Thrombosis in Space & Clotting Risk in COVID-19

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European Innovative Partnership Active & Healthy Aging Falls Prevention Task Force
After over 50 years of spaceflight, a **new risk** with the **potential to derail missions and seriously harm astronauts** appeared,

**clot in neck vein**

- with little forewarning:

• Started in 2020 January

• Nandu Goswami, Medical University of Graz (Co-Ordinator)

• 22 Members:
  - Austria
  - Belgium
  - Canada
  - France
  - Germany
  - Norway
  - Slovenia
  - UK
  - USA
COVID-19

Endothelium

Regulation of:
- Coagulation
- Fibrinolysis
- Vascular tone

Pathogenesis:
- Atherosclerosis
- Hypertension
- Heart failure

Heart Attack
Atherosclerosis
Coronary Artery Disease
Thrombosis

- Pro-coagulatory parameters
- Anti-coagulatory parameters

Goswami et al. (2020) J Clin Med. 9(10)
Goswami et al. (2020) J Clin Med. 9(11).

**ESA bedrest project:** “Coagulation and bed rest” (PI)

**EDCTP project:** “EndoCOVId” (PI)
European Developing Countries Trial Partnership (EDCTP) project:

“EndoCOVID” (2021-2023)

Risk of Coagulation in COVID-19 patients with HIV and receiving Anti-Retroviral Therapy

• Nandu Goswami, Medical University of Graz, Austria (Co-Ordinator)
• Benedicta Nkeh Chungag, Walger Sisulu University, S. Africa
• Simiat Elias, Lagos State Univ College of Medicine, Nigeria
• Knut Lundin, University of Oslo, Norway
"Dry" Immersion


**ESA project: Thromboembolism risk (PI)**
6 degree Head Down Tilt

Bedrest Confinement in Older Persons
Frailty: A Vicious Cycle

Immobilization → further → De-conditioning

Falls / Fear of falling
“Gravitational Physiology, Aging and Medicine” Unit

- Nandu Goswami
- Jerry Batzel
- Johann Wagner
- Andreas Rössler
- Helmut Hinghofer-Szalkay
- Andreas Jantscher
- Bianca Brix

GPM
“Gravitational Physiology, Aging and Medicine” Unit

Geriatric Institutions

Space Agencies

Expertise

• Cardiovascular regulation
  - Hemodynamics
  - Hormones
  - Autonomic function

• Orthostatic intolerance

• Vascular health & function

Geriatric care institution
Universities
Research Centers
Communication Platforms
Companies

NASA
ESA
IBMP, Russia
DLR, Germany
MEDES, France
Simon Fraser University
Spaceflight studies support geriatric health on Earth

Understanding the links between spaceflight physiology and the aging process can lead to improvements in human health not only for astronauts living in microgravity but also for older people living on Earth. This article provides a general overview of important physiological consequences of spaceflight, the aging process in humans on Earth, and important connections between these physiological states.

Ever since our ancestors started walking upright, the human body has adapted to the effects of gravity. For example, during standing the human heart — despite being located below the brain — is able to pump enough blood to the brain against the force of gravity to maintain proper brain function. The pooling of blood in the legs — which occurs due to gravitational forces — is counteracted by the muscle pump in the lower limbs by one-way leg venous valves as well as by the action of breathing. Additionally, the weight-bearing bones and anti-gravity muscles have adapted during evolution to ensure adequate support during standing. Thus humans can stand up without any real problems. The real importance of gravity on physiological systems is, however, seen when gravity is reduced or taken away, as in the microgravity environment.
Selected International Collaborators

- Daniel Devigo, Pontifica University, Buenos Aires, **Argentina**
- Patrick DeBoever, VITO, Mol, **Belgium**
- Paul Dendale, University of Hasselt, **Belgium**
- Andrew Blaber, Simon Fraser Univ., Vancouver, **Canada**
- Yunfang Gao, Northwest Univ., Xian, **China**
- Ines Drenjancevic, Univ. Josip Juraj, Osijek, **Croatia**
- Jörn Rittwegger, German Space Agency (DLR), **Germany**
- Laszlo Simon, Semmelweis Univ., Budapest, **Hungary**
- Giovanna Valenti, Univ. of Bari, **Italy**
- Satoshi Iwase, Aichi Medical Univ., **Japan**
- Inessa Kozlovskaya, IBMP, Moscow, **Russia**
- Rado Pisot, Univ. of Primorska, **Slovenia**
- Hans Strijdom, Univ. of Stellenbosch, Cape Town, **South Africa**
- Benedicta Chungag, Walter Sisulu University, Mthatha, **South Africa**
- Jean-Pierre Montani, University of Fribourg, **Switzerland**
- Simiat Elias, Lagos State Univ. College of Medicine, **Nigeria**
- Voyko Kavacic, Institute of Gerontology, Wayne State University, Michigan, **USA**
- Germaine Cornillessen, Halsberg Chronobiology Center, Minnesota, **USA**
International Co-operation for Space Life Sciences Knowledge Sharing & Development in Africa

International Academy of Astronautics (IAA):
Commission 2 - Space Life Sciences Study Group Report

Increasing Awareness and Collaboration: Needs

- Intercollaborative effort
- Interdisciplinarity
- Transdisciplinarity
- More willing partners
- Joint projects
- Repository of knowledge
- Consensus statements
- Systematic reviews/ meta-analysis
Fostering collaboration and dissemination of knowledge: Tools

- Regular meetings via ESA support: Webex

- SharePoint folder provided by ESA

- Tools to perform state-of-the-art systematic literature reviews in the field of Aerospace Medicine: Newcastle University's online resource:

  Space Biomedicine SR Methods (google.com)

  https://sites.google.com/view/sr-methods/home
Challenges Encountered in Developing Collaboration and Knowledge Sharing

- Interdisciplinarity issues
- Transdisciplinarity issues
- Lack of a repository where knowledge could be shared
- Sustainability of the group’s interest and focus
- Continuity of the project/ theme/ knowledge in the future