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The influence of subsequent cigarette smoking habits on causes and mode of death in survivors of unstable angina or myocardial infarction

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Information about the cigarette smoking habits at the time of death was available for 261 male decedents who had survived a previous bout of confirmed unstable angina or myocardial infarction. The cause and mode of death were known for 259 of these subjects. Smoking habits at time of death did not appear to affect the mode or cause of death.

Previous reports of a higher ratio of sudden death compared to deaths from myocardial infarction in smokers compared to non-smokers were not confirmed by us. A previous report of a high incidence of suicide and accidental death in healthy subjects who stopped smoking was not confirmed amongst these survivors of a coronary event. No case of suicide and only one accidental death was noted amongst 87 of 282 subjects who had stopped smoking after a coronary attack.

Cigarette smoking has been implicated as a cause of, or contributory factor to, a number of serious and life-shortening diseases including coronary heart disease, stroke, peripheral vascular disease, lung cancer and chronic bronchitis. It is also associated with carcinoma of the pharynx and bladder, duodenal ulcer, dental disease, chronic sinusitis and fetal morbidity[1].

It has been stated that current cigarette smokers who die a coronary death are more likely to die suddenly from a fatal arrhythmia than non-smokers who are more likely to die from myocardial infarction and its consequences[2]. It has recently been suggested that subjects who stop smoking may be more prone to suicide or accidental death because of the stress associated with the discontinuation of the habit[3].

We report the causes and mode of death of 261 male patients under 60 years who survived unstable angina or myocardial infarction by 28 days and who died during the subsequent follow-up period lasting from 4–19 years. The object of the study was to compare the cause and mode of death in patients who had never smoked or had stopped smoking with those who continued to smoke. We were particularly interested in the proportion of sudden deaths in the two groups and in the proportion of suicide or accidental deaths.

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Material

Six hundred and sixty-five male patients under 60 years who survived a first bout of unstable angina or myocardial infarction by 28 days were seen between January 1961 and December 1975. All were admitted to a long-term rehabilitation and secondary prevention programme. Subjects were seen annually up to last follow-up or death. Two were lost to follow-up. Two hundred and sixty-one deaths had occurred amongst the group up to 31 December 1979. Their cigarette smoking habits were known to us up to the time of death. The cause of death was unknown in two patients.

The patients were subdivided into 132 patients with unstable angina and 533 patients with myocardial infarction. Diagnostic criteria employed by us for unstable angina and myocardial infarction have already been described[4]. Sixty-two deaths (47%) occurred among the unstable angina group and 199 deaths (37·5%) occurred in the infarction group. Allowing for variable periods of follow-up,

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length of survival following the initial attack was not significantly different between the two groups.

The mean age of the 261 decedents at presentation was 51·8 years and at death 57·4 years, with a mean duration of follow-up of 5·6 years.

Non-smokers were those who had never smoked cigarettes.

Ex-smokers were those who had stopped cigarettes for at least three months before the initial heart attack, and who remained off smoking subsequently. Ex-smokers who had resumed cigarette smoking after the coronary attack were included in the continued smoking group.

Stopped smokers were those who were current smokers at the time of the first attack but who had stopped smoking at least three months before the last follow-up or death. In fact more than 90% of this group had stopped smoking after the initial coronary attack and had not re-started.

Continued smokers were those who continued to smoke regularly after the attack. More than half of these had substantially reduced their volume of smoking and a few were difficult to classify because of erratic smoking habits.

We have recently noted a high degree of veracity in the stated smoking habits of a sample of these subjects[5].

Sudden death is described as instantaneous death, death within the hour of the onset of the symptoms or unwitnessed death. The great majority in this group had instantaneous death. Mode of death was documented from hospital records, post-mortem reports, death certificates and by contacting family doctors and patients' relatives.

Results

Table 1 shows the number of patients in each follow-up smoking category and the number who have died during the follow-up period 1961–79, inclusive. Since this is a variable follow-up little significance can be attached to the death rates in this table. This paper is solely concerned with the causes and mode of death in the 261 decedents.

The mean ages at presentation of each smoking category were almost identical apart from non-smokers who were slightly older (54 years; overall mean 51·8 years). The mean time to death was 5·6 years. Non-smokers survived slightly longer (6·7 years) and ex-smokers had a slightly shorter survival (4·6 years). Stopped and continued smokers were closer to the mean at 6·3 and 5·2 years, respectively.

Table 2 records the mode of death and cause of death in each smoking category. Fifty-nine (48·4%) of the 122 decedents who had continued to smoke died suddenly and 35 (28·7%) died from fresh infarction. Seventy-two (52·2%) of the 138 decedents in the combined group of non-smokers, ex-smokers and stopped smokers died suddenly and 35 (25·4%) died from fresh myocardial infarction. There was no significant difference in the cause or mode of death between those who continued smoking and those who had never smoked or who had stopped.

Patients dying suddenly had a similar age to the overall mean (51·4 *v.* 51·8 years) and a similar survival time (5·5 *v.* 5·6 years). Examination of ages and survival times in all other categories of smoking and mode of death did not reveal major differences. Continued smokers who died of myocardial infarction had a shorter than average survival time (3·7 years). The two decedents in whom cause of death was unknown were younger than average at 41 and 45 years.

Table 3 records the non-vascular causes of death

Table 1 Number of deaths among 663 subjects admitted to study, divided into different smoking categories at last follow-up

	Non-smokers (%)	Ex-smokers* (%)	Stopped smokers† (%)	Continued smokers (%)	Total
Number in each category	53	93	282	235	663
Number of deaths	18 (34·0)	35 (37·6)	86 (30·5)	122 (51·9)	261

*Ex-smoker = had stopped before coronary attack.
†Stopped smoker = stopped after coronary attack.

Table 2 Cause and mode of death in different smoking categories

Mode and cause of death	Smoking category at last follow-up				Total
	Non-smoker (%)	Ex-smoker* (%)	Stopped smoker† (%)	Continued smoker (%)	
Sudden	12 (66·7)	20 (57·1)	40 (46·5)	59 (48·4)	131 (50·2)
Fresh myocardial infarction	3 (16·7)	7 (20·0)	25 (29·1)	35 (28·7)	70 (26·8)
Cardiac failure	1 (5·5)	3 (8·5)	4 (4·6)	9 (7·4)	17 (6·5)
Embolism	0	1 (2·9)	0	0	1 (0·4)
Other vascular causes	0	1 (2·9)	4 (4·6)	5 (4·1)	10 (3·8)
Non-vascular causes	2 (11·1)	3 (8·6)	12 (14·0)	13 (10·6)	30 (11·5)
Cause unknown	0	0	1 (1·2)	1 (0·8)	2 (0·8)
Total	18 (100)	35 (100)	86 (100)	122 (100)	261 (100)

*Ex-smoker = had stopped smoking before coronary attack.
†Stopped smoker = had stopped after coronary attack.
$\chi^2 = 12{\cdot}87$ d.f. = 18, NS.

Table 3 Non-vascular causes of death in different smoking categories

Cause of death	Smoking categories at last follow-up				Total
	Non-smoker	Ex-smoker*	Stopped smoking†	Continued smoking	
Cancer	1	3	8	6	18
Infection	1	–	–	3	4
Haemorrhage	–	–	1	2	3
Respiratory failure	–	–	1	1	2
Suicide	–	–	–	1	1
Cirrhosis of liver	–	–	1	–	1
Head injury	–	–	1	–	1
Total	2	3	12	13	30

*Ex-smoker = had stopped before coronary attack.
†Stopped smoker = had stopped after coronary attack.

in each group. Only one suicide was recorded in the continued smoking group and one accidental death in the stopped smoking group.

Discussion

We have already shown that survivors of unstable angina or myocardial infarction who continue to smoke have a significantly higher subsequent mortality compared to those who stopped smoking[4]. As regards mode of death in these subjects, the present study confirms our earlier report based on 128 decedents[6] that there was not an excessive proportion of sudden deaths from fresh myocardial infarction or other causes in those patients who continued to smoke cigarettes after an initial coronary attack compared to those who had stopped or who had never smoked. Other workers who studied subjects without a history of coronary heart disease reported a higher proportion of sudden deaths compared to deaths from myocardial infarction amongst smokers compared to non-smokers[2,7].

We have examined data relating cigarette smoking habits and mode of death in the Scottish and Newcastle clofibrate trials, both of which provided information on the subsequent smoking habits of patients with established coronary heart disease. The Scottish clofibrate trial[8] shows no significant difference in the ratio of sudden deaths to deaths from fresh myocardial infarction between smokers and non-smokers in their treatment and placebo groups. The Newcastle clofibrate trial[9] showed no difference in their treated group but a

significant ($P < 0{\cdot}05$) excess of sudden deaths in smokers compared to non-smokers in the placebo group. These two studies included patients with angina as well as those with a history of myocardial infarction.

The high ratio of sudden to non-sudden deaths in smokers compared to non-smokers noted in studies on apparently healthy people has been attributed to increased catecholamine production caused by nicotine and to the subsequent increased propensity to arrhythmias[10]. However, the thrombogenic effect of nicotine[11,12] and the raised carbon monoxide levels in cigarette smokers may be factors in increasing the propensity to infarction and to death from this cause.

Lee, in examining the data presented by Doll and Hill on mortality amongst British doctors, agreed that stopping smoking may be associated with reduced mortality from coronary heart disease, stroke and lung cancer but noted an increased mortality from accidents and suicide[3]. He postulated that those who stopped smoking may be more likely to commit suicide or may be more accident-prone because of the stress resulting from eschewing the smoking habit. Eighty-six of the 282 subjects who stopped smoking died during follow-up (Table 1). One died from head injury and none committed suicide. Whilst comparison of our post-infarction subjects with Doll and Hill's subjects must be made with caution, our findings do not support Lee's hypothesis.

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