HEALTHCARE IMAGING UPDATE

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IN THIS ISSUE

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CT scans and radiation exposure: Exactly how much is too much?

Controversial findings prompt new debate and calls for safeguards

There is no denying that the use of CT scans has increased dramatically since CT was first introduced in the 1970s. According to some estimates, the number of CT scans performed in the United States has grown from 3 million per year in 1980 to more than 62 million per year today, as the technology has become increasingly available and easy to use.[1]

However, with new concerns being raised about the risks associated with radiation from CT scans, debate is brewing among imaging professionals and other clinicians about whether CT scans are being used appropriately in all settings, and whether there are times when safer imaging alternatives, such as ultrasound, would be a better option.

Much of the current discussion regarding radiation exposure from CT scans stems from a review article by **David Brenner**, PhD, DSc, and **Eric Hall**, DPhil, DSc, both from the Center for Radiological Research at Columbia University Medical Center in New York City, recently published in the *New England Journal of Medicine*.[1] Relying largely on studies of survivors of the atomic bombs that were dropped on Japan in 1945, Brenner and Hall note that there was a significant increase in the overall risk of cancer in a subgroup of survivors who received low doses of radiation that are comparable to the

EXECUTIVE SUMMARY

Controversial new findings suggest that the dramatic increase in the use of CT scans in recent years also may be exposing people, especially children, to unacceptable levels of radiation exposure.

- While some professional societies question the new findings, they are also urging more judicious use of CT scans. They are taking steps to disseminate recommended guidelines on CTs use and calculations of the proper dosages of radiation.
- Experts worry that fears regarding radiation exposure may prevent people from getting needed tests. They urge clinicians to consider the benefits of CT as well as the risks.

doses of radiation associated with a typical CT study, involving two or three scans in an adult patient (about 40 mSv).

Brenner and Hall acknowledge that while the risk of developing cancer from a single CT scan is small, they nonetheless argue that clinicians need to consider the risks associated with repeated scans over a lifetime, and they are particularly concerned about the growing use of CT scans in asymptomatic patients and in children. Children are at greater risk because they are more sensitive to radiation and because they have more years ahead of them in which radiation-induced cancer could develop, they say.

Many organizations, such as the American College of Radiology (ACR), question the validity of comparing the radiation exposure received by atomic bomb survivors to that received by people undergoing CT scans of particular organs under controlled circumstances. Nonetheless, there is wide agreement that clinicians and imaging centers should be careful to only use CT scans when medically necessary and to always use the lowest recommended dose of radiation.

Consider the safest imaging procedure

Further, given that the issue is of particular concern with respect to young adults and children, the Alliance for Radiation Safety in Pediatric Imaging has unveiled a new campaign, dubbed *Image Gently*, designed to ensure that clinicians are aware of the enhanced risks posed by radiation exposure to children and that they follow established guidelines when ordering CT studies. **(See members of campaign, p. 15.)**

The alliance points out that there were four million CT scans conducted on children in the United States in 2006 and that the number of pediatric CT scans has tripled in the last five years. Consequently, through its web site, the alliance is making available guidelines and protocols pertaining to CT scanning in children, and it is publishing recommended dosing-reduction formulas to ensure that imaging centers appropriately "child size" the amount of radiation used when a CT scan is deemed medically necessary. **(See resource box, p. 15.)**

Donald Frush, MD, chair of the ACR Pediatric Imaging Commission, says, "I don't think we have a firm grasp on whether CT scans are overused or abused in a way that everybody would agree on." Consequently, he stresses that the campaign is an effort to disseminate best-practice information so that clinicians and imaging centers will, at least, begin to use appropriate techniques. "Any time a study is expected or anticipated, one should think about the safest way to [carry it out], and that would probably be ultrasound in a pediatric population," says Frush, noting that radiation is not an issue with MR either. "But if it is not a situation where those [modalities] are likely going to give adequate information, and CT is the indicated examination, then people need to go to CT."

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Senior Vice President/Group Publisher: **Brenda Mooney**, (404) 262-5403, (brenda.mooney@ahcmedia.com).
Associate Publisher: **Coles McKagen**, (404) 262-5420, (coles.mckagen@ahcmedia.com).
Managing Editor: **Joy Daughtery Dickinson**, (229) 551-9195, (joy.dickinson@ahcmedia.com).
Production Editor: **Ami Sutaria**

Editorial Questions

For questions or comments, call **Joy Daughtery Dickinson** at (229) 551-9195.

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Radiologists need to step up

Frush acknowledges that there are several factors that are driving the use of CT scanning devices. "It is an easy study to get. There are a lot of scanners around. And it is a very fast examination," says Frush, noting that children don't have to be sedated. Further, he points out that it is much easier to get a CT through an emergency department than it is to get an MRI examination.

Nonetheless, safety needs to be a primary concern, and Frush emphasizes that radiologists should serve as expert consultants to clinicians in recommending what is going to be the best examination in a particular circumstance. "That communication needs to be encouraged and cultivated," he says. "The radiologist needs to talk with clinicians about how specific examinations are done, and what they are good for too, and that comes from individual discussions with referring pediatricians, internists, and ER physicians."

In response to concerns about radiation exposure, the American Society of Radiologic Technologists (ASRT) plans to send an email message to all members who are involved with CT that will inform them of the Image Gently campaign and ask them to visit the campaign's web site. In addition, the CT division of ASRT is considering development of a pediatric CT practice position statement for deliberation by the organization's house of delegates in June 2008.

Consider the risks and benefits

While radiologists are in wide agreement that CT scans should only be used when indicated, they point out that there are other pressures in the medical environment encouraging them to order tests.

Kieran Murphy, a professor of radiology at Johns Hopkins Medical School in Baltimore, MD, says, "We are pushed on all sides." In the current medical-legal environment, physicians are getting sued, so they order studies, Murphy says. "There is a huge demand to diagnose what is wrong with the patient at the time of entry to the ER, and Medicare is going to make that the point that determines how the patient is billed from then on, so the patient is going to be studied with more CT," Murphy says.

Despite these pressures, there is anecdotal evidence that the concerns about radiation exposure, raised most recently by Brenner and Hall, are having the effect of prompting at least some clinicians to put more thought into the overall risks and benefits of ordering CT scans, according to **John Boone**, PhD, chairman of the American Association of Physicists in Medicine (AAPM) and a radiology professor of biomedical engineering at the University of California Davis Medical School in Sacramento.

"It has provoked a healthy and useful discussion that has brought the CT utilization issue to the attention of referring physicians and their patients," says Boone. However, he emphasizes that the article focused almost solely on the risks associated with CT scans, and he echoes the sentiments of many in the radiologist community by pointing out that the benefits of undergoing a CT exam need to be considered as well. "Referring physicians and radiologists need to consider the benefit/risk trade-off when a CT study is being ordered or performed, and as with all medical tests, a CT exam has risks and benefits, and both need to be considered before the exam is performed."

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RESOURCE

The Alliance for Radiation Safety in Pediatric Imaging has guidelines and protocols on its web site: www.imagegently.org. Click on "Pediatric CT Protocol Guidance." Also on the home page, click on "resources."

Are providers at the tipping point with CT?

With the dramatic increases in the use of CT in recent years, people are questioning whether all these tests are really necessary or whether they are just driving up health care expenses. The November 2007 issue of *Consumer Reports* highlighted 10 tests and treatments that the magazine said were overused, and three of them — whole-body scans, high-tech (CT) angiography, and virtual colonoscopy — involve CT.

Such concerns have generated heated reaction among industry experts and clinicians, many of whom believe that while there are legal and other non-clinical pressures in the health care system driving the use of imaging, blanket statements about overused tests or simple lists such as the one that appeared in *Consumer Reports* can dissuade people from undergoing procedures that are medically indicated.

With respect to CT angiography, some experts strongly disagree with the contention that the test is overused, including **Claudio Smuclovisky**, MD, director of the Cardiovascular Institute at South Florida Medical Imaging in Boca Raton, FL. "CT angiography demonstrates much more than the standard coronary angiogram, so the value of this test is enormous, and it is being underutilized," says Smuclovisky, who points out that 40% of the population will develop heart disease. "This is such an important technology that I predict in the future it will become as prevalent as screening mammography or colonoscopy."

Conversely, there is wide agreement in the radiologic community that there is no medical case to be made for whole-body CT scans, and these tests are therefore ill-advised considering that they expose patients to radiation needlessly. However, vendors tell *Healthcare Imaging Update* that there is little evidence that whole-body scanning is being particularly overused, as the practice has fallen off sharply in recent years. Peter Kingma, vice president of the CT division at Malvern, PA-based Siemens Medical Solutions, says, "The marketplace has moved steadily away from this, probably because there was not a high level of acceptance in terms of what you get as a clinical outcome versus the dose [of radiation] that you expose certain segments of the population to. We have had very little in the way of requests from the marketplace for systems that would do this."

The jury is still out on virtual colonoscopy or CT colonography (CTC), although it generally receives much higher marks from radiologists who perform the procedure than from gastroenterologists who tend to be more comfortable with colonoscopy. "It is a superb test that has been validated," stresses Smuclovisky of CTC. However, while his imaging center does perform CT colonography, there is little evidence that the test is being overused because, in most cases, insurance carriers do not yet reimburse for the procedure.

Robb Young, senior manager of the CT Business Unit for Tustin, CA-based Toshiba Medical Systems, agrees and notes that while newer studies indicate that the test shows promise and potentially could boost the colorectal screening rate, there is little impetus for imaging centers to offer the procedure on a larger scale until there is better reimbursement and until specialists show more interest in CTC. "Cardiac CT has moved very quickly to getting more reimbursement, and part of that is because cardiologists have a great interest in imaging. The difference with CTC is that gastroenterologists have not been as excited about using it," says Young. "The reality is: If the specialist isn't interested in it, it is very hard for that application to take effect." ■

Despite challenges, interest grows in CT colonography

Trial could trigger change in demand, reimbursement

While it is not without risks, optical colonoscopy (OC) has long been the gold standard for colorectal cancer screening. The problem is that most Americans fail to undergo screening as recommended, probably because it is an invasive procedure that requires what many consider to be an onerous preparation regimen designed to cleanse the colon. For that precise reason, there is growing interest in CT colonography (CTC) as an alternative screening procedure that could potentially encourage many more people to undergo colorectal screening, and ultimately save lives.

While early data regarding the use of CTC

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In the past, studies into the effectiveness of CT colonography (CTC) have delivered uneven results; however newer studies suggest that CTC may offer an appealing alternative to optical colonoscopy (OC) for colorectal cancer screening in adults of average risk.

- A significant drawback to CTC is that patients found to have suspicious lesions or polyps must then be referred to OC to have them removed. However, there is anecdotal evidence that patients may be more willing to undergo screening via CTC than OC.
- CTC typically is performed with a low dose of radiation, but some experts are concerned about the risks associated with a screening test that requires repeated exposures over time.

showed that the procedure did not approach the accuracy level of OC,[1] the procedure has undergone refinements and improvements in recent years. Newer data are more encouraging. For example, a non-randomized study comparing the use of CTC with OC for the detection of advanced neoplasia found that the two screening procedures resulted in similar detection rates.[2]

A co-author of that study, **Perry Pickhardt**, MD, associate professor of radiology at the University of Wisconsin Medical School in Madison, has extensive experience with CTC in part because he has received special authorization from local medical providers to be reimbursed for the procedure "The benefit of adding another effective option like CTC is that more folks will come off the screening sidelines," he says. "Our experience is that many folks are reluctant to undergo OC for primary screening, [but] these folks are often willing to undergo CTC."

However, in other states reimbursement for CTC is relatively rare except in cases where OC cannot be completed or OC is considered too risky for the patient to undergo. Further, no current guidelines recommend CTC as a primary screening alternative. Consequently, for many providers, CTC is a private pay option and is therefore in limited use.

CTC is a non-invasive test and is therefore generally less expensive to carry out than OC. However, part of the problem is that if the test identifies polyps that need to be removed, the patient then must be referred for OC as well so the polyp(s) can be removed. In Pickhardt's study, when CTC revealed polyps that were at least 6 mm in size, these patients were referred for OC to have those polyps removed. This referral occurred in 7.9% of the 3,120 patients who underwent CTC.[2]

However, gastroenterologists are worried that some radiologists performing CTC may be inclined to leave small polyps intact, rather than refer patients on to a second procedure. "Small polyps being ignored, we think is very dangerous," emphasizes **David Johnson**, MD, FACG, FACP, immediate past president of the American College of Gastroenterology and professor of medicine and chief of gastroenterology at Eastern Virginia School of Medicine in Norfolk. He points out that researchers have looked at the impact of disregarding smaller polyps (6-9 mm), and they have concluded that the practice can miss some high risk lesions.[3] However, Pickhardt counters that his approach with regard to small polyps (removing polyps that are 6 mm or larger) is sound medical practice. "The risks involved with sending a patient to OC for a small polyp outweigh the inherent risks of the polyp itself," he says.

Concerns with regular CTC scans

Johnson also raises the concern of radiation exposure involved with undergoing regular (every five years) CTC scans. "The concern is that radiation is just going through the roof in terms of exposure," says Johnson, noting that many people undergo diagnostic studies with regularity and especially abdominal CT scans. "If you superimpose on that [exposure] these screening tests with regularity, then you really start to ramp up the exposure risk for radiation."

The type of abdominal scan required for CTC requires 10-20 mSv of radiation, but Johnson points out that the dosage must, in some cases, be doubled for people who are obese. However, Pickhardt believes that the concerns about radiation exposure have been greatly exaggerated and that other risks should be considered as well. "The tiny theoretical risks associated with radiation at CTC pale in comparison to the very real risks of perforation and bleeding at OC," he says.

Many concerns about CTC are related to the fact that studies looking into the technology have been small and results have been relatively inconsistent, depending on which centers are involved.

However, these concerns should be addressed this year when the results of a large, multi-center trial are unveiled. The American College of Radiology Imaging Network (ACRIN) National CT Colonography Trial enrolled more than 2,300 participants at 15 sites. Each participant has undergone CTC followed by OC in the same day, so the effectiveness of the two techniques can be compared. **C. Daniel Johnson**, MD, a professor of radiology at Mayo Medical School in Rochester, MN, is leading the effort. He has indicated that he anticipates that the trial will settle many of the questions and concerns regarding CTC.

In fact, CTC technology, and associated CAD programs to assist the radiologist in locating areas of interest, have advanced since the ACRIN trial was launched in 2005, according to Pickhardt. "ACRIN represents the low end of the performance level that I would expect in the 'real world,'" says Pickhardt. Nonetheless, if the results suggest that CTC is comparable to OC as a screening modality, they could lead to more willingness on the part of guideline-writing committees to recommend CTC. That, in turn, could encourage more payers to reimburse for the test and more people to get screened.

"That is a significant trial," observes David Johnson, "and the data look reasonably promising."

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Ultrasound tool seen as a 'breakthrough' for AF

Safety, precision reported

Early feedback on a new ultrasound technology suggests that it is bringing important improvements to the table for the treatment of heart-rhythm disorders.

In fact, after using the system on just 30 patients, clinicians from Maywood, IL-based-

EXECUTIVE SUMMARY

Initial users report that a new ultrasound system from Biosense Webster offers an array of advantages, including safety and precision, when used to guide ablation procedures for atrial fibrillation.
* Users report that the Cartosound Image Integration module, Soundstar 3D Catheter, and Carto XP Navigation System make CT scans or MRI unnecessary before ablation procedures.
* The 3-D mapping system has potential application with respect to many other cardiac ultrasound techniques as well.

Loyola University Health System report that the new 3-D, real-time, mapping system, produced by Diamond Bar, CA-based Biosense Webster, is now their method of choice for guiding ablation of atrial fibrillation (AF). They report they no longer need to subject patients to the radiation exposure associated with CT prior to such procedures.

"In a series of about 10 minutes, you can [produce] somewhere around 15 to 20 two-dimensional images, and you get a really nice picture that gives you [nearly] all the detail that you can get from a CT scan without any radiation," explains **David Wilber**, MD, FAHA, FACC, professor of cardiovascular sciences at Loyola University's Stritch School of Medicine. "And it is immediate in the sense that it reflects the heart's condition within the past few minutes as opposed to whenever the CT scan was done, so for a procedure it is extremely helpful because it reflects current anatomy and volume."

The system consists of the Cartosound Image Integration module, Soundstar 3D Catheter, and the Carto XP Navigation System, and it represents the first integration of intracardiac echocardiography (ICE) with 3-D mapping, explains Nancy DeMars, the product director for imaging at Biosense Webster. "The ultrasound catheter utilizes an embedded position sensor to display location and beam orientation on the Carto XP System, which enhances visualization of ICE images and ablation catheter location," she says.

When used with the CartoMerge Image Integration Module, DeMars points out that the ICE images can be merged with previously acquired CT or MRI images and create a highly detailed picture. However, Wilber has found that this extra step is superfluous. "It makes the CT

scan unnecessary for the purposes of this procedure, and that is wonderful because the CT scan has significant radiation exposure, and an echo has no ionizing radiation, so to me, it is a huge step forward," says Wilber.

"If you take a predesigned image from a CT scan a couple of days ahead of time, the only way you can register it and get it into the right orientation to match the patient's position on the day of procedure is that you have to acquire a lot of information in the left atrium, so you have to be in the left atrium," he says. However, being in the left atrium creates potential problems in the form of blood clots, so a key advantage of the ultrasound technology is that images can be collected from the right atrium which is very benign, according to Wilber. "This has already become our preferred option, so we very quickly went from seeing how it works to concluding that this is so much better than anything else we had."

Wider applications possible

While Loyola Health System was the first center to use the new technology, it is now being used by electrophysiologists and interventional cardiologists at a handful of other centers including the Mayo Clinic in Rochester, MN, Brigham and Women's Hospital in Boston, and The Cleveland (OH) Clinic. Further, DeMars indicates that sales have exceeded the company's initial expectations since Biosense Webster began making the system available to customers in October 2007. The list price for the Cartosound Module is $75,000; the 3-D catheter is $2,950.

Thus far, the system has been used only for simple ablation procedures; however Wilber indicates that it potentially could be applied to all the things that people use cardiac ultrasound for, such as placement of devices in the left atrium, closing atrial septal defects, and plugging up left atrial appendages. The system's potential in the treatment of AF alone is huge, however, given that AF is the most common irregular heart beat rhythm disorder in the country, affecting more than two million Americans. Medical therapy often is effective for AF, but approximately 50,000 ablation procedures are performed each year in cases where medical therapy has been unsuccessful.

As one of the technology's initial users, Wilber is involved with training other clinicians in how to use the Cartosound system, but he indicates that this is not a lengthy process for anyone with experience in using phased array echo procedures. "You basically show people how to use it, and how to acquire the images, but it is so simple that, in fact, it doesn't require much training," he says. ■

MRI system offers potential for imaging of brain

Researchers move to human experiments

With initial safety trials of the world's most powerful MRI system completed, clinicians are one step closer to accessing real-time images of biological processes in the brain.

The device, which was constructed by investigators at the University of Illinois in Chicago (UIC), is the only human-sized MRI machine that has a 9.4 tesla magnetic field. The hope is that it eventually will provide clinicians with new insight into the workings of the brain so that diseases can be detected even before symptoms appear, and targeted therapies can be developed for stroke, cancer, and many other illnesses.

Most MR devices in clinical use have magnetic fields in the 1.5 to 3 tesla range, and they visualize water molecules so that biochemical processes can be tracked. What more powerful magnets can do is enable researchers to view different types of molecules such as sodium and oxygen, thereby providing a window to a new dimension of activity, according to **Keith Thulborn**, MD, PhD, director of UIC's Center for Magnetic Resonance Research. Thulborn worked with researchers at

EXECUTIVE SUMMARY

With initial safety studies successfully concluded, researchers at the University of Illinois have cleared one of their first hurdles in establishing the value of a 9.4 tesla MRI system, the most powerful, human-sized MRI system in the world. They plan to now move on to human experimentation involving sodium imaging.

- Investigators hope to enable researchers, and eventually clinicians, to gain new insight into the metabolic processes of the human brain.
- Potential capabilities of the system include gauging tumor response to treatment in real-time and developing new treatments for stroke.

Wauwatosa, WI, based-GE Healthcare, Americas, to develop the 9.4 tesla system, which has been in operation now for about three years.

In the safety trials, 12 men and 13 women were exposed to sodium imaging in a static magnetic field, and to a mock scanner that simulated the sound of a scanning device. There were no significant changes in vital signs recorded in the participants as a result of the scanner or the mock scanner, or in cognitive testing that was conducted on all the participants before and after each procedure. However, some of the participants did report some discomfort as a result of entering into the 9.4 tesla magnetic field.

"At least 25% of the people that went into the protocol experienced nothing, and around 60% experienced a slight spinning sensation," explains **Ian Atkinson**, PhD, a research specialist at UIC. In addition, Atkinson indicates that some of the participants reported having a metallic taste in their mouths when they were in the magnetic field, although he emphasizes that all the symptoms ceased when the participants stopped moving within the field. "There was nothing new that was unique to the 9.4 tesla that hadn't been seen at other fields," he says.

Human experimentation is next

As a result of the successful safety trials, researchers are submitting paperwork to the Food and Drug Administration (FDA) so that they can move on to human experimentation involving sodium imaging. This experimentation could lead to potential new treatments for stroke and the ability to monitor a tumor's response to treatment in real time. At the same time as this work is going on, researchers plan to begin safety trials involving other molecules such as phosphorus and oxygen. "If you do a timed series of oxygen [images] while a person is performing a task…you can get the metabolic rate of oxygen consumption, so you can basically [see] what is happening on a metabolic level in the brain," says Atkinson.

Ultimately, researchers have two chief goals in mind, according to Atkinson. "The first would be to take everything we have learned from high-field imaging and try to trickle it down to what is currently used in the clinical field, so everything we do with the 9.4 tesla, we will attempt to roll down to a 3 tesla scanner so it can be used clinically now and in the next couple of years," he says. The other goal, which is probably five years away at this point, according to Atkinson, is to be able to use the 9.4 tesla for patient care. "The FDA may raise its guidelines [from the current limit of 8 tesla to 9.4 tesla], at which point we could do more routine types of clinical imaging with the new protocols that we have developed." ■

Teleradiology gives 24/7 boost to small groups

For years, **Robert Lefsrud**, MD, a radiologist with a subspecialty in neuroradiology and musculoskeletal radiology, was a member of a large and busy radiology group providing services in the Twin Cities area of Minnesota. Two years ago, he and a colleague decided to branch out and form their own company, St. Croix Radiology Consultants in Dellwood, MN.

Over the years, Lefsrud has seen radiology transformed into a 24/7 practice in which radiologists can be called at all hours to provide services. But, instead of hiring more radiologists to provide round-the-clock coverage to two client hospitals and other facilities to meet that demand, his new company went virtual. Outside of the usual business hours, it uses a teleradiology services provider for assistance with CT, nuclear medicine, ultrasound, MRI, and radiographic images.

Lefsrud and his partner (who are assisted by two part-time radiologists) are working 7 a.m. to 5 p.m. shifts on weekdays, with nights, week-

EXECUTIVE SUMMARY

Small radiology groups are finding they can grow their businesses, but maintain normal work-life situations for employees, with the use of teleradiology services.

- Instead of hiring new radiologists, a "team" can be assembled to review images delivered via high-speed transmissions and provide preliminary reads.
- Issues to consider when selecting a company to provide teleradiology services are time, paperwork (in relation to credentialing and accreditation), quality control, and privacy issues.
- The teleradiology business may see upcoming changes soon, such as a greater interest in subspecialty care, as it matures.

ends, and holidays taken off. Providing coverage during those hours is a team of 27 radiologists hundreds and even thousands of miles away across the country employed by Virtual Radiologic Corp. (VRC) of Minnetonka, MN. VRC has hundreds of clients serving nearly 800 medical facilities.

"What keeps a lot of people now in large groups is the issue of coverage," Lefsrud says. "With VRC or companies like it, smaller groups are more feasible."

So what should a radiologist look for when selecting a company to provide teleradiology services?

• **Time**. Lefsrud was interested in delivery time. For example, how long did it take from transmitting the image to receiving a preliminary read? When his company did an audit of 1,000 cases, it found that the average turnaround time was about 18 minutes. With his previous employer, that time was a little over an hour.

• **Paperwork**. Each physician that provides a service to a hospital must be accredited by the hospital and licensed by the state, even if that physician is located and is performing the actual services in another state or another country. To help speed along this process (and reduce paperwork), VRC has been accredited by the Joint Commission.

This accreditation means that VCR completes strict licensing and credentialing verifications, to comply with Joint Commission health care quality and safety standards, before the teleradiologists' services are offered. "This makes the accrediting process simpler for our hospitals. Otherwise, it would be a lot of paperwork," Lefsrud says.

• **Quality control**. On average, the teleradiologists read about five images on weeknights and 20 on weekends. When Lefsrud's group analyzed quality control, they found that major discrepancies occurred only less than 1% of the time. These did not result in any adverse effects, he says. "We also have the option to ask, if we're unhappy with any particular reader, that they not read for us," he says. "But that hasn't been necessary."

• **Privacy issues**. Any company providing teleradiology should make it clear how patient privacy is being ensured, such as through record encryption or secure server systems, to comply with Health Insurance Portability and Accountability Act (HIPAA) regulations.

Since NightHawk Radiology Services of Coeur d'Alene, ID, first started the teleradiology trend a decade ago, using U.S.-trained physicians based in Sydney, Australia, to read radiological images transmitted through high-speed lines during nighttime hours from the United States, the interest has been high in this area.

The trend to use teleradiology in some fashion, whether internally through group or regional practices or with a large teleradiology company, has been on the rise, says **Arl Van Moore**, MD, president of Charlotte (NC) Radiology and chairman of the American College of Radiologist's Board of Chancellors. However, it's a market that has been consolidating in recent years, which has created concerns that some of the larger publicly-traded teleradiology companies may be more interested in answering shareholders rather than radiological groups, he says.

It's also a market that has expanded beyond the borders of the United States, which has created a new set of legal, regulatory, and even quality issues that need to be monitored. "Quality has always got to be an issue. The problem is how do you monitor it — especially in a foreign country half a world away," Moore says. "There's no jurisdiction in the U.S. or other countries of how we do it."

A change in the teleradiological services market also may be ahead as the adult market "comes to a point of saturation," says **Shehnaz Pancholi**, CEO and founder of Teleradiology America and Pediatric Radiology of America, headquartered in Roanoke, VA. This saturation may mean a greater emphasis on radiology subspecialties, such as pediatrics or cardio imaging. "With more technology coming out, it's going to be fairly easier for people to provide virtual subspecialty care," she says. ■

New equipment, techniques sought for larger patients

Accompanying the growing demand for radiological services across the country is the growing physical size of the patients requesting those services. This demand has brought new challenges in terms of obesity and radiology. Can good quality images be obtained from an obese patient, and can that obese patient even fit on a machine?

In a 2004 study that initially addressed the obesity issue, **Raul Uppot**, MD, an assistant radiologist at Massachusetts General Hospital in Boston, and his colleagues found that images varied by modality. "The modality most limited in terms of obesity was ultrasound. At around 250 pounds,

EXECUTIVE SUMMARY

As an increasing number of obese patients require radiology services, attention needs to be paid about what equipment can meet their needs in terms of accommodating their weight and size and providing clear images.

- Concerns have risen over patients who surpass the weight limit of the machine's table as specified by the manufacturer.
- MRIs produced for larger patients also have the advantage of making all patients feel less claustrophobic.

you started to notice the difficulty in imaging patients with ultrasound," he says.

Other modalities that were affected were chest radiographs, abdominal radiographs, and fluoroscopies, which ironically are used for obese patients seeking laparoscopic gastric bypass surgery. When Uppot and his colleagues examined tests performed between 1989 and 2003, they found that 0.10% of inconclusive exams were due to patient size in 1989, compared with 0.19% by 2003.

For other modalities such as CT and MRI, there were other issues, "but they weren't as great," Uppot says. "The main issue [for patients] was whether they could fit on the table."

If they could get on the table, adjustments could be made on a CT scanner, for example, to try to obtain better quality images and decreased "noise" from inadequate beam penetrations when compared to images made of a normal-sized person. These adjustments might result, though, in an increased radiation dose to the patient.

Will the patient damage the table?

Concerns have risen over patients who surpassed the weight limit of the table as specified by a manufacturer: They could damage a table or its motor mechanics. Usually, the cost of damage will not be covered if a heavier patient is placed on the table for imaging, which has led to a quandary for many health care institutions.

With these findings on obese patients and imaging equipment, manufacturers have begun to take notice. New fluoroscopic equipment is being introduced that is raising the table weight support limits from 350 pounds to upward of 550 to 700 pounds and increasing the bore diameter limits up to 70 cm.

New larger CT scans are being introduced that can accommodate upward of 680 pounds and have an increased gantry diameter of up to 90 cms. In comparison, most hospitals now have scans that are built to accommodate patients just up to 450 pounds. However, most of these new larger-bore CTs have been located in health care facilities for radiation oncology diagnosis and treatment. "They have not been used uniformly in radiology departments for diagnosis," Uppot said.

Some of the greater changes in diagnostic radiology equipment sizes have been occurring with MRIs. When patients are too large to fit inside the bore of a high-field MRI magnet, an open MRI system, with low-field magnets, could be used. The field strength of the magnets, measured in units of Tesla, would be in the area of 0.75 or 1 Tesla.

But new larger closed units also have been introduced with 1.5 Tesla. "The stronger the magnet, the better the quality of the images," says Jodi Hildestab, the radiology clinical coordinator manager with the Mayo Clinic in Jacksonville, FL. The clinic purchased its closed-unit MRI scanner, manufactured in 2004 by Siemens Medical Solutions, with U.S. headquarters in Malvern, PA. The table has a weight limit of 550 pounds and a bore opening of 70 cm in diameter (compared with the usual 60 cm diameter). The MRI scanner used by Mayo has one foot of free space between a patient's head and the magnet. At four feet long, the magnet allows more than 60% of exams to be completed with the patient's head outside the bore.

While the clinic doesn't encounter many morbidly obese patients, many patients do have weight issues. Using the larger unit has helped those patients and others feel less claustrophobic during the usual 45-minute period needed for an MRI scan, Hildestab says.

As manufacturers look at the idea that bigger is better, they may encounter some resistance. "There will be physics-related limitations," Uppot says. "Once you make the gantry diameter more than a certain diameter, [will it reach a point] where there will not be enough power for the X-ray beam to travel through the patient and get an image?"

For the current time, many radiology departments are facing the question of what to replace their imaging equipment with as it gets older. [See the resource box of manufacturers who are now producing equipment that can be used by heavier patients.] While equipment is available, from fluoroscopes to MRIs, that feature tables that can handle weights ranging from 500 to 700 pounds, Uppot suggests that weight load should not just be the

RESOURCES

Manufacturers producing radiological equipment to accompany larger sizes include:

• GE Healthcare Global Headquarters (U.S), Waukesha, WI. Phone: (800) 886-0815. Web: www.gehealthcare.com.
• Hitachi Medical Systems America, Twinsburg, OH. Phone: (800) 800-4925. Web: www.hitachimed.com.
* Philips Medical Systems Global Headquarters (U.S), Andover, MA. Phone: (978) 659-3000. Web: www.medical.philips.com.
• Shimadzu Medical Systems, Torrance, CA. Phone: (310) 217-8855. Web: www.shimadzu.com/products/medical/index.html.
• Siemens Medical Solutions, Malvern, PA. Phone: (800) SIEMENS or (610) 408-0920. Web: www.usa.siemens.com/medical.

predominating factor in making a selection.

"You have to see what the patient population of your institution is," he says. When he and his colleagues looked at his hospital's patient history over the past 10 years, they noted that only one patient ever came close to 700 pounds. Instead of just looking at upper weight capability, he suggested also examining the quality of the images produced by the machine and the level of service provided by the manufacturer, such as how quickly the manufacturer responds if the equipment breaks down.

In Uppot's recent investigations of what happens to patients who cannot fit on a table because of their size, he has disavowed one common misconception among physicians and radiologists: that they can use a CT at a local zoo. "I've tried to debunk that," he says. "I have called at least 20 zoos now across the country. There is not a single zoo that has a CT-machine that can accept larger patients." ■

Joint Commission seeks help developing standards

In a pilot test, The Joint Commission's new Web-based collaborative forum, called WikiHealthCare (wikihealthcare.jointcommission.org), is encouraging health care providers, administrators, researchers, and other health care professionals to add their comments on the development of standards pertaining to medication protocols in radiology and MRI safety.

Registered users on WikiHealthCare can discuss solutions, edit existing solutions, or create new solutions to a selection of quality improvement topics.

One of those areas in which The Joint Commission is requesting feedback addresses permission to use a medication protocol for administering IV contrast agents in radiology when a pharmacist's prospective and/or retrospective review of the medication order was not conducted. The Joint Commission said it is considering expanding this proposed revision to include nuclear medicine and MRI services. The Joint Commission said it also would like to

CNE objectives

To earn continuing education (CNE) credit for subscribing to *Healthcare Imaging Update*, CNE participants should be able to:

- Identify clinical or scientific issues related to development and provisions of diagnostic imaging and other radiology services.
- Describe how those issues affect service delivery and the benefits or problems created in patient care.
- Integrate practical solutions to problems and information into daily practices, according to advice from nationally recognized radiology experts. ■

COMING IN FUTURE MONTHS

- Controversy over "super X-rays"
- New recommendation from the U.S. Preventive Services Task Force
- Advancements in a radiation oncology treatment
- Is lithotripsy better than surgery?

identify organizations that have successfully implemented policies on the use of medication protocols in the area of radiology, nuclear medicine, echocardiography, and/or MRI. In particular, it would like to see comments on performance requirement pertaining to using gadolinium-based MR contrast agents.

Responses to The Joint Commission may include examples of protocols, policies, and procedures used within the registered user's organization; adding new performance requirements; or providing feedback on current experiences. The content developed on the site is considered non-proprietary, open source information. ■

CNE *questions*

5. Concerns about radiation exposure from CT scans are particularly relevant with respect to:
   A. Cardiac patients.
   B. Women of childbearing age.
   C. Children and young adults.
   D. People with a family history of cancer.

6. Currently, medical science does not support the use of:
   A. CT angiography.
   B. The use of MRI in pediatric populations.
   C. Whole-body CT scans.
   D. Ultrasound imaging for guiding ablation procedures.

7. Currently, CT colonography generally is recommended in cases in which:
   A. An optical colonoscopy cannot be completed.
   B. A patient is considered at high risk for perforation of the colon.
   C. A patient will not otherwise undergo any colorectal screening test.
   D. All of the above

8. On average, most hospitals now have CT scans that are built to accommodate patients just up to how many pounds?
   A. 350 pounds
   B. 450 pounds
   C. 550 pounds
   D. 650 pounds

Answers: 5. C; 6. C; 7. D; 8. B.

CNE instructions

Nurses participate in this continuing education program by reading the issue, using the provided references for further research, and studying the questions at the end of the issue. Participants should select what they believe to be the correct answers, then refer to the list of correct answers to test their knowledge. To clarify confusion surrounding any questions answered incorrectly, please consult the source material. After completing this semester's activity with the **June** issue, you must complete the evaluation form provided in that issue and return it in the reply envelope provided to receive a credit letter. ■