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Intérêt de l'entrainement avec BFR Blood Flow resctriction



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☑ Je n'ai pas de lien d'intérêt potentiel à déclarer



Two axes

Physiopathological aspects of ICUAW

Very Low dose of exercise during Critical illness





Critical illness Inflammation



Exercise	e in ICU				
Delayed intervention	Unsufficient workload	Sufficient workload	Ideal and safe workload	Maximal safe workload	Excessive/risked workload
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ROS in exercise

reactive oxygen species

He F. et al 2016 Frontiers in physiology





Oxidative stress can occur when the generation of ROS exceeds the ability of the antioxidant system Moderate exposure to ROS is necessary to induce adaptive antioxidant defense mechanisms

Hypoxia in skeletal muscle

Normobaric Hypoxic chamber (FiO2: 12-16%)



Blood flow restriction training



Skeletal muscle



Chronic hypoxia



Increase in:

- Protein turnover (degradation>synthesis)

- Inflammation

Decrease in:

- Physical activity
- Sleep
- Appetite

High Altitude (Hypobaric Hypoxia)



Critical illness + immobilization







Blood flow restriction (BFR) training

It was originally developed in Japan in the late 1970s termed as KAATSU training.



Vopat BG.

2020

JAAOS



Exercise modality

Aerobic-exersice Low-moderate intensity 40-60% VO₂max









Passive BFR (without exercise)

BFR + passive exercise

BFR + EMS



Patterson SD. *Front. Physiol.* 2019



Passive BFR



Figure 2—Relative decreases in muscular cross-sectional area during the period between 3rd and 14th days after the operation. Symbols just above the columns denote statistically significant changes from CSAs measured on the 3rd day after the operation (* P < 0.05 Wilcoxon signed-ranks test), whereas † denotes significant difference between control and experimental groups (P < 0.05, Mann-Whitney U-test). Surgical reconstruction of the anterior cruciate ligament (ACL) Day 3 to 14 180 – 260 mmHg



Takarada J. 2000 Medicine and Science in Sports and Exercise





BFR passive mobilization

20 ICU patients

Blood flow restriction prevented **6.5% of** muscle wasting



Control Leg: <u>Passive mobilization</u>: 3x 15 knee flexion-extension

Intervention Leg: Passive mobilization + blood flow restriction: (80% of tibial artery systolic blood pressure)

n = (age: 66 ± 4.3y) every day during the ICU stay





BFR + NEMS 9 spinal cord injury patients





The increase in endothelial-dependent nitric oxide secretion with BFR may likely contribute to skeletal muscle hypertrophy and improvement in FMD in persons with SCI. Flow mediated dilatation Spinal cord injury

6 weeks of training, twice weekly for 30 min

Fig. 1 Changes in skeletal muscle CSAs of ECRL and EDC following 6 weeks of training using NMES+BFR or NMES alone. * Statistical significance in ERCL CSA from pre-training to post-training; # statistical significance in ECRL between NMES+BFR and NMES alone following 6 weeks of training

Gorgey AS 2016 Eur J Appl Physiol



BLOOD FLOW RESTRICTION TRAINING AND THE EXERCISE PRESSOR REFLEX



Spranger MD 2015 Am J Physiol Heart Circ Physiol



BLOOD FLOW RESTRICTION TRAINING AND THE EXERCISE PRESSOR REFLEX



Spranger MD 2015 Am J Physiol Heart Circ Physiol



Portential risks

Application and side effects of blood flow restriction technique

A cross-sectional questionnaire survey of professionals

Victor Sabino de Queiros, MD^{a,*}, Matheus Dantas, MD^a, Gabriel Rodrigues Neto, PhD^b, Luiz Felipe da Silva, MD^a, Marina Gonçalves Assis, BSc^c, Paulo Francisco Almeida-Neto, MD^a, Paulo Moreira Silva Dantas, PhD^a, Breno Guilherme de Araújo Tinôco Cabral, PhD^a



Patterson SD. *Front. Physiol.* 2019

Blood Flow Restriction Exercise: Considerations of Methodology, Application, and Safety

Stephen D. Patterson¹*, Luke Hughes¹, Stuart Warmington², Jamie Burr³, Brendan R. Scott⁴, Johnny Owens⁵, Takashi Abe⁶, Jakob L. Nielsen⁷, Cleiton Augusto Libardi⁸, Gilberto Laurentino⁹, Gabriel Rodrigues Neto¹⁰, Christopher Brandner¹¹, Juan Martin-Hernandez¹² and Jeremy Loenneke⁶





Figure 3. Reported side effects (A) and contraindications (B) for using BFR technique.

В

Future data in ICU population

STUDY PROTOCOL

Open Access

Check for updates

The effect of passive mobilization associated with blood flow restriction and combined with electrical stimulation on cardiorespiratory safety, neuromuscular adaptations, physical function, and quality of life in comatose patients in an ICU: a randomized controlled clinical trial

Thaís Marina Pires de Campos Blazon¹, Cleiton Augusto Libardi², Jose Carlos Bonjorno Junior³ Flávia Rossi Caruso¹, Tamara Rodrigues da Silva Destro¹, Naiara Garcia Molina¹, Audrey Borghi Renata Gonçalves Mendes^{1*}¹⁰

STUDY PROTOCOL

Repetitive vascular occlusion stimulus (RVOS) versus standard care to prevent muscle wasting in critically ill patients (ROSProx):a study protocol for a pilot randomised controlled trial

Ismita Chhetri^{1,2}, Julie E. A. Hunt², Jeewaka R. Mendis², Stephen D. Patterson³, Zudin A. Puthucheary^{4,5,6,7,8}, Hugh E. Montgomery^{5,6} and Benedict C. Creagh-Brown^{1,2*}



Open Access



Conclusion

Enhancing exercise benefices at very low intensity/duration exercise is particularly attractive for the ICU population.

There are emerging literature in the ICU population to assess the feasibility, safety, practical application and appropriate selection of patients.