Refraining from cigarette smoking before premedication does not decrease the risk of acid pulmonary aspiration during anaesthesia

B. Adelhøj MD, O.U. Petring MD,
Birgitte Nybo Jensen MD, Susy Mikkelsen MD

Seventy-four habitual smokers who had refrained overnight from cigarette smoking and were undergoing elective orthopedic surgery were allocated randomly to two groups in order to investigate the effect of smoking two cigarettes before premedication on volume and pH of gastric contents. The smoking group was allowed to smoke two cigarettes while the non-smoking group was not allowed to smoke. There was no significant difference in volume or pH between the groups, either just after intubation or prior to extubation, thus indicating no decreased risk of acid pulmonary aspiration because of refraining acutely from cigarette smoking.

Aspiration of gastric contents is a well-known and feared complication of anaesthesia.¹ Patients at risk of developing pulmonary damage following aspiration have been defined as those with a gastric pH below 2.5²⁻³ and a gastric fluid volume above 25 ml.³⁻⁴

Studies of the effect of cigarette smoking on

human gastric emptying have produced conflicting results. One study showed that cigarette smoking accelerated the rate at which the liquid component of a meal left the stomach⁵ whereas another study found a marked delay.⁶ Cigarette smoking has been shown to increase⁷ and to have no effect on basal gastric secretion,⁸ and stimulation by pentagastrin has shown similar divergent results.⁹⁻¹⁰

In many hospitals, preoperative patients are not allowed to smoke during the fasting period, because of the fear of increased volume and decreased pH of gastric contents and therefore an increased risk of acid aspiration. We did not find any reports concerning the problem of acid aspiration in patients who had smoked shortly before anaesthesia.

The aim of the present study therefore was to investigate the effects of refraining overnight from cigarette smoking on the volume and pH of gastric contents in patients scheduled for elective surgery.

Methods

This study was approved by the Copenhagen human studies committee. After obtaining informed consent, 74 consecutive out-patients were studied. All patients were adults and habitual smokers for at least five years and with a minimum consumption of five cigarettes daily. All were without a history of gastrointestinal disease, undergoing elective surgery of the extremities. The patients were given written instructions not to eat or drink after the previous midnight of operation. The patients were allocated randomly to two groups. The smoking group (N = 36) was given written instructions to

Key words

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From the Department of Anaesthesiology, Kommunehospitalet, Copenhagen, Denmark.

Address correspondence to: Dr. B. Adelhøj, Department of Anesthesia, Gentofte Hospital, DK-2900 Hellerup, Denmark.

TABLE I Characteristics of the two groups (mean and range)

Group	No. of patients (female/male)	Age (years)	Height (cm)	Weight (kg)	No. of cigarettes daily	Cigarette consumption (years)	Duration of Anaesthesia (min)	Duration of surgery (min)
Non-smoking	38 (21/17)	37.3 (18-72)	1.71 (151-191)	67.3 (45-110)	15.8 (5-40)	17.3 (5-45)	87.6 (35-300)	57.1 (15-240)
Smoking	36 (16/20)	36.4 (19-67)	1.73 (152-188)	72.7 (52-104)	16.2 (5-30)	17.7 (5-40)	80.7 (30-160)	50.7 (15-120)

stop normal smoking from midnight and to smoke two cigarettes in the morning before premedication, whenever they wanted to. The non-smoking group (N = 38) received written instructions not to smoke after midnight on the day of their operation.

All patients were premedicated with diazepam 15 mg orally together with 50 ml of water one hour before surgery. A careful preanaesthetic report was made to control that both groups observed their instructions. After injection of atropine 1 mg IV and pancuronium 1 mg IV general anaesthesia was induced with thiopentone 4 mg·kg⁻¹ and oral intubation was facilitated by succinylcholine 100 mg IV.

Anaesthesia was maintained with halothane 1.0-1.5 per cent and nitrous oxide 67 per cent in oxygen with controlled ventilation. With the patients in the supine position a 16F Argyle-Salem® sump tube was passed into the stomach. The position of the tube was checked by auscultation of the gastric region while insufflating 5 ml of air. While tilting the patients from side to side and in the "head down" position, the liquid contents of the stomach and distal oesophagus was aspirated by intermittent hand suction for approximately 2 min and measured. At the end of surgery the stomach contents were aspirated once more and measured. The

aspirated material was analysed using a pH-meter (Radiometer, type PHM 26). The investigators who measured the gastric volumes and pH did not know to which group the patients belonged.

To compare the aspirated volumes and the pH value, the Mann-Whitney test was used and a p-value < 0.05 was considered significant.

Results

Anaesthesia and surgery were uncomplicated in all cases.

The two groups were comparable in relation to sex-ratio, age, height, weight, cigarette consumption, duration of anaesthesia and duration of surgery (Table I).

The differences in aspirated volume and pH between the two groups were not statistically significant (Table II).

After intubation nine patients in the non-smoking group and ten patients in the smoking group had a volume greater than 25 ml with a pH lower than 2.5. This difference was not statistically significant.

Before extubation one patient in the non-smoking group and no patients in the smoking group had a volume greater than 25 ml with a pH lower than 2.5. This difference was not statistically significant.

TABLE II Volume and pH of gastric contents immediately after induction and before extubation (mean and range)

Group	After induction		Before extubation	
	volume (ml)	pH	volume (ml)	pH
Non-smoking	23.3 (0-124)	2.16 (1.04-7.51)	5.53 (0-31)	2.96 (1.12-7.12)
Smoking	22.1 (0-150)	2.48 (1.05-7.25)	7.31 (0-25)	3.16 (1.27-7.62)

Discussion

Aspiration of gastric contents through a gastric tube may leave residual acid and volume in the stomach as complete aspiration is rarely achieved. Ong *et al.*¹¹ have shown that the volume aspirated was frequently much less than the volume calculated by the dilution method and the correlation between the amounts of gastric volume aspirated through a gastric tube and the gastric volumes determined by the dilution method was poor. The produced measurements of volume and of total acid will therefore tend to underestimate the quantity available to contaminate the lungs. As this reservation applies to both groups studied there is no reason to anticipate that the residual quantity would differ between the two groups.

We found no effect on volume and acidity of gastric fluid in habitual smokers refraining from cigarette smoking prior to premedication with diazepam 15 mg orally undergoing elective surgery.

Smoking makes the gastro-oesophageal sphincter incompetent, which allows reflux with accompanying risk of pulmonary aspiration. The incompetence in gastro-oesophageal sphincter begins within 4 min and returns to normal with 8 min after the end of smoking.^{6,12-14} In our study patients continued smoking only until one hour before anaesthesia, so the influence on the gastro-oesophageal sphincter should not increase the risk for acid pulmonary aspiration.

Consequently, refraining from smoking two cigarettes before premedication does not decrease the risk of acid pulmonary aspiration during or after elective anaesthesia, which is an advantage, since smokers do not, or cannot, heed advice to stop smoking in the morning prior to surgery.

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Résumé

Soixante-quatorze fumeurs qui s'étaient abstenus de fumer la veille d'une opération élektive en orthopédie ont été divisés au hasard en deux groupes afin d'étudier les effets de deux cigarettes avant prémédication sur le volume et le pH gastrique. Le groupe des fumeurs a été permis de fumer deux cigarettes alors que le groupe de non fumeurs n'était pas permis de fumer. Il n'y a eu aucune différence significative dans le volume ou le pH entre les deux groupes soit immédiatement après intubation ou avant l'extubation. Ainsi le risque d'aspiration n'est pas diminué si on s'abstient de fumer la cigarette pour une phase aiguë.