

# Rehabilitation of Persons with Bilateral Amputation of Lower Extremities

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The loss of both lower extremities through amputation represents one of the severest physical handicaps, particularly as it occurs most commonly in the older age group. During the last six and one-half years, from May, 1950, through December, 1956, over 500 persons with amputation of a lower extremity were admitted to the Bay State Medical Rehabilitation Clinic. Of these, 10% had bilateral amputations, and the present study deals with the end-results of rehabilitation in this group of patients. Of these 54 patients, 50 completed appropriate treatments and have been followed up for end-results.

## Case Material

*Age and Etiology.*—The average age of the 50 patients was 55. Of these, 41 were men, with an average age of 56, and 9 were women, with an average age of 52. As might be expected in this age group, etiology was most commonly that of peripheral vascular disease, usually arteriosclerosis, although a few cases of thromboangiitis obliterans were included. In 29 men, with an average age of 60, and 5 women, with an average age of 65, the etiology was peripheral vascular disease. The average age of these 34 patients was 61 years. In 12 men, with an average age of 46, and 4 women, with an average age of 38, the etiology was trauma and miscellaneous causes. The average age of these 16 patients was 43 years. The primary etiological causes of amputation were arteriosclerosis, 60%; diabetes mellitus, 38%; thromboangiitis obliterans, 8%; trauma, 25%; and miscellaneous, 6%.

*Site of Amputation.*—There were 31 patients, with an average age of 59, who had bilateral amputations above the knee, and 8, with an average age of 48, who had bilateral amputations below the knee. Eleven patients, with an average age of 52, had one amputation above and one below the knee. Table 1 shows the relationship between the site of amputation and the etiology.

*Training in Use of Prostheses.*—The amputees were given training in the use of prostheses in our clinic. The patients with amputations above the knee started with bilateral pylons or short non-articulated prostheses for training purposes and later used long standard above-knee prostheses. As the artificial limbs were often prescribed elsewhere, we did not have control of this entirely, and so some patients started immediately with bilateral

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long limbs. The number of visits required for training indicates that the longer the prostheses the greater the number of training periods necessitated. The 21 patients who used bilateral pylons required an average of 16 visits, the 10 who used bilateral above-knee prostheses required 31, the 10 who used one above-knee and one below-knee prostheses required 27, and the 8 who used bilateral below-knee prostheses required 21 visits for training purposes.

**Rehabilitation Results**—A grading table was used to measure degree of rehabilitation. Those persons in grades A and B (table 2) were considered to be successfully rehabilitated from an economic point of view. Those in grades C and D were considered rehabilitated, although not employed—usually because of age and general physical condition. The failures in rehabilitation received grades E, F, and G. From the tabulation of end-results, it can be seen that 30% of the patients became economically independent and that 70% were considered rehabilitated. Fifteen patients, or 30% were considered failures.

The relationship between end-result and age is noted in table 3 and the relationship between end-result and site of amputation in table 4. It is, perhaps, surprising to note the number of successful rehabilitations among the older groups and also in those with bilateral above-knee ampu-

TABLE 1.—*Relationship Between Etiology and Site of Amputation*

Etiology	Site of Amputation*			Total Patients
	AK-AK	AK-BK	BK-BK	
Peripheral vascular disease.....	23	4	2	34
Trauma and miscellaneous causes	3	7	6	16
Patients, no. ....	31	11	8	50

\* AK refers to amputation above and BK to amputation below the knee. tation sites. As would be expected, there were successes and failures in both the group with peripheral vascular disease and the group with trauma and miscellaneous ailments. There were 23 successes and 11 failures in the former group and 12 successes and 4 failures in the latter. This indicates that some factor other than age, etiology, or site of amputation determines the end-results as far as rehabilitation is concerned.

Some thought was given to the idea that perhaps the interval of time between operation and rehabilitation was the determining factor. There were 24 successes and 8 failures in the group for whom the interval of time between operation and rehabilitation was less than 1 year, 9 successes and 4 failures when the interval was 2 to 5 years, and 2 successes and 3 failures when the interval was 5 to 36 years. The number of successes and failures was not related to the factor of time of starting rehabilitation.

### Types of Prostheses

For training purposes for patients with bilateral amputation above the knee, training pylons are often used. These are short nonarticulated prostheses. They are constructed with willow sockets, usually for ischiatic weight bearing and with muscle contour, with pelvic band suspension, and with either a single or double swivel two-way hip joint. There are no knee joints. Occasionally ankle joints are included, with a balancing platform instead of a foot that has toes extending in reverse direction. The latest

TABLE 2.—*Results of Rehabilitation Program*

Results	Rehabilitation Grade	Patients, No.	% of Total Patients
Gainfully employed*.....	A	10	20
Homemaking; spouse employed*.....	B	5	10
Employable but not placed.....	C	6	12
Independent in activities of daily living but unemployable.....	D	14	28
Rehabilitated, total.....	A, B, C, D	35	70
Partial independence in activities of daily living and unemployable.....	E	5	10
Use of wheel chair necessary.....	F	7	14
Died during rehabilitation.....	G	3	6
Failures, total.....	E, F, G	15	30

\* Economically independent.

development in this type of prosthesis is the incorporation of quadrilateral socket fit, providing better control of the limb.

Long above-knee prostheses were manufactured from willow sockets of the same shape and the same suspension as those used for pylons. Standard knee joints were utilized, with the exception of an occasional case when a knee lock was necessary. In one instance a patient came to us with two temporary long limbs consisting of laced-leather thigh corsets, drop ring locks for the knees, and shoulder suspension. The patients with amputations below the knees were, with an exception, given standard below-knee prostheses. In one case, experimental suction sockets were provided and were very successful.

Analysis of our cases revealed that the factors of age, etiology, or amputation site were not the most significant factors in rehabilitation end-result, nor was the interval between surgery and prosthetic training. Because of the small numbers of patients involved, these conclusions cannot be drawn with entire satisfaction. Our experience indicates, however, that when patients were given equal opportunity for rehabilitation, success seemed

TABLE 3.—*Rehabilitation Results According to Age of Patient*

Age Group	Successes per Grade, No.				Failures per Grade, No.			Total Successes	Total Failures
	A	B	C	D	E	F	G		
20-30.....	1							1	
30-40.....	2							2	
40-50.....	2	1				2		3	2
50-60.....	2			1			1	3	1
60-70.....	1	2	2	4	2	1	1	9	4
70-80.....	2	1	3	8	2	3	1	14	6
80-90.....		1	1	1	2	1		3	2

most dependent on motivation. Unfortunately, this factor could not be pre-determined and was not measurable except through clinical judgment.

### Comment

It may be emphasized that this group of patients were mostly elderly individuals, who are generally considered poor candidates for training in the use of prostheses. Sixty per cent had arteriosclerotic changes and had bilateral amputations above the knee. The amputations due to trauma were mostly below the knee or combinations of above and below and occurred in patients with a wide range of ages. In spite of these handicaps, 70% of the entire group became independent, at least in self-care, and 30% achieved economic independence. If the three patients who died during the course of rehabilitation are excluded, rehabilitation figure would be 75%.

Our rehabilitation program consisted in preprosthetic training, instructions in activities of daily living, prevocational evaluation and guidance, and, finally, job placement when indicated. Our minimal goal, in general, was self-sufficiency in self-care of the patient by using prostheses so that the

TABLE 4.—*Rehabilitation Results According to Site of Amputation*

Location of Amputation	Successes per Grade, No.				Failures per Grade, No.			Total Successes	Total Failures
	A	B	C	D	E	F	G		
Bilateral, above knee -----	5	3	4	10	2	4	3	22	9
One above and one below knee	2	1	1	2	2	3		6	5
Bilateral, below knee -----	3	1	1	2	1			7	1
Total -----	10	5	6	14	5	7	3	35	15

family members could be free to carry on their own routine. In the younger patients, and whenever possible in others, we attempted to achieve employment as a goal. As a result of our study, we intend to prescribe prostheses and institute appropriate rehabilitation programs in the future for more patients with amputation of the lower extremities whenever they are motivated and regardless of age.

### Summary

During a six and one-half year period (May, 1950, through December, 1956), 50 patients with bilateral amputation of lower extremities were treated and followed up at the Bay State Medical Rehabilitation Clinic, Boston. On admission, one-half of them were over 60 years of age, with an average of 55 years for the entire group. There were 41 men and 9 women. There were 31 patients (62%) with bilateral amputations above the knee, 8 (16%) with bilateral amputations below the knee, and 11 (22%) with amputations both above and below the knee. Most of the arteriosclerotic patients were elderly and had bilateral amputations above the knee.

After appropriate training programs, 70% of the patients were considered rehabilitated, with 30% becoming economically independent. The effects of age, primary etiology, and site of amputation on the outcome of rehabilitation were analyzed. It seemed that these had no direct bearing on the patient's potentiality to become self-sufficient in activities of daily living. Lack of motivation and presence of severe medical complications were most likely the contributing factors in the failures.

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