Sex Differences in Fitness, LVEF, and Mortality in Cardiac Rehabilitation Patients

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Abstract

Undergoing therapy in cardiac rehabilitation (CR) is essential for patients to improve fitness and health as well as impacting overall and cardiovascular mortality (Galati et al., 2018; Pilmore et al., 2023). But male and female CR patients don't respond to prescribed exercise therapy in the same way (e.g., Kerkhof et al., 2018). It is less clear what differences there are in physiological responses to CR. Individualized exercise prescriptions are applied in CR, but since females are consistently underrepresented in practice and in research, more needs to be understood about sex differences to prescribe exercise that has maximal effectiveness.

PURPOSE: To evaluate sex differences in a large sample of CR patients in terms of changes in peak oxygen uptake (VO_2), performance on a 12-minute walk test (12 MWT), and Left Ventricular Ejection Fraction (LVEF) during CR, and overall mortality after CR.

METHODS: 810 patients (Age: 63.4 +/-11.5 years; 567 males and 243 females) completed 36 sessions of traditional outpatient phase II CR within 6 months of admission and completed a pre-12 MWT and post-12 MWT. Patients underwent a cardiopulmonary exercise (CPX) test pre- and post-rehab. One- and two-way ANOVAs were calculated to determine the effects of time and sex on the dependent variables.

RESULTS: In terms of fitness, VO_2 improved overall pre- to post-intervention ($p < .001$) with males improving more than females ($p = .022$) (*Mean, S.D.*: post-VO_2 M: 23.0, 5.9 vs. F: 19.6, 4.5 ml/kg·min). Also, distance walked on the pre- and post-12 MWTs was significantly different after the intervention ($p < .001$) with both males and females exhibiting similar improvements ($p = .163$) (post-12 MWT M: 3410, 726 vs. F: 3032, 740 ft). Females in this sample had greater mean LVEF ($p = .013$) (F: 52.6, 13.3 vs. M: 50.0, 12.8 %) despite peak VO_2 being greater in the males than females. No differences were found by sex in mortality (months discharged to death; $p = .553$).

CONCLUSIONS: In this group of CR patients there were sex differences in fitness (peak VO_2) and LVEF, but no differences in sex in terms of mortality. Further research on sex differences in CR may help in formulating tailored exercise prescriptions for males and females in CR.

Purpose

To evaluate sex differences in a large sample of CR patients for changes in peak oxygen uptake (peak VO_2), performance on a 12-minute walk test (12 MWT), and Left Ventricular Ejection Fraction (LVEF) during CR, and overall mortality after CR.

Methods

- 810 patients (Age: 63.4 +/-11.5 years; 567 males and 243 females) completed 36 sessions of traditional outpatient Phase II Cardiac Rehabilitation (CR) within 6 months of admission and completed a pre- and post-12 MWT
- Patients underwent a cardiopulmonary exercise (CPX) test pre- and post-CR
- One- and two-way ANOVAs were calculated to determine the effects of Time and Sex on the dependent variables

Results

- In terms of fitness, VO_2 improved overall pre- to post-intervention ($p < .001$) with males improving more than females ($p = .022$; Fig. 1) (*Mean, S.D.*: post-VO_2 Males: 23.0, 5.9 vs. Females: 19.6, 4.5 ml/kg·min)
- Also, distance walked on the pre- and post-12 MWT was significantly different after the intervention ($p < .001$; Fig. 2) with both males and females exhibiting similar improvements ($p = .163$) (post-12 MWT Males: 3410, 726 vs. Females: 3032, 740 ft)
- Females in this sample had greater mean LVEF ($p = .013$; Fig. 3) (Females: 52.6, 13.3 vs. Males: 50.0, 12.8 %) despite peak VO_2 being greater in the males than females
- No differences were found by sex in mortality (months discharged to death, $p = .553$; Fig. 4)

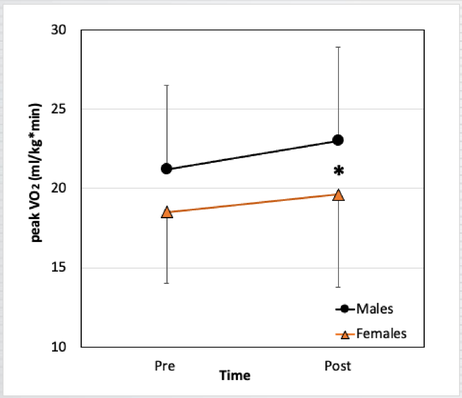

Figure 1. Peak VO_2 (CPX) pre- and post- Phase II Cardiac Rehabilitation (Males, *N* = 251; Females, *N* = 91)

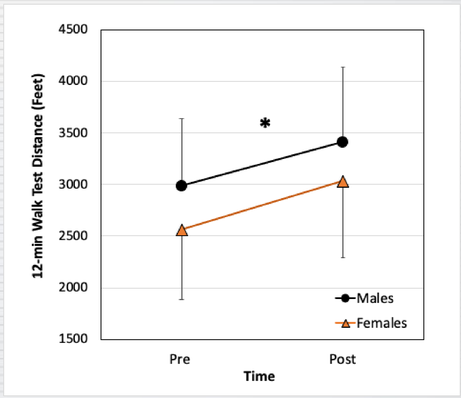

Figure 2. 12 MWT pre- and post- Phase II Cardiac Rehabilitation (Males, *N* = 556; Females, *N* =236)

Conclusions

- In this group of CR patients there were sex differences in fitness (peak VO_2) and LVEF, but no differences in mortality in terms of sex.
- Further research on sex differences in CR may help in formulating tailored exercise prescriptions for males and females in CR.

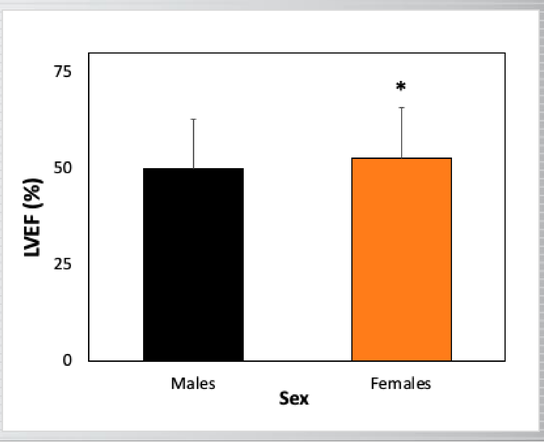

Figure 3. LVEF in males vs. females during Phase II Cardiac Rehabilitation; LVEF (%) Females > Males (Males, *N* = 531; Females, *N* = 227)

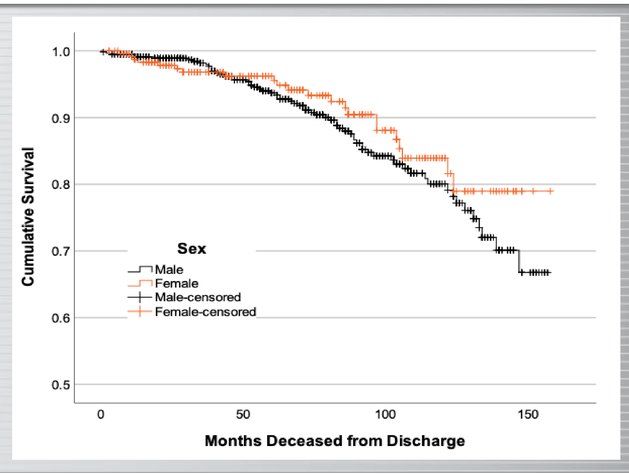

Figure 4. Cumulative survival in males vs. females after discharge from Phase II Cardiac Rehabilitation (Males, *N* = 567; Females, *N* = 243)

Key References

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