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Ten-year survival of Finnish lower limb amputees

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Abstract

Data on mortality for the ten years following lower limb amputation were obtained from all the 16 surgical units in Southern Finland and the National Social Insurance Institution. In Southern Finland during the period 1984-1985, amputations of the lower limb were performed on 705 patients, of whom 382 (54%) were women and 323 (46%) men. The majority of the amputations, 47%, were performed for vascular diseases and 41% were performed for diabetes mellitus. The overall survival was 62% at one year after amputation, 49% at two years, 27% at five years and 15% at ten years. The median survival after amputation was 1 yr 5 mth for the women and 2 yr 8 mth for the men. Of the arteriosclerotics, 43% died within one postoperative year while 43% lived longer than two years and 23% longer than five years. The median survival of arteriosclerotics was 1 yr 6 mth. The corresponding figure for patients with diabetes was 1 yr 11 mth. Of the diabetics, 38% died within one postoperative year while 47% lived longer than two years and 20% longer than five years. Of the trauma patients, 86% lived longer than five years and 71% longer than ten years. Of the trans-femoral amputees, 54% lived longer than one year, 36% over two years, 18% over five years and 8% over ten years. The corresponding figures for trans-tibial amputees were 70%, 53%, 21% and 4%. Many elderly vascular and diabetic patients undergoing amputation have a reduced physiological reserve and high mortality. The more proximal the amputation, the greater the risk that the patient will never be able to walk or that the duration of use of the prosthesis will be short. If a prosthesis seems to be a reasonable option for the elderly amputee, any delays in prosthetic fitting should be avoided in older age groups.

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Introduction

About 1500 lower limb amputations are performed annually in Finland. Most amputations involve geriatric patients with peripheral vascular disease (Pohjolainen and Alaranta, 1988). Ths disability following limb amputation is permanent, and in many cases amputees are made dependent on other people. Elderly amputees often have changes in organs other than limbs: they have heart diseases, brain disorders and, in diabetics, eye, kidney and neurological disorders. Arteriosclerosis and diabetes associated lower limb amputations especially represent a major socioeconomic and health problem. The amputee needs considerable in-patient and out-patient care and frequently makes demands upon social and welfare services.

According to the estimate of Finnish statistics, the age structure of the Finnish population will continue to shift upwards causing a twofold increase in the proportion of over 60-year-olds during the next 30 years. The majority of lower limb amputations performed in western society are on elderly people. The main condition leading to amputation is peripheral vascular disease and diabetes mellitus (Ebskov, 1996; Finch *et al.*, 1980; Kolind-Sorensen, 1974; Pohjolainen and Alaranta, 1988; Stewart *et al.*, 1992). In Finland trauma accounts for 2% (Pohjolainen and Alaranta, 1988) of lower limb amputations, in Denmark for 4% (Ebskov, 1988) and in Britain for 9% (Coddington, 1988). The major cause of lower limb amputations in children is trauma, which accounts for 75-80% of cases

(Baumgartner, 1979). Ten per cent of amputations in children are performed due to malignancy (Baumgartner, 1979). Ebskov (1988) reported the percentage of lower limb amputations due to tumour in Denmark from 1978 to 1983 as varying between 1.5 and 2.2% and Murdoch *et al.* (1988) found an almost exactly similar picture in Britain over the period 1965-1988.

Amputee statistics are needed for the planning of amputee rehabilitation. National epidemiological statistics would benefit the organisations responsible for planning services for lower limb amputees and organising the provision of prostheses and rehabilitation. The mortality of amputees is an important epidemiological parameter. Absolute mortality data reported in the literature usually cover only a single health care unit or hospital or a single disease and the statistics are usually influenced by local demographic factors.

The aim of this study was to assess the absolute mortality of lower limb amputees among the population of the defined area in Southern Finland during the ten year follow-up. The survival was analysed according to the subgroups of gender, age, diagnosis and amputation level.

Material and methods

To assess the situation in Southern Finland, data were collected on all lower limb amputations carried out by all the 16 surgical hospitals of the catchment area in the Helsinki University Central Hospital during the period 1984-1985. The catchment area had populations of 1,159,000 in 1984 and 1,171,000 in 1985, corresponding to 24% of the population of Finland.

Every patient's hospital record was examined thoroughly, and all data concerning demographic factors, diagnoses, surgical procedures and amputation levels were recorded. The dates of death were ascertained in collaboration with the National Social Insurance Institution (NSII). NSII contains the database concerning deaths of the whole population of Finland. Mortality data for the amputees studied could thus be obtained 10 years postoperatively. Survival distributions were compared graphically between subgroups by plotting the survival functions against time. Patients who are still alive at the date of the study and whose survival times are known only up to that point, were incorporated using the Kaplan-Meir method (Pocock, 1993; Stewart *et al.*, 1992).

During the period 1984-1985, amputations of the lower limb were performed on 705 patients, of whom 382 (54%) were women and 323 (46%) men. Vascular reconstruction, arterial embolectomy, thrombendarterectomy, lumbar sympathectomy or a combination of these preceded the amputation in the case of 168 amputees (24%).

Table 1 presents the distribution mean age of the patients according to the underlying

Table 1. Distribution and mean age of amputees by underlying diagnoses.

	Amputees				Mean age (years)		
Diagnosis	Women	Men	Total	Per cent	Women	Men	All
Arteriosclerosis	149	155	304	43.1	79.6	71.0	75.0
Diabetes mellitus	187	100	287	40.7	74.8	66.9	72.0
Frostbite	4	27	31	4.4	47.5	51.3	50.8
Embolism	19	8	27	3.8	73.1	67.4	71.4
Tumour	8	9	17	2.4	50.4	29.4	39.3
Trauma	5	9	14	2.0	43.6	39.4	40.9
Deformity	6	3	9	1.4	71.8	54.0	65.9
Burger's disease	–	3	3	0.5	–	44.0	44.0
Miscellaneous	2	4	6	0.8	38.0	50.5	44.3
Total	382	323	705	100.0	75.7	68.1	72.2

diagnoses. The majority of the amputations, 47%, were performed for vascular diseases; 41% were performed for diabetes mellitus (both insulin dependent diabetes mellitus and non-insulin dependent diabetes mellitus); and the third common reason for amputation was frostbite.

A total of 73 patients had undergone an amputation prior to 1984 at a lower level or on the contralateral limb. The cause of the previous amputation was vascular disease in 32 patients and diabetes in 40 patients. Table 2 shows the situations of the 705 amputees at the end of 1985. Previous amputations, amputations during the period 1984-1985, reamputations and contralateral amputations are included.

Table 2. Amputation levels at the end of 1985.

Type of amputation	n	Per cent
Unilateral		
Trans-femoral	288	41
Trans-tibial	156	22
Toe amputations	110	15
Foot amputations	19	3
Hip Disarticulation	7	1
Hemipelvectomy	1	0
Bilateral		
Trans-femoral/trans-femoral	41	6
Trans-tibial/trans-tibial	25	4
Trans-femoral/trans-tibial	23	3
Tmt/tmt or toe/toe*	13	2
Others	22	3

*Tmt = transmetatarsal

Results

The survival curve of both sexes based on the Kaplan-Meir method (Fig. 1) shows a sharp fall, especially in the older age groups (Fig. 2) during the first two years. The overall mortality during the three postoperative months was 190 (27%). A total of 135 amputees died during the first month. The overall survival was 62% at one year after amputation, 49% at two years, 27% at five years and 15% at ten years.

The median survival after amputation was 1 yr 5 mth for the women and 2 yr 8 mth for the men. About 56% of women were alive one year after operation while 42% lived over two years and 23% over five years. The corresponding figures for men were 69%, 56% and 31%. Of the total 382 women, 50 (13%) were alive ten years postoperatively, and of the total 323 men 55 (17%) lived over ten years (Fig. 1).

Figure 2 shows that the older the patient is during the amputation, the shorter is life expectancy. There was a prominent difference in survival comparing the patients aged over 60 to the younger group.

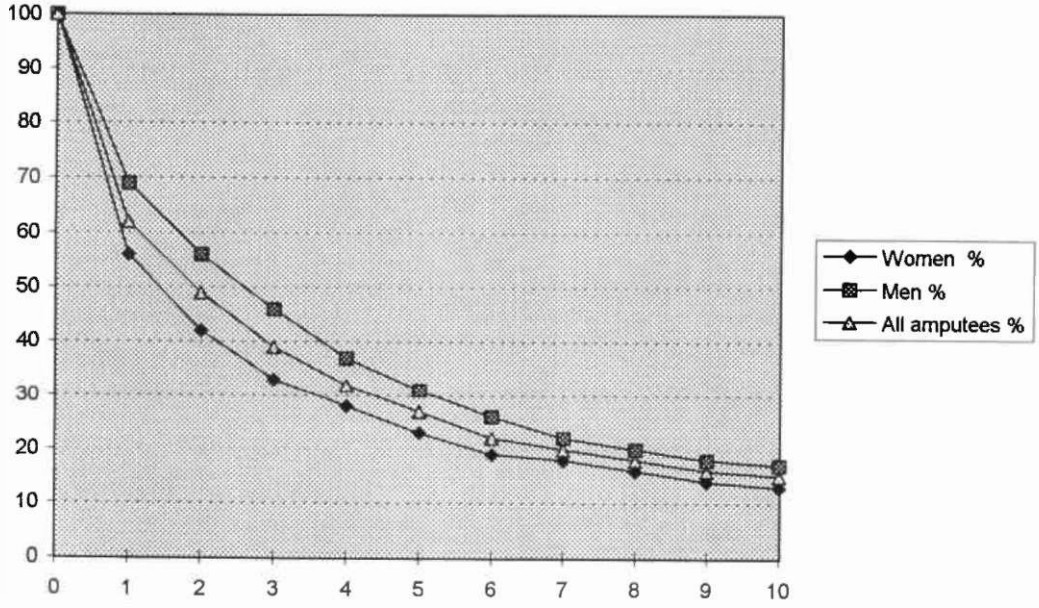

Fig. 1. Per cent survival among women and men during the ten postamputation years.

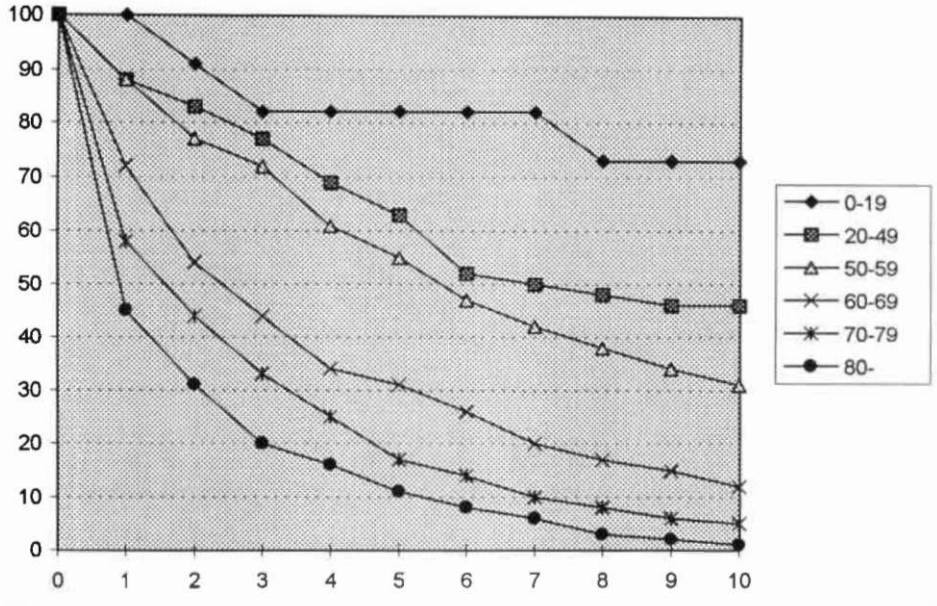

Fig. 2. Per cent survival among different age groups during the ten postamputation years.

Of the 304 arteriosclerotics, 43% died within one postoperative year while 43% lived longer than two years and 23% longer than five years. Of the 287 diabetics, 38% died within one postoperative year while 47% lived longer than two years and 20% longer than five years (Fig. 3). The median survival of arteriosclerotics was 1 yr 6 mth. The corresponding figure for patients with embolism was 8 mth and for diabetics 1 yr 11 mth.

Of the 18 tumour patients, 72% lived over one year, 61% over two years and 50% over five years (Fig. 3). None of the tumour patients died between five and the ten years postoperatively. The median survival of tumour patients was 5 yr 2 mth.

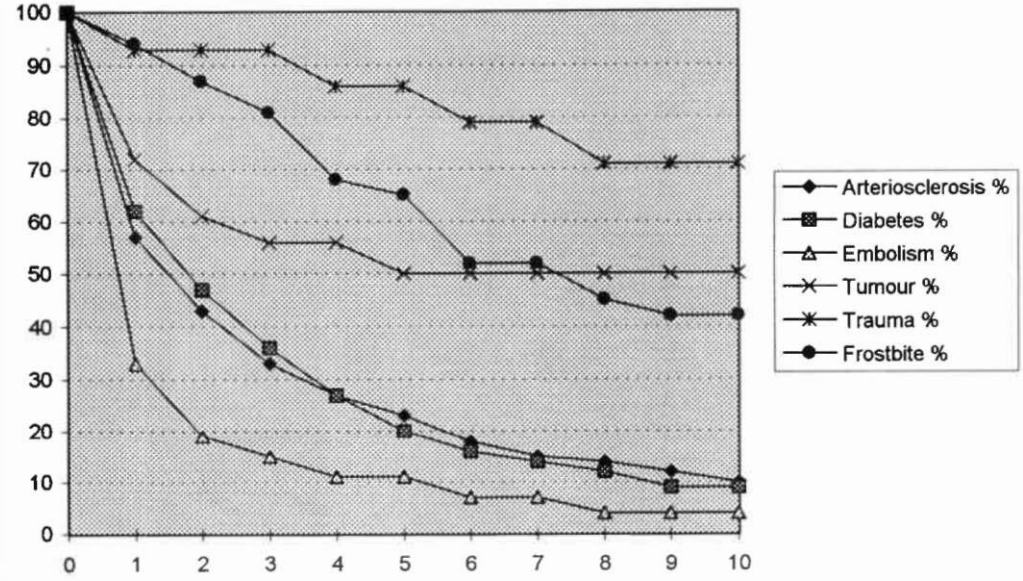

Fig. 3. Per cent survival among different diagnostic groups during the ten postamputation years.

Of the total 14 trauma patients, only one died during the three postoperative years while 12 (86%) lived longer than five years and 10 (71%) longer than ten years.

Two-thirds of the patients amputated for frostbite were alcohol abusers according to their medical histories. About 94% lived over one year, 65% over five years and 42% over ten years.

The median survival for the trans-femoral amputees was 1 yr 2 mth and 2 yr 3 mth for the trans-tibial amputees. Of the total 288 trans-femoral amputees, 54% lived over one year, 36% over two years, 18% over five years and 8% over ten years (Fig. 4). The corresponding figures for trans-tibial amputees were 70%, 53%, 21% and 4%. Of the 129 distally amputated patients (ankle, foot or toe), only 18% died within the first postoperative year while 78% lived longer than two years, 48% over five years and 27% over ten years.

Discussion

Finland had a population of 4.9 million in 1984-1985, about one-fourth of whom lived in the geographical area of the present study. In the study area, under 60-year-olds accounted for 83.8%, 60 to 69-year-olds for 8.1% and over 70-year-olds for 8.1% of the population. The corresponding figures for the whole of Finland were 82.5%, 8.9% and 8.6%. The study area closely resembles the whole of Finland in demographic structure, and thus the study is not influenced by local demographic factors.

Few studies have been published addressing the mortality of amputees with different diagnoses, covering a wide geographical area and extending over longer than a five-year period. Over the years, several studies have investigated the fate of arteriosclerotic or diabetic amputees (Hansson, 1964; Harris *et al.*, 1974; Kolind-Sorensen, 1974; Ebskov and Josephsen, 1980; Rush *et al.*, 1981; Murdoch *et al.*, 1988). Ebskov (1996) published a Danish nationwide epidemiological study including 3516 lower limb amputations in diabetic patients during the period 1982 to 1992. In the Scottish study, Stewart *et al.* (1992) reported that the survival of the trans-tibial and trans-femoral amputees with different diagnoses admitted to the Dundee Limb Fitting Centre increased during the two decades (1970-1979 and 1980-1989) from 3 yr 6 mth to 6 yr 6 mth. In this study, the follow-up was not limited to a single unit or hospital, unlike most of the previous studies. The follow-up included all amputees with different diagnoses and amputees fitted with a prosthesis and those who did not receive a prosthesis.

Regarding mortality, the interest will mainly be focused on vascular and diabetic patients

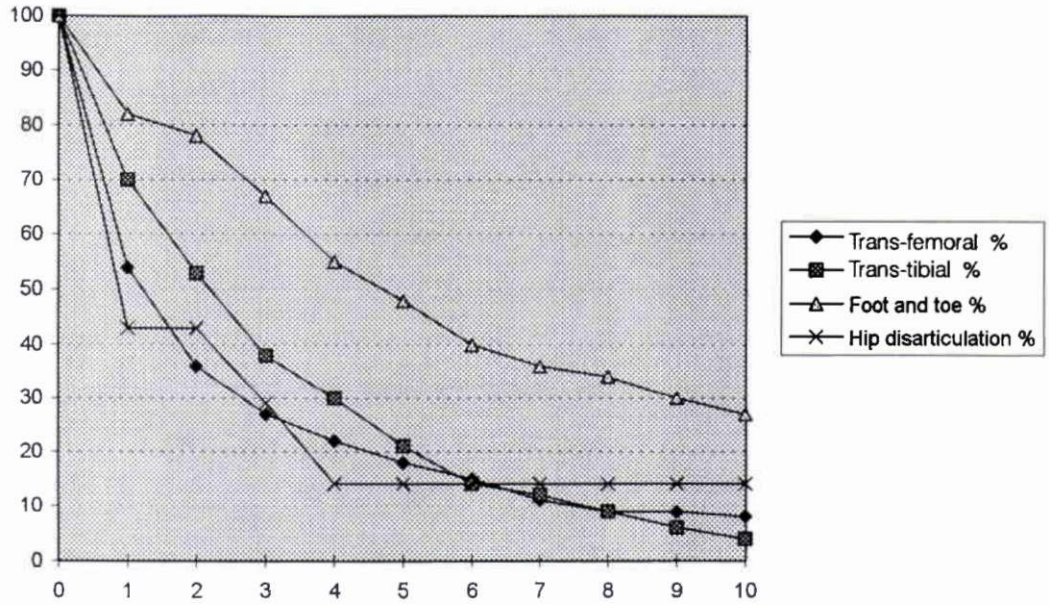

Fig. 4. Per cent survival among patient groups with different amputation levels during the ten postoperative years.

with lower limb amputations, since a majority of limb amputations are performed on these patients. Arterial occlusive disease is pansystemic in its manifestations, and thus amputation of the lower limb carries an associated risk that is different from the technical considerations of the operation. These patients have often had previous vascular operations, and failed revascularisation (Lambert, 1986; Mills, 1993). Vascular operations followed by amputation may cause a higher risk of mortality in elderly patients than does amputation alone. The high mortality rate during the first postoperative months among amputees with vascular diseases bears testimony to the advanced state of the disease. In this study, the rate of death within three months of initial surgery (27%) was higher than that in Denmark (16.6%) (Ebskov and Josephsen, 1980). In view of those figures, it may be that some of the elderly, severely ill patients with arterial gangrene or infection and sepsis should have been treated conservatively.

Trauma and neoplasia constitute a different clinical problem. The mortality during the first two years after amputation was high for amputees with neoplasia; on the other hand none of those patients died after five years from amputation. Most of the frostbite patients were alcoholics. The health of alcoholics may be poor but still only two of them died during the first postoperative year.

The survival rate was higher in the trans-tibial than in the trans-femoral amputation group during the six postoperative years. The highest survival rate was recorded for patients amputated at the feet, transmetatarsals or toes. The severity of the vascular disease and the ischaemia of the affected limb is probably the main reason for the higher mortality of the trans-femoral amputees. The five-year mortality rates in the trans-femoral and trans-tibial groups in this study are not different from those reported in USA (Roon *et al.*, 1977; Rush *et al.*, 1981).

Hansson (1964) reported from Sweden 45%, 58%, 71% and 76% mortality one, two, three and four years postoperatively, respectively. The above figures and the authors' two-year mortality rates of 58% and 57%, respectively, are worse than the figure of 19.2% from the Danish Amputation Register (Ebskov and Josephsen, 1980). The Finnish four-year mortality rate (Fig. 1) is better than the Swedish rate (Hansson, 1964) but clearly worse than the Danish figure (22.5%) (Ebskov and Josephsen, 1980). In an earlier Danish study, Kolind-Sorensen (1974) found a 50% five-year mortality among amputees with different diagnoses, which is also better than the rate in this study. The higher mortality rate of the first postoperative years in Finland may be partly due to the higher mean age of patients compared with other studies and the more advanced state of the vascular disease. Elderly vascular and diabetic patients undergoing amputation have a reduced physiological reserve and high mortality. In Finland, active vascular surgery may delay amputation. The high early mortality after amputation may also be due to postoperative rehabilitation and ambulation being too passive.

In the British study (Finch *et al.*, 1980) of 133 vascular amputees who survived at least one year after amputation; 55% were alive at the end of two years, 37% at the end of three years and 25% at the end of four years. In their studies, Kihn *et al.* (1972) and Huston *et al.* (1980) reported a 59% survival at two years and Couch *et al.* (1977) a 49% survival at three years.

According to the predictions of the Central Statistical Office of Finland the overall age structure of the Finnish population will continue to shift upwards causing twofold increase in proportion of over 60-year-olds in the next 30-40 years. It may influence the number of amputations. However, the incidences of lower limb amputations have not yet increased in Finland. In the authors' three surveys were 32.5-28.1 in 1984-1985, 22.0 in 1989 and 27.4 in 1992 (Alaranta *et al.*, 1995). The basic epidemiological study in 1984-1985 emphasised better appreciation and application of preoperative and postoperative mobilisation, better integration of prosthetic fitting and the total rehabilitation of the patient by his admission from the surgical ward to a residential rehabilitation unit and organised regular follow-up of amputees. Early ambulation has been shown to be advantageous for geriatric patients (Ham, 1986; Condie, 1988). If a prosthesis seems to be a reasonable option for the elderly amputee, any delays in prosthetic fitting must be avoided particularly in older age groups. The importance of this is that

patients must be fitted with prostheses whenever possible and offered comprehensive rehabilitation so that the quality of life can be maintained.

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