

Hibernation mechanism found in ICU patients with diaphragm contractile weakness due to mechanical ventilation

July 31 2024



Credit: Pixabay/CC0 Public Domain

The diaphragm is the most important breathing muscle. Researchers from Amsterdam UMC have found a new mechanism explaining

diaphragm weakness that arises during mechanical ventilation in the intensive care unit (ICU).

These findings were published in *Science Translational Medicine*. The research has great potential for future [drug development](#) to combat negative consequences of [mechanical ventilation](#).

"Since the corona pandemic, mechanical ventilation in the ICU has gained lots of attention. The failure to wean from ventilation costs many lives, as well as billions of euros per year. Our discovery will further boost the development of drugs that wake up hibernating proteins in the respiratory muscles to facilitate weaning from ventilation," says Coen Ottenheijm, professor of acquired and inherited muscle disease at Amsterdam UMC.

Mechanical ventilation

Patients who receive mechanical [ventilation](#) in the intensive care unit (ICU) often develop contractile weakness of the [diaphragm](#) muscle. This weakness can lead to difficulties in weaning from the ventilator and extubation failure. Weaning is the process of gradually decreasing respiratory support until patients are able to breathe independently from the ventilator. Difficulties during this process negatively affect mortality and have a major impact on the use of health care resources.

New mechanism of hibernation

Ottenheijm and his group have discovered a new mechanism that leads to weakness of the diaphragm in ICU patients. The muscles of these patients go into a state of hibernation. The researchers found that the main muscle protein, myosin, is trapped in an energy-sparing state in diaphragm muscle cells of ventilated ICU patients. At first, this state

benefits patients: The spared energy is available for overcoming critical illness. However, once recovered, patients must be weaned from the ventilator. Yet, the hibernating myosins are difficult to reactivate, and this compromises diaphragm strength and independent breathing.

Drug development

With this [research](#), Ottenheijm and colleagues also show that small molecule troponin activators can restore the force levels in diaphragm [muscle](#) cells of ventilated ICU patients. This could be a lead for [drug](#) development to "wake up" the muscles of these patients from the state of hibernation. In fact, the authors will soon start studies to test the efficacy of these drugs in ICU patients.

More information: Marloes van den Berg et al, Super-relaxed myosins contribute to respiratory muscle hibernation in mechanically ventilated patients, *Science Translational Medicine* (2024). [DOI: 10.1126/scitranslmed.adg3894](https://doi.org/10.1126/scitranslmed.adg3894).
www.science.org/doi/10.1126/scitranslmed.adg3894

Provided by Amsterdam University Medical Centers

Citation: Hibernation mechanism found in ICU patients with diaphragm contractile weakness due to mechanical ventilation (2024, July 31) retrieved 31 July 2024 from <https://medicalxpress.com/news/2024-07-hibernation-mechanism-icu-patients-diaphragm.html>

<p>This document is subject to copyright. Apart from any fair dealing for the purpose of private study or research, no part may be reproduced without the written permission. The content is provided for information purposes only.</p>
--