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**The growing
epidemic of obesity**

By Jeremy Kuhar



looming epidemic weighing on the minds of radiology professionals, is not going away anytime soon – obesity. More than 60 percent of American adults (about 127 million) are categorized as being overweight or obese, according to the National Institutes of Health, and each year healthcare costs associated with obesity amount to approximately \$100 billion.

But, perhaps nowhere is the problem of obesity seen more than in the radiology suite, where the concern actually has more to do with what cannot be seen. According to recent research from Massachusetts General Hospital (MGH), Boston, obesity limits what radiologists can see when using imaging equipment to diagnose patients. The end result is that many obese patients do not have access to sufficient imaging equipment – an essential element to proper healthcare.

“Hospital radiology departments are increasingly unable to adequately image and assess obese patients because of the limitations in current radiology equipment,” says Raul Uppot, MD, a fellow in abdominal imaging and interventional radiology at MGH and lead author of the study.

WEIGHTY DILEMMA

Uppot and colleagues conducted a 15-year retrospective study of all radiologic exams at MGH to determine how obesity affects the ability of radiology departments to provide optimum image quality and accurate diagnoses.

The study reviewed radiology reports filed between 1989 and 2003 that were labeled as “limited by body habitus,” meaning limited in quality due to the patient’s size. The percentage of these reports nearly doubled during the 15-year period, from 0.10 percent in 1989 to 0.19 percent in 2003, which strongly correlates with the increase in obesity in the state of Massachusetts from 9 percent in 1991 to 16 percent in 2001.

The imaging exam most often filed as limited was abdominal ultrasound (1.5 percent), followed by chest X-ray (0.08 percent) and abdominal CT (0.04 percent). Because ultrasound waves must penetrate through body tissue to produce quality diagnostic images, quality is compromised in even slightly overweight patients. X-rays can also be limited by inadequate penetration and film size.

CT and MR are predominantly limited by the amount of weight the equipment can support and the width of the bore, a tunnel through which patients must pass during the exam; neither is typically designed to accommodate larger patients.

Uppot calculated the direct costs of the incomplete radiologic exams at approximately \$100,000 in 2003, more than triple the cost of \$28,000 in 1995. “Although the direct cost impact of obesity on imaging is still relatively small today, it has grown at an alarming rate over the past 15 years,” he says.

Uppot says more research should focus on measuring medical and psychological costs from increased hospital stays, further diagnostic testing and misdiagnosis in individuals

who could not be imaged at all because they are too large for the equipment.

“Manufacturers need to think about design changes and technological advancements to obtain quality imaging in larger patients,” Uppot says. “In the meantime, radiologists need to be aware of the limitations of their current imaging equipment and optimize current protocols and equipment settings to accommodate America’s fattening population.”

BACK TO THE DRAWING BOARD

In a direct response to this growing epidemic, some manufacturers have literally gone back to the drawing board to see if they can engineer new imaging equipment to service these larger patients.

“We realized that our customers were faced with a dilemma,” says Anne Sheehan, marketing manager of open field MR products for Siemens Medical Solutions, Malvern, Pa. “Patients who were too large or too heavy to fit through the bore of an MRI scanner were being sent to an open MRI system so they could fit. But because of their size, they also needed a magnet with more signal-to-noise ratio. So there was this Catch-22. Physicians were sending their patients to a magnet that they could fit into, but the diagnostic scans were marginal – and most of the time not even acceptable – because the open systems had lower field strengths not capable of producing the necessary signal-to-noise. Then again, it was all their patients could get. So what do you do?”

According to Sheehan, Siemens’ customers were increasingly asking for an open magnet with a higher field strength that could

Did You Know?

Obesity is a chronic disease with a strong familial component.

- ▶ Obesity increases one’s risk of developing conditions such as high blood pressure, diabetes (Type 2), heart disease, stroke, gallbladder disease and cancer of the breast, prostate and colon.
- ▶ Health insurance providers rarely pay for treatment of obesity despite its serious effects on health.
- ▶ The tendency toward obesity is fostered by our environment: lack of physical activity combined with high-calorie, low-cost foods.
- ▶ If maintained, even weight losses as small as 10 percent of body weight can improve one’s health.
- ▶ The National Institutes of Health annually spends less than 1 percent of its budget on obesity research.
- ▶ Persons with obesity are victims of employment and other discrimination, and are penalized for their condition despite many federal and state laws and policies.

▶ *American Obesity Association*

accommodate these obese patients. “But how do you build a high field open MR? It’s an interesting engineering question,” she says.

When faced with this dilemma, some manufacturers opted to use permanent magnets. However, the higher the field strength, the bigger the magnet needed, which means it’s going to get heavier and heavier, limiting where you can site the scanner, says Sheehan. “Realistically, you can only get up to about .7T with an open-field permanent magnet,” she says, “and high field is generally considered to start at 1T.”

Other companies took a different approach and chose resistive magnets. However, resistive magnets have to run energy through them and they use a little bit of iron to help strengthen the field. Sheehan also cites the “tuning fork problem” associated with the dual pole design used with resistive magnets.

“You start running into vibration problems because the magnets act like a tuning fork when they are placed in a vertical field,” she explains. “The bigger you make the tuning fork, the more sensitive it is to vibrations, so imaging centers have a lot of problems siting these MR units. You need a super solid floor to avoid the vibrations, so now you’re looking at expensive concrete that you’ll have to pour.”

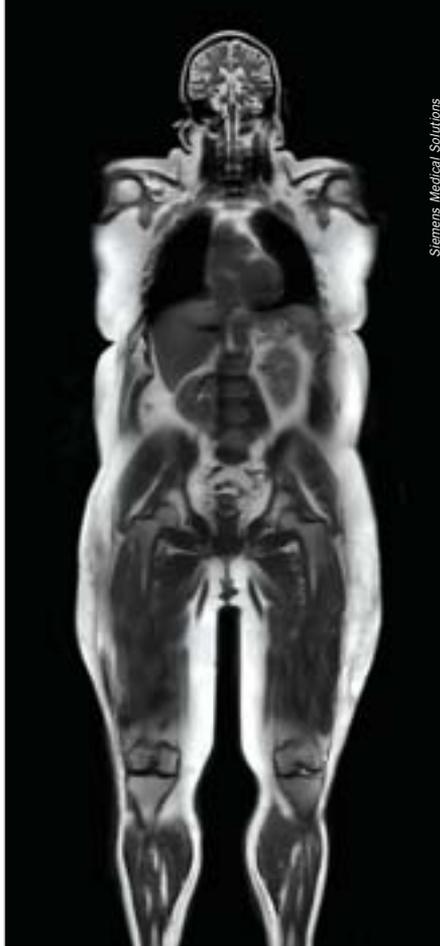
Even if the MR unit was placed in a barn out in the middle of a cow field completely devoid of these bothersome vibrations, the dimensions between the pole is limited, Sheehan adds. The problem is not about how to make the magnet stronger, but how to make the bore wide enough that obese patients can fit, while eliminating the vibration issues?

“You can only push the poles apart so far before you start approaching the tuning fork problems. There’s just nothing you can do. The more you try to drive those poles apart, the bigger the problems,” says Sheehan. “It’s just physics.”

To help solve the magnet problem, Sheehan says Siemens turned to another imaging modality for their inspiration. “We looked at CT and realized they had a 70 cm bore for a couple of decades. You don’t hear about people not being able to fit in there too often and you don’t hear about people not being able to tolerate it because of its shorter bore length,” says Sheehan. We looked at the whole CT bore construction and realized: This is how we can do it.”

Siemens redesigned the MR bore to be shorter and much more open – more like CT. And, as a result of this new approach, they produced their most recent MR product, the Magnetom Espree, which offers a 1.5T magnet with a beefy 70 cm wide bore that’s only 125 cm short. The bottom line? Obese patients fit comfortably, and clinicians get the images they need.

Apparently, Espree’s figure, a curvy 125-70-1.5 caught the eye of National Institutes of Health (NIH) researchers, who recently



Siemens Medical Solutions

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purchased an Espree to further their obesity studies. Sheehan says the scanner will be installed later in August.

While MRI is probably the first modality to draw engineers’ attention, ultrasound is also catching the attention of many device manufacturers, who are busy developing solutions to make a better transducer. One company trying to improve ultrasound technology is Philips Medical Systems, Andover, Mass.

“The growing ‘spread’ of America is a consideration in the transducers we design and manufacture and we strive to produce transducers that meet the broad needs of our customers,” says Jim Hutchins, marketing communications manager for Philips ultrasound division. “Noise and clutter in the image is common when imaging the obese patient. SonoCT technology helps to eliminate artifact (random noise and clutter) from the image thus improving spatial and contrast resolution. Xres adaptive real-time image processing further reduces artifacts resulting in enhanced tissue margins and borders that may be difficult to see in the obese patient. The iU22 iOptimize features, such as iScan with Adaptive Gain Compensation, also provide more image uniformity and consistency.”

A more recent technology development is the PureWave crystal technology that improves the efficiency of the transducer. “This piezoelectric material aligns the ‘dipoles’ so that there is a straighter signal, better penetration and improvement in viewing a wide variety of body types,” says Hutchins. “The efficiency of a PureWave transducer improves the conversion of electric to mechanical energy 65 percent to 85 percent in comparison to traditional ultrasound transducers. In addition to better image quality, it also allows for broader bandwidth, especially in the lower frequencies, which is required to image the obese patient.”

PATIENT RELATIONS

While engineers are busy at the drawing boards engineering new solutions to accommodate the largest patients, radiology professionals have had to do some re-engineering of their own.

“There’s a lot of attention paid to the health effects of being obese, but what the general public doesn’t understand is how much it makes proper diagnosis difficult,” says Levon N. Nazarian, MD, professor of radiology at Thomas Jefferson University Hospital in Philadelphia, in a recent interview with the *Washington Post*. “Every stage of an obese person’s medical care is compromised because of their size, and that includes diagnosis and treatment.”

Nazarian says he encounters about five patients per week whose imaging tests are deemed useless because they are obese.

He recalls trying to perform a routine ultrasound on a pregnant woman who weighed about 300 pounds. "I couldn't even see the number of chambers of the heart or the structure of the brain or the baby's sex, which she wanted to know," says Nazarian. "She wanted reassurance and I couldn't give it to her, and that was difficult. I didn't want to make her feel worse, so I didn't tell her what the problem was," he says. "I just said, 'The way the baby's lying, we're not getting a very good look.'"

The difficulty communicating with obese patients is not uncommon, says Dirk Rodriguez, MD, FACS, a Dallas-based surgeon specializing in bariatric surgery at the Texas Bariatric Center. Many radiologists and other healthcare professionals feel awkward when working with obese patients, he says. "The key is to not break your patient's trust. For example, try to be prepared as best you can. Know whether or not your equipment can handle patients weighing more than 350 pounds and make sure you have gowns that will accommodate larger patients. But most importantly, if you can't provide these services, do not place the blame on the patients. If you cannot obtain optimal results because of body habitus say, 'I'm sorry but our equipment cannot accommodate you' rather than 'You are too large for our equipment.'"

Rodriguez says the difference may be subtle to us, but to obese patients who may be sensitive to these scenarios, the switch in emphasis makes a big difference. "You are emphasizing the fact that as a service provider you are unable to accommodate them, rather than blaming them for not conforming to your standards, Rodriguez says."

Brette McWhorter Sember, author of *Your Plus-Size Pregnancy: The Ultimate Guide for the Full-Figured Expectant Mom* (Barricade Books, 2005), can't emphasize the importance of getting the gown size right – the first time. "It's important that you give obese patients gowns that actually fit their bodies," she says. "There is nothing worse than standing in the changing room or closet and realizing the gown does not completely cover you. You have to wait for the technologist to come back to get you and then tell her it does not fit. The entire process can be embarrassing."

Well, actually there is something worse, says Sember, like if the technologist takes a look at you and says, "Let me go get a bigger gown." These tasks can be done without comment. And larger gowns should always be available considering half of the U.S. population is overweight, she says.

The best plan, says Sember, is to try to be friendly and normal. When a radiologist is working with a patient, try to put the patient at ease. "Some patients worry they are too heavy to fit on a table or in a machine and may hesitate or be embarrassed," says Sember. "If a patient is worried about this, put him or her at ease and say that it's not a problem and they have nothing to worry about."

If a radiologist or technologist needs to tell a patient he or she will not fit in the machine, tell the patient the truth, but try not to do so in a way that conveys your annoyance or frustration. "Even though you may be frustrated by the limitations of your equipment or are upset that you will not be able to help the patient, this is often interpreted by patients as disapproval or frustration with them," she explains. "They take it personally even when you do not mean it personally."

Like Rodriguez, Sember suggests shifting the emphasis to what your facility is unable to do rather than blaming the patient. She also suggests that radiology professionals offer their patients



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alternatives if they are not able to accommodate them. Tell them what other tests are available, where they can go if your facility cannot provide the services or what the next step is. For example, do they need to return to the referring physician?

In Sember's book, a lot of overweight pregnant women shared horror stories with her. "Some women told me about sonographers who embarrassed them in front of family members who were in the room to see the baby and about sonographers who seemed to show no mercy pressing the transducer into their belly buttons. If you know a patient is overweight and a transvaginal ultrasound will work, try that," she says. "Don't put the patient through the embarrassment of digging a transducer into their stomach if you know the image will be useless."

In most cases it is not necessary to tell a patient you can't get a good image because he or she is overweight. If you need to explain why you can't get a good image, simply say that the patient's body type made getting a good image difficult.

"The thing to remember about weight is that it's like a third person in the room. Both of you know it's there, so do you really need to point it out?" asks Sember. "The patient is well aware of this and having it pointed out in this way implies he or she is dumb."

It is also important to recognize that while obesity is considered to be a medical diagnosis, there are overweight and obese patients who may be healthy. The medical condition that has brought them to radiology may have nothing at all to do with their weight. "Obese patients don't want to be treated as if being overweight is a 'diagnosis' in and of itself," explains Sember. "They really want to be treated like any other patient. They want information and facts."

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