Cardiac rehab in young patients with dilated cardiomyopathy

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Background

• Dilated cardiomyopathy (DCM) in youth is a deadly and costly disease

• Cardiac rehab (CR) is safe and beneficial for older adults with multiple types of heart failure including heart failure with reduced ejection fraction (HFrEF)
  • Class I recommendation from AHA

• Safety and efficacy of CR has not been established for young patients with DCM or other forms of heart disease

• We chose to focus on DCM given the similar cardiac phenotype of DCM vs adults with HFrEF
Hypothesis

• Participation in CR will be feasible, safe, and associated with improved cardiometabolic health in young patients with DCM

• Primary outcomes:
  • Adherence
  • Safety
  • Functional capacity: Six minute walk distance (6MWD)
  • Central adiposity: Waist circumference
  • Echocardiographic indices of LV function
  • Serum BNP
Methods

• A retrospective cohort study of DCM patients who completed CR at Cincinnati Children’s Hospital Medical Center from 2011 to June 2017
  • Adherence:
    • #Sessions attended / #sessions scheduled
  • Safety:
    • Adverse events during CR sessions
Methods

• Clinical endpoints were measured at baseline and at last CR visit

• Differences in continuous variables pre- and post-CR were tested for statistical significance with a two-tailed paired sample t-test (p ≤0.05)
Cardiac rehab protocol

• CR prescribed by primary cardiologists for the indication of DCM with or without HF symptoms

• CR sessions consisted of facility-based, supervised, personalized exercise therapy administered per the standards of the AACVPR
  • Each session lasted at least 45 minutes and included active warm-up, cardio, strength, flexibility and cool-down components
  • 75-85% heart rate reserve, calculated from baseline cardiopulmonary exercise test (CPET), maintained for a least half of each session
  • Patients encouraged to attend 2 sessions per week for up to 16 weeks
18 patients with DCM participated in CR during the study period

- Mean age 20 +/-8 years (range 10-39)
- 61% male
- Mean BMI = 34 +/-12 kg/m2
- AHA heart failure class B (n=4), C (n=11), and D (n=3)
- All on maximal medical therapy (typically ACEi/ARB, β-blocker, aldosterone antagonist, +/- loop diuretic)
- 3 patient with LV assist device (LVAD)
Baseline LV size & function

- Mean LV end diastolic diameter = 5.9 ±0.9 cm
- Overall mean left ventricular ejection fraction (LVEF) = 41 ±16%
  - In those with LVAD (n=3): mean LVEF = 24 ±13%
- Most had mild mitral valve regurgitation (n=10), others had none or trivial (n=8)
- No LV outflow tract obstruction
- Mean serum brain natriuretic peptide (BNP) = 202 pg/mL
Adherence and Reimbursement

• 372 of potential 455 (82%) CR sessions attended
  • Most common reasons for missed appointments:
    • Lack of time
    • Lack of travel arrangements
• All CR reimbursed by medical insurance in this study population
  • Historically our CR Program has ~80% reimbursement rate
Safety

• There were no serious adverse events
  • No injuries or hospitalizations for problems directly attributable to CR participation
  • Non-sustained ventricular ectopy (PVCs) during strenuous activity was common
  • CR was postponed for one patient with ischemic DCM and severe LV dysfunction (LVEF = 28%)
    • Contraindication: Inappropriate hypotension with exercise
    • Received heart transplant soon thereafter
    • Currently doing well post-transplant
Effect on LV

- Echo measures of LV dimensions and systolic function did not change with CR.
- Serum BNP decreased in all patients in whom it was measured by a mean of 144 pg/mL (n=7)
  - 6 of 7 with BNP >100 at baseline
  - 3 of 7 with BNP >100 post-CR
Central adiposity

Waist circumference decreased by mean 0.87 in
(95% CI, -0.002 to -1.73; p=0.05; n=16)
Six minute walk distance

6MWD increased by mean 69 m
(95% CI, 36 to 102; \( p=0.0004; n=16 \))
Representative case
Discussion

• Limitations:
  • Limited number of patients without control group
    • Reflection of the novel approach to treating young patients with CR
  • Medications were not controlled
  • Some participated in CR as inpatients while others were outpatients
    • A single exercise physiologist administered the sessions which limited variability in technique
  • Majority did not have a post-CR CPET
    • Limits the ability to state the effect on fitness
    • However the significant increase in 6MWD is compelling
Conclusions

- CR was feasible and associated with minimal risk in this sample of DCM patients
- We observed a significant improvement in:
  - Function capacity (6MWD)
  - Central adiposity (waist circumference)
  - Serum BNP
- No significant change in LV systolic function or AHA class
- Given the limited treatment options for DCM, these findings warrant further study with a prospective trial
Future directions

• Obtain pre- and post-CR CPETs on all patients
  • Better definition of improvement in cardiac vs pulmonary vs musculoskeletal performance
• Better definition of body composition with bioelectrical impedance analysis (BIA)
• Quality of life assessment
• Track long-term clinical outcomes, assess prognostic indicators
• Initiative to increase referrals for DCM and other forms of pediatric acquired and congenital heart disease
• Expand space and equipment
• Planning integrated home-based exercise therapy with ambulatory monitoring
• Building local registry in model of national AACVPR registry
• Disseminate research
• Goal of AACVPR accreditation for our CR Program
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“People pay me to put steps on their Fitbits.”

New Yorker cartoon