Pathophysiology of Exercise Intolerance in Hypertrophic Cardiomyopathy:

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Introduction:

Hypertrophic Cardiomyopathy:

Hypertrophic cardiomyopathy is a commonly inherited genetic disorder characterised by left ventricular enlargement in the absence of any secondary cause. Diagnosis of hypertrophic cardiomyopathy without any former family history is confirmed by the presence of a left ventricular wall thickness ≥ 15mm (fig 1).

Hypertrophic cardiomyopathy is thought to affect 1 in 500 individuals, however many are asymptomatic, and therefore the actual prevalence is predicted to be higher[1].

Common symptoms include:

- Chest palpitations and pain
- Dizziness or fainting
- Breathlessness
- Tiredness

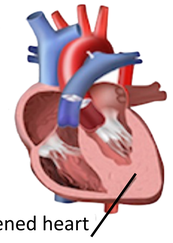

Figure 1 – Hypertrophic left ventricle

Link to Exercise Intolerance:

Exercise tolerance is the ability of the heart to pump enough oxygen rich blood and for the skeletal muscles to utilise delivered oxygen during exercise. It is defined as VO_2 (oxygen uptake) = QT (cardiac output) x AVO_{2DIFF} (arteriovenous oxygen difference). This study will look at the mechanisms that underpin the reduced exercise tolerance in hypertrophic cardiomyopathy patients in order to improve future treatments and quality of life[2].

Aim:

- To investigate the physiological mechanisms underlying exercise intolerance in HCM patients.

Methods:

1. **3 Hypertrophic cardiomyopathy patients and 3 matched controls**
2. **Baseline measurements** – including:
   - Heart rate
   - Blood pressure
   - Oxygen saturation
   - Temperature
   - ECG recording
3. **Exercise test** - metabolic function assessed

4. **Bioreactance** – cardiac output measurement at rest and peak exercise.

Results and Findings at Rest and Peak Exercise:

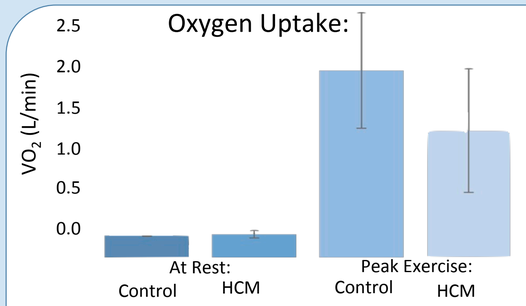

Figure 2: Quantification of mean oxygen uptake:

- No significant difference is seen between the different groups at rest and peak exercise.
- Initial data shows that there is a decrease in oxygen uptake for hypertrophic cardiomyopathy patients at peak exercise.

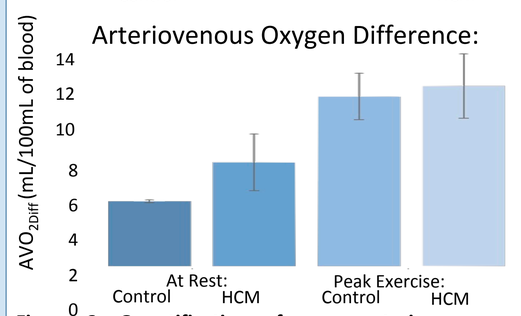

Figure 3: Quantification of mean arteriovenous oxygen difference:

- No significant difference between controls and patients at rest
- No significant difference between patients and controls at peak exercise.

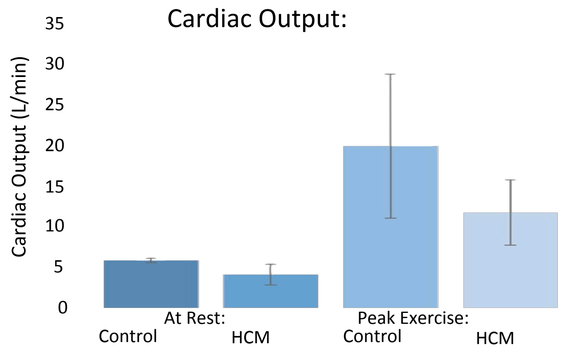

Figure 4: Quantification of mean cardiac output:

- Significant difference between controls and patients at rest
- No significant difference at peak exercise
- Mean data shows that hypertrophic cardiomyopathy patients have a lower cardiac output than controls.

Discussion and Conclusions:

- Cardiac output is potentially decreased in hypertrophic cardiomyopathy patients at rest and during exercise. Data seem to suggest that at rest, hypertrophic cardiomyopathy patients may not have symptoms of exercise intolerance due to increased utilisation of oxygen compared to control (fig 3).
- The above, might be a regulatory mechanism as during exercise, increased cardiac output is needed to ensure prolonged exercise tolerance.
- From the findings, we can conclude that a method of treatment could be to increase left ventricular chamber volume and/or use of vasodilators in order to reduce resistance and increase blood flow through the left ventricle into arteries.

References:

1. McCoy J, Bates M, Eggett C, Siervo M, Cassidy S, Newman J, Moore SA, Gorman G, Trenell MI, Velicki L, *et al.* Pathophysiology of exercise intolerance in chronic diseases: the role of diminished cardiac performance in mitochondrial and heart failure patients. Open Heart. 2017;4:e000632.
2. Geske JB, Ommen SR, Gersh BJ. Hypertrophic Cardiomyopathy: Clinical Update. JACC: Heart Failure. 2018;6(5):364-75.

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