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PET/CT-Guided Interventions in Oncology Patients: A Nursing Perspective

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A B S T R A C T

In the past 5 years, the utilization of positron emission tomography/computerized tomography (PET/CT) guidance is more commonly used for cancer patients undergoing biopsy and ablations at this National Cancer Institute-designated cancer center. The interventional use of PET/CT imaging requires nurses to have a thorough understanding of the mechanisms involved to provide the best care in an environment that is safe for patients and staff. Evidence suggests cohesive care, and safe practice measures are achieved when patients actively participate and understand their care. This article will discuss how a collaborative patient-centered approach in caring for oncologic patients undergoing PET/CT interventions is necessary for achieving quality patient outcomes.

Introduction

The foundation of positron emission tomography/computerized tomography (PET/CT) imaging dates back to the early 20th century, with Otto Warburg learning that cancer cells will switch from oxidative glucose metabolism to anaerobic glucose metabolism even in the presence of oxygen (Warburg, Posener, & Negelein, 1924). In 1998, the first PET/CT imaging modality was introduced by Townsend, Nutt, and Beyer (Beyer et al., 2004). Fluorine-18 fluorodeoxyglucose (FDG) was first synthesized in 1970, which later led to visualization of metabolic activity of metastatic tumors with PET imaging (Czernin, Allen-Averbach, Nathanson, & Herrman, 2013). In 1997, FDG was approved as a radiopharmaceutical and clinical application of FDG began to increase (Berry & Cook, 2006). The radionuclear marker, FDG, works similarly to glucose. Because malignant cells have increased levels of glucose transporters, glucose and FDG are moved across the cell membrane, allowing for illumination of malignant activity and malignant cells (Ott, 2010). Because the spatial resolution of PET imaging alone may not be sufficient for precise anatomical localization of areas of abnormal metabolism, they are commonly fused with simultaneously acquired CT images to overcome this problem. CT scan has two roles, one for anatomical localization of the annihilation process as well as for attenuation correction of the PET data. The combined PET/CT imaging results in highly accurate imaging, where diagnosing, staging, therapy, and treatment are endless in the oncology population (Czernin et al., 2013). The first PET/CT machine began clinical operation in 2001. By 2004, PET/CT was reported as the fastest growing imaging modality, with up to 1,000 systems installed worldwide (Berry & Cook, 2006). The National Oncologic PET Registry (NOPR) was developed in response to the Centers for Medicare and Medicaid to expand coverage for oncologic patients using PET with FDG. Since 2013, there are 979 documented facilities in the United States with at least one registered PET/CT scan using FDG (NOPR, 2013). With the growing number of PET/CT scans in the oncology patient population, more patients are found whose lesions are seen only with PET/CT imaging. In such patients, the best modality for image-guided intervention is based on PET/CT guidance. To achieve the best patient outcomes, it is essential for nurses to be adequately educated about the unique nursing considerations involved in PET/CT-guided interventions.

Nursing considerations

Nurses are involved in all aspects of patient care and management throughout the pre-, intra-, and postprocedural course for patients undergoing a PET/CT-guided biopsy or ablation. The role of the nurse is essential in providing safe procedural care, while engaging the patient and family in all aspects of care. The nurse acts to facilitate a successful procedure and provide patient education. Nurses also facilitate educational inservices to other nursing colleagues who provide care to inpatients and outpatients undergoing PET/CT-guided procedures. The nurse communicates with the patient to resolve any issues that arise and is the key person for the patient to communicate with during this time. It is important for patients to be

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met by confident nursing staff in stressful technological environments as they perceive quality of care with the information provided to them (Brask & Birkelund, 2014). It is important for the nurse to be aware of potential nursing diagnoses while caring for patient undergoing PET/CT-guided interventions (Figure 1).

Preprocedure

Preprocedural nursing considerations begin with education about the procedure and fasting. Patients undergoing PET/CT-guided procedures are consulted and educated in the interventional radiology clinic by both an interventional radiologist and a registered nurse. Patients are not permitted to consume solid foods after midnight and are instructed to limit consumption of clear liquids 6 hr before PET injection. Patients should limit strenuous and repetitive exercise activity 24 hr before the PET/CT scan as this can limit quality of PET images. If the patient is engaged in strenuous physical activity, the muscles would take up FDG in a fasting state, interfering with PET scan accuracy. In clinic, medications are reviewed for anticoagulants and any medications that require modification because of intervention. For patients on anticoagulants, appropriate bridging or cessation protocols are prescribed. Diabetes medications are among the medications that may require modification based on the fasting schedule. Education regarding by mouth and injectable diabetic medications is provided, and adjustments of long- and short-acting insulin are explained. The day of the procedure, the patient presents to the preoperative department, where a nurse conducts a full history and physical assessment, verifies laboratory values and initiates intravenous (IV) access. A patient's blood glucose is taken and reported to the nuclear medication nurse. Blood glucose levels need to fall between 60 and 199 mg/dL. If blood glucose levels are more than 200 mg/dL, the hyperglycemic patient may receive insulin or have their procedure rescheduled. Because the FDG tracer works similarly to glucose, it is important to have the patient's blood glucose controlled to limit the increase in metabolic activity interference with FDG uptake. Because it takes 60 to 90 min for the FDG isotope to be absorbed, the patient is taken to a shielded room, where FDG is administered by a nuclear medicine nurse, and radiation precautions are initiated. For FDG, there is a 10 min for every 1 mCi after injection for a patient to be under radiation precautions. Shielded rooms include the preprocedural room, procedural room, and if needed, postprocedural room. Patients are encouraged to relax and limit movements as this stillness helps regulate stimulation and unnecessary metabolic activity. For FDG PET/CT therapeutic ablations, medical physics staff is not required to be present because diagnostic dose is below the regulatory threshold. Nursing knowledge of radiation safety precautions is an integral part of education to the patient and family members.

Intraprocedure

In the procedural room, a patient is generally given moderate sedation for biopsies and general anesthesia for ablations. Patients are educated on sedation expectations and seen by an anesthesiologist before arriving to the procedural room. IV fluids and medications are administered at the discretion of the anesthesia team. Typically, the team uses normal saline fluid. It is important to keep the patients still, relaxed, and warm to prevent an increase in uptake of FDG because of regulation in thermogenesis (Ott, 2010).

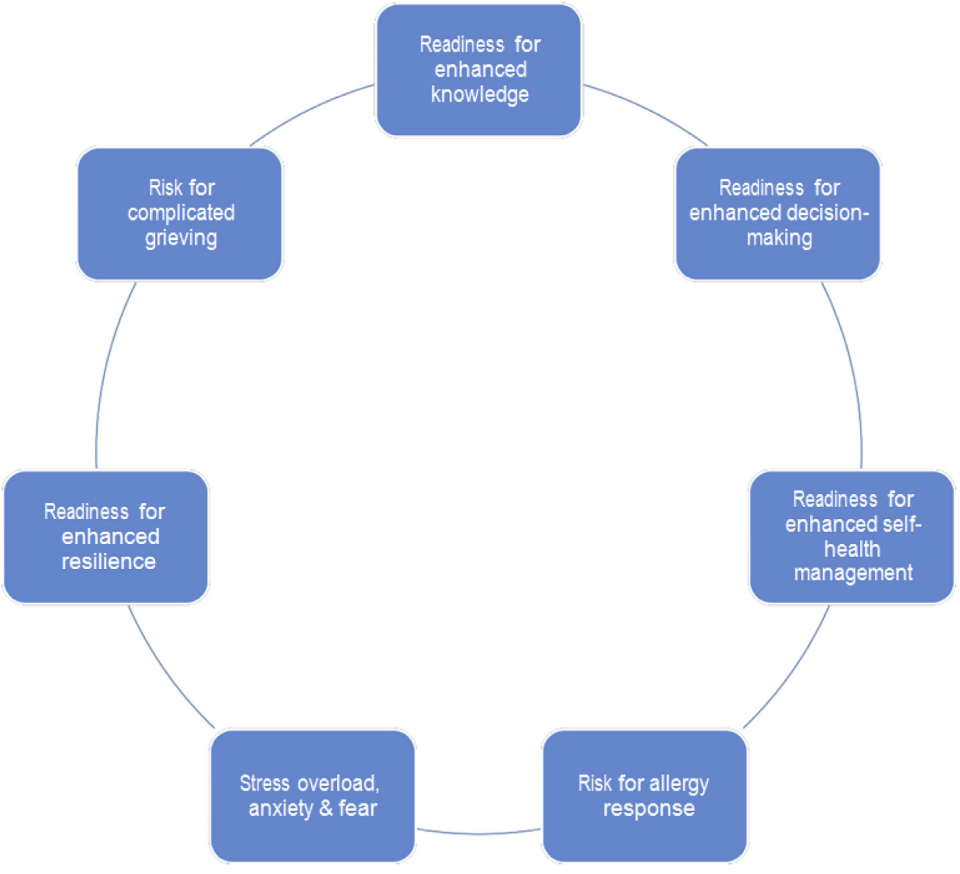

Figure 1. Nursing diagnoses.