Medical Policy

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Title: PET Scanning- Oncologic Applications (Thyroid, Neuroendocrine, Head and Neck)

Related Policies:	▪ *PET Scanning- Oncologic Applications (Breast and Gynecologic)* ▪ *PET Scanning- Oncologic Applications (Bone and Sarcoma)* ▪ *PET Scanning- Oncologic Applications (Hematologic)* ▪ *PET Scanning- Oncologic Applications (Lung)* ▪ *PET Scanning-* Oncologic *(Brain, Melanoma, Unknown Primary)* ▪ PET *Scanning- Oncologic Applications (Genitourinary)* ▪ *PET Scanning- Oncologic Applications (Gastrointestinal and Pancreatic)* ▪ *PET Scanning: Cardiac Applications* ▪ *PET Scanning: In Oncology to Detect Early Response during Treatment* ▪ *PET Scanning: Miscellaneous (Non-cardiac, Non-oncologic) Applications of Fluorine 18 Fluorodeoxyglucose*

Professional / Institutional
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Populations	Interventions	Comparators	Outcomes
Individuals: • With suspected coronary artery disease with an indeterminate single-photon emission computed tomography scan	Interventions of interest are: • Cardiac positron emission tomography perfusion imaging	Comparators of interest are: • Coronary angiography • Noninvasive tests for coronary artery disease (eg, stress echocardiography, exercise electrocardiography)	Relevant outcomes include: • Test accuracy • Disease-specific survival • Morbid events • Resource utilization
Individuals: • With severe left ventricular dysfunction who are potential candidates for revascularization	Interventions of interest are: • Cardiac positron emission tomography scanning to assess myocardial viability	Comparators of interest are: • Cardiac magnetic resonance imaging • Cardiac single-photon emission computed tomography scanning	Relevant outcomes include: • Test accuracy • Disease-specific survival • Morbid events
Individuals: • With coronary artery disease who require myocardial blood flow quantification for cardiac event risk stratification	Interventions of interest are: • Quantitative cardiac positron emission tomography perfusion imaging	Comparators of interest are: • Coronary angiography with fractional flow reserve • Clinical risk models	Relevant outcomes include: • Disease-specific survival • Morbid events
Individuals: • With suspected cardiac sarcoidosis who cannot undergo magnetic resonance imaging	Interventions of interest are: • Cardiac positron emission tomography scanning	Comparators of interest are: • Clinical evaluation • Myocardial biopsy	Relevant outcomes include: • Disease-specific survival • Test accuracy • Morbid events

DESCRIPTION

Positron emission tomography (PET) scans are based on the use of positron-emitting radionuclide tracers coupled to organic molecules, such as glucose, ammonia, or water. The radionuclide tracers simultaneously emit 2 high-energy photons in opposite directions that can be simultaneously detected (referred to as coincidence detection) by a PET scanner, comprising multiple stationary detectors that encircle the area of interest.

The utility of PET scanning for the diagnosis, staging and restaging, and surveillance of malignancies varies by type of cancer. In general, PET scanning can distinguish benign from malignant masses in certain circumstances and improve the accuracy of staging by detecting additional disease not detected by other imaging modalities. Therefore, PET scanning for diagnosis and staging of malignancies can be considered medically necessary when specific criteria are met for specific cancers, as outlined in the policy statements. For follow-up, after initial diagnosis and staging have been performed, there are a few situations in which PET can improve detection of recurrence, and lead to changes in management that improve the net health outcome.

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OBJECTIVE

The objective of this evidence review is to determine whether the use of positron emission tomography for the diagnosis, staging and restaging, and/or surveillance improves the net health outcome in individuals with head and neck, neuroendocrine, or thyroid cancer.

BACKGROUND

A variety of tracers are used for positron emission tomography (PET) scanning, including oxygen 15, nitrogen 13, carbon 11 choline, fluorine 18, gallium 68, fluciclovine 18, and copper 64. Because of their short half-life, some tracers must be made locally using an onsite cyclotron. The radiotracer most commonly used in oncology imaging has been fluorine 18 coupled with fluorodeoxyglucose (FDG), which correlates with glucose metabolism. Fluorodeoxyglucose has been considered useful in cancer imaging because tumor cells show increased metabolism of glucose. The most common malignancies studied have been melanoma, lymphoma, lung, colorectal, and pancreatic cancer.

This evidence review focuses on the use of radiotracers detected with dedicated PET scanners. Radiotracers, such as FDG, may be detected using single-photon emission computerized tomography cameras, a technique that may be referred to as FDG-single-photon emission computerized tomography imaging. The use of single-photon emission computerized tomography cameras for PET radiotracers presents unique issues of diagnostic performance and is not considered herein.

REGULATORY STATUS

As of September 2024 , the following radiopharmaceuticals have been granted approval by the U.S. Food and Drug Administration , to be used with PET for head and neck, neuroendocrine, or thyroid cancer-related indications (see Table 1).[1,]

Table 1. Radiopharmaceuticals Approved for Use With PET for Oncologic Applications

Radiopharmaceutical	Manufacturer	Name	Carcinoma-Related Indication With PET
Copper-64 dotatate	Curium	Detectnet™	Localization of somatostatin receptor-positive NETs in adult individuals
Fluorine-18 fluorodeoxyglucose (FDG)	Various		Suspected or existing diagnosis of cancer, all types
Gallium-68 dotatoc	UIHC - P E T Imaging Center		Localization of somatostatin receptor-positive NETs in adult and pediatric individuals

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Radiopharmaceutical	Manufacturer	Name	Carcinoma-Related Indication With PET
Gallium-68 dotatate	Advanced Accelerator Applications	NETSPOT™	Localization of somatostatin receptor-positive NETs in adult and pediatric individuals

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POLICY

A. **Head and Neck Cancer**
   1. PET scanning may be considered **medically necessary** in the evaluation of head and neck cancer in the
      a. Initial diagnosis of suspected cancer,
      b. Initial staging of disease, and restaging of residual or recurrent disease during follow-up; **AND**
      c. Evaluation of response to treatment.

B. **Neuroendocrine Tumors**
   1. PET scanning with gallium 68 and copper 64 may be considered **medically necessary** as a technique for staging neuroendocrine tumors either during initial staging or for restaging at follow-up.
   2. PET scanning with all other radiotracers is considered **experimental / investigational** in all aspects of managing neuroendocrine tumors.

C. **Thyroid Cancer**
   1. PET scanning may be considered **medically necessary** in the restaging of individuals with differentiated thyroid cancer when thyroglobulin levels are elevated and whole-body iodine-131 imaging is negative.
   2. PET scanning is considered **experimental / investigational** in the evaluation of known or suspected differentiated or poorly differentiated thyroid cancer in all other situations.

D. **Cancer Surveillance**
   1. PET scanning is considered **experimental / investigational** when used as a surveillance tool for individuals with cancer or with a history of cancer. A scan is considered surveillance if performed more than 6 months after completion of cancer therapy (12 months for lymphoma) in individuals without objective signs or symptoms suggestive of cancer recurrence (see Policy Guidelines section).

POLICY GUIDELINES

A. For this policy, PET scanning is discussed for the following 4 applications in oncology.
   1. Diagnosis
      Diagnosis refers to use of PET as part of the testing used in establishing whether a patient has cancer.
   2. Staging
      Staging refers to use of PET to determine the stage (extent) of the cancer at the time of diagnosis before any treatment is given. Imaging at this time is generally to determine whether the cancer is localized. This may also be referred to as initial staging.
   3. Restaging
      Restaging refers to imaging after treatment in 2 situations.
      a. Restaging is part of the evaluation of a patient in whom a disease recurrence is suspected based on signs and/or symptoms.
      b. Restaging also includes determining the extent of malignancy after completion of a full course of treatment.

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4. Surveillance
   Surveillance refers to the use of imaging in asymptomatic patients (patients without objective signs or symptoms of recurrent disease). This imaging is completed 6 months or more (≥12 months for lymphoma) after completion of treatment.

B. **Patient Selection**

As with any imaging technique, the medical necessity of positron emission tomography (PET) scanning depends in part on what imaging techniques are used before or after the PET scanning. Due to its expense, PET scanning is typically considered after other techniques, such as computed tomography (CT), magnetic resonance imaging (MRI), or ultrasonography, provide inconclusive or discordant results. If so, the medical necessity of subsequent imaging during the same diagnostic evaluation is unclear. Thus, PET should be considered for the medically necessary indications above only when standard imaging (eg, CT, MRI) is inconclusive or not indicated, including situations when an individual has a contraindication to intravenous contrast agents, making initial CT scans unattainable.

Selection criteria for PET scanning may also be complex. Due to the complicated hierarchy of imaging options in individuals with malignancy and complex selection criteria, a possible implementation strategy for this policy is its use for retrospective review, possibly focusing on cases with multiple imaging tests, including PET scans.

Use of PET scanning for surveillance as described in the policy statement and policy rationale refers to the use of PET to detect disease in asymptomatic individuals at various intervals. This is not the same as the use of PET for detecting recurrent disease in symptomatic individuals; these applications of PET are considered within tumor-specific categories in the policy statements.

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RATIONALE

This evidence review has been updated regularly with searches of the PubMed database. The most recent literature update was performed through September 27, 2024.

The review has been informed by multiple evaluations of positron emission tomography (PET), including TEC Assessments, other systematic reviews, meta-analyses, and decision analyses.

Evidence reviews assess whether a medical test is clinically useful. A useful test provides information to make a clinical management decision that improves the net health outcome. That is, the balance of benefits and harms is better when the test is used to manage the condition than when another test or no test is used to manage the condition.

The first step in assessing a medical test is to formulate the clinical context and purpose of the test. The test must be technically reliable, clinically valid, and clinically useful for that purpose. Evidence reviews assess the evidence on whether a test is clinically valid and clinically useful.

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Technical reliability is outside the scope of these reviews, and credible information on technical reliability is available from other sources.

Promotion of greater diversity and inclusion in clinical research of historically marginalized groups (e.g., People of Color [African-American, Asian, Black, Latino and Native American]; LGBTQIA (Lesbian, Gay, Bisexual, Transgender, Queer, Intersex, Asexual); Women; and People with Disabilities [Physical and Invisible]) allows policy populations to be more reflective of and findings more applicable to our diverse members. While we also strive to use inclusive language related to these groups in our policies, use of gender-specific nouns (e.g., women, men, sisters, etc.) will continue when reflective of language used in publications describing study populations.

POSITRON EMISSION TOMOGRAPHY AND POSITRON EMISSION TOMOGRAPHY PLUS COMPUTED TOMOGRAPHY

Clinical Context and Test Purpose

For this evidence review, PET and PET plus computed tomography (CT) scanning is discussed for the following 4 applications in oncology: diagnosis, staging, restaging, and surveillance. Diagnosis refers to the use of PET as part of the testing used in establishing whether an individual has cancer. Staging refers to the use of PET to determine the stage (extent) of cancer at the time of diagnosis before any treatment is given. Imaging during staging is generally to determine whether the cancer is localized. This also may be referred to as initial staging. Restaging refers to imaging after treatment in 2 situations. First, restaging is part of the evaluation of an individual in whom disease recurrence is suspected based on signs and/or symptoms. Second, restaging also includes determining the extent of malignancy after completion of a full course of treatment. Surveillance refers to the use of imaging in asymptomatic individuals (individuals without objective signs or symptoms of recurrent disease). Surveillance is completed 6 months or more (≥12 months for lymphoma) after completion of treatment. Interim scanning for early response is addressed in policy 6.01.51.

The following PICO was used to select literature to inform this review.

Populations

The relevant populations of interest are:

- Individuals who are suspected of having head and neck, neuroendocrine, or thyroid cancer.
- Individuals diagnosed with head and neck, neuroendocrine, or thyroid cancer and need information on the extent of cancer (initial staging upon diagnosis confirmation or restaging following treatment).
- Individuals with head and neck, neuroendocrine, or thyroid cancer who have completed a round of treatment and may be at risk of recurrence.

Interventions

The test being considered is PET or PET/CT. A PET scan is a nuclear medicine 3-dimensional imaging technique. Radioactive tracers are ingested or injected, and radioactive emissions are detected by an imaging device, allowing observations on blood flow, oxygen use, and metabolic processes around the lesions. When CT is added to PET, the images are superimposed, providing additional anatomic information. The most common radioactive tracer used for oncologic

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applications is fluorine 18 (^{18}F) fluorodeoxyglucose (FDG). Radiation exposure from PET and PET/CT is considered moderate to high.

Comparators
The comparators of interest are conventional imaging techniques such as ultrasound, magnetic resonance imaging (MRI), and x-rays.

Outcomes
The general outcomes of interest are related to the clinical validity of PET and PET/CT in (1) diagnosing suspected cancers, (2) providing staging or restaging information, and (3) detecting recurrence following cancer treatment. Clinical validity is most often measured by sensitivity, specificity, positive predictive values (PPV), and negative predictive values (NPV). For the clinical utility of PET and PET/CT to be demonstrated, the tests would need to inform treatment decisions that would improve survival and quality of life.

Clinical validity can be measured as soon as results from PET or PET/CT can be compared with results from conventional imaging techniques. Outcomes for clinical utility are long-term, which, depending on the type of cancer, can range from months or a few years for more aggressive cancers to many years for less aggressive cancers.

Study Selection Criteria
Methodologically credible studies were selected using the following principles:
- To assess the clinical validity of PET and PET/CT, studies should report sensitivity, specificity, PPV, and NPV. Additionally, studies reporting false-positive rates and false-negative rates are informative.
- To assess the clinical utility of PET and PET/CT, studies should demonstrate how results of these imaging techniques impacted treatment decisions and overall management of the patient.

Clinically Valid
A test must detect the presence or absence of a condition, the risk of developing a condition in the future, or treatment response (beneficial or adverse).

Clinically Useful
A test is clinically useful if the use of the results informs management decisions that improve the net health outcome of care. The net health outcome can be improved if individuals receive correct therapy or more effective therapy, avoid unnecessary therapy, or avoid unnecessary testing.

Direct Evidence
Direct evidence of clinical utility is provided by studies that have compared health outcomes for individuals managed with and without the test. Because these are intervention studies, the preferred evidence would be from randomized controlled trials (RCTs).

Chain of Evidence
Indirect evidence on clinical utility rests on clinical validity. If the evidence is insufficient to demonstrate test performance, no inferences can be made about clinical utility.

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Most of the evidence on the use of PET scanning in oncology focuses on clinical validity (sensitivity, specificity), and consists mostly of systematic reviews and meta-analyses. There are few rigorous studies assessing the impact of PET on clinical utility. A few studies that have reported on changes in staging and/or treatment that result from the PET scan do not evaluate whether these changes resulted in improvements in the net health outcome. Due to the lack of direct evidence for clinical utility, evidence for clinical validity is presented first, followed by clinical guidelines, which help to outline the indications for which clinical utility is supported.

REVIEW OF EVIDENCE

HEAD AND NECK CANCER

Systematic Reviews

A meta-analysis by Chen et al (2016) compared MRI, CT, and FDG-PET/CT in the detection of local and metastatic nasopharyngeal carcinomas.[2,] A literature search, conducted through April 2015, identified 23 studies (N=2413) for inclusion. Table 2 summarizes the results of the meta-analysis.

Table 2. Pooled Diagnostic Performance of FDG-PET/CT, MRI, and CT Alone in the Detection of Nasopharyngeal Carcinomas

Type of Imaging	No. of Studies (N)	Sensitivity (95% CI), %	Specificity (95% CI), %
T staging			
MRI	8 (984)	95 (93 to 97)	76 (71 to 80)
CT alone	4 (404)	84 (79 to 88)	80 (71 to 88)
N staging			
MRI	10 (750)	82 (79 to 84)	71 (65 to 78)
CT alone	4 (340)	92 (85 to 95)	93 (76 to 99)
FDG-PET/CT	10 (629)	88 (85 to 90)	95 (93 to 97)
M staging			
MRI	2 (261)	53 (35 to 70)	99 (96 to 100)
CT alone	2 (98)	80 (44 to 97)	93 (86 to 97)
FDG-PET/CT	7 (1009)	82 (74 to 88)	98 (96 to 99)

Adapted from Chen et al (2016).[69,]
CI: confidence interval; CT: computed tomography; FDG: fluorine 18 fluorodeoxyglucose; MRI: magnetic resonance imaging; M staging: distant metastases; MRI: magnetic resonance imaging; N staging: regional lymph nodes; PET: positron emission tomography; T staging: primary tumor.

A meta-analysis by Wei et al (2016) compared diagnostic capabilities of FDG-PET/CT, MRI, and single-photon emission CT in individuals with residual or recurrent nasopharyngeal carcinoma.[3,] The literature search, conducted through December 2014, identified 17 studies for inclusion. All studies scored at least 9 of 14 in the Quality Assessment of Diagnostic Accuracy Studies (QUADAS) tool. Pooled sensitivity and specificity for F^{18}-FDG-PET/CT (n=12 studies) were 90%

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(95% CI, 85% to 94%) and 93% (95% CI, 90% to 95%), respectively. Pooled sensitivity and specificity for single-photon emission CT (n=8 studies) were 85% (95% CI, 77% to 92%) and 91% (95% CI, 85% to 95%), respectively. Pooled sensitivity and specificity for MRI (n=9 studies) were 77% (95% CI, 70% to 83%) and 76% (95% CI, 73% to 79%), respectively.

Two meta-analyses evaluated FDG-PET or FDG-PET/CT in the detection of residual or recurrent head and neck cancer at various times following treatment.[4,5,] Results from these analyses are summarized in Table 3.

Table 3. Pooled Diagnostic Performance of FDG-PET or FDG-PET/CT in the Detection of Head and Neck Cancer

Indication	No. of Studies(N)	Sensitivity (95% CI), %	Specificity (95% CI), %
Cheung et al (2016)[4,]			
Residual/recurrent at primary site	18 (805)	86 (80 to 91)	82 (79 to 85)
Residual/recurrent at neck nodes	15 (726)	72 (63 to 80)	88 (85 to 91)
Recurrent at distant metastases	3 (184)	85 (65 to 96)	95 (90 to 98)
Local residual/recurrent, <12 wk since therapy	NR	85 (75 to 92)	80 (76 to 83)
Local residual/recurrent, ≥12 wk since therapy	NR	87 (78 to 94)	88 (83 to 93)
Nodal residual/recurrent, <12 wk since therapy	NR	67 (56 to 78)	86 (83 to 89)
Nodal residual/recurrent, ≥12 wk since therapy	NR	83 (61 to 95)	96 (90 to 99)
Sheikhbahaei et al (2015)[5,]			
Local recurrence, ≥4 mo since therapy	10 (992)	91 (86 to 95)	89 (83 to 94)
Regional recurrence, ≥4 mo since therapy	8 (885)	88 (80 to 93)	95 (92 to 97)
Distant metastases/second primary, ≥4 mo since therapy	9 (958)	93 (86 to 96)	97 (95 to 98)
Overall diagnostic performance, 4-12 mo since therapy	11 (1003)	95 (91 to 97)	78 (70 to 84)
Overall diagnostic performance, ≥12 mo since therapy	7 (923)	92 (85 to 96)	91 (78 to 96)

CI: confidence interval; CT: computed tomography; FDG: fluorine 18 fluorodeoxyglucose; NR: not reported; PET: positron emission tomography.

A systematic review by Sheikhbahaei et al (2015) calculated the predictive value of intratherapy or posttherapy FDG-PET or FDG-PET/CT for overall survival (OS) and event-free survival.[6,] The literature search, conducted through November 2014, identified 9 studies (n=600) for inclusion in OS calculations and 8 studies (n=479) for inclusion in event-free survival calculations. Individuals with a positive scan had significantly worse OS than individuals with negative scans (hazard ratio [HR], 3.5; 95% CI, 2.3 to 5.4). The pooled HR for event-free survival was 4.7 (95% CI, 2.6 to 8.6). Relative risks at 2 years and at 3 to 5 years for death and recurrence or progression were calculated, based on the timing of FDG-PET or FDG-PET/CT (see Table 4).

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Table 4. Pooled Diagnostic Performance of FDG-PET or FDG-PET/CT in the Detection of Head and Neck Cancer

Outcome	No. of Studies	2 Year RR (95% CI)	No. of Studies	3 to 5 Year RR (95% CI)
Death				
Final FDG-PET or FDG-PET/CT	6	8.3 (3.8 to 18.0)	6	2.2 (1.6 to 3.2)
FDG-PET or FDG-PET/CT, <12 wk posttreatment	8	3.0 (1.9 to 4.6)	4	2.0 (1.3 to 3.2)
FDG-PET or FDG-PET/CT, ≥12 wk posttreatment	3	8.5 (4.0 to 18.3)	6	2.8 (1.9 to 4.0)
Recurrence or progression				
Final FDG-PET or FDG-PET/CT	6	5.2 (3.3 to 8.3)	5	2.6 (1.7 to 4.1)
FDG-PET or FDG-PET/CT, <12 wk posttreatment	9	3.2 (2.0 to 5.2)	6	4.3 (2.1 to 8.7)
FDG-PET or FDG-PET/CT, ≥12 wk posttreatment	2	3.2 (2.0 to 5.2)	2	2.2 (1.5 to 3.1)

Adapted from Sheikhbahaei et al (2015).[73,]
CI: confidence interval; CT: computed tomography; FDG: fluorine 18 fluorodeoxyglucose; PET: positron emission tomography; RR: relative risk.

Four meta-analyses in 2013, 2014, and 2018 reported good sensitivities and specificities with FDG-PET/CT for diagnosing head and neck squamous cell cancers (better than CT and MRI), detecting head and neck cancer metastases (better than bone scintigraphy), and detecting recurrence.[7,8,9,10,]

Additional meta-analyses by Li et al (2017) and Lin et al (2017) have reported that higher values of standard uptake value, metabolic tumor volume, and total lesion glycolysis from FDG-PET/CT might predict a poorer prognosis for individuals with nasopharyngeal cancer.[11,12,]

Among the 3 studies identified in the TEC Assessment (2000) that used other diagnostic modalities to identify a primary tumor in individuals with positive cervical lymph nodes, PET found more primary tumors than the other modalities in 2 studies and identified similar proportions in the third.[13,] When data from these 3 studies were pooled, PET was found to identify a tumor in 38% of cases and other modalities in 21% of cases.

When PET was used to stage cervical lymph nodes initially, the addition of PET to other imaging modalities increased the proportion of individuals correctly staged, as confirmed histologically. When compared directly with other imaging modalities, pooled data from several studies has suggested that PET has a better diagnostic performance than CT and MRI. Of 8 studies focusing on the use of PET to detect residual or recurrent disease, 5 found PET to be more specific and sensitive, 2 reported mixed or equivalent results, and 1 reported worse results compared with CT.

A 2022 systematic review and meta-analysis by Zhu et al assessed the diagnostic accuracy of PET/CT and MRI for surveillance of treated head and neck squamous cell cancer.[14,] The meta-

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analysis included 3 studies that included 176 individuals who underwent imaging 3 to 6 months post-treatment for assessment of potential recurrence or residual disease. For a positive imaging test, the reference standard was histological confirmation, and for a negative imaging test the reference standard was histological confirmation or clinical follow up for at least 6 months. Sensitivity of PET/CT was 68% (95% CI, 49% to 84%) and specificity was 89% (95% CI, 84% to 93%); corresponding values for MRI were 72% (95% CI, 54% to 88%) and 85% (95% CI, 79% to 89%). The review concluded that evidence was insufficient to recommend either imaging modality over the other for surveillance of recurrent or residual head and neck cancer.

GUIDELINES

American College of Radiology

In 2023, the American College of Radiology (ACR) issued an Appropriateness Criteria for staging and post-therapy assessment of head and neck cancer.[15,] For initial staging in suspected or diagnosed cancer of the oral cavity, oropharynx, hypopharynx, larynx, nasopharynx, EBV-associated, paranasal sinuses, nasal cavity, major salivary gland, or cancer of unknown primary of the head and neck, FDG-PET/CT of the skull base to mid-thigh is considered usually appropriate. Use of FDG-PET/CT was also considered usually appropriate for surveillance imaging or follow-up imaging for suspected or known recurrence in treated head and neck cancers. There is no mention of appropriateness of FDG-PET/CT in asymptomatic individuals after completion of treatment.

National Comprehensive Cancer Network

Current National Comprehensive Cancer Network (NCCN) guidelines on head and neck cancer (v. 4.2024) indicate that PET/CT can be appropriate for disease evaluation, for detection of metastases or recurrence, and for evaluation of response to treatment (at a minimum of 12 weeks posttreatment to reduce false-positive rate).[16,] For surveillance of locoregionally advanced disease, an initial 3-month PET/CT scan may be useful, but if the scan is negative, then further routine imaging is not supported in an asymptomatic patient.

Section Summary: Head and Neck Cancer

Evidence for the use of FDG-PET/CT in the management of individuals with head and neck cancer consists of systematic reviews and meta-analyses. In individuals with head and neck cancers, PET or PET/CT is better able to detect local and metastatic disease than other imaging techniques. Evidence has also shown that FDG-PET/CT may be useful in predicting response to therapy. Two meta-analyses calculated the ability of FDG-PET or PET/CT to detect the residual or recurrent disease during various stages of treatment and another meta-analysis calculated the ability of positive PET or PET/CT results to predict overall survival and event-free survival. The evidence supports the use of FDG-PET and FDG-PET/CT for the diagnosis and staging and restaging of head and neck cancer.

The evidence does not support the use of FDG-PET and FDG-PET/CT for surveillance of head and neck cancer.

NEUROENDOCRINE TUMORS

SYSTEMATIC REVIEWS

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^{68}Ga-PET and ^{68}Ga-PET/CT

Barrio et al (2017) conducted a systematic review and meta-analysis on the impact of gallium 68 (^{68}Ga) PET/CT on management decisions in individuals with neuroendocrine tumors.[17,] Reviewers selected 14 studies (N=1561). Change in management occurred in 44% of the individuals following ^{68}Ga-PET/CT. Clinical outcomes were not reported.

Deppen et al (2016) conducted a systematic review assessing the use of ^{68}Ga-PET/CT for the diagnosis and staging of gastroenteropancreatic neuroendocrine tumors.[18,] Seventeen studies (N=971) were included in the analysis. Comparators differed among the studies: octreotide and conventional imaging (3 studies), other radiopharmaceuticals without direct imaging comparators (5 studies), and conventional imaging (9 studies). Meta-analysis of the 9 studies that compared ^{68}Ga-PET/CT scanning with conventional imaging resulted in a sensitivity of 91% (95% CI, 81% to 96%) and a specificity of 91% (95% CI, 78% to 96%).

Two meta-analyses from Treglia et al (2012) addressed the use of PET in individuals with neuroendocrine tumors.[19,20,] One report included individuals with thoracic and gastroenteropancreatic neuroendocrine tumors who had imaging with PET using ^{68}Ga-PET and ^{68}Ga-PET/CT.[19,] Sixteen studies (N=567) were included in the analysis. The studies were considered medium to high quality, based on an assessment using the QUADAS tool. Meta-analysis showed a sensitivity and specificity of 93% (95% CI, 91% to 95%) and 91% (95% CI, 82% to 97%), respectively, with histology and/or clinical or imaging follow-up as the reference standard in diagnostic accuracy.

^{18}F-DOPA PET and ^{18}F-DOPA PET/CT

The other meta-analysis included studies of individuals with paragangliomas scanned by PET with fluorine 18-dihydroxyphenylalanine (^{18}F-DOPA) PET and ^{18}F-DOPA PET/CT.[20,] Eleven studies (N=275) were analyzed. The QUADAS tool was used to assess quality: 2 studies had a B rating, 4 a C rating, and 5 a D rating. Reference standards varied across studies, with 2 using MRI, 3 using histology on all individuals, and the remaining using histology only when feasible. Meta-analysis showed a sensitivity and specificity of 91% (95% CI, 87% to 94%) and 79% (95% CI, 76% to 81%), respectively.

PROSPECTIVE STUDIES

^{64}Cu-PET and ^{64}Cu-PET/CT

Delpassand et al (2020) conducted a phase 3, reader-masked, controlled trial to evaluate the sensitivity and specificity of copper 64 (^{64}Cu) PET/CT for detecting neuroendocrine tumors.[21,] Individuals with known or suspected disease, along with healthy volunteers, were recruited and results of imaging with ^{64}Cu PET/CT was compared against a standard of truth, based on an alternative, established imaging modality. Three readers evaluated the sensitivity and specificity of ^{64}Cu PET/CT compared with a standard truth in 63 evaluable individuals with known or suspected neuroendocrine tumors. The overall sensitivity and specificity based on the standard of truth was 100% and 96.8%, respectively. This translated to a PPV of 96.7%, a NPV of 100%, and an accuracy of 98.4%.

Johnbeck et al (2017) conducted a head-to-head trial comparing the diagnostic performance of ^{64}Cu PET/CT to ^{68}Ga-PET/CT in individuals with neuroendocrine tumors. Individuals (N=59) were prospectively enrolled and underwent both ^{64}Cu PET/CT and ^{68}Ga-PET/CT within 1

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week.[22,] Clinical follow-up was over 2 years, which allowed verification of discordant lesions (only found by 1 tracer) as either true- or false-positive findings. Overall, 701 PET-positive lesions were found by both tracers (concordant lesions), whereas an additional 68 discordant lesions were found. Forty-two of the discordant lesions were found by ^{64}Cu PET/CT, of which 33 were eventually confirmed to be true-positives. In contrast, ^{68}Ga-PET/CT found 26 discordant lesions, of which 7 were confirmed as true-positives. The probability that a true-positive discordant lesion was detected by ^{64}Cu PET/CT was 83% (95% CI, 67% to 93%; p<.001 compared to ^{68}Ga-PET/CT).

GUIDELINES

National Comprehensive Cancer Network

Current NCCN guidelines for neuroendocrine tumors (v.2.2024) have recommended somatostatin receptor-based imaging with PET/CT or PET/MRI, using somatostatin receptor PET tracers,^{68}Ga-dotatate, ^{68}Ga-dotatoc, or ^{64}Cu-dotatate,to assess receptor status and presence of distant disease.[23,] Somatostatin receptor imaging can assist in determining if a patient would benefit from receiving a somatostatin receptor-directed therapy. Use of FDG-PET may be considered to identify high-grade active disease in selected individuals when high-grade neuroendocrine tumors or poorly differentiated carcinomas are documented or suspected or when disease is growing rapidly. For certain types of neuroendocrine tumors (eg, well-differentiated, grade 3), somatostatin receptor-based imaging with PET/CT or PET/MRI or FDG-PET/CT scans for surveillance are recommended as clinically indicated. Use of ^{18}F-DOPA PET/CT is not discussed in the guidelines.

Section Summary: Neuroendocrine Tumors

Evidence for the use of PET or PET/CT in the management of individuals with neuroendocrine tumors consists of meta-analyses and prospective, comparative studies. Meta-analyses of studies using ^{68}Ga-PET/CT as the radiotracer for diagnosis and staging of neuroendocrine tumors report relatively high sensitivities and specificities compared with conventional imaging techniques. A study comparing the diagnostic performance between ^{64}Cu PET/CT and ^{68}Ga-PET/CT reported an increase in detection of lesions with ^{64}Cu PET/CT. Current guidelines recommend using somatostatin receptor PET tracers, ^{68}Ga-dotatate, ^{68}Ga-dotatoc, or ^{64}Cu-dotatate, to assess receptor status and presence of distant disease.

The evidence does not support the use of FDG-PET/CT for the diagnosis, staging, and restaging of neuroendocrine tumors.

The evidence does not support the use of FDG-PET/CT for surveillance of neuroendocrine tumors.

The evidence supports the use of ^{68}Ga or ^{64}Cu PET/CT for the diagnosis, staging, and restaging of neuroendocrine tumors.

The evidence does not support the use of ^{68}Ga or ^{64}Cu PET/CT for surveillance of neuroendocrine tumors.

THYROID CANCER

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SYSTEMATIC REVIEWS

Differentiated

Schutz et al (2018) conducted a systematic review and meta-analysis of 29 prospective studies (22 differentiated, 7 medullary) investigating the staging, restaging, and recurrence of thyroid cancer.[24,] Meta-analyses showed higher sensitivity and specificity with PET compared with conventional imaging.

Haslerud et al (2016) conducted a systematic review of studies using FDG-PET to detect recurrent differentiated thyroid cancer in individuals who had undergone ablative therapy.[25,] The literature search, conducted through December 2014, identified 34 studies (N=2639) for inclusion: 17 using FDG-PET/CT, 11 using FDG-PET, and 6 using both methods. Study quality was assessed using the QUADAS tool. Pooled sensitivity and specificity for FDG-PET/CT were 80% (95% CI, 74% to 86%) and 76% (95% CI, 63% to 85%), respectively. Pooled sensitivity and specificity for FDG-PET alone were 77% (95% CI, 63% to 86%) and 76% (95% CI, 60% to 87%), respectively. Combining all 34 studies in the meta-analysis resulted in a pooled sensitivity and specificity of 79% (95% CI, 74% to 84%) and 79% (95% CI, 71% to 85%), respectively. A NCCN report conducted by Podoloff et al (2009) showed that PET can localize recurrent disease when other imaging tests are negative.[26,] Additionally, PET was found to be prognostic in this setting, showing that more metabolically active lesions on PET were strongly correlated with reduced survival.[27,]

Medullary

A meta-analysis of studies on detecting recurrent or metastatic medullary thyroid carcinoma was conducted by Cheng et al (2012).[28,] The literature search, conducted through December 2010, identified 15 studies to be included in the meta-analysis: 8 used FDG-PET and 7 used FDG-PET/CT. The pooled sensitivity for FDG-PET alone in detecting recurrent or metastatic medullary thyroid cancer was 68% (95% CI, 64% to 72%). The pooled sensitivity for FDG-PET/CT was 69% (95% CI, 64% to 74%).

GUIDELINES

National Comprehensive Cancer Network

Current NCCN guidelines for thyroid carcinomas (v.4.2024) support use of FDG-PET/CT during disease monitoring for thyroid carcinomas when iodine-131 imaging is negative and stimulated thyroglobulin is greater than 2 to 5 ng/mL.[29,] For medullary thyroid cancer, Ga-68-dotatate PET/CT may be considered as part of the diagnostic workup, and recommend Ga-68-dotatate PET/CT or FDG-PET in certain cases for disease monitoring. Additionally, FDG-PET/CT may be considered as part of the diagnostic workup and as part of disease monitoring 3 to 6 months after initial therapy for anaplastic carcinoma.

Section Summary: Thyroid Cancer

Evidence for the use of PET and PET/CT to diagnose recurrently differentiated and medullary thyroid cancer consists of systematic reviews and meta-analyses. Pooled sensitivity and specificity for FDG-PET and FDG-PET/CT in detecting recurrent differentiated thyroid cancer were comparable, ranging from 76% to 80%. Pooled sensitivity for both PET and PET/CT in detecting recurrent medullary thyroid cancer were also comparable (68% to 69%). The evidence supports

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the use of FDG-PET and FDG-PET/CT for the diagnosis and staging and restaging of thyroid cancer.

The evidence does not support the use of FDG-PET and FDG-PET/CT for surveillance of thyroid cancer.

SUPPLEMENTAL INFORMATION

The purpose of the following information is to provide reference material. Inclusion does not imply endorsement or alignment with the evidence review conclusions.

Practice Guidelines and Position Statements

Guidelines or position statements will be considered for inclusion in 'Supplemental Information' if they were issued by, or jointly by, a US professional society, an international society with US representation, or National Institute for Health and Care Excellence (NICE). Priority will be given to guidelines that are informed by a systematic review, include strength of evidence ratings, and include a description of management of conflict of interest.
Current National Comprehensive Cancer Network, American College of Radiology, and other relevant U.S.-based guidelines are summarized in each section of the Rationale.

U.S. Preventive Services Task Force Recommendations

Not applicable.

Ongoing and Unpublished Clinical Trials

A search of ClinicalTrials.gov in September 2024 identified a large number of ongoing and unpublished trials that would likely influence this review.

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CODING

The following codes for treatment and procedures applicable to this policy are included below for informational purposes. This may not be a comprehensive list of procedure codes applicable to this policy.

Inclusion or exclusion of a procedure, diagnosis or device code(s) does not constitute or imply member coverage or provider reimbursement. Please refer to the member's contract benefits in effect at the time of service to determine coverage or non-coverage of these services as it applies to an individual member.

The code(s) listed below are medically necessary ONLY if the procedure is performed according to the "Policy" section of this document.

CPT/HCPCS	
78608	Brain imaging, positron emission tomography (PET); metabolic evaluation
78609	Brain imaging, positron emission tomography (PET); perfusion evaluation
78811	Positron emission tomography (PET) imaging; limited area (e.g. Chest, head/neck)
78812	Positron emission tomography (PET) imaging; skull base to mid-thigh
78813	Positron emission tomography (PET) imaging; whole body
78814	Tumor imaging, positron emission tomography (PET) with concurrently acquired computed tomography (CT) for attenuation correction and anatomical localization; limited area (e.g. chest, head/neck)
78815	Tumor imaging, positron emission tomography (PET) with concurrently acquired computed tomography (CT) for attenuation correction and anatomical localization; skull base to mid-thigh
78816	Tumor imaging, positron emission tomography (PET) with concurrently acquired computed tomography (CT) for attenuation correction and anatomical localization; whole body
A9552	Fluorodeoxyglucose F-18 FDG, diagnostic, per study dose, up to 45 millicuries
A9587	Gallium ga-68, dotatate, diagnostic, 0.1 millicurie
A9597	Positron emission tomography radiopharmaceutical, diagnostic, for tumor identification, not otherwise classified
A9598	Positron emission tomography radiopharmaceutical, diagnostic, for non-tumor identification, not otherwise classified
G0235	PET imaging, any site not otherwise specified

REVISIONS	
Posted 01-28-2025 Effective 02-27-2025	Oncologic Applications Thyroid, Neuroendocrine, Head and Neck was originally part of the Positron Emission Tomography (PET) Scanning: Oncologic Applications medical policy. Oncologic Applications for Thyroid, Neuroendocrine, Head and Neck has been pulled out and placed into a separate medical policy, Positron Emission Tomography (PET) Scanning: Oncologic Applications (Thyroid, Neuroendocrine, Head and Neck). The medical policy language was unchanged.

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