

Effect of Cigarette Smoking in Non-Per os Period on Gastric Fluid Volume and pH

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Background: We investigated the effects of cigarette smoking in non-per os (NPO) period on volume and pH of gastric contents in smoker male patients.

Methods: In a prospective cohort study, 86 male smoker patients undergoing elective non-abdominal surgery under general anesthesia, were surveyed. They were NPO for at least 8-12 hrs. prior to surgery without direction to smoking. Then they were divided in two groups in the operation room based on smoking during NPO period. The study was continued until 43 patients entered in each group. After induction of anesthesia, gastric contents were aspirated by NG tube then volume and pH of gastric contents were measured. There were no significant differences in basic characteristics of patients such as age and weight between two groups.

Results: The pH of gastric content was significantly lower in the smokers group (1.57 ± 0.74 vs 3.12 ± 1.90 $p=0.001$). The mean volume was significantly higher in the smokers' group (34.60 ± 20.90 vs 19.86 ± 14.72 ml, $p=0.001$).

Conclusion: Smoking during NPO period in habitual smokers before elective surgery increases the volume and acidity of gastric contents and probably increases risk of acid pulmonary aspiration.

Keywords: anesthesia; gastric content; smoking

Cigarette smoking does not increase the gastric volume or alters the pH of the gastric secretions [1]. Smoking does make the gastroesophageal sphincter incompetent, which allows reflux, with accompanying risks of pulmonary aspiration [2]. For decades it has been assumed, that smoking within 6 hours of anesthesia and surgery raises the incidence of perioperative cardiopulmonary complications including aspiration. Thus, patients are advised to stop smoking a day before surgery and avoid it altogether on the day of surgery [3], and fasting guidelines in connection with smoking have been discussed in the anesthesia literature [4]. The critical values of gastric volume and pH at which patients develop an increased risk of aspiration, with associated increased morbidity and mortality is unclear [5]. Aspiration of gastric contents is a well-known and feared complication of anesthesia [6]. Patients at risk of developing pulmonary damage following

aspiration have been defined as those with a gastric pH below 2.5-3 and a gastric fluid volume above 25 ml [7-8]. One of the reasons for restricting smoking in the immediate preoperative period has also been due to the fear of an increase in gastric acid secretion, and hence the risk of pulmonary aspiration [1-4]. Studies on the effect of smoking on the volume and pH of gastric contents in patients, who had smoked shortly before anesthesia, however, have been inconclusive.

The purpose of this study was to determine the effect of smoking cigarettes in the preoperative NPO period on the volume and pH of gastric contents in smoker patients.

Methods

This study was approved by the Medical Ethics Committee of Tehran University of Medical Sciences. After obtaining written informed consent, 86 patients were studied. All patients were male habitual smokers who smoked 20 cigarettes or more per day and undergoing elective non-abdominal surgery under general anesthesia. Patients with a history of gastroduodenal disease needing medication or surgical intervention, change in smoking habits, gastroparesis and those using opium were excluded. In a prospective cohort study, all patients had abstained from oral intake for at least 8-12 hrs. Prior to surgery, they had not been given any instruction regarding smoking during NPO time. In the operation room, they were asked about smoking during NPO period. The patients were divided in two groups; smoking (case) and non-smoking (control) groups. The study was continued until 43 patients entered in each group. After premedication with fentanyl $1 \mu\text{g}/\text{kg}$ and

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midazolam 1mg, general anesthesia (GA) was induced with sodium thiopental 5mg/kg and atracurium 0.6 mg/kg in all patients. After orotracheal intubation, GA was maintained with isoflurane 1.5%, oxygen and N₂O 50%. Then a large, vented, multiorifice gastric tube was passed into the stomach and gastric contents aspirated. Gastric fluid volume (GFV) was measured by a technician who did not know to which group the patients belonged and the sample was sent to laboratory for pH assessment by pH-meter with accuracy of two points decimal.

After the completion of the data study in code sheets, information was entered to SPSS for windows version 12. To compare the aspirated volumes and the pH value, the Independent samples t-test was used and a p-value < 0.05 was considered significant.

Table 1- Characteristic of the two groups

Variable	Smoking (43) (mean±SD)	Non-smoking (43) (mean±SD)	P value
Age (years)	38.53±13.01	0.448	36.35±13.58
Weight(Kg)	69.33±9.98	0.782	69.88±8.63

Table 2- Volume and pH of gastric contents of two groups

Variable	Smoking (mean±SD)	Non-smoking (mean±SD)	95%CI	P value
Number of patients	43	43		
Volume of aspirated gastric content (ml)	34.60±20.90	19.86±14.72	(-22.500) - (- 6.989)	0.001
PH of aspirated gastric content	1.57±0.74	3.12±1.90	0.936-2.178	0.001

Discussion

In our study, we found that smoking during NPO period and prior to anesthesia, significantly increased both the volume and acidity of gastric juice in habitual male smokers. In one study by Adelhoj et al. [1], it was concluded that refraining from smoking before premedication did not decrease the risk of pulmonary aspiration, this conclusion had been based on a finding that gastric fluid volume and pH in habitual smokers who smoked two cigarettes prior to premedication was not different from those who abstained from smoking from midnight. Our finding is in contrast to their finding, this contradiction may be due to the fact that in our study, the patients had not been given any instructions regarding smoking during NPO period. Therefore, patients were free to smoke or not to smoke, which is closer to physiological changes during perioperative period. This implicates that patients in none of the groups had apprehension and anxiety or withdrawal symptoms of abstinence.

In another study, effect of nicotine gum on withdrawal symptoms and gastric contents prior to general anesthesia, in habitual smokers has been surveyed, which showed no significant difference in gastric fluid volume or pH between patients who chewed nicotine gum or did not chew [9]. This study does not match our study, since nicotine is only one of thousands of substances present in cigarettes and does not evaluate the effects of other substances. Hardy et al. [10]

Results

Anesthesia and surgery were uncomplicated in all cases. Mean age of patients was 37.44±13.27 years (range, 19-74 years). There was no significant difference between smoked and non-smoked groups with respect to age and weight (p=0.448 and p=0.782 respectively) (Table 1).

Patients who smoked cigarette in the NPO period had significantly larger GFV than patients who did not smoke (p=0.001) (Table 2).

The pH of gastric content was significantly lower in patients who smoked cigarette in the NPO period than in patients who did not smoke (p=0.001) (Table 2).

found that there was no significant difference in gastric fluid volume or pH between smokers and non-smokers. Therefore, smoking was not associated with significant modification of gastric fluid volume or pH. Others have also reported the same finding [11-14]. Zwissler et al [3] also concluded that smoking does not increase either the volume or the acidity of gastric juices. They stated that there is a certain delay in the propagation of solid food as a result of smoking, while emptying of liquid gastric juice is not influenced by smoking. As we note, none of the studies addressed the very close physiological perioperative scenario and effect of smoking during perioperative period in a cohort study. This may strengthen the very contrast finding of our study. Despite these findings, we cannot state the effect of smoking on the risk of aspiration because it needs a larger multi-center study of the same design but specifically addressing the issue of aspiration.

Conclusion

Smoking during the perioperative period in habitual smokers during NPO period caused a significant increase in gastric fluid volume and acidity.

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