PREPARING PATIENTS FOR PET IMAGING

FIGURE 1. Patient had previous mediastinal radiotherapy for thymoma. No history of diabetes or abnormal glucose metabolism.

FIGURE 2. Patient with isolated thyroid malignancy and high serum calcium level.


FIGURE 4. Patient who had nasocystic duct drainage for ethmoid sinusitis. A 24-hour fast before FDG-PET study.

FIGURE 5. Patient with a history of smoking and heavy alcohol intake. A 4- to 6-hour fast before FDG-PET study.

FIGURE 6. Patient with known history of chronic obstructive pulmonary disease. A 4- to 6-hour fast before FDG-PET study.

FIGURE 7. Patient with a history of chronic renal failure. A 2- to 4-hour fast before FDG-PET study.

FIGURE 8. Patient with a history of chronic liver disease. A 2- to 4-hour fast before FDG-PET study.

FIGURE 9. Patient with a history of chronic pancreatitis. A 4- to 6-hour fast before FDG-PET study.

FIGURE 10. Patient with a history of chronic gastroparesis. A 4- to 6-hour fast before FDG-PET study.

FIGURE 11. Patient with a history of chronic cholecystitis. A 4- to 6-hour fast before FDG-PET study.

FIGURE 12. Patient with a history of chronic appendicitis. A 4- to 6-hour fast before FDG-PET study.

FIGURE 13. Patient with a history of chronic diverticulitis. A 4- to 6-hour fast before FDG-PET study.

FIGURE 14. Patient with a history of chronic irritable bowel syndrome. A 4- to 6-hour fast before FDG-PET study.

FIGURE 15. Patient with a history of chronic colitis. A 4- to 6-hour fast before FDG-PET study.

FIGURE 16. Patient with a history of chronic peptic ulcer disease. A 4- to 6-hour fast before FDG-PET study.

FIGURE 17. Patient with a history of chronic gastritis. A 4- to 6-hour fast before FDG-PET study.

FIGURE 18. Patient with a history of chronic enteritis. A 4- to 6-hour fast before FDG-PET study.

FIGURE 19. Patient with a history of chronic cholangitis. A 4- to 6-hour fast before FDG-PET study.

FIGURE 20. Patient with a history of chronic hepatitis. A 4- to 6-hour fast before FDG-PET study.

FIGURE 21. Patient with a history of chronic cirrhosis. A 4- to 6-hour fast before FDG-PET study.

FIGURE 22. Patient with a history of chronic alcoholic liver disease. A 4- to 6-hour fast before FDG-PET study.

FIGURE 23. Patient with a history of chronic drug-induced liver injury. A 4- to 6-hour fast before FDG-PET study.

FIGURE 24. Patient with a history of chronic autoimmune hepatitis. A 4- to 6-hour fast before FDG-PET study.

FIGURE 25. Patient with a history of chronic primary biliary cirrhosis. A 4- to 6-hour fast before FDG-PET study.

FIGURE 26. Patient with a history of chronic cryptogenic cirrhosis. A 4- to 6-hour fast before FDG-PET study.

FIGURE 27. Patient with a history of chronic hepatitis C virus infection. A 4- to 6-hour fast before FDG-PET study.

FIGURE 28. Patient with a history of chronic hepatitis B virus infection. A 4- to 6-hour fast before FDG-PET study.

FIGURE 29. Patient with a history of chronic alcoholic hepatitis. A 4- to 6-hour fast before FDG-PET study.

FIGURE 30. Patient with a history of chronic nonalcoholic steatohepatitis. A 4- to 6-hour fast before FDG-PET study.

FIGURE 31. Patient with a history of chronic primary sclerosing cholangitis. A 4- to 6-hour fast before FDG-PET study.

FIGURE 32. Patient with a history of chronic autoimmune sclerosing cholangitis. A 4- to 6-hour fast before FDG-PET study.

FIGURE 33. Patient with a history of chronic primary biliary cirrhosis. A 4- to 6-hour fast before FDG-PET study.

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FIGURE 38. Patient with a history of chronic autoimmune sclerosing cholangitis. A 4- to 6-hour fast before FDG-PET study.

FIGURE 39. Patient with a history of chronic primary biliary cirrhosis. A 4- to 6-hour fast before FDG-PET study.

FIGURE 40. Patient with a history of chronic primary sclerosing cholangitis. A 4- to 6-hour fast before FDG-PET study.

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FIGURE 43. Patient with a history of chronic nonalcoholic steatohepatitis. A 4- to 6-hour fast before FDG-PET study.

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FIGURE 45. Patient with a history of chronic primary sclerosing cholangitis. A 4- to 6-hour fast before FDG-PET study.

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FIGURE 49. Patient with a history of chronic primary biliary cirrhosis. A 4- to 6-hour fast before FDG-PET study.

FIGURE 50. Patient with a history of chronic primary sclerosing cholangitis. A 4- to 6-hour fast before FDG-PET study.

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PREPARING PATIENTS FOR PET IMAGING

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Before the scan was obtained. A: Note the marked increase in glucose levels at the time of FDG injection. Depending on the outcome, proceed as follows:

- If blood sugar levels are >150 mg/dL, give 25 g Glutol orally.
- If blood sugar levels are >200 mg/dL, do not give Glutol.
- Determine blood glucose levels again 60 minutes after Glutol administration.

- If blood sugar is 100 to 150 mg/dL, inject 2 units of regular human insulin. Wait 15 minutes, inject FDG (dose calculated by weight) and begin imaging 45 minutes after FDG injection. Patient must drink 8 oz. of fruit juice immediately before the scan.

- If blood sugar levels are >150 mg/dL, the attending physician or nuclear cardiologist should do the following:
  1. Administer regular insulin intravenously, based on the recommended dose in the table below.
  2. Fifteen minutes after insulin administration, check whether the glucose level has declined.
  3. Repeat steps 1 and 2 until blood sugar levels are <150 mg/dL.

- If blood sugar levels are <150 mg/dL, inject FDG (dose calculated by weight) and begin imaging 45 minutes after FDG injection. Patient must drink 8 oz. of fruit juice immediately before the scan.

- Take the following steps after completion of FDG-PET image acquisition.

  - Check the FDG-PET images before the patient is released. If the degree is high and the image is of nondiagnostic quality, consult with the nuclear cardiologist to determine whether imaging should be repeated or IV insulin administered to clear blood pool activity. If IV insulin is required, check the blood glucose levels before giving another dose of regular insulin.

- Before the patient is discharged, check blood glucose levels and inform the patient about the possibility of hypoglycemia (if IV insulin was given). The patient may eat a snack or drink more fruit juice at this time. Explain the symptoms associated with hypoglycemia and instruct the patient accordingly. A patient who becomes severely hypoglycemic should receive IV glucose, typically in the form of 20% dextrose.

- The nuclear cardiologist should inform the patient’s status and insulin administration.

- Nondiabetic manipulations must be appropriately recorded in the patient’s nuclear medicine folder.

AVOIDING ARTIFACTS AND PITFALLS

Proper preparation of patient preparation can help avoid artifacts and the following common problems in PET imaging.

- Patient who is eating: FDG is not reabsorbed by the renal tubules and is therefore excreted in the collecting system of the kidney. Patient cooperation is often problematic:
  - Head and neck studies. Evaluation of the head and neck region often is complex, as evaluation of multiple anatomic sites is required. Many of these regions are closely related to muscle groups, tonsils, vocal cords, and fatty areas, which can be problematic. Figure 3 is a patient who was being evaluated for lymphoma. The initial FDG-PET image demonstrated increased neck and supraclavicular activity. The findings disappeared in a repeat scan after administration of diazepam.
  - Sacral activity: The findings disappear in repeat scan after administration of diazepam. Patients undergoing head and neck evaluation are instructed not to chew, sip, talk, or in any way exercise the muscles of the head and neck region.

PET/CT COMBINED STUDY

Many centers are beginning to use a combination imaging system that consists of a high-resolution CT scanner and an integrated high-resolution PET scanner.

Preparation of patients for this exam consists mainly of direct communication: the pitfalls of PET imaging. The pitfalls of PET imaging. The pitfalls of PET imaging. The pitfalls of PET imaging. The pitfalls of PET imaging. The pitfalls of PET imaging. The pitfalls of PET imaging. The pitfalls of PET imaging. The pitfalls of PET imaging. The pitfalls of PET imaging.

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Reduced muscle and soft-tissue activity. Patient preparation is ordinarily show high concentration. This concerns muscles as well as any neoplasm, which may contain glucose. Elevation of the glucose levels at the time of FDG injection tends to ensure that the material being given does not clear the collecting system of activity in the kidneys and the ureter. To avoid a high concentration of activity in the kidneys of the head and neck region is often complex, as evaluation of multiple anatomic sites is required. Many of these sites are closely related to muscle groups, tonsils, vocal cords, and fatty areas, which can be problematic. Figure 3 is a patient who was being evaluated for lymphoma. The initial FDG-PET image demonstrated increased neck and supraclavicular activity. The findings disappeared in a repeat scan after administration of diazepam.

PET/CT COMBINED STUDY

Many centers are beginning to use a combination imaging system that consists of a high-resolution CT scanner and an integrated high-resolution PET scanner. Preparation of patients for this exam consists mainly of explaining that they will undergo two individual tests done within minutes. The CT is generally completed first and is immediately followed by the PET scan. If no contrast agent is used for the CT portion, and most institutions have abandoned the practice.

Musculoskeletal system. Exercising muscle causes hypermetabolism, resulting in increased activity of FDG in muscle groups that have recently undergone contraction. Subjects are told to avoid exercise such as weightlifting or competitive sports may result in extended periods of hypermetabolism, so patients are instructed to avoid exercise for 36 to 48 hours before a PET scan. Figure 4 is a patient who had exercised vigorously with body-building equipment 24 hours before his PET study. He had also taken a glucose-containing drink for a foot scanner. Diabetic patients on insulin may demonstrate increased muscle activity if the insulin is given within two hours prior to the FDG injection. Because insulin drives glucose into muscle, attempting to reduce muscle activity by injecting insulin immediately before the exam results often in a suboptimal result, due to increased muscle activity in the heart and muscles of the axial skeleton.

AVOIDING ARTIFACTS AND PITFALLS

Preparation procedures of patient preparation can help avoid artifacts and the following common problems in PET imaging. FDG-PET imaging of the head and neck region tends to result in extended motion artifacts on the PET scan, and they often resulted in overcorrection of the study, no additional patient preparation was required.

Patients undergoing head and neck evaluation are instructed not to chew, sip, talk, or in any way exercise the muscles of the head and neck region. Maintaining head and neck comfort during the scan is critical to avoid excessive muscle uptake in these regions. Some institutions advocate the use of diazepam prior to the FDG scan to minimize uptake in the head and neck region.

- Bowel activity. Increased activity in the GI tract, especially the large bowel, is not uncommon. No compelling evidence indicates that bowel preparation is helpful. In the past, patients were often given a bowel preparation to reduce bowel activity before a gallium-67 scan, but it has been determined that this is not helpful, and most institutions have abandoned the practice.

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Preparing Patients for PET Imaging: The Importance of Precise Communication

By Alan D. Waxman, M.D., and Paula Barondess, CNMT

The use of whole-body PET scanning has dramatically increased in the past five years as PET as fluorodeoxyglucose (FDG) has begun to play a major role in managing patients with cancer. Increasing applications are emerging in cardiology, as well, especially in determining myocardial viability. PET has also been demonstrated effective in the evaluation of brain disorders, particularly in patients with dementia and epilepsy. Recent studies have shown a high degree of sensitivity and specificity for the detection of Alzheimer’s disease, even at early stages, and in some instances before the disease has become manifest. Use of FDG-PET for brain tumor evaluation has also proved useful, especially for differentiating radiation necrosis from recurrent tumor.

To maximize the success of the examination and achieve optimal sensitivity, specificity, and accuracy, it is critical that practitioners follow the correct protocols, tailored to the individual patient.

Whole-Body Oncology PET Scan

Prior to the whole-body FDG-PET scan, a set of instructions should be faxed or mailed to the patient. This communication should include a brief introduction that explains the purpose of the study and instructions about diet and exercise limitations before the scan, as well as a description of the procedure. As part of the patient preparation, all healthcare personnel are to be used in the combined study. The preparation is more extensive; precautions normally taken for contrast CT should be observed. Pretest questions for the contrast CT concern possible allergies. Precautions should be taken that the patient has a history of iodine allergies or intolerance to previous contrast studies. Because the contrast agents are hypersomolar, a careful evaluation of the patient’s potential for renal dysfunction should be explored. Patients should be asked whether they have diabetes, known kidney disease, a single kidney, HIV, or have undergone recent chemotherapy. Patients who are taking diuretics may also be subject to renal dysfunction following contrast administration. A creatinine title should be obtained in a patient with potential for renal dysfunction; the reading should be less than 1.4 mg/dL for the scan to proceed.

Patients taking Glucophage, Glucovance, or Metaglip should discontinue these medications for 48 hours after the contrast study. The patient’s creatinine title should be monitored for approximately 48 hours.

Because of the high photon absorption of contrast agents containing iodine, the interpretation of a combined PET/CT study should be approached with the understanding that overcorrection artifacts resulting from attenuation correction may be encountered.

SUMMARY

Appropriate patient preparation is essential to optimize the results of an FDG-PET scan. Specific protocols for some studies need to be implemented. Unnecessary preparation procedures can add to the patient’s discomfort, increase the cost of the examination, and result in a study that is no better than a simpler approach. Patient preparation should be as simple as possible but should achieve the goals of improving tumor-to-background ratio, avoiding artifacts and pitfalls, and keeping patient discomfort to a minimum.

REFERENCES


3. Dasso MN, Wink M, Shor M, Alvi A. Pretest questions for the contrast CT concern possible allergies. Precautions should be taken that the patient has a history of iodine allergies or intolerance to previous contrast studies. Because the contrast agents are hypersomolar, a careful evaluation of the patient’s potential for renal dysfunction should be explored. Patients should be asked whether they have diabetes, known kidney disease, a single kidney, HIV, or have undergone recent chemotherapy. Patients who are taking diuretics may also be subject to renal dysfunction following contrast administration. A creatinine title should be obtained in a patient with potential for renal dysfunction; the reading should be less than 1.4 mg/dL for the scan to proceed.


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