OR Manager Inc

OR Manager
Vol. 27 No. 5
May 2011

OR design & construction

Hybrid ORs: What's behind the increasing demand?

Imaging has a long history in the operating room. In the 1960s, x-ray units were mounted on the ceiling, as they might be today. But the surgeon had to go to an adjacent room to view the image, and images could only be stored for 10 minutes. Mobile C-arms, introduced in the late 1960s, have been a mainstay of OR imaging. But more hospitals are finding these C-arms can no longer meet their OR imaging needs.

Increasingly complex surgical and interventional approaches require more advanced imaging. In response, many larger facilities have replaced the conventional OR configuration with new configurations known as hybrid ORs. These combine surgical equipment and instrumentation for open procedures with a fixed and dedicated imaging system as well as an imaging-compatible surgical table, lights, and surgical booms to accommodate open, minimally invasive, and interventional procedures. Hybrid ORs are housed in a sterile environment.

Demand grows

Initially, hybrid ORs were installed by facilities considered to be early adopters of technologic innovations. Though the concept of hybrid ORs was introduced in the 1990s, until 2008 adoption was slow. The high cost and complexity of implementation limited diffusion to academic institutions and well-funded community hospitals with high cardiac procedure volumes.

The rate of adoption and diffusion has begun to increase in the past few years, despite an economic recession that has limited growth in conventional surgical services. According to anecdotal reports in trade journals, the market for advanced hybrid OR imaging systems grew 17% between 2008 and 2009, while the market for more traditional surgical imaging systems grew only 1%.

Demand for hybrid ORs is expected to continue to increase, given the growing numbers of patients with complex cardiovascular and neurological diseases requiring treatment better delivered in a hybrid OR setting. Within the next 5 years, it is expected that most hospitals with larger cardiac and neurosurgery services will be planning or will have implemented at least one hybrid OR.

What's included?

The most common configuration includes a flat-panel angiographic x-ray imaging system and surgical equipment for open cardiac surgery. Very few facilities have integrated robotic surgery, CT systems, or MRI systems into the OR setting.The second most common configuration is for interventional and surgical neuro applications, although only a few hospitals have installed dedicated neuro hybrid ORs.

Hybrid ORs cost several million dollars and include equipment from multiple vendors (sidebar, next page). The equipment selected varies depending on the room configuration and its planned uses.

What are the benefits?

Published evidence on the clinical benefits of hybrid ORs is limited, but studies are ongoing, especially for cardiovascular applications.

Some technical and review articles (Bonatti et al, 2010; Kpodonu, 2010; Urbanowicz et al, 2010; PhysOrg.com, 2010) as well as anecdotal reports from hospitals with hybrid ORs suggest these clinical and operational benefits:

- shorter patient recovery time due to elimination of the physiologic stress related to multiple procedures with anesthesia
- decreased length of stay due to elimination of staging between multiple procedures and reduction in resources needed for patient management
- streamlined care delivery, with fewer clinical staff involved in patient care and an improvement in cross-specialty communication
- minimized risk for communication-related errors across clinical specialties
- lower overall cost of care
- potential for revenue growth— use of a hybrid OR frees interventional suites and standard ORs for additional procedures.

Procedure benefits

Current cardiovascular procedures, such as aortic stent-graft placement and treatments for heart failure and cardiac rhythm disturbances, may be performed more efficiently in a hybrid OR. A hybrid OR also has the potential to improve the clinical care of patients with complex cardiovascular disease, pediatric patients with congenital heart disease, and patients requiring valve repair. The hybrid OR is being recommended as the preferred setting for new procedures, such as hybrid coronary revascularization and percutaneous valve replacement, to improve patient safety and physician performance of complex procedures (Vahanian et al, 2010; Nollert et al, 2009).

For neurointerventional procedures, a neuro hybrid OR can potentially provide clinical benefits in complex brain and spine cases, trauma requiring neurointervention, stroke, brain aneurysm, pediatric neurovascular cases, and endovascular cases. New procedures, such as endovascular neurosurgery, are evolving as neuro hybrid ORs are able to provide advanced image guidance to allow the use of catheters and guidewires.

Successful implementation, management

Despite the benefits, successful implementation and operation of a hybrid OR may be limited by conflicts among staff and workflow problems. Some advice to ensure smooth implementation and management:

Plan for multidisciplinary guidance

Implementing a hybrid OR requires significant advance planning and coordination among multiple departments, clinical staff members, facilities personnel, and equipment vendors. Planning and ongoing evaluation by a multidisciplinary committee are essential. The committee should include key administrative and clinical staff from all specialties that will use the hybrid OR.

Too often, nursing staff, anesthesiologists, perfusionists, and technologists are excluded. As a result, critical issues are not addressed that adversely affect the hybrid OR's operation, such as lack of appropriate OR imaging support, anesthesiology services, perfusion support, and delays in OR setup and patient preoperative care. Problems have been reported related to scheduling of equipment installations and placement of imaging equipment. Biomedical engineering and information technology staff should also be involved to ensure seamless OR equipment installation and integration with existing facility infrastructure.

Trends drive need for imaging

Trends are driving the need for more imaging in the OR:

- A growing aging population means more people are living longer to require surgery best performed with image guidance.
- More than 60% of all patients having surgical procedures are overweight or obese and often have comorbid diabetes and cardiovascular disease.

These trends increase the likelihood of more complications during interventional procedures, often leading to the need to convert to an open surgical procedure.

- The lines between interventional and surgical specialties are blurring—interventional procedures are becoming more complex, and surgical procedures are becoming less invasive.
- Increasing numbers of patients with complex disease are forcing cardiac surgeons and interventional cardiologists to collaborate more frequently.
- New technologies approaching commercial availability for percutaneous valve replacement will require more advanced imaging in the surgical setting, according to reports by Hayes, Inc.

More complex procedures in the interventional suite mean patients will require more clinical supervision and possibly a more intense level of care.

A hybrid operating room at the University of Maryland Medical Center. The university built a pediatric hybrid OR in 2004 and will open an adult hybrid room this year.

Analyze volumes

Hospitals should analyze interventional and surgical volumes to determine if a hybrid OR would be supported by existing caseloads. Projected future volumes should also be analyzed to ascertain how a hybrid OR would affect usage of existing interventional suites and ORs.

Evaluate infrastructure, capacity

Thoroughly evaluate the existing infrastructure and capacity for renovation and expansion to determine if a hybrid OR can be installed in existing space or will require substantial renovation or new construction.

Renovation of existing ORs may be required because a hybrid OR requires more space than a traditional OR or interventional suite. Although space may be available in the hospital's interventional area, the cost and effort may be substantial to ensure that converting an interventional suite to a hybrid OR will meet surgical standards. Generally, interventional cardiology and neuroradiology suites do not have positive ventilation, a scrub area, sterilization area, or access to surgical equipment and instrumentation.

Experts have reported it is less expensive and easier to construct a hybrid OR in existing ORs, where surgical support services are already in place, rather than convert an interventional suite and duplicate surgical support in another area of the hospital. In general, installing a hybrid OR in existing OR space requires only modifications for advanced imaging equipment.

Fostering collaboration

These suites come with other complex issues, such as collaboration across multiple departments and clinical specialties, with the potential for "turf wars." Disputes may arise among clinical staff regarding what type of imaging and surgical equipment to include in the hybrid OR because of the large number of staff involved in hybrid procedures. Surgical and interventional physicians may "jockey for position"

Hybrid OR equipment

Equipment that may be installed in a hybrid OR (list not inclusive):

- Single-plane or biplane flat-panel angiographic x-ray imaging system
- CT system
- Surgical lights
- Surgical table
- Surgical (endoscopy) video systems
- Surgical booms
- Anesthesia system
- Robotic surgery system
- MRI system
- Magnetic catheter navigation system
- Heart-lung bypass system
- Intravascular and/or cardiac ultrasound system
- Operating microscope
- Neurosurgical navigation system.

in the OR, and supporting clinical specialties, such as anesthesiology and nursing, may need to modify workflow to accommodate the integration of equipment.

In addition, a hybrid OR will compete with existing interventional procedure rooms and ORs. Physicians and departments may compete for time in the new hybrid OR, even when procedures could be performed in a standard OR or interventional suite. Disputes over room usage are likely, especially in facilities with high surgical and interventional volumes. Establishing room usage guidelines and scheduling can alleviate disputes.

Potential for new revenue

While the initial outlay for a hybrid OR is substantial, new revenue and cost savings are possible if installation, implementation, and operation are managed effectively with multidisciplinary collaboration. The ability to perform new types of procedures and the publicity value of a new hybrid OR can provide a competitive advantage in the local market, creating the potential for new revenue. Combining imaging, intervention, and surgery into a "one-stop shop" and streamlining workflow and procedural throughput can result in cost savings. ❖

—Jennifer Van Pelt
Senior Research Analyst/Senior Hospital Consultant
Hayes, Inc, Lansdale, Pennsylvania

For more information on hybrid ORs and emerging technologies related to hybrid cardiovascular and neurointerventional procedures, visit www.hayesinc.com.

References

Bonatti J, Lehr E, Vesely M R, et al. Hybrid coronary revascularization: Which patients? When? How? *Curr Opin Cardiol*. 2010. 25:568-574.

Hayes, Inc. Hayes Prognosis Overview. CoreValve Transcatheter Aortic Valve System. Lansdale, PA: Hayes, Inc, October 21, 2010.

Hayes, Inc. Hayes Prognosis Overview. Edwards Sapien Trans- catheter Heart Valve. Lansdale, PA: Hayes, Inc, October 20, 2010.

Hybrid operating rooms help rescue patients. www.stltoday.com/lifestyles/health-med-fit/fitness/3d8203da-b215-5848-b750-6ac8f2a040e5.html September 22, 2010.

Hybrid operating rooms mean collaboration, growth for Steris Corp. www.medcitynews.com/2009/05/hybrid-operating-rooms-mean-collaboration-growth-for-steris-corp/. May 21, 2009.

Kpodonu J. Hybrid cardiovascular suite: The operating room of the future. J Card Surg. 2010;25:704-709.

Nollert G, Wich S. Planning a cardiovascular hybrid operating room: The technical point of view. Heart Surg Forum. 2009;12(3):E125-130.

Operating room radiography to transform surgery. PhysOrg.com. April 2, 2010. www.physorg.com/news189437698.html.

Urbanowicz J A, Taylor G. Hybrid OR: Is it in your future? *Nurs Manage*. May 2010; 41:22-27.

Vahanian A, Alfieri O, Al-Attar N, et al. Transcatheter valve implantation for patients with aortic stenosis: A position statement from the European Association of Cardio-thoracic Surgery (EACTS) and the European Society of Cardiology (ESC), in collaboration with the European Association of Percutaneous Cardiovascular Interventions (EAPCI). *EuroIntervention*. 2008;4(2):193-199.

Copyright © 2011. OR Manager, Inc. All rights reserved. 888/707-5814.