

## **Incidence and prognosis of dysvascular amputations in Okayama Prefecture (Japan)**

H. NAGASHIMA\*, H. INOUE\* and H. TAKECHI\*\*

*\*Central Rehabilitation Service, Okayama University Hospital, Okayama, Japan*

*\*\*Kibikogen Rehabilitation Centre, Okayama, Japan*

### **Abstract**

This survey analysed the clinical characteristics of subjects who first underwent major amputation of lower limbs necessitated by dysvascular disease during the 5 year period from 1984 to 1988. All were residents of Okayama Prefecture, Japan, and have been issued with a Physically Disabled Person's Certificate.

In total, 114 dysvascular amputees, representing 58.2% of all lower limb amputations performed in the resident population during the study period, were surveyed. The underlying diagnosis was arteriosclerotic obstruction in 64.9% of the subjects, diabetic gangrene in 22.8%, acute embolism in 7.0% and Buerger's disease in 5.3%. The yearly incidence of new dysvascular amputees per 100,000 people was estimated to be 1.2 among the general population and 5.7 among those aged over 65 years.

At three years after primary amputation, the survival rate was 52.3% in arteriosclerotic obstruction, and 66.7% in diabetic gangrene. Secondary amputation was performed in 17.0% of the entire group. The concurrent incidence of hemiplegic stroke was 19.8%

Among 36 amputees due to arteriosclerotic obstruction, who survived 3 years postoperatively, 10 (27.8%) were fitted with prosthetic limbs.

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All correspondence to be addressed to Dr. H. Nagashima, Central Rehabilitation Service, Okayama University Hospital, 2-5-1 Shikata-cho, Okayama-shi, Japan.

### **Introduction**

Although numerous reports have investigated the epidemiology and prognosis of amputations necessitated by dysvascular disease, only a few have surveyed the status of amputations in a defined region. The true, overall picture cannot be extrapolated from any experiences at isolated centres or statistical data on subjects with prosthetic limbs. The results would of course also be influenced by the patient criteria, such as whether or not finger amputations were included. Denmark, the only country which has established a national registration system, has demonstrated an annual increase in the number of dysvascular amputations. The present study, designed to derive an understanding of the status of amputations performed in Okayama Prefecture, having a population of roughly 2 million inhabitants, was carried out to support the reassessment of integrated rehabilitation strategy.

### **Subjects and methods**

At the start, amputees were identified through the resources of the Welfare Office, which maintained generally accurate data, derived in the process of issuing Physically Disabled Person's Certificates, to patients with amputations performed in the area. As the possession of this certificate conveys significant economic benefits, virtually all amputees are expected to apply for and be certified within a few months postoperatively.

Table 1. Number of new amputations proximal to the transmetacarpal or transmetatarsal level.

Years	Total	Upper-limb	Lower-limb
1979-83	225	64	161
1984-88	226	30	196

The total number of amputees from various causes was 226, undergoing primary procedures during the 5 year period from January 1984 to December 1988. Data for upper limb were collected for amputations proximal to the transmetacarpal level, and those for the lower limb were collected for amputations proximal to the transmetatarsal level. Among the 226 subjects, 30 (13.3%) underwent amputation of the upper limb and 196 (86.7%) amputation of the lower limb (Table 1).

Among 196 lower limb amputees, 114 were due to dysvascular diseases. The main purpose of this survey was the analysis of these dysvascular amputees. Follow-up data for the 114 dysvascular amputees, for the period up to November 1991, were obtained through personal letters with attached questionnaires, hospital records or census registration offices. This allowed for the prognoses of 106 subjects (93%) to be investigated retrospectively. The interval between the primary amputation procedure and follow-up ranged from 3 to 8 years. The population of Okayama Prefecture was 1.91 million inhabitants in 1984 and 1.93 million in 1988.

## Results

### Incidence

The 114 new dysvascular amputations which took place from 1984 to 1988 were all in the lower limbs, 1.5 times the number for the previous 5 year period. In particular, there was an increase in amputations necessitated by arteriosclerotic obstruction (ASO) and gangrene associated with diabetes mellitus (Table 2).

The underlying diagnosis in the 114 amputees was ASO in 64.9%, diabetic gangrene in

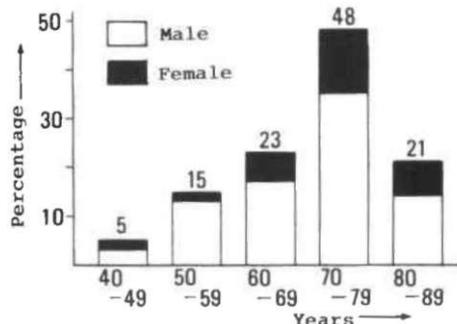


Fig. 1. Age and sex distribution in 112 dysvascular amputees (the figure does not contain information about 2 males aged 24 and 91 years).

22.8%, acute embolism in 7.0% and Buerger's disease in 5.3%. In ASO, acute embolism and Buerger's disease, the concomitance of diabetes mellitus was not obvious. The age distribution ranged from 26 to 91 years. By age, subjects in their 70's constituted the largest group, with those over 65 years accounting for 67.5% of the total. Males outnumbered females, the overall ratio being 3:1 and for the 80's age group 2:1 (Fig. 1).

For each disease category the mean age at amputation was 74.5 years (47-91) for ASO, 61.4 years (46-75) for diabetic gangrene, 65.0 years (26-84) for acute embolism, and 57.7 years (45-74) for Buerger's disease. The level of amputation was selected to be above the knee in 71.6% of ASO and only one (3.8%) of diabetic gangrene. On the other hand, amputation below the knee was performed in 23.0% of ASO and 88.5% of diabetic gangrene (Fig. 2).

### Survival

Survival rates at 3 years after primary amputation was 52.3% in ASO and 66.7% in diabetic gangrene (Table 3).

The 3 year survival rates by age group in ASO were 51.4% for the 70's and 35.0% for the 80's (Table 4).

Secondary amputation, i.e. ipsilateral reamputation or contralateral amputation, was performed in 15 ASO cases (21.7%), and in 1

Table 2. Causes of new lower-limb amputation from the transmetatarsal level proximally.

Years	Total (n)	Dysvascular (%)	Trauma (%)	Tumour (%)	Miscellaneous (%)
1979-83	161	45.3	25.5	21.7	7.5
1984-88	196	58.2	26.2	9.7	6.1

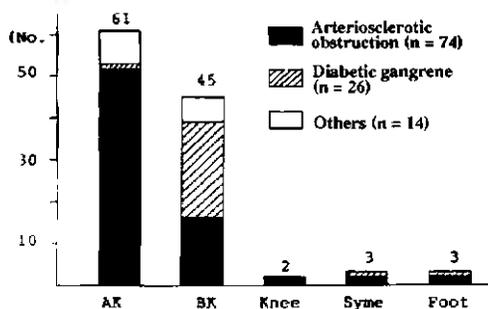


Fig. 2. Level of primary amputation, 1984-1988.

case each of diabetic gangrene and acute embolism. There were 9 bilateral amputees, 8 of which had ASO (Table 5).

Complications of hemiplegic stroke occurred in 17 ASO cases (24.6%), 1 case of diabetic gangrene and 3 cases of acute embolism.

#### Prosthetic appliances

Prosthetic appliances were distributed according to the Welfare Law to 12 of 69 ASO cases (17.4%) and 13 of 24 diabetic gangrene cases (54.2%). The distribution to 3 year survivors was 10 of 35 ASO cases (28.6%) and 10 of 16 diabetic gangrene cases (62.5%).

#### Discussion

Reports of the epidemiology and prognosis of amputees in a given area are relatively rare. Reports from Denmark (Danish Amputation Register, DAR) provide accurate statistics on a national scale, but other countries have only issued partial statistical data. In Scandinavia, the annual incidence of new amputations is 30-40 per 100,000 inhabitants, with dysvascular amputations accounting for about 90% (Ebskov, 1986; Larsson and Risberg, 1988; Pohjolainen *et al.*, 1989). Corresponding figures are somewhat lower in the United States (Bradway *et al.*, 1984) and United Kingdom (Sethia *et al.*, 1986; Murdoch *et al.*, 1988), and appear to be even still lower in Asia (Hla Pe, 1988; I-Nan Lien, 1989). In Japan, epidemiological surveys on amputees are

Table 3. Survival rates (%) after primary amputation.

	1-year	2-year	3-year
Arteriosclerotic obstruction (n=69)	89.9	72.5	52.3
Diabetic gangrene (n=24)	91.7	84.0	66.7

Table 4. Percentage surviving in 69 amputees for arteriosclerotic obstruction within different age groups.

Age (years)	Years after amputation		
	1	2	3
<60 (n=5)	100	100	100
60-69 (n=9)	100	88.9	66.7
70-79 (n=35)	82.8	71.4	51.4
≥80 (n=20)	90.0	60.0	35.0

practically nonexistent. This report presented the results for the single region of Okayama Prefecture. Our survey findings indicated that the mean annual incidence of new, major lower limb amputations is about 2 per 100,000 inhabitants, with dysvascular amputations accounting for about 60% of the total. In terms of the population aged over 60 years, the respective values were 6.4 per 100,000 inhabitants and 78.1%. These figures are forecast to continue to rise hereafter, in line with the increasing trend throughout the world.

The ratio of ASO to diabetic gangrene was 3:1. Although amputations necessitated by diabetes mellitus are tending to decline in Denmark (Ebskov, 1988), the results of this survey demonstrated that amputations necessitated by ASO as well as those for diabetic gangrene are comparably increasing. As the prevalence of aortic stenosis is generally claimed to be lower in Orientals than in Western people (Gore *et al.*, 1960), this disparate trend may be ascribed to differences in genetic characteristics and diet. However, recent years have witnessed a dramatic increase in protein and fat intake in Japan, combined with remarkable aging of the population. Although the current incidence of dysvascular amputation is 1/30 that of Scandinavia, the difference will most likely become smaller in the near future.

Table 5. Incidence of secondary amputation.

	Ipsi-lateral	Contra-lateral	Total
Arteriosclerotic obstruction (n=69)	7	8	15
Diabetic gangrene (n=24)	1	1	2
Acute embolism (n=8)	0	0	0
Buerger's disease (n=5)	1	0	1

The level of primary amputation was above-knee in 71.6% of ASO cases and below-knee in 88.5% of diabetic gangrene cases. There are very few reports investigating the ratio of above-knee amputations in ASO in a given region. Based on a survey of Copenhagen, Denmark, in the 1970's, Jensen *et al.* (1982) reported that the ratios of above-knee, through-knee and below-knee amputations in ASO were 35%, 23% and 42%, respectively. The relatively fewer above-knee amputations of diabetic gangrene cases in the present study was in sharp contrast to the Scandinavian study (Ebskov, 1983; Christensen *et al.*, 1988). This difference may reflect the lower incidence of severe diabetes mellitus in Japan.

Three year survival rates were about half in ASO and close to 70% in diabetic gangrene. Twenty in ASO cases (29%) survived for at least 3 years without secondary amputation or hemiplegic stroke. These figures are far better than the inaccurate estimations that existed before the survey. Moreover, after 4 years survival rates continued to decline in ASO, whereas it appeared to remain generally stable in diabetic gangrene. Pohjolainen *et al.* (1989) investigated survival rates by disease in Southern Finland in the 1980's. They reported that the 2 year survival rates were found to be 38% in ASO and 48% in diabetes mellitus. Their subjects with the term of diabetes mellitus may be amputees caused from diabetic gangrene. The results of the present survey demonstrated 2 year survival rates to be 60% in ASO even for patients in their 9th decade, while that for diabetic gangrene was even higher. The incidence of secondary amputation was 21.7% in ASO and 8.3% in diabetic gangrene. Compared with other reports, these figures were moderate for ASO and very low for diabetic gangrene (Ebskov, 1983; Stirnemann *et al.*, 1987; Murdoch *et al.*, 1988; Pohjolainen *et al.*, 1989). The low rate of secondary amputation in diabetic gangrene may be attributed to the fact that Syme's or foot amputation was not frequently employed.

The use of prosthetic appliances in ASO amputees of subjects in the present study was low similar to some reports (Malone *et al.*, 1981; Stirnemann *et al.*, 1987; Beekman and Axtell, 1987; Pohjolainen *et al.*, 1989). In this survey, the above-knee ASO amputees without secondary amputation or hemiplegic stroke,

Table 6. Ambulatory appliances distributed through the Welfare Law among unilateral above-knee amputees caused from arteriosclerotic obstruction, without secondary amputation or hemiplegia.

	Prosthesis	Wheelchair	None
Total (n=32)	6.3%	50.0%	50.0%
3-year survivors (n=13)	15.4%	53.8%	38.5%

represented 32 cases (46.4%) of all ASO amputees. Thirteen of these amputees survived for more than 3 years, but only three possessed a prosthetic limb according to the results of the questionnaire (Table 6).

The growth in the aged segment of the population is particularly dramatic in Japan. Statistics of the World Health Organization forecast that the proportion of the population aged over 65 years will exceed 23% in Japan by the year 2020. The incidence of dysvascular amputations, which is particularly high in aged patients, is consequently forecast to further increase hereafter. Japan is thus facing a situation where integrated planning of the treatment and welfare of amputees must undergo serious reconsideration.

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