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**ASSOCIATE PROFESSOR THEODOROS KOFIDIS**, head and senior consultant of the department of cardiac, thoracic and vascular surgery at NUHCS, on the use of holographic technology.

Associate Professor Theodoros Kofidis (centre), from the National University Heart Centre, Singapore (NUHCS), with (from far left) Mr Ng Kian Wei, data scientist at the National University Health System; Dr Ilias Skaltsiotis, clinical fellow at NUHCS; Dr Chang Guohao, consultant surgeon at NUHCS; and Dr Gao Yuja, associate consultant at the National University Hospital, all of whom were part of the team behind Singapore's first holography-guided heart operation. They are holding the HoloLens 2, which enables surgeons to see a three-dimensional hologram of a patient's heart.  
ST PHOTO: NG SOR LIUAN

## Holographic visor helps surgeons see with 'X-ray' vision

Use of tech allows NUHCS to better plan surgery, anticipate problems

Clara Chong

A science-fiction trope has turned into reality with Singapore's first holography-guided heart operation successfully conducted by a team of surgeons from the National University Heart Centre, Singapore (NUHCS).

The doctors, wearing holographic visors, could see a three-dimensional (3D) hologram of the patient's heart - derived from a CT scan and projected into space - giving them a coloured "X-ray" vision of the exact inner organ anatomy and position in space, as if they could peek through the chest wall in real time.

The technology serves mainly as

an aid for doctors to better plan surgery and anticipate potential difficulties, potentially reducing trauma and bleeding complications that might arise during surgery.

"(It) is especially useful for patients with unusual anatomy, allowing us to get the best operative view and make the smallest cut possible," said Associate Professor

Theodoros Kofidis, head and senior consultant of the department of cardiac, thoracic and vascular surgery at NUHCS.

"The technology allows us to know the exact location and which angle to make the incision and cut the chest during (the) operation, as well as provide a guide during the initial part of the surgery on whether the procedure is going to be a simple or challenging one."

Prof Kofidis carried out what was reportedly the world's first holography-guided minimally-invasive adult heart operation in late October last year.

Since then, four other patients have had this technology used for heart surgery.

So far, the National University Hospital (NUH) is the only hospital in Singapore with this technology. Some hospitals in countries such as South Korea, Japan and China have also adopted this technology.

The surgeons are able to move, resize and rotate the 3D hologram with simple gestures, as well as superimpose the hologram onto the patient's chest during surgery.

The first patient was a 75-year-old man diagnosed with advanced-

stage aortic valve leakage, a condition that occurs when the heart's aortic valve does not close tightly, resulting in some back flow of blood.

The man's heart was dilated and losing function, and he needed a valve replacement, which could be done through keyhole surgery.

"This means that we planned for a tiny cut - totally endoscopic procedure - and so anticipated to work in a very confined space... the HoloLens 2 helped me place my incision exactly in the right spot, through the space between the ribs, and at the right height on the chest, so I was exactly over the area where I needed to work," Prof Kofidis said.

HoloLens 2 is a pair of mixed-reality smart glasses from Microsoft through which a person can view the hologram.

"HoloLens 2 allowed me to assess the exact distance between the patient's heart structures... These are structures where essential tools will go in," he added.

The HoloLens also helped Prof Kofidis anticipate the difficulty of the procedure, any complications such as bleeding, which instru-

ments are most optimum, and how best to manage his team.

This successful use of holographic technology in heart surgery has been submitted for publication at the International Society for Minimally Invasive Cardiac Surgery conference, set to take place in Europe in June.

Higher numbers of holographic-assisted heart operations will need to be conducted to determine the extent to which patient outcomes have improved.

HoloLens 2 may be especially useful when it comes to congenital heart surgery on children to correct birth defects, as it would allow the patients and their family to visualise the defect, as well as understand the surgical plan, Prof Kofidis said.

Currently, there is no additional cost of using this technology compared with conventional procedures.

Holomedicine technology was first used in NUH's neurosurgery department in 2020 to spatially locate brain tumours when operating on patients.

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