Outpatient endoscopic survey of smoking and peptic ulcer

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SUMMARY A survey of the smoking habits of 1217 outpatients undergoing upper gastrointestinal endoscopy was carried out over an 18 month period. Six hundred and twenty four were current smokers, 248 ex-smokers and 345 non-smokers. 11.9% of smokers had gastric ulcers, 7.7% of ex-smokers ($p < 0.025$) and 4.6% of non-smokers ($p < 0.001$). 2.8% of smokers had duodenal ulcers, 6.8% of ex-smokers ($p < 0.01$) and 6.1% of non-smokers ($p < 0.001$). There was a dose response effect between the number of cigarettes smoked and duodenal and gastric ulceration. Gastric cancer was also more frequent in smokers than non-smokers ($p < 0.01$), but macroscopic oesophagitis less frequent ($p < 0.001$). The results confirm the association between smoking and peptic ulcer.

An association between peptic ulcer and smoking is established. Healing of both gastric and duodenal ulcers is impaired in smokers,¹⁻⁷ whilst relapse is more common once healing has occurred.⁸⁻¹² Most epidemiological studies have shown that there is an increased prevalence of smoking in peptic ulcer¹³⁻¹⁶ and conversely an increased prevalence of peptic ulcer in smokers.¹⁷⁻²² Further, the frequency of peptic ulcer increases with the number of cigarettes smoked.^{17 20 21}

The epidemiological evidence is weakened, however, both because gastric and duodenal ulcer have not been distinguished and, more importantly, because most reports were based on questionnaires completed by either the subjects or their physicians without objective evidence of peptic ulcer.²³ A radiographically based survey from Israel confirmed an increased prevalence of peptic ulcer in smokers, but failed to show a dose response effect.²² Endoscopy is the technique of choice for accurate diagnosis of peptic ulcer, but the only endoscopy based report of smoking and peptic ulcer did not show an association.²⁴ We have therefore carried out a prospective survey of smoking habits in patients having routine outpatient endoscopy.

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Methods

PATIENTS

The endoscopy unit at St Thomas' Hospital provides an outpatient endoscopy service open to all general practitioners and hospital doctors. All patients aged over 18 years were included in the survey for an 18 month period between January 1980 and June 1981. Before endoscopy they completed a questionnaire on details of their smoking history, including age at which regular smoking started, age at which smoking stopped for ex-smokers, type of tobacco used, and average daily consumption. The questionnaire was checked with an endoscopy nurse and any errors or omissions corrected. Endoscopy was carried out and the diagnosis entered on the form. Although the endoscopists were not formally blinded to the smoking data of the patients, the questionnaires were only seen by them after endoscopy, and it is unlikely that the information influenced reporting. An ulcer was defined as a mucosal break of 5 mm or more.

The patients were divided into current smokers, non-smokers, and ex-smokers if they had stopped smoking regularly at least six months before endoscopy and not as a result of their symptoms or medical advice consequent on their symptoms. If they had stopped smoking less than six months previously, or as a result of their symptoms, they were classed as current smokers.

Statistical analysis was by χ^2 testing.

Results

One thousand, two hundred and seventeen patients completed and returned the questionnaires, 750 men and 467 women, of whom 624 were current smokers, 248 ex-smokers and 345 non-smokers. Table 1 shows the frequency of endoscopic findings in each of the three groups. Fifty eight per cent of non-smokers had normal endoscopic findings compared with 47% of current smokers ($p<0.01$) and 45% of ex-smokers ($p<0.01$). Both gastric ($n=109$) and duodenal ($n=118$) ulceration was more common in smokers compared with non-smokers ($GU\chi^2=15.5$, $p<0.001$; $DU\chi^2=12.2$, $p<0.001$), ex-smokers ($GU\chi^2=5.4$, $p<0.025$; $DU\chi^2=6.9$, $p<0.01$) and non-smokers and ex-smokers combined ($GU\chi^2=13.3$, $p<0.001$; $DU\chi^2=14.3$, $p<0.001$). In addition, gastric carcinoma ($n=30$) was more frequent in smokers compared with non-smokers ($\chi^2=6.8$, $p<0.01$), but not with ex-smokers ($\chi^2=0.4$, $p=NS$). In contrast, macroscopic oesophagitis ($n=120$) was less common in smokers than non-smokers ($\chi^2=15.6$, $p<0.001$), and non-smokers and ex-smokers combined ($\chi^2=22.3$, $p<0.001$). Other differences were minor. The increased frequency of gastric and duodenal ulcer in smokers occurred in both men and women, although this was not significant for duodenal ulcer in men and gastric ulcer in women (Table 2).

To determine whether a dose response effect was present, we divided the smokers into those consuming 15 or less cigarettes per day (light smokers), and 16 or more per day (heavy smokers). This division was chosen as the multiple of five cigarettes closest

Table 2 Frequency of peptic ulcer in male and female smokers, ex-smokers and non-smokers

	Smokers	Ex-smokers	Non-smokers
Men			
Gastric ulcer	12.3%†	7.9%*	2.5%
Duodenal ulcer	11.1	7.4	8.2
Total	415	176	159
Women			
Gastric ulcer	11.0	6.9	6.4
Duodenal ulcer	16.3†‡	5.5	4.3
Total	209	72	186

Compared with non-smokers: * $p<0.05$, † $p<0.001$

Compared with ex-smokers: ‡ $p<0.025$.

to the median consumption of 17 cigarettes per day of the current smokers. Compared with non-smokers, there was a progressive increase in the frequency of both gastric and duodenal ulceration in ex-smokers, light smokers and heavy smokers (Figure). The increase between light and heavy smokers was significant for duodenal ($p<0.05$), but not gastric ulcer. Further, this increased frequency of gastric and duodenal ulcer was present even in smokers consuming between one and 10 cigarettes per day ($p<0.05$, GU and DU) when compared with non-smokers. A similar trend was also observed when smokers of between one and five cigarettes per day were compared with non-smokers, but the numbers were small and hence not statistically significant.

Table 1 Frequency of endoscopic diagnoses in current smokers, ex-smokers and non-smokers

Endoscopic diagnosis	Smokers	Ex-smokers	Non-smokers	Overall
Normal	46.5%*	44.7%*	57.7%	49.5%
Oesophagitis	5.9†§	14.9	13.3	9.9
Gastritis	6.1	8.1	5.8	6.4
Duodenitis	15.7	17.3	9.8	14.4
Gastric ulcer	11.9†‡	7.7	4.6	9.0
Duodenal ulcer	12.8†§	6.8	6.1	9.7
Gastric cancer	3.5*	2.4	0.6	2.5
Oesophageal cancer	1.3	0.4	0.8	1.0
Other	0.4	1.2	3.2	1.4
Total	624	248	345	1,217

Compared with non-smokers: * $p<0.01$, † $p<0.001$, compared with ex-smokers: ‡ $p<0.025$, § $p<0.01$.

Figure Frequency of gastric and duodenal ulcer in relation to smoking status.

Discussion

In a prospective endoscopic survey, we have provided objective evidence of an association between smoking and both gastric and duodenal ulceration. This supports the majority of the literature which has until now been mostly questionnaire based and thus without proof of past or present peptic ulceration.²³ The ratio of the prevalence of peptic ulceration in smokers compared with non-smokers of 1.8 is close to the mean ratio from other studies of 1.9.²⁵ Further, there was a small increase in the frequency of peptic ulcer in ex-smokers which has been noted previously (Figure).²⁵

There was a clear dose response effect between the number of cigarettes smoked and duodenal ulcer, and a similar trend was seen for gastric ulcer, although the increased frequency in heavy smokers was smaller and did not reach significance. Most previous reports also describe a dose response effect^{17 20 21} but have not differentiated between gastric and duodenal ulcer. Even those smokers who consume fewest cigarettes have an increased frequency of both gastric and duodenal ulcer compared with non-smokers, and this suggests that there is no 'safe' cigarette consumption with respect to peptic ulceration.

There are two other studies of smoking and peptic ulcer that have been based on objective criteria. A large radiographically based survey of 895 patients with peptic ulcer found an increased prevalence in smokers, but there was no dose response effect.²² Wursch *et al*, in the only other endoscopic survey, failed to show an association between peptic ulcer and 'nicotine abuse', which they defined as a cigarette consumption of greater than 10 per day.²⁴ In our study, however, smokers consuming 10 cigarettes per day or less had a greater prevalence of peptic ulcer than non-smokers, and so by combining these two groups as non-nicotine abusers for comparison with nicotine abusers it is possible that Wursch *et al* missed a true association with smoking.

Of our subjects, 51% were current smokers which is higher than the average figure for the adult UK population of 39%.²⁶ This increased frequency of smokers was true of both men (55% compared with the UK average of 42%) and women (44% compared with 37%) and probably reflects the low socio-economic class of most of our subjects. There was also a large excess of men in our series, which was unexpected and unexplained.

The choice of controls was difficult. While community or hospital based controls would be the most appropriate, there would then be no objective information on the presence of peptic ulceration, since it is unethical to endoscope asymptomatic

individuals. We therefore chose patients found to have a normal endoscopy. These are not normal asymptomatic subjects, but the presence of a known normal endoscopy outweighed this disadvantage. There is little information on the effect of smoking on other causes of abdominal pain or symptoms likely to result in an endoscopy being done, but it is unlikely that these controls are biasing our results or conclusions, which are in accord with most previous reports. We did not examine other possible associations with peptic ulcer in this study as we were primarily interested in smoking, and, apart from analgesic ingestion and gastric ulcer, other factors appear unimportant.^{19 27} In an attempt to overcome these difficulties, however, we are currently carrying out a further more detailed study with community based controls.

Two other differences emerged. Firstly, the unexpected reduced frequency of macroscopic oesophagitis in smokers compared with non-smokers and ex-smokers. The opposite would be expected from the effect of smoking on lower oesophageal sphincter pressure,²⁸ but there is no epidemiological evidence to support such an association. Secondly, the increased frequency of gastric carcinoma in smokers compared with non-smokers. Surprisingly, this potential association has received little attention. In a prospective Japanese study there was a mortality ratio for gastric cancer of 1.47 in male smokers to non-smokers ($p < 0.01$), and 1.25 in women ($p < 0.01$).²⁹ Our results suggest a much stronger link with gastric cancer, which was increased six-fold in smokers compared with non-smokers. We were unable to confirm statistically the established association between smoking and oesophageal cancer,³⁰ but there was a positive trend in the 12 cases that occurred.

In conclusion, we have confirmed in an outpatient endoscopic survey, an association between smoking and both gastric and duodenal ulcer, with a significant dose response effect for duodenal but not gastric ulcer.

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