

Outpatient Rehabilitation in Patients With Coronary Artery and Peripheral Arterial Occlusive Disease

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ABSTRACT. Jeger RV, Rickenbacher P, Pfisterer ME, Hoffmann A. Outpatient rehabilitation in patients with coronary artery and peripheral arterial occlusive disease. *Arch Phys Med Rehabil* 2008;89:618-21.

Objective: To assess participation rates and outcome in outpatient cardiac rehabilitation (OCR) of patients with peripheral arterial occlusive disease (PAOD).

Design: Prospective cohort study.

Setting: Referral center, ambulatory care.

Participants: All patients undergoing OCR at 2 university hospitals in Switzerland from March 1999 to August 2005.

Intervention: OCR during 3 months.

Main Outcome Measures: Primary endpoints were workload during bicycle stress test and quality of life (QOL), both at the end of OCR. Secondary endpoints were complications during OCR and termination of OCR.

Results: Of 1508 patients, 99 (7%) had PAOD (27 with Fontaine stage I, 69 with stage II, 3 with stage III). Patients with PAOD were older, had more cardiovascular risk factors, and were more likely to have undergone cardiac bypass grafting than those without PAOD. PAOD patients at OCR entry achieved a lower exercise workload than non-PAOD patients (PAOD patients, 105 ± 31 W and $69\% \pm 17\%$ of target vs non-PAOD patients, 125 ± 38 W and $79\% \pm 19\%$; $P < .001$) but both groups achieved similar gains in exercise capacity at the end of OCR (PAOD patients, 126 ± 44 W and $82\% \pm 25\%$ vs non-PAOD patients, 153 ± 48 W and $98\% \pm 24\%$; $P < .001$). For both groups, QOL was similar at baseline and follow-up, and improved equally in most dimensions. OCR was discontinued more often in patients with PAOD than in those without (18% vs 10%, $P = .018$). Cardiac and noncardiac complication rates were similar.

Conclusions: Patients with PAOD undergoing OCR have a similar benefit but higher dropout rates than other patients. Thus, PAOD patients should be encouraged to participate in OCR, possibly by creating specifically tailored concepts.

Key Words: Cardiovascular diseases; Exercise test; Quality of life; Peripheral vascular diseases; Rehabilitation.

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IN CORONARY ARTERY disease (CAD), outpatient cardiac rehabilitation (OCR) is indicated,¹⁻⁵ with the important aim of secondary prevention to reduce the risk of future cardiovascular events or cardiac death.⁶ Physical activity is an important aspect of cardiac rehabilitation but needs to be complemented by other concepts such as risk factor modification, behavioral education, nutritional counseling, and medical evaluation.

CAD and peripheral arterial occlusive disease (PAOD) share their common risk factors, that is, cigarette smoking, diabetes mellitus, hypertension, and hyperlipidemia.⁷ Consequently, the incidence of PAOD is high in patients with CAD,^{8,9} but severity often is underestimated due to lower exercise capacity and limiting symptoms. Therefore, patients with CAD as well as PAOD may benefit from OCR to the same extent as other patients. However, limited physical ability in PAOD patients might limit beneficial effects of OCR produced by exercise training in CAD, although the effect of cardiac risk factor modification, behavioral education, nutritional counseling, and medical evaluation may be similar in PAOD patients as in other patients. Therefore, it can be hypothesized that patients with PAOD may not be considered for OCR due to concern about their decreased physical capacity, limiting symptoms, and less anticipated benefit. Unfortunately, data are sparse regarding the important clinical question whether patients with PAOD should be offered OCR in the same way as patients without PAOD, and whether these patients derive similar benefit from OCR despite their symptomatic limitation, that is, whether cardiac rehabilitation is beneficial in these patients.

To answer these questions, we compared baseline characteristics, complications during rehabilitation, rate of and reason for discontinuation of the program, and both physical and psychosocial parameters at the entry and the end of the 3-months program in a large cohort of consecutive patients with and without PAOD referred for cardiac rehabilitation over a period of more than 6 years.

METHODS

All patients undergoing OCR at the Divisions of Cardiology of the University Hospital Basel and the Kantonsspital Bruderholz from March 1999 until August 2005 were enrolled in a prospective cohort study. The rehabilitation program has been described previously in detail.¹⁰ Briefly, it is an ambulatory rehabilitation program for patients with CAD, that is, prior myocardial infarction or angina pectoris with or without revascularization, valvular heart disease, previous cardiac surgery, or congestive heart failure. The program consists of medical evaluation, prescribed and supervised physical activity, relaxation, cardiac risk factor modification, education, and counseling. At our institutions, approximately 30% of all patients with previous cardiac surgery or interventional revascularization undergo OCR, 40% are referred to inpatient cardiac rehabilitation at specialized institutions, and another 30% do not receive any formal rehabilitation at all. Patients are referred based on their preferences or on those of their physicians. The program is divided into a buildup and a consolidation phase. The buildup phase consists of 4 weeks of intense rehabilitation

with daily activities for approximately 3 hours in the afternoon including education, counseling, physical training, and relaxation, and the consolidation phase lasts for another 8 weeks with biweekly physical activities for approximately 3 hours daily in the afternoon. Physical training consists of mixed activities for 1 to 2 hours including endurance training on bicycle ergometers or treadmills at 60% to 80% of the maximal heart rate achieved at the baseline exercise test or a rate of perceived exercise of 5/10 to 6/10, strength training (eg, weight and resistance training on special equipment), and coordination training (ie, balancing, juggling, ball games, and rhythmical drills).

We assessed demographic data, reason for rehabilitation, cardiovascular risk factors, and medication at baseline. Left ventricular ejection fraction was assessed either by coronary angiography, echocardiography, myocardial perfusion single-photon emission computed tomography, or radionuclide ventriculography before enrollment. For all patients, a symptom-limited bicycle stress test by ramp protocol or a spiroergometry was performed both at baseline and the end of the program, and achieved values are given in percentage of target workload, that is, workload expected as given by published nomograms.¹¹ Complications were assessed during the whole 3-month program and defined as unexpected events due to cardiac or noncardiac reasons leading to therapeutic interventions including hospitalization and, eventually, discontinuation of the program. Cardiac complications were further divided into ischemic or arrhythmic complications. Quality of life (QOL) was assessed using the Profil der Lebensqualität Chronisch Kranker (PLC) questionnaire,¹² both at baseline and the end of the program measuring QOL on the physical, emotional, and social levels with 40 questions that assess 6 dimensions of health (ie, physical capacity, psychological functioning, positive mood, negative mood, social functioning, social well-being). The PLC questionnaire is a generic instrument created to assess time-related changes in health for most of the chronic or degenerative diseases specifically developed for a German-speaking cohort, and has been validated.¹³ PAOD was defined as either a previous diagnosis of PAOD or a history of leg claudication during walking; patients entering OCR were not routinely screened for PAOD by physical examination (ie, testing of peripheral pulses), because PAOD was not the indication for rehabilitation. Patients were classified according to the Fontaine classification based on their symptoms as follows: stage I, asymptomatic; stage II, intermittent claudication; stage III, rest/nocturnal pain; and stage IV, necrosis/gangrene.¹⁴ The OCR program did not differ for patients with and without PAOD.

For this study, primary endpoints achieved were workload and QOL after 3 months; secondary endpoints were complications during the program and exit from the program. For all patients, follow-up time was equal to the duration of the OCR (ie, 3mo).

Statistical Analysis

Descriptive statistics are presented as means ± standard deviation (SD) or as percentages. Categorical variables were compared using the chi-square test. Continuous variables were compared using the Student *t* test. All *P* values were 2-sided and considered statistically significant if equal to .05 or less.

RESULTS

The total cohort consisted of 1508 patients, of whom 99 (7%) had PAOD. Of all PAOD patients, 27 had PAOD Fontaine stage I, 69 had stage II, and 3 had stage III; there were no

Table 1: Baseline Characteristics

Characteristics	No PAOD (n=1409)	PAOD (n=99)	<i>P</i>
Age (y)	62±12	66±9	<.001
Female sex	16	12	.47
LVEF (%)	56±16	56±15	.93
History of hypertension	53	76	<.001
History of dyslipidemia	71	77	.30
History of diabetes mellitus	14	31	<.001
History of smoking	34	39	.28
Current smoking	35	20	.13
Family history of CAD	53	76	<.001
Prior PCI	97	97	.76
Prior CABG	26	49	<.001
Reason for rehabilitation*			
Coronary heart disease	92	97	.11
Valvular heart disease	8	8	1.00
Dilated cardiomyopathy	2	6	.034

NOTE. Values are mean ± SD or percent. Abbreviations: CABG, coronary artery bypass graft surgery; LVEF, left ventricular ejection fraction; PCI, percutaneous coronary intervention.

*Multiple reasons possible.

patients with stage IV. In patients with PAOD, prior percutaneous transluminal angioplasty was performed in 22% and peripheral bypass surgery in 8%.

Patients with PAOD were older and more often had a history of hypertension and diabetes mellitus than did patients without PAOD. Almost half of the patients with PAOD underwent prior coronary artery bypass graft surgery, but only a quarter of the patients without PAOD did. In contrast, there were no differences regarding other cardiovascular risk factors, left ventricular ejection fraction, or reason for rehabilitation (table 1).

Achieved workload in the bicycle stress test both at the entry and the end of the program was lower in patients with PAOD than in patients without PAOD; of note, both groups were able to increase their physical capacity similarly (table 2).

In both groups, there were similar rates for both cardiac and noncardiac complications with a similar distribution between ischemic and arrhythmic complications (see table 2). However, complications led more often to a discontinuation of the program in patients with than without PAOD (18% vs 10%, *P*=.018).

QOL did not differ statistically between the 2 groups at baseline or at the end of the program. Except for negative mood that decreased and social well-being that remained constant, all dimensions increased similarly in both groups (fig 1). There was only a tendency toward an increase in positive mood in the PAOD group, whereas the increase in positive mood was significant in patients without PAOD. Although social well-being decreased numerically in patients with PAOD, there was a tendency toward an increase in this domain for patients without PAOD.

DISCUSSION

The present analysis shows that patients with PAOD undergoing OCR benefit equally but have a higher dropout rate than those without PAOD. Although starting at lower levels, patients with PAOD were able to increase their workload and QOL during OCR to a similar relative extent as those without PAOD. Despite a comparable rate of complications, PAOD patients discontinued the program more frequently. The limited

Table 2: Achieved Baseline and Follow-Up Workload, Complications, and Discontinuation

Outcome Measurements	No PAOD (n=1409)	PAOD (n=99)	P
Baseline test workload	125±38* (79±19)	105±31* (69±17)	<.001
Follow-up test workload	153±48* (98±24)	126±44* (82±25)	<.001
Discontinuation of rehabilitation	10	18	.018
Complications			
Cardiac	7	11	.096
Ischemic	6	9	.17
Arrhythmic	1	2	.33
Noncardiac	7	8	1.00

NOTE. Values are mean workload ± SD (mean percentage of target workload ± SD) and percent.
*Baseline vs follow-up (P<.001).

number of PAOD patients enrolled in our OCR program might be secondary to selection bias inherent in the referral pattern.

In PAOD patients there is a large body of evidence that rehabilitation is beneficial regarding exercise performance and walking ability,¹⁴ but data on the effect of cardiac rehabilitation programs in patients with CAD as well as PAOD are scarce. It can be hypothesized that effects of rehabilitation including supervised physical activity, risk factor modification, education, and counseling might be similar in the atherosclerotic disease of different vascular beds. However, patients with CAD who suffer from PAOD might not be referred to rehabilitation programs due to decreased exercise capacity, limiting symptoms, and less anticipated benefit. In the present analysis we have shown that PAOD patients with CAD are a population with a higher risk profile and a lower achieved workload than others, a result that might have been expected. Because the prevalence of PAOD is estimated to be between 15% and 20% in the general population¹⁵ and up to 30% in patients with CAD,¹⁴ the rather low percentage found in the present analysis indicates a possible selection bias. Possible reasons may be limiting symptoms such as leg claudication in physical activities, which prevent physicians from referring PAOD patients to rehabilitation programs, and older age and higher rates of diabetes mellitus, hypertension, and prior coronary artery bypass surgery and PAOD itself, which are conditions that limit

the ability of PAOD patients to successfully initiate, continue, and complete cardiac rehabilitation programs. However, most of our patients suffered from moderate symptoms only, which did not preclude participation and completion of the program. Although no formal screening test was performed at study entry, it is unlikely that PAOD patients are under-reported within the analyzed cohort, because in our analysis PAOD is a clinical diagnosis graded by the extent of subjective limitation to the patients.

Of special concern, however, was the elevated dropout rate despite a similar complication rate. Because PAOD patients have a similar benefit from OCR in terms of physical improvement and QOL, the risk for a cardiac complication during OCR is very low,¹⁶ and cardiac rehabilitation has proven benefit in preventing future cardiovascular events,⁶ patients with PAOD should be encouraged both to participate in and to complete OCR. Therefore, activities tailored to the abilities of patients with PAOD should be offered. Such activities might consist of a high-frequency but low-impact exercise training, disease-specific education, and disease management strategies tailored for PAOD patients to improve adherence. The differences in social well-being between patients with and without PAOD might be a signal for caregivers to give special attention to this specific aspect.

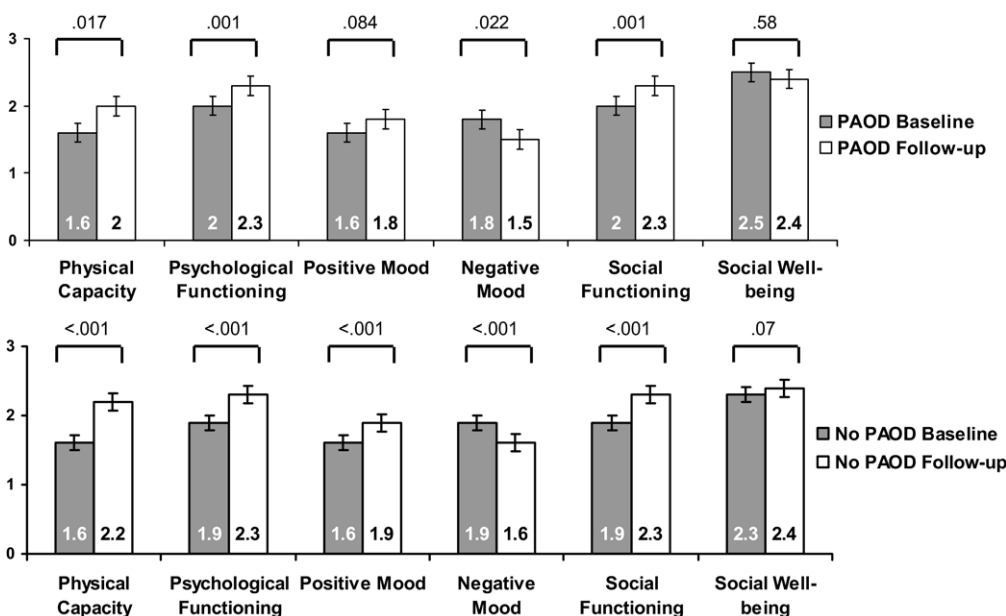


Fig 1. QOL scales in patients with and without PAOD (PLC questionnaire). The comparison of PAOD versus no PAOD was not significant. All scales range from 0 to 4. Higher scores indicate better QOL, except for scale 4 (negative mood). Error bars denote ± 1 SD.

Study Limitations

First, the maximal follow-up duration of this analysis was 3 months, which may be judged too short to assess the whole spectrum of complications and late outcome of the studied population. However, because this analysis aimed at the short-time effects of rehabilitation only, this follow-up duration should be sufficient to estimate positive and negative results of the program. Furthermore, our population of CAD patients with PAOD might represent a positive selection of patients able and willing to participate in OCR programs; therefore, the conclusions of our analysis might not be applicable to PAOD populations with less personal motivation or at higher Fontaine stages. Although this selection bias might be a limitation, it represents an important finding of the present study as well. Finally, the limited number of PAOD patients may have prevented final conclusions.

CONCLUSIONS

Outpatient cardiac rehabilitation patients both with and without PAOD benefit similarly from rehabilitation in both physical ability and QOL. However, PAOD patients have an elevated dropout rate of nearly double the rate of non-PAOD patients despite similar complication rates. Therefore, PAOD patients should be encouraged to participate in rehabilitation programs and special efforts need to be taken to keep them in, possibly by creating exercises specifically tailored to their needs.

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Supplier

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