

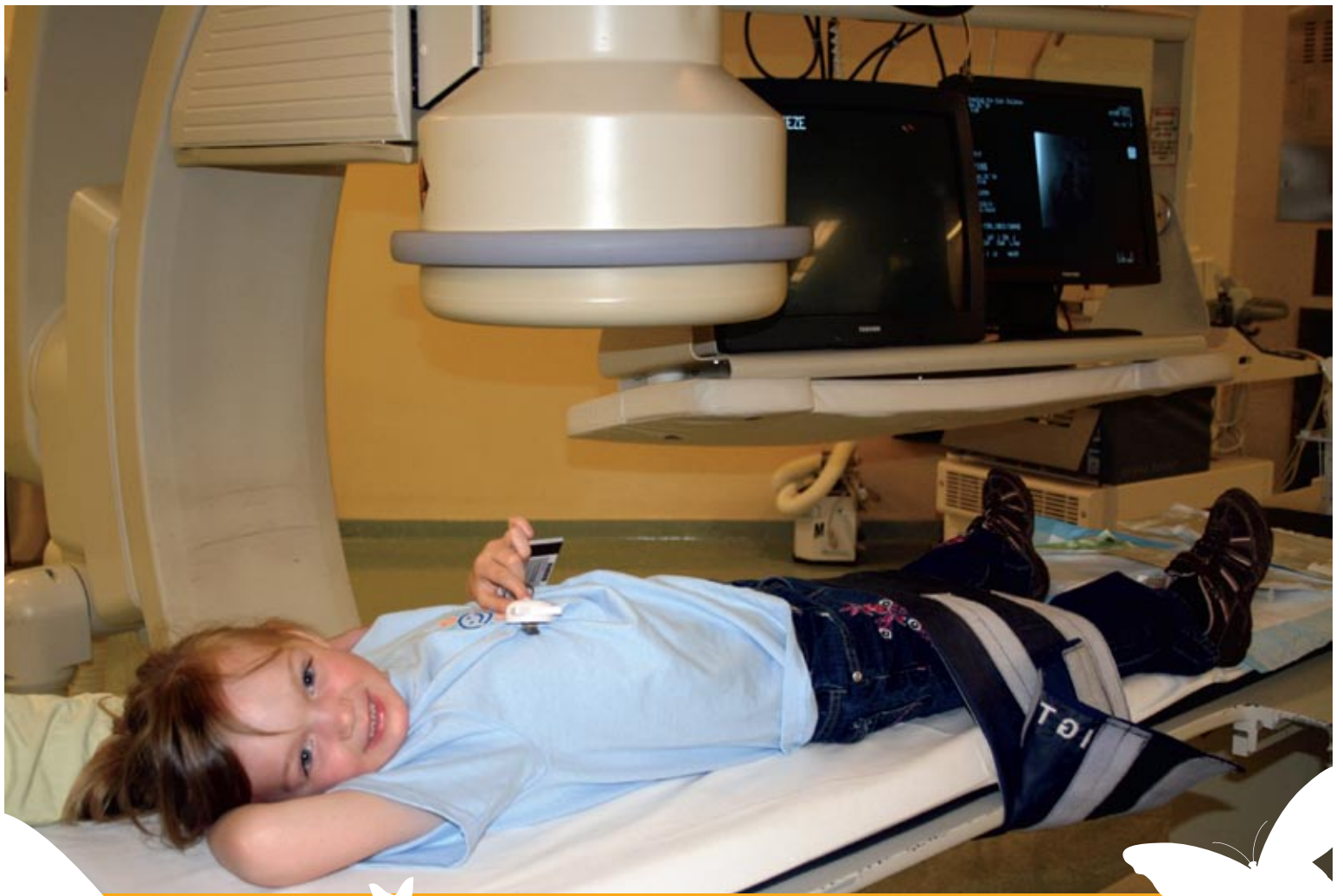


What Parents Should Know

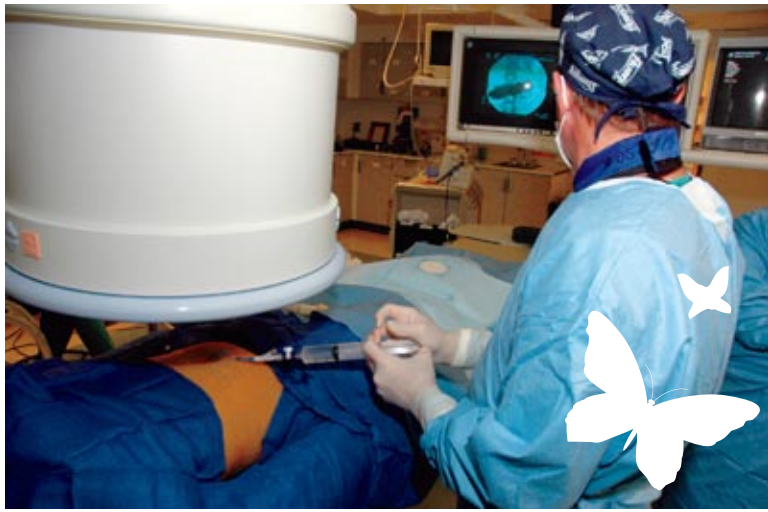
About Medical
Radiation Safety
in Pediatric
Interventional
Radiology

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Imaging helps physicians see into the body as they perform interventional radiology procedures to diagnose and treat their patients. Some types of imaging used for interventional radiology use ionizing radiation. The following information will help parents and caregivers understand some of the issues and questions surrounding this topic.



What is Pediatric Interventional Radiology (IR)?

Pediatric interventional radiology (IR) is a medical field that diagnoses and treats medical illness using small instruments such as catheters or tubes in children. In some instances, it replaces the need for a child to have surgery with a larger incision.

IR doctors guide small needles, catheters and other small medical equipment into the body through tiny incisions in the skin. These instruments are manipulated by the radiology doctors, who guide the instruments by seeing into the body, using X-rays, computed tomography (CT) scans, ultrasound or magnetic resonance imaging (MRI). The instruments are used to target and treat disease at its source in the body. In general, all the IR techniques used in adults can be performed in children although the medical conditions in children may differ from those in adults.

Abnormal blood vessels or cancerous and non-cancerous tumors are just a few of the types of medical problems that may be treated by IR. In some cases, IR treatments can solve problems faster and with smaller incisions than can other techniques, resulting in less pain and a shorter time to heal. In other cases, they can help treat medical problems that cannot be solved any other way. Pediatric and interventional radiologists are experts in these treatments and their follow-up in children, whose small size and special needs may require extra care.

IR procedures may be performed in a special room, called an IR, “angiography” or “special procedures” room, which is like an operating room equipped with specialized imaging equipment. Other IR procedures may be performed within a CT scanner, MRI scanner, ultrasound room or at the patient’s bedside. Your IR doctor will select the best equipment and place to treat your child’s condition effectively and safely.

For many IR procedures, sedation is given to children to help them to stay still and remain comfortable while the test is being performed. X-ray or MRI medicine called “contrast” also may be given, into the blood vessels or organs, to help see them better. Your pediatric interventional radiology doctor will explain these details of the procedure in advance. These medicines are usually safe. Children with severe kidney problems may not be able to get the contrast medicine or may require a different type of contrast, as the medicine gets removed from the body through the kidneys. Allergic reactions from the contrast or other medications may occur rarely in children. Before contrast or medication is given, you will be asked if your child has unusual allergies or kidney problems. It is important for you to discuss these issues with your doctor prior to the study being performed.

What is medical radiation?

There are several different ways radiation can be used to help children medically. Radiation can be used for imaging or for therapy. Imaging techniques using radiation include X-rays, computed tomography (CT) scans, angiograms and radionuclide (nuclear medicine) studies. Examples of therapeutic techniques include radiation for the treatment of cancer or an overactive thyroid gland and opening blocked vessels with a small balloon (angioplasty). Interventional radiology may be used for diagnosis or for treatment of medical conditions.

What is an X-ray?

X-rays are invisible beams of ionizing radiation that pass through the body and are removed by different tissues or organs to create images. This results in a two- or three-dimensional picture that shows bones, lungs and many organs, and can be used to guide interventional radiology (IR) procedures. Real time X-rays used to guide IR procedures can show the heart beating or a catheter (tube) moving in the body while it is taking place. This is similar to a video camera that takes “live” pictures compared to a camera that takes “still” pictures. The “live” or “real time” pictures using X-ray are referred to as fluoroscopy. In IR, guidance techniques that use X-rays include X-ray pictures, fluoroscopy and CT scans.



How much radiation is used in these exams?

We all are exposed to small amounts of radiation daily from soil, rocks, building materials, air, water, and cosmic radiation. This is called naturally occurring background radiation. The amount we receive depends on where we live. For example, people living in high mountains are exposed to more cosmic radiation than people who live at sea level. Radiation measurements are used to estimate the amount of radiation deposited in the whole body or to an individual organ. The deposited energy represents the patient's radiation dose. Because every patient is different in size and shape, different X-ray settings are used to accommodate these differences resulting in a unique radiation dose for each patient and procedure. Comparing estimated doses for different exams is confusing. One way of looking at doses

from X-ray examinations is to compare effective radiation dose estimates from different sources using millisievert units (mSv).

Doses from IR procedures vary widely depending on the type of test, how complicated your child's medical condition is, and your child's size and shape. The examples in the chart below are samples and the radiation dose for your child could be lower or higher. In some cases, the procedure may be safely performed under ultrasound or, rarely, MRI guidance alone, in which case no ionizing radiation is used. However, most IR procedures are performed with X-ray guidance, as the organs, tissues or blood vessels are often seen the best with X-ray, fluoroscopy or CT. Your IR doctor will be able to answer questions regarding which way is best to treat your child's condition.

Non Medical Radiation Source	Radiation Dose Estimate	Equivalent Amount Background Radiation
Natural background radiation = 3 mSv/yr	3 mSv	1 year
Airline passenger (cross country)	0.04 mSv	4 days

Medical Radiation Source*	Radiation Dose Estimate	Equivalent Amount Background Radiation
Blood vessel central line, PICC (peripherally inserted central catheter) or port placement, simple	0.4 mSv	1 -2 months
Stomach (gastrostomy) tube placement	0.8 mSv	3 months
Blood vessel central line revision or removal, difficult	0.5-5 mSv	2-20 months
Visualization of brain blood vessels (cerebral angiography)	3 mSv	12 months
Visualization of body blood vessels (angiography/venography)	11-33 mSv	4-11 years
CT guided IR procedures	11-17 mSv	4-6 years

*Glennie D, Connolly BL, Gordon C. Entrance skin dose measured with MOSFETs in children undergoing interventional radiology procedures. *Pediatr Radiol* 2008; 38 11 1180-7

*Ahmed B, Shroff P, Connolly B et al. Estimation of Cumulative Effective Doses From Diagnostic and Interventional Radiological Procedures in Pediatric Oncology Patients. Abstract presented at the Society for Pediatric Radiology Annual Meeting, Scottsdale, 2008.

How can we minimize radiation risk to my child?

There are ways to ensure that your child is exposed to the smallest amount of radiation possible during an IR procedure. The Image Gently Campaign is promoting the following techniques for medical imaging examinations performed on children:

- Treat when there is a clear medical benefit.
- Use the safest imaging techniques for procedure guidance, matched to the size of the child.
- Use alternative imaging methods (such as ultrasound or, rarely, MRI) when possible.

If my child's doctor requests an IR procedure, should I allow it?

As with any medical procedure, the benefit of the procedure should always outweigh any risk. In some cases, IR techniques can solve problems faster and with less pain than can other techniques, resulting in a faster and easier recovery. In other cases, they can help treat complex medical problems that cannot

be solved any other way. It is important to remember that if your child faces a serious illness that requires an IR procedure, you should have no reluctance about having the exam. The benefits often clearly outweigh the risks to your child. If an IR procedure is required, ask if your IR doctor uses appropriate low dose techniques to minimize radiation exposure.

Ultrasound and MRI are imaging techniques that do not use radiation. Sometimes these imaging methods can provide similar guidance for an IR procedure and can be used instead of fluoroscopy or CT. Many other times, the important anatomy may only be seen or best seen by fluoroscopy or CT. In these cases, the best IR treatment for your child may require X-ray or CT imaging for guidance.

How can I be sure my IR facility is using appropriate reduced radiation techniques?

Some facilities that perform IR procedures may not use radiation dose reduction techniques when treating children. You won't know unless you ask, and it is reasonable and within your rights to ask. Your IR provider should be able to provide you with information about how they reduce radiation doses.



What are the alternatives to IR?

An IR procedure may be the best way to treat your child's condition. At times your doctor may decide it is safer to simply observe your child before committing them to a procedure. Waiting may be difficult for you and your family, but may result in the same outcome without exposing your child to unnecessary radiation. Your doctor may also suggest a different type of treatment including medical treatment alone or open surgical treatment. You should ask your IR doctor which alternatives are appropriate for your child's situation.

If I still have concerns regarding radiation dose to my child, who should I talk to?

Initial discussions should begin with the physician who is requesting the procedure. Medical professionals must balance the risks and benefits to your child of performing the study. Your pediatric doctor and your IR doctor can work together on decisions about which study is best to perform. If your referring doctor cannot answer your questions, your radiology and IR specialists can provide further information. There may be variations in treatment that may be recommended based on individual facts and circumstances. The information contained in this publication should not be used as a substitute for the medical care and advice of your doctor.

Image Gently is the educational and awareness campaign created by the Alliance for Radiation Safety in Pediatric Imaging, formed in July 2007. It is a coalition of health care organizations dedicated to providing safe, high quality pediatric imaging nationwide. The Society for Pediatric Radiology, Society for Pediatric Interventional Radiology, Society of Interventional Radiology as well as over 38 other societies are members of this coalition, representing more than 600,000 health care professionals in radiology, pediatrics, medical physics and radiation safety. More information can be found at www.imagegently.org.



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Helpful web sites

www.imagegently.org

www.pedrad.org

www.spirweb.org

www.sirweb.org

www.radiologyinfo.org

<http://www.cancer.gov/cancertopics/interventionalfluoroscopy>