AMBULATORY SURVEILLANCE OF PATIENTS REFERRED FOR CARDIAC REHABILITATION FOLLOWING CARDIAC HOSPITALIZATION: A FEASIBILITY STUDY

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Abstract

Purpose—To examine the feasibility of implementing an ambulatory surveillance system for the monitoring of patients referred to cardiac rehabilitation following cardiac hospitalizations.

Methods—This study consists of 1208 consecutive referrals to cardiac rehabilitation between October 2007 and April 2008. Patient attendance to cardiac rehabilitation, waiting-times for cardiac rehabilitation, and adverse events while waiting for cardiac rehabilitation were tracked by telephone surveillance by a nurse.

Results—Among the 1208 consecutive patients referred, only 44.7% of referred patients attended cardiac rehabilitation; 36.4% of referred patients were known not to have attended any cardiac rehabilitation, while an additional 25.8% of referred patients were lost to follow-up. Among the 456 referred patients who attended the cardiac rehabilitation program, 19 (4.2%) experienced an adverse event while in the queue (13 of which were for cardiovascular hospitalizations with no deaths) with mean waiting times of 20 days and 24 days among those without and with adverse events, respectively. Among the 440 referred patients who were known not to have attended any cardiac rehabilitation program 114 (25.9%) had adverse clinical events while in the queue; 46 (10.4%) of these events required cardiac hospitalization and 8 (2%) patients died.

Conclusions—Ambulatory surveillance for cardiac rehabilitation referrals is feasible. The high adverse event rates in the queue, particularly among patients who are referred but who do not attend cardiac rehabilitation programs underscores the importance of ambulatory referral surveillance systems for cardiac rehabilitation following cardiac hospitalizations.

Introduction

Randomized clinical trials have shown that cardiac rehabilitation programs are associated with a 20%–25% reduction in mortality following cardiovascular hospitalizations.^{1, 2} Given

that fewer than 30% of eligible patients are referred to cardiac rehabilitation programs,^{3, 4} many jurisdictions are now including cardiac rehabilitation as a quality indicator in the continuum of cardiovascular care,^{5, 6} and are advocating for a systematic referral process to cardiac rehabilitation programs following hospitalization for cardiac events.^{2, 7-9} In so doing, hospitals are being encouraged to identify and refer eligible patients to cardiac rehabilitation at the time of hospital discharge.¹⁰ Such systematic referral systems are also intended to mitigate the biases associated with patient selection, which have historically resulted in the referrals of lower risk, healthier cardiac rehabilitation populations.¹¹

Notwithstanding the presence of such systematic referral processes, available evidence has shown that results vary and many patients still do not attend cardiac rehabilitation programs despite program referral.^{10, 12} Such low participation rates may be at least partially attributable to excessive waiting-time delays and/or adverse clinical events experienced by patients while in the cardiac rehabilitation queue.¹³⁻¹⁵ Moreover, given that the events following cardiac hospitalization are time-dependent,^{16, 17} early referrals for cardiac rehabilitation demarcate a particularly vulnerable time period where patients are at high risk of sustaining recurrent adverse cardiac events.

While cardiac rehabilitation programs routinely track and report the outcomes of cardiac rehabilitation participants once programs have been initiated, no study has examined the outcome experiences of patients waiting in the cardiac rehabilitation queue. Such surveillance systems would necessitate the prospective follow-up of individuals during a key transitional phase of disease which immediately follows a cardiac hospitalization where care delivery is often most fragmented and poorly coordinated.¹⁸⁻²⁰

Accordingly, the objective of this study was to explore the feasibility of ambulatory surveillance for patients referred to, and waiting for, cardiac rehabilitation following cardiovascular hospitalizations.

Methods

Setting and Sample

Southlake Regional Health Centre is the largest community-based (non-teaching) tertiary hospital in Canada, with over 9000 cardiovascular admissions per year for acute coronary syndromes and coronary interventions. The institution serves as a regional cardiac centre for 11 community outlying hospitals and over 1.5 million residents throughout Central Ontario. All patients admitted through the emergency room at Southlake, or are transferred to Southlake from an outside hospital are referred to Southlake's Cardiac Rehabilitation program using an automated referral mechanism. Over 80% of patients referred to Southlake's cardiac rehabilitation program originate from in-hospital referrals, the vast majority of which involve patients having had percutaneous coronary interventions and/or acute coronary syndromes. The remaining patients originate from office based referrals or from other surrounding hospitals and were excluded from this study.

This prospective study consisted of a sample of consecutive referrals to Southlake Regional Health Centre between October 2007 and April 2008.

Design & Procedure

All patients who were referred to Southlake's Cardiac Rehabilitation program through the hospital's systematic automated referral mechanism were identified at the time of referral. Detailed clinical variables were collected through history and/or collected through medical chart abstraction by a clinical nurse. Each referred patient was given contact information for the cardiac rehabilitation program at the time of hospital discharge. Those who experienced an adverse event while waiting for cardiac rehabilitation were either noted at the time of program intake, or in the case of non-attendance to cardiac rehabilitation, identified through patient telephone follow-up surveillance or captured through correspondence between the cardiac rehabilitation program and the waiting-list nurse as communicated by patients, family or physicians prior to the patient's intake assessment.

Given the inherent biases associated with consent-based registries,²¹ individual patient consent was not required for tracking such patients. The study received Research Ethics Board approval from Southlake Regional Health Centre.

Data variables and adverse clinical events

Adverse clinical events of referred patients consisted of mortality and recurrent cause-specific hospitalizations prior to and/or up until the pre-scheduled cardiac rehabilitation program intake assessment date. If patients did not attend cardiac rehabilitation, adverse clinical events were tracked for a maximum of three months post hospital discharge.

Statistical Analyses

Descriptive statistics, including frequency, means, and medians were computed for cardiac rehabilitation enrollment, wait times and clinical events. A cumulative event rate while in the cardiac rehabilitation queue was estimated for the study sample.

Results

In total, 1208 patients were referred to cardiac rehabilitation between October 2007 and April 2008 and comprised the study sample. The mean age of our sample was 61 years (range of 28–94); 31% were female (Table 1).

Among the 1208 consecutive patients referred, 540 patients (44.7%) attended cardiac rehabilitation programs (456 patients attending Southlake's Cardiac Rehabilitation Program), while 440 (36.4%) referred patients were known not to have attended any cardiac rehabilitation program. In total, 312 patients (25.8%) were lost to follow-up. Among the 456 referred patients who attended cardiac rehabilitation programs for whom follow-up data was tracked, 19 (4.2%) experienced an adverse event (13 of which were for cardiovascular hospitalizations with no deaths. The mean waiting time for patients in the cardiac rehabilitation was 20 days for patients without adverse events, and 24 days for patients with adverse events.

Among the 440 referred patients who were known not to have attended a cardiac rehabilitation program 114 (25.9%) had adverse clinical events; 46 (10.4%) of these events required cardiac hospitalization and 8 (2%) patients died (Table 2). The total cost associated

with the implementation of the cardiac rehabilitation waiting list surveillance and monitoring feasibility study was \$17,120.

Discussion

Our study is the first to evaluate the implementation of an ambulatory surveillance system for patients referred for cardiac rehabilitation following cardiac hospitalization. While the mean waiting-times among those attending cardiac rehabilitation fell within national targets, ⁷ fewer than half of the original eligible referred sample ultimately attended cardiac rehabilitation. The adverse event rate among the overall eligible and referred sample of patients waiting for cardiac rehabilitation exceeded 10%, and exceeded 25% among patients who were referred but who never attended cardiac rehabilitation.

Given the high baseline risk for recurrent cardiovascular events, the weeks and months following cardiovascular hospitalizations represent a key transitional period of disease recovery as patients re-integrate and convalesce within community and ambulatory care environments.^{16, 22–24} The adverse event rates observed in our prospective study were consistent with those reported in other population-based studies,^{16, 25} and underscore the medical risks and vulnerabilities associated with cardiac rehabilitation eligible populations during key transitional phases of care following cardiovascular hospitalization.

Our study illustrates that participation in cardiac rehabilitation remains low. Reasons for cardiac rehabilitation non-attendance were likely multifactorial. While referral barriers have been identified as one of the explanations for low participation rates for cardiac rehabilitation,²⁶ all patients in our study were already referred to cardiac rehabilitation through systematic automated referral mechanisms. Accordingly, attendance gaps persisted despite the implementation of automated cardiac rehabilitation referral processes. In this regard, our findings are also consistent with others.^{3, 8, 10, 12, 27, 28} For example, Grace and colleagues recently demonstrated that while automated referral processes improved cardiac rehabilitation participation by 2-fold as compared with usual-care, up to 40% of patients referred through automated referrals never attended cardiac rehabilitation. However, participation rates increased an additional 2-fold when combining automated cardiac rehabilitation referral processes with a nurse liaison who met with and engaged cardiac rehabilitation referred patients at the time of hospital discharge.¹² At least one recent study has confirmed that intensive nurse liaison strategies in addition to automated referral processes were required to optimize participation in cardiac rehabilitation.²⁹ Other reasons for non-attendance may include patient preferences, travel barriers, poor awareness regarding the need for cardiac rehabilitation, employment, financial constraints, and disease-related complications.^{3, 4, 30} With regards to the latter, the high numbers of adverse events among those patients never attending cardiac rehabilitation raises the possibility that poor health status, disability, and illness severity may be important factors in explaining cardiac rehabilitation non-participation.

We do not know the extent to which adverse events in the cardiac rehabilitation queue could have been avoided. The average cardiac rehabilitation waiting time in our study was not particularly lengthy and fell within national recommended cardiac rehabilitation waiting-

time guidelines.⁷ It is unlikely that earlier implementation of exercise-based programs would have averted adverse events in the queue, given that the survival benefits associated with cardiac rehabilitation accrue over longer periods of time (i.e., 1–2 years) than the ones examined in our study.^{1, 31, 32} Nonetheless, it is possible that excessive waiting times for cardiac rehabilitation do exist elsewhere, and if so, could negatively impact on enrollment into, and outcomes associated with, cardiac rehabilitation.¹⁵

Given the high frequency of adverse events, the low program participation, and the number of patients who were lost to follow-up, some may argue that all post-hospitalized cardiac rehabilitation referred patients may benefit from earlier and more intensive case-management, which would begin immediately or soon following hospital discharge thereby allowing for more seamless transition between hospital and ambulatory care environments. Case-management could have identified changes in symptom status prior to the development of adverse events, could have facilitated real-time communication between patients and health care providers, and could have led to alterations to medical and self-management where appropriate.³³ The incorporation of quality improvement initiatives into such ambulatory surveillance systems have been used to narrow care-gaps elsewhere.^{34, 35, 36} We advocate for further research which evaluates the effectiveness and cost-effectiveness of implementing case-management strategies among patients referred to cardiac rehabilitation following hospitalization.

There are noteworthy study limitations. First, the study consisted of referrals predominating from one single tertiary centre. Moreover, our study sample size was modest. Second, adverse clinical events were tracked from a single coordinating centre, and relied upon various levels of correspondence between the research coordinator and patients, families, and/or other medical staff associated with patients. Finally, limited follow-up information for those who were managed outside of Southlake's regional health centre was available. That said, our study did consist of a consecutive sample of patients and by design, was intended only as a study of feasibility. Future studies will need to evaluate the feasibility, effectiveness and cost-effectiveness of implementing ambulatory surveillance systems for patients referred to cardiac rehabilitation following cardiac hospitalization within broader institutional and geographical contexts.

In conclusion, ambulatory surveillance for cardiac rehabilitation referrals is feasible. The high adverse event rates in the queue, particularly among patients who are referred to but who never attend cardiac rehabilitation programs underscores the importance of ambulatory referral surveillance systems for cardiac rehabilitation following cardiac hospitalizations. Cardiac rehabilitation eligible populations, as identified at the time of hospital discharge, serves as a logical inception and entry point from which high-risk populations can be followed and monitored during key post-hospitalized transitional phases of disease. Future research must evaluate the effectiveness and cost-effectiveness of implementing case-management strategies soon following the cardiac rehabilitation referrals at hospital discharge, which might facilitate the monitoring, management, and engagement of such patients so that the survival benefits of patient referred to cardiac rehabilitation programs are fully realized.

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Table 1

Sociodemographic and Clinical Characteristics of Sample according to cardiac rehabilitation attendance at South Lake Regional Hospital.

Characteristic	Attended Cardiac Rehabilitation N=456	Did not attend Cardiac Rehabilitation N =668
Sociodemographic		
Mean age, yrs (SD)	58 ($\pm$ 30)	64 ($\pm$ 33)
Sex, female, n (%)	123 (27%)	250 (33%)
Clinical		
Cardiac indication, * n (%)		
Other	15 (3.3%)	7 (1.0%)
CABG	127 (27.9%)	35 (5.2%)
STEMI	23 (5.0%)	2 (0.3%)
NSTEMI	4 (0.9%)	2 (0.3%)
PTCA	165 (36.2%)	641 (96.0%)
AVR	16 (3.5%)	9 (1.3%)
MVR	12 (2.6%)	4 (0.6%)
Unstable Angina	1 (0.2%)	1 (0.1%)
Stable CAD	117 (25.7%)	35 (5.2%)
Cardiomyopathy	6 (1.3%)	0 (0%)
Dysrhythmia	2 (0.4%)	0 (0%)
CHF	57 (12.5%)	0 (0%)
Acute coronary syndrome	3 (0.7%)	0 (0%)
Unknown	3 (0.7%)	16 (2.4%)

* The percentages exceed 100% because some patients may have had more than one referral indication

Table 2

Outcomes among patients tracked within the Cardiac Rehabilitation waiting list registry

Patients known to have attended cardiac rehabilitation (N=456)		
No adverse events		437
Adverse clinical events *	Total	19
	Death	0
	Cardiac hospitalizations	19
	Non-cardiac hospitalizations	0
Mean waiting times in days for patients with no adverse events (95% CI)		20 (0 – 126)
Mean waiting times in days for patients with adverse events (95% CI)		24.8 (1 – 60)
Patients known to have not attended cardiac rehabilitation or patients lost-to-follow (N=668)		
Lost to follow-up		312
Successfully tracked		440
Adverse clinical events †	Total	114
	Death	8
	Cardiac Hospitalizations	46
	Non-cardiac hospitalizations	60

* Each patient event is counted only once according to the hierarchy of death, cardiac hospitalizations, non-cardiac hospitalizations.

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