Lansoprazole in the prophylaxis of acid aspiration during elective surgery

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Summary
We have assessed the efficacy of a single dose of lansoprazole in increasing the pH and decreasing the volume of gastric residue at induction of anaesthesia in adult patients undergoing elective orthopaedic surgery. We studied 66 ASA I-II patients, allocated to one of three groups to receive either placebo (group 1), lansoprazole 30 mg (group 2) or lansoprazole 60 mg (group 3), 8–12 h before induction of anaesthesia. Volume and pH of gastric contents were measured after induction of anaesthesia by aspiration via a 16-French gauge gastric tube. Patients who received lansoprazole had a significantly higher pH than the placebo group (P < 0.01) but there was no difference between the two lansoprazole groups. The volume of gastric residue was significantly smaller (P < 0.01) in both lansoprazole groups compared with the placebo group: 28% of those in group 3 had a pH of gastric residue < 2.5 and volume > 25 ml compared with 30% in group 2 and 63% in group 1, respectively. (Br. J. Anaesth. 1995; 74: 614–615)

Key words

In 1946 Mendelson described an acid aspiration syndrome in obstetric patients and showed that when gastric juice was neutralized, there was little reaction in the lungs of affected rabbits [1]. A gastric pH of 2.5 was suggested as the critical pH for severe lung damage and a volume of 25 ml or 0.4 ml kg⁻¹ of fluid of pH < 2.5 the critical volume in humans [2]. A more recent study in rats has shown that pH is more important than volume in determining mortality [3]. However, 30–50% of patients undergoing elective surgery after a fasting period of more than 8 h have a gastric volume greater than 25 ml and 64–82% have a gastric pH less than 2.5 [4].

Prophylaxis against aspiration includes reduction of gastric volume and increase in the pH of gastric contents using various combinations of histamine type-2 (H₂) antagonists, proton pump inhibitors, antacids and metoclopramide. An ideal regimen has not been defined and many different regimens are used.

Lansoprazole is a new second-generation proton pump inhibitor which appears to provide more effective inhibition than omeprazole because of structural differences which result in 50% more parietal cells being blocked. The key structural difference is the addition of a trifluoroethoxy group which confers better absorption and bioavailability resulting in a greater degree and duration of acid suppression and leads to earlier healing and superior pain relief in peptic ulcer disease and reflux oesophagitis [5].

Methods and results
We studied 66 adult patients, ASA I–II, undergoing elective orthopaedic surgery. The patients were aged 18–50 yr and informed written consent was obtained from each patient, after obtaining approval from the local Ethics Committee. Exclusion criteria included obesity (body weight 20% above ideal weight), past history of gastrointestinal disease, treatment with drugs that alter gastric acidity or volume, pregnant or lactating women, and treatment with oral contraceptives, anticoagulants, phenytoin and steroids. Patients were allocated randomly to one of three groups, each consisting of 22 patients. Group 1 received placebo orally at 22:00 h on the night before surgery, group 2 received lansoprazole 30 mg orally at 22:00 h and group 3 received lansoprazole 60 mg orally at 22:00 h. All patients were given clorazepate dipotassium 25 mg orally at the same time.

Anaesthesia was induced with thiopentone 4–6 mg kg⁻¹ and fentanyl 1 μg kg⁻¹. Neuromuscular block was produced with vecuronium 0.1 mg kg⁻¹ and the trachea intubated. Anaesthesia was maintained with 0.5–1.5% isoflurane and 66% nitrous oxide in oxygen. A 16-French gauge gastric tube was inserted into the stomach after induction of anaesthesia and the gastric contents were aspirated using a 50-ml syringe. Aspiration was performed in the left and right lateral positions, supine with head-up tilt and supine with head-down tilt. The investigators who took the samples were unaware of the group to which the patient had been allocated. The volume of gastric contents was recorded and the pH measured using a Radiometer (Copenhagen) pH meter. Age, weight and fasting interval were recorded for each patient.

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Data were analysed using analysis of variance and comparison of contrasts for the quantitative data. Chi-square analysis was used to compare the proportion of patients with pH > 2.5 in the three groups.

All three groups were comparable in age, weight and fasting interval. The pH and volume of gastric residue are shown at table 1. Gastric contents could not be obtained in one patient in group 1 (placebo), four in group 2 (lansoprazole 30 mg) and one in group 3 (lansoprazole 60 mg), and therefore pH data are not available for these patients. The mean pH of gastric contents in groups 2 (2.46) and 3 (2.64) was significantly higher than the mean pH in group 1 (1.89) (P < 0.01). There was a significant difference (P < 0.05) between the percentage of patients with pH > 2.5 in group 1 (5%) and the two other groups (33% for group 2, 38% for group 3). There was no significant difference between the pH values of groups 2 and 3.

The mean volume of gastric contents was significantly less (P < 0.01) in groups 2 (27.3 ml) and 3 (22.6 ml) compared with group 1 (43.9 ml). There was no significant difference in the volume of gastric contents between groups 2 and 3: 68% of patients in group 1 had gastric volumes > 25 ml compared with 41% in group 2 and 40% in group 3. The gastric contents of 63% of patients in group 1 had pH < 2.5 and volume > 25 ml compared with 30% in group 2 and 28% in group 3, with group 1 showing a significant difference (P < 0.05) from the other groups.

In this study we found that lansoprazole was effective in significantly reducing the residual volume and increasing the pH of gastric contents compared with placebo. We found no significant difference between lansoprazole 30 mg and lansoprazole 60 mg in this respect. We also found that lansoprazole reduced the number of patients at risk from aspiration of gastric contents, with 72% of patients in group 3 and 70% in group 2 having pH > 2.5 and residual volume < 25 ml compared with 27% in the placebo group. However, 30% of patients in group 2 and 28% in group 3 remained at risk of pulmonary injury if acid aspiration occurred despite the use of lansoprazole. We sampled gastric contents via a 16-French gauge gastric tube which may underestimate the total volume, although a good correlation has been shown between volume aspirated and volume determined by the indicator dilution method.

One possible reason for the failure of lansoprazole to produce more profound suppression of acid secretion is inadequate dose. However, lansoprazole 30 mg daily has been shown to maintain an intragastric pH of more than 3.0 for up to 20 h a day in studies of peptic ulcer healing and so this seems unlikely. Another possible reason for the failure is incorrect timing of administration of the drug. A greater increase in intragastric pH might be shown if lansoprazole was administered on the evening before surgery and again on the morning of operation.

Comment

Some authors have stated that a pH less than 2.5 is a critical factor in the development of pulmonary damage, following aspiration of gastric contents, but Crawford has suggested that a pH limit of 3.5 is acceptable [6]. Volume is perhaps less important, but 25 ml or 0.4 ml kg⁻¹ is recognized as being the critical volume required before pulmonary damage occurs: 17–64% of fasted adult patients presenting before elective surgery have volumes greater than 25 ml and pH less than or equal to 2.5 and are therefore at risk of acid aspiration. If Crawford's pH criteria of 3.5 is used then even more patients are at risk.

Many different regimens are used in the prophylaxis against acid aspiration, including the use of antacids alone or in combination with H₂ antagonists, proton pump inhibitors or metoclopramide, but no ideal regimen has been defined.

References