

# Amputation of the Lower Extremity in Diabetes Mellitus

A FOLLOW-UP STUDY OF 294 CASES

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The duration of life in patients with diabetes mellitus who have required an amputation of a lower extremity because of gangrene generally is regarded as relatively short. However, the available statistical information on the life expectancy of such patients is meagre. Joslin stated that "Among 206 gangrene cases, 48 died in the first year after operation, but the average length of life was 2.9 years after operation."<sup>1</sup> In my experience reported in 1948<sup>2</sup> about 40 per cent of diabetic patients were found at that time to live more than three years after amputation of a leg.

Additional information also is needed with reference to the number of patients who require amputation of the remaining leg, and the length of the interval between amputations. Joslin<sup>3</sup> stated that "Of 100 patients, 39 subsequently required amputation of the second leg," but the length of the period between amputations was not given. In my study mentioned above, it was observed that about 40 per cent of diabetic

patients who survive for three years after the loss of one leg will have required amputation of the second leg within that period.

The present study, based on a larger series of cases and including many in which amputations were performed within the past decade, was undertaken to determine the postoperative course at the present time. Many factors, such as prolongation of life in the general population, the use of new antibiotic preparations, and better understanding of the problems of peripheral vascular disease, might be reflected in a longer survival period following amputation and a decrease in the number of second amputations.

## CLINICAL MATERIAL

This study deals with 294 cases of diabetes mellitus from the private practice of the author in which there were

AMPUTATION OF LOWER EXTREMITY

**TABLE 1** Age at time of amputation in 294 cases of diabetes

	30-39	40-49	50-59	60-69	70-79	80-89	Total
Male	2	12	55	63	34	—	166
Female	1	4	28	63	29	3	128
Total	3	16	83	126	63	3	294

**TABLE 2** Survival period between amputation and death in 172 cases of diabetes

Years	Male		Female		Total
	Midleg	Midhigh	Midleg	Midhigh	
Less than 1	9	5	11	7	32
Between 1 and 2	11	5	12	2	30
Over 2 and under 3	4	5	5	7	21
Over 3 and under 4	12	4	4	3	23
Over 4	2	10	3	3	18
Over 5	3	3	1	3	10
Over 6	1	4	3	3	11
Over 7	4	2	4	1	11
Over 8	1	3	—	—	4
Over 9	—	3	—	1	4
Over 10	3	4	1	—	8
Total	50	48	44	30	172

**TABLE 4** Survival period after amputation in cases of diabetes with age over 60

Survival Period	3 Years			5 Years		
	Male	Female	Total	Male	Female	Total
Living patients who survived for period shown	19	17	36	9	10	19
Dead patients who survived for period shown	31	25	56	14	14	28
Patients who died within period shown	29	31	60	46	42	88
Total patients followed sufficient time	79	73	152	69	66	135

3-year period  
92 of 152 or 60 per cent survived  
Males: 50 of 79 or 63 per cent survived  
Females: 42 of 73 or 58 per cent survived

5-year period  
47 of 135 or 35 per cent survived  
Males: 23 of 69 or 33 per cent survived  
Females: 24 of 66 or 36 per cent survived

one or more amputations of a lower extremity. Of these patients, 166 were male and 128 female. The distribution by age and sex is shown in Table 1.

Of the 294 cases, 172 were followed until the time of death. The period of survival of this group is summarized in Table 2. Of the 122 patients who are still alive, 57 have survived operation for less than 3 years and 65 for longer than 3 years. Amputation of the second leg has been required by 72 of the 294 patients. In 52 of these patients, the second amputation was performed within three years of the first amputation. The remaining 20 patients required a second operation more than three years after the first amputation.

These data show that of 237 patients who were followed to the time of death or for a period of three years, 154 or 65 per cent survived at least 3 years after amputation of the first leg. Of the 209 patients who were followed to the time of death or for a period of

five years, 85 or 41 per cent survived for five years or longer (Table 3). These findings show a longer life expectancy than that found in the previous study.<sup>2</sup>

A comparison of the period of survival of males and females suggests a longer period of survival in the males. Further analysis shows that the sex difference is more apparent than real and was caused by the inclusion of a greater number of males of the younger age groups (Table 1). This disparity disappears when the groups are limited to patients over 60 years of age (Table 4).

It is a melancholy fact that many patients who have lost one leg are later obliged to lose the remaining leg as well. In this series, 172 patients were followed long enough to determine the frequency of second amputations in the three-year period following the first operation, and 122 long enough to evaluate a five-year period. Thirty per cent of these patients required a second amputation within three years and 51 per cent within

**TABLE 3** Survival period after amputation in cases of diabetes

	3 Years						Grand Total	5 Years						Grand Total
	Male		Total	Female		Total		Male		Total	Female		Total	
	Thigh	Leg		Thigh	Leg		Thigh	Leg	Thigh		Leg	Thigh		Leg
Living patients who survived for period shown	25	16	41	7	17	24	65	14	9	23	4	10	14	37
Dead patients who survived for period shown	33	26	59	14	16	30	89	19	12	31	8	9	17	48
Patients who died within period shown	15	24	39	16	28	44	83	29	38	67	22	35	57	124
Total patients followed sufficient time	73	66	139	37	61	98	237	62	59	121	34	54	88	209

3-year period  
154 of 237 or 65 per cent survived  
Males: 100 of 139 or 72 per cent survived  
Females: 54 of 98 or 55 per cent survived

5-year period  
85 of 209 or 41 per cent survived  
Males: 54 of 121 or 45 per cent survived  
Females: 31 of 88 or 35 per cent survived

five years (Table 5). Although the incidence of second operations is high, a comparison with the incidence reported in 1948<sup>2</sup> suggests a favorable trend.

TABLE 5 Frequency of amputation of second extremity in cases of diabetes

	Period After First Amputation	
	3 Years	5 Years
Second amputation required within period shown	52	62
Second amputation required after period shown	20	10
Patients who survived without second amputation more than period shown	100	50
Total patients followed sufficient time	172	122

52 of 172 or 30 per cent required second amputation within 3 years  
62 of 122 or 51 per cent required second amputation within 5 years

#### COMMENT

Reliable information on the natural course of the disease is necessary in order to evaluate the efficacy of therapeutic procedures. It is hoped that the present study will contribute to knowledge of the life expectancy of patients with diabetes mellitus who require amputation of the lower extremity because of gangrene. Furthermore, it is important to have available information concerning the expected incidence of second amputations and the predicted intervals between amputations. With such information available, patients who have undergone an amputation of one leg serve, to a certain

extent, as controls in the evaluation of various therapeutic procedures, such as the use of sympathectomy, vasodilator drugs and lipotropic agents.

#### SUMMARY

This paper presents a study of the life expectancy in a series of 294 cases with diabetes mellitus who have required amputations of one or both lower extremities because of gangrene. Sixty-five per cent survived more than three years after amputation of the first leg, and 41 per cent survived five years or longer. There were no significant sex differences in the survival period.

One hundred and seventy-two patients who suffered an amputation of one leg were followed long enough to determine the incidence of second leg amputation. Of these, 30 per cent required amputation of the remaining leg within a period of three years, and 51 per cent required the second amputation within five years.

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