16%? Had our patients reported substantial alteration in their way of life as a result of stimulation then perhaps the risk would be worth running. Although objective improvement was seen on urodynamic testing, only a minority noticed amelioration in their pattern of micturition, and in all instances this was of minor degree. No patient reported reduction of socially inconvenient symptoms such as incontinence or nocturia. Given that only three (10%) of a selected group of sufferers from multiple sclerosis derived lasting benefit and that this was obtained at considerable time, expense, and inconvenience to profession and patient we conclude that at present dorsal column stimulation has no place in the routine management of multiple sclerosis. As a research procedure it holds considerable fascination, but at present further gains must be made for the patient and assessments of response need to be controlled, objective, and unemotional.

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Risk of early death in extremely overweight young men

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Abstract

The effect of pronounced obesity in youth on later mortality was studied in 1239 men with extreme overweight, defined as a weight/height$^2 \geq 31$ kg/m^2, in the population of 331 919 men liable for military service in the Copenhagen area during the period 1943-1977. A random sample of 2948 drawn from the remaining study population served as a control group. All men were followed up until November 1980, by which time 33 deaths had occurred among the extremely overweight subjects compared with 89 in the control group. This gave a mortality ratio (observed to expected number of deaths) of 1·14 (95% confidence limit 0·91-1·40) for controls with a significantly greater mortality of 1·73 (95% confidence limit 1·20-2·41) for obese subjects. The relative risk, estimated from the survival time distributions, was fairly constant around 1·6 throughout the 37 years of observation. Taking into account age at and year of entry in a regression analysis did not change the relative mortality risk. The proportion of natural death was significantly higher in the obese group than in the control group until the age of 30 but not thereafter.

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Pronounced obesity in youth is a health hazard, manifesting itself particularly in a distinct increase in mortality from natural causes in early adulthood.

Introduction

The effect of obesity on mortality has been the subject of extensive research throughout this century.[1 2] In principle the studies have been based on sampling from the population irrespective of the degree of obesity. Consequently, the number of obese subjects decreases with increasing degree of obesity and even the largest studies include rather few with morbid obesity.[1-4] Owing to the increasing prevalence of obesity with advancing age this problem of design is worse the younger the population under study. Those who are severely obese in youth are, however, of particular clinical interest from both a prophylactic and therapeutic point of view. The huge life insurance studies suggest that the relative mortality risk is increasing with increasing overweight, particularly among young men.[1] It is well recognised that this experience may hold only for the insured population due to the particular selection process in underwriting. In this study we used the obligatory draft board examination to collect an unbiased sample of reasonable size to allow assessment of the mortality among men considerably obese as young adults.

Subjects and methods

In Denmark all men are registered with the military authorities when they reach the age of 18. Except for those who volunteer before this age, all are examined by the medical board within the next few

years. The number and records of the volunteers are not available, but according to the authorities this group comprised about 2% of all men at the age of 18 during our study period.

Our study population comprised the 331 919 men who, according to the official statistics, were processed by the board in the metropolitan area of Copenhagen from 1943 to 1977. To describe the study population we drew a 1% random sample; this sample numbered 3084 men, which was fewer than the 3319 expected because records were unavailable for those examined and found fit for service from 1958 to 1968 who were living in another region in 1969. Those unquestionably unfit for service (123, 4%) did not appear before the board. The remaining 2961 men had undergone systematic examination, including measurement of height and weight. Thus about 296 100 men were available for study. Details of the population have been given elsewhere.[5-7]

Obese group—Extreme overweight is defined here as a body mass index, weight/height^2 $\geq$ 31 kg/m^2,[8] which is about 45% or more above the old insurance standard.[9] We searched the files and found 1239 men fulfilling the criterion for extreme overweight.

Control group—The control group was derived from the random sample drawn from the study population.[7] After exclusion of those for whom no record of height and weight were available as well as of 13 extremely overweight men already included in the obese group, the control group comprised 2948 men.

Follow up—By use of the national registers all men in the two groups were followed up until 1 November 1980, or until death, emigration, or disappearance. Each death was documented by the death certificate, which classified the mode of death: natural death, accident, suicide, homicide, or unknown. Emigration and disappearance were considered as censored follow up.

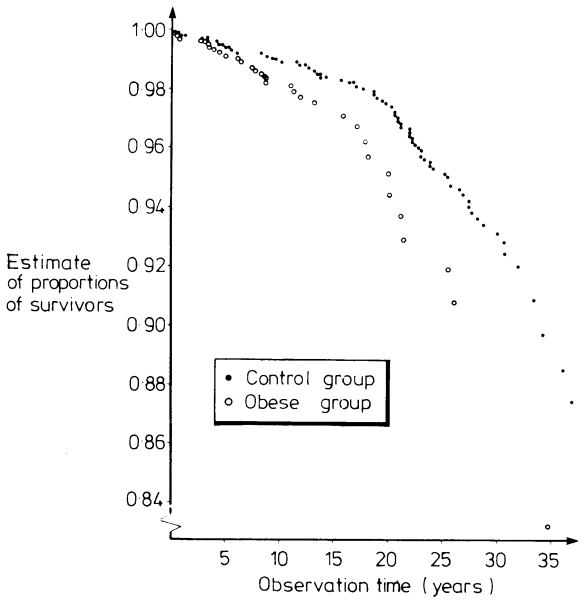

FIG 1—Kaplan-Meier plot for obese group and control group.

Statistical methods—The expected number of deaths during the study period was calculated from official Danish mortality statistics, taking into account sex, age, and year of board examination. The mortality ratio is the ratio of observed to expected numbers of deaths, and its confidence limits are based on the Poisson distribution of the observed number of deaths. Survival time distribution was described by the Kaplan-Meier plot[10] and compared with Gehan's generalisation of the Wilcoxon test.[11] The relative mortality risk, obtained by comparing the obese with the control group, was illustrated by plotting the mutual cumulated hazard functions.[12] The relative risk and the influence of covariables were estimated by Cox's multivariate regression model for survival data.[13]

A part of the obese group, followed until 1974, has previously been compared with official statistics.[6]

Results

A total of 89 deaths occurred in the control group and 33 in the obese group. The observed number of deaths in the control group did not differ significantly from that expected from the official statistics, with a mortality ratio of 1·14 (95% confidence limit 0·91-1·40), whereas the obese group showed a significant extra mortality, the mortality ratio being 1·73 (95% confidence limit 1·20-2·41).

The survival curves show a shorter life expectation in the obese group during the entire study period of 37 years (Gehan's U statistic 2·23, p = 0·026) (fig 1). Thus 95% survival was 20 years for the obese and 25 years for the control. Figure 2 shows the cumulative hazard plot with the solid line being based on the relative risk calculated from Cox's regression model without consideration of covariables. A fairly linear relation was found throughout the follow up period, corresponding to a relative risk in the obese group of 1·63 (95% confidence limit 1·08-2·45).

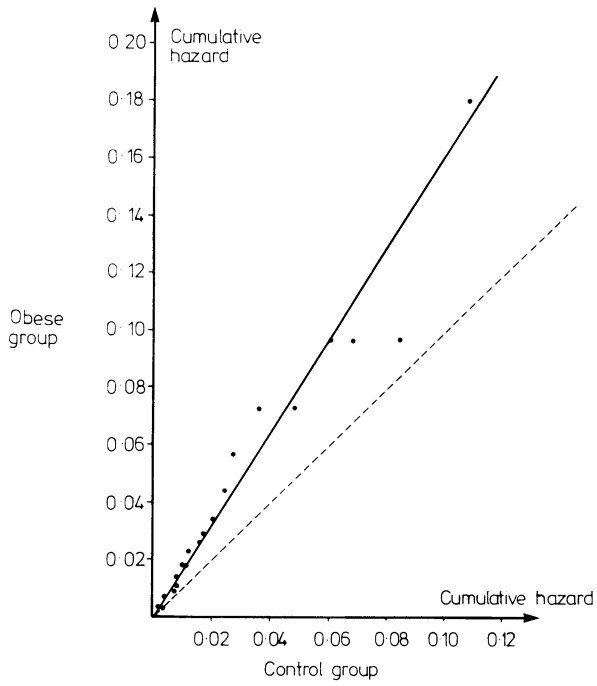

FIG 2—Cumulative hazard function for obese group compared with control group. Broken line indicates a relative risk of 1·00. Solid line indicates a relative risk of 1·63 according to Cox's regression model without taking covariables into account.

The age at board examination had a moderate influence on the mortality, whereas the year of examination was unimportant (table I). Taking both variables into consideration, the relative risk in the obese group versus the control group was virtually unchanged compared with the unadjusted results (table I).

The relative mortality showed a slight but insignificant increase with increasing body mass index in both the control group and the obese group (table I). A subdivision of the control group into four sections according to body mass showed no significant differences in mortality between the sections (all p values > 0·26).

In the obese group 64% of the deaths were natural compared with 53% in the control group (table II) but this difference was not significant. There was, however, a significant predominance of natural death in the obese group for those who died before the age of 30 years (p < 0·005). This trend was still present, although not significant, for deaths in the age group 30-39 years. In the older age

TABLE I—*Relative risk ratios (95% confidence limits) estimated from a regression model of Cox (ref 13)*

Variables	Relative risk ratio	U*	p
Age at examination (years)	1·09 (1·00-1·20)	1·86	0·06
Time of examination (years)	0·99 (0·96-1·01)	0·93	0·35
Obese versus control:			
Unadjusted	1·63 (1·08-2·45)	2·32	0·02
Adjusted for age and time	1·67 (1·10-2·53)	2·39	0·02
Weight/height^2 (kg/m^2):†			
Among controls	1·04 (0·95-1·15)	0·82	0·41
Among obese men	1·01 (0·89-1·15)	0·19	0·85

*Standardised normal deviate.
†Adjusted for age and time.

TABLE II—*Mode of death in relation to age at death*

Age at death	Obese subjects: Natural death No	Obese subjects: Natural death %	Obese subjects: Total	Controls: Natural death No	Controls: Natural death %	Controls: Total	χ^2_1	p
18-29	10	59	17	3	11	27	9·23	0·005
30-39	7	78	9	11	55	20	0·57	NS
40-49	2	57	5	27	79	35	0·56	NS
50-59	2		2	6		7		
Total	21	64	33	47	53	89*	0·75	NS

*In five cases the mode of death was unknown, because death occurred abroad (three) or the death certificate was unavailable (two).

groups the trend apparently was reversed, but the number of deaths in the obese group was too small for a valid comparison (the prevalence of extreme overweight in the study population was rather low before 1960[5] so the number of obese men followed up to the age of 40 is relatively small).

Discussion

Our results indicate that in men pronounced obesity developed before adulthood is followed by excess mortality manifested as early as in their 20s. The risk for obese young men is 1·6 times that for the general population and is constant for the entire period of this study. The 95% survival rate was reached at 25 years' follow up in the control group but at 20 years' follow up in the obese group. The higher mortality in the obese group can be ascribed to an excess of natural death in the men in their 20s and 30s.

The design of our study should satisfy the basic requirements for attacking the problem. Although conducted retrospectively, the design is prospective, and the representativeness of the sample is optimised by the fact that all Danish men must by law appear before the board. The proportion of the total population not studied was small and the prevalence of obesity in this group probably did not deviate appreciably from that found in the study population.[6] The measurement of height and weight was performed under standardised conditions. The mortality in the control group was only slightly, not significantly, larger than that expected from nationwide statistics. The results obtained by the various statistical techniques agreed well; in particular, the adjustment for age and time did not alter the estimated risk. The control group covered the range of body mass index up to 31 kg/m² but the insignificant internal relationship between body mass index and mortality makes it reasonable to use the undivided group as reference for the obese group.

In the Build study in 1979,[1] the insurance companies' experience of mortality through 22 years was presented for those aged 15-39 years in relation to percentage departure from average weight for given height. The experience showed a ratio of actual to expected mortality of 1·41, for those 35-45% over the average weight, 2·11 for those 45-55% over, and 2·27 for those 55-65% over average weight. The data for policies issued to those aged under 20 years were presented separately and showed essentially the same trend, but in this group the experience was scarce and presumably highly selected. The result of our study is compatible with the experience of the insurance companies although we found no statistically significant increase in mortality with increasing body mass index within the obese group.

The selection process in underwriting may entail different opposing mechanisms.[1] Generally, insurance is accepted only for applicants in fairly good health, which presumably is the reason for lower mortality in the insurance studies than in other population studies.[4] On the other hand, insurance may be applied for particularly by subjects who do not feel quite healthy though they have no manifest disease.[1] The weighting of these mechanisms may in an unforeseeable manner depend on the degree of overweight. The agreement between our results and the insurance data suggests that the selection effects balance each other.

We conclude that pronounced obesity in youth is a health hazard that manifests itself in a distinct increase in mortality from natural causes in early adulthood.

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SUPPURING MEDICINES—These have a great affinity with emolients, like to them in temperature, only emolients are somewhat hotter. Yet is there a difference as apparent as the sun when he is upon the meridian, and the use is manifest. For, Emolients are to make hard things soft, but what suppures, rather makes a generation than an alteration of the humour. Natural heat is the efficient cause of suppuration, neither can it be done by any external means. Therefore such things are said to suppure, which by a gentle heat cherish the inbred heat of man. This is done by such medicines which are not only temperate in heat, but also by a gentle viscosity, fill up or stop the pores, that so the heat of the part affected be not scattered. For although such things as bind hinder the dissipation of the spirits, and internal heat, yet they retain not the moisture as suppuring medicines properly and especially do. The heat then of suppuring medicines is like the internal heat of our bodies. As things then very hot, are ingrateful either by biting, as Pepper, or bitterness; in suppuring medicines, no biting, no binding, no nitrous quality is perceived by the taste. For reason will tell a man, that such things hinder rather than help the work of nature in maturation. Yet it follows not from hence, that all suppuring medicines are grateful to the taste, for many things grateful to the taste provokes vomiting, therefore why may not the contrary be? The most frequent use of suppuration is, to ripen *Phlegmonae*, a general term physicians give to all swellings proceeding of blood, because nature is very apt to help such cures, and physic is an art to help, not to hinder nature. The time of use is usually in the height of the disease, when the flux is stayed, as also to ripen matter that it may be the easier purged away. (Nicholas Culpeper (1616-54) *The Complete Herbal*, 1850.)