Fiducial Marker Placement

Fiducial marker placement uses imaging guidance to place small objects called fiducial markers in or near a tumor in preparation for radiation therapy. The markers help pinpoint the tumor's location with greater accuracy and allow the treatment team to deliver the maximum radiation dose to the tumor while sparing healthy tissue.

Your doctor will instruct you on how to prepare, including any changes to your medication schedule. Tell your doctor if there's a possibility you are pregnant and discuss any recent illnesses, medical conditions, allergies and medications you're taking, including herbal supplements and aspirin. You may be advised to stop taking aspirin, nonsteroidal anti-inflammatory drugs (NSAIDs), or blood thinners several days prior to your procedure. You also may be told not to eat or drink anything for several hours before your procedure. Leave jewelry at home and wear loose, comfortable clothing. You may be asked to wear a gown. Plan to have someone drive you home.

What is fiducial marker placement?

Fiducial marker placement is an image-guided procedure often performed by an interventional radiologist in preparation for certain types of radiation therapy, such as stereotactic radiosurgery (SRS) and stereotactic body radiotherapy (SBRT) (https://www.radiologyinfo.org/en/info/stereotactic) , or proton therapy (https://www.radiologyinfo.org/en/info/protonthera) .

Fiducial markers are small metal (typically gold) spheres, coils or cylinders about the size of a grain of rice that are placed in or near a tumor to help guide treatment.

What are some common uses of the procedure?

Fiducial markers are implanted to define and target lesions located within the soft tissues of the:

- chest, including the lung and chest wall
- abdomen, including the liver, gallbladder, kidney and pancreas
- pelvis, including the prostate
- head and neck.

How should I prepare?

Prior to your procedure, some blood tests may be needed.

You should report to your doctor all medications that you are taking, including herbal supplements, and if you have any allergies, especially to local anesthetic medications, general anesthesia or to contrast materials containing iodine. Your physician may advise you to stop taking aspirin, nonsteroidal anti-inflammatory drugs (NSAIDs) or blood thinners for a specified period of time before your procedure.

Also inform your doctor about recent illnesses or other medical conditions.

Women should always inform their physician and x-ray technologist if there is any possibility that they are pregnant. Many imaging tests are not performed during pregnancy to avoid exposing the fetus to radiation. If an x-ray is necessary, precautions will be taken to minimize radiation exposure to the baby. *See the Radiation Safety (https://www.radiologyinfo.org/en/info/safety-radiation) page for more information about pregnancy and x-rays.*

You will receive specific instructions on how to prepare, including any changes that need to be made to your regular medication schedule. Other than medications, you may be instructed to not eat or drink anything for several hours before your procedure if you will be getting sedation or anesthesia.

You may be asked to remove some or all of your clothes and to wear a gown during the exam. You may also be asked to remove jewelry, eye glasses and any metal objects or clothing that might interfere with the x-ray images.

You should plan to have a relative or friend drive you home after your procedure.

What does the equipment look like?

Fiducial markers are implanted using a delivery device that looks similar to a biopsy needle. Placement of fiducial markers is typically guided by computed tomography (CT) (https://www.radiologyinfo.org/en/info/bodyct) or ultrasound (https://www.radiologyinfo.org/en/info/genus) and may also involve the use of an endoscope (a camera that can see inside your intestines).

How does the procedure work?

Fiducial markers are placed using a delivery needle that is inserted into the area to be treated with the help of computed tomography (CT) or ultrasound (US). The fiducial markers come from the manufacturer pre-loaded in the delivery needle. They are placed in pre-determined, carefully plotted positions in and around the tumor.

How is the procedure performed?

The placement of fiducial markers is typically performed as an outpatient procedure (several) days before treatment planning begins.

Before the procedure begins, imaging may be performed.

You will lie on the procedure table.

The doctor or nurse may connect you to monitors that track your heart rate, blood pressure, oxygen level, and pulse.

A nurse or technologist may insert an intravenous (IV) line into a vein in your hand or arm so that sedation or relaxation medication may be given during the procedure. You may also be given a mild sedative and/or antibiotic prior to the procedure. Typically antibiotics are given for transrectal ultrasound (https://www.radiologyinfo.org/en/info/us-prostate) -guided prostate seed placement.

When marker placement is performed on a child, it is more likely that general anesthesia will be required to keep them comfortable during the procedure.

Your doctor will numb the area with a local anesthetic. This may briefly burn or sting before the area becomes numb.

The doctor will make a very small skin incision at the site.

Using computed tomography (CT) or ultrasound (US) guidance, the needle is inserted through the skin and advanced to the site of the lesion. Typically, at least three markers are implanted in or around the tumor to give positional information. The type of imaging and number of markers used depend on the type and location of tumor being treated.

Once the marker is placed, the needle is removed.

The doctor applies pressure to reduce bleeding and covers the opening in the skin with a bandage. No sutures are necessary.

Additional images may be taken to confirm the placement of fiducial markers. This procedure is usually completed within one hour. You may be required to stay in an area for observation for several hours.

What will I experience during and after the procedure?

You will feel a slight pin prick when the needle is inserted into your vein for the intravenous line (IV) and when the local anesthetic is injected. Most of the sensation is at the skin incision site when it is anesthetized using local anesthetic.

You may feel some pressure when the fiducial delivery needle is inserted. The needle insertion area may feel sore for a few days. If you have significant pain, your doctor may prescribe pain relief medication.

Aftercare instructions vary. Typically, you may remove your bandage one day after the procedure, and you may bathe or shower as normal.

Who interprets the results and how do I get them?

After the procedure is complete, the interventional radiologist will tell you whether the procedure was a success.

What are the benefits vs. risks?

- The use of fiducial markers helps pinpoint the location of a tumor with greater accuracy, enabling a treatment team to deliver the maximum dosage of radiation to the tumor while minimizing the dose delivered to nearby healthy tissue.
- Fiducial markers may move away from where they were originally implanted. There must be sufficient time between the implantation of markers and treatment in order for the markers to stabilize.
- Fiducial markers placed in the lung may result in a complication called pneumothorax or collapsed lung, in which air becomes trapped in the space between the lung and the chest wall. This condition may require the insertion of a chest tube to remove the air pocket and re-expand the lung. You may also have a bloody cough after your procedure.

What are the limitations of fiducial markers?

Fiducial markers are inert elements that typically do not react with the body or result in any imaging artifacts. They typically do not set off airport scanners. There is a small risk that fiducial markers may be misplaced during placement or may migrate to other areas potentially causing adverse events. This risk is very rare.

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