nosed (11 cases; relative risk 2.42 (95% confidence interval 1.2 to 4.3)). The combined relative risk of cancers that are known to be associated with tobacco smoking was reduced (0.49), but the combined relative risk of cancers of specified sites other than those associated with smoking was close to that expected (1.01).

Comment

We found a low incidence of cancers associated with tobacco smoking, mainly lung and bladder cancer, among patients with Parkinson's disease. In addition, smokers are less likely to develop Parkinson's disease.¹ The most simple explanation of these findings is that tobacco smoking in some way exerts a protective effect against the development of Parkinson's disease, possibly through the effect of nicotine on dopamine concentrations in the brain,⁵ and that patients with Parkinson's disease therefore tend to have smoked less during their lives than the population at large.

The close temporal association between diagnosis of Parkinson's disease and incidence of brain tumours suggests that brain tumours may on rare occasions be erroneously diagnosed as Parkinson's disease. We found an excess of six cases of brain tumours among 7046 patients with Parkinson's disease. This implies

that no more than one in 1000 diagnoses of Parkinson's disease is an unrecognised brain tumour.

The increased incidence of malignant melanoma lends support to the idea that treatment with levodopa may increase the incidence of malignant melanoma.³ Malignant melanoma cells possess a unique biochemical pathway for the conversion of levodopa to melamine, and they selectively incorporate levodopa.⁴ Levodopa treatment may therefore accelerate the growth of a preclinical melanoma. We emphasise, however, that the observed effect is rather weak: around one excess case per 3500 patients with Parkinson's disease per year.

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Effect of physical activity on femoral bone density in men

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Although most patients with osteoporosis are women, up to one third of hip fractures occur in men. There is little information about which factors influence bone density in men.¹ Vigorous activity may lead to bone gain, while immobilisation causes bone loss. A sedentary lifestyle could, therefore, increase the risk of fractures.² We therefore examined the relation between physical activity and bone density in normal men.

Subjects, methods, and results

One hundred and thirty seven healthy white men, comprising husbands of women attending our osteoporosis clinic, laboratory staff, and hospital workers who were enrolled in a normal bone study, listed their regular physical and sporting activities. Subjects taking drugs or with diseases likely to affect calcium metabolism were excluded. Forty eight were smokers (mean 15 cigarettes/day), and 120 drank alcohol (mean 8.6 g of alcohol/day). The time per week spent on each activity was multiplied by the energy expenditure for that activity and expressed in METs per week (a MET is an arbitrary unit of metabolic activity equivalent to average sitting oxygen consumption); 56 METs per week were subtracted for sleeping time.³

Bone density was measured in the forearm by single photon absorptiometry (Molsgaard Bone Mineral Analyser) and in the spine (L2-L4), femoral neck, Ward's triangle, and trochanter by dual energy x ray absorptiometry (Lunar DPX-L). Results were analysed by Student's *t* test and linear regression; age correction was done by multiple linear regression with age expressed as a quadratic function. Since bone loss accelerates in men over 50,¹ measurements were evaluated separately in men aged 50 and over and in

those aged under 50. A *P* value <0.05 was considered significant.

The subjects' mean age was 47 (range 20-83), weight 77 kg (range 60-98), height 177 cm (range 157-200), and body mass index 24.7 kg/m² (range 18.8-32.1). Forearm bone density was lower in those aged 50 and over than in those aged under 50 (472 (SD 77.6) v 522 (56.5) 95% confidence interval for difference: 25.6 to 74.4; *P* <0.001), but energy expenditure was similar in the two groups (129 (14.7) METs per week in the former and 131 (17.1) in the latter), equivalent to about 2.5 hours' jogging or 5.5 hours' walking. In the whole set activity was related to age-corrected bone density in the femoral neck (*r*=0.26, *P*<0.01) but not in the forearm or spine (*r*=−0.056 and 0.140 respectively). Activity and bone density were not related in men aged 50 and over. In those aged under 50 they were significantly related in the spine, femoral neck, Ward's triangle, and trochanter. These relations were unaffected by adjustment for age (table). Femoral neck bone densities in all subjects who jogged (22), walked regularly (53), or were sedentary (21) were 1.098 (0.121), 0.984 (0.152), and 0.962 (0.120) g/cm² respectively; the difference between the joggers and sedentary men was significant (0.136; 95% confidence interval: 0.097 to 0.225; *P* <0.01).

Partial coefficients of correlation (age corrected) of bone density variables and activity score

Site	Age < 50 (n=71)		Age ≥ 50 (n=66)	
	r	P value	r	P value
Forearm	0.028	0.796	−0.148	0.304
Lumbar	0.245	0.039	0.031	0.929
Femoral neck	0.394	0.001	0.106	0.552
Ward's triangle	0.305	0.010	0.221	0.142
Trochanter	0.257	0.031	0.126	0.378

Comment

The major new finding in this study is of a continuous positive relation between physical activity and bone density in normal white men. This relation may reflect selection bias, inherent in a cross sectional

study, but this is unlikely. Men who undertake regular outdoor activity have been shown to have a lower prevalence of hip fracture than those who do not,³ and active men have a higher bone density than sedentary men.⁴ Our data suggest that any exercise is beneficial to bone and that, within the normal range, the more the better.

Slemenda *et al*⁵ reported that the high leg and pelvic bone densities in young female figure skaters aged 10-25 were not evident until their mid-teens, suggesting that selection of skaters from a biased population was unlikely. Furthermore, the effect of exercise on bone appears to be related to site. Most of the activities we recorded were weight bearing and likely to stress the upper femur. The mean difference in femoral bone density across the range of activities recorded was 12%,

equivalent to 18 years of bone loss.¹ The observation that bone density was related to physical activity only in those aged up to 50 suggests that exercise may have its major effect on peak bone density.

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The time of death after trauma

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The pre-eminence of trauma as a cause of death in young adults in the United Kingdom is well established, but little is known about the temporal distribution of these deaths.¹ The only complete data are from a frequently quoted paper, in which Trunkey described trauma deaths in San Francisco over two years.² These data are nearly two decades old and come from a country where the causes of trauma and the system for dealing with it differ from those in the United Kingdom.

Patients, methods, and results

All patients aged over 12 who died after trauma in the Lothian and Borders regions of Scotland between 1 February 1992 and 31 January 1994 were studied prospectively by the Scottish Trauma Audit Group and the university department of forensic medicine. The time and mechanism of injury and the time of death were recorded. Postmortem examinations were performed in every case, and injury severity scores calculated, using the abbreviated injury scale, 1990 revision. The definition of trauma used was that previously used by Trunkey, allowing direct comparison.

There were 331 deaths following trauma, including 26 murders and 98 suicides. Of the victims, 253 (76%) died within one hour of injury; 248 of these died instantaneously and had unsurvivable injuries (abbreviated injury scale 6, injury severity score 75) or were found dead. The remaining five patients died at the scene or in transit to hospital. Seventy eight patients survived more than one hour after injury; 59 surviving for more than four hours. The table compares the timing of deaths after trauma in this study with the United States data.

Comment

In his analysis Trunkey suggested that deaths after trauma follow a trimodal distribution.² The first and

largest peak, comprising 50% of the total, is seen immediately, or within seconds of injury. The second peak, 30% of deaths, occurs up to four hours later, while the third comprises those 20% of patients who die after four hours.

Much significance has been placed on this temporal relation, particularly to the second peak.^{2,3} Many commentators believe that appropriate intervention for patients in this group offers the greatest potential for preventing unnecessary deaths.^{2,3} As a result, the provision and nature of prehospital and hospital trauma services have been profoundly affected, both in the United States and the United Kingdom. In particular, ambulance service paramedic training and the concept of trauma centres have received considerable attention.^{4,5}

It is therefore relevant that three quarters of the patients in this study died immediately or were found dead at the scene. Furthermore, the subsequent deaths do not cluster together into the peaks previously described in north America. The accepted concept of a trimodal distribution of death after trauma does not apply in our area. This may be partly due to improvements in trauma care, resulting in fewer unnecessary deaths. Data from the Scottish trauma audit group for our region confirm that there are significantly more survivors after trauma than predicted from the United Kingdom dataset, but the numbers in this category are small and insufficient to affect the overall conclusions. A more important factor is likely to be the type of trauma seen.

If our results are mirrored throughout the United Kingdom, they necessitate a re-evaluation of pre-hospital and trauma care systems. Attempts to improve care for those who initially survive major trauma must continue, but our study emphasises that prevention offers the most cost effective and rational approach.

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Timing of deaths after trauma in San Francisco compared with south east Scotland

Time of death (hours after injury)	San Francisco (%)	South east Scotland (%)
<1	50	76
1-4	30	7
>4	20	17