

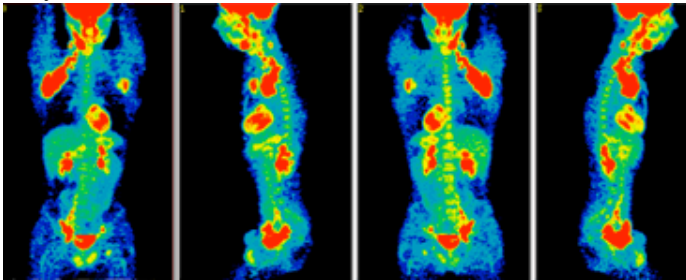
Positron Emission Tomography

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Abstract—this paper is about positron emission tomography which is a type of medical imaging used today. It works by picking up emitted gamma rays. It is a rather costly procedure, but can be worth the money.

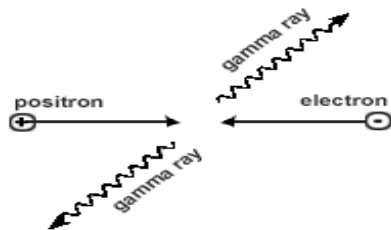
I. INTRODUCTION

POSITRON emission tomography or PET, is a medical imaging method that produces a three dimensional image. So a PET scan is an imaging test that uses a radioactive substance called a tracer to look for disease in the body. The difference between a PET scan and another medical imaging scan, like an MRI, is that a PET scan results in a three dimensional image that shows the functionality of organs and tissue, instead of just the flow of blood in the body.



II. METHODS

So how does a PET machine work? It's actually quite simple. A patient is injected with a radioactive substance. This substance has a short decay time (anywhere from 2-10 hours). Radioactive atoms that are commonly used are Carbon-11, Flourine-18, Oxygen-15, or Nitrogen-13. Once the patient is in the machine, it picks up the gamma ray emitted from the patient. These gamma rays are created from the annihilation of a positron and electron (this is where the name positron emission tomography comes from).



The positron comes from the radioactive substance injected in the patient and the electron comes from the patient's own body. PET scans are very effective at locating or scanning for cancer because tumors require more energy to grow. This means that they have more electrons around them, and there will be more annihilation with positrons. Several PET scans can also show how well a patient is responding to treatment. Besides detecting cancer, a PET scan is also used check brain function, show areas in which there is poor blood flow to the heart, and diagnose heart problems and brain disorders.

III. RISKS

For this procedure, there are very minimal risks. The main reason for this is that it is a noninvasive procedure. Only minimal radiation is used due to the short-lived tracers being utilized, so there is virtually no radiation risk unless the patient is very sensitive to the used tracer. Also, it is very rare for a patient to have an allergic reaction to a tracer material. Some patients will experience redness, pain or swelling at the injection site; but this can be reduced or treated. The one big risk factor is if a patient is pregnant or breast feeding. If either is the case, then the patient cannot get a PET scan. This is because infants developing in the womb, as well as babies, are more sensitive to radiation because their organs are still growing.

IV. DISCUSSION

There are many advantages to the getting a PET scan, especially if the patient in question is suspected to have some form of cancer, brain disorder, or heart problem. However, it is an extremely expensive procedure. One PET scan can cost anywhere from \$3,000- \$6,000. The cost is split up into three sub-categories; FGD Radiopharmaceutical Fees, Technical Fees, and Professional Fees. The first is just the cost of the radioactive element used as a tracer, and averages around \$527. The second is the cost of the procedure, and is where there is the most room to reduce the total cost. The last category is the cost associated with having the radiologist interpret the test results and is usually about \$1,880. It is understandable why these tests are expensive when one looks at the price of the machine its self (around \$1.9 million). Although these scans are expensive, especially compared to other imaging procedures, they have proven to lower diagnostic work-up in certain situations because it helps to avoid unnecessary invasive diagnostic and surgical procedures in patients where these procedures do not help diagnose the condition. For this reason, more and more insurance companies are offering to reimburse for PET scans.

REFERENCES

- [1] "Compare PET Scan Cost." *PET Scan Cost and Pricing Information*. N.p., n.d. Web. 27 Mar. 2013.
- [2] Dugdale, David C. "PET Scan: MedlinePlus Medical Encyclopedia." *U.S National Library of Medicine*. U.S. National Library of Medicine, 9 Nov. 2012. Web. 26 Mar. 2013.
- [3] Freudenrich, Ph.D., Craig. "How Nuclear Medicine Works" 18 October 2000. HowStuffWorks.com. <<http://science.howstuffworks.com/nuclear-medicine.htm>> 26 March 2013.
- [4] "How Much Does a Positron Emission Tomography Machine Cost?" *Yahoo! Answers*. Yahoo!, 2009. Web. 27 Mar. 2013.
- [5] *Positron Emission Tomography (PET) at the Helmholtz-Zentrum Dresden-Rossendorf*. Youtube. Helmholtz-Zentrum Dresden-Rossendorf, n.d. Web. 26 Mar. 2013.