

Function after lower limb amputation

Functional ability and social dependence were investigated by personal interview of 107 lower limb amputees surviving 1-5 years postoperatively. Among eight independent variables studied by multiple regression analysis, increased age was associated unfavorably with physical ability and social dependence. Independence from social provisions preoperatively showed favorable relationships with functional capacity and postoperative dependence. Above-knee or bilateral amputation and postoperative pain were associated with reduced functional ability, but not with social dependence. No significant association was found with cause of operation or sex of the amputees. The importance of proper prosthetic fitting and pain control is emphasized.

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In a population of consecutively operated lower limb amputees, we have analyzed the consequences of pre- and postoperative factors and level of amputation for the functional ability and social dependence of the survivors.

Patients and methods

The population base consisted of 257 patients (149 men and 108 women) with below-knee (BK) or above-knee (AK) amputation between 1976 and 1979 in our department. During this period, neither through-knee amputations nor hemipelvectomies were carried out. Amputations distal to the BK level were excluded.

Median age at operation was 75 (38-95) years. The women were older (median age 79 years) than the men (median age 72 years).

The indication for operation was ischemia due to primary arteriosclerosis in 175 patients (68 per cent), ischemia associated with diabetes mellitus in 56 (22 per cent), and other reasons in 26 (10 per cent). There was no sex difference with respect to indication for operation.

The majority of the 257 patients had a unilateral amputation, almost equally often BK and AK (Table 1). Bilateral amputation was more frequent among the men. Reamputations had been performed in 23 patients.

At the turn of the year 1980/81, the surviving 107 patients (59 men and 48 women) were interviewed in their homes.

The patients were studied as follows with regard to function, pain, and social dependence:

1. Patient wears prosthesis all day. Walks alone, even outdoors. At times uses one cane outdoors, but not indoors. Does not use a wheelchair.
2. Patient wears prosthesis all day. Walks alone with one cane indoors or two canes outdoors. At times uses a wheelchair outdoors.
3. Patient wears prosthesis part of the day. Uses two canes or a walker. Walks alone indoors, but not outdoors, where a wheelchair is used. Patient benefits from prosthesis.
4. Patient does not wear prosthesis or wears it only occasionally for cosmetic purposes.

Pain at the time of the interview:

1. No pain, neither phantom limb pain nor pain in the stump.
2. Mild intermittent pain, does not need analgesics.
3. Intense constant pain, needs analgesics.

Social dependence before the operation and at the time of the interview, modified after Thomas & Stevens (1974):

Table 1. Lower limb amputations in 257 patients, 107 of whom had survived for follow-up (in parentheses)

Level	Men	Women	Total
<i>Unilateral</i>			
BK	54 (23)	44 (20)	98 (43)
AK	53 (21)	51 (22)	104 (43)
<i>Bilateral</i>			
BK/BK	9 (3)	1 (1)	10 (4)
BK/AK	10 (3)	3 (2)	13 (5)
AK/AK	23 (9)	9 (3)	32 (12)
Total	149 (59)	108 (48)	257 (107)

$$\chi^2 = 9.71; \text{ df} = 1; \text{ p} < 0.01.$$

Physical function at the time of the interview, modified after Hansen (1978):

1. Independent, no domestic help, does own house-keeping, lives in own home.
2. Slightly dependent, domestic help 1–4 hours weekly and/or unable to do own housekeeping.
3. Moderately dependent, domestic help for at least 5 hours weekly and/or unable to perform personal toilet.
4. Totally dependent, staying in nursing home or similar institution.

Multiple regression analysis was used to evaluate the influence on function and social dependence post-operatively of eight independent variables, controlling for variations in the other variables. The eight variables were: sex, preoperative social dependence, cohabitation, age at operation, cause of operation, level of amputation, concurrent disease, and pain. The nominal variables were transformed into dummy variables (Miller & Erickson 1981). Significance of the regression coefficients was tested by means of the Student's *t*-test, and $p < 0.01$ was chosen as the level of significance. Processing of data was performed using the Statistical Analysis System at the Northern Europe Computing Centre, Copenhagen.

Results

Among the 107 survivors interviewed, 78 were fitted with prostheses. However, 19 of these patients did not wear their prosthesis or they used it for cosmetic purposes only. Prostheses were fitted in 80 per cent of the unilaterally amputated patients, but only in half of the bilaterally amputated patients.

Data on all eight independent variables entered in the multiple regression analysis of functional ability and social dependence were available for 93 of the 107 patients (Table 2). Two of the variables, i.e., age and preoperative dependence, displayed similar patterns with respect to postoperative functional ability and dependence. Thus, unfavorable associations were found with increasing age; slight social dependence or independence preoperatively showed a favorable relationship compared with total dependence. Moreover, bilateral or AK amputation, as well as postoperative pain, was

Table 2. Multiple dummy-regression analysis of determinants for class of function and social dependence at follow-up ($N = 93$)

Variable	Category	Regression coefficient	
		Function	Dependence
Intercept		-1.21	0.83
Age at operation		0.05***	0.04***
Sex	Men	0.10	-0.16
	Women	-	-
Cohabiting	Yes	-0.14	-0.39
	No	-	-
Class of preoperative social dependence	Independent	-0.57	-1.29***
	Slightly dependent	-1.16**	-0.90
	Moderately dependent	-0.26	-0.65
	Totally dependent	-	-
Cause of operation	Other cause	0.54	0.20
	Diabetes mellitus	0.39	0.40
	Arteriosclerosis	-	-
Concurrent disease	Yes	0.45	-0.06
	No	-	-
Level of amputation	Bilateral	1.06***	0.50
	Unilateral AK	0.88***	0.06
	Unilateral BK	-	-
Pain in amputated leg	Intense pain	0.96***	0.22
	Mild pain	0.75**	0.09
	No pain	-	-
R^2		0.55	0.49

** $p < 0.01$; *** $p < 0.001$.

A negative regression coefficient indicates better function or less dependence compared with the reference category.

associated with reduced function. In contrast, these variables showed no significant relationship with postoperative social dependence. No significant associations were found between functional ability and social dependence, on the one hand, and sex, cohabitation, cause of operation, or the presence of concurrent disease, on the other.

Together, the eight independent variables accounted for about half of the variation in postoperative function and social dependence, leaving half of the variation unexplained.

Comparison of pre- and postoperative social dependence revealed that only 6 per cent of the patients became less dependent after operation, whereas in 36 per cent of the patients the degree of dependence remained unchanged and in 58 per cent it increased. Two thirds of the patients still managed to reside in their own home at follow-up.

On an average, the unilaterally amputated patients could walk farthest (Table 3).

Two thirds of the 107 patients complained of phantom limb pain, whereas pain in the stump was reported by 47 patients. Intense pain of one or both categories was stated by 22 patients and mild pain, by 56 patients. The presence of pain did not correlate with sex, age, indication for operation, or level of amputation.

Discussion

The higher age at operation among the women is in agreement with previous observations (Mandrup-Poulsen & Jensen 1982). It may re-

flect earlier onset of arteriosclerosis in men, who also had bilateral amputations performed more often than women. Primary arteriosclerosis, which caused two thirds of our lower limb amputations, would seem to have become more common during the last decade when compared with diabetes mellitus (Jensen et al. 1982, Kolind-Sørensen 1974, Liedberg & Persson 1983).

Even though most of the patients became more dependent after the operation, their social situation postoperatively was largely determined by factors not directly related to the amputation. Thus, age and preoperative social condition were more determinant than, for instance, level or cause of amputation. The sex of the amputee did not affect social dependence.

In accordance with previous findings (Burgess et al. 1971), function, including walking capacity, was closely related to the level of amputation. Expectedly, bilateral amputation and unilateral AK amputation resulted in poor function more often than unilateral BK amputation. A favorable class of function signifies that prosthetic fitting has proved useful to the patient.

We conclude that the prognosis after amputation is best in relatively young, less dependent patients who are subjected to unilateral BK amputation; furthermore, absence of pain contributes to a favorable prognosis. This emphasizes the necessity of proper prosthetic fitting and sufficient prescription of analgesics.

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Table 3. Mean and maximal walking distance, in meters, of 78 patients with prosthesis at follow-up related to level of amputation. Walking distance unknown for 3 patients.

Level	N	\bar{x}	Maximal
<i>Unilateral</i>			
BK	35	480	2000
AK	30	270	5000
<i>Bilateral</i>			
BK/BK	4	80	200
BK/AK	4	40	150
AK/AK	2	0	0

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