

LOWER EXTREMITY AMPUTATIONS IN THE COUNTY OF AALBORG 1961-1971

Population Study and Follow-up

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All lower extremity amputations in the county of Aalborg, Denmark, during the period 1961-1971 were analysed. During this 10-year period the amputation rate did not increase. Those requiring amputation were predominantly arteriosclerotics followed by diabetics. The diabetics underwent amputation 3 years younger on average than the arteriosclerotics, but it was more often possible to preserve the knee in diabetics. There was a far higher rate of successful prosthetic fitting among patients in whom the knee had been preserved. Despite a high mortality, also beyond the first postoperative months, prosthetic fitting was of such psychological and social value, that every effort should be made to ambulate the patients. The majority could be looked after in their homes. This was the most positive finding in the present study.

Key words: leg amputation; follow-up, incidence, life expectancy; peripheral vascular diseases; prosthetics

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In recent years there has been an increasing frequency of lower extremity amputations, with serious consequences for the patients and society at large. In the county of Uppsala, Sweden, Hierton & James (1973) found the frequency to increase during the period 1947 to 1969. Alffram & Holmquist (1961) and Hansson (1964) have carried out population studies among lower extremity amputees in two large Swedish towns, Malmö and Gothenburg.

To assess the situation in a Danish district the author studied all lower extremity amputations in the county of Aalborg, Denmark, during the period 1961-1971, analysing the operative indication and level, the patient's age, and

the survival time. In the case of the survivors the social conditions were investigated.

MATERIAL

In 1961 the county of Aalborg had a population of 240,000 and in 1971 it was 260,000, with a large proportion in the rural districts. In Denmark as a whole the urban-rural ratio is 2:1; in the county of Aalborg it is 1.1:1.

The amputations had been performed in two large hospitals in Aalborg, in one smaller orthopaedic hospital in Aalborg, and in five small hospitals in the county. Twenty-two patients had the amputations in orthopaedic units outside the county of Aalborg.

The below-knee amputations included amputations between the ankle and knee and one Syme amputation (diabetes), but no partial foot amputations, whereas in the group of

Table 1. Diagnosis and level.

	Below knee	Re- amp.	Above knee	
Arterioscl.	33	8	142	175
Diabetes	56	3	95	151
Trauma	11		18	29
Tumour	2		7	9
Other	2	1	6	8
	104		268	372

Arterioscl.	19 % → 14 % below knee.
Diabetes	37 % → 35 % below knee.

above-knee amputations there were two through-knee amputations (diabetes and tumour) and four exarticulations of the hip (malignant tumours).

Incidence

A total of 372 amputations were performed on 321 patients, all causes included. This means an amputation rate of 14.9 per 100,000 of the population per annum. Out of this number, 326 amputations on 277 patients were for peripheral vascular diseases (Table 1), giving an amputation rate for this category of 13.1 per 100,000 of the population. There had been no increase in the rate in the course of the decade studied.

Diagnosis, age and level

The diagnosis in 175 amputations was arteriosclerosis, and in 151 it was diabetic vasculopathy; 29 amputations followed trauma, 9 were because of tumours, and there were 8 for other reasons. The arteriosclerotic group also included 14 patients who had had an operation for vascular disease or for embolism.

Figure 1 gives the age distribution at amputa-

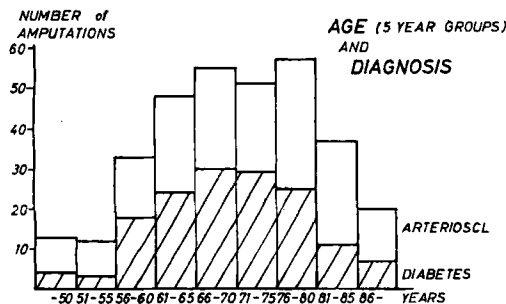


Figure 1. Age at amputation for patients with peripheral vascular disease.

tion for patients with vasculopathy. The patients with tumours averaged 30.1 years of age (5-71 years); the patients who had sustained trauma 50.2 years (8-83 years). The mean age at amputation for the diabetics was 68.6 years, whereas for the arteriosclerotics it was 71.6 years.

As already mentioned, the analysis comprised eight surgical units during a period of 10 years. There had been no attempt made to standardize the surgical technique or the indications for the level of amputation. The only common feature was that the symptoms and signs before amputation were pain and/or gangrene (threatening or manifest).

In amputations on patients with vascular disease the surgically safe level had been preferred, the majority being high amputations: 237 (73 per cent) above-knee and 89 (27 per cent) below-knee (Table 1). In 35 per cent of the diabetics and in 14 per cent of the arteriosclerotics the knee was preserved.

There had been no preoperative measurement of temperature, no thermography, or Xenon-133 studies, and immediate postoperative prosthetic fitting had not been carried out.

Healing and complications

The mean healing time of the amputation stump was the same for diabetics and arteriosclerotics: about 5 weeks (2-14 weeks).

Local complications were equally common for diabetics and arteriosclerotics, 25 per cent in all (including all minor, superficial infections).

The complications were as follows:

	Arterio- scl.	Diabetes	B/K	A/K*
Superficial infection	9	5	8	6
Deep infection	2	8	1	9
Necrosis	21	25	25	21
Exposed bone	7	3	2	8

* B/K = below-knee, A/K = above-knee.

The least number of complications occurred after high amputations: 19 per cent after above-knee amputations and 42 per cent after below-knee amputations. As a result, 12 per cent of the patients having below-knee amputations had to have re-amputations above the knee, whereas only 3 per cent of the patients having above-knee amputations required re-amputations higher up. Local revisions were carried out in 8 per cent.

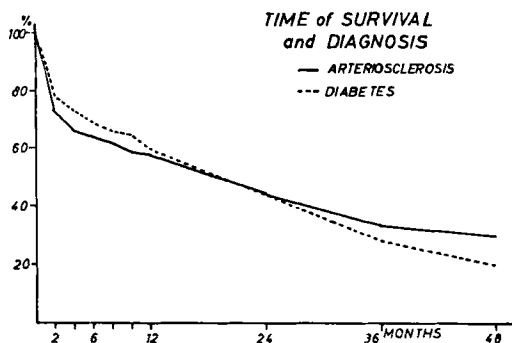


Figure 2. Survival and diagnosis.

Mortality

The mortality after 1–2 years (Figure 2) appears to have been the same in the group of diabetics as in the arteriosclerotics, about 40–60 per cent, but it must be noted that the diabetics were 3 years younger at the time of amputation and at the end of 4 years they had a lower survival rate.

Prosthetic fitting

In the surgical unit where the amputation was carried out, the suitability of the patient for prosthetic fitting was assessed, and thereafter about 60 per cent of the patients who survived the operation were referred to a limb fitting centre.

In relation to the amputation of the first leg, 64 out of 312 patients died. Of the surviving 248 patients, 74 were considered unsuited for wearing a prosthesis. Fifty-three below-knee prostheses and 118 above-knee prostheses (primary prostheses) were supplied.

Table 2 gives the supply of prostheses to unilateral amputees (corrected for re-amputations).

During the training period one B/K and nine A/K amputees gave up using the prosthesis, and later three B/K and 15 A/K gave up. Thus four

Table 2. Unilateral amputation: survival and prosthetic fitting.

	Deaths	No prosthesis	+ prosthesis
B/K			
vascular	14	13	31
non vasc.	—	1	12
A/K			
vascular	49	67	105
non vasc.	2	6	13

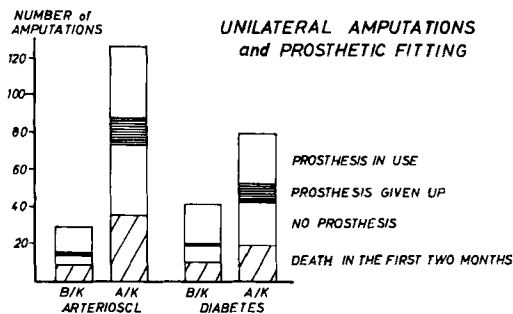


Figure 3. Unilateral amputations and prosthetic fitting. Prosthesis in use/given up refers to results taken from case reports.

out of 53 B/K and 24 out of 118 A/K stopped using their prostheses. All those who gave up were of the arteriosclerotic or diabetic groups. These figures were found on perusal of the case records, as so far the patients had not been systematically followed up. Presumably more than 24 have given up using above-knee prostheses. Figure 3 sets out the final result according to the case records.

Only a few patients over 75 years had been fitted with prostheses (Figure 4). Out of 181 prostheses 116 were worn for more than 6 months (64 per cent).

An average of 17.7 weeks elapsed from the time of amputation until walking on a prosthesis was established in the case of the below-knee amputees and in the above-knee amputees it was 19.5 weeks.

Social situation

Two-thirds of the surviving patients with vascular disease were discharged to their homes: 161 out of 249. Thirty-nine were transferred to old age homes and 49 to nursing homes. It was

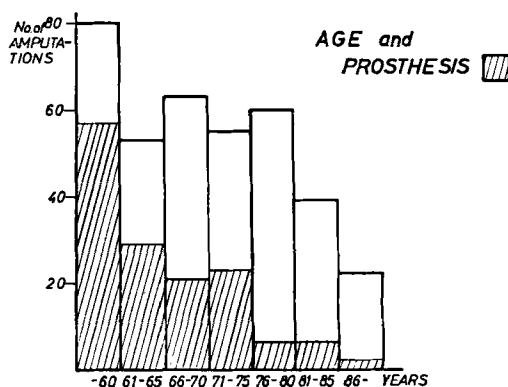


Figure 4. Age and prosthesis.

the above-knee amputees in particular who entered institutions. Out of 45 patients without vasculopathy four died, eight were admitted to old age homes, and 33 were discharged to their own homes.

Bilateral amputations

During the study period 51 persons had bilateral amputations, and 10 had previously undergone amputation of the contralateral leg. Thus, the material includes 61 bilateral amputees, viz., 37 diabetics, 22 arteriosclerotics, and two amputated after trauma.

The interval between amputations averaged 12 months for patients with peripheral vascular disease. Thirty-five had bilateral above-knee amputation and nine bilateral below-knee amputation. Ten of the 61 patients died within 2 months of the second leg amputation. Primarily 37 were discharged to their homes, 12 to old age homes, and 12 to nursing homes. Five of the nine bilateral below-knee amputees learnt to walk. This applied to one out of 35 bilateral above-knee amputees and to four out of 17 with one A/K and one B/K amputation.

FOLLOW-UP

At follow-up 62 out of the 321 patients were alive, 3–13 years after the amputation. Only 41 out of 272 patients (15 per cent) with vascular disease were alive, whereas 15 out of 25 patients with post-trauma amputation and five with amputation for tumour were alive. Twenty-six of the 41 survivors with vascular disease were wearing prostheses, and of them 10 required help putting it on. To be able to walk 19 had to use a stick at all times, whereas six used a stick only out of doors. One used a walker.

Amputation level/stick in 54 unilateral amputees:

	No stick	Stick out of doors	Stick always required	No ambulation
B/K	9	2	10	2
A/K	8	4	15	4

Out of eight bilateral amputees one was able to walk on two below-knee prostheses without using a stick.

Phantom pain was present in 53 out of the 62 patients, but was severe in only three. Twenty-

five patients had local stump pain, and one had recurrent infection.

There were no other complaints.

DISCUSSION

The increase in the amputation rate which has been observed elsewhere had occurred in this county before the present study period. The amputation rate may depend upon the attitude of the hospitals and upon the geographic background. In Malmö the rate was about 7.1 per 100,000 from 1949–1958, whereas Gothenburg exhibited an increase from 6 to 17 during the period 1947–1962. The county of Uppsala had 17 in 1967–1969, and Lund had 20. The latter two are mixed urban-rural districts and correspond more closely to ours (Alffram & Holmquist 1961, Hansson 1964, Hierton & James 1973, Persson & Sundén 1971).

In two previous Danish series (Lindal & Bolund 1969, Kolind Sørensen 1974) arteriosclerosis has predominated among patients with peripheral vascular diseases, just as in the present study. The same finding was made by Chilvers in London in 1971 (Chilvers et al. 1971). In the two Swedish analyses diabetes was the predominating diagnosis (Hansson 1964, Hierton & James 1973). Tibell (1971), in an analysis of peripheral arterial insufficiency, found a falling ratio diabetes:arteriosclerosis in the course of time, so that they became more equal (Table 3).

During recent years it has been possible to achieve a higher proportion of below-knee amputations. Within a comparatively short period of time (1953–1963 compared with 1964–1968) Sarmiento et al. (1970) were able to alter the percentage of above-knee amputations from 69 to 17, without using a new technique. Persson & Sundén (1971) have developed a special new technique for below-knee amputations (sagittal) which has afforded a higher frequency of primary healing. There was no change in

Table 3. Amputations in vascular diseases: age, level and survival.

	Number of amputations		Average age at amputation		Level of amputations. No. of amputations			Per cent alive one year after amputation	
	artscl.	diab.	artscl.	diab.	B/K	T/K	A/K	artscl.	diab.
				years					
<i>Hierton & James</i> (1973)	38	56	76	72	55	—	38	40	60
<i>Hansson</i> (1964)	93	143	72	69	84	—	112	(45-55)	
<i>Alffram & Holmquist</i> (1961)	64	61	69	69	87	—	60	(60-55)	
<i>Persson & Sundén</i> (1971)	89	54	—	—	—	—	—	54	32
<i>Lindahl & Bolund</i> (1969)	109	74	70		5	14	76	—	—
<i>Chilvers et al.</i> (1971)	58	17	60		53	22		—	—
<i>Tibell</i> (onset of symptoms) (1971) ♂	—	—	68	68	—	—	—	—	—
♀			69	76	—	—	—	—	—
Present study	175	151	72	69	88	1	237	53	60

Artscl. = arteriosclerosis. Diab. = diabetes.

B/K = below knee. T/K = through knee.

A/K = above knee.

the amputation level during the decade of the present study.

We are dealing with a category of patients at risk, and more than one operation within a short time should be avoided. However, owing to the desire to preserve as much as possible of the extremity, the risk of having to do secondary surgery must often be accepted. *Hierton & James* (1973) and *Green et al.* (1972) found a higher complication rate after below-knee amputations. The same was found in our material in which the re-amputation rate was 6.6 per cent and the revision rate 8.5 per cent. *Persson & Sundén* (1971) reported a better healing tendency in diabetics than in arteriosclerotics, but we found no difference.

Our mortality corresponds largely to that reported by others.

Prosthetic fitting in many series is about 50 per cent for patients over 60-65 years (*Bertelsen & Rønn* 1960, *Alffram & Holmquist* 1961, *McKenzie* 1953). Only about 25 per cent of the unilateral above-knee amputees are fitted with prostheses (*Hierton & James* 1973). In our material 47 per cent of the unilateral above-knee amputees had been fitted with pros-

theses, or 59 per cent of the patients who survived the operation. However, about one-quarter of the fitted prostheses were not worn. Sixty-four per cent of all unilateral below-knee amputees were fitted with prostheses, or 77 per cent of those who survived the operation. Among the bilateral amputees this rate was lower.

A decrease in the use of the prosthesis occurs in a few months. *McKenzie* defined the prosthetic fitting as successful, if it is worn for six months, and according to this definition 64 per cent of the limb fitting in this study was successful.

Discharge from hospital to full nursing care may become very expensive, but the more patients that can be discharged to their homes or to institutions with moderate nursing care, the less the expense. *Hansson* (1964) reported that 1 year after amputation at the age of 60, 108 patients were alive, and of them 78 were in nursing institutions. In Bergen, Norway, *Kinge* (1971) found that two-thirds of the survivors were in nursing institutions. In our material one-third (88 out of 249) were discharged to old age homes or nursing homes.

Conclusion

Now that the mean lifetime appears to have reached a peak, the number of amputations for peripheral vascular diseases would be expected to have become fairly stable, possibly with a slightly rising tendency.

Since anaesthetic facilities have been so extensively developed, also in small hospitals, the risk connected with anaesthesia has been essentially reduced, and the risk which was previously involved in having repeated anaesthesias must be considerably less. Thus, a lower amputation may be ventured, although it involves the risk of re-amputation.

The present analysis showed: Patients in whom the knee has been preserved have a far greater chance of being fitted with a prosthesis and are most likely to go on wearing it. Patients over 75 years of age can seldom be fitted with prostheses. The prosthetic fitting should be done as soon as possible. If the patients can be ambulated, they are far more likely to be able to return to the environment from which they came, and thus expensive care in nursing institutions can be avoided. Moreover, it is of the utmost psychological value to the patients to be able to return to their own environment.

This study showed that patients amputated because of vasculopathy have a shorter survival time and that those patients who live longer are not such a burden on society as might be feared.

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