# Hualien Tzu Chi Hospital Advanced Hybrid Operating Room Activated

**The cardiology department, cardiac surgical department, and the medical team of Hualien Tzu Chi Hospital jointly performs the transcatheter aortic valve implantation (TAVI) in the advanced hybrid operating room, and the patient Hsu En-Li recovers well after the surgery.**

**By/ Huang Szu-Chi**

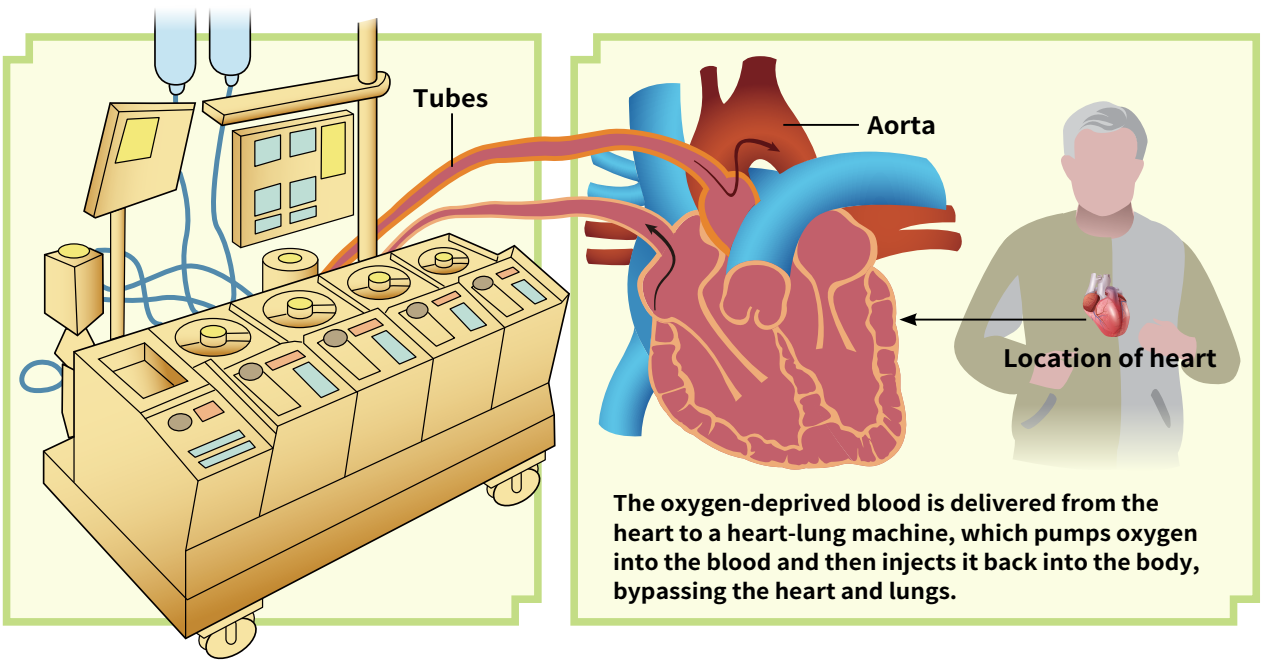
If you start to experience tightness in the chest, dizziness, or shortness of breath as you grow older, please see a doctor for a check-up to see if there is a heart problem.

Everyone wants to live an open-hearted life, but when the word "open-heart" scares people, because it implies a major surgery that require a 20 cm incision in the chest, and connection to a heart-lung machine while your heart stops beating. With the advancement of medical technology, minimally invasive surgery with small wounds has replaced the traditional open heart surgery; now, there is a new option that is more minimally invasive than minimally invasive: hybrid cardiac surgery. Hybrid cardiac surgery is a combined approach by the interventional cardiologist(s) and the cardiac surgeon(s), and the advantages are smaller incision, faster operating time, and quicker recovery time.

**Hualien Tzu Chi Hospital has set up an "Advanced Hybrid Operating Room" to allow cardiological and cardiac surgical teams to work together in the operating room to complete heart surgery in the shortest possible time.**

## Traditional Open Heart Surgery

In traditional open heart surgery, an artificial heart-lung machine is used to make the heart still for a while.




**The oxygen-deprived blood is delivered from the heart to a heart-lung machine, which pumps oxygen into the blood and then injects it back into the body, bypassing the heart and lungs.**

### Aortic Valve Degeneration or Disease

The aortic valve is the outlet for blood from the heart, and like many organs and tissues in the human body, it may degenerate with age, or experience abnormalities due to diseases, which is known as aortic valve stenosis, where your "heart gate" fails to open properly and leads to obstructed blood flow out of the heart and back flow of blood when heart contract. Dr. Chen Yu-Chih (Michael Chen), director of cardiology at Hualien Tzu Chi Hospital, said aortic valve stenosis is a common form of heart disease among the elderly, and the degeneration that comes with age or rheumatic heart disease can cause problems with the aortic valve. Just because it is common does not mean it's not dangerous, he added, because if left untreated and without proper treatment, the mortality rate of aortic valve stenosis is nearly 50 percent.

"Fainting is a critical indicator," Dr. Michael Chen stressed. When the aortic valve hardening, calcification and other lesions grow serious, it may cause

cardiac hypertrophy, and even heart failure. Dr. Chen said, when normal heart beat can no longer supply the blood flow necessary for the whole body, the human body will force the heart beat harder and harder in order to satisfy the demand, and as a result the heart muscles will become increasingly hypertrophied. The problem is, there is a limitation no matter how strong the muscle may be, and when the heart reaches that limit, it will enter into heart failure, where the heart gradually loses its function as if it is cancerous.

## Open Heart Surgery - from Minimally Invasive to Hybrid Surgery

Aortic valve surgery is one of the treatments for aortic stenosis. Dir. Chang Jui-Chih, Department of Surgery, Hualien Tzu Chi Hospital, warned that if people have symptoms such as angina pectoris, chest tightness, dizziness, or shortness of breath, they should see a doctor right away. Aortic valve abnormalities can be

**The team is performing transcatheter aortic valve implantation (TAVI). From left to right: Medical imaging technologist, cardiac surgeon Dr. Chan Chin-Yu, director of cardiac surgery Dr. Chang Jui-Chih, and director of cardiology, Dr. Chen Yu-Chih.**

identified clinically through ultrasound examination. if the degree of abnormality is less than moderate, regular follow-up will be arranged in conjunction with treatment with the cardiology department. If the abnormality is moderate or severe, which means symptoms like angina pectoris, chest tightness, dizziness and shortness of breath have all appeared, and heart failure is only few steps away, then aortic valve replacement is needed.

According to Dir. Chang, traditional aortic valve replacement surgery requires splitting the sternum, leaving a long, straight scar of 20 cm in length on the chest after the surgery. In traditional open heart aortic valve replacement surgery, the patient must be connected to a heart-lung machine to keep the heart still, but the heart-lung machine may produce some inflammatory reactions, or may cause complications such as pneumonia and kidney failure. The minimally invasive aortic valve replacement can reduce the time on heart-lung machine with smaller wounds and faster recovery; however, it is still a burden to elderly patients or patients with chronic diseases. That is why TAVI (Transcatheter Aortic valve implantation), a new procedure where heart-lung machine is not required, becomes a new and important option. Not only does it significantly reduce surgery time, there is less bleeding and quicker recovery.

## Advanced Hybrid Operating Room Combines Cardiologist and Cardiac Surgeon

One of the most important prerequisites for a TAVI is a hybrid operating room. This is an integrated surgical platform that allows cardiologists and cardiac surgeons to work together in the same operating room to perform this complex procedure together. The advanced hybrid operating room is equipped with advanced X-ray imaging and positioning systems, so that valves can be replaced without the need to open the patient's chest.

In order to provide more accurate and appropriate medical services, Hualien Tzu Chi Hospital, after two years of planning, began to set up the first advanced hybrid operating room in Eastern Taiwan in 2019, and was completed in June. After a month of testing, four cases of TAVI were completed in August and September. Dr. Lin Shinn-Zong said that the advanced hybrid operating room can be used in different departments including orthopedics, cardiology, neurosurgery, and organ transplantation, which is of notable help to the medical team. He is grateful for the support and efforts of Master Cheng Yen, Tzu Chi Foundation and all the medical team members, who

all believe that these valuable resources can become an important force in protecting the health of our patients.

The key difference between the advanced hybrid operating room and a normal operating room is that the hybrid one has a built-in imaging system that can provide real-time images during surgery for more precise surgical treatment. According to Dir. Chang Jui-Chih of the Department of Surgery, the application of the advanced hybrid operating room in cardiac treatment allows the cardiology and surgery departments to jointly perform the TAVI. Aortic valve replacement can be accomplished by delivering a sutureless valve through a cardiac catheter to the junction of the aorta and the heart, with no need for a heart-lung machine, has small incision, and noticeably less bleeding. The fact that a heart-lung machine for extracorporeal circulation is not required can reduce surgical risk and is applicable to elderly patients or patients with chronic diseases who are not suitable for open heart surgery.

## No Need to Open the Chest, Small Wounds, Less Bleeding, Fast Recovery

Hsu En-Li, nearly 80 years of age, had a cardiac stent inserted in an out-of-town hospital for his cardiovascular disease, and was later admitted to Hualien Tzu Chi Hospital for dialysis due to kidney failure. Recently, his blood pressure began to drop suddenly when he was on dialysis, and his systolic pressure dropped to less than 90 mmHg despite having high blood pressure. He fainted and was sent to the emergency room, where he was found to have aortic valve stenosis after examination. Dr. Michael Chen pointed out that Hsu En-Li was already experiencing chest tightness, dizziness, and heavy breathing, and further testing indicated signs of heart failure, so after a discussion with Dir. Chang Jui-Chih, and considering the patient's physical condition, he recommended Hsu En-Li to undergo TAVI.

"I can finally breath now," Hsu said. He is especially grateful to the medical team led by Dr. Michael Chen and Dir. Chang Jui-Chih for giving him his life back. Before the aortic valve replacement surgery in early August, Hsu said, he was wheezing when walking and often felt like he was out of breath, and now these symptoms are all gone. That is why he wants to encourage other patients like him to see a doctor instead of toughing it out. "After the open heart surgery, I am now a happy man," said Hsu.

Most of the patients who have undergone TAVI at Hualien Tzu Chi

Hospital are in their eighties, only one of them is in his forties. According to Dir. Chang, this patient had an aortic dissection prior and had undergone open heart surgery, so there was adhesion to the heart and nearby blood vessels, and it would be dangerous to perform a second open heart surgery. One of the hardest challenges is successively remove the adhesion around the heart, he pointed out, a single tear to the heart and the patient may die on the operating table.

## Heavy Loading of Saving Lives Is Worth It

Traditional cardiac surgery is complex and may take more than ten hours. Now, inside the hybrid operating room, cardiologists and surgeons work hand-in-hand to solve patients' problems by taking advantage of new technology and new medical materials. The director of the Center for Surgical Medicine

**The "advanced hybrid operating room" is not only a platform for medical and surgical collaboration, but also allows medical imaging system to assist the surgery on-site and in realtime, so every member of the team has to wear a 6 kg lead apron under their germ-proof gown.**

**Transcatheter aortic valve implantation (TAVI), which does not require a heart-lung machine, is where the cardiologists insert a catheter into the patients' body, and the heart surgeon will then take over the procedure and deliver a new sutureless valve to the heart to replace or repair the valve that is no longer usable. Pictured are cardiologists Dr. Wang Ji-Hung (right) and Dr. Chen Yu-Chih (Michael Chen)(left).**

Development at Hualien Tzu Chi Hospital, Prof. Lai Hong-Shiee, said that the hybrid surgery performed in the advanced hybrid operating room is "patient-centered"; because it serves the patients' needs. Hybrid surgery is a gospel for patients who need both surgery and angiography. One of the trends of modern medical treatment is "team medical care". Advanced hybrid operating room is more than just a platform that facilitate the cooperation of medical and surgical departments, it also allows simultaneous diagnosis and operation through imaging medicine system and therefore permit far more accurate and timely surgeries.

Dr. Michael Chen said, "When we face our patients, aside from caring for and saving lives, cardiologists would often say that we must make a heart beats if it stops, and prevent it from not beating afterwards. However, during the process of treating patients, we often worry about whether the patients will

be afraid because of lack of understand or physical discomfort. Buddha said, treatment is more than just about treating peoples' diseases, it is about treating their heart as well. With the help of advanced technology, we can save more than just our patients' hearts and lives, but also to make them feel more comfortable and at ease throughout the process."

Ten minutes on the stage is worth ten years of work off the stage. The same logic can be applied to the "operating table" as well. Dir. Chang said, for patients, TAVI has faster surgery time, lesser bleeding, and quicker recovery; but these advantages is based on the additional time and effort from the medical team.


In addition to the two year of planning on the set up of the advanced hybrid operating room, take Mr. Hsu's surgery for example, the surgical procedure requires two cardiologists with more than ten years of experience in cardiac catheterization and cardiac pacemakers, two cardiac surgeons with more than ten years of experience in cardiovascular surgery, an anesthesia care team, a medical imaging team, operating room nurses and the administration staff all working together. Moreover, because of the imaging equipment used in the surgery, the team had to wear a six kilograms of lead aprons throughout the entire procedure. All these efforts are worth it when they see the smile of the patients and their families, Dir. Chang said.