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Invited Editorial for JHLT

Rehabilitating Cardiac Rehabilitation After Heart Transplantation

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For many decades, cardiac rehabilitation (CR) and exercise training (ET;CRET) programs have been indicated in patients with coronary heart disease (CHD) following major CHD events and revascularization procedures, [1,2] but this therapy is greatly under-utilized. [3]. More recently, this therapy has become indicated for patients with chronic systolic heart failure (HF). [4] Although especially in CHD, there may be benefits of other components of CR, by far the main component is the ET with improvements in cardiorespiratory fitness (CRF), which likely explains most of the benefits of CR in CHD and HF. Typically, phase II CRET programs begin early following major cardiovascular disease (CVD) events, and consists of 36 education and ET sessions, performed 3 times weekly in the CR center for 12 weeks, which is similar to the CR programs used following heart transplantation (HT).

In the present issue of JHLT, Bachmann and colleagues[5] reported on 2,531 HT patients in the US in 2013, specifically examining 595 (24%) under Medicare coverage, demonstrating that 55% participated in formal CRET programs, with higher use in the Midwest and increasing rates over time from 2008 to 2013. Although they "spin" this as a disappointment, saying "only half of HT recipients participate in CR programs in the US," the 55% participation is actually extremely high compared to most assessments of patients with CHD and HF. In addition to CR participation increasing, they also demonstrated increasing numbers of individual CRET sessions actually attended. More importantly, they demonstrated that hospital re-admissions at 1-year were reduced by 29% in those who participated in formal CRET compared with non-participants.

Although Bachmann and colleagues[5] stated several limitations of their study, which included representing only 24% of HT recipients in 2013 and only including fee for service Medicare recipients, a more substantial limitation is that these data were from a large database that does not allow for assessment of all potential confounders and is not nearly as valuable as randomized controlled data.

Selection bias could be present in that those who freely decided to attend formal CRET after HT compared to non-participants, who may have different characteristics and levels of motivation. Importantly, the causes of hospitalizations were unavailable, and it is probably rare to be readmitted for "frailty" or "failure to thrive", which further raises the possibility of "enrollment bias" or confounding due to selection of healthier individuals for CR participation. Nevertheless, these data add to that from a recent analysis of 201 HT recipients at Mayo Clinic, where amazingly 93.5% attended at least one CRET session (mean 14±8 sessions).[6] Rosenbaum and colleagues[6] reported from this cohort that the number of CR sessions attended in the first 90 days after HT predicted survival in multivariate regression, even correcting for CRF (assessed by 6-minute walk test) and rejection episodes (hazard ratio 0.90; 95% CI, 0.82-0.97; p=0.007), suggesting for the first time an association between CR and long-term survival in patients after HT. Although the mean number of CR sessions attended was far lower than the standard 36 session CRET programs, attending 8 or more sessions was associated with survival post-HT, with incrementally greater survival for each session beyond 8 attended.[6] A recent Cochrane review of ET-based CR after HT assessed 10 randomized controlled trials of 300 participants, indicating that CR following HT significantly improved measures of CRF (peak oxygen consumption or VO_2) , although there was no impact in this meta-analysis on health-related quality of life from the CR.[7]

We[8-10] and others[11] have also reported numerous benefits of ET after HT, including improvements in pulmonary oxygen uptake kinetics, skeletal muscle function, and particularly aerobic capacity, including peak VO_2, which likely explains much of the benefits noted with CRET following HT. Likely, the improvement in peak VO_2 is mostly from peak arterial-venous oxygen differences being higher after CRET due to improvements in peripheral mechanics, including improved microvascular and/or skeletal muscle function, as previously demonstrated in older patients with HF and preserved ejection fraction.[12] Also, as in other types of patients with CVD, high intensity interval training (HIIT) may lead to greater improvements in cardiac structure and function and CRF, as was also evident in one of the trials (N=16) in the Anderson et al[7] meta-analysis. Limited data, however, is present in CHD, HF or HT regarding "hard" clinical outcomes following HIIT.[16-18] Since HT patients achieve peak heart rate responses rapidly due to partial or complete denervation following surgery, there is more reason to think that HIIT or “burst ET” may be particularly beneficial following HT, potentially more so than for other CVD patients.

This current study also raises several opportunities to “rehabilitate “ CR in HT. The model used is an early and one-time event, which discourages repeat or later interventions at time points when patients may be more prepared to undergo this type of strategy, later in their course. Also, as discussed frequently with CR in CHD, reducing barriers to implementation, such as reducing reliance on having the patient come to the CR Center for 36 sessions, and implementing more home-based CR or CR with tele-communications using digital technologies would also be potentially extremely useful. [1,2] Also, we may need to re-think the 36 session model currently utilized throughout CR. Although the Bachmann study [5] demonstrated that the mean number of CR sessions was increasing over time, Rosenbaum et al [6] study suggested a survival benefit beginning at 8 sessions, with incremental benefits on survival associated with more sessions. Nevertheless, it is quite possible that near maximal benefit may occur with 16,18, or 20 sessions , instead of 36, with possibly additional sessions if desired being attended remotely outside the CR Center to maximize compliance .Finally, ET-based CR in HT, similar to CHD and HF, has mostly focused on aerobic or isotonic ET, whereas muscular mass and strength, which can be increased with isometric or resistance ET, could be equally or more important, especially early after HT, to prevent frailty , muscle wasting and bone density loss in HT, similar to its potential benefits in patients with advanced HF. [15-17]

Finally , we congratulate the authors of the current study for further demonstrating the potential benefits of CR in HT to include prevention of hospital re-admissions. We also applaud the HF/HT clinicians across the US for getting a much higher attendance in CRET in their HT patients than we have obtained in patients with CHD over many decades. With further "rehabilitation " of CR following HT, as discussed above, as well as increasing utilization outside the Midwest, we hope to see greater "value" in CRET programs to enhance its utilization for more HT recipients.

Disclosures

The authors do not have any disclosures.

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