

Rehabilitation enrollment after cardiac procedures

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Summary

Background: Cardiac rehabilitation programmes are effective for implementing secondary prevention in coronary heart disease. Variables influencing the rate of rehabilitation enrollment after PCI or CABG are largely unknown.

Methods: A cohort of consecutive patients were interviewed 6–8 weeks after cardiac interventions to assess the reasons, as well as demographic and comorbid variables influencing rehabilitation enrollment.

Results: Among 309 patients, 160 (52%) responded to structured personal or telephone interviews. After PCI, 29/78 (37%) patients were enrolled in rehabilitation programmes and after CABG 79/82 (96%) ($p < 0.001$). Lack of information or missing referral were the main reasons for not participating in rehabilitation (44% of patients after PCI). Multivariate regression analysis showed significant independent variables predicting participation: cardiac surgery (OR = 58; 95% CI 12.8–261.5, $p < 0.001$), being depressed according to the screening questions of Arroll (OR = 0.26; 95% CI 0.08–0.88, $p = 0.031$). Lower age and complications during hospitalisation were additional significant univariate predictors for participation.

Multivariate analysis revealed predictors for selection of an in- vs outpatient rehabilitation programme: Cardiac surgery (OR = 54; 95% CI 6.4–460.2, $p < 0.001$), non-smoking status (OR = 22; 95% CI 2.5–194.0, $p < 0.005$), presence of a comorbid condition (OR = 7; 95% CI 1.4–35.7, $p < 0.02$), living alone (OR = 0.04; 95% CI 0.005–0.36, $p < 0.004$). Female gender was an additional univariate predictor for inpatient rehabilitation.

Conclusions: Rehabilitation enrollment is unsatisfactory after PCI, in contrast to cardiac surgery, mostly due to the lack of standardised information or referral policies. Independent predictors of participation are lower age, surgical intervention and absence of depressive symptoms. Predictors for selecting inpatient vs outpatient programmes were complications after the index procedure and comorbidities.

Key words: cardiac rehabilitation; cardiac surgery; PCI; secondary prevention

Introduction

Cardiovascular rehabilitation has widely acknowledged benefits [1–4] and is recommended by several international guidelines as a class IA or IB indication in patients with a variety of cardiovascular conditions [5–7], including interventions not only for acute coronary syndromes but also for chronic symptomatic disease states [8, 9]. It was shown to be both effective and cost-effective in patients with high and low risk of disease progression [10].

Despite this, rehabilitation enrollment is reported to be surprisingly low in some countries around the world [11]. To date, there are no figures for rehabilitation enrollment reported in Switzerland, but it is estimated to be lower than ideal by experienced clinicians, especially in nonsurgical patients.

Therefore, the aim of this study was to evaluate rehabilitation enrollment in Switzerland in patients after cardiac procedures, in whom a particularly strong case can be made for this form of treatment. In addition, we sought to identify factors that influence rehabilitation enrollment.

Methods

All patients who underwent cardiac surgery or catheter interventions at the University Hospital in Basel/CH between 29 October 2011 and 17 January 2012 were included in the study. The study was approved by the local ethics committee.

Patients were given written information about the study at the time of the intervention and asked for consent to be contacted later. A structured telephone interview was conducted by one single person (B.S.) 6–8 weeks after the index procedure. The interview was divided into three sections, complemented by information from the medical records:

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- questions as to sociodemographic and vocational status;
- questions concerning health status, including cardiovascular risk factors and comorbid state and assessment of depressivity by two screening questions of Arroll [12];

Table 1

Patient flow chart.

	Catheter inter- vention N = 196	Cardiac surgery N = 113
Foreign language	–30	–12
Unreachable	–47	–10
Refused	–35	–9
Previously included (op)	–4	
Died	–4	
Included and followed	78	82

Table 2

Patient characteristics.

Variable		All		PCI		OP		p-value
		mean	SD	mean	SD	mean	SD	
Age	years	69.2	10.66	71.2	10.75	67.2	10.39	.021
BMI	kg/m ²	26.6	3.63	26.3	3.29	26.9	3.97	.405
Hospital stay	days	n.a.	n.a.	4.4	4.2	9.2	5.2	.001
		N	%	N	%	N	%	
Gender	male	106	66.3	58	74.4	49	59.8	.034
	female	54	33.7	20	25.6	33	40.2	
Rehabilitation	yes	108	67.5	29	37.2	79	96.3	.001
	no	52	32.5	49	62.8	3	3.7	
	inpatient	71	65.7	8	27.6	63	79.7	
	outpatient	37	34.3	21	72.4	16	20.3	
LVEF	normal	141	88.1	73	93.6	68	82.9	.037
	abnormal	19	11.9	5	6.4	14	17.1	
Arroll	positive	49	30.6	22	28.2	27	32.9	.517
	negative	111	69.4	56	71.8	55	67.1	
Smoking	never	72	45.0	29	37.2	43	52.4	.152
	former	65	40.6	36	46.2	29	35.4	
	current	23	14.4	13	16.7	10	12.2	
Physical activity	inactive	52	32.5	26	33.3	26	31.7	.309
	<3× weekly	50	31.3	28	35.9	22	26.8	
	≥3× weekly	58	36.3	24	30.8	34	41.5	
Diabetes mellitus	yes	32	20.0	16	20.5	16	19.5	.874
	no	128	80.0	62	79.5	66	80.5	
COPD	yes	11	6.9	6	7.7	5	6.1	.690
	no	149	93.1	72	92.3	77	93.9	
PAOD	yes	14	8.8	7	9.0	7	8.5	.922
	no	146	91.3	71	91.0	75	91.5	
Arthrosis	yes	20	12.5	16	20.5	4	4.9	.003
	no	140	87.5	62	79.5	78	95.1	

BMI = body mass index; LVEF = left ventricular ejection fraction; COPD = chronic obstructive pulmonary disease; PAOD = peripheral arterial occlusive disease; PCI = percutaneous catheter intervention; OP = cardiac surgery, n.a. = not analysed

- questions concerning rehabilitation enrollment, type of programme, reasons for participation or nonparticipation. Nonparticipants were at that time offered free individual counseling on physical activity for three months;
- information on the type of intervention, LV function, complications and other medical variables were taken from the hospital records.

Those patients declaring nonparticipation were offered free individual counseling by an exercise specialist (M.B.) for three months to increase physical activity.

Statistics

Data were evaluated using the SPSS 19.0 software. Univariate analysis of participants versus nonparticipants was made first. Multivariate regression analysis using significant and near significant variables from the univariate analysis was then performed using participation and inpatient vs outpatient programmes as dependent variables.

Results

Among 309 patients, 160 (52%) responded to personal structured interviews. There were 106 men and 54 women aged 69 ± 11 years (mean \pm SD).

A patient flow chart is shown in table 1. Patient characteristics are listed in table 2.

Hospital stay for surgical patients was significantly longer than for PCI patients. Moreover patients with elective PCI had an even shorter stay of a mean of 1.8 days in the hospital. Rehabilitation enrollment for the entire cohort was 68% (108/160 pts, table 3); two thirds of the participants attended an inpatient facility, whereas one third were attending an outpatient programme.

Reasons for nonparticipation in 52 patients were said to be personal in 14 (27%), medical in 15 (29%) and lack of information/referral in 23 (44%) patients.

The 52 patients declaring nonparticipation were offered a free individual counseling by an exercise specialist for three months to increase physical activity. Six patients gave initial consent but only three individuals finally took part in this programme. The most important barriers to regular physical activity in this group were multiple comorbidities in patients over age 70.

Univariate and multivariate predictors of participation in a rehabilitation programme are shown in tables 4 and 5. Among participants, more patients were younger than 65, and more often had complications during the index hospitalisation, but fewer had previous infarctions, interventions or arthrosis. There was no difference as to the proportion of ACS between participants (38%) and nonparticipants (37%). In the regression analysis, the only independent predictors that remained were surgery as the type of intervention and absence of depressive symptoms.

Table 3
Rehabilitation enrollment.

	Rehab. enrollment	inpatient	outpatient
Total (160)	108 (68%)	71 (66%)	37 (34%)
pts after PCI (78)	29 (37%)	8 (28%)	21 (72%)
pts after CABG (82)	79 (96%)	63 (80%)	16 (20%)

Table 4
Significant univariate predictors for participation.

	Participants N = 108	Non-participants N = 52	p-value
Age <65	45 (42%)	9 (17%)	<0.01
Previous MI / intervention	27 (25%)	25 (48%)	<0.01
Complications during hospitalisation	36 (33%)	5 (10%)	<0.001
Absence of arthrosis	100 (93%)	40 (77%)	<0.01

Univariate and multivariate predictors for selection of either an inpatient or outpatient programme were analysed and are shown in tables 6 and 7.

In the multivariate regression analysis, cardiac surgery again remained as an independent variable predicting the selection of an inpatient programme. Comorbidity and a non- or ex-smoking status was also found to favour inpatient rehabilitation, whereas living alone was negatively associated with selecting an inpatient facility.

Discussion

Participation rate

The overall rate of participation in cardiovascular rehabilitation programmes after cardiac procedures in this Swiss university hospital setting was 68%. This is in the upper range or above the rates found in other countries. Rates as low as 1% and as high as 90% have been found across Europe [13]. In the Netherlands, the rate was reported to be 3% in patients with stable chronic angina, 29% after ACS and 59% after cardiac surgery [14]. A registry from 19 US sites showed that patients after AMI had been referred to rehabilitation at rates of 29% after 1 month and 48% after 6 months [15]. Other sources in the US indicate participation rates of 14%–35% after heart attacks and 31% after cardiac surgery [16], 21% for patients with chronic angina, and 47% after MI, respectively [17].

The figures reported in our study seem to be representative for Switzerland, since we know of some 17,000 PCI and 7,000 cardiac surgical interventions compared to an estimated total of 7,000 inpatient and 4,000 outpatient rehabilitation participants during the year 2007 [18].

Predictors of rehabilitation enrollment

Independent factors influencing rehabilitation enrollment in our cohort were surgery as type of intervention, and absence of depressive symptoms. Almost all of our surgical patients (96%) entered a rehabilitation programme, in contrast to only 37% of patients after PCI. This dramatic difference might be explained by various factors. Firstly, there was a substantial number of repeat procedures among PCI patients. Secondly, since PCI is performed in many polymorbid patients well into advanced age, there might be various comor-

Table 5

Multivariate predictors for participation.

	OR	95% CI	p-value
Cardiac surgery	58	12.8–261.5	<0.001
Depressive symptoms	0.26	0.08–0.88	0.031

Table 6

Significant univariate predictors for selecting an inpatient programme.

	Inpatient N = 71	Outpatient N = 37	p-value
Surgery	63	16	<0.001
Female gender	30	8	<0.05
Ex-/non-smoker	65	29	<0.05
Comorbidity	47	24	<0.05
Previous intervention	13	14	<0.005

Table 7

Multivariate predictors for selecting an inpatient programme.

	OR	95% CI	p-value
Cardiac surgery	54	6.4–460.2	<0.001
Non- / ex-smoking	22	2.5–194.0	<0.005
Comorbidity	7	1.4–35.7	<0.02
Living alone	0.04	0.005–0.36	<0.004

bid conditions limiting mobility and ability to take part especially in an outpatient setting. Lastly, an operation has a far greater subjective impact on a patient who after such an intervention is more motivated to undergo formal rehabilitation. Also of note is the fact that hospital stays are of much longer duration in surgical vs nonsurgical patients (table 2). Surgical patients are staying in a specialised cardiac unit, where they are given more information about follow-up treatment after the acute-hospital-phase, including standardised recommendations for rehabilitation. In contrast, PCI patients mostly stay on general internal medicine wards. Those 30% of patients with elective PCI stayed for a mean of 1.8 days in a ward.

The absence of depressive symptoms had a large impact on rehabilitation enrollment in our cohort. Indeed this variable is widely recognised as negatively influencing not only rehabilitation enrollment but also its further course and disease outcome, in general [19, 20]. In other studies, the following negative predictors for rehabilitation uptake were found: older age, smoking and previous interventions making it less likely to happen [15, 21–23]. Likewise, older age, female gender and comorbidity as well as geographical distance to a rehabilitation facility were found to be negative predictors in the Dutch study [14]. In the Minnesota Heart survey [17], lower age, male gender, higher education and revascularisation procedures were predictors of rehabilitation enrollment.

Physicians' recommendations may be influenced by several factors, last but not least by the perceived impact of their intervention rather than by the fact that secondary prevention should be endorsed in a formal way in all patients. In this context, it is of note that in our patients, not participating in formal rehabilitation programmes the most important reason given was lack of information or referral (44% of patients after PCI). Individual counseling after PCI might therefore differ according to the underlying disease state, and whether an intervention was undertaken for an acute coronary syndrome or for chronic symptoms [8, 14]. In our cohort however, the prevalence of ACS did not influence rehabilitation enrollment. It should also be underlined that current guidelines do not take into account this differentiation.

In order to ensure rehabilitation enrollment after PCI, we recommend that a formal assessment of the needs and expectations regarding secondary prevention should be held with every patient as a routine before hospital discharge. It is our experience that when a decision concerning rehabilitation is postponed, the patient will likely be lost. Individual exercise counseling does not seem to be an alternative to formal rehabilitation since it was accepted by only a very few patients.

Inpatient vs outpatient programmes

Two thirds of the participants attended an inpatient programme, most of them had surgical interventions. Despite a lower mean age in comparison with patients after PCI, surgical patients tended to favour inpatient programmes because of comorbid conditions, general frailty, distance to an outpatient facility or other psychosocial circumstances. Patients who continue smoking were more likely to choose an outpatient programme which might allow them to smoke during their free time at home. It would be more helpful however if smokers attended inpatient programs, since the mostly smoke-free environment would help them to quit.

In conclusion, rehabilitation enrollment after PCI is unsatisfactory, in contrast to CABG or other surgical procedures, mostly due to lack of standardised information or referral policies. Individual exercise counseling seems to be an alternative to a formal rehabilitation programme for only a very few selected patients. It is desirable that interventional cardiologists routinely endorse formal rehabilitation following their procedures.

Limitations

The rate of response (52%) was rather low and this could lead to a possible bias since non-responders to the interview are less likely to attend a rehabilitation programme than responders. The number of patients included in this study may also seem rather small. This is mostly due to the single centre design with the advantage that one interviewer alone provided consistency of questioning.

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