

One-Stop Hybrid Approach for Cardiovascular Disease: From Conception to Practice

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The history of modern cardiac surgery extends only 50 years; however, cardiac surgeons currently experience a great challenge from the physicians of related disciplines. Catheter-based therapy has now been widely applied to patients who traditionally could be treated only by surgeons. The most simple congenital and coronary heart disease can be treated successfully by the percutaneous approach in many heart centers worldwide. In Western countries, the workload of the cardiac surgery program has been decreased dramatically within the past decade.

The major disadvantage of cardiac surgery is the huge surgical trauma, which arouses surgeons' enthusiasm to minimize the incision and avoid the cardiopulmonary bypass. Furthermore, surgeons gradually understand the notion that the application of catheter-based therapy does not belong solely to the invasive cardiologists; therefore we should embrace all emerging techniques for our patients.

A hybrid approach for cardiovascular disease is a mixture of therapies from different subspecialties and a combination between surgical and catheter-based intervention for heart disease. This idea was advocated by Angelini and associates in *Lancet* in 1996 when they combined percutaneous transluminal coronary angioplasty and minimally invasive direct coronary bypass surgery to treat multivessel coronary heart disease.¹⁾ Six years later, another group from London reported its preliminary experiences of the intraoperative application of stenting for the management of complex heart disease.²⁾ But until now most hybrid procedures were performed in sequence in a catheter lab or operation room. In an

excellent worldwide review of 10 years of experiences regarding the hybrid approach to coronary heart disease, simultaneous hybrid revascularization strategy was applied in only 22 out of a total of 367 cases.³⁾

With the development of devices and techniques of real-time imaging, setting up a truly hybrid operation room to perform both surgery and catheterization at the same table and at the same time became a reality. Such a one-stop operation could not only reduce the applications of anesthesia and the unnecessary patient transfer; most important, it offered a new platform to promote cardiologists and surgeons working together to minimize the trauma and to improve the outcomes for the patients. It actually practiced the principle of "Patients Always First" and the mission to provide incremental benefits to patients.

Three elements are involved in the one-stop hybrid approach. First, the procedure should be performed in a hybrid operation room that is equipped with fluoroscopy, echocardiography, and other diagnostic imaging outfits. Second, the use of intraoperative imaging techniques should be extensive. And third, both the cardiac surgeon and the invasive cardiologist can use a catheter-based device with or without the chest being opened. In other words, the cardiologists can perform regular percutaneous treatment before or after open chest surgery with respect to the subject adult heart disease. Alternatively, during the chest opening the surgeons can apply the devices freely with no weight or vascular-access limitation for the newborns.

In June 2006, we started the first program of one-stop hybrid approach for heart disease in China, and this program included treatments for both congenital and acquired heart disease. Intraoperative echocardiography is still the most popular imaging approach to guide the one-stop procedures.⁴⁾ In a series of hybrid procedures for neonates with pulmonary atresia with intact ventricular septum, the epicardial echo probe was placed, and it guided the open-chest percutaneous balloon perforation and valvuloplasty.⁵⁾ For the management of Fallot's tetralogy with major aorto-

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pulmonary collateral arteries, cardioangiography was performed first, and then the invasive cardiologists would deliver the occluder percutaneously. Lastly the surgeons opened the chest and repaired the defects with a conventional approach. Compared with the above open-chest perventricular devices treatment, the current institute protocol for major collateral arteries is another typical procedure of hybrid approach, which will allow all procedures to be performed by the cardiac surgeon and cardiologists in a single specially designed room.

Avoiding the utility of a pump and choosing the minimal incision have been landmarks in the development of cardiac surgery. So could the hybrid approach be the next wave for cardiac surgery in this new century?

With the developments of image techniques, more image outfits could be included, such as intracardiac and 3-D echo and magnetic resonance imaging. How to design and manage such a complicated operation room will be a very interesting issue for the surgeons and businessmen from the medical industry. Catheter-based devices are the new tools for the cardiac surgeon in hybrid surgery. Besides the occluder, stent, and balloon, many more cutting-edge devices have now been transferred from the bench to the bedside, such as a novel tissue valve for a transapical beating heart aortic valve implantation.⁶⁾ It is no doubt that the surgeons and cardiologists will experience the learning curve to be familiar with the devices or surgical procedures and to accumulate the knowledge for image interpretation. Therefore a new training program should be initiated to

culture the new generation to perform hybrid procedure.

In conclusion, the one-stop hybrid procedure holds great potential applications and could be the future direction of the management of cardiovascular diseases. The integrations of the real-time imaging and new developed devices could soon be changing conventional cardiac surgery. It is the hybrid time for cardiac surgeons and cardiologists to cooperate in the same room in their fight against cardiovascular disease.

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