

INCREASED INCIDENCE OF LOWER LIMB AMPUTATION FOR ARTERIAL OCCLUSIVE DISEASE

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The number of amputations in Malmöhus county with just over 500 000 inhabitants had increased from 14 to 161 during the years 1910–79 measured each fifth year comprising totally 724 observations. The number of amputations compared to the age related incidence 1979 had increased four times. Age, diabetes mellitus and sex proportions of ischemic amputees were studied and compared to other Scandinavian reports over the last 30 years. The proportion of diabetic amputees (0.37) and the male proportion (0.54) seemed unchanged, but the proportion of amputees at least 80 years old had increased from about 0.09 to 0.38.

Key words: amputation; arterial occlusive diseases; epidemiology

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In Scandinavia as in other parts of Western world the number of major amputations due to ischemic vascular disease is increasing (Hansson 1964, Lindholm 1964, Hierton & James 1973). In the United States of America more than 60 000 amputations are performed annually (Berardi & Keonin 1978). The county of Aalborg, Denmark, however, had no increase from 1961 through 1971 (Christensen 1976). Besides amputations, vascular surgery and other hospital admissions caused by peripheral arterial insufficiency are increasing (Tibell 1971, Eickhoff 1981). Refined methods for treatment of traumatic and tumorous conditions of the limbs have reduced the need of amputation so that vascular disease now accounts for about 90% of all lower limb amputations (Renström 1981). Although the mortality in these age groups is high it should be noted that 4 years after initial amputation three out of four patients are still alive (Ebskov & Josephsen 1980) and many bilaterally amputated. Most studies do not account exactly for population background when reporting on amputation num-

bers. In this study therefore we have analysed the incidence of amputation during an extended time period covering both medical progress and changes in diseases and population. Simultaneously the present age, sex and occurrence of diabetes mellitus were studied.

MATERIAL AND METHOD

To study the incidence of major amputations due to ischemia, excluding traumatic and tumorous conditions, the county surrounding the University Hospital of Lund was chosen including five other hospitals. This region is Malmöhus county and does not include the city of Malmö. The inhabitants of this county just exceed half a million, distributed between agricultural areas and five cities. The population is shown in Table 1 in the years 1910–79 calculated into 10-year groups.

Medical data from before 1970 regarding major amputation of lower extremities not caused by trauma, tumour or congenital deformities was obtained from the annual reports of all six hospitals in the county. Major amputation includes below knee amputation or more proximal levels. For 1970 and later years the information was derived from the computerized medical re-

Table 1. Population in Malmöhus County, Sweden 1910–79

Age	Year							
	1910	1920	1930	1940	1950	1960	1970	1980
0–39	184 300	250 800	253 700	228 500	222 200	211 500	251 300	290 800
40–49	38 500	41 600	45 800	48 500	56 900	54 400	54 600	56 800
50–59	33 900	33 400	38 600	41 000	45 300	54 000	54 400	56 100
60–69	25 600	27 300	28 400	31 800	35 200	40 400	49 700	50 300
70–79	14 800	15 900	18 000	18 600	22 500	26 300	30 800	38 000
80–	4 000	4 900	5 800	6 300	7 400	10 100	13 100	16 100
Total	301 100	373 900	390 300	374 700	389 500	396 700	453 900	508 100

gistration maintained by the authorities. Regarding concomitant diabetes mellitus the material was further studied in case records; those receiving insulin or oral antidiabetic drugs were recorded as diabetics.

RESULTS

The number of amputations due to ischemia during the years 1910 through 1979 in Malmöhus county is shown in Figure 1. The number of amputations had increased from 14 to 161. To evaluate how the amputation figures related to different age groups of the population the amputees from 1979 were studied; 74% of ischemic

amputees were above 70 years and 93% above 60 and 54% were men. 37% of the amputees were diabetics (Table 2). The rising number of elderly citizens was not enough to explain the increasing number of ischemic amputations (Figure 2).

From the number of amputations performed in different age groups among the 161 in 1979 it was possible to ascertain age-related incidences (Table 2). The yearly incidence in population 60 years or older was 1.4 per 1000. The incidence in population was 0.3 per 1000. The yearly incidence in 1970 in the population 80 years or older was 2.7 per 1000 and in 1975 2.2.

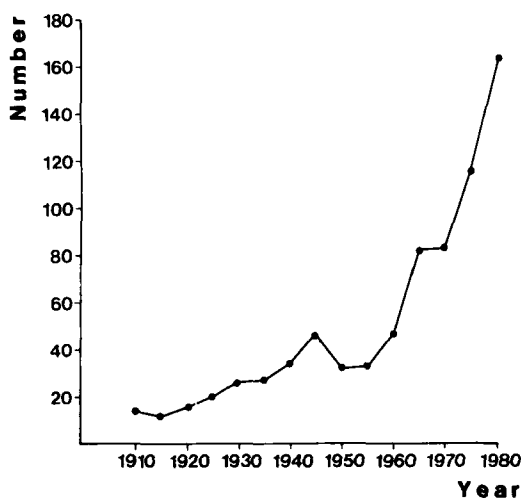


Figure 1. Total number of amputations for ischemia 1910–79 in Malmöhus County, Sweden.

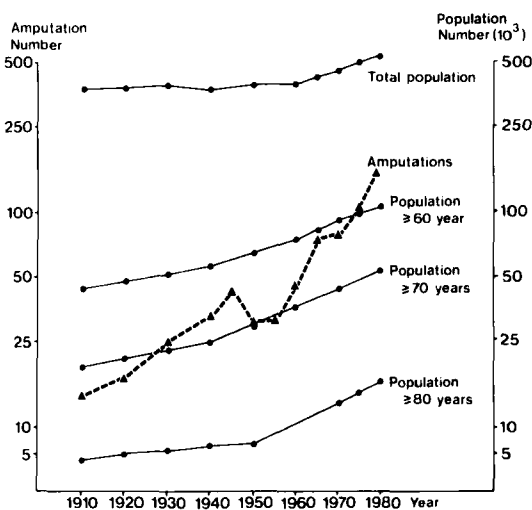


Figure 2. Total number of amputations for ischemia in Malmöhus County 1910–79 in relation to thousands of inhabitants in different ages and total population.

Table 2. Incidence, age, sex and diabetes of amputees in Malmöhus County, 1979

Age group	No. of inhabitants	No. of amputations	Proportion men	Proportion diabetics	Incidence per thousand
—40	290 800	—	—	—	—
40–59	112 900	11	0.45	0.64	0.1
60–69	50 300	31	0.65	0.39	0.6
70–79	38 000	58	0.50	0.34	1.5
80–	16 100	61	0.54	0.34	3.8
Total	508 100	161	0.54	0.37	0.32

From Table 2 it was possible to calculate an expected, backwards theoretically extrapolated number of amputations that should have occurred if the age related incidence had been the same during the last 70 years. The application of the age related incidences of 1979 to the population at various times gave a theoretical curve (Figure 3). In 1910 14 amputations were performed but the extrapolated calculated number should have been 61.

This means there had been a fourfold age adjusted increase in amputations from 1910–79. The actual number of amputations had increased more than 10 times and the population at risk 60 years or more, 2.4 times.

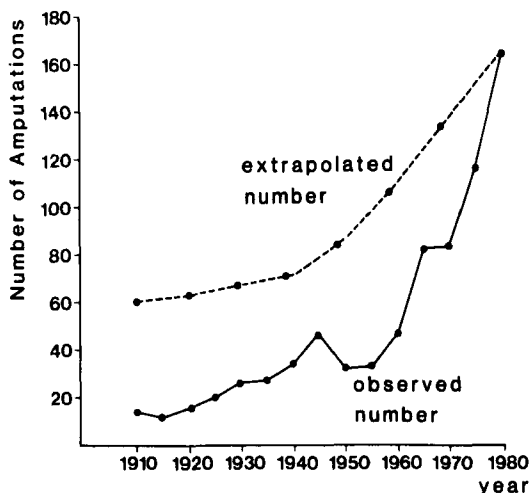


Figure 3. Backwards extrapolated number of amputations if age-related incidence had been as in 1979.

DISCUSSION

One possible reason for the increased number of major amputations for ischemic disease might be that the indications for ischemic amputations have become more liberal during the years.

The largest increase in amputation rate, however, is after 1950. It is unlikely that any significant continuous change in the indication has occurred after World War II, as different forms of anesthesia, antibiotics, insulin and blood transfusions were available even earlier than that.

We use four possible indications for amputation:

1. To save life (gangrene with septicemia or toxemia).
2. To relieve pain (intractable despite analgesics).
3. To improve function (when a prosthesis is better than the limb).
4. To solve hygienic problems (in patients severely deteriorated when life, pain and function is no longer of consideration).

It is therefore unlikely that the indication for surgery has become so much broader that it can explain the increased number of amputations.

The population 80 years or older has increased from a little more than 4000 to a little more than 16000 during the studied time. The high incidence in this age group, however, only partially explains the increase in amputations. Another possibility might be that residual life expectancy has grown so much that it would be necessary to take this into account. The residual life expectancy

tancy of 80-year-old men was 5.7 years at the start of the century and 5.8 years in 1961–65. For women the residual life expectancy has grown from 5.8 to 6.4 years (Hofsten 1975). This means that the age distribution in the population 80 or older has been similar during the studied time.

The population in the 70–79 age group had increased 2.6 times since 1910 and in this age group more than four times the total number of amputations performed in 1910 were performed in 1979. The similarity in life expectancy is important in the calculation of Figure 3. This means that the ratio between the theoretical curve and the observed curve gives the rise in incidence with regard to the change in the age distribution of the population.

It was found that the proportion of elderly amputees had increased. From Scandinavian reports during the last 40 years a significant change towards a greater proportion of elderly amputees has occurred (Table 3).

The effect of exogenous factors like food, drugs, poisons, etc., could account for vascular changes at an earlier age. During this period vascular surgery has become a fairly common treatment modality with an incidence of 0.5 per thousand in the older age groups (Eickhoff 1981).

The introduction of insulin, of course, has increased the survival rate of diabetics. This could explain an increase in the number of amputees now. Even if one excludes amputations among diabetics (Figure 3), however, the age-related incidence has grown almost three times since 1910, and the proportion of diabetics among ischemic

Table 3. Proportion of patients 80 years and older at amputation for ischemia in Scandinavian studies

Period	Authors	n	Proportion
1949–59	Alffram & Holmquist	125	0.09
1947–61	Hansson	261	0.19
1950–63	Vankka	184	0.12
1961–71	Christensen	326	0.18
1973–77	Renström*	200	0.27
1979	Present study	161	0.38

* Below-knee amputations only.

Table 4. Proportion of patients with diabetes at amputation for ischemia in Scandinavian studies

Period	Authors	n	Proportion
1947–61	Hansson	269	0.53
1949–59	Alffram & Holmquist	125	0.49
1959–65	Lindahl & Bolund	183	0.40
1961–71	Christensen	326	0.46
1967–69	Hierton & James	94	0.60
1966–71	Persson & Sundén	143	0.37
1973–77	Renström*	183	0.54
1979	Present study	161	0.37

* Below-knee amputations only.

Table 5. Proportion of men at amputation for ischemia in Scandinavian studies

Period	Authors	n	Proportion
1930–60	Lindholm	531	0.60
1947–61	Hansson	261	0.54
1950–63	Vankka	184	0.60
1967–69	Hierton & James	94	0.44
1973–77	Renström*	200	0.53
1979	Present study	161	0.54

*Below-knee amputations only.

amputees is now not more than about 37 per cent.

The number of elderly and of diabetics thus cannot alone account for the increase in amputations. It is of interest to note whether the proportion of amputations in diabetics has changed during the years, but the proportions seem unchanged ranging between 0.37 and 0.53, with the present series at the lower border (Table 4).

A number of Scandinavian reports concerning the sex distribution have been listed. There has been no change that indicates time related factors leading to amputation affect the sexes differently (Table 5). The increase of ischemic amputation is unquestionable and this increase is not dependent only on age and on diabetes mellitus.

The increased incidence of amputation for ischemia can be explained to a limited extent by the increased number of elderly non-diabetic and diabetic patients. Other contributing factors such as food, smoking habits, environmental pollution

and change in physical activities require further investigation. It is possible that the notch seen in Figure 1 during 1940–60 mirrors such environmental factors influenced by World War II.

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