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Infrapopliteal Bypass Reduces Amputation Incidence in Elderly Patients: a Population-Based Study

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Objective: *to examine the association between the incidences of infrapopliteal bypass for critical limb ischaemia (CLI) and major amputation in Finns aged ≥70 years.*
Methods: *patients undergoing infrapopliteal bypass or major amputation for CLI during 1997 were retrospectively analysed. The incidence of major amputation in a group of hospitals performing infrapopliteal bypass "actively" was compared to that in a group performing such surgery "passively".*
Results: *the incidence of major amputations in the active (978 bypasses per million inhabitants) and passive (57 per million) groups was 1976 and 3177 per million, respectively ($p = 0.016$). There was a significant ($p = 0.012$) inverse relationship between the incidence of the two procedures in patients aged ≥80, but not <80 years.*
Conclusions: *these results suggest that infrapopliteal bypass is effective in reducing the requirement for major amputation in patients aged ≥80 years.*

Key Words: Chronic critical lower limb ischaemia; Infrapopliteal bypass; Age.

Introduction

The principal aim of lower limb revascularisation is to prevent major amputation due to critical limb ischaemia (CLI).[1–6] A nationwide Finnish study has suggested an inverse relationship between the incidence of infrapopliteal reconstruction and below-knee amputations.[7] However, the value of such surgery in the elderly has been questioned.[8–10]

Finland has 21 central hospital regions served by five university hospitals and 16 central hospitals. There are also 22 district hospitals. The population of these hospital regions varies from approximately 70 000 to 1 300 000. Vascular surgery is performed regularly in the university and central, but seldom in the district, hospitals. Amputations are done in all hospitals. The National Research and Development Centre for Welfare and Health (STAKES) receives demographic, ICD-10 and operative (Nomesko nomenclature) data on all hospital discharges in Finland. The aim of this study was to use STAKES analyse the relationship between infrapopliteal bypasses for CLI and amputation in the Finnish elderly (≥70 years) population.

Methods

STAKES data for infrapopliteal bypass and major amputation were retrospectively analysed for the year 1997. Hospital regions were divided into two equal groups according to the numbers of infrapopliteal bypasses performed on patients aged ≥80 years. The "active" group (A) comprised 11 regions serving 83 905 people over 80 years. The "passive" group (B) comprised 10 regions serving 82 305 people. Inhabitants in the two groups of regions are likely to be similar with regard to demography and risk factors (Table 1). Group A performed 102 and group B only 7 infrapopliteal reconstructions in patients ≥80 years. The relationship between the incidences of infrapopliteal bypass and major amputation were analysed by calculating the Spearman rank correlation coefficient for each group in patients aged 70–74, 75–79 and ≥80 years. Differences between two groups were also tested with the Mann–Whitney *U*-test. Statistically significance was defined as a two-tailed

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Table 1. Two groups of hospital regions divided by their activity in performing distal bypass surgery and amputations for CLI in patients 80 or more years of age.

Regions	Total population (*n*)	80 or more years of age					75–79 years of age					70–74 years of age				
		n	Population (%)	Infra-popliteal by-passes (*n*)	Amputations (*n*)	BK amputations (*n*)	*n*	Population (%)	Infra-popliteal by-passes (*n*)	Amputations (*n*)	BK amputations (*n*)	*n*	Population (%)	Infra-popliteal by passes (*n*)	Amputations (*n*)	BK amputations (*n*)
Active regions																
A1	795 000	16 682	2.1	22	48	27	14 681	1.8	19	20	11	21 298	2.7	9	11	7
A2	536 000	19 315	3.6	21	38	11	14 465	2.7	17	21	9	18 249	3.4	13	8	3
A3	165 000	6472	3.9	4	11	8	5385	3.3	1	3	1	7467	4.5	2	4	2
A4	207 000	6855	3.3	5	12	2	6178	3.0	2	4	0	8632	4.2	5	4	2
A5	131 000	4835	3.7	7	6	0	4120	3.1	5	5	2	5776	4.4	7	1	0
A6	178 000	6081	3.4	4	13	2	5487	3.1	5	6	1	7816	4.4	6	6	1
A7	167 000	7169	4.3	23	8	1	5693	3.4	9	0	0	7393	4.4	5	2	1
A8	363 000	9154	2.5	7	29	12	8505	2.3	6	9	5	12 328	3.4	3	10	6
A9	90 000	2458	2.7	5	9	0	2408	2.7	2	6	3	3864	4.3	8	6	1
A10	71 000	1817	2.6	1	0	0	1903	2.7	0	2	1	2968	4.2	1	0	0
A11	129 000	3067	2.4	3	7	4	2927	2.3	0	2	2	4629	3.6	0	6	2
Total	2 832 000	83 905	3.3*	102	181	67	71 752	2.7*	66	78	35	100 420	4.2*	59	58	25
Passive regions																
P1	257 000	8510	3.3	2	29	11	7790	3.0	3	13	2	11 246	4.4	1	6	4
P2	79 000	2619	3.3	1	5	1	2277	2.9	1	2	1	3145	4.0	3	1	0
P3	187 000	7032	3.8	1	15	9	5967	3.2	1	4	4	8570	4.6	0	6	3
P4	259 000	8149	3.1	0	24	7	7583	2.9	4	9	5	10 827	4.2	3	15	5
P5	109 000	4026	3.7	2	18	4	3655	3.4	3	12	4	5211	4.8	2	4	2
P6	236 000	8770	3.7	1	23	11	7165	3.0	1	14	8	10 307	4.4	1	6	3
P7	69 000	2860	4.1	0	17	9	2502	3.6	0	6	3	3489	5.1	0	6	5
P8	200 000	7585	3.8	0	29	12	6795	3.4	2	15	7	9247	4.6	5	16	14
P9	442 000	15 613	3.5	0	36	7	13 309	3.0	4	23	9	18 471	4.2	3	12	7
P10	444 000	17 141	3.9	0	61	11	13 915	3.1	0	22	8	18 902	4.3	1	17	8
Total	2 282 000	82 305	3.7*	7	257	82	70 958	3.1*	19	120	51	99 415	4.4*	19	89	51

p-value < 0.05 (SPSS 9.0 for Windows, SPSS Inc., Chigaco, IL, U.S.A.).

Results

The overall incidence of major amputation in patients ≥ 80 years of age was 2635 per million (Table 2) and was significantly lower in group A than in group B ($p = 0.016$). Similar trends were seen with respect to below knee (BK) amputations and in the 70–74 and 75–79 age groups (Figs 1 and 2). In patients ≥ 80 years, there was a significant inverse correlation between incidences of infrapopliteal bypass and major amputation ($r = -0.54$, $p = 0.012$, Table 3). There was a similar trend with regard to BK amputations. There was also a significant inverse correlation between bypass and BK amputations in patients aged 70–74 years ($r = -0.63$, $p = 0.002$).

Discussion

The incidence of CLI and amputations increases with age[11] and, as elderly amputees are less likely to mobilise with a prosthesis,[12–14] an aggressive approach to limb salvage has been justified in such patients on humanitarian and socio-economic grounds.[15–18] Although institutional studies have shown excellent limb salvage after arterial reconstruction,[19,20] it has been much harder to demonstrate the effectiveness of such surgery in population-based studies and in the elderly.[7,21–29] In two Finnish study, age per se was not found to be an independent predictor of

Table 2. Differences in incidences of distal reconstructions and amputations between groups.

Age group	Median incidence* (range)		p
	Group A (active)	Group B (passive)	
70–74			
Distal reconstructions	579 (0–2070)	130 (0–954)	0.043
Amputations	516 (0–1553)	734 (318–1730)	0.114
Below-knee amputations	232 (0–487)	381 (0–1514)	0.029
75–79			
Distal reconstructions	831 (0–1581)	297 (0–821)	0.072
Amputations	1058 (0–2492)	1698 (670–3283)	0.036
Below-knee amputations	525 (0–1246)	673 (257–1199)	0.114
80 and over			
Distal reconstructions	978 (550–3208)	057 (0–497)	<0.0005
Amputations	1967 (0–3662)	3177 (1909–5944)	0.016
Below-knee amputations	329 (0–1619)	1124 (382–3147)	0.114

* Per million inhabitants in the age group examined.

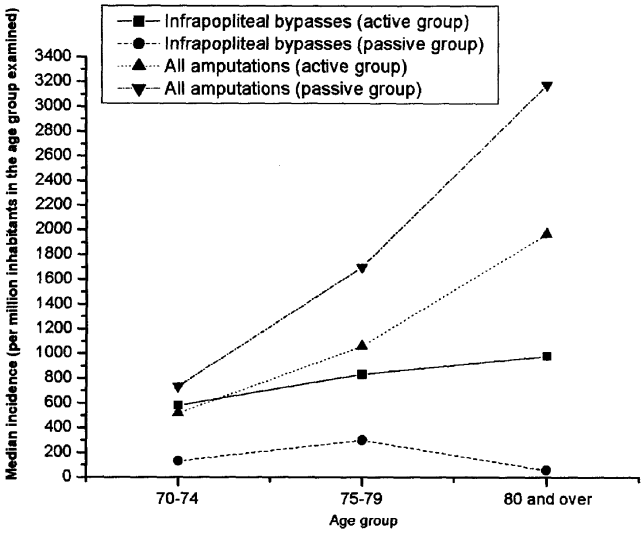

Fig. 1. Tendency of distal reconstructions and amputations in different age groups.

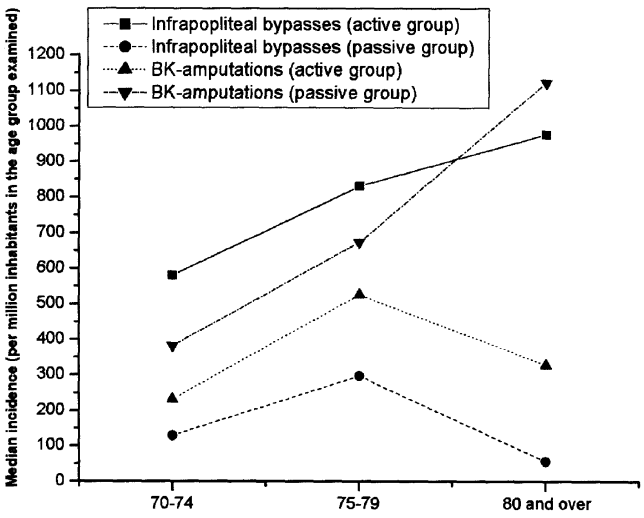

Fig. 2. Tendency of distal reconstructions and BK-amputations in different age groups.

Table 3. Correlation of amputation incidence to incidence of infrapopliteal reconstructions for CLI in different age groups.

Infrapopliteal reconstructions, age group	All amputations		Below-knee amputations	
	Spearman's ρ	*p*	Spearman's ρ	*p*
70–74	−0.343	0.118	−0.633**	0.002
75–79	−0.020	0.928	−0.202	0.367
80 and over	−0,535*	0.012	−0.363	0.106

* Correlation is significant at the 0.05 level.
** Correlation is significant at the 0.01 level.

outcome from distal bypass surgery for CLI.[1,30] The purpose of this population-based study was to determine if an active policy with regard to infrapopliteal can reduce amputation rates in the elderly.

Despite nationwide data collection (population of Finland 5.2 million), the numbers of patients operated in any one year are relatively small making statistical analysis and interpretation more difficult. However, it is clear that an active approach to distal bypass is associated with reduced requirement for amputation, especially in patients aged ≥ 80 years.[1,31] No patient should be denied such surgery on the basis of age alone.

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