients more than eight hours postpartum and control patients in terms of gastric volume and pH. Gastric emptying, therefore, must occur sometime between delivery and eight hours postpartum, but the exact interval has not been determined. We are content that an eight-hour delay following delivery is practical. We are not prepared to shorten this interval in order to explore the question of postpartum gastric emptying further, since we may be risking patient safety in order to pursue this point.

Our results do indicate that if eight hours is allowed to elapse between delivery and anesthesia, the postpartum patient is no more at risk for general anesthesia than the elective surgical patient.

Tebeaunt, and more recently, Roberts suggested that at least 25 ml of fluid of pH less than 2.5 must be aspirated to produce acid pneumonitis in a normal woman. Using Roberts’ suggestion, then, seven (33 per cent) of our postpartum patients and seven (64 per cent) of our control patients had sufficient volumes of fluid of low enough pH in the stomach to cause acid pneumonitis. The dilution method we used would, if anything, underestimate the actual gastric volume if mixing were incomplete, and would also therefore underestimate the danger of aspiration in both control and study groups.

In summary, we have determined that postpartum patients undergoing tubal ligation more than eight hours after delivery are no more at risk than elective surgical patients. In either group, however, a number of individuals had sufficient gastric contents of low enough pH to cause severe acid pneumonitis if it were aspirated.

**References**