

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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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

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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