Introduction to Radiology

What are imaging tests?

An imaging test is a way to let doctors see what's going on inside the body. These tests send forms of energy (x-rays, sound waves, radioactive particles, or magnetic fields) through the body. The changes in energy patterns made by body tissues create an image or picture. These pictures can show normal body structures and functions as well as abnormal ones caused by diseases like cancer.

What are imaging tests used for?

Imaging tests are used for cancer in many ways:

• For cancer screening, in looking for cancer in its early stages (when it's small and has not spread), even though a person has no symptoms. An example of which is a mammogram test.

• To look for a mass or lump (tumor) if a person has symptoms. They can also help find out if the symptoms are caused by a tumor or by some other type of disease.

• To help predict whether a tumor is likely to be cancer. This can help doctors decide if a biopsy is needed. (In a biopsy, a tissue sample is removed and looked at under the microscope.) A biopsy is almost always needed to know for sure that a tumor is cancer. An example is a CT-guided biopsy.

• To show exactly where the tumor is, even deep inside the body. This helps if a sample (biopsy) of the tumor is needed for further study.

• To help find out the stage of the cancer (figure out how far the cancer has spread).

• To plan treatment, such as when pinpointing where the beams should be focused in radiation therapy. They can also be used to guide needles into tumors for some types of cancer treatments, such as radiofrequency ablation (using heat to destroy a tumor).

• To show if a tumor has gotten smaller, stayed the same, or grown after treatment. This can give a doctor an idea of how well treatment is working.

• To help find out if a cancer has come back (recurred) after treatment.

• Baseline Studies. Many doctors ask that x-rays or other imaging tests be done before

treatment starts so they can then track changes during treatment. Baseline studies show how things looked at the start. Doctors can compare them with later images to see the results of treatment over time. They can also be used later on to find out if the cancer has progressed.

Who does imaging tests and who interprets them?

A doctor, a certified technologist, or other health professional may do an imaging test. A radiologist is a specialist in imaging techniques. He or she is the person who usually reads (interprets) the image made during the test. The radiologist writes a report on the findings and sends the report to the doctor. A copy of the report will become part of the patient records. Other members of you medical team (oncologists, surgeons, etc.) may look at the images, too.

Types of imaging tests relevant to GIST

- **Computed Tomography**

CT scans show a slice, or cross-section, of the body. The image shows the bones, organs, and soft tissues more clearly than standard x-rays and all at the same time. CT scans can show a tumor's shape, size, and location, and even the blood vessels that feed the tumor – all without having to cut into the patient. Because the picture is made by a computer, it can be enlarged to make it easier to see and interpret. The computer then creates a black and white picture that shows a slice of a certain area of the body – much like looking at a single slice from a loaf of bread. The picture can be made clearer by the use of special contrast materials which can be swallowed as a liquid, put into a vein, or put into the intestines through the rectum as an enema. Because body tissues absorb these materials differently, the CT image will show greater contrast between types of tissues. This allows things like tumors to be seen more clearly.

- **Magnetic Resonance Imaging**

Like CT scans, MRI creates cross-section pictures of the insides. But MRI uses strong magnets instead of radiation to make the images. MRI creates pictures of soft tissue parts of the body that are sometimes hard to see using other imaging tests. MRI is very good at finding and pinpointing some cancers. Using MRI, doctors can sometimes tell if a tumor is benign (not cancer) or malignant (cancer). Gadolinium is the contrast material used for MRI.

- **Positron Emission Tomography**

(PET) scan is an imaging test that uses a radioactive substance called a tracer to look for disease in the body. The image reveals how parts of the patient's body function by the way they break down the radiotracer. A PET image will display different levels of positrons according to brightness and color. The tracer is given through a vein (IV), most often on the inside of the elbow and travel to areas inside the body that use the natural chemical. For example, FDG (fluorodeoxyglucose - a radioactive drug) is tagged to glucose to make a radiotracer. The glucose goes into those parts of the body that use glucose for energy. Cancers, for example, use glucose differently from normal tissue - so, FDG can show up cancers. A normal result means there were no problems seen in the size, shape, or position of an organ. There are no areas in which the tracer has abnormally collected.

• **X-Rays**

Radiographs, most often called x-rays, produce shadow-like images of bones and certain organs and tissues. X-rays are very good at finding bone problems. They can show some organs and soft tissues, but MRI and CT scans often give better pictures of them. Still, x-rays are faster, easy to get, and cost less than other scans, so they may be used to get information quickly. Typically, CT, MRI or PET are the preferred method.

• **Ultrasound**

Other names include ultrasonography, sonography, or sonogram. An ultrasound machine creates images called sonograms by giving off high-frequency sound waves that go through the body. As the sound waves bounce off the organs and tissues, they create echoes. The machine makes these echoes into real-time pictures that can be seen on a computer display screen. Ultrasound is very good at getting pictures of some soft tissue diseases that do not show up well on x-rays. Ultrasound is also a good way to tell fluid-filled cysts from solid tumors because they make very different echo patterns. Ultrasound images are not as detailed as those from CT or MRI scans. Ultrasound cannot tell a benign (not cancer) tumor from one that is cancer. Its use is also limited in some parts of the body because the sound waves cannot go through air (such as in the lungs) or through bone.

• **Endoscopy**

Endoscopy is a medical procedure that uses an instrument called an endoscope. The endoscope

is put into the body to look inside, and is sometimes used for certain kinds of surgery. Looking with an endoscope is different from using imaging tests, like x-rays and CT scans, which can get pictures of the inside the body without putting tools or devices into it. There are many different kinds of endoscopes, or "scopes." Most are like thin, hollow tubes that allow the doctor to look right into the body. Most are lighted, and some have a small video camera on the end that puts pictures on a computer screen. There's a new one small enough to be swallowed, which transmits images wirelessly. Each type is specially designed for looking at a certain part of the body.

Endoscopy plays a role in the prevention, early detection, diagnosis, staging, and treatment of cancer. Some types of endoscopes can be used to look for cancer in people who have no symptoms. For example, colonoscopy and sigmoidoscopy are used to screen for colon and rectal cancer. These procedures can also help prevent cancer because they let doctors find and remove polyps (growths) that might become cancer if left alone. Endoscopy can sometimes be used to find cancer early, before it has had a chance to grow or spread.

General Questions and Answers

Can radiation cause risk of developing cancer?

In large doses, radiation can cause serious tissue damage and increase a person's risk of later developing cancer. The low doses of radiation used for imaging tests might increase a person's cancer risk slightly, but it's important to put this risk into perspective.

Because radiation exposure from all sources can add up over a lifetime, and radiation can, indeed, increase cancer risk, imaging tests that use radiation should only be done for a good reason. But if there's a reason to believe that an x-ray or CT scan is the best way to look for cancer or other diseases, the person will most likely be helped more than the small dose of radiation can hurt.

Which scan does not expose the body to radiation?

MRI and ultrasound exams do not expose you to radiation. If you have concerns about the radiation you may get from a CT scan, or any other imaging test, check with your doctor if an MRI is an appropriate option.

What are ways to minimize exposure to radiation?

The best advice at this time is to only get imaging tests that are needed and try to limit your

exposure to all forms of radiation. If you do need to have a test that will expose you to some radiation, ask if there are ways to shield the parts of your body that aren't being imaged from being exposed. For example, a lead apron can sometimes be used to protect parts of your chest or abdomen from getting radiation, and a lead collar (known as a thyroid shield or thyroid collar) can be used to protect your thyroid gland.

Keeping a "medical imaging history" that will allow you to track your own medical imaging history and share it with your health care providers is a helpful tool.

Who should not be exposed to radiation?

Children are more sensitive to radiation and should be protected from it as much as possible.

What are the possible complications and side effects in imaging tests?

Most known complications and side effects are possible reactions to the contrast dye which include:

• Rash

• Nausea

• Wheezing

• Shortness of breath

• Itching or facial swelling that can last up to an hour

• Pain at the needle site

• A headache that develops a few hours after the test is over

• Low blood pressure leading to a feeling of lightheadedness or faintness (this is rare) These symptoms usually are mild and they most often go away on their own, but they can sometimes signal a more serious reaction that needs to be treated. Be sure to let your radiology technologist and your health care team knows if you notice any changes after getting the contrast dye. In rare cases, people can have a severe allergic reaction that causes low blood pressure or trouble breathing and requires treatment right away.

Factors that determine which imaging tests are used in different types of cancer

Many different scans are used to get images of what's happening inside the body, including

x-rays, ultrasound, MRI, nuclear medicine scans and others. The tests your health care team recommends may depend on a number of factors, such as:

• Where the tumor is and what type it is; some imaging studies work better for certain organs or tissues

• Whether or not a biopsy (tissue sample) is needed

• The balance between any risks or side effects and the expected benefits

• Cost

References:

http://www.cancer.org/acs/groups/cid/documents/webcontent/003177-pdf.pdf

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