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Many ICU patients trade critical illness for new illness, ICU-acquired weakness

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A growing number of patients are being discharged from intensive care units, cured of the critical illness that put them there but facing a new and potentially debilitating condition—ICU-acquired weakness.

Intensive care patients are known to lose muscle mass and function for many reasons, ranging from prolonged immobilization, to the effects of ICU treatments such as mechanical ventilation to the critical illness itself.

While the mechanisms of muscle atrophy (loss) and function during an ICU stay have been studied well, little research has been conducted into the cellular and molecular mechanisms responsible for recovering muscle strength over the long-term.

A new study published today in the *American Journal of Respiratory and Critical Care Medicine* found that some patients who continue to suffer from weakness six months after they were discharged from the ICU, demonstrate persistent muscle wasting, even when the biologic functions that commonly cause muscles to atrophy have returned to normal such as inflammation or the breakdown of proteins in muscle tissue.

Furthermore, there is no guarantee that reconstitution of muscle size, normalizes strength; patients who managed to regrow muscle remained weak. In some cases, this muscle weakness causes profound disability and reduced quality of life, and can last a lifetime, said the study's lead author, Dr. Jane Batt, a respirologist at St. Michael's Hospital.

"We know ICU patients lose muscle mass and function. Critical illness literally causes their muscles to dissolve," said Dr. Batt, a scientist in the hospital's Keenan Research Centre for Biomedical Science. "Some people grow it back and some don't. Some people can regrow the muscle, but it doesn't function properly."

Dr. Batt said the novel finding of her study was that sustained muscle atrophy in the long term is the result of impaired regrowth and is associated with a decrease in the number of satellite cells, the precursors to muscle cells.

"While satellite cells are not required for existing muscle fibres to grow in size, they are essential for the regeneration of injured muscle," she said. Decreased number of satellite cells also contribute to age-related muscle loss, she noted.

"Critical illness appears to permanently change muscle biology so your regenerative capacity seems to be lost," she said.

Dr. Batt said ICU-acquired weakness can be a profound disability.

"You may not be able to bathe yourself, feed yourself, go to the toilet yourself, dress yourself," she said. "This can be a very difficult life to live."

Dr. Batt's study looked at critically ill patients who had spent at least one week on a ventilator in an ICU. The study is the first phase of the MEND ICU research program, spearheaded by Dr. Batt and Dr. Claudia dos Santos, an intensivist at St. Michael's. It is part of the RECOVER program, a multi-centre study that evaluates patient and caregiver outcomes after prolonged mechanical ventilation with a goal of developing a family-centred rehabilitation program after severe critical illness.

The number of patients in the study was small, Dr Batt acknowledged. She said this reflected the difficulty in completing long-term mechanistic studies with people who experience critical illness, as many of those who wanted to take part in the study, died, had to return to the ICU, or developed other serious medical problems necessitating treatment that precluded safe continuation in the study.

A companion study was published in the *American Journal of Respiratory and Critical Care Medicine* in March by the RECOVER program lead, Dr. Margaret Herridge of Toronto General Hospital. That study found that critically ill patients who spend more than one week on ventilation can be divided into four risk groups and that the degree of disability seven days after discharge will determine the one-year mortality and recovery trajectory, including ICU and hospital readmission. The older the patient, the worse the disability, this study found, although the first risk group was patients in their early 40s.

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