



Press Release

Amrita Institute of Medical Sciences (AIMS) in Kochi, India, Becomes the First Hospital in the World to Carry Out Bilateral Upper Limb Transplant using HEMO₂life[®]

HEMO₂life[®] oxygen carrier medical device derived from *Arenicola marina* lugworm facilitating grafts preservation without delayed graft function opens up new opportunities to complex transplants



Operating theater, Amrita Institute of Medical Sciences in Kochi, September 25th 2021

Morlaix (France), Kochi (India), November 9th, 2021 - Hemarina, a biotech company based in Brittany and Amrita Institute of Medical Sciences (AIMS) based in Kochi (Kerala) in India, announced today that on September 25th 2021, the first double upper limb transplant was performed on a young double amputee patient, using HEMO₂life[®] graft preservation technology based on physiological release of oxygen from *Arenicola marina* lugworm hemoglobin. For AIMS, it is the 9th double upper limb transplant surgery and the first one to be performed with HEMO₂life[®] medical device. Unlike kidney or liver transplants which are routinely conducted every week, approximately only around 200 hand transplants have been performed worldwide in the last 20 years and double upper limb transplants are extremely rare worldwide mainly due to the difficulty of the surgery which requires many hours of intervention and complex logistics involving a large number of doctors and paramedics.

In the present case, the recipient is a 34-year-old male, Mr Basavana Gowda, a farmer who lost both upper limbs at the proximal forearm level because of a high tension electrical burn injury, whereas the donor was a 25-year-old male who was pursuing his higher studies in France and was visiting India on holiday when he died. He was declared brain-dead after suffering hypoxic encephalopathy. Donor's father agreed to donate his upper limbs as well as other organs for transplants.

Vascular Composite allotransplantations (VCA) are a group of transplants used in reconstructive surgery in extreme cases such as limbs amputations or severe facial injuries. They are composed of several tissues with different metabolic rates with a great sensitivity to ischemia, high oxygen needs and immunogenicity.

Both Prof Mohit Sharma, Head of the department of Plastic and Reconstructive surgery at Amrita Institute of Medical Sciences and Prof Subramania Iyer, his senior colleague and Chairman of the department heard about HEMO₂life[®] technology through the case published in The Lancet¹ reporting the First human facial re-transplantation driven by Prof Laurent Lantieri, Department of Plastic, Reconstructive, and Aesthetic Surgery, Hospital European Georges Pompidou, Assistance Publique - Hôpitaux de Paris in 2017 and identified that HEMO₂life[®] could solve many problems encountered during such complex surgeries amplified by the fact that a bilateral upper arms transplantation required much more time and consequently much more oxygen.

HEMO₂life[®] is composed of an extracellular hemoglobin extracted from *Arenicola marina* discovered by a biomimetic approach. Indeed, this lugworm contains human hemoglobins ancestor which were not included in a red blood cell 450 million years ago, since the marine organisms first appeared on earth. This lugworm is in a position to remain at least 6 hours without breathing thanks to his hemoglobin which fills with oxygen at high tide. It was able to cope with tides phenomenon. High tide / low tide cycle is similar to ischemia-reperfusion in medicine. A graft disconnected from the donor is oxygen-deprived can be compared to low tide lugworm living on its oxygen supply. Providing lugworm oxygen-rich hemoglobin to the graft helps it getting enough physiological oxygen to be maintained alive, despite being disconnected. This universal oxygen carrier was developed after several years of research carried out by the breton biotech company Hemarina and is the first product clinically efficient in the prevention of ischemia/reperfusion in organ transplant.

This world first bilateral upper limbs transplant using HEMO₂life[®] was unique in many aspects. Indeed, this complex surgery took 14 hours of operating time, involving 10 plastic and reconstructive surgeons, 4 orthopaedic surgeons, 6 anaesthesiologists and 25 supporting staff including many scrub nurses.

“In case of vascular composite allotransplantations, it is very important to restore circulation early so that the oxygen could be delivered to the tissues and permanent damage to the muscles and nerves is avoided. The use of HEMO₂life[®] is an important advance as it releases the oxygen in to the tissues even before the start of the circulation minimizing the impact of ischemia/ reperfusion injury. In this particular case, transplants were done in the upper third of the forearms. A special attention was given to minimize the ischemic time and prevent graft damage” declared Prof Mohit Sharma, who adds *“Safe and efficient dissection of the donor’s upper limbs maintaining the correct bone alignment restoring the circulation efficiently accurate repair of nerves and muscle overlapping is very challenging at this level of transplantation. Based on our clinical observations, we noticed a significant reduction in cold ischemia time: only 10 minutes were necessary for the cold hands to get fully perfused after opening the anastomosis, compared to approximately one hour time in the previous cases where the HEMO₂life[®] oxygen carrier had not been used”*.

“Mr Basavana has accepted the donor’s upper limbs and is showing promising signs of recovery. He has been shifted out of the intensive care unit and is receiving daily active and passive physical therapy. As this is proximal forearm level transplantation, he will be able to actively move his fingers only after a few months time when the neural innervation of his forearm muscles is adequate. He is actively

^{1 1} First human facial retransplantation: 30-month follow-up
Lantieri et al.

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[https://www.thelancet.com/journals/lancet/article/PIIS0140-6736\(20\)32438-7/fulltext](https://www.thelancet.com/journals/lancet/article/PIIS0140-6736(20)32438-7/fulltext)

supported by a dedicated team of physical therapists and his loving family” added Prof Subramania Iyer.

“We are extremely proud that our technology has made it possible this world first, for the patient and his family and also for our contribution to such a major medical advance in a surgery as complex as the transplantation of two arms. This world premiere done in India confirms the potential value of HEMO₂life[®] containing M101, a molecule allowing the physiological transport of oxygen and its release without oxidative damage” concluded Dr Franck Zal, founder and CEO of Hemarina who adds “The use of HEMO₂life[®] in this surgical procedure proves one more time the interest of the M101 compound used as an innovative oxygen carrier replacing red blood cells in various ischemical pathologies. HEMO₂life[®] demonstrated again its safety and its tolerance on a recipient after perfusion of his limbs with a large amount of product. I would like to express my sincere thanks and my deep respect to all medical teams involved in this extraordinary surgical operation which gives hope to all complex transplantations”.

About Hemarina

Hemarina is a company founded in 2007 and headquartered in Morlaix (France). The company specializes in the development of universal therapeutic oxygen carriers derived from marine invertebrates. Hemarina has a technical & commercial affiliate in Boston (Hemarina, Inc.) and a production subsidiary for its raw materials located on the island of Noirmoutier. Hemarina is developing several breakthrough innovative medical devices using its hemoglobin M101 platform.

For more information, visit the website: <https://www.hemarina.com/>

About Amrita Institute of Medical Sciences

Amrita Institute of Medical Sciences (Amrita Hospital), based in Kochi, Kerala, is recognised as one of the premier hospitals in South Asia. Our commitment to affordable quality care has attracted a dedicated team of highly qualified medical professionals and other healthcare professionals from across the world to provide the highest standards of medical treatment. Founded in 1998 by Mata Amritanandamayi Devi (known worldwide as AMMA), Amrita Hospital offers a full range of primary and specialty care medical services, with cross-specialty consultation. AMMA’s vision of providing advanced medical care to the poor and disadvantaged was the inspiration for Amrita Hospital, which today is a 1100-bed (490 units) tertiary referral and teaching hospital, serving more than 10 lakh outpatients and more than 70,000 inpatients annually. The massive healthcare infrastructure with over 3.33 million sq.ft. of built-up area, spread over 125 acres of land, supports a daily patient volume of approximately 3500 outpatients with 95 percent inpatient occupancy. There are 12 superspeciality departments, 45 other departments, 4500 support staff and 670 faculty members.

For more information, visit the website: <https://www.amritahospitals.org/>

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