

## Incidence of major amputations following gangrene of the lower limb

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### Abstract

The incidence of major amputations following gangrene of the lower limb during the period 1971 to 1979 in the county of Copenhagen was calculated. The overall incidence was found to be about 0.3 per thousand inhabitants over 40 years of age, the ratio of men to women was 2:1. The incidence was found to increase exponentially with age. The amputation-rate of the lower limb did not change during the 8 year period.

### Introduction

Only a limited number of studies have been carried out to determine the incidence of major amputations of the lower limb due to vascular gangrene, even though the incidence was found to increase steadily from the Forties to the Sixties in Sweden (Hansson 1964, Hierton and James 1973) and despite the fact that the group of elderly amputees represents an increasingly important medical and socio-economic problem.

This study deals with the incidence of amputations due to gangrene of the lower limb in a suburban area in the Seventies.

### Patients and Methods

During the period April 1st 1971 to March 31st 1979 amputation of the lower limb was performed in 307 patients over 40 years of age. The age and sex distribution is shown in Figure 1. The mean age was 70 years (the range being 40-94). Males with a mean age of 68 years (42-90) constituted 58 per cent (179/307) of the series, while females were on average 5 years older, their mean age being 73 years (40-94).

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The cause of amputation was gangrene due to chronic arteriosclerotic vascular disease or acute thrombosis in 75 per cent of cases (230/307), the remainder had concomitant diabetes mellitus. The primary level of amputation was above-knee (AK) in 33 per cent of cases (101/307), through-knee (TK) in 21 per cent (66/307) and below-knee (BK) in 46 per cent of cases (140/307).

In the suburban area studied there was a total of 1,027,867 inhabitants over 40 years of age resident during the 8 year period. This is equivalent to a background population of approximately 130,000 inhabitants. The number of elderly people increased slowly during the observation period. The patients were subdivided into age groups with 5 year increments and also according to sex. The population of the area was similarly subdivided into age and sex groups according to information obtained from the Danish Central Bureau of Statistics. From these data the incidence of major amputations of the lower limb was calculated and analysed by a multiplicative Poisson model (Andersen 1977).

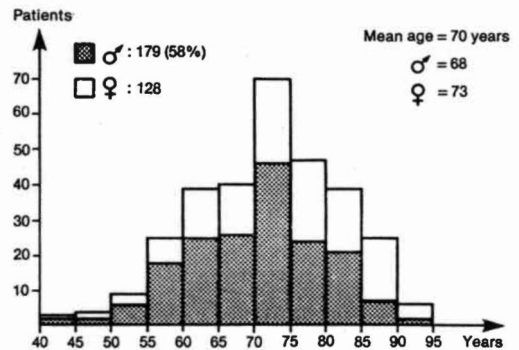


Fig. 1. Age and sex distributions for 307 patients over the age of 40 with amputations of the lower limb.

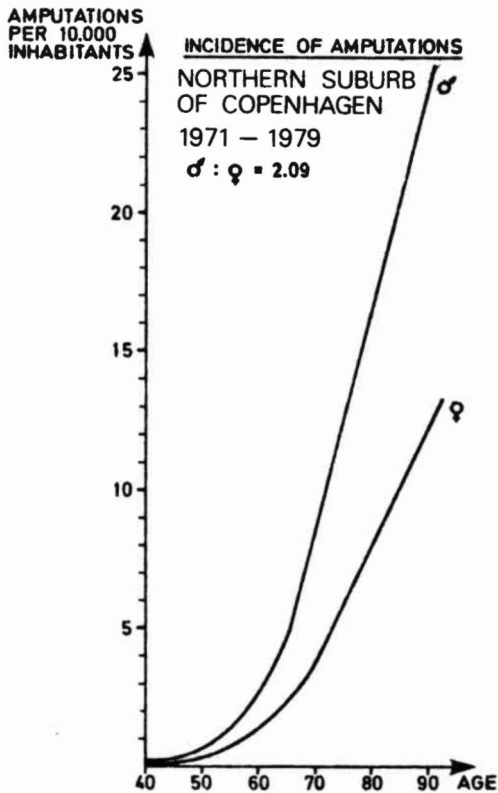


Fig. 2. Incidence of major amputations of the lower limb.

### Results

The difference in mean age of 5 years between male and female amputees was significant ( $P < 0.04$ ). The ratio of men to women was 2.09. The incidence of amputations of the lower limb did not change significantly during the 8 year period of observation. The overall incidence was 0.3 per thousand inhabitants over 40 years of age. As shown in Figure 2 the incidence of major amputations of the lower limb increased exponentially with age from the beginning of the 5th decade. The incidence increased tenfold from 0.1 per thousand at 55 years of age to 1 per thousand at 76 years of age. At 92 years of age the incidence had increased to 2 per thousand.

The distribution between the cause of amputation in relation to age and sex was analysed as shown in Figure 3. In males amputation was due to gangrene by arteriosclerotic vascular disease without

concomitant diabetes mellitus in 75 per cent and this was independent of age. In females a decrease in the percentage of chronic arteriosclerotic vascular disease as cause of amputation was observed around the 7th decade.

### Discussion

Hansson (1964) found the incidence of amputations on the lower limb over the age of 60 to increase from 34 to 93 per hundred thousand inhabitants during a 25 year period from 1947 to 1962. In a similar study by Hierton and James (1973) the increase was found to be 43 to 85 per hundred thousand in the period 1947 to 1969. Vitali and Harris (1964) reports the total number of patients provided with a prosthesis in England and Wales increased from 3262 new cases in 1959 to 4251 new cases in 1962. Using information from the British Central Statistical Office the incidence of patients over the age of 40 provided with a prosthesis can be calculated to be 16 per hundred thousand in 1959 and 20 per hundred thousand in 1962.

In the present study the amputation rate was constant from 1971 to 1979 which accords with the result of Christensen (1976) who studied the period of 1961 to 1971.

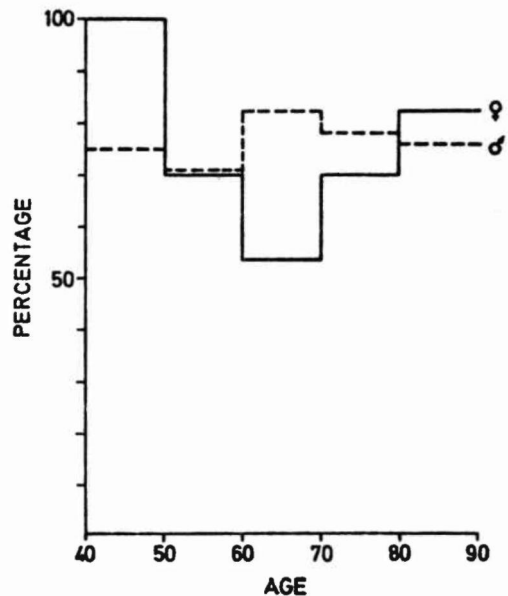


Fig. 3. Vascular causes of amputation in relation to age and sex.

Persson and Sundén (1971) found an incidence of 20 per hundred thousand in the county of Lund in Sweden in a comparable group of amputees with a mean age of 77 years and a lower age limit of 40 years. The population in the county of Lund is of mixed urban/rural composition, as it is in the county of Aalborg, Denmark, where the urban-rural ratio is 1:1:1. In the latter population Christensen (1976) found an amputation rate of 13.1 per hundred thousand inhabitants over the age of 50. In the present series an overall incidence of 30 per hundred thousand inhabitants over 40 years of age was found. The incidence was found to increase exponentially with increasing age. The difference in geographic background and populational composition might be an explanation for the different amputation rates found in the methodologically comparable studies. In the suburban county of Copenhagen presented in this paper there is almost no rural population, and there is a prevalence of the eldest age groups with a higher economic status than in most parts of Denmark.

The difference in mean age between male and female amputees, the male amputees being 5 years younger than female and the ratio of men to women of 2:1 most likely reflects a higher prevalence and an earlier debut of arteriosclerotic vascular complications in males. The decrease in the percentage of chronic arteriosclerotic vascular disease as cause of amputation in females around the 7th decade is not readily explainable.

Since the elderly amputee requires a long hospitalization time after amputation and since frequent control is necessary during prosthetic fitting, incidence studies provide an important and realistic basis for the planning of the hospital care of patients with gangrene of the lower limb.

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#### REFERENCES

- ANDERSEN, E.B. (1977). Multiplicative Poisson models with unequal cell rates. *Scand. J. Statist.* **4**, 153-158
- Central Statistical Office (1965). Annual abstract of statistics, 102. HMSO, London.
- CHRISTENSEN, St. (1976). Lower extremity amputations in the county of Aalborg 1961-1971. Population study and follow-up. *Acta Orthop. Scand.* **47**, 329-334
- HANSSON, J. (1964). The leg amputee. A clinical follow-up study. *Acta Orthop. Scand.* suppl. 69.
- HIERTON, T. and JAMES, U. (1973). Lower extremity amputation in Uppsala county 1947-1969, incidence and prosthetic rehabilitation. *Acta Orthop. Scand.* **44**, 573-582.
- PERSSON, B. M. and SUNDEN, G. (1971). Amputation på underbenet vid åldersgrän. *Nord. Med.* **86**, 1045-1049.
- VITALI, M. and HARRIS, E. E. (1964). Prosthetic management of the elderly lower limb amputee. *Clin. Orthop.* **37**, 61-81