News and Views From the Literature

Cardiac Rehabilitation

Cardiac Rehabilitation Reduces the Long-Term Risk of Death and Cardiovascular Complications

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[*Rev Cardiovasc Med.* 2010;11(3):e181-e184 doi: 10.3909/ricm0543]

Relationship Between Cardiac Rehabilitation and Long-Term Risks of Death and Myocardial Infarction Among Elderly Medicare Beneficiaries

Hammill B, Curtis L, Schulman K, Whellan D.

Circulation. 2010;121:63-70.

There has been increasing scientific evidence suggesting that cardiac rehabilitation (CR) reduces long-term risk of death and cardiovascular (CV) complications and improves quality of life in selected patients.[1] Meta-analysis of several randomized, controlled trials by Clark and colleagues[2] demonstrated 15% overall and 47% 2-year reduction in mortality and 17% 1-year reduction in myocardial infarction (MI). However, there are no well-defined guidelines on the "most favorable" dose of CR. It is unknown if there is a dose-dependent relationship (ie, the higher the number of sessions attended the greater the reduction in CV outcomes and mortality), and if the risks outweigh the benefits after some threshold dose is reached.

Hammill and coworkers conducted a historical cohort study on a Medicare population to determine the dose-dependent effect of CR for ischemic indications. The study used Medicare claims data for a national 5% sample (n = 30,161) of beneficiaries from the Centers for Medicare and Medicaid Services over a period of 7 years. The study cohort was aged 65 years and older, had at least 1 Medicare claim for outpatient CR, and enrolled in Medicare fee-for-service for the full year before the first claim (index date). For each patient, CR sessions in the 36 weeks after the first claim were searched up to a total of no more than 36 sessions per patient. Data were obtained for every patient on demographics, comorbid conditions in the year before the first claim, and

qualifying indications for CR. When there was more than one indication, qualifying indication was selected in the order of coronary artery bypass graft (CABG), MI, and angina. The main study outcomes were all-cause death and subsequent MI, the latter determined by the first emergency department visit after the index date for new MI.

The authors used the Cox proportional hazards models to estimate the relationship between the number of CR sessions and each outcome. To estimate the association of demographics and comorbidities, a regression model was used. A Kaplan-Meier curve was used to describe the mortality rate of the study subjects. Patients were included in the analysis only if they were alive until 36 weeks after the index date.

The 30,161 Medicare beneficiaries that constituted the study population were predominantly white (95%), and 64% were men. Mean age of the study population was 74 years. CABG was the most frequent qualifying indication (61%), followed by MI (20%) and stable angina (15%). The most common diagnoses were hypertension (87%), followed by heart failure (HF) (40%) and diabetes (36%). Other common comorbid conditions included chronic obstructive pulmonary disease, cerebrovascular disease, and peripheral vascular disease. A total of 40% of study participants attended $>$ 30 CR sessions; 13% attended $<$ 6 CR sessions. Rate of hospitalization during the 36 weeks was very high, with nearly 33% of the patients hospitalized at some point after the index date. The results of the study showed an inverse relationship between the number of CR sessions attended and mortality, as well as risk of subsequent MI. The highest mortality rate was noted in those who attended $<$ 12 sessions, whereas those who attended $\geq$ 36 sessions had the lowest mortality rate ($P < .001$). Similar results were observed for subsequent MI with the highest incidence in those who attended $<$ 12 sessions and the lowest in those who attended $>$ 24 sessions ($P = .002$). The authors also noted that mortality progressively decreased as the number of CR sessions attended increased. That is, the risk of death was 18% lower in those who attended 36 sessions compared with 24 sessions (95% confidence interval [CI], 0.73-0.92), 29% lower compared with those who attended 12 sessions (95% CI, 0.64-0.78), and 58% lower in those who attended 1 session (95% CI, 0.38-0.47). The incidence of subsequent MI was 15% lower in those who attended 36 sessions compared with 24 sessions (95% CI, 0.81-0.90), 28% lower when compared with those who attended 12 sessions (95% CI, 0.64-0.80), and 38% lower than those who attended only 1 session (95% CI, 0.52-0.73). They also analyzed the dose-dependent effect of CR for each indication—CABG, MI, and stable angina. For each of the above indications, the risk of subsequent MI decreased as the number of sessions attended increased. It was also noted that there was no significant difference in the estimated risk for patients who underwent CABG between 24 versus 36 sessions. However, the difference was significant between 36 versus 15 sessions or fewer—14% lower risk (95% CI, 0.76-1.0). For stable angina, this effect reached a plateau at 18 sessions. However, for MI and HF, the risk of death was significantly lower in those who attended 36 sessions when compared with any number of sessions. After adjustment, the risk decreased by 5% ($P = .02$), 6% ($P = .03$), and 11% ($P = .01$) for CABG, MI, and stable angina, respectively, with each additional 6 CR sessions attended. It was also important to note that those who underwent CABG attended 0.5 more sessions than those with MI and 1 more session than those with stable angina.

The authors concluded that there is a strong association between the number of CR sessions attended and mortality, as well as subsequent risk of MI for any eligible indication for CR—more sessions, more benefit, and lower mortality. However, there are several issues noteworthy of discussion with regard to this study. One major concern is the inability to generalize the results. The mean age of the study cohort was 74 years (all $>$ 65 years). Those who attended more CR sessions are not expected to be similar in their baseline characteristics to those who did not attend any or those who attended fewer sessions; the authors did not supply any data on this detail. We also do not know the difference in comorbidities between the 2 groups, or the reasons for noncompliance (which could be a higher comorbidity burden and a sicker population); in addition, a higher noncompliance rate is expected in the latter group with regard to their cardiac medications, lipid management, diabetes control, and follow-up with their physicians. If these are considered reasons for attending fewer sessions, mortality is certainly expected to be lower in the group that attended more sessions. The lower CV event rate would be due to the overall better health status of these participants and not due to the dose response of CR.

The main strength of this study compared with the previous work is that the authors used dose as a continuous measure, whereas previous data treated dose as a dichotomous measure (which would lead to a higher statistical power). The results of this study are also compatible with previous data on the extremely low participation rate for eligible indications in these CR sessions.

In summary, it is hard to draw any definite conclusion from the results of this study given the reasons discussed here. Ideally, one would conduct a randomized trial in which patients are randomly assigned to different numbers of sessions and study the differences in mortality and CV events in the various groups.

Current American College of Cardiology/American Heart Association (ACC/AHA) guidelines recommend CR for those patients with a diagnosis of MI/acute coronary syndrome, CABG and percutaneous coronary intervention (PCI), stable angina, surgical repair or replacement of heart valve, and heart or heart/lung transplantation within the previous year. Evidence also suggests benefit in those with chronic HF or peripheral artery disease.[3,4] Pooled data from randomized controlled trials of CR suggest that there is a 20% to 25% reduction in mortality over a median follow-up of 12 months, as well as a trend toward reduction in nonfatal MI. However, despite these convincing data on the benefits of CR, fewer than 30% of patients are known to participate in these programs after a CV event.[5,6]

There are several topics that are important to discuss. First, it is striking to note the markedly low participation rates in these CR programs despite the qualifying indication and proven benefits. A recent study by Brown and colleagues[7] that studied the referral patterns for CR in coronary artery disease patients found that, out of those who qualified for CR referral at discharge, only 63% were actually referred. The referral rate among those who underwent CABG or PCI was higher than for those who were admitted for MI but didn't undergo any intervention. The authors also noticed that patients with the highest comorbidity burden are the ones that are least likely to be referred, although they are most likely to benefit from such sessions. Data showed that women are less likely to participate, as were the elderly, nonwhite populations, those with low socioeconomic status, and patients with higher comorbidities.[8,9] There were also noteworthy regional and national variations in the participation rates of these CR programs, with the lowest rate in the South (4-fold higher in the north central states than in the southern states).[8] This is despite the fact that diabetes and obesity prevalence is highest in the southern states.

The reasons for this underutilization include both patient compliance factor and physician referral patterns. There is likely a significant lack of awareness and understanding among physicians about the role and indications of CR referral. The ACC/AHA published performance measures to address some of these issues and to improve the delivery of CR by reducing gaps in delivery.[10] One of the major concerns related to poor referral rates is doubt about the safety of such sessions. However, it is important to note that none of the randomized controlled trials of CR in patients with heart disease showed any increased mortality when compared with control subjects. In addition to poor referral rates, one of the major factors contributing to low participation rate is the distance of CR facilities from patients' homes. A recent meta-analysis by Dalal and coauthors[11] comparing home-based versus center-based CR showed that there was no significant difference in terms of mortality (relative risk 1.31; 95% CI, 0.65, 2.66), cardiac events, exercise capacity, and modifiable risk factors such as blood pressure and low-density lipoprotein cholesterol between the 2 groups. However, adherence was superior in the former group. They also didn't find any consistent difference in the health care costs for the 2 forms of CR. This supports the statement that, if there is no significant cost factor involved and one can improve the participation and adherence rates, home-based CR should be promoted.

In summary, there is no doubt that CR improves mortality and reduces the risk of subsequent CV events in selected patients. It also improves exercise tolerance, blood pressure, diabetes, and lipid control, as well as physical and psychological well-being. The study by Hammill and colleagues provides data on the dose-dependent response of CR. However, further studies are needed, especially data from prospective cohort and randomized trials, to decide on the most optimal dose. Adherence to such programs must be improved by educating both patients and their physicians and considering home-based CR where appropriate. ■

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