The Obesity Paradox and Discrepancy between $O_2$ Consumption and Heart Failure Prognosis – It’s All in the Fat

Lorraine S. Evangelista, PhD, RN
Assistant Professor, UCLA School of Nursing
Objectives

- Demonstrate the paradox between obesity and heart failure prognosis.
- Discuss the rationale for correction of cardiopulmonary stress data (used as predictors of survival and listing of cardiac transplantation) for lean weight (as opposed to total body weight).
Case Study

- 59 y.o. man presented to the HF clinic for evaluation
  - Dyspnea on exertion, orthopnea, PND, edema lower extremities (NYHA class II to III status)
  - Optimized on diuretics, digitalis, ACE inhibitors, β-blockers, and spironolactone.
  - Ht 70’ wt, 217 lb, BMI, 31 kg/m²; 33% body fat.
  - Resting HR 60 bpm, BP 112/68 mm Hg.
  - CPX - max peak HR 130 bpm, BP 190/90 mm Hg.
    - Peak VO₂ 13.4 mL/kg/min, peak O₂ pulse (peak VO₂ /peak heart rate) 11.8 mL per beat
Obesity is a risk factor for the development of HF\textsuperscript{1-2}

- Obesity and HF often co-exist \textsuperscript{3}
  - 15\% to 35\% of patients with HF are obese
  - 30\% to 60\% of patients with HF are overweight
Intermediate Pathways

**Risk Factors**
- **Obesity**
  - Increased adiposity
  - Sympathetic nervous system↑
  - RAAS, Endothelin-1, vasopressin↑
  - Natriuretic peptides↑

**Diabetes**
- Glucose intolerance↓
- Insulin resistance
- Dyslipidemia
- Hypertension
- Hypercoagulability

**Intermediate Pathways**
- **Preload**
  - RA, RV
  - Blood volume
  - Plasma viscosity
  - Peripheral Resistance
  - Conduit stiffness

**Atrial Remodeling**
- LA

**LV Remodeling**
- LV

**PA Pressure**
- Afterload

**Hemodynamic changes**
- **Asymptomatic LV systolic & diastolic dysfunction**

Modified from Vasan RS. Heart 2003; 89;1127-29
The Obesity Paradox

Obesity in general is associated with ↑ mortality 4-11
Pts in the highest quintile had better event-free survival than pts in the lowest quintile.

In a logistic regression analysis, a higher % of body fat ($X^2, 9.1; P=.002$) was the strongest independent predictor of event-free survival.

For every 1% absolute ↑ in % of body fat, a ↓ in major clinical events exceeding 13% reported.

Cardiopulmonary Exercise (CPX)

- CPX has become the accepted standard for HF prognostication & risk stratification (RS) for transplant; Peak VO$_2$ >14 mL/kg/min cut-off value of RS$^{12-15}$
  - Peak VO$_2$ >18 mL/kg/min have a very good prognosis
  - Peak VO$_2$ <10 ml/kg/min have very poor prognosis

- Generally corrected for total wt (opposed to lean wt) despite the fact that fat is not aerobically active. $^{13,15}$

- CPX may lose prognostic power in some sub-groups with ↑% body fat – obese patients and women.

- In an era of β-blockers, adjusted exercise indices may predict better outcome.
These figures show that adjusted exercise indices (including peak VO2 and peak O2 pulse) predict prognosis better than non-adjusted indices.

Case Study Revisited

- Patient’s peak VO$_2$ & O$_2$ pulse corrected for lean body mass
  - $19.7 \text{ mL/kg/min}$ & $15.6 \text{ mL per beat}$.

- These adjusted indices suggest a favorable prognosis; thus patient can qualify for a heart transplant.

- Recommendations: consistently have the peak VO$_2$ lean reported and utilize these values in evaluating sub-groups of patients.
References