

MEDIA RELEASE

22 May 2025

FROM SURVIVAL TO STRENGTH: PHYSICAL REHABILITATION DURING AND POST-ECMO CRUCIAL TO BETTER QUALITY OF LIFE AND FASTER RECOVERY

Awake life support and early rehabilitation efforts by multidisciplinary team at NUHCS and NUH help young patients regain strength after life-threatening illnesses



A multidisciplinary team from NUHCS and NUH working on a physical rehabilitation programme with an awake ECMO patient to improve muscle strength and speed up recovery

SINGAPORE — When 30-year-old Nathan Tan* was placed on extracorporeal life support after a particularly aggressive bout of pneumonia and eventually required a below-the-knee amputation, he thought he would be never able to dance again. When 22-year-old nursing student Gwendolyn Lye was placed on extracorporeal life support due to a failing heart, she wondered if she would survive. Fortunately for both young patients, they not only pulled through – they returned to doing what they love, thanks to early and intensive rehabilitation efforts that began while they were still critically ill.

Their journeys highlight the life-changing impact of rehabilitation during and after Extracorporeal Membrane Oxygenation (ECMO) life support, a highly specialised and



complex form of life support that takes over the functions of the heart and lungs when no other treatment works.

At the National University Heart Centre, Singapore (NUHCS) and the National University Hospital (NUH), a dedicated multidisciplinary team has been leading efforts to integrate rehabilitation into ECMO care, including a rare but promising approach: **awake ECMO** – a form of ECMO performed when patients are awake.

Fighting ICU-acquired weakness

Studies have shown that critically-ill patients, especially those in the intensive care unit (ICU), are at high risk of developing ICU-acquired weakness, a debilitating condition that can develop within the first 10 days of ICU admission.^{1, 2} Muscle loss in such patients is rapid and severe, where a quarter of muscle mass can be lost in just four days, and up to 50 per cent within a week. This often leads to longer hospital stays, higher mortality, and significant declines in quality of life and physical function.

Patients on ECMO are particularly vulnerable, as they are traditionally sedated and placed in a medically induced coma for an average of seven to 10 days. But at NUHCS, a national referral centre for patients needing advanced cardiopulmonary support such as ECMO, new approaches are shifting this paradigm.

Rehabilitation while on life support

Since last year, the NUHCS CTICU has successfully performed awake ECMO on three patients, with Gwendolyn being one of them.

As her heart was too weak for general anaesthesia, Gwendolyn remained conscious when she was put on ECMO. While on life support, her care team, which included CTICU nurses and physiotherapists, initiated gentle exercise sessions, which included assisted stretching and mobility drills, to prevent rapid loss of muscle mass.

Research has shown that in ICU patients, early physical rehabilitation can alleviate or prevent weakness syndromes, improve muscle strength, as well as decrease the duration of mechanical ventilation and length of ICU and hospital stay^{3,4}.

Dr Geetha Kayambu, Principal Physiotherapist and Lead in Physiotherapy Research at the Department of Rehabilitation at NUH, said: "The incorporation of physical rehabilitation exercise can prevent and mitigate the effects of ICU-acquired weakness, but this is particularly challenging in unconscious ECMO patients. By assisting patients with targeted movements while on awake ECMO, we help them return to function sooner which shortens their recovery time."

https://doi.org/10.1179/1743288X11Y.000000002

¹ Fazzini, B., Märkl, T., Costas, C. et al. The rate and assessment of muscle wasting during critical illness: a systematic review and meta-analysis. Crit Care 27, 2 (2023). https://doi.org/10.1186/s13054-022-04253-0.

² Hayes K, Holland AE, Pellegrino VA, Mathur S, Hodgson CL. Acute skeletal muscle wasting and relation to physical function in patients requiring extracorporeal membrane oxygenation (ECMO). J Crit Care. 2018 Dec;48:1-8. doi: 10.1016/j.jcrc.2018.08.002. Epub 2018 Aug 7. PMID: 30118978.

³ Kayambu G, Boots R, Paratz J. Physical therapy for the critically ill in the ICU: a systematic review and meta-analysis. Crit Care Med. 2013 Jun;41(6):1543-54. doi: 10.1097/CCM.0b013e31827ca637. PMID: 23528802.

⁴ Paratz, J. D., & Kayambu, G. (2011). Early exercise and attenuation of myopathy in the patient with sepsis in ICU. Physical Therapy Reviews, 16(1), 58–65.



Gwendolyn was eventually able to come off ECMO in just four days, half the average time for a patient on traditional ECMO. She has since recovered well and returned to her nursing studies.

Her quick recovery and return to good health highlight the potential of awake ECMO in supporting not just survival, but faster and more complete recovery.

Returning to the rhythm of life

Adjunct Associate Professor Ramanathan K.R., Senior Consultant in the Cardiothoracic ICU, Department of Cardiac, Thoracic and Vascular Surgery (CTVS) at NUHCS said: "We know that not all patients are suitable candidates for awake ECMO. Patient selection is critical, and we consider factors such as the severity of illness, ability to maintain a clear airway and tolerate life support while fully conscious. For some, traditional ECMO with sedation remains the safest approach."

In March 2023, Nathan had to be placed in an induced coma and connected to ECMO for a month after being diagnosed with severe pneumonia. While he eventually recovered following the ECMO procedure, his infection had caused gangrene, leading to a leg amputation.

An avid dancer, Nathan feared he would never be able to live a normal life again. However, with his strong willpower and support from his rehabilitation team, Nathan has not only gone back to work, but has also returned to dancing.

His first milestone post-surgery was to sit up and participate in exercises with the ICU physiotherapist during ECMO. Gradually, he progressed to building lower body strength through stationary cycling using cycle ergometry. Following his discharge from NUH, Nathan continued rehabilitation for six months at Alexandra Hospital (AH).

With hard work and perseverance, he eventually returned to the dance floor with a prosthetic leg in February 2024.

Nathan fondly recalls how his physiotherapists at NUHCS, NUH and AH had supported him every step of the way in his recovery journey, incorporating dance-inspired movements into his rehabilitation exercises after they realised that dancing was a core part of his identity. Their encouragement played a pivotal role in helping him regain confidence and eventually return to the art form he loves.

For both Nathan and Gwendolyn, their recovery emphasises how early and targeted rehabilitation, both during and post-ECMO, is key to restoring quality of life. Their stories also underscore the vital role of multidisciplinary teamwork in every stage of a patient's healing journey.

*Individual's name has been changed

Chinese Glossary



National University Heart Centre, Singapore	新加坡国立大学心脏中心
(NUHCS)	(国大心脏中心)
National University Hospital (NUH)	国立大学医院(国大医院)
Alexandra Hospital (AH)	亚历山大医院
Awake Extracorporeal Membrane Oxygenation (ECMO)	清醒体外膜肺氧合
Adjunct Associate Professor Ramanathan K.R. Senior Consultant Cardiothoracic ICU, Department of Cardiac, Thoracic and Vascular Surgery (CTVS) National University Heart Centre, Singapore (NUHCS)	Ramanathan K.R. 客座副教授 心胸加护病房 高级顾问医生 胸肺外科部门 国大心脏中心
Dr Geetha Kayambu Principal Physiotherapist and Lead in Physiotherapy Research Department of Rehabilitation National University Hospital (NUH)	Geetha Kayambu 博士 首席物理治疗师 物理治疗研究首席 复健中心 国大医院

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About the National University Heart Centre, Singapore (NUHCS)

The National University Heart Centre, Singapore (NUHCS) is an academic, national specialist centre under the National University Health System (NUHS). NUHCS brings together the resources, expertise and capabilities in the areas of Cardiology, Cardiothoracic and Vascular Surgery to better meet the needs of the growing number of patients with heart disease and raise the future generation of medical professionals.

As one of two national heart centres in Singapore for the treatment and management of complex cardiovascular diseases, NUHCS offers six core clinical programmes including Heart Failure & Cardiomyopathy, Structural Heart Disease, Acute Coronary Syndrome, Heart Rhythm, Congenital & Structural Heart Disease and Women's Heart Health. The centre has been awarded two institutional Peaks of Excellence for its Minimally-invasive Cardiothoracic Surgery and Aortic Centre Programme, and has been ranked top in Singapore for three consecutive years in 2022, 2023 and 2024 for the specialty of Cardiac Surgery in Newsweek's "World's Best Hospital" Award.

Comprising a team of internationally-recognised cardiologists and surgeons from the cardiothoracic and vascular specialties, NUHCS serves as a referral national centre for cardiothoracic and vascular conditions and provides a comprehensive approach to the treatment of these patients. The holistic patient-care approach is backed by leading translational research at the Cardiovascular Research Institute (CVRI) and Cardiovascular Metabolic Translational Program, all of which complements these



advanced quaternary clinical services to deliver state-of-the-art treatment solutions to the most challenging heart, lung and circulatory diseases.

NUHCS services span across four locations to serve the western and central locations in Singapore:

- NUHCS at National University Hospital (NUH), Kent Ridge Main Operations
- NUHCS Heart Clinic @ Ng Teng Fong General Hospital (NTFGH)
- NUHCS Heart Clinic @ Jurong Medical Centre (JMC)
- NUHCS Heart Clinic @ Alexandra Hospital (AH)

For more information, visit: <u>https://www.nuhcs.com.sg</u>.

About the National University Hospital (NUH)

The National University Hospital (NUH) is Singapore's leading university hospital. While the hospital at Kent Ridge first received its patients on 24 June 1985, our legacy started from 1905, the date of the founding of what is today the NUS Yong Loo Lin School of Medicine. NUH is the principal teaching hospital of the medical school.

Our unique identity as a university hospital is a key attraction for healthcare professionals who aspire to do more than practise tertiary medical care. We offer an environment where research and teaching are an integral part of medicine, and continue to shape medicine and transform care for the community we care for.

We are an academic medical centre with over 1,200 beds, serving more than one million patients a year with over 50 medical, surgical and dental specialties. NUH is the only public and not-for-profit hospital in Singapore to provide trusted care for adults, women and children under one roof, including the only paediatric kidney and liver transplant programme in the country.

The NUH is a key member of the National University Health System (NUHS), one of three public healthcare clusters in Singapore.