LOWER OESOPHAGEAL REFLUX DURING PRIMING WITH VECURONIUM

C. MARTIN, J.-C. GUILLEN, B. DUPIN, J. RAGNI, P. AKNIN AND F. GOUIN

SUMMARY

We have studied the effects of vecuronium given in divided doses (priming principle) on the frequency of acid reflux into the oesophagus. Two groups of 16 patients were studied. After induction with thiopentone 6 mg kg⁻¹ and fentanyl 3 µg kg⁻¹, patients in one group were given vecuronium 0.01 mg kg⁻¹ as a priming dose, followed by an intubation dose of 0.1 mg kg⁻¹ 4 min later. Patients in the other group were given no priming dose. Lower oesophageal pH was monitored continuously and acid reflux was defined as a decrease in pH to less than 4.0. One patient in each group had acid reflux during the time course of the induction. This study suggests that vecuronium 0.01 mg kg⁻¹ given as a priming dose does not increase the risk of acid reflux into the oesophagus.

KEY WORDS


The present study was designed to evaluate the risk of acid regurgitation into the oesophagus after administration of the recommended priming dose of vecuronium (0.01 mg kg⁻¹) [2, 3]. An oesophageal probe was used to provide continuous measurement of the pH in the lower oesophagus.

PATIENTS AND METHODS

Following institutional approval and informed consent, 32 patients (ASA class I or II) were studied. All patients were scheduled to have elective thoracic surgery. No patient had a nasogastric tube inserted or had received anticholinergic drugs, antacids or H₂-receptor antagonists. No patient had a clinical history of gastrooesophageal reflux. They were premedicated with flunitrazepam 0.015 mg kg⁻¹ i.m. approximately 45 min before induction of anaesthesia.

After admission of the patient to the operating room and before anaesthesia, a soft plastic pH-probe, approximately 3 mm in diameter and containing a combined glass electrode (Ingold) was inserted into the patient’s oesophagus, via the nose to permit continuous monitoring of lower oesophageal pH until the trachea was intubated. The probe was connected to a portable, self-programmable pH-meter (Proxima Light 1 computer, Proxima Electronic Company, Mantova, Italy). The probe was calibrated with two reference solutions (pH 4 and pH 7). The range of the pH-meter was from 0.1 to 12.9, with a resolution of 0.1 and a precision greater than 1%.
[5]. Up to 15,000 pH values can be stored in a solid-state memory. During the procedure, pH measurements were obtained at 2-s intervals. Data were analysed at the end of the procedure by transcribing the stored values on a printer giving a continuous record of pH for each patient.

The probe was positioned while the patient was seated on the operating table. To ensure that the probe was positioned correctly in the lower oesophagus, the following procedure was adopted. The nasal mucosa was anaesthetized and the probe advanced into the hypopharynx. The patient was then asked to swallow the probe until pH 1 or 2 was obtained, indicating that the probe had reached the stomach. It was then withdrawn approximately 5–6 cm to obtain a stable pH of between 5 and 7 and the probe was considered to be in the lower oesophagus [5, 6]. The probe was secured to the nose to avoid any displacement during anaesthesia. In one patient, a gastric pH of 1 or 2 could not be obtained, and the patient was excluded.

An internal clock in the computer allowed the program to determine the time at which an event took place. The standard program calculated the beginning and end of any periods of acid reflux, defined as episodes of pH \( \leq 4 \) [6]. The computer also recorded the timing of the sequence of events during induction of anaesthesia and subsequently printed them on the pH record.

Anaesthesia was induced with patients in the supine position. Thiopentone 6 mg kg\(^{-1}\) i.v. and fentanyl 3 \( \mu \)g kg\(^{-1}\) i.v. were given and increments of thiopentone 50 mg i.v. were administered if the eye-lash reflex was not abolished. During the study, anaesthesia was maintained with 50% nitrous oxide in oxygen via a face mask.

Neuromuscular function was monitored using the electromyogram (Relaxograph Monitor Datex). When a stable electromyographic response was obtained after injection of thiopentone and fentanyl, patients were assigned randomly to one of two groups. Patients in group 1 were given no priming dose of vecuronium and received normal saline 10 ml i.v. as placebo. Patients in group 2 were given a priming dose of vecuronium 0.01 mg kg\(^{-1}\) i.v. The anaesthetist performing the manual ventilation was blinded to the treatment. The lungs of patients in both groups were ventilated manually for 4 min and vecuronium 0.1 mg kg\(^{-1}\) was given i.v. in both groups; the trachea was intubated after 95–100% depression of the electromyographic response had occurred.

For each patient, onset time of effect of vecuronium was measured. During the period of manual ventilation, end-tidal carbon dioxide concentration was monitored and maintained at 4–5%.

Results are given as mean (sd). Statistical evaluation of variations in pH values for each subject during the procedure, and variations between the two groups were performed using analysis of variance, Student’s t test for unpaired data and Chi-square test where appropriate. \( P < 0.05 \) was chosen as significant.

**RESULTS**

There were 16 patients in group 1 (12 male), of mean age 51 (14) yr and mean weight 64 (11) kg.

There were 16 patients in group 2 (13 male), of mean age 55 (11) yr and mean weight 68 (12) kg.

There was no difference between the groups with regard to age, weight and sex ratio.

The time to tracheal intubation was shortened significantly when a priming dose was given:

- Group 1 = 202 (55) s
- Group 2 = 129 (24) s

\( P < 0.005 \).

Lower oesophageal pH varied between 1 and 6.9. The pH values at the different stages of the induction of anaesthesia did not differ between the two groups (table I). One patient in each group had acid reflux during induction of anaesthesia. The patient in group 1 had an 8-min reflux before induction of anaesthesia and a second episode starting just before the injection of thiopentone and finishing before the injection of vecuronium. The pH remained > 4.0 thereafter. The patient in group 2 had an episode of reflux which commenced with the injection of thiopentone and fentanyl and persisted until after the trachea was intubated 8 min later. In neither patient was the acid reflux related to the injection of vecuronium.

| Table I. Lower oesophageal pH (mean (sd) [range]) at three stages during induction of anaesthesia |
|------------------------------------------|----------------|----------------|
| Induction & Intubation dose & Intubation | 5.7 (1.3) & 5.9 (0.5) & 5.9 (0.6) |
| No priming & (n = 16) | [1–6.9] & [4.2–6.8] & [4.2–6.6] |
| Group 2 & Priming & (n = 16) | 5.6 (1.3) & 5.6 (1.3) & 5.6 (1.2) |
| & | [1–6.8] & [1.2–6.8] & [1.2–6.8] |
DISCUSSION

The lower oesophageal sphincter (LOS) represents the major barrier to regurgitation of acid gastric contents into the oesophagus. Many drugs affect LOS by increasing or decreasing its tone. Drugs which decrease LOS tone during induction of anaesthesia may increase the risk of regurgitation of acid from the stomach and of subsequent aspiration into the lungs [8, 9]. Little is known of the effects of non-depolarizing neuromuscular blocking drugs on LOS tone. Pancuronium may slightly increase the barrier pressure of LOS, probably by acting on α-adrenergic receptors [10]. Atracurium has been demonstrated to have no effect on LOS pressure [10], while vecuronium produces a very small increase [7]. These studies were carried out using full doses for tracheal intubation, but no information is available regarding the use of small doses such as those used during priming.

Our study was not designed to evaluate the direct effects of priming doses of vecuronium on LOS tone, but was intended to assess the occurrence of acid reflux into the lower oesophagus. One episode of acid reflux was seen in each group. These episodes were not related to the use of vecuronium. In one patient reflux was related to the use of thiopentone and fentanyl, drugs which are known to decrease LOS tone [7]. An increase in intragastric pressure during mask ventilation might also have contributed to the occurrence of gastric regurgitation. Thiopentone and fentanyl were given before the priming dose of vecuronium, as the nerve stimulator is painful in awake patients. As both groups of patients were given thiopentone and fentanyl, any further modification in LOS tone could be attributed to the priming dose of vecuronium. As no difference was seen between the two groups in the occurrence of acid reflux, it may be assumed that the use of vecuronium 0.01 mg kg\(^{-1}\) for priming is safe in this regard. Given our sample size of 32 patients, we may have failed to distinguish a small difference between the two groups. The possibility of a type II error does exist and we cannot reject the null hypothesis. Nevertheless, our results suggest that the use of a priming dose of vecuronium 0.01 mg kg\(^{-1}\) does not influence the likelihood of gastric acid reflux. This dose is regarded as optimal for priming [2, 3, 11]. Greater doses, such as 0.02 mg kg\(^{-1}\), are not recommended and may be responsible for objective and subjective side effects [3, 11].

REFERENCES