

## Equipping Your OR for the Future

As minimally invasive surgery evolves, the integrated surgical suite will become the new standard of care.

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The advent of video endoscopy in the mid-1980s accelerated an evolution in surgical processes unrivaled in other clinical departments. Building on new devices and techniques that facilitated the delivery and expanded the range of minimally invasive surgery, endoscopic imaging — once limited to a single video monitor — became integrated into surgical suite systems. The result: multiple high-resolution display monitors; input from cameras, C-arms, picture archiving and communication systems (PACS), facility and surgical information systems; centralized control systems; and recording and capture devices.

As these integrated surgical suites become more affordable and as surgeons experience the tangible benefits they afford, it's almost certain that they'll see widespread adoption by ambulatory surgical facilities. The resulting transition will affect change across the span of surgical facility operations, from staffing to infrastructure. Here's a primer on equipping your OR with surgical suite technology.

### **Informed, in time, in control**

To recognize the value of the integrated surgical suite, first consider such common procedures as gall bladder removal or hip and knee replacement. They were once time-consuming, resource-intensive and highly invasive operations requiring large incisions, lengthy hospital stays and weeks of recovery. Now laparoscopic cholecystectomy and minimally invasive total knee and hip arthroplasty have streamlined the procedures to outpatient possibilities, and patients can return to normal activity in a week.

It's no surprise that today's surgeons have, in essence, retired the scalpel in favor of high-tech tools that extend their reach into spaces far too small for a surgeon's hand and their vision into areas of the body where no eye could previously see. Video endoscopy has eliminated the need for surgical incisions large enough to allow the surgeon a direct view of the surgical site. As a result of these advances, infection rates have plummeted as procedure and recovery times have radically decreased. Collateral damage to surrounding tissue has been minimized and the spectrum of surgical possibilities available to patients has expanded.

These advances have also exacerbated the need for timely access to diagnostic and patient information. In the days when hip replacement might take eight to 10 hours, waiting 20 minutes for the radiology department to deliver X-ray film had little impact on the procedure time. Today's laparoscopic hip replacement, on the other hand, takes about 90 minutes. A 20-minute wait would be an unacceptable delay that would have a ripple effect not only on the infection control, anesthesia and recovery time of the procedure at hand, but also on the staffing and scheduling of the surgery center as a whole.

Integrated surgical suites can boost OR efficiency and decision-making by providing each surgical team member with an unobstructed view of the procedure — no small feat, considering the larger surgical team required to operate minimally invasive surgery's specialized equipment — as well as access to PACS images, lab results and other diagnostic information generated outside the OR as soon as it becomes available.

As procedure times become shorter, the ability to monitor the progress of a procedure from outside the OR has become a valuable management tool. This, too, can be achieved through a surgical suite system. A facility manager who can visually monitor her ORs can reduce turnover times by arranging for cleanup

and setup to begin as soon as a procedure ends and for anesthesia drips and preps to ready the next patient for surgery as soon as the room is open.

Integrated suites and their automated video systems are the equipment industry's response to the clinical need to capture, control and display information in a variety of formats and locations. In new construction, every equipment boom and surgical light hub should be prepared for the potential installation of arms for the mounting of video monitors.

### **Before you buy: a questionnaire**

Before you ask manufacturers for price quotes for an integrated surgical system, meet with your surgeons to discuss their needs and to understand how the new equipment will support the clinicians who practice in your center. You'll want to be able to answer the following questions:

- What types of procedures will each system need to support? Anticipating your procedure load lets you group procedures with similar time and equipment requirements together. Then you'll know which system represents the best investment and how it can be optimally configured to accommodate specific requirements.
- Do you anticipate changes in the number and type of procedures? If you're planning to recruit more surgeons or introduce more services — or if a surgeon plans to increase his caseload after you install the integrated suite — keep these plans in mind as you assess your equipment choices.
- Do your surgeons perform enough procedures to justify the investment? A solid commitment from a surgery group to perform a high volume of procedures using an integrated surgical suite helps to ensure that the equipment will pay for itself.
- Will our facility's current infrastructure support an integrated surgical suite? It's fairly easy to prepare a new surgical center for the installation of video displays and cameras. An existing facility, however, will require the installation of monitor booms, cameras, wiring and a documentation station to house the video control equipment.
- Are your facility's ORs adequate in size to accommodate an integrated surgical suite? The size and potential for expansion of the ORs at your center may dictate your choice of equipment, but the equipment and staff involved in an integrated surgical suite generally require a room of at least 550 to 650 square feet in size. Since minimally invasive procedures generally require more equipment, suspending it from the ceiling or housing it in a documentation station will relieve congestion at the table.
- Do your surgeons have strong equipment preferences? Surgeons are more likely to schedule cases at a facility that affords them access to equipment they like to use.

### **Putting the pieces together**

Understanding the major components in an integrated surgical suite will let you ask the manufacturers' reps good questions when they present their proposals. Let's review video display monitors, video controllers and teleconferencing hubs.

- **Video display monitors.** These are essential for viewing the procedure, surgical images and other diagnostics. The latest technology in monitors is the overwhelmingly popular digital flat-panel screens. Monitors can be mounted on equipment booms, on independent monitor arms — which provide greater flexibility and ease of movement during setup and surgery — or on OR walls. Due to their size and weight, monitors with 20-inch to 22-inch screens are most often used on booms and arms. Since ORs are being built larger to fit more equipment, wall-mounted monitors often aren't the best option because of their distance from the surgical field and because they may not be visible to all team members. However, wall mounts do accommodate 42-inch or larger screens, which are particularly useful for viewing PACS images.
- **How many monitors do you need?** In an already crowded, equipment-intensive environment, it can be difficult to determine the optimal number of display monitors. This decision can be

complicated by the fact that the optimal number varies by procedure and by surgeon. Some rooms have as many as six. Here's a simple standard: Each surgical suite system should provide enough to allow the entire team a view of the procedure.

- **Plasma or LCD?** Plasma screens offer spectacular brightness and contrast, but they weigh more and have a shorter life than lighter weight LCD (liquid crystal display) monitors. Many experts predict that surface-conduction electron-emitter displays (SEDs), a new technology currently under development, will eventually replace both plasma screens and LCDs.
- **What about image quality?** Surgeons have strong and oftentimes very different perceptions of the image quality of displays. The University of California-Irvine Medical Center recently arranged a side-by-side product comparison to resolve a display quality debate among its surgeons and staff. Four manufacturers set up sample displays and provided scopes that connected to each display monitor. Surgeons concluded — to their surprise — that all four displays provided images of equal quality. This demonstration let hospital management focus its purchasing decision on issues of greater importance, including ease of control and the number of display screens needed in each suite.
- **Video controllers.** As support devices, video controllers vary from simple switching systems to sophisticated computerized video management systems capable of producing effects such as split screen, picture-in-picture, zooming and telestration. Video controllers also manage recording, screen capture and printing and even communication with practitioners consulting from a remote location.

Where video controllers are located can be particularly important, as team members use the controller during a surgical procedure to select video sources for display, to change displays from one screen to another, to manipulate special effects, to start and stop recording, to capture and print still images and to set up two-way video teleconferencing with other practitioners. Locating the video controller near the PACS and charting workstations can help facilitate the selection of information for display. Several video controller models offer remote touchscreen controls with abbreviated function menus that can be placed near the surgical field for use by the surgical team during a procedure. Most computerized video controllers provide onboard digital video recording and editing capabilities and let staff download information to a DVD-RW drive.

- **Video hub.** Most systems also offer an optional video hub, which supports teleconferencing with off-site practitioners for education and consultation. Some manufacturers incorporate remote communication capabilities into each video controller; others offer separate devices that control remote communications for several suites. When service providers begin to offer guaranteed virtual private network (VPN) bandwidth to individual customers, most remote communications may connect through the Internet.

## Scopes and accessories

The earliest endoscopes were passive optical devices fitted with an eyepiece, a light source channel and tubing for insufflation, irrigation and instrument access. Today's video scopes still include those functions, although the role of the simple eyepiece has been largely replaced by a camera processor, display monitor and, oftentimes, recording and screen-capture printing devices.

Although the handheld component of a scope system is typically known as the camera, it's actually half of one: the optics and image capture device, or "camera head." The camera's external image processor contains the electronics necessary to make the camera work. Manufacturers separated the two components to make the handheld portion smaller, lighter and easier to manipulate — today's sleekest units weigh only a few ounces — but as a result, camera heads from one manufacturer are almost never compatible with processors made by another.

In an effort to make their scopes easier for surgeons to use, manufacturers have integrated a variety of ancillary capabilities into the camera head, including controls for the system's insufflators, irrigation flow, light sources, brightness, and even table position and surgical light intensity. While several manufacturers

have also extended some or all of these controls to their video controllers, the value of this duplication is questionable if the surgeon has the controls at his fingertips and may not be entirely safe.

In addition to the scopes themselves, these options are available through integrated suites.

Often mounted in the OR lights, a surgical site camera provides the entire team with an over-the-surgeon's-shoulder view. This perspective becomes increasingly valuable as laparoscopic techniques are used to perform more deep-incision procedures in which only the surgeon has a clear view of the procedure itself. Surgical site cameras can also be located on separate arms suspended from the equipment boom or on light hubs.

Physiological monitors that display patients' vital signs from locations easily observed by the entire surgical team can provide for quicker responses to changes in patients' conditions.

PACS is now the standard for image access and display in surgery departments, thanks to the availability of higher capacity, lower cost file servers as well as faster networks and more powerful workstations. The value of digital image distribution is especially notable in larger ORs, where wall-mounted view boxes would be too far from the surgery table for easy viewing. Interim solutions such as mobile view boxes or mobile PACS workstations address these issues, but both of these solutions are compromises that tend to exacerbate increasing congestion around the surgery table.

Live images produced by C-arms with live video outputs enable staff to perform X-rays during procedures and immediately display the images for the team to view.

As electronic medical records gain ground on paper, immediate access to a patient's chart, lab and radiology reports will become the standard. The computerization of patient records has made real-time charting a practical reality and the display of patient information within view of each team member fosters better communication.

Surgical microscopes equipped with video capability allow the entire team to see what the surgeon is seeing, while pathology microscopes equipped with two-way video capability allow the surgeon to view the actual biopsy slide as the pathologist describes it or the pathologist to view the surgical site from a remote location.

### **Single-source versus mixed**

One of the most vexing questions that managers contemplating the purchase of new surgical video systems face is whether equipment from different manufacturers — for instance, their existing equipment and that which they're considering buying — can be integrated in the new system. Most facilities use scopes and cameras produced by several different manufacturers for a variety of reasons, ranging from surgeon preference to an identifiable advantage of one manufacturer's equipment for a specific procedure. So it's extremely likely that you'll face the need to connect cameras from several manufacturers into a new integrated system.

Fortunately, most surgical suite system manufacturers base their products on an open architecture concept. As a result, their equipment should be compatible with any camera currently on the market. As long as each camera delivers industry-standard video formats, compatibility with other manufacturers' monitors should not be an issue. However, ensuring that the cameras already in use at your facility are compatible with any system you plan to purchase is critical.

Although most facilities will continue to use cameras from different manufacturers, standardizing to a single manufacturer for most of the equipment in a completely automated surgical video suite creates many managerial, operational, maintenance and cost efficiencies.

### **New standard of practice**

A recent study revealed that 79 percent of surgical procedures are now performed with video scopes. This number will almost certainly increase with the development of more sophisticated instruments, procedures and techniques, and as the number of skilled practitioners grows.

The integrated surgical suite will soon be the standard of practice for both inpatient and ambulatory surgical venues. As the number and type of small-incision surgical procedures continue to increase, equipment planners have been recommending that every new OR built should be equipped with an automated video system or at the very least prepped for future installation. While integrated surgical suites currently come at a high cost, they have the potential to offer a high payoff in the form of reduced case times, improved outcomes, better documentation and ready access to remote consultation. Anticipating this trend, many surgical instrument manufacturers have shifted their product development efforts to address the growing demand for an integrated approach to the capture and display of surgical information. Administrators who understand the trends in surgical equipment technology and the different ways it may impact the delivery of ambulatory procedures will be in the best position to take advantage of the benefits these systems afford.