Hybrid Brings Hope to the Heart

The introduction of high-end imaging capabilities into hospital operating rooms, which allows image-guided interventions and surgery to take place concomitantly, has opened new options for doctors dealing with high-risk patients and emergency cases. The AXIOM Artis U, a room-mobile unit from Siemens, is the choice of the St. Bartolo Hospital in Vicenza, Italy, both for its flexibility and its cost efficiency.

By Claudia Flisi

June 29, 2009. The 85-year-old woman lay on the operating table, completely covered except for an exposed area of her left torso between the shoulder and the waist. That patch of skin bore a five- to seven-centimeter incision into which cardiac surgeon Alessandro Fabbri and his team were positioning a catheter tube: It would be used for a transcatheter aortic valve implantation.

Without a new valve, the woman's days would have been numbered. But she would not have survived traditional open-heart surgery, in which the physician performs a sternotomy (saws and divides the breastbone for access) and entrusts the patient's cardiovascular system to a heart-lung machine while operating on the heart.

Instead, Dr. Fabbri had opted for a "minimally-invasive surgical technique," one that has come into its own only in the last few years, made possible by advances in operating room technology involving digital imaging. The name is based on the small incisions (or ports) that are used to gain access to the heart, rather than a sternotomy. Some minimally invasive techniques require the use of a heart-lung machine (for example, port-access coronary artery bypass) while others – such as the minimally invasive coronary artery bypass performed by Dr. Fabbri – do not.

About 2,500 such operations have been performed worldwide since 2006, so it is still premature for long-term conclusions. Nevertheless, such techniques are already a viable alternative for high-risk patients, including the 85-year-old patient at the St. Bartolo Hospital in Vicenza, Italy. Her entire operation lasted less than 90 minutes and her heart never stopped beating on its own. Had she been deemed a candidate for traditional open-heart surgery, she would have been on the operating table for four to five hours and a bypass machine would have been required in the OR. In addition, complications would have been expected, given the patient's age and state of health.

Although the patient spends about the same amount of time in the hospital with either type of operation, according to Dr. Fabbri, recovery time is faster with minimally-invasive surgery and the incision is less painful. It is not without risks, however: the mortality rate is 10 percent for the kind of valve replacement operation he performed on June 29. At the Vicenza hospital, only high-risk patients undergo this surgery, and the average age is 78, so a 90 percent success rate is gratifying. Besides, those undergoing this surgery would die if they didn't have it.

The emergence of hybrid ORs

One of the advances that has made minimally invasive techniques possible is high-end imaging equipment in the operating room itself. While radiologists and cardiologists use imaging to make diagnoses pre- or post-surgery, the ability to track the course of an operation in real time is invaluable in certain kinds of surgical procedures. Such ORs are called "hybrid ORs," where diagnosis and surgery take place concomitantly.

For example, a patient arrives in a hospital emergency room as the result of a car accident. He or she has to go immediately to the OR or risk dying. There is no time to wheel a patient to the radiology department, which may be far from the OR. So the surgeon has to operate without any background information.

In such cases, explains Dr. Fabbri, "We save time with a hybrid OR. The patient goes into surgery immediately to fix the immediate life-threatening problem, and then we do imaging while they are still on the operating table so we can address other potentially serious problems while they are still under anesthesia."

The situation is similar for a heart attack victim. While the patient receives emergency treatment, the medical team studies images generated in real time. "We might discover vegetation (small masses on the inner surface of the heart caused by endocarditis). If so, we can do a bypass at the same time we are addressing the heart attack, avoiding a second operation," Dr. Fabbri notes.

Imaging has become so important in

Hybrid Rooms vs. Hybrid Procedures

The term "hybrid OR" is sometimes confused with "hybrid surgery," but the two concepts, while overlapping, are different. Hybrid operating rooms are traditional ORs to which sophisticated imaging equipment – fixed or mobile – has been added. Hybrid surgery refers to a mixture of medical procedures drawn from different subspecialties, such as combining minimally invasive coronary artery bypass surgery (totally endoscopic coronary artery bypass or minimally invasive direct coronary artery bypass) with catheter-based coronary intervention (percutaneous transluminal coronary angioplasty or stenting).

Hybrid surgery is done in hybrid ORs, but hybrid ORs can accommodate simple surgery as well. For example, with imaging equipment in the OR, a surgeon can perform an angiogram at the end of a routine cardiac surgical case to make sure grafts are in place and blood is flowing properly. An X-ray study after such an operation is not standard operating procedure at all hospitals, but it is simple and cost-effective in a hybrid OR.

surgery today that up to 50 percent of imaging may be done by specialists who are not radiologists. This trend is likely to continue, claims radiologist Dr. Rob Chen of Boston General Hospital in Massachusetts. Therefore, imaging equipment must be simple to use, easy to handle, and adaptable to a range of medical needs.

Filling a niche with AXIOM Artis U

As in many hospitals, the operating rooms at St. Bartolo are not large, so one attraction of the AXIOM Artis U is that it fits compactly into an average-sized (30 m²) operating room. The problem with a hybrid OR is that the surgeon has to be able to move around the patient, and when too many monitors and machines clutter the room, the surgeon's space becomes limited. The AXIOM Artis U was designed to facilitate the surgeon's need to maneuver. Although the ORs in Vicenza were not originally built as hybrid suites, they have been adapted to meet the requisites of the new technology. "We reconceived the layout," recalls Dr. Fabbri. "You have to be able to block the

Dr. Fabbri and his surgery team from the St. Bartolo Hospital in Vicenza, Italy

doors, lower the lights, and install the screens."
The hospital first installed a mobile imaging system (not Siemens) in 2002. In the intervening seven years, imaging quality had improved so much that Fabbri's team felt a newer model would serve their patients better. Overweight patients in particular need a system capable of producing high-quality imagery.
However, the major problem of the previous system was that it would overheat during angiographic surgery, so the doctors would have to stop during an operation to let it cool off. This was dangerous and inefficient during interventions that lasted more than an hour or two.
The AXIOM Artis U arrived in March 2009. The quality of its images helps doctors see more quickly where to operate and requires less contrast fluid and fewer X-rays per second than previous systems. It has a large powerful generator – in two versions (65 kW or 80 kW) to visualize thin guidewires and to quantify small vessels and delicate anastomoses.
An 80kW generator is also the minimum recommendation for performing cardiac angiography and interventions, as stated by many institutions such as the American College of Cardiology. The high heat-storage capacity (783 kHU) of the X-ray tube avoids the problem of overheating even in complex operations taking 120 minutes or more. Because of the additional power, operations can be done more quickly, smoothly and confidently, without interruptions and with obvious benefits for the patient as well as the hospital. Siemens makes the only room-mobile system with such a powerful generator, capable of taking up to 30 images per second. In effect, it has created a new category niche between small mobile units and large powerful stationary systems.
St. Bartolo was the first hospital in the tri-Veneto area of northeast Italy to install the AXIOM Artis U, one of 13 systems in all of Italy as of early July, 2009. Dr. Augusto D'Onofrio, a cardiac surgeon in Dr. Fabbri's department, ticks off several of its attractive features: "The AXIOM Artis U lasts longer, has better quality, and enables continuity in the OR. We don't have to stop during surgery as we did before when the machine would overheat. It also continuously monitors radiation emissions. And another very important point is that you can change positions rapidly." His verdict after the first three months: "We have done a variety of diagnostics with it and are very pleased."
Artis U is well-suited to St. Bartolo's specialty areas: transcatheter aortic valve replacement and complex endovascular repair. It improves existing procedures rather than creating new options, according to Dr. Fabbri, who estimates that about 10-15 percent of the department's 600 operations in 2009 will make use of the hybrid capabilities made possible by the new equipment.
Interest in the Artis U is high, he says, from both Italy's aging population and from other surgeons. "We didn't have to publicize this equipment, because the interest is there," he notes. "Patients may have read something about minimally invasive surgery and may ask for it, regardless of their suitability. Surgeons see what equipment you have, and they want it too."

For more information on the Artis U and Siemens solutions for hybrid rooms, please visit:
www.siemens.com/surgery

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AXIOM Artis U Applications

The AXIOM Artis U supports a wide field of applications besides cardiovascular surgery, such as:

Angiography
Outstanding image quality for a clear picture of vessels and excellent support in the control of stent implantations.

Cardiology and electrophysiology
Performance of numerous cardiological procedures including coronary angiograms, angioplasty, placement of pacemakers and implants.

Orthopedics
A broad application spectrum including vertebroplasties, hip replacements, pinnings, fracture repairs and open fracture to trauma and maxillary facial procedures.