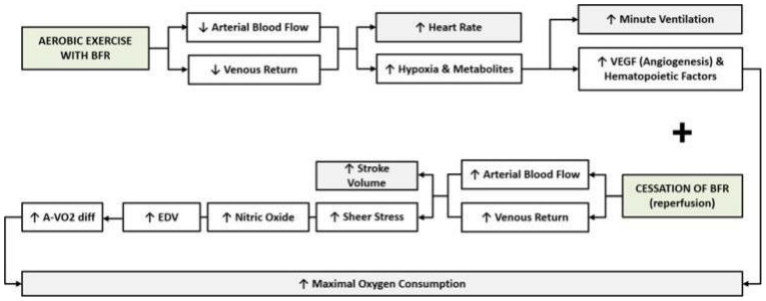
- Session Title: **Providing Blood Flow Restriction Exercise to Patients with Cardiovascular & Pulmonary Disease: A Practical Session**

- **Session Description**: Exercise training (ET) with blood flow restriction (BFR) is becoming increasingly popular in rehabilitation, allowing skeletal muscle strengthening and hypertrophy to be accomplished using lower workloads, fewer repetitions, and shorter durations.[1] These benefits have been seen across a variety of musculoskeletal conditions and age ranges. While the majority of BFR ET studies have evaluated these effects on skeletal muscle strength and hypertrophy, the effects of BFR ET on aerobic capacity have also been studied.[3-14] Aerobic ET with BFR has been shown to improve aerobic capacity due to the effects of hypoxia on vascular endothelial growth factor (VEGF) during BFR as well as the increase in endothelium-dependent vasodilation from increased shear stress and nitric oxide production during cuff release and reperfusion after BFR as shown in the below **Figure**.[3-15] Increased VEGF and endothelium-dependent vasodilation from BFR ET have the capacity to improve oxygen delivery and uptake. Furthermore, additional beneficial effects of BFR ET include improved autonomic nervous system activity as well as cardiorespiratory performance resulting in improvements in both cardiac and pulmonary function. The above literature will be reviewed and an extensive practical laboratory session will provide methods to apply and perform BFR ET in subjects with cardiovascular and pulmonary disease.



- **Teaching Method**: Didactic lecture mixed with clinical application and photos/videos as well as a laboratory session.

- **Objectives**:

1. Understand the mechanisms of action of BFR ET on increasing skeletal muscle strength and hypertrophy as well as improving bone health.

2. Understand the mechanisms of action of BFR ET on improving cardiovascular system function.

3. Understand the mechanisms of action of BFR ET on improving pulmonary function.

4. Understand the effects of ET with and without BFR training on maximal oxygen consumption and its clinical relevance for physical therapists and the clients/patients that they serve.

- **Clinician/educator takeaways/skills**: Understanding the mechanisms of action of BFR ET on skeletal muscle, the cardiovascular system, pulmonary function, and oxygen consumption as well as applying and performing BFR ET in subjects with cardiovascular and pulmonary disease.

- **Session Outline (90 min)**:

- Introduction and clinical relevance (5 min) - Cahalin
    - Introduce speakers and brief overview of BFR exercise training
- BFR Training: Strength and hypertrophy of skeletal muscle (10 min) - Owens
    - BFR training and strength
    - BFR training and hypertrophy
- BFR Training: Cardiovascular Benefits (10 min) - Cahalin
    - Blood flow restriction phase
        - At rest, during exercise, or during recovery after exercise?
    - Blood flow release (reperfusion) phase
        - At rest, during exercise, or during recovery after exercise?
    - Mechanisms of action improving cardiovascular function
- BFR Training: Pulmonary Benefits (10 min) - Bajafar
    - Blood flow restriction phase
        - At rest, during exercise, or during recovery after exercise?
    - Blood flow release (reperfusion) phase
        - At rest, during exercise, or during recovery after exercise?
    - Mechanisms of action improving pulmonary function
- BFR Exercise Training Laboratory Session with Question & Answer Period (50 min) – All Speakers
- Final Question & Answer Period (5 min) – All Speakers

- **Content Level**: Intermediate to Advanced

- **Copyright Permission**: I confirm that all graphs, charts, and photographs to be presented are original work or will have published copyright permissions: **Yes**
- **References**:

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- **Biographical Information For Each Speaker**:

Lawrence P. Cahalin PhD, PT, CCS is a Professor in the Department of Physical Therapy at the University of Miami in Miami, Florida. He received his BS in Physical Therapy at Saint Louis University, a MA in Physical Therapy at the University of Iowa, and a PhD in Gerontology at the University of Massachusetts Boston. He enjoys integrating the interrelatedness of the cardiovascular, pulmonary, and muscular systems using novel examination and management techniques. Dr. Cahalin has been actively involved in clinical research and clinical practice in cardiovascular and pulmonary physical therapy for over 40 years.

Johnny Owens BS, MPT is Director of Clinical Education for Owens Recovery Science, INC and a Clinical Researcher at the Center for the Intrepid at San Antonio Military Medical Center where he was formerly the Chief of Human Performance Optimization Programs. He completed his undergraduate course work in Biology at The University of Texas at Austin and earned his Masters in Physical Therapy at The University of Texas Medical Branch. He serves as a medical consultant for teams in the NFL, NBA, MLB, NHL and collegiate sports. He is also involved in numerous clinical trials involving regenerative medicine, sports medicine, blood flow restriction and high energy trauma. Owens has been published extensively in the peer-reviewed literature, regularly speaks at the national and international level and his work has been featured on 60 Minutes, Time Magazine, NPR, Discovery Channel and ESPN.

Dr. Gabriela Tenorio PT, DPT, is completing a Cardiovascular and Pulmonary Physical Therapy Residency at the University of Miami/Jackson Health System. Her interests include cardiopulmonary and critical care rehabilitation, particularly among medically complex patients requiring mechanical circulatory and ventilatory support. At the APTA CVP Academy Fall Conference, she will present a case report on the feasibility of low-load blood flow restriction training during CVICU rehabilitation in a patient supported by an axillary Impella while awaiting heart transplantation.