

Effect of Drinking Water on Image Quality FDG PET/CT Scan Test and How Can Water Reduce the Radiation In Human Body

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Abstract: *The study focuses on the role of water in reducing radiation exposure during FDG PET/CT scans. Water consumption prior to the scan hydrates the body, improves blood circulation, and facilitates efficient distribution uptake of the radioactive tracer, FDG. This leads to more accurate detection of areas with high metabolic activity, such as cancer cells. Furthermore, water reduces the concentration of residual FDG in the bladder or kidneys, having a low radioactive count during the image capture. After the scan, isotonic is achieved with aid of water to eliminate any remaining FDG as a move towards minimizing radiation consequences. The research also focuses on the type of radiation, dividing it into ionizing radiation and non-ionizing radiation as well as the hazards of radioactive substances. The paper explores the nature of tumors, the working of PET and CT equipments, and synergistic impact of PET/CT. Pet: The focus is on one more radioactive material – FDG which is used widely in pet scan and its properties like half-life, shelf-life, composition and where it gets energy from.*

Keywords: FDG, PET-CT, Water, Uptake, Exposure

Introduction

This paper aims to establish the extent to which water consumption influences PET/CT scans and the accuracy of its findings in relation to radiation quantity (Hoekstra et al, 2000).

If a patient consumes water prior to the scan then it works to their advantage as they will be hydrated and the body operates much better (Townsend et al, 2004). Appropriate hydration promotes flow of blood hence facilitating proper distribution of the radioactive tracer FDG in the entire body (Townsend et al, 2004). It means that it is easier to identify areas having high metabolic rates, as well as malignant cells of a tumor (Yau et al, 2003).

In addition, intake of drinking water prior to the scan aids in reducing concentration of the FDG tracer left inside the bladder or the kidneys (Hammoodi et al, 2014). Thus, during imaging, the absorption of radiation in these organs is reduced as much as possible

(Hicks, 2012). It is important to note this because radiation which is in lots of quantity presents unpleasant impacts on a majority of these delicate organs (Yun et al, 2010).

Abbott and company authors in this article mentioned some reasons why patient should be encouraged to take water before PET/CT scan (Murata et al, 2007). That is why it is helpful to get to know the role of water in PET/CT for everyone who once undergone this kind of diagnosis test (Hammudi et al, 2025). Drinking water is also very good in the health of the patient and further helps to minimize the amount of radioactive tracers in the body by peeing which in one way reduces the amount of exposure that patient is subjected to (Stillinger et al, 1974) (Mustafa et al, 2024).

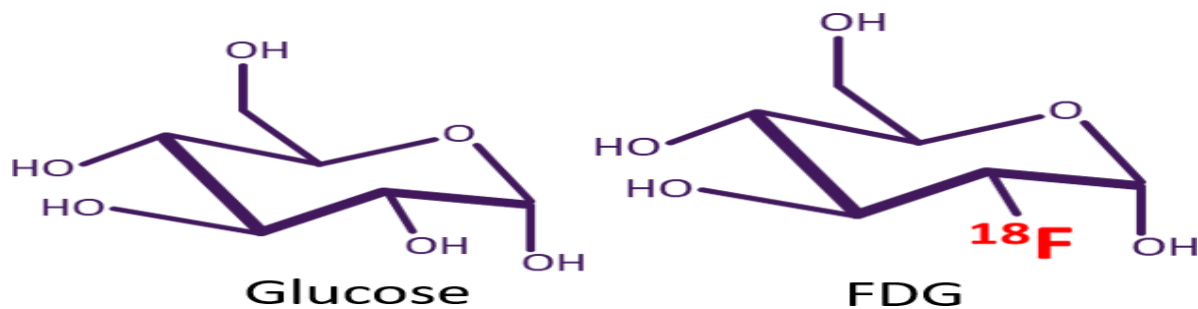


Figure 1. shown the chamechal structure for FDG

Methodology

1. Raw Materials

- **Water:** Before starting the test, the patient is just allowed to drink water. The dosage before the test following injection is entitled. The sample is currently recommended to drink at least 1000ml of water after the test. Dosages are also given after taking water and after urinating (Wu, 2019).
- **FDG:** FDG is a metastable isomer which can be included in PET scans as a radioactive tracer.

2. Devices

- **Dosimeter:** A personal dosimeter is an individual is an instrument worn by radiographers, nuclear power station employees, and those doctors practising radiotherapy to measure the amount of exposure at their place of work.
- **PET/CT Scan:** This equipment is made of both PET and CT that work simultaneously to give clear scans in the body (Zorina, 2022).

3. Procedure

The procedure involves several steps:

- **Preparation:** This type of scan may require the patient to fast and only have water for several hours before the scan was done on the patient.
- **Injection of Radio-tracer:** A source of radiation is administered to the patient through the flow of blood; this substance is called the radio-tracer (Nakada, 2020).

- **Radio-tracer Distribution:** It circulates in bloodstream and accumulates in organs and tissues of patients. Sites in the body where there is elevated metabolism or biochemical activity will known take up the tracer (Sorlini, 2019).
- **Scan:** After that the radio-tracer is infused, the patient is positioned on a bed which is moved into a long bore, in which the PET is conducted.
- **Image Generation:** The detected radiation is employed to generate structural images and give molecular data.

4. Exposure Measurement

In fact, the exposure measurement in a PET/CT scan is functionally linked to the quantity of the radioactive tracer utilized (Chowdhury, 2023). The idea is to achieve diagnostic image quality in the least amount of time and radiation necessary.

5. Preparing and Protecting During a PET/CT Scan

Namely, some specific procedures are entertained to safeguard the patient and the quality of the scan; such as preparation for the scan; administering the radio-tracer; instructing the patient during the scan, measures for protection of the patient; and, finally, post-scan activities (Lundqvist, 2019).

6. Instructions to the Patient Before the Examination

The patients are read some conditions before the examination; the patient's history on medication, recent treatment, or tests among others. Pregnant women are advised not to go near the nuclear medicine unit (Säve-Söderbergh, 2020).

7. Instructions Inside the Nuclear Medicine Unit

Prior to injection, patients are presented an opportunity to make inquiries, and after injection, they are supposed to wait in intended rooms.

8. Patient Preparation Before an Atomic Scanning Examination

Patients are advised to fast, drink water, and avoid muscular effort before the examination.

9. Post-Examination Instructions

During the examination, patients are encouraged to take a lot of liquids and do not interact with children and pregnant women for six hours (Pyuskyulyan, 2024).

10. What to Expect

PET-CT or PET-MRI is actually a big structure that looks more like an enormous doughnut set on its end. The procedure is fairly long and may take an average of two hours to be through, although the patient may not be needed to spend the night in the hospital .

11. Risks

Apart from that, the tracer might cause radiation exposure to an unborn baby if the patient is pregnant, radiation exposure to a child if the patient is breastfeeding or an allergic reaction.

Result and Discussion

In a study for the effectiveness of water intervention in minimising radiation exposure during FDG-PET/ CT scans was conducted. The key findings are:

1. Water Consumption and PET/CT Scans

A study discovered that water intake had a major impact on PET/CT outcomes and radiation dose. Drinking water prior to the scan provides improved blood flow and distribution of the substance called Fluorodeoxyglucose or FDG to parts of the body with a metabolism level above the normal activity, for instance cancerous tissues.

2. Reducing Radiation Exposure

Taking water before a scan reduces the amount of FDG left in the bladder or kidney, reducing radiation dose when imaging. After the scan it is vital to wash out the remaining FDG out of the body by drinking lots of water.

3. Patient Cases

One produced case studies comparing radiation reduction levels before injection, after drinking water, after the examination, and after urination (Chen, 2023). The highest decrease of levels was noticed after defecation and after urination they were also significantly low.

4. Limited Water Intake

An example of patient who took much less water demonstrated smaller improvement in the level of radiation therefore it is clear that volume consumed has significant influence on the result.

Table 1. Show The Patient Information

Patient Name	Patient:A. K. S.	Patient:M.R.Y.	Patient:Z.K.S.
Age			
Weight	80kg	54kg	84kg
Length	160cm	147cm	158cm
Blood sugar	110 mg/dl	90 mg/dl	131 mg/dl
Dosage	260MBq (FDG)	280MBq (FDG)	310MBq (FDG)
Injection time	14:01 pm	12:24 pm	12:24 pm
Dosage after injection	5 CC: 198.5 μ Sv/h. At time 14:08 pm 1meter:17.91 μ Sv/h. At time 14:11pm	5 CC: 327.4 μ Sv/h. At time 12:35 pm 1meter:15.12 μ Sv/h. At time 12:38 pm	5 CC: 294.3 μ Sv/h. At time 12:28 pm 1meter:10.57 μ Sv/h. At time 12:31 pm
Dosage after drinking an amount of water estimated at 600ml	5cc:182.31 μ Sv/h. At time 14:17pm 1m:13.71 μ Sv/h.At time 14:20pm	5cc:271.6 μ Sv/h. At time 12:53 pm 1m:10.03 μ Sv/h. At time 12:56pm	5cc:235.4 μ Sv/h. At time 12:44 pm 1m:8.97 μ Sv/h. At time 12:47pm

After the examination	5cc:135.02 $\mu\text{Sv/h}$. At time 14:53pm 1m:9.89 $\mu\text{Sv/h}$. At time 14:56pm	5cc:203.5 $\mu\text{Sv/h}$. At time 13:27 pm 1m:8.16 $\mu\text{Sv/h}$. At time 13:30 pm	5cc: 173 $\mu\text{Sv/h}$. At time 13:12pm 1m:5.74 $\mu\text{Sv/h}$. At time 13:15pm
After drinking an amount of water estimated at 400mL	5cc:123.31 $\mu\text{Sv/h}$. At time 15:02pm 1m:5.23 $\mu\text{Sv/h}$. At time 15:05pm	5cc:171.4 $\mu\text{Sv/h}$. At time 13:35 pm 1m:7.63 $\mu\text{Sv/h}$. At time 13:38 pm	'This patient drank the least amount he can drink because does not feel comfortable drinking more, so we notice the amount of radiation did not decrease as expected compared to the rest of the two cases'

Conclusion

This research proves that water has an important influence in minimising exposure to radiation during the PET/CT scans. It is rather useful for patients who will have to go through this type of diagnostic test and focuses on the importance of the patient's intake of water before and after the test. Besides, taking water helps in diminishing radiation effects because it helps the organism to eliminate radioactive tracers, which are used in many investigations. The findings of this study might change current practices of patients who are prepared for PET/CT scans which include recommendations of adequate water intake before the scan and after it.

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