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Looking Inside

Get the Facts About Radiation

Radiation can be dangerous, but it can also save lives. How can that be? Harnessed properly, radiation can help diagnose and even treat disease. So when you're faced with a medical test that uses radiation, don't let fear get in your way. Learn about the risks and benefits, and know what questions to ask. If medical radiation is really needed, take steps to ensure that it's done as safely as possible.

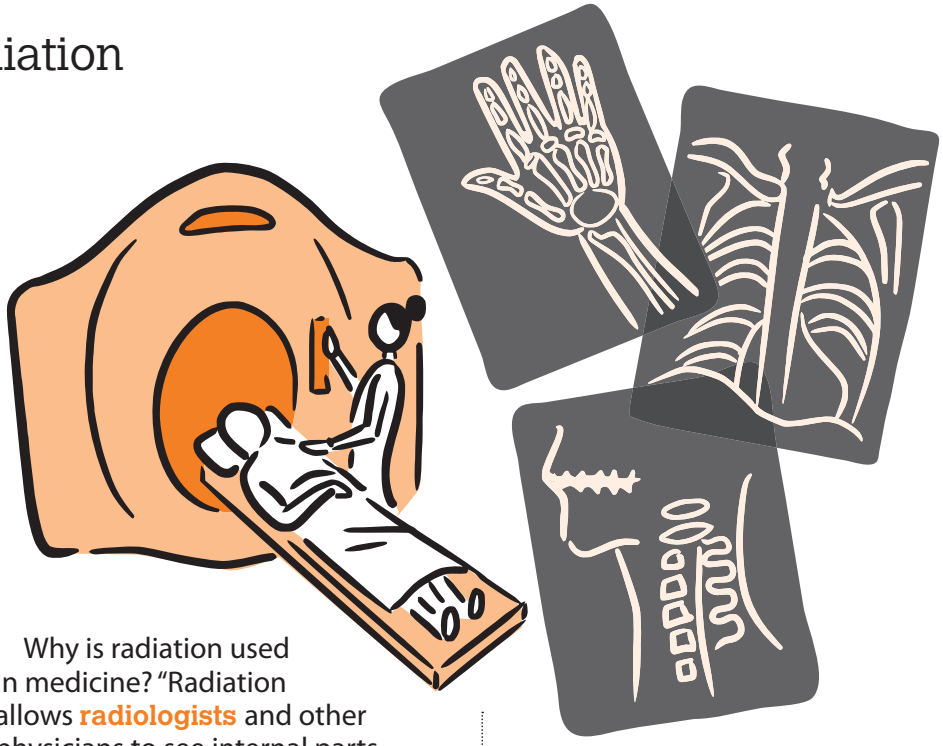
Radiation, simply put, is the transfer of energy through space. The energy may be in the form of invisible particles or waves. Radiation is all around us—and has been throughout our evolution—so our bodies are designed to deal with the low levels we're exposed to every day. Excess radiation, however, can damage tissues and lead to serious problems.

Definitions

Radiologists
Doctors who specialize in creating and analyzing images of the inside of the body. The pictures might be produced with X-rays, sound waves or other types of energy.

X-rays
A type of radiation used to diagnose and treat cancer and other diseases.

CT Scans
Short for "computed tomography," this method uses special X-ray equipment to create 2- or 3-D pictures of organs and structures inside the body.



Why is radiation used in medicine? "Radiation allows **radiologists** and other physicians to see internal parts of the body that they aren't able to see directly with their eyes or through other physical examination measures," explains Dr. Steven Krosnick, a radiologist at NIH.

Techniques like **X-rays** and **CT scans** send controlled amounts of radiation through the body and create images based on what comes through the other side. Another imaging method called nuclear medicine uses compounds that emit radiation, which can then be detected outside the body. Injected or swallowed, these compounds can target a specific area and reveal internal problems. Or they can be used to track how well internal organs are working.

With these advanced imaging tools, doctors can detect disease early, when it's easier to treat. As a result, use of medical radiation has been rising. But with these benefits come some risks.

"One of the main risks of being exposed to radiation is the possibility of developing a cancer," says Krosnick. Cancer takes years to develop, so it's nearly impossible to tell exactly what causes any given cancer. As a result, it's hard for researchers to gauge exactly how much risk a given amount of radiation poses.

Children's growing bodies are even more susceptible to radiation dam-

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age than those of adults. Children have a long lifetime ahead. Any damage caused by radiation has a longer period of time to show itself.

Earlier this year, a worrisome report linked childhood CT scans to 2 types of cancer later in life: leukemia and brain cancer. The NIH-funded study looked at more than 175,000 children and young adults. Depending on the radiation dose, those who'd received 2 or more scans had a small boost in cancer risk. Because these cancers are rare, the benefits of CT scans likely outweigh the risks, the researchers concluded. Still, they suggest that doctors consider alternatives to CT scans or use the lowest possible radiation doses.

Strangely enough, radiation can also be used to treat cancer. Focused doses of high-energy radiation can kill cancer cells and shrink tumors. Medical imaging tests, in contrast, use much lower doses.

"The fundamental thing to understand is that these procedures all deliver a generally low amount of dose," says Dr. George Sgouros at the Johns Hopkins University School of Medicine. "In some cases, depending on your disease, it's potentially riskier to not get the scan or nuclear medicine procedure than to get it."

Sgouros and his colleagues have been investigating how to strike a balance between radiation risk and the benefit of having clear images for diagnosis. "If you're so concerned about the radiation risk that you give too little, you could misdiagnose the patient," he says.

Traditionally, the amount of radiation used in an imaging test was based on weight. Sgouros's team used computer simulations to examine the effects of different doses in a nuclear medicine scan. "We found that we could give roughly half as much of the radioactivity to a tall, thin child than to a short, stout child and get the same quality image," he says.

His group is now planning to do similar analyses for a variety of different body shapes and sizes. Eventually, the researchers hope to create guidelines that take into account not only weight but also height, sex, age and other factors. Similar efforts are under way to optimize CT scans and X-rays.

Dr. Rebecca Smith-Bindman of the University of California, San Francisco, has been studying the trends. She thinks we're turning to radiation-based tests too often. This summer, her group published a report showing a sharp rise in the use of these tests between 1996 and 2010. "It's not just the sick and the intensive care patients getting these exams," she says. "Everyone's getting them, across a whole spectrum of disease, both serious and trivial, and therefore any potential harm really needs to be considered."

If a doctor recommends a test that uses radiation, ask about its risks and benefits. If the test is truly needed, do some research into the imaging facilities. Find one that monitors the doses they're giving patients and takes pride in low doses. "We have found that there's enormous variation in dose for the same clinical test," Smith-Bindman says. Doses can vary not only between facilities, she explains, but at the same facility based on the time of day and who's conducting the test.

If you're faced with the prospect of an imaging test, fight fear with knowledge. Check out our "Wise Choices" box for some questions to ask your doctor. ■

Wise Choices
Ask About Your Imaging Test

If you're considering an imaging test, here are some questions to ask:

- What are we hoping to learn from the test?
- How is it going to help me?
- Will the test results change how my disease is managed?
- Do I need the test now, or can I wait?
- Is there another test I can use instead? If so, what are the benefits and risks of each?
- How can I be sure the test will be done in the safest way possible?
- Can you make sure to use the lowest radiation dose for what you need to know?
- For children: Is the facility using pediatric protocols for the test?

Web Links

For more about medical imaging and radiation, click the "Links" tab at:
http://newsinhealth.nih.gov/issue/Oct2012/Feature1

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National Institutes of Health
Office of Communications
& Public Liaison
Building 31, Room 5B64
Bethesda, MD 20892-2094
nihnewsinhealth@od.nih.gov
Tel: 301-435-7489 Fax: 301-496-0019

Managing Editor Harrison Wein, Ph.D.
Editor Vicki Contie

Contributors Vicki Contie, Alan Defibaugh (illustrations) and Harrison Wein

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Can't Curb the Urge to Move?

Living With Restless Legs Syndrome

Staying active is usually a good thing. But the motivation to move goes to unwelcome extremes for people with restless legs syndrome. The condition can cause throbbing, pulling or creeping sensations in the legs along with a powerful need to move around for relief. The feelings can range from uncomfortable to agonizing.

"People with this condition feel they just absolutely have to move their legs. Their legs feel uncomfortable or even painful unless they move them," says Dr. Richard P. Allen, an expert on restless legs syndrome at Johns Hopkins Bayview Medical Center. "When it's extreme, patients with this condition can be sitting—in a meeting, in a conversation, watching TV—and they have to keep moving their legs, which could be very disturbing to themselves and to other people."

By some estimates, about 1 in 20 people nationwide has restless legs syndrome. It's about twice as common in women than in men. The disorder can arise at any age, but it's generally more serious in middle-age and beyond.

Wise Choices
Recognizing Restless Legs

Restless legs syndrome brings all 4 of these characteristics:

- A strong urge to move your legs, often with unpleasant feelings like tingling, burning or throbbing in the legs.
- Symptoms that get better with movement.
- Symptoms that worsen at night and are mostly gone in the morning.
- Symptoms triggered by inactivity.

Activity relieves the discomfort that people with restless legs syndrome feel, so they often keep their legs in motion. They may pace, jiggle or flex their legs, and toss and turn in bed. This need for movement can make it hard to fall asleep and stay asleep, which can lead to exhaustion.

The irony of restless legs syndrome is that the very act of lying down and trying to relax only activates the symptoms. Symptoms usually arise if you're inactive for extended periods, such as on long flights or car trips. They are often worse at night and gone in the early morning, so some people catch up on sleep at sunrise.

Once it appears, restless legs syndrome generally doesn't go away. Symptoms might decrease or disappear for days, weeks or months, but they usually return. The condition can affect one or both legs and even the arms or torso.

The cause of restless legs syndrome in most cases is unknown. Research shows that affected people often have too little or malfunctioning iron in the brain. "We also know that there's some problem with the **dopamine** system, and patients often have a good response to dopamine medicine," says Allen. Imaging studies show that people with restless legs syndrome have abnormalities in a movement-related brain region where dopamine is active.

Because the disorder tends to run in families, **genes** likely play a role.

Definitions

Dopamine
A brain chemical that regulates movement, motivation and other functions.

Genes
Stretches of DNA, a substance you inherit from your parents, that define characteristics such as how likely you are to get certain diseases.

Learning more about the underlying genes might lead to improved treatments in the future.

Although there's no cure for restless legs syndrome, medications and lifestyle changes can help minimize symptoms and increase restful sleep. Cutting back on caffeine, alcohol and tobacco may help. Taking a hot bath, massaging the legs or using a heating pad or ice pack can also relieve symptoms. Your doctor might recommend medications that boost dopamine levels or other medicines to address your symptoms.

"In general it helps to stay active, stay in good health and try to keep good sleep habits," says Allen. If you're concerned about restless legs syndrome, talk with your health care provider. A combination of approaches can usually provide some relief. ■

Web Links

For more information about restless legs syndrome, click the "Links" tab at:
http://newsinhealth.nih.gov/issue/Oct2012/Feature2

Health Capsules

For links to more information, see these stories online:
http://newsinhealth.nih.gov/issue/Oct2012/Capsule1

Antibodies Protect Against Range of Flu Viruses

Scientists isolated antibodies that protect mice against several deadly flu viruses. The accomplishment is a step toward a flu vaccine that can protect against multiple viral strains for several years.

Flu is caused by influenza viruses, which infect the nose, throat and lungs. These viruses constantly change, or mutate. Researchers need to reformulate the flu vaccine each year to match new strains. If a vaccine could prompt the body to make antibodies that latch onto unchanging parts of the virus, it might provide long-lasting protection.

NIH-funded researchers previously isolated antibodies that target a wide range of influenza "type A" viruses. Type A viruses are responsible for avian flu, the 1918 pandemic flu and seasonal flu.

In the new study, scientists took a similar approach to find antibodies that neutralize influenza "type B" viruses. Influenza B viruses have received less attention. They're less likely to cause worldwide outbreaks. But they can cause seasonal flu.

Researchers collected and tested antibodies from people recently vaccinated for seasonal flu. The scientists identified 3 antibodies that latched onto a specific region on different influenza B viruses. One of these 3 also bound type A viruses.

All 3 antibodies protected mice from deadly influenza B viruses. The broader-binding one also guarded against lethal doses of 2 types of influenza A viruses.

"To develop a truly universal flu vaccine or therapy, one needs to be able to provide protection against influenza A and influenza B viruses," says one of the head authors, Dr. Ian A. Wilson of the Scripps Research Institute. "With this report, we now have broadly neutralizing antibodies against both." ■

MRI Shows Promise for Heart Procedures

An experimental MRI method may be as safe and swift as standard X-ray procedures for imaging the heart during certain types of surgery. The new finding suggests a radiation-free alternative to the current method.

Doctors use a procedure called cardiac catheterization to diagnose and treat certain heart conditions. They ease a thin flexible tube, or catheter, through blood vessels, usually beginning in the arm, neck or leg and ending in specific areas of the heart.

To make sure the catheter is reaching the right spot, surgeons often use special X-ray "movies" that show the tube's movement. The movies use low, generally safe doses of radiation. But the X-rays can pose risks to children and people who undergo long or repeated procedures.

NIH scientists have been working to develop rapid MRI methods that that can help surgeons see and place cardiac catheters without radiation. MRI uses harmless radio waves and magnetic fields to create pictures.

In the study, 15 patients with heart disorders underwent cardiac catheterization using first X-ray and then MRI guidance. The average procedure time for the 2 approaches was similar. Procedure steps were as successful with MRI as with X-ray guidance.

"This could be the first chapter of a big story," says Dr. Robert S. Balaban, a heart imaging expert at NIH. "It provides evidence that clinical heart catheter procedures are possible without using radiation, which could be especially valuable in areas such as pediatrics." ■

Featured Website

College Drinking: Changing the Culture

www.collegedrinkingprevention.gov

Concerned about college drinking? This up-to-date website provides students, parents and educators with research-based information related to alcohol abuse and binge drinking among college students.

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