CLINICAL GUIDELINES

Pediatric Oncology Imaging Policy

Version 1.0

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eviCore healthcare Clinical Decision Support Tool Diagnostic Strategies: This tool addresses common symptoms and symptom complexes. Imaging requests for individuals with atypical symptoms or clinical presentations that are not specifically addressed will require physician review. Consultation with the referring physician, specialist and/or individual's Primary Care Physician (PCP) may provide additional insight.

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Pediatric Oncology Imaging Guidelines

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Abbreviations for Pediatric Oncology Imaging Guidelines

AFP	Alpha-fetoprotein (tumor marker)
ALCL	Anaplastic large cell lymphoma
ALL	Acute lymphoblastic leukemia
AML	Acute myelogenous leukemia
β−hCG	Human chorionic gonadotropin beta-subunit (tumor marker)
BKL	Burkitt's lymphoma
BWT	Bilateral Wilms tumor
CCSK	Clear cell sarcoma of the kidney
CNS	Central nervous system
COG	Children's Oncology group
CPT®	Current procedural terminology; trademark of the American Medical Association
CSF	Cerebrospinal fluid
CT	Computed tomography
CXR	Chest x-ray
DAWT	Diffuse anaplasia Wilms tumor
ESFT	Ewing sarcoma family of tumors
FAWT	Focal anaplasia Wilms tumor
FHWT	Favorable histology Wilms tumor
HL	Hodgkin lymphoma
HSCT	Hematopoietic stem cell transplant (bone marrow or peripheral blood)
HVA	Homovanillic acid
LL	Lymphoblastic lymphoma
MIBG	Metaiodobenzylguanidine (nuclear scan using ^{123}i or ^{131}i)
MPNST	Malignant peripheral nerve sheath tumor
MRI	Magnetic resonance imaging
NBL	Neuroblastoma
NED	No evidence of disease
NHL	Non-hodgkin lymphoma
NPC	Nasopharyngeal carcinoma
NRSTS	Nonrhabdomyosarcomatous soft tissue sarcomas
OS	Osteosarcoma
PET	Positron emission tomography
PMBCL	Primary mediastinal b-cell lymphoma
PNET	Primitive neuroectodermal tumor
RCC	Renal cell carcinoma
RMS	Rhabdomyosarcoma
US	Ultrasound
VMA	Vannilylmandelic acid
WBC	White blood cell count
XRT	Radiation therapy

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PEDONC-1: General Guidelines

PEDONC-1.1: Age Considerations
PEDONC-1.2: Appropriate Clinical Evaluations
PEDONC-1.3: Modality General Considerations
PEDONC-1.4: PET Imaging in Pediatric Oncology
PEDONC-1.5: Diagnostic Radiation Exposure in Pediatric Oncology

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PEDONC-1.1: Age Considerations

The majority of malignancies occurring in the pediatric population are different diagnoses than those occurring in the adult population. For those diseases which occur in both pediatric and adult populations, minor differences may exist in management between pediatric and adult medical oncologists due to patient age, comorbidities, and differences in disease natural history between children and adults.

- Patients who are < 18 years old at initial diagnosis should be imaged according to the Pediatric Oncology Imaging Guidelines, and patients who are ≥ 18 years at initial diagnosis should be imaged according to the adult Oncology Imaging Guidelines, except where directed otherwise by a specific guideline section.
- Patients who are 15 to 39 years old at initial diagnosis are defined as Adolescent and Young Adult (AYA) Oncology patients. There is significantly more overlap between cancer types in this age group.
  - When unique guidelines for a specific cancer type exist only in either Oncology or Pediatric Oncology, AYA patients should be imaged according to the guideline section for their specific cancer type, regardless of the patient's age.

End of PEDONC-1.1

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PEDONC-1.2: Appropriate Clinical Evaluations

- In general, a recent (within 60 days) detailed history and physical examination and appropriate laboratory studies should be performed prior to considering advanced imaging, unless the patient is undergoing guideline-supported scheduled off-therapy surveillance evaluation.
  - Because of the relatively small number of childhood cancer treatment centers, it is common to combine off-therapy visits with imaging and other subspecialist visits to accommodate families traveling long distances for their child's care.
- The majority of pediatric oncology imaging indications are listed in the diagnosis-specific guideline sections, but for rare malignancies and other circumstances not specifically addressed elsewhere in the pediatric oncology guidelines, the following general principles apply:
  - Routine imaging of brain, spine, neck, chest, abdomen, pelvis, bones, or other body areas is not indicated in the absence of localizing symptoms or abnormalities on plain radiography or ultrasound.
- The overwhelming majority of pediatric oncology patients treated in the United States will be enrolled on or treated according to recent Children's Oncology Group (COG) protocols. These imaging guidelines are consistent with evaluations recommended by COG protocols commonly used for direct patient care (whether formally enrolled on study or not).
- For patients enrolled on a COG study, imaging recommended by COG protocols should generally be approved unless the imaging is being performed solely to address a study objective and would not be indicated in usual clinical care.

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Phases of Pediatric Oncology Imaging:

- Screening:
  - All imaging studies requested for patients at increased risk for a particular cancer in the absence of any clinical signs or symptoms.
  - Screening using advanced imaging is only supported for conditions listed in **PEDONC-2: Screening Imaging In Cancer Predisposition Syndromes**.
- Initial staging:
  - All imaging studies requested from the time cancer is first clinically suspected until the initiation of specific treatment (which may be surgical resection alone)
  - Pediatric malignancies in general behave more aggressively than adult cancers, and the time from initial suspicion of cancer to specific therapy initiation can be measured in hours to days for most pediatric cancers
    - It is recommended that children with pediatric solid tumors undergo CT evaluation of the Chest prior to general anesthesia for biopsy or resection due to the risk of post-operative atelectasis mimicking pulmonary metastasis resulting in inaccurate staging and/or delay in therapy initiation
    - If CTs of other body areas are indicated, (Neck, Abdomen, Pelvis), they should be performed concurrently with Chest CT to avoid overlapping fields and the resulting increase in radiation exposure
    - Metastatic CNS imaging and nuclear medicine imaging are generally deferred until after a histologic diagnosis is made, with the exception of aggressive non-Hodgkin Lymphomas
- Treatment response:
  - All imaging studies completed during any type of active treatment (chemotherapy or other medications, radiation therapy, or surgery), including evaluation at the end of planned active treatment
  - Unless otherwise stated in the diagnosis-specific guidelines, imaging for treatment response can be approved after every 2 cycles, which is usually ~6 weeks of therapy for solid tumors and usually ~8 to 12 weeks for CNS tumors
- Surveillance:
  - All routine imaging studies requested for a patient who is not receiving any active treatment, even if residual imaging abnormalities are present
  - Unlike adult cancers, in most pediatric cancers surveillance does not begin until all planned multimodal therapy is completed. Pediatric cancers where surgical resection is considered curative are listed in the diagnosis-specific guideline sections
  - The recommended timing for surveillance imaging studies in these guidelines refers to patients who are asymptomatic or have stable chronic symptoms
  - Certain tumor types do not require surveillance with advanced imaging as patient outcomes following relapse are not improved by surveillance imaging. See diagnosis-specific guideline sections for details.
  - PET imaging is not supported for surveillance imaging unless specifically stated in elsewhere in the diagnosis-specific guideline sections

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- Patients with new or changing clinical signs or symptoms suggesting recurrent disease should have symptom-appropriate imaging requests approved even when surveillance timing recommendations are not met.

- Recurrence:
  - All imaging studies completed at the time a recurrence or progression of a known cancer is documented or is strongly suspected based on clinical signs or symptoms, laboratory findings, or results of basic imaging studies such as plain radiography or ultrasound
  - Following documented recurrence of childhood cancer, any studies recommended for initial staging of that cancer type in the diagnosis-specific imaging guideline section should be approved
  - During active treatment for recurrent pediatric cancer, conventional imaging evaluation (CT or MRI, should use the same modality for ongoing monitoring as much as possible) of previously involved areas should be approved according to the treatment response imaging in the diagnosis-specific guideline section:
    - Imaging may be indicated more frequently than recommended by guidelines with clinical documentation that the imaging results are likely to result in a treatment change for the patient, including a change from active treatment to surveillance
  - Unless otherwise specified for a specific cancer type, PET is generally not indicated for routine treatment response evaluation during active treatment for recurrent pediatric cancer
    - In rare circumstances, PET may be appropriate when results are likely to result in a treatment change for the patient, including a change from active treatment to surveillance.
    - These requests will be forwarded for Medical Director review.
  - If a patient with recurrent pediatric cancer completes active treatment with no evidence of disease (NED), s/he should be imaged according to the diagnosis-specific surveillance guideline sections

Radiation Treatment Planning In Pediatric Oncology:

- Imaging performed in support of radiation therapy treatment planning should follow guidelines outlined in **ONC-1.5: Unlisted Procedure Codes in Oncology**.

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Cardiac Function Assessment in Pediatric Oncology During Active Treatment:

- Echocardiography (CPT® 93306, CPT® 93307, or CPT® 93308) is preferred for evaluation of cardiac function prior to cardiotoxic chemotherapy and can be performed as often as each chemotherapy cycle at the discretion of the treating pediatric oncologist based on:
  - Cumulative cardiotoxic therapy received to date
  - Patient's age and gender
  - Most recent echocardiogram results
  - New or worsening cardiac symptoms
- **Mu**lti-**g**ated **a**cquisition (MUGA, CPT® 78472) blood pool nuclear medicine scanning should not be approved for cardiac function monitoring in pediatric oncology patients unless one of the following applies:
  - Echocardiography yielded a borderline shortening fraction (< 30%) and additional left ventricular function data are necessary to make a chemotherapy decision
  - Echocardiography windowing is suboptimal due to body habitus or tumor location

Immunosuppression during Pediatric Cancer therapy and imaging ramifications:

- Patients may be severely immunocompromised during active chemotherapy treatment and any conventional imaging request to evaluate for infectious complications during this time frame should be approved immediately
- Imaging requests for infectious disease concerns for all patients with absolute neutrophil count (ANC) < 500 or inconclusive findings on Chest x-ray or US at any ANC during active treatment should be approved as requested
- Additionally, patients may have therapy-induced hypogammaglobulinemia which requires supplemental intravenous immune globulin (IVIG) during maintenance therapy. Patients receiving supplemental IVIG should be treated similarly to patients with ANC < 500 with regards to imaging for infectious disease.
- Some patients are treated with very intensive chemotherapy regimens (including autologous stem cell transplantation - See **ONC-29: Hematopoietic Stem Cell Transplantation** and spend the majority of their chemotherapy treatment phase in the hospital. Due to the high risk of invasive infections, frequent CT may be indicated to evaluate known sites of invasive fungal infection, and in general these should be approved as requested.
  - Surveillance imaging of asymptomatic patients to detect invasive fungal infection has not been shown to impact patient outcomes. Imaging requests in these circumstances should only be approved when acute clinical decisions will be made based on the imaging.

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Hematopoietic Stem Cell Transplant (HSCT) in Pediatric Oncology:

- Transplantation of hematopoietic stem cells from bone marrow, peripheral blood, or cord blood is commonly used in the following clinical situations in pediatric hematology and oncology patients:
  - High risk or recurrent leukemia (allogeneic)
  - Recurrent lymphoma (allogeneic or autologous)
  - Hemophagocytic lymphohistiocytosis (allogeneic)
  - High risk sickle cell disease (allogeneic)
  - High risk neuroblastoma (autologous)
  - High risk CNS tumors (autologous)
  - Recurrent Ewing sarcoma family of tumors (autologous, rarely allogeneic)
- Imaging considerations for HSCT should follow guidelines in: **ONC-29: Hematopoietic Stem Cell Transplantation**.

End of PEDONC-1.2

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PEDONC-1.3: Modality General Considerations

- Plain radiography
  - Chest x-ray (CXR) can provide a prompt means to evaluate primary intrathoracic tumors and continues to be the initial imaging study recommended to detect complications, such as suspected infection, in symptomatic patients undergoing treatment.
  - CXR continues to be the initial imaging study recommended for pulmonary surveillance for some pediatric cancers. See diagnosis-specific guideline sections for details.
  - Plain radiography continues to be the initial imaging study recommended for evaluation of lesions involving the appendicular skeleton, both during and after completion of treatment. See diagnosis-specific guideline sections for details.
  - Plain abdominal radiographs have been replaced by ultrasound, CT, or MRI
- Ultrasound
  - Ultrasound is not widely used in pediatric oncology for staging, but is frequently used for surveillance in patients who have successfully treated (primarily abdominal or pelvic) tumors with little or no residual disease. See diagnosis-specific guideline sections for details.
- CT
  - CT with contrast is the imaging study of choice in pediatric patients with lymphomas or solid tumors of the neck, thorax, abdomen, and/or pelvis
    - If CT contrast use is contraindicated due to allergy or impaired renal function, either CT without contrast or MRI without and with contrast may be substituted at the discretion of the ordering physician
- MRI
  - MRI without and with contrast is the study of choice for CNS and musculoskeletal tumors
    - If MRI contrast use is contraindicated due to allergy or impaired renal function, MRI without contrast may be substituted at the discretion of the ordering physician
  - Due to the length of time for image acquisition and the need for stillness, anesthesia is required for almost all infants and young children (age < 7 years), as well as older children with delays in development or maturity. In this patient population, MRI imaging sessions should be planned with a goal of avoiding a short-interval repeat anesthesia exposure due to insufficient information using the following considerations:
    - MRI should always be performed without and with contrast unless there is a specific contraindication to gadolinium use, since the patient already has intravenous access for anesthesia.
      - Recent evidence based literature demonstrates the potential for gadolinium deposition in various organs including the brain, after the use of MRI contrast.

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        - The U.S. food and drug administration (FDA) has noted that there is currently no evidence to suggest that gadolinium retention in the brain is harmful and restricting gadolinium-based contrast agents (GBCAS) use is not warranted at this time. It has been recommended that GBCA use should be limited to circumstances in which additional information provided by the contrast agent is necessary and the necessity of repetitive MRIs with GBCAS should be assessed.
        - If requesting clinicians indicate that a non-contrast study is being requested due to concerns regarding the use of gadolinium, the exam can be approved.
    - If multiple body areas are supported by eviCore guidelines for the clinical condition being evaluated, MRI of all necessary body areas should be obtained concurrently in the same anesthesia session

- Nuclear medicine
    - General PET imaging consideration can be found in **PEDONC-1.4: PET Imaging in Pediatric Oncology**.
    - Bone scan is frequently used for evaluation of bone metastases during initial treatment, treatment response, and surveillance in pediatric oncology
        - For the purposes of these guidelines, any of the following codes can be approved where “bone scan” is indicated:
            - CPT® 78300
            - CPT® 78305
            - CPT® 78306
            - CPT® 78803
            - CPT® 78305 and CPT® 78803
            - CPT® 78306 and CPT® 78803
            - If CPT® 78300 and CPT® 78803 are requested together, only CPT® 78803 should be approved
            - CPT® 78315 has no specific indications for evaluation of malignant disease
    - ^{123}I-metaiodobenzylguanidine (MIBG) scintigraphy is the preferred metabolic imaging for neuroblastoma and is positive in 90 to 95% of neuroblastomas, and is also used for evaluation of pheochromocytomas, paragangliomas, ganglioneuromas, and ganglioneuroblatomas
        - For the purposes of these guidelines, any of the following codes can be approved where “MIBG” is indicated:
            - CPT® 78800
            - CPT® 78801
            - CPT® 78802
            - CPT® 78803
            - CPT® 78804
    - Octreotide and gallium scans use the same CPT codes as MIBG

End of PEDONC-1.3

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PEDONC-1.4: PET Imaging in Pediatric Oncology

Note: *Some payors have specific restrictions on PET imaging, and those coverage policies may supersede the recommendations for PET imaging in these guidelines.*

Throughout these guidelines, the term "PET" refers specifically to ^{18}F-FDG-PET imaging and also applies to PET/CT fusion studies.

- PET imaging in pediatric Oncology should use PET/CT fusion imaging (CPT® 78815 or CPT® 78816) unless there is clear documentation that the treating facility does not have fusion capacity, in which case PET alone (CPT® 78812 or CPT® 78813) can be approved along with the appropriate CT studies. Unbundling PET/CT imaging into separate PET and diagnostic CT codes is otherwise not supported.
- The decision whether to use skull base to mid-femur ("eyes to thighs") procedure code for PET (CPT® 78812 or CPT® 78815) or whole body PET (CPT® 78813 or CPT® 78816) is addressed in the diagnosis-specific guideline sections.
- PET imaging is not reliable for the detection of anatomic lesions smaller than 8 mm in size.
- PET imaging using isotopes other than ^{18}F-FDG and ^{68}Ga-DOTATATE is considered investigational at this time.
- PET has not been shown to be diagnostically useful in all forms of childhood cancer. PET is supported for pediatric malignancies with significant published evidence regarding its diagnostic accuracy and importance in accurately directing patient care decisions. See diagnosis-specific guideline sections for details.
- PET imaging is not specific to cancer, and has a high rate of false positivity. Inflammation, infection (especially granulomatous), trauma, and post-operative healing may show high levels of FDG uptake and be false-positive for malignant lesions.
- PET for rare malignancies not specifically addressed by eviCore guidelines is generally not indicated, due to lack of available evidence regarding diagnostic accuracy of PET in the majority of rare cancers. Conventional imaging studies should be used for initial staging and treatment response for these diagnoses. PET can be approved if ***all*** of the following apply:
  - Conventional imaging (CT, MRI, US, plain film) reveals findings that are equivocal or suspicious
  - No other specific metabolic imaging (MIBG, octreotide, technetium, etc.) Is appropriate for the cancer type
  - The submitted clinical information describes a specific decision regarding the patient's care that will be made based on the PET results
  - These requests will be forwarded for Medical Director review
- PET imaging is not supported for surveillance imaging unless specifically stated elsewhere in the diagnosis-specific guideline sections

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- Unless otherwise specified for a specific cancer type, once PET has been documented to be negative for a given patient's cancer or all PET-avid disease has been surgically resected, PET should not be used for continued disease monitoring or surveillance unless one of the following applies:
  - Conventional imaging (CT, MRI, US, plain film) reveals findings that are inconclusive or suspicious for recurrence
    - Residual mass that has not changed in size since the last conventional imaging does **not** justify PET imaging
    - PET avidity in a residual mass at the end of planned therapy is **not** an indication for PET imaging during surveillance.
  - Very rare circumstances where tumor markers or obvious clinical symptoms show strong evidence suggesting recurrence and PET would replace conventional imaging modalities
  - The patient is undergoing salvage treatment for a recurrent solid tumor with residual measurable disease on conventional imaging and confirmed repeat negative PET imaging will allow the patient to transition from active treatment to surveillance.
  - These requests will be forwarded for Medical Director review.

End of PEDONC-1.4

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PEDONC-1.5: Diagnostic Radiation Exposure in Pediatric Oncology

Young children are presumed to be at increased risk for malignancy from diagnostic radiation exposure, most commonly from CT and nuclear medicine imaging. They are more sensitive to radiation than adults and generally live longer after receiving radiation doses from medical procedures, resulting in a larger number of years during which to manifest a cancer.

- Because of this presumed increased risk in young children, requests to substitute MRI without and with contrast for CT with contrast to avoid radiation exposure can be approved if all of the following criteria apply:
  - The patient is presently a young child and the ordering physician has documented the reason for MRI, rather than CT, is to avoid radiation exposure.
  - The disease-specific guidelines do not list CT as superior to MRI for the current disease and time point, meaning the MRI will provide equivalent or superior information relative to CT.
  - The request is for a body area other than Chest as MRI is substantially inferior to CT for detection of small pulmonary metastases.

The guidelines listed in this section for certain specific indications are not intended to be all-inclusive; clinical judgment remains paramount and variance from these guidelines may be appropriate and warranted for specific clinical situations.

End of PEDONC-1.5

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PEDONC-2: Screening Imaging in Cancer Predisposition Syndromes

PEDONC-2.1: Screening Imaging in Cancer Predisposition Syndromes –General Considerations
PEDONC-2.2: Li-Fraumeni Syndrome (LFS)
PEDONC-2.3: Neurofibromatosis 1 and 2 (NF1 and NF2)
PEDONC-2.4: Beckwith-Wiedemann Syndrome (BWS)
PEDONC-2.5: Denys-Drash Syndrome (DDS)
PEDONC-2.6: Wilms Tumor-Aniridia-Growth Retardation (WAGR)
PEDONC-2.7: Familial Adenomatous Polyposis (FAP) and Related Conditions
PEDONC-2.8: Multiple Endocrine Neoplasias (MEN)
PEDONC-2.9: Tuberous Sclerosis Complex (TSC)
PEDONC-2.10: Von Hippel-Lindau Syndrome (VHL)
PEDONC-2.11: Rhabdoid Tumor Predisposition Syndrome
PEDONC-2.12: Familial Retinoblastoma Syndrome
PEDONC-2.13: Hereditary Paraganglioma-Pheochromocytoma (HPP) Syndromes
PEDONC-2.14: Costello Syndrome
PEDONC-2.15: Constitutional Mismatch Repair Deficiency (CMMRD or Turcot Syndrome)

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PEDONC-2.1: Screening Imaging in Cancer Predisposition Syndromes – General Considerations

This section is intended to give guidance for screening imaging prior to diagnosis with a specific malignancy. Once a patient with a cancer predisposition syndrome has been diagnosed with a malignant disease, future imaging decisions should be guided by the appropriate disease-specific guidelines except as explicitly stated elsewhere in this section.

This section's guidelines are limited to cancer predisposition syndromes with screening imaging considerations. Syndromes requiring only clinical or laboratory screening are not discussed here.

- In general, a recent (within 60 days) detailed history and physical examination and appropriate laboratory studies should be performed prior to considering advanced imaging, unless the patient is undergoing guideline-supported scheduled screening evaluation identified in this section
- Many of these cancer predisposition syndromes also affect adults as survival continues to improve for these patients. Adults with syndromes covered in this section may follow these imaging guidelines except where contradicted by specific statements in the adult imaging guidelines or payor-specific coverage policies.

Documentation of genetic or molecular confirmation of the appropriate syndrome with increased cancer risk is preferred for any patient to qualify for screening imaging. There are a number of complex ethical, social, and financial issues involved in the decision to complete genetic testing in a pediatric patient:

- Note: Some payors consider certain genetic tests to be experimental, and those coverage policies supersede the recommendations for genetic testing in this section.
- From the 2013 AAP Policy Statement, "Predictive genetic testing for adult-onset conditions generally should be deferred unless an intervention initiated in childhood may reduce morbidity or mortality." ***Imaging surveillance is one such intervention and should not be performed without justifiable cause.***
- Genetic testing should be performed in conjunction with genetic counseling for appropriate communication of risks identified by testing
- When genetic testing is not possible or not supported by health plan coverage policies, formal diagnosis after evaluation by a physician with significant training and/or experience in cancer predisposition syndromes (most commonly a geneticist or oncologist) is generally sufficient to confirm eligibility for screening imaging.
- Due to the length of time for image acquisition and the need for stillness, anesthesia is required for almost all infants and young children (age < 7 years), as well as older children with delays in development or maturity. In this patient population, MRI imaging sessions should be planned with a goal of avoiding a short-interval repeat anesthesia exposure due to insufficient information using the following considerations:

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- MRI should always be performed without and with contrast unless there is a specific contraindication to gadolinium use, since the patient already has intravenous access for anesthesia.
  - Recent evidence based literature demonstrates the potential for gadolinium deposition in various organs including the brain, after the use of MRI contrast.
  - The U.S. food and drug administration (FDA) has noted that there is currently no evidence to suggest that gadolinium retention in the brain is harmful and restricting gadolinium-based contrast agents (GBCAS) use is not warranted at this time. It has been recommended that GBCA use should be limited to circumstances in which additional information provided by the contrast agent is necessary and the necessity of repetitive MRIs with GBCAS should be assessed.
  - If requesting clinicians indicate that a non-contrast study is being requested due to concerns regarding the use of gadolinium, the exam can be approved.
- If multiple body areas are supported by eviCore guidelines for the clinical condition being evaluated, MRI of all necessary body areas should be obtained concurrently in the same anesthesia session

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PEDONC-2.2: Li-Fraumeni Syndrome (LFS)

Syndrome inherited in an autosomal dominant manner (50% risk to offspring) associated with germline mutations in *TP53* resulted in an increased susceptibility to a variety of cancers.

- Eighty percent of individuals will have germline *TP53* mutation:
  - Tumor-specific *TP53* mutations are much more common than germline *TP53* mutations and are not associated with an increased risk for subsequent cancers
  - If *TP53*-negative, formal diagnosis of LFS should be assigned by a physician with significant training and/or experience in LFS (most commonly a geneticist or oncologist) based on specified clinical criteria prior to beginning a screening imaging program
  - *TP53* mutations may be present in 50 to 80% of pediatric adrenocortical carcinoma, 10% of pediatric rhabdomyosarcoma, and 10% of pediatric osteosarcoma patients
- Patients with LFS have an increased sensitivity to ionizing radiation, so screening strategies resulting in significant radiation exposure are not appropriate (CT and nuclear medicine).

The following imaging studies should be considered appropriate in patients with LFS:

Annual complete detailed physical examinations, complete blood counts, and urinalyses form the backbone of LFS cancer screening.
Annual MRI Brain without and with contrast (CPT® 70553) for all patients

- Annual whole-body MRI (WBMRI, CPT® 76498) for all patients
- Substantial variation continues to exist in WBMRI techniques, and a specific CPT code for WBMRI has not yet been assigned. As a result, CPT® 76498 is the only approvable code for a WBMRI study at this time.
- Abdominal (CPT® 76700) and Pelvic (CPT® 76856) ultrasound every 3 months from birth to age 18 (for adrenocortical carcinoma screening)
- Annual Breast MRI (CPT® 77049) alternating every 6 months with breast ultrasound for breast cancer screening is appropriate for LFS patients beginning at age 20 (See BR-6: Breast MRI Indications)
- Targeted MRI imaging without and with contrast of any body area(s) with documented signs or symptoms suggestive of possible malignancy
- When a specific malignancy is suspected, the patient should be imaged according to the eviCore imaging guideline specific to the suspected cancer type
- Studies ordered as part of a screening imaging program based on specific family cancer history that has been developed for an individual patient in conjunction with a multidisciplinary team including at least genetics and Oncology
- Specifics of the program should be obtained and available for the Medical Director reviewing the case

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PEDONC-2.3: Neurofibromatosis 1 and 2 (NF1 and NF2)

NF1:

Common syndrome inherited in an autosomal dominant manner (50% risk to offspring) affecting 1 in 2500 people. The diagnosis is commonly made based on established clinical criteria including café-au-lait spots, lisch nodules of the iris, axillary freckling, family history, and the presence of NF-associated tumors.

Genetic testing is encouraged for children with possible NF1 and no family history prior to assigning a diagnosis, but will not identify a mutation for all patients with NF1. The majority of tumors are benign in nature, but malignant degeneration can occur. The most frequent neoplasms associated with NF1 in children are malignant peripheral nerve sheath tumor (MPNST), glioma, pheochromocytoma, and leukemia.

NF1-affected persons have increased sensitivity to ionizing radiation, so CT and nuclear medicine imaging are not appropriate screening or surveillance studies for these patients. CT and/or nuclear medicine studies may be indicated for acute clinical situations and should be judged on a case-by-case basis. These requests will be forwarded for Medical Director review.

Annual ophthalmology evaluation is strongly recommended beginning at the time of diagnosis of NF1 to evaluate for optic pathway abnormalities:

- Screening MRIs of the Brain (CPT® 70553) and Orbits (CPT® 70543) for asymptomatic individuals are not generally recommended due to the ~60% rate of unidentified bright objects (UBOs, T2-weighted signal abnormalities) which mostly disappear by age 30
  - A one-time MRI Brain (CPT® 70553) and Orbits (CPT® 70543) without and with contrast can be approved to clarify the diagnosis of NF1 if evaluation by a physician with significant training and/or experience in neurofibromatosis is inconclusive (most commonly a neurologist, geneticist, ophthalmologist, or oncologist)
  - MRI Brain (CPT® 70553) and Orbits (CPT® 70543) without and with contrast can be approved for any new or worsening symptoms
  - Routine follow up imaging of UBOs is not warranted in the absence of acute symptoms suggesting new or worsening intracranial disease
  - Children with negative brain and orbital screening at age 15 months generally do not develop optic pathway gliomas
- Patients with NF1 and documented optic pathway gliomas should be imaged according to **PEDONC-4.2: Intracranial Low Grade Gliomas**.

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NF1 patients are at increased risk for plexiform neurofibromas (PN) and malignant peripheral nerve sheath tumors (MPNST— a high grade sarcoma).

- Screening imaging of asymptomatic patients for these tumors is not supported by evidence. PET imaging is not supported for PN surveillance in asymptomatic patients at this time as the positive predictive value is only 60 to 65% even in symptomatic patients.
- MRI imaging without and with contrast is appropriate for any clinical symptoms suggestive of change in a known PN in a patient with NF1 (examples include pain, rapid growth, and neurologic dysfunction).
- Although PET imaging has a positive predictive value of only 61 to 63% in NF1 patients with suspected transformation to MPNST, the negative predictive value is high (96 to 99%)
  - PET imaging is indicated for evaluating NF1 patients with clinical symptoms concerning for malignant transformation of a known PN when all of the following conditions exist:
    - Recent MRI is inconclusive regarding transformation or progression
    - Negative PET will result in a decision to avoid biopsy in a difficult or morbid location
  - Inconclusive PET findings should lead to biopsy of the concerning lesion
    - Repeat PET studies are not indicated due to the poor positive predictive value in this setting
- Patients with NF1 and known plexiform neurofibromas should be imaged according guidelines in **PEDPN-2.1: Neurofibromatosis 1**.
- Patients with NF1 and new soft tissue masses should be imaged according to **ONC-12: Sarcoma** or **PEDONC-8.3: Non-Rhabdomyosarcoma Soft Tissue Sarcomas**, depending on the patient's age at the time the mass is discovered.
- Patients with NF1 and new bone masses should be imaged according to **PEDONC-9: Bone Tumors**.

NF2:

NF2 is substantially less common than NF1. It is inherited in an autosomal dominant manner (50% risk to offspring) affecting ~1 in 25000 people. NF2 is associated with increased risk for meningiomas (50% of affected individuals), vestibular schwannomas, and spinal tumors (75% of affected individuals).

- Patients with NF2 and known vestibular schwannomas should be imaged according to guidelines in **PEDPN-2.2: Neurofibromatosis 2**.
- Patients with NF2 and known meningioma should be imaged according to guidelines in **ONC-2.8: Meningiomas**.
- Patients with NF2 and known ependymoma should be imaged according to guidelines in **PEDONC-4: Ependymoma**.

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Recommended cancer screening imaging includes:

- Annual MRI Brain without and with contrast (CPT® 70553) beginning at age 10 years
- MRI spine without and with contrast (Cervical-CPT® 72156, Thoracic-CPT® 72157, Lumbar-CPT® 72158) can be approved every 3 years beginning at age 10 years for patients without spinal tumors
  - Annual MRI spine can be approved for all patients with NF2 and a history of spinal tumors

Additional appropriate imaging requests include:

- MRI Brain without and with contrast (CPT® 70553) should be approved for any patient with NF2 and clinical symptoms of intracranial mass or vestibular disease
- MRI spine without and with contrast (Cervical-CPT® 72156, Thoracic-CPT® 72157, Lumbar-CPT® 72158) should be approved for any patient with NF2 and:
  - Clinical symptoms suggestive of new or progressive spinal or paraspinal tumors, including uncomplicated back pain or radiculopathy
  - Recent diagnosis with a meningioma or vestibular schwannoma

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PEDONC-2.4: Beckwith-Wiedemann Syndrome (BWS)

Inherited syndrome characterized by macroglossia, hemihypertrophy, macrosomia, organomegaly, and neonatal hypoglycemia. Patients with isolated hemihypertrophy are also imaged according to this guideline.

Caused by mutation at chromosome 11p15, affected children are predisposed to Wilms tumor, hepatoblastoma, rhabdomyosarcoma, and adrenal tumors.

Recommended cancer screening imaging includes:

- Abdominal ultrasound (CPT® 76700) every 3 months from birth to the 8th birthday
  - Patients found to have adrenal masses on screening ultrasound should receive additional imaging as follows:
    - Purely cystic mass:
      - Continue screening ultrasound every 3 months without additional imaging
    - Solid or mixed mass in patients age 0 to 5 months:
      - If mass 0 to 3 cm in diameter→MIBG imaging and either CT or MRI Abdomen (contrast as requested)
        - If no evidence of malignancy based on MIBG, CT or MRI, Urine HVA/VMA, and serum ACTH, then repeat abdominal ultrasound every 6 weeks for 2 years
      - If mass > 3 cm in diameter→MIBG imaging and MRI Abdomen (contrast as requested)
    - Solid or mixed mass in patients age 6 months or greater:
      - MIBG imaging prior to biopsy or resection
      - If no evidence of malignancy on biopsy or resection, resume screening abdominal ultrasound every 3 months
- Patients with BWS and known renal tumors should be imaged according to guidelines in **PEDONC-7: Pediatric Renal Tumors**.
- Patients with BWS and known hepatoblastoma should be imaged according to guidelines in **PEDONC-11.2: Hepatoblastoma**.
- Patients with BWS and known neuroblastoma should be imaged according to guidelines in **PEDONC-6: Neuroblastoma**.
- Patients with BWS and known adrenocortical carcinoma should be imaged according to guidelines in **PEDONC-14: Pediatric Adrenocortical Carcinoma**.
- Patients with BWS and known pheochromocytoma should be imaged according to guidelines in **ONC-15: Neuroendocrine Cancers and Adrenal Tumors**.

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PEDONC-2.5: Denys-Drash Syndrome (DDS)

Characterized by pseudohermaphroditism, early renal failure, and > 90% risk of Wilms tumor development in each kidney. Associated with mutations at 11p13, risk of renal failure after detection of symptomatic Wilms tumor is 62%, so early detection may allow for renal-sparing surgical approaches.

Recommended cancer screening imaging includes:

- Abdominal ultrasound (CPT® 76700) every 3 months from birth to the 8th birthday
- Patients with DDS and known renal tumors should be imaged according to guidelines in **PEDONC-7: Pediatric Renal Tumors**.

End of PEDONC-2.5

PEDONC-2.6: Wilms Tumor-Aniridia-Growth Retardation (WAGR)

Named for the components of the disorder, it is associated with mutations at 11p13. As the name suggests, patients are predisposed to Wilms tumor, with 57% of patients in one cohort developing Wilms tumor. Risk of renal failure after detection of symptomatic Wilms tumor is 38%, so early detection may allow for renal-sparing surgical approaches

Recommended cancer screening imaging includes:

- Abdominal US (CPT® 76700) every 3 months from birth to the 8th birthday
- Patients with WAGR and known renal tumors should be imaged according to guidelines in **PEDONC-7: Pediatric Renal Tumors**.

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PEDONC-2.7: Familial Adenomatous Polyposis (FAP) and Related Conditions

Inherited in an autosomal dominant manner (50% risk to offspring), it is also known as Adenomatous Polyposis Coli (APC). It is associated with the development of thousands of colonic polyps by age 20 and > 90% risk of colorectal carcinoma. Prophylactic total colectomy is recommended by age 20 for most patients. FAP is also associated with hepatoblastoma, tumors of the pancreas and small bowel, medulloblastoma, and thyroid cancer.

Patients with Lynch, Gardner, and Turcot syndromes should also be imaged according to these guidelines.

Recommended cancer screening imaging includes:

- Abdominal US (CPT® 76700) every 3 months from birth to the 6th birthday
  - Annual Abdominal US for life after age 6 with family history of desmoid tumors
- Serum AFP every 3 months to the 6th birthday
- Annual colonoscopy beginning at age 10
- Annual esophagogastroduodenoscopy beginning at age 10
- Annual thyroid ultrasound (CPT® 76536) beginning at age 12
- Annual pelvic ultrasound (CPT® 76856) beginning at age 30
- Patients with FAP and known colorectal tumors should be imaged according to guidelines in **ONC-16: Colorectal Cancer.**
- Patients with FAP and known desmoid tumors should be imaged according to guidelines in **PEDONC-8.3: Non-Rhabdomyosarcoma Soft Tissue Sarcomas (NRSTS).**

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PEDONC-2.8: Multiple Endocrine Neoplasias (MEN)

Inherited in an autosomal dominant manner (50% risk to offspring)

MEN1 is characterized by parathyroid, pancreatic islet cell, and pituitary gland tumors (3 P's), as well as carcinoid tumors in the chest and abdomen, and 28% of patients will develop at least one tumor by age 15.

MEN2a is characterized by medullary thyroid carcinoma, parathyroid adenomas, and pheochromocytomas.

MEN2b is characterized by ganglioneuromas of the GI tract and skeletal abnormalities presenting in infancy.

Recommended cancer screening imaging includes:

- MEN1
  - Annual MRI Brain without and with contrast (CPT® 70553) can be approved beginning at age 5
  - Annual MRI Abdomen without and with contrast (CPT® 74183), CT Abdomen with contrast (CPT® 74160), or ultrasound (CPT® 76700) can be approved beginning at age 5
  - Annual MRI Chest without and with contrast (CPT® 71552) or CT Chest with contrast (CPT® 71260) can be approved beginning at age 15
  - Annual Octreotide study (CPT® 78800, CPT® 78801, CPT® 78802, CPT® 78803, or CPT® 78804) can be approved beginning at age 5
- Patients with MEN1 and known thyroid cancer should be imaged according to guidelines in **ONC-6: Thyroid Cancer**
- Patients with MEN1 and known pheochromocytoma should be imaged according to guidelines in **ONC-15: Neuroendocrine Cancers and Adrenal Tumors**
- MEN2a and MEN2b
  - Annual measurement of catecholamines for pheochromocytoma screening
  - MRI Abdomen without and with contrast (CPT® 74183) can be approved every 3 years beginning at age 5
  - Octreotide study (CPT® 78800, CPT® 78801, CPT® 78802, CPT® 78803, or CPT® 78804) or Adrenal Nuclear Imaging (CPT® 78075) can be approved for elevated catecholamines or inconclusive adrenal mass on MRI
- Patients with MEN2a or MEN2b and known pheochromocytoma should be imaged according to guidelines in **ONC-15: Neuroendocrine Cancers and Adrenal Tumors**

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PEDONC-2.9: Tuberous Sclerosis Complex (TSC)

Inherited in an autosomal dominant manner (50% risk to offspring), affecting ~1 in 6000 individuals, it is associated with benign tumors, hypopigmented skin macules (ash leaf spots), pulmonary lymphangioleiomyomatosis, developmental delay, and epilepsy.

Malignancies associated with this syndrome include:

- Subependymal giant cell astrocytomas (SEGA tumors)
  - Historically, early surgery was important to reduce morbidity related to these tumors
  - More recently, everolimus has been successfully used to treat these tumors without surgery, and early detection remains an important feature for success
- Renal cell carcinoma
- Cardiac rhabdomyosarcoma
- Pulmonary lymphangioleiomyomatosis

Recommended cancer screening imaging includes:

- Annual ophthalmologic and dermatologic evaluation
- Annual Brain MRI without and with contrast (CPT® 70553) beginning at age 3 until age 25
- Annual Renal US (CPT® 76770) beginning at age 3
  - Annual MRI Abdomen without and with contrast (CPT® 74183) can be substituted for Renal US in patients with documented renal lesions
- Annual Echocardiography
- CT Chest without contrast (CPT® 71250) every 5 years beginning at age 18 years
  - Additional CTs may be approved every 1 year for patients with documented abnormalities
  - CT Chest without contrast should be approved for evaluation of any new pulmonary symptoms or worsening pulmonary function testing
- Patients with TSC and known SEGA tumors should be imaged according to **PEDONC-4.2: Intracranial Low Grade Gliomas (LGG)**
- Patients with TSC and known renal cell carcinoma should be imaged according to **PEDONC-7.4: Pediatric Renal Cell Carcinoma (RCC)**

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PEDONC-2.10: Von Hippel-Lindau Syndrome (VHL)

Inherited in an autosomal dominant manner (50% risk to offspring), it is associated with CNS hemangioblastomas, retinal angiomas, endolymphatic sac tumors (ELST), gastrointestinal stromal tumor (GIST), renal cell carcinoma (RCC), and pheochromocytomas and other neuroendocrine tumors (NETs). Pediatric patients are at risk of developing hemangioblastomas and pheochromocytomas that can remain clinically occult until symptoms become severe. Historically, substantial mortality was attributable to RCC, pancreatic NET, and CNS hemangioblastoma.

Recommended cancer screening imaging includes:

- Annual ophthalmologic evaluation beginning at birth
- Annual measurement of catecholamines beginning at age 2
  - Octreotide study (CPT® 78800, CPT® 78801, CPT® 78802, CPT® 78803, or CPT® 78804) or Adrenal Nuclear imaging (CPT® 78075) can be approved for elevated catecholamines or inconclusive adrenal mass on MRI
- Audiology assessment every 2 years beginning at age 5
  - If frequent ear infections are present, MRI Brain without and with contrast (CPT® 70553) with attention to internal auditory canals can be approved
- MRI Brain without and with contrast (CPT® 70553) every 2 years beginning at age 8
  - Patients with known hemangioblastoma that has not been resected can have MRI Brain every 1 year or for any new or worsening symptoms
- MRI Spine without and with contrast (Cervical-CPT® 72156), Thoracic-CPT® 72157, and Lumbar-CPT® 72158) every 2 years beginning at age 8
    - Patients with known hemangioblastoma that has not been resected can have MRI Spine every 1 year or for any new or worsening symptoms
- Annual Abdominal US (CPT® 76700) beginning at age 5
- MRI Abdomen without and with contrast (CPT® 74183) every 2 years beginning at age 10
- Patients with VHL and known CNS Hemangioblastoma should be imaged according to **PEDONC-4.2: Intracranial Low Grade Gliomas (LGG)**
- Patients with VHL and known renal cell carcinoma should be imaged according to **PEDONC-7.4: Pediatric Renal Cell Carcinoma (RCC)**
- Patients with VHL and known pheochromocytoma or other neuroendocrine tumors should be imaged according to guidelines in **ONC-15: Neuroendocrine Cancers And Adrenal Tumors**

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PEDONC-2.11: Rhabdoid Tumor Predisposition Syndrome

Inherited in an autosomal dominant manner (50% risk to offspring), it is associated with malignant rhabdoid tumors of the kidney and extrarenal locations, and atypical teratoid/rhabdoid tumors (ATRT) of the CNS. It is caused by a germline mutation in *INI1* or *SMARCB1*, and is associated with a more variable prognosis than de novo rhabdoid tumors.

- Targeted advanced imaging should be approved for any patient with this syndrome and any clinical symptoms to suggest malignancy
- Ultrasound of the head (CPT® 76506), abdomen (CPT® 76700), and pelvis (CPT® 76856) monthly from birth to 12 months of age
- MRI can be approved for clarification of inconclusive findings on ultrasound, and should be used in place of ultrasound for remainder of planned screening
- MRI Brain (CPT® 70553) and Spine (CPT® 72156, 72157, & 72158) without and with contrast every 3 months from age 1 to 5 years
- MRI (CPT® 74183 & 72197) or Ultrasound Abdomen and Pelvis (CPT® 76700 & 76856) every 3 months from age 1 to 5 years
  - Whole-body MRI resolution may not be sufficient to detect small rhabdoid tumors, so is not recommended in lieu of conventional MRI studies

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PEDONC-2.12: Familial Retinoblastoma Syndrome

This syndrome is inherited in an autosomal dominant manner (50% risk to offspring). As the name suggests, it is associated with retinoblastoma, as well as osteosarcoma, pediatric melanoma, and a significantly increased risk for radiation-related malignancies.

Regular physical and ophthalmologic evaluations under anesthesia (EUA) are the hallmark of surveillance strategies for these patients, and asymptomatic screening imaging does not have a defined role at this time.

- Patients with retinomas (premalignant retinal lesions) can have annual MRI Orbits (CPT® 70543)

When advanced imaging is necessary for evaluation of inconclusive EUA findings or new symptoms, ultrasound or MRI should be used if at all possible in lieu of CT or nuclear imaging if at all possible to avoid radiation exposure in these patients

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PEDONC-2.13: Hereditary Paraganglioma-Pheochromocytoma (HPP) Syndromes

Caused by mutations in *SDHx* genes, this syndrome is inherited in an autosomal dominant manner (50% risk to offspring), and is associated with pheochromocytomas and paragangliomas.

Patients with multiple endocrine neoplasias should not use this guideline and should be imaged according to **PEDONC-2.8: Multiple Endocrine Neoplasias (MEN)**.

Cancer screening should begin at age 6. The following recommended imaging can be approved:

- All patients with *SDHx* mutations:
  - Annual measurement of catecholamines
  - One of the following every 2 years:
    - Whole body MRI (CPT® 76498)
    - MRI Neck (CPT® 70543), Chest (CPT® 71552), Abdomen (CPT® 74183), Pelvis (CPT® 72197) without and with contrast
    - CT Neck (CPT® 70491), Chest (CPT® 71260), and Abdomen/Pelvis (CPT® 74177) with contrast
    - MRI is preferred to CT to minimize radiation exposure given these patients' lifelong need for screening
- Patients with HPP and known pheochromocytoma or other neuroendocrine tumors should be imaged according to guidelines in **ONC-15: Neuroendocrine Cancers and Adrenal Tumors**

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PEDONC-2.14: Costello Syndrome

Caused by mutations in *HRAS* genes, this syndrome is inherited in an autosomal dominant manner (50% risk to offspring), and is associated with rhabdomyosarcoma and neuroblastoma in early childhood, and transitional cell cancer of the bladder in older children and adults.

Recommended Screening Imaging Includes:

- Following initial diagnosis, any or all of the following are indicated:
  - Echocardiogram (CPT® 93306)
  - MRI Brain (CPT® 70553) without and with contrast
  - MRI Cervical (CPT® 72156) and Thoracic Spine (CPT® 72157) without and with contrast
- Ultrasound of the Abdomen (CPT® 76700) and Pelvis (CPT® 76856) every 3 months from birth to 10th birthday
- Echocardiogram (CPT® 93306) as requested for patients with Costello syndrome and known cardiac disease
- Patients with Costello syndrome and known rhabdomyosarcoma should be imaged according to guidelines in **PEDONC-8.2: Rhabdomyosarcoma (RMS)**
- Patients with Costello syndrome and known neuroblastoma should be imaged according to guidelines in **PEDONC-6: Neuroblastoma**

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PEDONC-2.15: Constitutional Mismatch Repair Deficiency (CMMRD or Turcot Syndrome)

A highly penetrant and aggressive cancer predisposing syndrome resulting from autosomal recessive inheritance of biallelic mutations in mismatch repair genes, CMMRD syndrome leads to substantial risk for several commonly fatal childhood malignancies - high-grade CNS tumors (glioma, PNET, medulloblastoma) and hematologic malignancies (non-Hodgkin lymphoma, acute lymphoblastic leukemia). CMMRD patients are also at increased risk for gastrointestinal tumors.

Recommended Screening Imaging Includes:

- MRI Brain without and with contrast (CPT® 70553) every 6 months after CMMRD diagnosis is confirmed
- Annual whole body MRI (CPT® 76498) beginning at age 6 years
- Annual esophagogastroduodenoscopy and colonoscopy beginning at age 4 years

End of PEDONC-2.15

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PEDONC-3: Pediatric Leukemias

PEDONC-3.1: Pediatric Leukemia General Considerations
PEDONC-3.2: Acute Lymphoblastic Leukemia (ALL)
PEDONC-3.3: Acute Myeloid Leukemia (AML)

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PEDONC-3.1: Pediatric Leukemia General Considerations

The overwhelming majority of leukemias occurring in children are acute. Chronic myelogenous leukemia (CML) is rare in children, and the occurrence of chronic lymphocytic leukemia (CLL) appears to have only been reported once in pediatric patients to date.

- MRI Brain without and with contrast (CPT® 70553) can be performed in patients exhibiting CNS symptoms and in patients found to have high tumor burden on CSF cytology.
- There is not sufficient evidence to support the use of PET imaging for any indication in the management of acute lymphoblastic leukemia, acute myeloid leukemia, or chronic myeloid leukemia.
- Routine advanced imaging is not indicated in the evaluation and management of chronic myeloid leukemia in the absence of specific localizing clinical symptoms or clearance for hematopoietic stem cell transplantation. See **ONC-29: Hematopoietic Stem Cell Transplantation** for imaging guidelines related to transplant.

End of PEDONC-3.1

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PEDONC-3.2: Acute Lymphoblastic Leukemia (ALL)

- The majority of ALL patients have B-precursor ALL and routine advanced imaging is not necessary.
- Patients with B-precursor or T-cell lymphoblastic lymphoma without bone marrow involvement are treated similarly to leukemia patients of the same cell type and should be imaged according to this guideline section.
- This section does not apply to patients with mature B-cell histology (primarily Burkitt's in children). Please refer to **PEDONC-5.3: Pediatric Aggressive Mature B-Cell Non-Hodgkin Lymphomas (NHL)** for guidelines for these patients.
- CXR should be performed to evaluate for mediastinal mass in suspected cases or upon initial diagnosis.
  - If mediastinal widening is seen on CXR, CT Chest with contrast (CPT® 71260) is indicated immediately to evaluate for airway compression and anesthesia safety prior to attempting histologic diagnosis.
  - Patients with known or strongly suspected T-cell histology or other suspected lymphoblastic lymphoma involvement can have either of the following approved for initial staging purposes:
    - CT Neck (CPT® 70491), CT Chest (CPT® 71260) and CT Abdomen/Pelvis (CPT® 74177) with contrast OR
    - PET/CT (CPT® 78815 or 78816)
- MRI Brain without and with contrast (CPT® 70553) can be performed in patients exhibiting CNS symptoms and in patients found to have high tumor burden on CSF cytology.

Additional imaging in lymphoblastic lymphoma:

- Follow up CT to assess response to therapy is indicated only for patients with known bulky nodal disease (usually with T-cell histology) at the end of induction (~4 to 6 weeks). Patients with residual masses can be evaluated with every new therapy phase (Consolidation, Interim maintenance, etc., generally every 8 to 12 weeks) until disease resolution is seen.
  - PET/CT (CPT® 78815) can be approved when residual mass ≥ 8 mm in diameter is present on recent CT imaging and there is documentation of how PET findings will affect immediate treatment decision making. These requests should be forwarded for Medical Director review.
- Once CT imaging shows no evidence of disease, further surveillance should use CXR or Abdominal Ultrasound (CPT® 76700) only, as indicated by site(s) of bulky disease present at diagnosis.
  - Patients with persistent residual masses can have CT of all involved bulky nodal areas performed as part of an end of therapy evaluation

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Immunosuppression during ALL therapy and imaging ramifications:

- ALL patients are severely immunocompromised during the first 4 to 6 weeks of treatment (induction) and any conventional imaging request to evaluate for infectious complications during this time frame should be approved immediately.
- CT or MRI imaging requests for infectious disease concerns for ALL patients with absolute neutrophil count (ANC) < 500 or inconclusive findings on chest x-ray or US at any ANC during active treatment should be approved as requested.
- Additionally, patients may have therapy-induced hypogammaglobulinemia which requires supplemental intravenous immune globulin (IVIG) during maintenance therapy. Patients receiving supplemental IVIG should be treated similarly to patients with ANC < 500 with regards to imaging for infectious disease.

Imaging during therapy for relapsed ALL:

- Relapsed ALL patients are treated with very intensive chemotherapy regimens and most patients spend the majority of their chemotherapy treatment phase in the hospital. Due to the high risk of invasive infections, frequent CT or MRI imaging may be indicated to evaluate known or suspected new sites of invasive fungal or other aggressive infections, and in general these should be approved as requested.
  - Surveillance imaging of asymptomatic patients to detect invasive fungal infection has not been shown to impact patient outcomes. Imaging requests in these circumstances should only be approved when acute clinical decisions will be made based on the imaging.

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Imaging of known or suspected osteonecrosis in ALL:

- Osteonecrosis (ON) in ALL patients is a relatively common complication of ALL and its treatment, primary corticosteroids. Approximately 3% of younger children and 12 to 15% of adolescents are affected by ON at some point during therapy. The peak incidence occurs approximately one year from the time of diagnosis.
  - For patients with symptoms suggesting osteonecrosis, MRI without contrast or without and with contrast of the affected joint(s) can be approved.
    - CT without contrast can be approved when MRI is contraindicated or unavailable, or for diagnosis of suspected subchondral fracture
  - Screening MRI of asymptomatic patients age ≤ 10 years to detect osteonecrosis has not been shown to impact patient outcomes, and it is not standard to alter treatment based on imaging findings alone without symptoms
    - A single screening MRI Bilateral Hips (CPT® 73721 or CPT® 73723 with modifier -50) can be approved 6 to 9 months after diagnosis for patients age ≥11 years
  - If osteonecrosis is detected on initial MRI, corticosteroids are often withheld during maintenance chemotherapy (but continued in earlier phases of therapy).
  - In patients whose symptoms have resolved and are still receiving active treatment, repeat MRI without contrast of the affected joint(s) can be approved every 2 cycles of maintenance (~every 6 months) if reintroduction of corticosteroids is being considered.
  - MRI without contrast of the affected joint(s) can be approved if requested for preoperative planning in patients undergoing core decompression
  - See **PEDONC-19.4: Osteonecrosis In Long Term Cancer Survivors** for information on osteonecrosis in ALL patients who have completed therapy

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PEDONC-3.3: Acute Myeloid Leukemia (AML)

The majority of AML patients do not have any bulky disease and routine advanced imaging is not necessary.

Advanced imaging may be indicated for rare patients with bulky tumor masses (commonly referred to as chloromas, leukemic sarcomas, or myeloid sarcomas) noted on physical examination or other imaging such as plain film or ultrasound.

- AML patients are treated with very intensive chemotherapy regimens and spend the majority of their chemotherapy treatment phase in the hospital. Due to the high risk of invasive infections, frequent CT or MRI imaging may be indicated to evaluate known sites of invasive fungal infection, and in general these should be approved as requested.
  - Surveillance imaging of asymptomatic patients to detect invasive fungal infection has not been shown to impact patient outcomes. Imaging requests in these circumstances should only be approved when acute clinical decisions will be made based on the imaging.

End of PEDONC-3.3

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PEDONC-4: Pediatric CNS Tumors
PEDONC-4.1: Pediatric CNS Tumors General Considerations
PEDONC-4.2: Intracranial Low Grade Gliomas (LGG)
PEDONC-4.3: High Grade Gliomas (HGG)
PEDONC-4.4: Medulloblastoma (MDB), Supratentorial Primitive Neuroectodermal Tumors (sPNET), and Pineoblastoma
PEDONC-4.5: Atypical Teratoid/Rhabdoid Tumors (ATRT)
PEDONC-4.6: Pineocytomas
PEDONC-4.7: CNS Germinomas and Non-Germinomatous Germ Cell Tumors (NGGCT)
PEDONC-4.8: Ependymoma
PEDONC-4.9: Malignant Tumors of the Spinal Cord
PEDONC-4.10: Craniopharyngioma and Other Hypothalamic/Pituitary Region Tumors
PEDONC-4.11: Primary CNS Lymphoma
PEDONC-4.12: Meningiomas
PEDONC-4.13: Choroid Plexus Tumors

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PEDONC-4.1: Pediatric CNS Tumors General Considerations

Central nervous system tumors are the second most common form of childhood cancer, accounting for ~20% of all pediatric malignancies.

Red flag symptoms raising suspicion for CNS tumors include:
Any headache complaint from a child age ≤ 5 years
Headaches awakening from sleep
Focal findings on neurologic exam
Clumsiness (common description of gait or coordination problems in young children)
Headaches associated with morning nausea/vomiting
New onset of seizure activity with focal features
Papilledema on physical exam

- MRI is the preferred imaging modality for all pediatric CNS tumors. The primary imaging study for pediatric brain tumors is MRI Brain without and with contrast (CPT® 70553).
  - For children able to undergo MRI without sedation, MRI Brain without contrast (CPT® 70551) can be approved if requested for initial evaluation of suspected CNS tumor.
  - Younger patients requiring sedation for MRI should have their initial MRI performed without and with contrast in order to avoid a second anesthesia exposure.
- CT can be approved for evaluation of ventriculomegaly or other operative considerations, or for children who cannot undergo MRI safely.
  - Because of the significant percentage of pediatric CNS tumors occurring in the posterior fossa, CT is not a recommended study for evaluation of pediatric headache when brain tumor is clinically suspected because of its limited diagnostic accuracy in this area. MRI should be used as first line imaging in these cases.
  - CT should not be used in place of MRI to avoid sedation in young children when red flag symptoms for CNS tumors are present
  - CT can also be approved for evaluation of headaches related to head trauma or evaluation of skull or facial bone abnormalities
- MRA or CTA are not routinely indicated in pediatric CNS tumors but can be approved for preoperative planning or to clarify inconclusive findings on MRI or CT.
- Definitive imaging should be completed prior to considering biopsy given the high degree of morbidity associated with operating on the CNS
  - Occasionally biopsy is not necessary because the imaging findings provide a definitive diagnosis. Examples include diffuse intrinsic pontine glioma and optic pathway gliomas in a patient with known neurofibromatosis.

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- Perioperative imaging frequency
  - Children may undergo very frequent imaging in the immediate perioperative period around resection or debulking of a CNS tumor due to the small anatomic spaces involved. Requests for imaging during this time period to specifically evaluate postoperative course or ventriculoperitoneal shunt functioning should, in general, be approved as requested.
  - A one-time MRI Brain without and with contrast (CPT® 70553) can be approved in the immediate preoperative period (even if another study has already been completed) to gain additional information which can be important in optimizing patient outcomes, such as:
    - Completion of additional specialized MRI sequences such as diffusion-tensor imaging, perfusion imaging, tractography, or other sequences not reported under a separate CPT® code but not part of a routine MRI Brain series
  - Repeat MRI Brain that is being requested solely for loading into operative navigation software should not be requested as a diagnostic code, but can be approved under a treatment planning code (CPT® 76498). These requests should be forwarded for Medical Director review.

MR Spectroscopy (MRS, CPT® 76390):

Note: *Some payors have specific restrictions on MR Spectroscopy, and those coverage policies may supersede the recommendations for MRS in these guidelines.*

- MRS is only supported for use in brain tumors of specified histologies where diagnostic accuracy has been established in peer-reviewed literature
  - See diagnosis-specific guidelines for MRS indications
- MRS is considered investigational/experimental for all other histologies and indications not listed in a diagnosis-specific guideline section
- MR spectroscopy is not indicated for routine surveillance
- Requests for MRS should be forwarded for Medical Director review

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PET Brain Imaging (CPT® 78608 and CPT® 78609):

Note: *Some payors have specific restrictions on PET Brain Metabolic imaging, and those coverage policies may supersede the recommendations for this study in these guidelines.*

- PET Brain Metabolic imaging (CPT® 78608) is only supported for use in brain tumors of specified histologies where diagnostic accuracy has been established in peer-reviewed literature
  - See diagnosis-specific guidelines for PET indications
- PET Brain Metabolic imaging is considered investigational/experimental for all other histologies and indications not listed in a diagnosis-specific guideline section
- PET Brain Perfusion imaging (CPT® 78609) is not indicated in the evaluation or management of primary CNS tumors
- Fusion PET/CT studies (CPT® 78814, CPT® 78815, or CPT® 78816) are not indicated in the evaluation or management of primary CNS tumors
- PET Brain Metabolic is not indicated for routine surveillance
- Requests for PET Brain Metabolic should be forwarded for Medical Director review

End of PEDONC-4.1

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PEDONC-4.2: Intracranial Low Grade Gliomas (LGG)

Account for 40 to 60% of pediatric CNS tumors. These tumors are defined as having a WHO histologic grade of I or II (out of IV), can occur anywhere in the CNS, and includes the following tumors:

- Pilocytic Astrocytoma
- Fibrillary (or Diffuse) Astrocytoma
- Optic Pathway Gliomas
- Pilomyxoid Astrocytoma
- Oligodendroglioma
- Oligoastrocytoma
- Oligodendrocytoma
- Subependymal Giant Cell Astrocytoma (SEGA)
- Ganglioglioma
- Gangliocytoma
- Dysembryoplastic Infantile Astrocytoma (DIA)
- Dysembryoplastic Infantile Ganglioglioma (DIG)
- Dysembryoplastic Neuroepithelial Tumor (DNT)
- Tectal Plate Gliomas
- Cervicomedullary Gliomas
- Pleomorphic Xanthoastrocytoma (PXA)
- Any other glial tumor with a WHO grade of I or II

- PET Brain Metabolic imaging (CPT® 78608) can be approved in the following circumstances:
  - To determine need for biopsy when transformation to high grade glioma is suspected based on clinical symptoms or recent MRI findings
  - To evaluate a brain lesion of indeterminate nature when the PET findings will be used to determine whether biopsy/resection can be safely postponed
- MR spectroscopy (MRS, CPT® 76390) can be approved in the following circumstances:
  - To distinguish low grade from high grade gliomas
  - To evaluate a brain lesion of indeterminate nature when the MRS findings will be used to determine whether biopsy/resection can be safely postponed
  - To distinguish radiation-induced tumor necrosis from progressive disease within 18 months of completing radiotherapy.

Note: *Some payors have specific restrictions on PET Brain Metabolic imaging and/or MR Spectroscopy, and those coverage policies may supersede the recommendations for PET Brain or MRS in these guidelines*

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Low Grade Gliomas Initial Staging:

- MRI Brain without and with contrast (CPT® 70553) is indicated for all LGG
- MRI Spine without and with contrast (Cervical-CPT® 72156, Thoracic-CPT® 72157, Lumbar-CPT® 72158) can be approved for all LGG patients if requested, and spinal imaging is particularly recommended for patients with:
  - Multicentric tumors
  - Intracranial leptomeningeal disease
  - Clinical signs or symptoms suggesting spinal cord involvement
  - MRI Spine with contrast only (Cervical-CPT® 72142, Thoracic-CPT® 72147, Lumbar-CPT® 72149) can be approved if being performed immediately following a contrast-enhanced MRI Brain.
- Patients with neurofibromatosis and small optic pathway tumors may not undergo biopsy or resection and will proceed directly to treatment or surveillance.

Low Grade Gliomas Treatment Response:

- Children who have resection of the tumor can have a single MRI Brain without and with contrast (CPT® 70553) approved following resection to establish baseline imaging and those with a complete resection should then be imaged according to surveillance guidelines
- Children with neurofibromatosis and small optic pathway gliomas may be observed without specific treatment and should be imaged according to surveillance guidelines for LGG.
- Patients age > 10 years with incompletely resected tumors usually receive adjuvant radiation therapy and can have a single MRI Brain without and with contrast (CPT® 70553) approved at completion of radiotherapy and should then be imaged according to surveillance guidelines
- Patients age ≤ 10 years with incompletely resected tumors are commonly treated with chemotherapy and can have MRI Brain without and with contrast (CPT® 70553) approved every 2 cycles during active treatment and at the end of planned chemotherapy
- Spinal imaging is not indicated during treatment response for patients without evidence of spinal cord involvement at initial diagnosis
- Spinal imaging is appropriate every 2 cycles during induction chemotherapy for patients with measurable spinal cord disease on MRI

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Low Grade Gliomas Surveillance:

- MRI Brain without and with contrast (CPT® 70553) can be approved after completion of therapy every 3 months for 2 years, then every 6 months for 3 years, then annually thereafter.
  - MRI Orbits without and with contrast (CPT® 70543) can be approved for patients with optic pathway glioma and either a history of intra-orbital involvement or a history of NF1
- MRI Spine is not indicated during surveillance in patients without prior history of spinal involvement except to evaluate symptoms suspicious for spinal cord recurrence
- For patients with cord involvement at diagnosis, MRI Spine without and with contrast (Cervical-CPT® 72156, Thoracic-CPT® 72157, Lumbar-CPT® 72158) can be approved after completion of therapy every 3 months for 2 years, then every 6 months for 3 years, then annually thereafter.
  - MRI Spine with contrast only can be approved (Cervical-CPT® 72142, Thoracic-CPT® 72147, Lumbar-CPT® 72149) if being performed immediately following a contrast-enhanced MRI Brain
- MR Spectroscopy and PET Brain Metabolic are not indicated for routine surveillance

End of PEDONC-4.2

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PEDONC-4.3: High Grade Gliomas (HGG)

Rare in children compared with the adult population, but represent 10 to 20% of pediatric CNS tumors. Prognosis is very poor, and survival significantly beyond 3 years from diagnosis is rare, even with complete surgical resection at initial diagnosis.

These tumors are defined as having a WHO histologic grade of III or IV (out of IV) can occur anywhere in the CNS (though the majority occur in the brain), and includes the following tumors:

- Anaplastic astrocytoma
- Glioblastoma multiforme
- Diffuse intrinsic pontine glioma (DIPG, or “Brainstem glioma”)
- Gliomatosis cerebri
- Gliosarcoma
- Anaplastic oligodendroglioma
- Anaplastic ganglioglioma
- Anaplastic mixed glioma
- Anaplastic mixed ganglioneuronal tumors
- Any other glial tumor with a WHO grade of III or IV

- PET Brain Metabolic Imaging (CPT® 78608) can be approved in the following circumstances:
  - To distinguish radiation-induced tumor necrosis from progressive disease within 18 months of completing radiotherapy
  - To evaluate inconclusive MRI findings when the PET findings will be used to determine need for biopsy or change in therapy, including a change from active therapy to surveillance
  - To evaluate a brain lesion of indeterminate nature when the PET findings will be used to determine whether biopsy/resection can be safely postponed
  - PET Brain is not indicated in gliomas occurring in the brain stem due to poor uptake and lack of impact on patient outcomes
- MR Spectroscopy (MRS, CPT® 76390) can be approved in the following circumstances:
  - To distinguish low grade from high grade gliomas
  - To evaluate a brain lesion of indeterminate nature when the MRS findings will be used to determine whether biopsy/resection can be safely postponed
  - To distinguish radiation-induced tumor necrosis from progressive disease within 18 months of completing radiotherapy.

Note: *Some payors have specific restrictions on MR Spectroscopy, and those coverage policies may supersede the recommendations for MRS in these guidelines*

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High Grade Gliomas Initial Staging:

- MRI Brain without and with contrast (CPT® 70553) is indicated for all HGG
- MRI Spine without and with contrast (Cervical-CPT® 72156, Thoracic-CPT® 72157, Lumbar-CPT® 72158) can be approved for all HGG patients if requested, and spinal imaging is particularly recommended for patients with:
  - Multicentric tumors
  - Intracranial leptomeningeal disease
  - Clinical signs or symptoms suggesting spinal cord involvement
  - MRI spine with contrast only (Cervical-CPT® 72142, Thoracic-CPT® 72147, Lumbar-CPT® 72149) can be approved if being performed immediately following a contrast-enhanced MRI Brain

High Grade Gliomas Treatment Response:

- Patients who have resection of the tumor can have a single MRI Brain without and with contrast (CPT® 70553) approved following resection to establish baseline imaging and those with a complete resection should then be imaged according to surveillance guidelines
- If receiving adjuvant radiotherapy after a completely resected tumor, an additional MRI Brain without and with contrast (CPT® 70553) can be approved at the end of radiotherapy
- Patients with incompletely resected tumors are commonly treated with chemotherapy and can have MRI Brain without and with contrast (CPT® 70553) approved every 2 cycles during active treatment and at the end of planned chemotherapy
- Spinal imaging is not indicated during treatment response for patients without evidence of spinal cord involvement at initial diagnosis
- Spinal imaging is appropriate every 2 cycles during induction chemotherapy for patients with measurable spinal cord disease on MRI

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High Grade Gliomas Surveillance:

- MRI Brain without and with contrast (CPT® 70553) can be approved after completion of therapy every 3 months for 3 years, then every 6 months thereafter
- MRI Spine is not indicated during surveillance in patients without prior history of spinal involvement except to evaluate symptoms suspicious for spinal cord recurrence
- For patients with cord involvement at diagnosis, MRI Spine without and with contrast (Cervical-CPT® 72156, Thoracic-CPT® 72157, Lumbar-CPT® 72158) can be approved after completion of therapy every 3 months for 3 years, then every 6 months thereafter
  - MRI Spine can be performed with contrast only (Cervical-CPT® 72142, Thoracic-CPT® 72147, Lumbar-CPT® 72149) if being performed immediately following a contrast-enhanced MRI Brain
- MR Spectroscopy and PET Brain Metabolic are not indicated for routine surveillance

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PEDONC-4.4: Medulloblastoma (MDB), Supratentorial Primitive Neuroectodermal Tumors (sPNET), and Pineoblastoma

Account for 15 to 25% of pediatric CNS tumors, prognosis is generally favorable. Leptomeningeal spread is common and can occur after initial diagnosis.

Includes the following tumors:
➢ Medulloblastoma and Pineoblastoma ➢ sPNET ◆ Medulloepithelioma ◆ Cerebral or cerebellar neuroblastoma ◆ Cerebral or cerebellar ganglioneuroblastoma ◆ Ependymoblastoma
Risk assessment is important in determining optimal treatment **High risk features include the following:**
➢ Spinal metastasis (including cytology positive only) ➢ Multifocal intracranial tumors ➢ Anaplastic histology ➢ All sPNET and pineoblastomas ➢ > 1.5 cm^2 residual tumor area on postoperative MRI and age < 3 years
Patients without any high risk features are considered "average risk"

- PET Brain Metabolic Imaging (CPT® 78608) can be approved in the following circumstances:
  - To distinguish radiation-induced tumor necrosis from progressive disease within 18 months of completing radiotherapy
  - To evaluate inconclusive MRI findings when the PET findings will be used to determine need for biopsy or change in therapy, including a change from active therapy to surveillance
  - To evaluate a Brain lesion of indeterminate nature when the PET findings will be used to determine whether biopsy/resection can be safely postponed
- MR Spectroscopy (CPT® 76390) can be approved in the following circumstances:
  - To evaluate a brain lesion of indeterminate nature when the MRS findings will be used to determine whether biopsy/resection can be safely postponed

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Medulloblastoma, sPNET, Pineoblastoma Initial Staging:

- Preoperative MRI Brain without and with contrast (CPT® 70553) is indicated for all patients
- Postoperative MRI Brain without and with contrast (CPT® 70553) is required (preferably within 48 hours of surgery) to quantify residual tumor volume
- MRI spine without and with contrast (Cervical-CPT® 72156, Thoracic-CPT® 72157, Lumbar-CPT® 72158) is required for all patients either preoperatively or within 28 days postoperatively
  - MRI Spine with contrast only (Cervical-CPT® 72142, Thoracic-CPT® 72147, Lumbar-CPT® 72149) can be approved if being performed immediately following a contrast-enhanced MRI Brain

Medulloblastoma, sPNET, Pineoblastoma Treatment Response:

Patients generally proceed to chemoradiotherapy within 31 days of surgical resection. All patients receive adjuvant chemotherapy lasting 6 to 12 months that begins ~6 weeks after completion of chemoradiotherapy.

- MRI Brain without and with contrast (CPT® 70553) and MRI spine without and with contrast (Cervical-CPT® 72156, Thoracic CPT® 72157, Lumbar-CPT® 72158) is appropriate at the start of adjuvant chemotherapy and every 2 cycles until therapy is completed
  - MRI Spine with contrast only (Cervical-CPT® 72142, Thoracic-CPT® 72147, Lumbar-CPT® 72149) can be approved if being performed immediately following a contrast-enhanced MRI Brain
  - Children age < 3 years are often treated with multiple cycles of high dose chemotherapy with autologous stem cell rescue in lieu of radiotherapy, and disease evaluations may occur prior to each cycle (every 4 to 6 weeks) if needed for response determination.
- End of treatment evaluation should include MRI Brain without and with contrast (CPT® 70553) and MRI Spine (with *or* without and with contrast)

Medulloblastoma, sPNET, Pineoblastoma Surveillance:

- MRI Brain without and with contrast (CPT® 70553) can be approved after completion of therapy every 3 months for 2 years, then every 6 months for 3 years, then annually for 10 years
- MRI Spine without and with contrast (Cervical-CPT® 72156, Thoracic-CPT® 72157, Lumbar-CPT® 72158) can be approved after completion of therapy every 3 months for 2 years, then every 6 months for 3 years, then annually for 10 years
  - MRI Spine with contrast only (Cervical-CPT® 72142, Thoracic-CPT® 72147, Lumbar-CPT® 72149) can be approved if being performed immediately following a contrast-enhanced MRI Brain
- MR Spectroscopy and PET Brain Metabolic are not indicated for routine surveillance

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PEDONC-4.5: Atypical Teratoid/Rhabdoid Tumors (ATRT)

Highly aggressive tumor occurring primarily in very young children that has a clinical presentation very similar to medulloblastoma with a much higher rate of leptomeningeal spread. Metastases can occur outside the CNS, and associated tumors can also arise in the kidneys (Malignant Rhabdoid Tumor of the Kidney, MRT). Rhabdoid malignancies occurring outside the CNS should be imaged according to **PEDONC-7.6: Malignant Rhabdoid Tumor of the Kidney (MRT) and Other Extracranial Sites**.

Overall prognosis is poor, with < 20% of patients surviving beyond 2 years from diagnosis.

Atypical Teratoid/Rhabdoid Tumor Initial Staging:

- Preoperative MRI Brain without and with contrast (CPT® 70553) is indicated for all patients
- Postoperative MRI Brain without and with contrast (CPT® 70553) is required (preferably within 48 hours of surgery) to quantify residual tumor volume
- MRI Spine without and with contrast (Cervical-CPT®72156, Thoracic-CPT® 72157, Lumbar-CPT® 72158) is required for all patients either preoperatively or within 28 days postoperatively
  - MRI Spine with contrast only (Cervical-CPT® 72142, Thoracic-CPT® 72147, Lumbar-CPT® 72149) can be approved if being performed immediately following a contrast-enhanced MRI Brain
- Renal US (CPT® 76770) is indicated to evaluate for renal masses at initial diagnosis
  - CT Abdomen/Pelvis with contrast (CPT® 74177) or MRI Abdomen and Pelvis without and with contrast (CPT® 74183 and CPT® 72197) can be approved if a renal lesion is detected on US.
  - If a renal lesion is also present, imaging guidelines for MRT should be followed (See: **PEDONC-7.6: Malignant Rhabdoid Tumor of the Kidney (MRT) and Other Extracranial Sites**)
- PET Brain Metabolic does not have a defined role in the evaluation of ATRT at this time
- MR Spectroscopy (CPT® 76390) can be approved in the following circumstances:
  - To evaluate a brain lesion of indeterminate nature when the MRS findings will be used to determine whether biopsy/resection can be safely postponed

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Atypical Teratoid/Rhabdoid Tumor Treatment Response:

Patients generally proceed to induction chemotherapy shortly following surgical resection or biopsy.

- MRI Brain without and with contrast (CPT® 70553) and MRI Spine without and with contrast (Cervical-CPT® 72156, Thoracic-CPT® 72157, Lumbar-CPT® 72158) is appropriate after every 2 cycles of induction chemotherapy
  - MRI spine with contrast only (Cervical-CPT® 72142, Thoracic-CPT® 72147, Lumbar-CPT® 72149) can be approved if being performed immediately following a contrast-enhanced MRI Brain
  - Children with ATRT are often treated using consolidation chemotherapy with 2 to 4 cycles of high dose chemotherapy with autologous stem cell rescue. Disease evaluation is indicated following the end of the planned stem cell rescues but may occur prior to each cycle (every 4 to 6 weeks) if needed for response determination.
- Following completion of chemotherapy some patients will proceed to radiotherapy. MRI performed at the end of consolidation therapy should serve as the diagnostic MRI prior to radiotherapy.
- MRI Brain without and with contrast (CPT® 70553) and MRI Spine without and with contrast (Cervical-CPT® 72156, Thoracic-CPT® 72157, Lumbar-CPT® 72158) is appropriate at the end of all planned therapy
  - MRI Spine with contrast only (Cervical-CPT® 72142, Thoracic-CPT® 72147, Lumbar-CPT® 72149) can be approved if being performed immediately following a contrast-enhanced MRI Brain.

Atypical Teratoid/Rhabdoid Tumor Surveillance:

- MRI Brain without and with contrast (CPT® 70553) can be approved after completion of therapy every 3 months for 2 years, then every 6 months for 3 years, then annually for 10 years
- MRI Spine without and with contrast (Cervical-CPT® 72156, Thoracic-CPT® 72157, Lumbar-CPT® 72158) can be approved after completion of therapy every 3 months for 2 years, then every 6 months for 3 years, then annually for 10 years
  - MRI Spine with contrast only (Cervical-CPT® 72142, Thoracic-CPT® 72147, Lumbar-CPT® 72149) can be approved if being performed immediately following a contrast-enhanced MRI Brain.
- MR Spectroscopy is not indicated for routine surveillance

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PEDONC-4.6: Pineocytomas

Low grade malignancy that is similar in presentation to low grade glioma (LGG).

PET Brain Metabolic imaging and MR Spectroscopy do not have a defined role in the evaluation of pineocytoma.

Pineocytomas Initial Staging:

- MRI Brain without and with contrast (CPT® 70553) is indicated for all patients
- MRI Spine without and with contrast (Cervical-CPT® 72156, Thoracic-CPT® 72157, Lumbar-CPT® 72158) can be approved for patients with:
  - Multicentric tumors
  - Atypical histology including pineoblastoma-like elements
  - Clinical signs or symptoms suggesting spinal cord involvement
  - MRI Spine with contrast only (Cervical-CPT® 72142, Thoracic-CPT® 72147, Lumbar-CPT® 72149) can be approved if being performed immediately following a contrast-enhanced MRI Brain

Pineocytomas Treatment Response:

- Surgical resection is curative for most patients. Patients who have resection of the tumor can have a single MRI Brain without and with contrast (CPT® 70553) approved following resection to establish baseline imaging and those with a complete resection should then be imaged according to surveillance guidelines
- Patients with incompletely resected tumors may receive adjuvant radiation therapy and can have a single MRI Brain without and with contrast (CPT® 70553) approved at completion of radiotherapy and should then be imaged according to surveillance guidelines
  - Spinal imaging is not indicated for patients without evidence of spinal cord involvement at initial diagnosis
  - Spinal imaging is appropriate at completion of radiotherapy for patients with measurable spinal cord disease on MRI

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Pineocytomas Surveillance:

- MRI Brain without and with contrast (CPT® 70553) can be approved after completion of therapy every 3 months for 1 year, then every 4 months for 1 year, then every 6 months for 1 year, then annually thereafter
- MRI Spine is not indicated during surveillance in patients without prior history of spinal involvement except to evaluate symptoms suspicious for spinal cord recurrence
- For patients with cord involvement at diagnosis, MRI Spine without and with contrast (Cervical-CPT® 72156, Thoracic-CPT® 72157, Lumbar-CPT® 72158) can be approved after completion of therapy every 3 months for 1 year, then every 4 months for 1 year, then every 6 months for 1 year, then annually thereafter
  - MRI Spine with contrast only (Cervical-CPT® 72142, Thoracic-CPT® 72147, Lumbar-CPT® 72149) can be approved if being performed immediately following a contrast-enhanced MRI Brain

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PEDONC-4.7: CNS Germinomas and Non-Germinomatous Germ Cell Tumors (NGGCT)

More common in older school age children and younger adolescents, but can occur throughout the pediatric age range. Although leptomeningeal spread is common, prognosis is excellent due to high sensitivity to chemotherapy and radiotherapy.

Includes the following tumors:
➢ CNS Germinoma ➢ Non-Germinomatous Germ Cell Tumors (NGGCT) ◆ Embryonal carcinoma ◆ Yolk sac tumor ◆ Choriocarcinoma ◆ Teratoma ◆ Mixed germ cell tumor

- PET Metabolic Brain imaging does not have a defined role in the evaluation of CNS GCT.
- MR Spectroscopy (CPT® 76390) can be approved in the following circumstances:
  - To evaluate a brain lesion of indeterminate nature when the MRS findings will be used to determine whether biopsy/resection can be safely postponed

CNS Germinoma & NGGCT Initial Staging:

- MRI Brain without and with contrast (CPT® 70553) is indicated for all patients
- MRI Spine without and with contrast (Cervical-CPT® 72156, Thoracic-CPT® 72157, Lumbar-CPT® 72158) is indicated for all patients
  - MRI Spine with contrast only (Cervical-CPT® 72142, Thoracic-CPT® 72147, Lumbar-CPT® 72149) can be approved if being performed immediately following a contrast-enhanced MRI Brain

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CNS Germinoma & NGGCT Treatment Response:

Patients generally proceed to chemotherapy shortly following surgical resection or biopsy and will usually receive 2 to 4 cycles.

- MRI Brain without and with contrast (CPT® 70553) is appropriate after every 2 cycles of induction chemotherapy
- MRI Spine without and with contrast (Cervical-CPT® 72156, Thoracic-CPT® 72157, Lumbar-CPT® 72158) is appropriate at the end of induction chemotherapy for patients with localized intracranial tumors
  - MRI Spine with contrast only (Cervical-CPT® 72142, Thoracic-CPT® 72147, Lumbar-CPT® 72149) can be approved if being performed immediately following a contrast-enhanced MRI Brain
  - Spinal imaging is appropriate every 2 cycles during induction chemotherapy for patients with measurable spinal cord disease on MRI
- Following completion of chemotherapy, patients with residual disease will proceed to second-look surgery and/or radiotherapy
  - MRI of all known sites of measurable disease can be performed prior to surgery and prior to radiotherapy, if necessary
- MRI Brain without and with contrast (CPT® 70553) and MRI Spine (with or without and with contrast) is appropriate at the end of all planned therapy

CNS Germinoma & NGGCT Surveillance:

- MRI Brain without and with contrast (CPT® 70553) can be approved every 3 months for 1 year, then every 4 months for 1 year, then every 6 months for 1 year, then annually until 5 years after completion of therapy
  - For additional imaging guidelines for patients in long term follow up after CNS tumor treatment that included radiation therapy, See **PEDONC-19.3: Second Malignant Neoplasms (SMN)**
- MRI Spine without and with contrast (Cervical-CPT® 72156, Thoracic-CPT® 72157, Lumbar-CPT® 72158) can be approved every 3 months for 1 year, then every 4 months for 1 year, then every 6 months for 1 year, then annually until 5 years after completion of therapy
  - MRI Spine with contrast only (Cervical-CPT® 72142, Thoracic-CPT® 72147, Lumbar-CPT® 72149) can be approved if being performed immediately following a contrast-enhanced MRI Brain
- Patients with new or worsening neurologic symptoms (including worsening of diabetes insipdus:
  - MRI Brain without and with contrast (CPT® 70553)
  - MRI Spine without and with contrast (Cervical-CPT® 72156, Thoracic-CPT® 72157, Lumbar-CPT® 72158)
    - MRI Spine with contrast only (Cervical-CPT® 72142, Thoracic-CPT® 72147, Lumbar-CPT® 72149) can be approved if being performed immediately following a contrast-enhanced MRI Brain

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PEDONC-4.8: Ependymoma

Occur primarily intracranially, roughly 2/3 in the posterior fossa. Overall prognosis is very good, with supratentorial tumors faring better. Primary spinal tumors can also occur, and are more common in adult patients than pediatric patients.

- Surgery is the primary treatment modality. Radiotherapy +/- chemotherapy is used for:
  - Incompletely resected tumors
  - Anaplastic histology
  - Infratentorial location
- PET Brain Metabolic imaging does not have a defined role in the evaluation of ependymoma.
- MR Spectroscopy (CPT® 76390) can be approved in the following circumstances:
  - To evaluate a brain lesion of indeterminate nature when the MRS findings will be used to determine whether biopsy/resection can be safely postponed

Ependymoma Initial Staging:

- MRI Brain without and with contrast (CPT® 70553) is indicated for all patients
- MRI Spine without and with contrast (Cervical-CPT® 72156, Thoracic-CPT® 72157, Lumbar-CPT® 72158) is indicated for all patients
  - MRI Spine with contrast only (Cervical-CPT® 72142, Thoracic-CPT® 72147, Lumbar-CPT® 72149) can be approved if being performed immediately following a contrast-enhanced MRI Brain

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Ependymoma Treatment Response:

- Patients who have resection of the tumor can have a single MRI Brain without and with contrast (CPT® 70553) or MRI without and with contrast of involved spinal level(s) approved following resection to establish baseline imaging and those with a complete resection should then be imaged according to surveillance guidelines
- Patients with incomplete resection or high risk histology receiving adjuvant radiation therapy can have a single MRI Brain without and with contrast (CPT® 70553) or involved spinal level(s) approved at completion of radiotherapy and should then be imaged according to surveillance guidelines
- Patients treated with chemotherapy can have MRI Brain without and with contrast (CPT® 70553) or involved spinal level(s) approved every 2 cycles during active treatment and at the end of planned chemotherapy
- MRI Spine without and with contrast (Cervical-CPT® 72156, Thoracic-CPT® 72157, Lumbar-CPT® 72158) is appropriate at the end of induction chemotherapy for patients with localized intracranial tumors
  - MRI Spine with contrast only (Cervical-CPT® 72142, Thoracic-CPT® 72147, Lumbar-CPT® 72149) can be approved if being performed immediately following a contrast-enhanced MRI Brain
- MRI Brain without and with contrast (CPT® 70553) is appropriate at the end of induction chemotherapy for patients with localized intraspinal tumors
- Following completion of chemotherapy some patients will proceed to second-look surgery and/or radiotherapy
  - MRI of all known sites of measurable disease can be performed prior to surgery and prior to radiotherapy, if necessary
- MRI Brain without and with contrast (CPT® 70553) and MRI Spine without and with contrast (Cervical-CPT® 72156, Thoracic-CPT® 72157, Lumbar-CPT® 72158) is appropriate at the end of all planned therapy for all patients
  - MRI Spine with contrast only (Cervical-CPT® 72142, Thoracic-CPT® 72147, Lumbar-CPT® 72149) can be approved if being performed immediately following a contrast-enhanced MRI Brain

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Ependymoma Surveillance:

- For patients with primary **intracranial** ependymoma:
  - MRI Brain without and with contrast (CPT® 70553) can be approved after completion of therapy every 3 months for1 year, then every 6 months for 1 year, then annually for 10 years
  - MRI Spine without and with contrast (Cervical-CPT® 72156, Thoracic-CPT® 72157, Lumbar-CPT® 72158) can be approved annually for 2 years after completion of therapy for patients with no history of spinal cord involvement
  - For patients with metastatic cord involvement at diagnosis, MRI Spine without and with contrast (Cervical-CPT® 72156, Thoracic-CPT® 72157, Lumbar-CPT® 72158) can be approved after completion of therapy every 3 months for 1 year, then every 6 months for 1 year, then annually for 10 years
    - MRI Spine with contrast only (Cervical-CPT® 72142, Thoracic-CPT® 72147, Lumbar-CPT® 72149) can be approved if being performed immediately following a contrast-enhanced MRI Brain
- For patients with primary **intraspinal** ependymoma:
  - MRI without and with contrast of the involved spinal level(s) can be approved after completion of therapy every 3 months for1 year, then every 6 months for 1 year, then annually for 10 years
  - MRI Brain without and with contrast (CPT® 70553) can be approved annually for 2 years after completion of therapy for patients with no history of intracranial involvement
  - For patients with metastatic intracranial involvement at diagnosis, MRI Brain without and with contrast (CPT® 70553) can be approved after completion of therapy every 3 months for 1 year, then every 6 months for 1 year, then annually for 10 years
- MR Spectroscopy is not indicated for routine surveillance

End of PEDONC-4.8

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PEDONC-4.9: Malignant Tumors of the Spinal Cord

Treatment principles are the same as tumors of the brain, and should follow imaging guidelines according to the specific histologic type.

Multiple spinal cord tumors should raise suspicion for neurofibromatosis.

Common histologies of primary spinal cord tumor in children include:

- Low Grade Glioma, See **PEDONC-4.2: Intracranial Low Grade Glioma (LGG)** for guidelines
- Ependymoma, See **PEDONC-4.8: Ependymoma** for guidelines
- Any type can occur, but other histologies are rare

- Primary site imaging should always include MRI Spine without and with contrast of all involved levels (Cervical-CPT® 72156, Thoracic-CPT® 72157, Lumbar-CPT®72158)
  - Entire spine imaging may be indicated based on the histologic type
- MRI Brain without and with contrast (CPT® 70553) is indicated at initial diagnosis, but may be not be necessary during treatment response and surveillance
  - Given the rarity of primary spinal cord tumors in children, MRI Brain requests should, in general, be approved for surveillance after recent evaluation by a physician with significant training and/or experience in pediatric spinal cord tumors (most commonly a pediatric neurosurgeon or pediatric oncologist) as the need for intracranial surveillance is highly individualized
- Asymptomatic surveillance imaging should generally end at the time point appropriate for the specific tumor type

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PEDONC-4.10: Craniopharyngioma and Other Hypothalamic/Pituitary Region Tumors

Imaging guidelines and treatment approaches for pediatric pituitary tumors other than craniopharyngioma are consistent with those used for adults with pituitary tumors. For these tumors follow guidelines in **HD-19: Pituitary**

Craniopharyngiomas are less common, accounting for 6 to 8% of pediatric CNS tumors. Most commonly affects children in the preadolescent ages. Several key imaging findings can be used to differentiate the tumors in this region including the presence of calcifications, cysts, and T1/T2 enhancement patterns in craniopharyngiomas. These are best evaluated using a COMBINATION of both MRI and CT modalities. Preoperative prediction is much more successful when BOTH modalities are obtained prior to biopsy.

Other less common tumors in the optic chiasm, sella, and suprasella region may include Germ Cell Tumors (GCT, see **PEDONC-4.7**) and Langerhans Cell Histiocytosis (LCH, see **PEDONC-18**).

- PET Brain Metabolic Imaging and MR Spectroscopy do not have a defined role in the evaluation of craniopharyngioma.

Craniopharyngioma Initial Staging:

- MRI Brain without and with contrast (CPT® 70553) is indicated for all patients
- Concurrent CT Head without contrast (CPT® 70450) can be approved in addition to MRI if cranipharyngioma is suspected
- MRI Spine without and with contrast (Cervical-CPT® 72156, Thoracic-CPT® 72157, Lumbar-CPT® 72158) can be approved for patients with:
  - Multicentric tumors
  - Clinical signs or symptoms suggesting spinal cord involvement
  - MRI Spine with contrast only (Cervical-CPT® 72142, Thoracic-CPT® 72147, Lumbar-CPT® 72149) can be approved if being performed immediately following a contrast-enhanced MRI Brain

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Craniopharyngioma Treatment Response:

- Surgical resection is curative for many patients. Patients who have resection of the tumor can have a single MRI Brain without and with contrast (CPT® 70553) approved following resection to establish baseline imaging and those with a complete resection should then be imaged according to surveillance guidelines.
- Patients with incomplete resection and receiving adjuvant radiation therapy can have a single MRI Brain (CPT® 70553) approved at completion of radiotherapy and should then be imaged according to surveillance guidelines
- Those rare patients who are treated with chemotherapy can have MRI Brain without and with contrast (CPT® 70553) approved every 2 cycles during active treatment and at the end of planned chemotherapy
  - Spinal imaging is appropriate every 2 cycles during induction chemotherapy for patients with measurable spinal cord disease on MRI

Craniopharyngioma Surveillance:

- MRI Brain without and with contrast (CPT® 70553) can be approved every 3 months for 1 year, then every 4 months for 1 year, then every 6 months for 1 year, then annually until 10 years after completion of therapy as late progressions can occur
  - For additional imaging guidelines for patients in long term follow up after CNS tumor treatment that included radiation therapy, See **PEDONC-19.3: Second Malignant Neoplasms (SMN)**
- MRI Spine is not indicated during surveillance in patients without prior history of spinal involvement except to evaluate symptoms suspicious for spinal cord recurrence

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PEDONC-4.11: Primary CNS Lymphoma

Primary CNS lymphoma is a solitary or multifocal mass occurring in the brain without evidence of systemic (bone marrow or lymph node) involvement. Usually associated with immunodeficiency, this is a very rare entity in pediatrics accounting for < 0.1% of pediatric malignancies, so age-specific guidelines have not been established.

Primary CNS lymphoma imaging indications in pediatric patients are identical to those for adult patients. See **ONC-2.7: CNS Lymphoma** for imaging guidelines.

CNS lymphomas also involving bone marrow and/or lymph nodes should be imaged according to: **PEDONC-5.3: Pediatric Aggressive Mature B-Cell Non-Hodgkin Lymphomas (NHL)**.

End of PEDONC-4.11

PEDONC-4.12: Meningiomas

Account for 1 to 3% of pediatric CNS tumors. Usually associated with neurofibromatosis type 2 (NF-2) or prior therapeutic radiation exposure to the brain. Lifetime risk may be as high as 20% for young children receiving whole brain radiotherapy, most commonly occurring 15 to 20 years after radiation exposure.

Meningioma imaging indications in pediatric patients are identical to those for adult patients. See **ONC-2.8: CNS Meningioma** for imaging guidelines.

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PEDONC-4.13: Choroid Plexus Tumors

As a group these account for 1 to 4% of pediatric CNS tumors, and 70% of choroid plexus tumors present within the first 2 years of life.

- Includes the following tumors:
  - Choroid plexus papilloma
  - Choroid plexus adenoma, or atypical choroid plexus papilloma
  - Choroid plexus carcinoma
- PET Metabolic Brain imaging does not have a defined role in the evaluation of choroid plexus tumors.
- MR Spectroscopy (CPT® 76390) can be approved in the following circumstances:
  - To evaluate a brain lesion of indeterminate nature when the MRS findings will be used to determine whether biopsy/resection can be safely postponed

Choroid Plexus Papilloma

Choroid plexus papillomas outnumber other choroid plexus tumors by 4 to 5 times. These ventricular tumors commonly present with hydrocephalus caused by increased CSF production, resulting in signs of increased intracranial pressure. Appearance on MRI Brain without and with contrast (CPT® 70553) is typical, and they are usually treated by excision.

- Regrowth is rare, but repeat MRI Brain without and with contrast (CPT® 70553) is indicated if return of hydrocephalus is suspected or seen on CT imaging

Choroid Plexus Adenoma or Atypical Choroid Plexus Papilloma

These are extremely rare tumors with features midway in the malignant spectrum between papillomas and carcinomas. They are more prone to local invasion, but rarely to metastasis. Presenting symptoms are similar to papillomas. Appearance on MRI Brain with and without contrast (CPT® 70553) is typical, and they are usually treated by excision.

- Spinal imaging may be approved if requested at initial diagnosis
- Regrowth is rare, but repeat MRI Brain without and with contrast is indicated if return of hydrocephalus is suspected or Seen on CT imaging

Choroid Plexus Carcinoma

This is a very aggressive malignancy, with high rates of metastasis to other parts of the CNS. Prognosis is significantly less favorable than for papillomas with overall survival rates of 35 to 40%. Overall incidence of metastases in choroid plexus carcinoma is 12–50%, which is associated with a worse outcome. *TP53* mutations and alternative lengthening telomeres (ALT) are common in patients with choroid plexus carcinoma.

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Choroid Plexus Carcinoma Initial Staging:

- MRI Brain without and with contrast (CPT® 70553) is indicated for all patients
- MRI Spine without and with contrast (Cervical-CPT® 72156, Thoracic-CPT® 72157, Lumbar-CPT® 72158) is indicated for all patients
  - MRI Spine with contrast only (Cervical-CPT® 72142, Thoracic-CPT® 72147, Lumbar-CPT® 72149) can be approved if being performed immediately following a contrast-enhanced MRI Brain

Choroid Plexus Carcinoma Treatment Response:

- Surgical gross total resection is curative for many patients. Patients who have gross or subtotal resection of the tumor can have a single MRI Brain without and with contrast (CPT® 70553) approved following resection to establish baseline imaging.
  - Patients with confirmed gross total resection should then be imaged according to surveillance guidelines.
- Patients with incomplete resection who receive adjuvant radiation therapy can have a single MRI Brain without and with contrast (CPT® 70553) approved at completion of radiotherapy and should then be imaged according to surveillance guidelines
- Patients treated with chemotherapy can have MRI Brain without and with contrast (CPT® 70553) approved every 2 cycles during active treatment and at the end of planned chemotherapy
- MRI Spine without and with contrast (Cervical-CPT® 72156, Thoracic-CPT® 72157, Lumbar-CPT® 72158) is appropriate at the end of chemotherapy for patients with localized intracranial tumors
  - MRI Spine with contrast only (Cervical-CPT® 72142, Thoracic-CPT® 72147, Lumbar-CPT® 72149) can be approved if being performed immediately following a contrast-enhanced MRI Brain
  - Spinal imaging is appropriate every 2 cycles during chemotherapy for patients with measurable spinal cord disease on MRI
- Following completion of chemotherapy some patients will proceed to second-look surgery and/or radiotherapy
  - MRI of all known sites of measurable disease can be performed prior to surgery and prior to radiotherapy, if necessary
- MRI Brain without and with contrast (CPT® 70553) and MRI Spine without and with contrast (Cervical-CPT® 72156, Thoracic-CPT® 72157, Lumbar-CPT® 72158) is appropriate at the end of all planned therapy
  - MRI Spine with contrast only (Cervical-CPT® 72142, Thoracic-CPT® 72147, Lumbar-CPT® 72149) can be approved if being performed immediately following a contrast-enhanced MRI Brain

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Choroid Plexus Carcinoma Surveillance:

- MRI Brain without and with contrast (CPT® 70553) can be approved every 4 months for 3 years, then every 6 months for 2 years after completion of therapy
  - For additional imaging guidelines for patients in long term follow up after CNS tumor treatment that included radiation therapy, See **PEDONC-19.3: Second Malignant Neoplasms (SMN)**
- MRI Spine without and with contrast (Cervical-CPT® 72156, Thoracic-CPT® 72157, Lumbar-CPT® 72158) can be approved at 12 and 24 months after completion of therapy for patients with no history of spinal cord involvement
- For patients with cord involvement at diagnosis, MRI Spine without and with contrast (Cervical-CPT® 72156, Thoracic-CPT® 72157, Lumbar-CPT® 72158) can be approved every 4 months for 3 years, then every 6 months for 2 years after completion of therapy
  - MRI Spine with contrast only (Cervical-CPT® 72142, Thoracic-CPT® 72147, Lumbar-CPT® 72149) can be approved if being performed immediately following a contrast-enhanced MRI Brain
- MR Spectroscopy is not indicated for routine surveillance

End of PEDONC-4.13

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PEDONC-5: Pediatric Lymphomas

PEDONC-5.1: Pediatric Lymphoma – General Considerations
PEDONC-5.2: Pediatric Hodgkin Lymphoma (HL)
PEDONC-5.3: Pediatric Aggressive Mature B-Cell Non-Hodgkin Lymphomas (NHL)
PEDONC-5.4: Anaplastic Large Cell Lymphoma (ALCL)

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PEDONC-5.1: Pediatric Lymphoma – General Considerations

- Lymphoma mostly commonly involves the lymph nodes (LNs). However, lymphoma can also arise from primary lymphoid tissues (bone marrow or thymus) or various secondary lymphoid tissues (spleen, mucosa-associated lymphoid tissue) or non-lymphoid organs (skin, bone, brain, lungs, liver, salivary glands, etc).
- Pediatric lymphomas are generally Hodgkin Lymphomas, Aggressive B-Cell Non-Hodgkin Lymphomas, Lymphoblastic Lymphomas, or Anaplastic Large Cell Lymphomas
- Patients with Lymphoblastic Lymphoma (even those with bulky nodal disease) are treated using the leukemia treatment plan appropriate to the cell type (B or T cell). These patients should be imaged using guidelines in **PEDONC-3.2: Acute Lymphoblastic Leukemia (ALL)**.
- Other histologies are rare in pediatric patients, and should be imaged according to the following guidelines:
  - Follicular lymphoma: **ONC-27.3: Follicular Lymphoma**
  - Marginal zone or MALT lymphomas: **ONC-27.4: Marginal Zone Lymphomas**
  - Mantle cell lymphomas: **ONC-27.5: Mantle Cell Lymphoma**
  - Cutaneous lymphomas: **ONC-27.8: Cutaneous Lymphomas and T Cell Lymphomas**
    - **Exception:** Cutaneous B-Lymphoblastic Lymphoma should be imaged using guidelines in **PEDONC-3.2: Acute Lymphoblastic Leukemia (ALL)**
  - Castleman's Disease: **ONC-31.11: Castleman's Disease (Unicentric and Multicentric)**
- All CT imaging recommended in this section refers to CT with contrast only.
  - Noncontrast CT imaging has not been shown to be beneficial in the management of pediatric lymphomas
  - Given the limited utility of noncontrast CT imaging in pediatric lymphomas, MRI without or without and with contrast is recommended in place of CT for patients who cannot tolerate CT contrast due to allergy or impaired renal function
- MRI without and with contrast of symptomatic or previously involved bony areas can be approved in known lymphoma patients without prior plain x-ray or bone scan evaluation
  - Bone scan is inferior to MRI for evaluation of known or suspected bone metastases in lymphoma
- MRI Brain without and with contrast (CPT® 70553) is the preferred study for evaluation of suspected Brain metastases in pediatric lymphoma
  - CT Head with (CPT® 70460) or without and with contrast (CPT® 70470) can be approved when MRI is contraindicated

End of PEDONC-5.1

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PEDONC-5.2: Pediatric Hodgkin Lymphoma (HL)

Pediatric Hodgkin Lymphoma Initial Staging:

- All patients should undergo CT Neck (CPT® 70491), Chest (CPT® 71260), Abdomen/Pelvis (CPT® 74177), and CT with contrast or MRI without and with contrast of any other symptomatic body area is indicated for all patients (See **PEDONC-5.1: Pediatric Lymphoma – General Considerations**) as pediatric patients have a high rate of neck and Waldeyer's ring involvement with Hodgkin Lymphoma
- PET/CT (CPT® 78815) is indicated for initial staging of all patients, and can be performed prior to biopsy if necessary for patient scheduling
  - Whole body PET/CT (CPT® 78816) may be approved if there is clinical suspicion of skull or distal lower extremity involvement
- CT or MRI of other body areas (See **PEDONC-5.1: Pediatric Lymphoma – General Considerations**) may be indicated for rare patients based on physical findings or PET/CT results.

Pediatric Hodgkin Lymphoma Treatment Response:

- Restaging for treatment response can be performed as often as every 2 cycles of chemotherapy
- Both CT of Neck (CPT® 70491), Chest (CPT® 71260), and Abdomen/Pelvis (CPT® 74177) and other previously involved areas **and** PET/CT (CPT® 78815) can be approved during early treatment response evaluations as decisions about chemotherapy drug selection and radiation treatment are frequently made based on both anatomic (CT-based) and metabolic (PET/CT-based) responses.
  - For patients with low risk (stage IA or IIA) mixed cellularity Hodgkin lymphoma, PET/CT can be performed for treatment response after cycles 1 and 3 instead of cycles 2 and 4
- Once a particular patient has a negative PET/CT (either Deauville or Lugano 1, 2 or 3 as reported in formal radiology interpretation), all subsequent treatment response evaluations should use CT only, including end of therapy evaluation.

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Pediatric Hodgkin Lymphoma Surveillance:

Most patients experiencing recurrence are detected based on physical findings, and frequent CT surveillance imaging of Hodgkin Lymphoma after completion of therapy does not improve post-recurrence overall survival.

- CT of the Neck (CPT® 70491), Chest (CPT® 71260), Abdomen/Pelvis (CPT® 74177) and other previously involved or currently symptomatic areas OR PET/CT (CPT® 78815 or 78816) should be approved for any patient with clinical symptoms suggesting recurrence
- Patients with stage I or II HL:
  - CT of the Neck/Chest (CPT® 70491 and CPT® 71260) and other previously involved areas at 6 months and 12 months after completing therapy
  - Surveillance at other time points from the end of therapy should use physical exam and CXR only
- Patients with stage III or IV HL:
  - CT of the Neck (CPT® 70491), Chest (CPT® 71260), and Abdomen/Pelvis (CPT® 74177) and other previously involved areas at 6 months and 12 months after completing therapy
  - Surveillance at other time points from the end of therapy should use physical exam and CXR only
- Patients with recurrent HL with no evidence of disease following successful treatment:
  - CT of the Neck/Chest/Abdomen/Pelvis every 3 months for 1 year after completing therapy for recurrence
- PET/CT is not indicated for surveillance, but can be approved to clarify inconclusive findings on conventional imaging to evaluate the need for biopsy to establish recurrence. These requests should be forwarded for Medical Director review.

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PEDONC-5.3: Pediatric Aggressive Mature B-Cell Non-Hodgkin Lymphomas (NHL)

- Aggressive mature B-Cell NHL includes all of the following diagnoses, all of which should be imaged according to this section:
  - Burkitt's lymphoma/leukemia (BL)
  - Diffuse Large B-Cell Lymphoma (DLBCL)
  - Primary Mediastinal Large B-Cell Lymphoma (PMBCL)
  - Post-transplant Lymphoproliferative Disorder (PTLD)
    - Most commonly occurs following solid organ or stem cell transplantation
  - Viral-associated lymphoproliferative disorders
    - Most commonly occurs following hematopoietic stem cell transplantation or in patients with primary immunodeficiency

Pediatric Aggressive Mature B-Cell NHL Initial Staging:

- CT of the Neck (CPT® 70491), Chest (CPT® 71260), and Abdomen/Pelvis (CPT® 74177) and CT with contrast or MRI without and with contrast any other symptomatic body area is indicated for all patients (See **PEDONC-5.1: Pediatric Lymphoma – General Considerations**)
- MRI Brain without and with contrast (CPT® 70553) is indicated if symptoms or extent of disease suggest intracranial extension (skull base involvement, for example) or metastasis
- PET/CT (CPT® 78815) is indicated for initial staging for all patients
  - Whole body PET/CT (CPT® 78816) may be approved if there is clinical suspicion of skull or distal lower extremity involvement.
  - Due to the extremely aggressive nature of this group of tumors (the doubling time can be as short as 8 hours) it may not be possible to obtain PET/CT prior to therapy initiation. PET/CT should be approved for treatment response in these cases as these lymphomas are nearly universally FDG-avid.

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Pediatric Aggressive Mature B-Cell NHL Treatment Response:

- Initial treatment is usually 7 days of low intensity therapy, with early response evaluation determining next steps in therapy using CT with contrast or MRI without and with contrast of previously involved areas performed around day 6
  - Patients are customarily still inpatient for this evaluation so outpatient requests should be rare for this time point
- Following initial response evaluation, restaging for treatment response using CT with contrast or MRI without and with contrast (should be same modality as initial diagnosis if possible) of previously involved areas and PET/CT can be performed as often as every cycle of chemotherapy (~every 3 weeks)
- Once a particular patient has a negative PET/CT (either Deauville or Lugano 1, 2 or 3 as reported in formal radiology interpretation), all subsequent treatment response evaluations should use CT imaging only, including end of therapy evaluation
  - PET/CT may be indicated to assess disease activity in inconclusive residual masses seen on conventional imaging

Pediatric Aggressive Mature B-Cell NHL Surveillance:

Routine asymptomatic surveillance with advanced imaging has not been found to impact patient outcomes as the majority of these patients present clinically at relapse due to the highly aggressive nature of these lymphomas.

- CXR and Abdominal (CPT® 76700) and Pelvic (CPT® 76856) ultrasound are sufficient to follow asymptomatic patients with residual masses in the chest or abdomen/pelvis. Surveillance imaging with CT or MRI has not been shown to improve patient outcomes following recurrence and is not the standard of care.
- CT of the Neck (CPT® 70491), Chest (CPT® 71260), Abdomen/Pelvis (CPT® 74177) and other previously involved or currently symptomatic areas OR PET/CT (CPT® 78815 or 78816) should be approved for any patient with clinical symptoms or laboratory findings suggesting recurrence.
  - PET/CT (CPT® 78815) can be approved for suspected PTLD recurrence with documentation of new palpable nodes, rising LDH, or rising quantitative EBV PCR
- PET/CT is not indicated for surveillance, but can be approved to clarify inconclusive findings on conventional imaging to evaluate the need for biopsy to establish recurrence. These requests should be forwarded for Medical Director review.

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PEDONC-5.4: Anaplastic Large Cell Lymphoma (ALCL)

Similar in presentation to Hodgkin Lymphoma, and may be indistinguishable until immunocytology and molecular studies are complete.

Anaplastic Large Cell Lymphoma Initial Staging:

- All patients should undergo CT of the Neck/Chest/Abdomen/Pelvis (CPT® 70491, CPT® 71260, and CPT® 74177) and CT with contrast or MRI without and with contrast any other symptomatic body area is indicated for all patients (See **PEDONC-5.1: Pediatric Lymphoma – General Considerations**)
- PET/CT (CPT® 78815) is indicated for initial staging of all patients and can be performed prior to biopsy if necessary for patient scheduling.
  - Whole body PET/CT (CPT® 78816) may be approved if there is clinical suspicion of skull or distal lower extremity involvement.
- CT or MRI of other body areas may be indicated for rare patients based on physical findings or PET/CT results. Rarely patients will have primary tumor sites outside the Neck→Pelvis region, and MRI without and with contrast may be substituted for soft tissue extremity or paraspinal primary masses as necessary.
- Bone scan (See **PEDONC-1.3: Modality General Considerations**) is indicated for patients with bony primary tumors or metastatic disease

Anaplastic Large Cell Lymphoma Treatment Response:

- Restaging for treatment response using CT with contrast or MRI without and with contrast of previously involved areas (should be same modality as initial diagnosis if possible) should be performed at the end of induction chemotherapy (commonly 4 to 6 weeks)
- For patients treated with cytotoxic chemotherapy, either CT of previously involved areas or PET/CT may be approved for treatment response as often as every 2 cycles of chemotherapy as decisions about chemotherapy drug selection and radiation treatment can be made based on either anatomic or metabolic responses.
  - If CT is performed for primary treatment response, PET/CT can be approved to clarify inconclusive findings detected on conventional imaging
  - If PET/CT is performed for primary treatment response, CT or MRI can be approved to clarify inconclusive findings detected on PET imaging
- Once a particular patient has a negative PET/CT (either Deauville or Lugano 1, 2 or 3 as reported in formal radiology interpretation), all subsequent treatment response evaluations should use CT imaging only, including end of therapy evaluation.

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Anaplastic Large Cell Lymphoma Surveillance:

- CT of the Neck (CPT® 70491), Chest (CPT® 71260), Abdomen/Pelvis (CPT® 74177) and other previously involved or currently symptomatic areas should be approved for any patient with clinical symptoms suggesting recurrence.
- CT with contrast or MRI without and with contrast of all previously involved areas is indicated at 3, 6, 12, and 18 months after therapy is completed.
- Bone scan (See **PEDONC-1.3: Modality General Considerations**) is indicated at 3, 6, 12, and 18 months after therapy is completed for patients with bony primary tumors or metastatic disease
- PET/CT is not indicated for surveillance, but can be approved to clarify inconclusive findings on conventional imaging to evaluate the need for biopsy to establish recurrence. These requests should be forwarded for Medical Director review.

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PEDONC-6: Neuroblastoma

PEDONC-6.1: Neuroblastoma – General Considerations
PEDONC-6.2: Staging and Risk Grouping – Neuroblastoma
PEDONC-6.3: Neuroblastoma – Initial Staging
PEDONC-6.4: Neuroblastoma – Treatment Response Imaging (Risk Group Dependent)
PEDONC-6.5: Neuroblastoma – Surveillance Imaging (Risk Group Dependent)

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PEDONC-6.1: Neuroblastoma – General Considerations

Note: *Some payors consider PET to be experimental for the treatment of neuroblastoma, and those coverage policies may supersede the recommendations for PET in this section.*

Neuroblastoma is the most common extracranial solid tumor of childhood, and generally arises from the adrenal gland or along the sympathetic chain. Neuroblastoma is divided into very low, low, intermediate, and high risk disease based on International Neuroblastoma Risk Group (INRG) Staging System (see: **PEDONC-6.5**). The treatment approaches for each risk group vary widely and have distinct imaging strategies.

90 to 95% of neuroblastomas secrete homovanillic acid (HVA) and vannilylmandelic acid (VMA) in the urine, and urine HVA/VMA should be performed at every disease evaluation for patients with positive HVA or VMA at diagnosis.

- Esthesioneuroblastoma should be imaged according to guidelines in **ONC-3: Squamous Cell Carcinomas of the Head And Neck**
- **PET imaging is rarely indicated in neuroblastoma, but can be approved in the following situations:**
  - **Patients with MIBG-negativity documented at initial diagnosis**
    - For these patients, MIBG should not be repeated and whole body PET (CPT® 78816) may be performed rather than MIBG for metabolic tumor assessment.
    - Patients who are MIBG positive at diagnosis and then become MIBG negative in response to treatment should continue to use MIBG (CPT® 78800, 78801, 78802, 78803, or 78804) for metabolic imaging indications
  - For all patients, PET may be approved at major decision points such as hematopoietic stem cell transplantation or surgery **if MIBG and CT/MRI findings are inconclusive**
  - **Patients currently receiving medications that may interfere with MIBG uptake** that cannot safely be discontinued prior to imaging, including:
    - Tricyclic antidepressants (amitriptyline, imipramine, etc.)
    - Selective serotonin reuptake inhibitors (SSRI's, sertraline, paroxetine, escitolapram, etc.)
    - Neuroleptics (risperidone, haloperidol, etc.)
    - Antihypertensive drugs (alpha or beta blockers, calcium channel blockers)
    - Decongestants (phenylephrine, ephedrine, pseudoephedrine)
    - Stimulants (methylphenidate, dextroamphetamine, etc.)
    - PET should only be approved for this indication when specific documentation of the medication interaction is included with the current PET imaging request. These requests will be forwarded for Medical Director review.
- 99mTc-MDP bone scan does not identify foci of disease that affect staging or clinical management and provides no advantage over MIBG scintigraphy and is not used for evaluation of most patients with neuroblastoma

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PEDONC-6.2: Staging and Risk Grouping – Neuroblastoma

- Most recent treatment protocols are using the recently validated International Neuroblastoma Risk Group (INRG) staging system, which is primarily defined by the complexity of local tumor extension and the presence or absence of distant metastases:
  - L1: Localized tumor not involving vital structures as defined by the list of image-defined risk factors and confined to one body compartment
    - Image-defined risk factors include a list of specific imaging findings defining patients less likely to be candidates for complete surgical resection
    - These risk factors involve the encasement of major blood vessels, airway, skull base, costovertebral junction, brachial plexus, spinal canal, or major organs or structures
  - L2: Locoregional tumor with presence of one or more image-defined risk factors
  - M: Distant metastatic disease (except stage MS)
    MS: Metastatic disease in children younger than 18 months with metastases confined to skin, liver, and/or bone marrow with < 10% involvement (MIBG must be negative in bone and bone marrow)

INRG Neuroblastoma Risk Grouping
Very low risk neuroblastoma (28% of patients, event-free survival > 85%) includes:
➢ Stage L1 or L2 maturing ganglioneuroma or intermixed ganglioneuroblastoma ➢ Stage MS patients meeting all of the following: ◆ Age < 18 months ◆ Without *MYCN* amplification ◆ Without 11q aberration
Low Risk Neuroblastoma (27% of patients, event-free survival > 75 to ≤ 85%) includes:
➢ Stage L2 patients age < 18 months meeting all of the following: ◆ Any histology except maturing ganglioneuroma or intermixed ganglioneuroblastoma ◆ Without *MYCN* amplification ◆ Without 11q aberration ➢ Stage L2 patients age ≥ 18 months meeting all of the following: ◆ Differentiating neuroblastoma or nodular ganglioneuroblastoma ◆ Without *MYCN* amplification ◆ Without 11q aberration ➢ Stage M patients meeting all of the following: ◆ Age < 18 months ◆ Without *MYCN* amplification ◆ With hyperdiploidy (tumor DNA index > 1)

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Intermediate Risk Neuroblastoma (9% of patients, event-free survival ≥ 50 to ≤ 75%) includes:
➢ Stage L2 patients age < 18 months meeting all of the following: ◆ any histology except maturing ganglioneuroma or intermixed ganglioneuroblastoma ◆ With 11q aberration ➢ Stage L2 patients age ≥ 18 months meeting all of the following: ◆ Neuroblastoma or nodular ganglioneuroblastoma ◆ Without *MYCN* amplification ◆ With 11q aberration ➢ Stage M patients meeting all of the following: ◆ Age < 18 months ◆ Without *MYCN* amplification ◆ With diploidy (tumor DNA index = 1)
High Risk Neuroblastoma (36% of patients, event-free survival < 50%, includes the following)
➢ All patients age ≥ 18 months with stage M disease regardless of other factors ➢ All patients with neuroblastoma and *MYCN* amplification regardless of other factors ➢ All stage MS patients with 11q aberration regardless of other factors

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PEDONC-6.3: Neuroblastoma – Initial Staging

- One of the following imaging groups for all patients:
  - CT with contrast of the Neck/Chest/Abdomen/Pelvis (CPT® 70491, 71260, and 74177) OR
  - MRI without and with contrast of the Neck/Chest/Abdomen/Pelvis (CPT® 70543, 71552, 74183, and 72197)
- MRI without and with contrast is preferred for evaluation of paraspinal tumors where cord compression is a possibility
- Metabolic imaging in neuroblastoma:
  - Adrenal nuclear imaging (CPT® 78075) can be approved for evaluation of suspected adrenal neuroblastoma, ganglioneuroblastoma, or ganglioneuroma when CT or MRI is inconclusive
  - ^{123}I-metaiodobenzylguanidine (MIBG - CPT® 78800, 78801, 78802, 78803, or 78804) scintigraphy is the preferred metabolic imaging for neuroblastoma and is positive in 90 to 95% of neuroblastomas.
    - MIBG provides superior sensitivity and sensitivity for detecting viable osseous disease compared with bone scintigraphy so technetium bone scan is not necessary when MIBG is utilized
  - Most MIBG imaging studies are SPECT/CT studies using CT for localization only. Separate diagnostic CT codes should not be approved for this purpose. See **PREFACE-4.6: SPECT/CT imaging**.
  - Occasionally MIBG cannot be performed prior to initiation of therapy. In this circumstance MIBG should be completed within 3 weeks of therapy initiation as the reduction in MIBG avidity in response to chemotherapy is not immediate. Inability to complete MIBG before starting therapy is not an indication to approve PET imaging.
  - PET imaging is inferior to MIBG in neuroblastoma, and should not be used unless one of the exceptions stated in section PEDONC-6.1 is present
- Brain metastases are rare in neuroblastoma, but if clinical signs/symptoms suggest brain involvement, MRI Brain without and with contrast (CPT® 70553) is preferred for evaluation.
  - MRI Brain of asymptomatic patients with no history of brain metastases is not indicated for neuroblastoma.

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PEDONC-6.4: Neuroblastoma – Treatment Response Imaging (Risk Group Dependent)

Risk grouping will not be known at the time of initial staging, but is critical for all imaging decisions after initial staging is complete. **The treating oncologist should always know the patient's risk grouping**. It is not possible to establish the appropriate imaging plan for a neuroblastoma patient without knowing his/her risk group.

All Very Low Risk and Low Risk Neuroblastoma Not Receiving Chemotherapy:

- All patients can have CT with contrast or MRI without and with contrast of the primary tumor site 6 to 8 weeks after diagnosis to determine if additional treatment is necessary.
  - Ultrasound may be used in place of CT or MRI to avoid radiation and/or anesthesia exposure in low risk patients
- Many patients will be treated with surgical resection only without adjuvant therapy, and these patients enter immediately into surveillance.

All Intermediate Risk Neuroblastoma and Very Low Risk or Low Risk Neuroblastoma Receiving Chemotherapy:

Patients generally receive 2 to 12 cycles of moderate-intensity chemotherapy depending on response to treatment.

Surgical resection may occur prior to or following chemotherapy depending on disease stage. Restaging prior to surgery is appropriate.

- Treatment response assessment can be approved as often as every 2 cycles of chemotherapy (~every 6 weeks and at the end of planned treatment) and includes:
  - CT with contrast of the Chest/Abdomen/Pelvis (CPT® 71260, and CPT® 74177) or MRI without and with contrast, (CPT® 71552, CPT® 74183, and CPT® 72197) and other sites with prior measurable disease
  - Urine HVA/VMA (if positive at diagnosis)
  - Bone marrow aspiration/biopsy if positive at diagnosis
- MIBG scan (CPT® 78800, 78801, 78802, 78803, or 78804) can be approved every 4 cycles and at the end of planned treatment

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High Risk Neuroblastoma:

This group of patients receives highly aggressive therapy using sequential chemotherapy, surgery, high dose chemotherapy with stem cell rescue, radiotherapy, monoclonal antibody (mAb) immunotherapy, and biologic therapy.

- Treatment response assessment can be approved as often as every 2 cycles of chemotherapy, mAb, or biologic therapy (~every 6 weeks) and includes:
  - CT with contrast, of the Chest/Abdomen/Pelvis (CPT® 71260, and CPT® 74177) or MRI without and with contrast, (CPT® 71552, CPT® 74183, and CPT® 72197) and other sites with prior measurable disease
  - Urine HVA/VMA (if positive at diagnosis)
  - Bone marrow aspiration/biopsy if positive at diagnosis
  - MIBG scan (CPT® 78800, 78801, 78802, 78803, or 78804)
    - ^{123}I-MIBG scan is also indicated following ^{131}I-MIBG therapy, but FDG-PET cannot be used after ^{131}I-MIBG therapy
- Treatment response assessment is necessary at every change in modality (prior to surgery, HSCT, XRT, and mAb therapy) as well as at the end of therapy
- More frequent imaging can be approved around the time of surgery if needed for preoperative planning

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PEDONC-6.5: Neuroblastoma – Surveillance Imaging (Risk Group Dependent)

Very Low Risk and Low Risk Neuroblastoma:

- Urine HVA/VMA (if positive at diagnosis) at 1, 2, 3, 6, 9, 12, 18, 24, 36, 48, and 60 months after surgery
- CT with contrast or MRI without and with contrast of the primary tumor site 3, 6, 9, 12, 18, 24, and 36 months after surgery. If negative at 36 months, no further advanced imaging is necessary.
  - Ultrasound may be sufficient to evaluate the primary tumor site for certain patients and may be approved if requested to replace CT or MRI.
- MIBG is not indicated for surveillance of low risk neuroblastoma, but can be used to clarify findings suspicious for disease recurrence
- CT Chest is not indicated in asymptomatic surveillance imaging of neuroblastoma patients with no prior history of thoracic disease

Intermediate Risk Neuroblastoma:

- Urine HVA/VMA (if positive at diagnosis) every month until 12 months after completion of therapy, then at 14, 16, 18, 21, 24, 30, and 36 months after completion of therapy, then annually until 10 years after completion of therapy
- CT with contrast or MRI without and with contrast of the primary tumor and known metastatic sites at 3, 6, 9, 12, 18, 24, and 36 months after completion of therapy. If negative at 36 months, no further advanced imaging is necessary.
  - Ultrasound may be sufficient to evaluate the primary tumor site for certain patients and may be approved if requested to replace CT or MR
- For all patients with stage 4 or M disease or patients with stage 4S or MS disease AND positive MIBG at completion of therapy, MIBG scan (CPT® 78800, 78801, 78802, 78803, or 78804) at 3, 6, 9, 12, 24, and 36 months after completion of therapy.
  - If negative at 36 months, no further MIBG imaging is necessary.
  - For **all other intermediate risk neuroblastoma patients**, MIBG (or PET, if MIBG-negative at initial diagnosis) during surveillance is not indicated.
- CT Chest is not indicated in asymptomatic surveillance imaging of neuroblastoma patients with no prior history of thoracic disease.

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High Risk Neuroblastoma:

- Urine HVA/VMA (if positive at diagnosis) at 3, 6, 9, 12, 18, 24, 30, 36, 42, 48, 54, and 60 months after completion of therapy, then annually until 10 years after completion of therapy.
- CT with contrast or MRI without and with contrast of the primary tumor site at 3, 6, 9, 12, 18, 24, 30, 36, 42, 48, 54, and 60 months, then annually until 10 years after completion of therapy. If negative at 10 years, no further advanced imaging is necessary.
- MIBG scan (CPT® 78800, 78801, 78802, 78803, or 78804) at 3, 6, 9, 12, 18, 24, 30, and 36 months after completion of therapy. If negative at 36 months, no further MIBG or PET imaging is necessary.
  - Early detection of recurrence with ^{123}I-MIBG has been shown to improve post-relapse outcomes in high risk neuroblastoma
- CT Chest is not indicated in asymptomatic surveillance imaging of neuroblastoma patients with no prior history of thoracic disease.
- For patients with suspected recurrence:
  - CT with contrast, of the Chest/Abdomen/Pelvis (CPT® 71260, and CPT® 74177) or MRI without and with contrast, (CPT® 71552, CPT® 74183, and CPT® 72197) and other sites of prior measurable disease or current symptoms
  - MIBG scan (CPT® 78800, 78801, 78802, 78803, or 78804)
  - Urine HVA/VMA

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PEDONC-7: Pediatric Renal Tumors
PEDONC-7.1: Pediatric Renal Tumors – General Considerations
PEDONC-7.2: Unilateral Wilms Tumor (UWT)
PEDONC-7.3: Bilateral Wilms Tumor (BWT)
PEDONC-7.4: Pediatric Renal Cell Carcinoma (RCC)
PEDONC-7.5: Clear Cell Sarcoma of the Kidney (CCSK)
PEDONC-7.6: Malignant Rhabdoid Tumor of the Kidney (MRT) and Other Extracranial Sites
PEDONC-7.7: Congenital Mesoblastic Nephroma (CMN)

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PEDONC-7.1: Pediatric Renal Tumors – General Considerations

Note: *Some payors consider PET imaging to be experimental for the treatment of Wilms tumor and other kidney tumors, and those coverage policies may supersede the recommendations for PET imaging in this section.*

- A variety of tumors can occur in the pediatric kidney, and include the following:
  - Wilms Tumor
    - Favorable Histology (FHWT)
    - Focal Anaplasia (FAWT)
    - Diffuse Anaplasia (DAWT)
    - Bilateral Wilms Tumor (BWT)
  - Renal Cell Carcinoma (RCC)
  - Clear Cell Sarcoma of the Kidney (CCSK)
  - Malignant Rhabdoid Tumor of the Kidney (MRT)
  - Congenital Mesoblastic Nephroma (CMN)
  - Other cancers occurring in the kidney:
    - Neuroblastoma
    - Primitive Neuroectodermal Tumor
    - Rhabdomyosarcoma
    - Non-Rhabdomyosarcoma Soft Tissue Sarcomas
    - These and other rare tumors have been reported occurring primarily in the kidney and should be imaged according to the guidelines for the specific histologic diagnosis.

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PEDONC-7.2: Unilateral Wilms Tumor (UWT)

Unilateral Wilms Tumor Initial Staging:

Many patients will present with an asymptomatic abdominal mass, and will undergo ultrasound as a primary evaluation. Doppler ultrasound to evaluate for tumor thrombus is no longer necessary unless CT findings are inconclusive, and should not be performed if CT is already completed.

- CT Abdomen/Pelvis with contrast (CPT® 74177) is indicated for all unilateral Wilms tumor patients
  - If bilateral renal lesions are noted on ultrasound or CT, MRI Abdomen (CPT® 74183) and Pelvis (CPT® 72197) without and with contrast should be strongly considered for better characterization
- CT Chest with (CPT® 71260) *or* without contrast (CPT® 71250) should be completed prior to anesthesia exposure if possible
- MRI Brain without and with contrast (CPT® 70553) is indicated for initial staging for any patient with neurologic signs or symptoms raising suspicion of CNS metastases as only ~0.5% of Wilms tumor patients will ever develop brain metastases
- Bone scan (See **PEDONC-1.3**) is indicated for any patient with signs or symptoms raising suspicion of bony metastases
- PET is not indicated in the initial staging of any pediatric renal tumor

Unilateral Wilms Tumor Treatment Response:

A very low risk subset of stage I FHWT will be observed after nephrectomy, and enter directly into surveillance.

The majority of patients will receive chemotherapy with or without XRT, beginning within 14 days of initial surgery.

- CT Chest with (CPT® 71260) *or* without contrast (CPT® 71250) can be performed every 2 cycles during treatment and at the end of planned therapy
- CT Abdomen/Pelvis with contrast (CPT® 74177) or MRI Abdomen (CPT® 74183) and Pelvis (CPT® 72197) without and with contrast can be performed every 2 cycles during treatment and at the end of planned therapy
- PET is not routinely utilized to assess treatment response in Wilms tumor.
  - However, since most Wilms tumors are FDG-avid, rare circumstances may occur where PET imaging should be approved to establish the presence of active disease only when a major therapeutic decision depends on PET avidity. These requests will be forwarded for Medical Director review.

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Unilateral Wilms Tumor Surveillance Imaging:

There are no data to support the use of PET imaging for routine surveillance in any patient with Wilms tumor.

- Very low risk FHWT treated with nephrectomy only:
  - CT Chest with (CPT® 71260) *or* without contrast (CPT® 71250) OR CXR at 3, 6, 12, and 18 months after nephrectomy
  - CT Abdomen and Pelvis with contrast (CPT® 74177) OR Ultrasound (CPT® 76700 and 76506) of Abdomen and Pelvis at 3, 6, 12, and 18 months after nephrectomy
  - Surveillance pelvic imaging is indicated in this patient group due to higher risk of recurrence in surgery only treatment
  - Other surveillance imaging should be by Abdominal US (CPT® 76700) and CXR
- FHWT treated with chemotherapy with or without XRT:
  - CT Chest with (CPT® 71260) *or* without contrast (CPT® 71250)every 6 months for 3 years after completion of all therapy
  - CT Abdomen with contrast (CPT® 74160), MRI Abdomen without and with contrast (CPT® 74183), or Ultrasound (CPT® 76700) of the Abdomen every 6 months for 3 years after completion of all therapy
  - Pelvic imaging is not indicated for surveillance unless prior pelvic involvement has been documented or there was tumor rupture at diagnosis
  - Other surveillance imaging should be by Abdominal US and CXR
- FAWT or DAWT treated with chemotherapy with or without XRT:
  - CT Chest with (CPT® 71260) *or* without contrast (CPT® 71250) every 3 months for 2 years after completion of all therapy
  - CT Abdomen and Pelvis with contrast (CPT® 74177) or MRI Abdomen and Pelvis without and with contrast (CPT® 74183 and CPT® 72197) every 3 months for 2 years after completion of all therapy
  - Other surveillance imaging should be by Abdominal US and CXR
- Surveillance imaging with CT of the Chest/Abdomen/Pelvis (CPT® 71260 and CPT® 74177) following successful treatment for recurrent unilateral Wilms tumor can be approved at every 3 months for 1 year after completing therapy for recurrence.
  - Surveillance imaging later than 12 months after completing therapy for recurrence should follow the standard timing listed in this surveillance section.

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PEDONC-7.3: Bilateral Wilms Tumor (BWT)

Bilateral Wilms Tumor Initial Staging:

Many patients will present with an asymptomatic abdominal mass, and will undergo ultrasound as a primary evaluation. Doppler ultrasound to evaluate for tumor thrombus is no longer necessary unless CT findings are inconclusive, and should not be performed if CT is already completed.

Patients with bilateral Wilms Tumor may begin therapy without a histologic diagnosis to preserve a localized disease stage and attempt to shrink the tumors to allow for renal-sparing surgical approaches.

- MRI Abdomen and Pelvis without and with contrast (CPT® 74183 and CPT® 72197) is the preferred imaging modality for patients with bilateral Wilms tumor
  - CT Abdomen and Pelvis with contrast (CPT® 74177) is often performed prior to discovery of bilateral lesions and should not prevent MRI from being approved
  - CT Abdomen and Pelvis with contrast (CPT® 74177) may be used for patients with a contraindication to MRI
    - Avoidance of anesthesia exposure is not a contraindication to MRI for these patients
- CT Chest with (CPT® 71260) *or* without contrast (CPT® 71250) is indicated in the initial workup of all pediatric renal tumors and should be completed prior to anesthesia exposure if possible
- MRI Brain without and with contrast (CPT® 70553) is indicated for initial staging for any patient with neurologic signs or symptoms raising suspicion of CNS metastases as only ~0.5% of Wilms tumor patients will ever develop brain metastases
- Bone scan (See **PEDONC-1.3: Modality General Considerations**) is indicated for any patient with signs or symptoms raising suspicion of bony metastases
- PET is not indicated in the initial staging of any pediatric renal tumor

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Bilateral Wilms Tumor Treatment Response:

- MRI Abdomen and Pelvis without and with contrast (CPT® 74183 and CPT® 72197) can be performed every 2 cycles during treatment and at the end of planned therapy
  - CT Abdomen and Pelvis with contrast (CPT® 74177) may be used for patients with a contraindication to MRI
  - If treating with chemotherapy without a biopsy, disease evaluation is indicated at week 6. If either tumor has not shrunk 50%, then open biopsy is indicated to confirm favorable histology.
  - If partial nephrectomy still not feasible at week 6, the next disease evaluation is at week 12. Surgical resection should occur no later than week 12.
- CT Chest with (CPT® 71260) *or* without contrast (CPT® 71250) can be performed every 2 cycles during treatment and at the end of planned therapy
- PET is not routinely utilized to assess treatment response in Wilms tumor.
  - However, since most Wilms tumors are FDG-avid, rare circumstances may occur where PET should be approved to establish the presence of active disease only when a major therapeutic decision depends on PET avidity. These requests will be forwarded for Medical Director review.

Bilateral Wilms Tumor Surveillance Imaging:

- CT Chest with (CPT® 71260) *or* without contrast (CPT® 71250) every 6 months for 3 years after completion of all therapy
- CT Abdomen with contrast (CPT® 74160) or MRI Abdomen without and with contrast (CPT®74183) every 6 months for 3 years after completion of therapy
  - "Extra" one-time imaging is supported at 3 months after completion of all therapy because close surgical margins occur frequently in patients undergoing nephron-sparing surgical approaches, and the risk for early local recurrence is higher
- Pelvic imaging is not indicated for surveillance unless prior pelvic involvement has been documented or there was tumor rupture at diagnosis
- Other surveillance imaging should be by Abdominal US (CPT® 76700) and CXR
  - When CT or MRI Abdomen no longer indicated, patients with bilateral Wilms tumor should have screening Abdominal ultrasound every 3 months until age 8
- Surveillance imaging with CT of the Chest/Abdomen/Pelvis (CPT® 71260 and CPT® 74177) following successful treatment for recurrent bilateral Wilms tumor can be approved every 3 months for 1 year after completing therapy for recurrence.
  - Surveillance imaging later than 12 months after completing therapy for recurrence should follow the standard timing listed in this surveillance section.

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PEDONC-7.4: Pediatric Renal Cell Carcinoma (RCC)

A majority of pediatric cases have a novel subtype involving TFE3 or TFEB translocations, which have a different natural history than "adult type" RCC. Patients of any age with TFE3 or TFEB translocated RCC should be imaged according to this guideline section.

40 to 45% of pediatric RCC cases have similar histologies to adult RCC (clear cell, papillary, chromophobe, etc.) and imaging decisions will be similar to adult oncology guidelines. Patients with all other subtypes of RCC should be imaged according to **ONC-17: Renal Cell Cancer (RCC)**.

Pediatric Renal Cell Carcinoma Initial Staging:

Many patients will present with an asymptomatic abdominal mass, and will undergo ultrasound as a primary evaluation. Doppler ultrasound to evaluate for tumor thrombus is no longer necessary unless CT findings are inconclusive, and should not be performed if CT is already completed.

- CT Abdomen and Pelvis with contrast (CPT® 74177) is indicated in all patients
  - If bilateral renal lesions are noted on ultrasound or CT, MRI Abdomen and Pelvis without and with contrast (CPT® 74183 and CPT® 72197) should be strongly considered
- CT Chest with (CPT® 71260) *or* without contrast (CPT® 71250) should be completed prior to anesthesia exposure if possible
- Other staging imaging should be deferred until a histologic diagnosis is made, by complete nephrectomy for most unilateral renal tumors and biopsy for bilateral renal tumors or inoperable unilateral tumors
- MRI Brain without and with contrast (CPT® 70553) is indicated for any patient with neurologic signs or symptoms raising suspicion of CNS metastases
- Bone scan (See **PEDONC-1.3: Modality General Considerations**) is indicated for any patient with signs or symptoms raising suspicion of bony metastases
- PET scan is not indicated in the initial staging of any pediatric renal tumor

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Pediatric Renal Cell Carcinoma Treatment Response:

Most patients will have surgical resection of all disease at the time of diagnosis and will enter directly into surveillance.

- Patients with residual measurable disease after initial surgery and receiving adjuvant medical therapy can have CT Chest with (CPT® 71260) *or* without contrast (CPT® 71250) and CT Abdomen with contrast (CPT® 74160) every 2 cycles during active treatment
- Pelvic imaging is not indicated unless prior pelvic involvement has been documented
- PET is not routinely utilized to assess treatment response in pediatric RCC.
  - However, since some RCC tumors are FDG-avid, rare circumstances may occur where PET should be approved to establish the presence of active disease only when a major therapeutic decision depends on PET avidity these requests will be forwarded for Medical Director review.

Pediatric Renal Cell Carcinoma Surveillance Imaging:

- All pediatric RCC patients:
  - MRI Brain without and with contrast (CPT® 70553) every 6 months for 2 years after completion of all therapy only for patients with documented CNS metastases or new signs/symptoms suggestive of CNS recurrence.
- TFE3 or TFEB subtype:
  - CT Chest with (CPT® 71260) *or* without contrast (CPT® 71250) every 3 months for 2 years, then every 6 months for 2 years after completion of all therapy
  - CT Abdomen with contrast (CPT® 74160) or MRI Abdomen without and with contrast (CPT® 74183) every 3 months for 2 years, then every 6 months for 2 years after completion of all therapy
  - Pelvic imaging is not indicated for surveillance unless prior pelvic involvement has been documented
- All other histologies:
  - Surveillance imaging is appropriate as listed in the adult Oncology Imaging Guidelines: **ONC-17.4: Renal Cell Cancer (RCC) – Surveillance**

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PEDONC-7.5: Clear Cell Sarcoma of the Kidney (CCSK)

Be careful not to confuse the diagnosis with clear cell RCC. See ONC-17: Renal Cell Cancer (RCC) for imaging guidelines.

Clear Cell Sarcoma Of The Kidney Initial Staging:

Many patients will present with an asymptomatic abdominal mass, and will undergo ultrasound as a primary evaluation. Doppler ultrasound to evaluate for tumor thrombus is no longer necessary unless CT findings are inconclusive, and should not be performed if CT is already completed.

- CT Abdomen and Pelvis with contrast (CPT® 74177) is indicated in all patients
  - If bilateral renal lesions are noted on ultrasound or CT, MRI Abdomen and Pelvis without and with contrast should be strongly considered
- CT Chest with (CPT® 71260) *or* without contrast (CPT® 71250) should be completed prior to anesthesia exposure if possible
- Other staging imaging should be deferred until a histologic diagnosis is made, by complete nephrectomy for most unilateral renal tumors and biopsy for bilateral renal tumors or inoperable unilateral tumors
- MRI Brain without and with contrast (CPT® 70553) is indicated for initial staging in all patients with clear cell sarcoma of the kidney
- Bone scan (See **PEDONC-1.3: Modality General Considerations**) is indicated in all patients with clear cell sarcoma of the kidney
- PET is not indicated in the initial staging of any pediatric renal tumor

Clear Cell Sarcoma Of The Kidney Treatment Response:

- CT Chest with (CPT® 71260) *or* without contrast (CPT® 71250) can be performed every 2 cycles during treatment and at the end of planned therapy
- CT Abdomen and Pelvis with contrast (CPT® 74177) or MRI Abdomen and Pelvis without and with contrast (CPT® 74183 and CPT® 72197) can be performed every 6 weeks during treatment and at the end of planned therapy
- MRI Brain without and with contrast (CPT® 70553) can be performed:
  - Every 2 cycles during treatment for patients with CNS metastases at initial staging
  - At the end of planned therapy for all patients with CCSK
- Bone scan (See **PEDONC-1.3: Modality General Considerations**) at the end of planned therapy
- PET is not routinely utilized to assess treatment response in CCSK
  - However, since clear cell sarcomas have been shown to be FDG-avid in other anatomic locations, rare circumstances may occur where PET should be approved to establish the presence of active disease only when a major therapeutic decision depends on PET avidity. These requests will be forwarded for Medical Director review.

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Clear Cell Sarcoma Of The Kidney Surveillance Imaging:

- CT Chest with (CPT® 71260) *or* without contrast (CPT® 71250) every 3 months for 2 years after completion of all therapy
- CT Abdomen and Pelvis with contrast (CPT® 74177) or MRI Abdomen and Pelvis without and with contrast (CPT® 74183 and CPT® 72197) every 3 months for 2 years after completion of all therapy
- MRI Brain without and with contrast (CPT® 70553) every 6 months for 3 years after completion of all therapy
- Bone scan (See **PEDONC-1.3: Modality General Considerations**) every 3 months for 1 year, then every 6 months for 1 year after completion of all therapy
  - If negative at 36 months, no further advanced imaging is necessary.
- Other surveillance imaging should be by Abdominal US (CPT® 76700) and CXR

End of PEDONC-7.5

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PEDONC-7.6: Malignant Rhabdoid Tumor of the Kidney (MRT) and Other Extracranial Sites

Be careful not to confuse the diagnosis with rhabdomyosarcoma. See PEDONC-8.2: Rhabdomyosarcoma (RMS) for Imaging Guidelines.

A highly aggressive histologic variant that can also occur in other locations and all non-CNS sites should follow these guidelines.

Primary CNS rhabdoid malignancies should be imaged according to **PEDONC-4.5: Atypical Teratoid/Rhabdoid Tumors (ATRT)**.

Malignant Rhabdoid Tumor Initial Staging:

Many patients will present with an asymptomatic abdominal mass, and will undergo ultrasound as a primary evaluation. Doppler ultrasound to evaluate for tumor thrombus is no longer necessary unless CT findings are inconclusive, and should not be performed if CT is already completed.

- CT Abdomen and Pelvis with contrast (CPT® 74177) is indicated in all patients
  - If bilateral renal lesions are noted on ultrasound or CT, MRI Abdomen and Pelvis without and with contrast should be strongly considered
- CT Chest with (CPT® 71260) *or* without contrast (CPT® 71250) should be completed prior to anesthesia exposure if possible
- Other staging imaging should be deferred until a histologic diagnosis is made, by complete nephrectomy for most unilateral renal tumors and biopsy for bilateral renal tumors or inoperable unilateral tumors
- MRI Brain without and with contrast (CPT® 70553) is indicated for all patients with MRT of the kidney or other non-CNS site
- Bone scan (See **PEDONC-1.3: Modality General Considerations**) is indicated in all patients with MRT of the kidney or other non-CNS site
- PET is not indicated in the initial staging of any pediatric renal tumor

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Malignant Rhabdoid Tumor Treatment Response:

- CT Chest with (CPT® 71260) *or* without contrast (CPT® 71250) can be performed every 2 cycles during treatment and at the end of planned therapy
- CT Abdomen and Pelvis with contrast (CPT® 74177) or MRI Abdomen and Pelvis without and with contrast (CPT® 74183 and CPT® 72197) can be performed every 2 cycles during treatment and at the end of planned therapy
  - If primary site other than kidney, perform CT with contrast or MRI without and with contrast of primary site in place of abdominal and pelvic imaging
- MRI Brain without and with contrast (CPT® 70553) can be performed:
  - Every 2 cycles during treatment for patients with CNS metastases at initial staging
  - At the end of planned therapy for all patients with MRT
- Bone scan (See **PEDONC-1.3: Modality General Considerations**) at the end of planned therapy only if positive at initial diagnosis
- PET is not routinely utilized to assess treatment response in MRT.
  - However, since malignant rhabdoid tumors have been shown to be FDG-avid, rare circumstances may occur where PET should be approved to establish the presence of active disease only when a major therapeutic decision depends on PET avidity. These requests will be forwarded for Medical Director review.

Malignant Rhabdoid Tumor Surveillance Imaging:

- CT Chest with (CPT® 71260) *or* without contrast (CPT® 71250) every 3 months for 2 years after completion of all therapy
- CT Abdomen and Pelvis with contrast (CPT® 74177) or MRI Abdomen and Pelvis without and with contrast (CPT® 74183 and CPT® 72197) every 3 months for 3 years after completion of all therapy
  - If primary site other than kidney, perform CT with contrast or MRI without and with contrast of primary site in place of abdominal imaging
- MRI Brain without and with contrast (CPT® 70553) every 3 months for 1 year, then every 6 months for 1 year after completion of all therapy
- Bone scan (See **PEDONC-1.3: Modality General Considerations**) every 3 months for 1 year, then every 6 months for 1 year after completion of all therapy only if positive at initial diagnosis
  - If negative at 36 months, no further advanced imaging is necessary
- Other surveillance imaging should be by Abdominal US (CPT® 76700) and CXR

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PEDONC-7.7: Congenital Mesoblastic Nephroma (CMN)

This is the most common primary renal tumor occurring in young infants, and the overall prognosis is very good.

Complete surgical removal is curative in most cases, and histologically confirmed metastatic disease or bilateral disease has never been reported.

Congenital Mesoblastic Nephroma Initial Staging

Many patients will present with an asymptomatic abdominal mass at the time of birth or abnormal prenatal ultrasound, and will undergo ultrasound as a primary evaluation.

- CT Abdomen and Pelvis with contrast (CPT® 74177) is indicated in all patients
- CT Chest with (CPT® 71260) can be approved to evaluate inconclusive findings on Chest X-ray
- PET is not indicated in the initial staging of any pediatric renal tumor

Congenital Mesoblastic Nephroma Treatment Response:

- Surgical resection is curative in most patients. Children who have resection of the tumor can have a single CT Abdomen and Pelvis with contrast (CPT® 74177) approved following resection to establish baseline imaging and those with a complete resection should then be imaged according to surveillance guidelines
- Some patients will receive preoperative chemotherapy to facilitate safer resection and can have CT Abdomen and Pelvis with contrast (CPT® 74177) approved every 2 cycles of therapy until surgery, and should then be imaged according to surveillance guidelines after their postoperative baseline imaging study

Congenital Mesoblastic Nephroma Surveillance Imaging

- Recurrences are rare, but most occur within 12 months of diagnosis
- Given the young age of the patients with CMN, ultrasound is the preferred surveillance imaging modality to avoid radiation and anesthesia exposures
  - CT Abdomen and Pelvis with contrast (CPT® 74177) or MRI Abdomen and Pelvis without and with contrast (CPT® 74183 and CPT® 72197) can be approved every 3 months for 1 year after completion of all therapy for patients with residual abnormalities present on post-operative imaging or inconclusive findings on ultrasound

End of PEDONC-7.7

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PEDONC-8: Pediatric Soft Tissue Sarcomas

PEDONC-8.1: Pediatric Soft Tissue Sarcomas – General Considerations
PEDONC-8.2: Rhabdomyosarcoma (RMS)
PEDONC-8.3: Non-Rhabdomyosarcoma Soft Tissue Sarcomas (NRSTS)

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PEDONC-8.1: Pediatric Soft Tissue Sarcomas – General Considerations

Note: Some payors consider PET to be experimental for the treatment of rhabdomyosarcoma and other soft tissue sarcomas, and those coverage policies may supersede the recommendations for PET in this section.

Soft tissue sarcomas occur in both adult and pediatric patients, but some histologic types are more common in one age group than the other. Unless specified below, patients who are <18 years old should be imaged according to this guideline section. Exceptions include:

- Rhabdomyosarcoma patients of all ages should be imaged according to guidelines in **PEDONC-8.2: Rhabdomyosarcoma (RMS)**
- Kaposi's sarcoma patients of all ages should be imaged according to guidelines in **ONC-31.10: Kaposi's Sarcoma**

Pediatric soft tissue sarcomas are divided into **two** groups:

1. Rhabdomyosarcoma (RMS) accounts for ~60% of soft tissue sarcomas in young patients, but only ~25% of soft tissue sarcomas in adolescents
2. Non-rhabdomyosarcoma soft tissue sarcomas (NRSTS) which encompasses all other histologic subtypes

- Evaluation of soft tissue masses of uncertain nature prior to biopsy should follow general imaging guidelines in **PEDMS-3: Soft Tissue and Bone Masses** for patients who are age 0 (newborn) through 17 years old, and **MS-10: Soft Tissue Mass or Lesion of Bone** for patients who are ≥18 years old.

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PEDONC-8.2: Rhabdomyosarcoma (RMS)

Rhabdomyosarcoma Initial Staging:

- Because RMS can arise from any muscle tissue, the presenting symptoms and primary tumor sites vary widely and strongly influence the appropriate imaging decisions
  - Either CT with contrast or MRI without and with contrast is acceptable for primary site imaging of RMS arising in the abdomen or pelvis at the discretion of the treating oncologist.
  - CT with contrast is the preferred primary site imaging modality for RMS arising in the thoracic cavity (not the chest wall).
  - MRI without and with contrast is the preferred primary site imaging modality for RMS occurring in all other anatomic locations, including the chest wall.
- Evaluation for lung metastases using CT Chest with (CPT® 71260) *or* without contrast (CPT® 71250) is indicated in the initial workup of all pediatric soft tissue sarcomas and should be completed prior to anesthesia exposure if possible
- Other staging imaging should be deferred until a histologic diagnosis is made
  - PET/CT is superior to conventional imaging for detection of nodal and bony metastases in pediatric RMS and is indicated in the initial staging of all patients after histologic diagnosis is established
    - Whole body PET/CT (CPT® 78816) is the preferred study for initial staging of RMS
    - Bone scan (See **PEDONC-1.3: Modality General Considerations**) may be substituted for PET imaging if PET not available
  - CT Abdomen and Pelvis with contrast (CPT® 74177) is not routinely indicated in the initial metastatic staging of all patients with pediatric RMS, but can be approved in the following situations:
    - Evaluation of inconclusive PET findings
    - Primary site of abdomen or pelvis
    - Lower extremity primary sites
  - MRI Brain (CPT® 70553) and Spine without and with contrast (Cervical-CPT® 72156, Thoracic-CPT® 72157, Lumbar-CPT® 72158) is indicated for initial staging in the following pediatric RMS:
    - Primary site involving the paraspinal or paravertebral region
    - PET or bone scan-avid lesions in skull, neck, vertebrae
    - Any patient with neurologic signs or symptoms raising suspicion of CNS metastases

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Rhabdomyosarcoma Treatment Response:

- CT Chest with (CPT® 71260) *or* without contrast (CPT® 71250) can be performed every 2 cycles during treatment and at the end of planned therapy for all patients
- Primary site imaging:
  - CT with contrast or MRI without and with contrast can be performed every 2 cycles during treatment and at the end of planned therapy
  - Restaging imaging is appropriate after local control surgery (complete or partial resection) is completed
- Metastatic site imaging:
  - Repeat imaging of all known metastatic sites using the same modality as during initial staging is appropriate whenever primary site imaging is necessary
- PET is not routinely utilized to assess treatment response in RMS, but is indicated in the following circumstances:
  - Response assessment prior to local control surgery or radiation therapy
  - Evaluation of residual mass visible on conventional imaging as part of end of therapy evaluation
  - Response assessment of disease visible on PET but not conventional imaging
  - Once PET has been documented to be negative for a given patient's cancer or all PET-avid disease has been surgically resected, PET should not be used for continued disease monitoring or surveillance unless one of the exceptions in section **PEDONC-1: General Guidelines** applies. These requests will be forwarded for Medical Director review.
  - PET is generally not indicated during active treatment for recurrent pediatric cancer. In rare circumstances, PET may be appropriate when results are likely to result in a treatment change for the patient, including a change from active treatment to surveillance. These requests will be forwarded for Medical Director review.

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Rhabdomyosarcoma Surveillance Imaging:

- All patients with localized RMS:
  - Primary tumor site should be imaged with either CT with contrast or MRI without and with contrast every 3 months for 1 year, then every 4 months for 2 years, then every 6 months for 1 year after completion of all therapy
  - CXR every 3 months for 1 year, then every 4 months for 2 years, then every 6 months for 1 year after completion of all therapy
    - CT Chest with (CPT® 71260) *or* without contrast (CPT® 71250) is indicated for new or worsening clinical symptoms of chest disease or new findings on CXR
- All patients with metastatic RMS:
  - Primary tumor site should be imaged with either CT with contrast or MRI without and with contrast every 3 months for 1 year, then every 4 months for 2 years, then every 6 months for 1 year after completion of all therapy
  - CT Chest with (CPT® 71260) *or* without contrast (CPT® 71250) and all known metastatic sites every 3 months for 1 year, then every 4 months for 2 years, then every 6 months for 1 year after completion of all therapy
  - Nuclear bone scan (See **PEDONC-1.3: Modality General Considerations**) should be used for surveillance of known bony metastases every 3 months for 1 year, then every 4 months for 2 years, then every 6 months for 1 year after completion of all therapy
- PET should not be used for surveillance imaging of RMS unless one of the following applies:
  - Conventional imaging (CT, MRI, US, plain film) reveals findings that are inconclusive or suspicious for recurrence and PET avidity will determine whether biopsy or continued observation is appropriate
    - Residual mass that has not changed in size since the last conventional imaging does **not** justify PET imaging
    - PET avidity in a residual mass at the end of planned therapy is **not** an indication for PET imaging during surveillance.
  - Rare circumstances where obvious clinical symptoms show strong evidence suggesting recurrence and PET would replace conventional imaging modalities. These requests will be forwarded for Medical Director review.

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PEDONC-8.3: Non-Rhabdomyosarcoma Soft Tissue Sarcomas (NRSTS)

All soft tissue sarcomas other than RMS fall into this category.

NRSTS Initial Staging:

- Because soft tissue sarcomas can arise from any soft tissue, the presenting symptoms and primary tumor sites vary widely and strongly influence the appropriate imaging decisions.
  - Either CT with contrast or MRI without and with contrast is acceptable for primary site imaging of NRSTS arising in the abdomen or pelvis at the discretion of the treating oncologist.
  - CT with contrast is the preferred primary site imaging modality for NRSTS arising in the thoracic cavity (not the chest wall).
  - MRI without and with contrast is the preferred primary site imaging modality for NRSTS occurring in all other anatomic locations, including the chest wall.
- In addition, evaluation for lung metastases using CT Chest with (CPT® 71260) *or* without contrast (CPT® 71250) is indicated in the initial workup of all pediatric soft tissue sarcomas and should be completed prior to anesthesia exposure if possible
- Other staging imaging should be deferred until a histologic diagnosis is made:
  - PET/CT (CPT® 78815) may be considered in the following:
    - Desmoplastic small round cell tumor
    - Prior to neoadjuvant chemotherapy
    - Evaluating inconclusive findings found on conventional imaging
    - Whole body PET/CT (CPT® 78816) may be approved if there is clinical suspicion of skull or distal lower extremity involvement
  - Nuclear bone scan (See **PEDONC-1.3: Modality General Considerations**) is used to evaluate for bony metastases but should be omitted if PET is performed
  - CT Abdomen and Pelvis with contrast (CPT® 74177) is not routinely indicated in the initial metastatic staging of pediatric NRSTS, but can be approved in the following situations:
    - Evaluation of inconclusive PET findings
    - Primary site of abdomen or pelvis
    - Lower extremity primary sites
    - Desmoplastic small round cell tumor
  - MRI Brain (CPT® 70553) and Spine (Cervical-CPT® 72156, Thoracic-CPT® 72157, Lumbar-CPT® 72158) without and with contrast is indicated for initial staging in the following pediatric NRSTS:
    - Primary site of paraspinal or paravertebral region
    - PET or nuclear bone scan-avid lesions in skull, neck, vertebrae
    - Any patient with neurologic signs or symptoms raising suspicion of CNS metastases

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NRSTS Treatment Response:

Many patients with NRSTS will be treated with surgical resection alone, and these patients enter immediately into surveillance

- CT Chest with (CPT® 71260) *or* without contrast (CPT® 71250) can be performed every 2 cycles during treatment and at the end of planned therapy
- Primary site imaging:
  - CT with contrast or MRI without and with contrast can be performed every 2 cycles during treatment and at the end of planned therapy
  - Restaging imaging is appropriate after local control surgery (complete or partial resection) is completed
- Metastatic site imaging:
  - Repeat imaging of all known metastatic sites using the same modality as during initial staging is appropriate whenever primary site imaging is necessary
- PET imaging is not routinely utilized to assess treatment response in NRSTS, but is indicated in the following circumstances if positive at initial diagnosis.
  - Response assessment prior to local control surgery or radiation therapy
  - Evaluation of residual mass visible on conventional imaging as part of end of therapy evaluation
  - Response assessment of disease visible on PET but not conventional imaging
  - Once PET has been documented to be negative for a given patient's cancer or all PET-avid disease has been surgically resected, PET should not be used for continued disease monitoring or surveillance unless one of the exceptions in section **PEDONC-1: General Guidelines** applies. These requests will be forwarded for Medical Director review.
  - PET imaging is generally not indicated during active treatment for recurrent pediatric cancer. In rare circumstances, PET imaging may be appropriate when results are likely to result in a treatment change for the patient, including a change from active treatment to surveillance. These requests will be forwarded for Medical Director review.

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Surveillance Imaging:

- All patients with localized NRSTS:
  - Primary site should be imaged with either CT with contrast or MRI without and with contrast every 6 months for 5 years after completion of all therapy
  - CT Chest with (CPT® 71260) *or* without contrast (CPT® 71250) every 6 months for 5 years after completion of all therapy
- All patients with metastatic NRSTS:
  - Primary site should be imaged with either CT with contrast or MRI without and with contrast every 6 months for 5 years after completion of all therapy
  - CT Chest with (CPT® 71260) *or* without contrast (CPT® 71250) and all known metastatic sites every 6 months for 5 years after completion of all therapy
  - Nuclear bone scan (See **PEDONC-1.3: Modality General Considerations**) should be used for surveillance of known bony metastases every 6 months for 5 years after completion of all therapy
- Surveillance after recurrence:
  - Surveillance imaging using CT Chest (CPT® 71260) and CT with contrast or MRI without and with contrast of the primary site following successful treatment for recurrent NRSTS can be approved every 3 months for 1 year after completing therapy for recurrence.
    - Surveillance imaging later than 12 months after completing therapy for recurrence should follow the standard timing listed in this surveillance section.
- PET should not be used for surveillance imaging of NRSTS unless one of the following applies:
  - Conventional imaging (CT, MRI, US, plain film) reveals findings that are inconclusive or suspicious for recurrence and PET avidity will determine whether biopsy or continued observation is appropriate
    - Residual mass that has not changed in size since the last conventional imaging does **not** justify PET
    - PET avidity in a residual mass at the end of planned therapy is **not** an indication for PET imaging during surveillance.
  - Rare circumstances where obvious clinical symptoms show strong evidence suggesting recurrence and PET would replace conventional imaging modalities
  - These requests will be forwarded for Medical Director review.

End of PEDONC-8.3

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PEDONC-9: Bone Tumors

PEDONC-9.1: Bone Tumors – General Considerations
PEDONC-9.2: Benign Bone Tumors
PEDONC-9.3: Osteogenic Sarcoma (OS)
PEDONC-9.4: Ewing Sarcoma Family of Tumors (ESFT), Including Primitive Neuroectodermal Tumors (PNET)

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PEDONC-9.1: Bone Tumors – General Considerations

These guidelines include both benign and malignant lesions.

- Bone tumors occur in both adult and pediatric patients, but some are more common in one age group than the other. Unless specified below, patients who are < 18 years old should be imaged according to this guideline section. Exceptions include:
  - Osteogenic sarcoma patients of all ages should be imaged according to guidelines in **PEDONC-9.3: Osteogenic Sarcoma (OS)**
  - Ewing sarcoma and primitive neuroectodermal tumor patients of all ages should be imaged according to guidelines in **PEDONC-9.4: Ewing Sarcoma and Primitive Neuroectodermal Tumors (ESFT).**
  - Chondrosarcoma patients of all ages should be imaged according to guidelines in **ONC-12.6: Bone Sarcomas – Initial Work-up/Staging**
  - Chordoma patients of all ages should be imaged according to guidelines in **ONC-12.6: Bone Sarcomas – Initial Work-up/Staging**
  - Giant cell tumor of bone and enchondroma patients of all ages should be imaged according to guidelines in **ONC-12.9: Benign Bone Tumors – General Considerations**
  - Other benign bone tumor patients of all ages should be imaged according to guidelines in **PEDONC-9.2: Benign Bone Tumors**

All bone tumors should be evaluated by plain x-ray prior to any advanced imaging.

PET does not reliably distinguish between benign and malignant bone tumors and should not be performed prior to biopsy.

End of PEDONC-9.1

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PEDONC-9.2: Benign Bone Tumors

- Osteochondroma
  - Plain x-ray appearance is diagnostic for the majority of patients and advanced imaging is generally unnecessary
  - MRI without and with contrast can be approved after evaluation by the operating surgeon for preoperative planning
  - MRI without contrast OR without and with contrast, as requested, is appropriate for patients with osteochondroma when there is clinical concern for malignant transformation based on new or worsening pain symptoms or a change on a recent plain x-ray
- Osteoid osteoma
  - CT without contrast is often the primary study when osteoid osteoma is suspected based on clinical history and plain film findings
  - Bone scan SPECT (CPT® 78803) is indicated for suspected osteoid osteoma
  - Some patients will require both CT without contrast as well as MRI without and with contrast to make a definitive diagnosis
- Other benign tumors
  - Variety of diagnoses, including osteoid osteoma, osteoblastoma, aneurysmal bone cysts, fibrous dysplasia, chondroblastoma and others,
  - Plain x-ray appearance is diagnostic for many benign bone tumors and advanced imaging is generally unnecessary except for preoperative planning
  - MRI without and with contrast is the primary modality for advanced imaging of bone tumors, and can be approved to help narrow differential diagnoses and determine whether biopsy is indicated
    - For certain tumors, CT (contrast as requested) provides better visualization of specific bony details, and requests after evaluation by the operating surgeon for preoperative planning should generally be approved
- Surveillance imaging, when indicated, should utilize plain x-ray
  - Some benign bone tumor types carry a risk of malignant degeneration over time, but routine advanced imaging surveillance has not been shown to improve outcomes for these patients
  - MRI without and with contrast can be approved to evaluate new findings on plain X-ray or new/worsening clinical symptoms not explained by a recent plain x-ray
- There are no data to support the use of PET in the evaluation of benign bone tumors, and PET requests should not be approved without biopsy confirmation of a malignancy.

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PEDONC-9.3: Osteogenic Sarcoma (OS)

Osteogenic Sarcoma Initial Staging:

- All bone tumors should be evaluated by plain x-ray prior to any advanced imaging
- MRI without and with contrast is the preferred primary site imaging
  - CT, contrast as requested, can be approved if there is a contraindication to MRI or if requested after evaluation by the operating surgeon to clarify inconclusive MRI findings for preoperative planning
  - MRA and/or CTA may rarely be indicated for complicated surgical resections, and can be approved after evaluation by the operating surgeon to clarify inconclusive MRI findings for preoperative planning
  - Requests for CT, MRA, or CTA should be forwarded for Medical Director review
- CT Chest with (CPT® 71260) *or* without contrast (CPT® 71250) is superior to PET/CT for the detection of pulmonary metastases, and is indicated in the initial workup of all suspected malignant bone tumors and should be completed prior to anesthesia exposure if possible
- Other staging imaging should be deferred until a histologic diagnosis is made, initially by biopsy, as definitive resection is usually performed after neoadjuvant chemotherapy
  - Distant bony metastases are rare in OS, but cause a significant change in treatment approach.
  - Whole body PET/CT (CPT® 78816) is the preferred study for initial staging of OS after histologic diagnosis is established
    - PET has superior sensitivity to bone scan (95% vs. 76%) but equivalent overall diagnostic accuracy (98% vs. 96%) for detection of bony metastases in pediatric OS
    - Nuclear bone scan (See **PEDONC-1.3: Modality General Considerations**) may be substituted for PET imaging if PET not available
    - If PET/CT is negative at initial diagnosis, bone scan (See **PEDONC-1.3: Modality General Considerations**) is preferred for asymptomatic surveillance for bony metastases at time points after local control surgery
- CT Abdomen and Pelvis with contrast (CPT® 74177) is not routinely indicated in the initial metastatic staging of pediatric OS, but can be approved in the following situations:
  - Evaluation of inconclusive PET findings
  - Primary site of abdomen or pelvis

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Osteogenic Sarcoma Treatment Response:

Most OS patients undergo restaging after 10 to 12 weeks of neoadjuvant chemotherapy prior to local control surgery to confirm the absence of progressive disease prior to the extended break necessary for postoperative healing.

- Restaging at this time point should include:
  - MRI without and with contrast of primary site
  - CT Chest with (CPT® 71260) *or* without contrast (CPT® 71250)
  - Whole body PET/CT (CPT® 78816) or bone scan (See **PEDONC-1.3: Modality General Considerations**)
- Following local control surgery, the following imaging guidelines should be used until the end of planned chemotherapy:
  - MRI without and with contrast of primary site ~6 weeks after surgical procedure and at the end of planned chemotherapy
  - Plain x-rays of the primary site and chest every 2 months
  - CT Chest (with *or* without contrast, as requested):
    - Measurable pulmonary metastases: every 6 weeks and at the end of planned chemotherapy
    - No measurable pulmonary metastases: every 4 months and at the end of planned chemotherapy
  - Bone scan (See **PEDONC-1.3: Modality General Considerations**) every 4 months and at the end of planned chemotherapy
    - Whole body PET/CT can be used in place of bone scan, if positive for distant bone metastases at initial diagnosis
- Patients with metastatic disease do not routinely undergo local control surgery unless metastatic disease has resolved with chemotherapy.
  - CT Chest with (CPT® 71260) *or* without contrast (CPT® 71250) can be performed every 2 cycles during treatment and at the end of planned chemotherapy
  - MRI without and with contrast of primary site can be performed every 2 cycles during treatment and at the end of planned chemotherapy
  - If previously positive for bony metastases, whole body PET/CT (CPT® 78816) or bone scan (See **PEDONC-1.3: Modality General Considerations**) every 2 cycles during treatment and at the end of planned chemotherapy
  - Imaging may be indicated more frequently around the time of surgical resection of primary or metastatic lesions to assess for resectability
- PET is generally not indicated during active treatment for recurrent pediatric cancer. In rare circumstances, PET imaging may be appropriate when results are likely to result in a treatment change for the patient, including a change from active treatment to surveillance. These requests will be forwarded for Medical Director review.

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Osteogenic Sarcoma Surveillance Imaging:

- Appendicular bone primary tumor site:
  - Plain x-rays of the primary tumor site should be completed every 3 months for 1 year, then every 4 months for 1 year, then every 6 months for 1 year, then annually for 2 years after completion of all therapy
  - MRI is not routinely indicated for surveillance imaging of appendicular primary sites but should be approved for the following:
    - The patient does not have an endoprosthesis that will cause MRI or CT artifact
    - To clarify inconclusive findings on plain x-ray
    - To evaluate significant pain symptoms suggestive of primary site recurrence
- Axial bone primary tumor site:
  - MRI without and with contrast of the primary tumor site can be approved every 3 months for 1 year, then every 4 months for 1 year, then every 6 months for 1 year, then annually for 2 years after completion of all therapy
- Metastatic disease surveillance:
  - Patients with localized OS:
    - CT Chest with (CPT® 71260) *or* without contrast (CPT® 71250) every 3 months for 1 year then every 4 months for 1 year after completion of all therapy
      - Chest X-ray (CXR) should be used for pulmonary recurrence surveillance after 24 months, and CT Chest can be approved to clarify inconclusive CXR findings
  - Patients with metastatic or recurrent OS:
    - CT Chest with (CPT® 71260) *or* without contrast (CPT® 71250) every 3 months for 1 year, then every 4 months for 1 year, then every 6 months for 1 year, then annually for 2 years after completion of all therapy
  - Nuclear bone scan (See **PEDONC-1.3: Modality General Considerations**) should be used for evaluation of distant bony metastases every 3 months for 1 year, then every 6 months for 2 years, then annually for 2 years after completion of all therapy
  - PET/CT has no established role for asymptomatic surveillance of OS, but can be approved in the following circumstances:
    - Conventional imaging reveals findings that are inconclusive or suspicious for recurrence and PET avidity will determine whether biopsy or continued observation is appropriate
    - Rare circumstances where obvious clinical symptoms show strong evidence suggesting recurrence and PET would replace conventional imaging modalities
    - Restaging after biopsy-confirmed recurrence
    - These requests will be forwarded for Medical Director review.

End of PEDONC-9.3

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PEDONC-9.4: Ewing Sarcoma Family of Tumors (ESFT), Including Primitive Neuroectodermal Tumors (PNET)

ESFT Initial Staging:

- All bone tumors should be evaluated by plainx-ray prior to any advanced imaging
- ESFT can also occur in the soft tissues, soft tissue masses without bony involvement that are ill-defined or non-discrete should be evaluated by limited ultrasound prior to any advanced imaging.
- MRI without and with contrast is the preferred primary site imaging
  - CT, contrast as requested, can be approved if there is a contraindication to MRI or if requested after evaluation by the operating surgeon to clarify inconclusive MRI findings for preoperative planning
  - MRI Chest without and with contrast is indicated for chest wall primary tumors, in addition to the CT Chest for pulmonary metastasis detection
  - MRA and/or CTA may rarely be indicated for complicated surgical resections, and can be approved after evaluation by the operating surgeon to clarify inconclusive MRI findings for preoperative planning
  - Requests for CT, MRA, or CTA should be forwarded for Medical Director review
- CT Chest with (CPT® 71260) *or* without contrast (CPT® 71250) is superior to PET/CT for the detection of pulmonary metastases, and is indicated in the initial workup of all suspected malignant bone tumors and should be completed prior to anesthesia exposure if possible
- Other staging imaging should be deferred until a histologic diagnosis is made, initially by biopsy, as definitive resection is performed after neoadjuvant chemotherapy
  - Bone and bone marrow metastases can occur in ESFT, and cause a significant change in treatment approach. PET/CT can replace bone scan and bone marrow biopsy in ESFT patients and is indicated in the initial staging of all ESFT patients after histologic diagnosis is established
    - Whole body PET/CT (CPT® 78816) is the preferred study for initial staging of ESFT
    - Bone scan (See **PEDONC-1.3: Modality General Considerations**) may be substituted for PET imaging if PET not available
    - If PET/CT is negative for bony metastases at initial diagnosis, bone scan (See **PEDONC-1.3: Modality General Considerations**) is preferred for asymptomatic surveillance at all-time points after completion of therapy
  - CT Abdomen and Pelvis with contrast (CPT® 74177) is not routinely indicated in the initial metastatic staging of pediatric ESFT, but can be approved in the following situations:
    - Evaluation of inconclusive PET findings
    - Primary site involving the abdomen or pelvis

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ESFT Treatment Response:

All ESFT patients undergo restaging after ~12 weeks of neoadjuvant chemotherapy prior to local control surgery to confirm the absence of progressive disease prior to the extended break necessary for postoperative healing.

- Restaging at this time point should include:
  - MRI without and with contrast of primary site
  - CT Chest with (CPT® 71260) *or* without contrast (CPT® 71250)
  - Whole body PET/CT (CPT® 78816) or bone scan (See **PEDONC-1.3: Modality General Considerations**)
- Following local control surgery, the following imaging guidelines should be used until the end of planned chemotherapy:
  - MRI without and with contrast of primary site 3 months after surgical procedure and at the end of planned chemotherapy
  - Plain x-rays of the primary site and chest immediately after local control then every 3 months
  - CT Chest with (CPT® 71260) *or* without contrast (CPT® 71250):
    - Measurable pulmonary metastases: every 6 weeks and at the end of planned chemotherapy
    - No measurable pulmonary metastases: every 3 months and at the end of planned chemotherapy
  - Whole body PET/CT (CPT® 78816) or bone scan (See **PEDONC-1.3: Modality General Considerations**) at the end of planned chemotherapy
- Patients with metastatic disease do not routinely undergo local control surgery unless metastatic disease has resolved with chemotherapy.
  - CT Chest with (CPT® 71260) *or* without contrast (CPT® 71250) can be performed every 2 cycles during treatment and at the end of planned chemotherapy
  - MRI without and with contrast of primary site can be performed every 2 cycles during treatment and at the end of planned chemotherapy
  - If previously positive for bony metastases, whole body PET/CT (CPT® 78816) or bone scan (See **PEDONC-1.3: Modality General Considerations**) every 2 cycles during treatment and at the end of planned chemotherapy
  - Imaging may be indicated more frequently around the time of surgical resection of primary or metastatic lesions to assess for resectability
- PET is generally not indicated during active treatment for recurrent pediatric cancer. In rare circumstances, PET may be appropriate when conventional imaging is inconclusive and results are likely to result in a treatment change for the patient, including a change from active treatment to surveillance. These requests will be forwarded for Medical Director review.

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ESFT Surveillance Imaging:

- Appendicular bone primary tumor site:
  - Plain x-rays of the primary tumor site should be completed every 3 months for 1 year, then every 4 months for 1 year, then every 6 months for 1 year, then annually for 2 years after completion of all therapy
    - MRI is not routinely indicated for surveillance imaging of these primary sites after completion of chemotherapy but should be approved for the following:
      - The patient does not have an endoprosthesis that causes MRI or CT artifact
      - To clarify inconclusive findings on plain x-ray
      - To evaluate significant pain symptoms suggestive of primary site recurrence
- Axial bone or any soft tissue primary site:
  - CT with contrast or MRI without and with contrast of the primary tumor site can be approved every 3 months for 1 year, then every 4 months for 1 year, then every 6 months for 1 year, then annually for 2 years after completion of all therapy
- Metastatic disease surveillance:
  - Patients with localized ESFT:
    - CT Chest with (CPT® 71260) *or* without contrast (CPT® 71250) every 3 months for 1 year then every 4 months for 1 year after completion of all therapy
      - Chest X-ray (CXR) should be used for pulmonary recurrence surveillance after 24 months, and CT Chest can be approved to clarify inconclusive CXR findings
  - Patients with metastatic or recurrent ESFT:
    - CT Chest with (CPT® 71260) *or* without contrast (CPT® 71250) every 3 months for 1 year, then every 4 months for 1 year, then every 6 months for 1 year, then annually for 2 years after completion of all therapy
  - Nuclear bone scan (See **PEDONC-1.3: Modality General Considerations**) should be used for evaluation of distant bony metastases every 3 months for 1 year, then every 4 months for 1 year, then every 6 months for 1 year, then annually for 2 years after completion of all therapy
  - PET/CT has no established role for asymptomatic surveillance of ESFT, but can be approved in the following circumstances:
    - Conventional imaging reveals findings that are inconclusive or suspicious for recurrence and PET avidity will determine whether biopsy or continued observation is appropriate
    - Rare circumstances where obvious clinical symptoms show strong evidence suggesting recurrence and PET would replace conventional imaging modalities
    - Restaging after biopsy-confirmed recurrence
    - These requests will be forwarded for Medical Director review.

End of PEDONC-9.4

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PEDONC-10: Pediatric Germ Cell Tumors

Malignant pediatric germ cell tumors commonly include one of four histologic subtypes (yolk sac tumor, choriocarcinoma, embryonal carcinoma, or mixed histology), but the overall treatment strategies are similar for all malignant germ cell tumors. Tumors can occur in testicular, ovarian or extragonadal primary locations.

- This section applies to primary germ cell tumors occurring outside the central nervous system in children who are ≤15 years old at the time of initial diagnosis. For patients who are >15 years old at diagnosis, the overall prognosis is inferior and these patients should be imaged according to adult guidelines in: **ONC-20: Testicular, Ovarian and Extragonadal Germ Cell Tumors** in the Oncology Imaging Guidelines.
- Sex cord stromal tumors (granulosa cell, theca, sertoli, and leydig tumors) are rare in pediatrics and should be imaged according to adult guidelines in: **ONC-20: Testicular, Ovarian and Extragonadal Germ Cell Tumors** in the Oncology Imaging Guidelines.
- For CNS germ cell tumors, use the imaging guidelines in: **PEDONC-4.7: CNS Germinomas and Non-Germinomatous Germ Cell Tumors (NGGCT)**.

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Pediatric GCT Initial Staging:

- Ovarian, testicular, and abdominal extragonadal GCT should have ultrasound and tumor markers (AFP, β-hCG) as initial evaluation
  - Mediastinal primary tumors should be evaluated by CT Chest with contrast
  - Ovarian masses that are <10 cm in size, have minimal or no visible solid component on ultrasound, and have normal tumor markers are almost universally benign teratomas or functional cysts and advanced imaging is not necessary unless ultrasound is insufficient for immediate preoperative planning.
- Once a primary mass suspected to be GCT is discovered, initial staging with CT Abdomen/Pelvis with contrast (CPT® 74177) is indicated prior to histologic confirmation
  - The degree of abdominal exploration and node sampling necessary for adequate staging is determined in part by imaging findings and is required for preoperative planning
  - Testicular primary tumors can defer abdominal imaging until after histologic confirmation at the discretion of the operating surgeon
  - MRI Abdomen and Pelvis without and with contrast (CPT® 74183 and CPT® 72197) can be approved to clarify inconclusive CT findings or for patients with a known contraindication to CT contrast
- CT Chest with contrast (CPT® 71260) is indicated in the initial workup of all pediatric GCT and should be completed prior to anesthesia exposure if possible
- MRI Brain without and with contrast (CPT® 70553) can be approved for patients with symptoms suggesting CNS metastases
- Nuclear bone scan (See **PEDONC-1.3: Modality General Considerations**) should be used for initial evaluation of bony metastases in patients with systemic symptoms or bone pain
- There has been no published evidence to date supporting the routine use of PET/CT in the evaluation of pediatric GCT
  - Additionally, PET has been found to have similar efficacy to CT imaging in initial staging of adults with non-seminomatous GCT (the majority of pediatric GCT are non-seminomatous)

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Pediatric GCT Treatment Response:

Patients with localized GCT are often cured with surgery alone and do not receive adjuvant therapy. These patients should be imaged using surveillance guidelines after surgery is completed.

Patients receiving adjuvant chemotherapy are usually treated with 4 to 6 cycles of combination chemotherapy.

- The primary method of response assessment is by tumor marker decrease
  - For patients with disease not completely resected at initial diagnosis, repeat imaging with CT Chest/Abdomen/Pelvis (CPT® 71260 and CPT® 74177) with contrast can be approved every 2 cycles (~every 6 weeks)
  - CT imaging may be indicated more frequently to assess for surgical resectability in patients who have received more than 4 cycles of chemotherapy
- CT Chest/Abdomen/Pelvis with contrast (CPT® 71260 and CPT® 74177) is indicated at the end of planned chemotherapy or following neoadjuvant chemotherapy for initially unresectable tumors
- Imaging of any metastatic sites should be approved every 2 cycles and at the end of planned therapy with the same modality used during initial staging
- PET as a marker of treatment response has been shown not to be predictive of patient outcomes in GCT and should not be approved
  - Suspicious lesions seen on conventional imaging should be biopsied to confirm active disease
  - Alternatively, a short-interval CT study can be approved if the relapse risk is determined to be low by the treating physician and biopsy would cause unnecessary morbidity for the patient

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Pediatric GCT Surveillance Imaging:

The primary method of surveillance in pediatric GCT is frequent assessment of serum tumor markers, unless tumor markers were not elevated at diagnosis.

- CT Chest/Abdomen/Pelvis with contrast (CPT® 71260 and CPT® 74177) should be approved for any clinically significant rise in tumor markers or symptoms suggesting recurrent disease
- CT Abdomen/Pelvis with contrast (CPT® 74177) can be approved every 6 months for 2 years then every 12 months for 3 years after completion of all therapy for patients with normal tumor markers at the time of diagnosis
- For stage I patients age 0-10 years treated with surgery only:
  - Chest X-ray (CXR) should be completed every 3 months for 1 year after completion of all therapy
    - CT Chest is indicated to evaluate abnormal CXR findings or if the primary tumor site was in the thoracic cavity
  - CT Abdomen/Pelvis with contrast (CPT® 74177) can be approved every 3 months for 1 year after completion of all therapy
- For stage I patients ages 11+ years treated with surgery only:
  - Chest X-Ray (CXR) should be completed every 4 months for 2 years, then every 6 months for 1 year, then every 12 months for 1 year after completion of all therapy
    - CT Chest is indicated to evaluate abnormal CXR findings or in lieu of CXR if the primary tumor site was in the thoracic cavity
  - CT Abdomen/Pelvis with contrast (CPT® 74177) can be approved every 4 months for 2 years, then every 6 months for 1 year, then every 12 months for 1 year after completion of all therapy
- For stage II-IV patients:
  - Chest X-ray (CXR) should be completed every 6 months for 2 years then every 12 months for 1 year after completion of all therapy
    - CT Chest is indicated to evaluate abnormal CXR findings or in lieu of CXR if a primary or metastatic tumor site was in the thoracic cavity
  - CT Abdomen/Pelvis with contrast (CPT® 74177) can be approved every 6 months for 2 years, then every 12 months for 1 year completion of all therapy
- Patients with brain or bone metastases should have surveillance imaging on the same schedule as the primary site imaging with the same modality used during initial staging.

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PEDONC-11: Pediatric Liver Tumors

PEDONC-11.1:Pediatric Liver Tumors – General Considerations
PEDONC-11.2: Hepatoblastoma
PEDONC-11.3:Pediatric Hepatocellular Carcinoma (HCC)

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PEDONC-11.1: Pediatric Liver Tumors – General Considerations

Note: *Some payors consider PET imaging to be experimental for the treatment of hepatobiliary tumors, and those coverage policies may supersede the recommendations for PET imaging in this section.*

Pediatric liver tumors primarily include hepatoblastoma and hepatocellular carcinoma, but hepatic germ cell tumors and primary hepatic sarcomas occur with some frequency. Tumormarkers are useful for initial evaluation as well as treatment response, particularly in hepatoblastoma. Early consideration of liver transplant may be undertaken in children and adolescents with unrespectable localized disease, provided that the disease remains confined to the liver.

- Primary hepatic germ cell tumors should follow imaging guidelines in: **PEDONC-10: Pediatric Germ Cell Tumors**.
- Primary hepatic sarcomas should follow imaging guidelines in: **PEDONC-8.3:Non-Rhabdomyosarcoma Soft Tissue Sarcomas (NRSTS)**.
- Imaging requests relating to liver transplant surgery and surveillance should follow guidelines in section **AB-42: Transplant** in the Abdomen Imaging Guidelines.

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PEDONC-11.2: Hepatoblastoma

Hepatoblastoma Initial Staging:

Hepatoblastoma occurs most commonly in very young children (median diagnosis age of 19 months). Most cases of hepatoblastoma are sporadic, but some are associated with genetic abnormalities, including Beckwith-Wiedemann syndrome, familial adenomatous polyposis, and trisomy 18.Most suspected liver tumors will have ultrasound and tumormarkers (AFP, β-HCG, CEA) as part of the initial evaluation.

- Ultrasound may be approved even after MRI or CT imaging in order to allow evaluation for tumor thrombus
- Once a primary liver mass is discovered, definitive imaging is indicated prior to histologic diagnosis, and may involve any of the following:
  - MRI Abdomen and Pelvis without and with contrast (CPT® 74183 and CPT® 72197) is preferred for evaluating tumor margins and vascular anatomy
    - CT Abdomen/Pelvis with contrast (CPT®74177)
    - Noncontrast imaging is not indicated due to the increased radiation exposure and limited additive benefit
  - Some tumors may require both MRI and CT during initial evaluation
  - MRA (CPT®74185) or CTA (CPT®74175) Abdomen are often indicated to evaluate vascular invasion
- CT Chest with (CPT® 71260) or without contrast (CPT® 71250) is indicated in the initial work-up of all pediatric liver tumors and should be completed prior to anesthesia exposure if possible
- MRIBrain without and with contrast (CPT® 70553) can be approved only for patients with symptoms suggesting CNS metastases
- Bone scan (See **PEDONC-1.3: Modality General Considerations**) should be used for initial evaluation of bony metastases only in patients with systemic symptoms or bone pain
- There has been no published evidence to date supporting the routine use of PET/CT imaging in the evaluation of pediatric hepatoblastoma
  - PET/CT should only be considered in very rare circumstances for preoperative planning when MRI and CT scans are insufficient for surgical decision making.
  - PET/CT should not be approved in lieu of biopsy of suspicious lesions
  - These requests will be forwarded for Medical Director review.

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Hepatoblastoma Treatment Response:

Patients with localized hepatoblastoma of pure fetal histology are often cured with surgery alone and do not receive adjuvant therapy. These patients should be imaged using surveillance guidelines after surgery is completed.

Patients receiving adjuvant chemotherapy are usually treated with 2 to 8 cycles of combination chemotherapy. Tumor marker decrease is important in response assessment but does not eliminate the need for advanced imaging in patients with unresected hepatoblastoma.

- For patients with disease not completely resected at initial diagnosis, the following can be approved every 2 cycles (~6 weeks) and at the end of planned therapy for all patients:
  - CT Chest with (CPT® 71260) *or* without contrast (CPT® 71250)
  - CT Abdomen/Pelvis with contrast (CPT® 74177) or MRIAbdomen and Pelvis without and with contrast (CPT® 74183 and CPT® 72197)
    - While the majority of patients will require abdomen and pelvis imaging at all time points, the pelvis imaging may be omitted at the discretion of the ordering physician based on the patient's specific clinical situation
    - MRA (CPT® 74185) or CTA (CPT® 74175) Abdomen are often indicated to evaluate vascular invasion
  - Imaging of any metastatic sites with the same modality used during initial staging
- Imaging may be indicated more frequently to assess for surgical resectability in patients who have received more than 4 cycles of chemotherapy.
- Abdominal ultrasound is indicated if tumor thrombus was detected at initial diagnosis
  - If no tumor thrombus was present, continued ultrasound evaluations are not indicated without a specific reason documented in the clinical records
- PET/CT should only be considered in very rare circumstances for preoperative planning when MRI and CT scans are insufficient for surgical decision making.
  - PET/CT should not be approved in lieu of biopsy of suspicious lesions.
  - These requests will be forwarded for Medical Director review.

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Hepatoblastoma Surveillance Imaging:

The primary method of surveillance in hepatoblastoma is frequent assessment of serum tumormarkers (primarily AFP).

- No specific imaging is indicated for surveillance in patients with an AFP of >100 ng/ml at diagnosis or recurrence.
  - CT Chest and Abdomen with contrast (CPT® 71260 and CPT® 74160) can be approved for any clinically significant rise in tumor markers or symptoms suggesting recurrent disease
- For patients with AFP ≤100 ng/ml at diagnosis or recurrence, the following imaging is appropriate:
  - CT Abdomen with contrast (CPT® 74160) should be completed every 3 months for 2 years then every 4 months for 2 years after completion of all therapy
  - ChestX-ray or CT Chest with contrast (CPT® 71260) should be completed every 3 months for 2 years then every 4 months for 2 years after completion of all therapy
  - Patients with brain or bone metastases should have surveillance imaging on the same schedule as the primary site imaging with the same modality used during initial staging.
- PET/CT has no documented role in the surveillance evaluation of pediatric hepatoblastoma

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PEDONC-11.3: Pediatric Hepatocellular Carcinoma (HCC)

Pediatric HCC Initial Staging:

HCC, including its rare histologically distinct variant fibrolamellar hepatocellular carcinoma (FL-HCC), occurs mostly in older children and adolescents. Despite recent advances in treatment, overall survival of pediatric HCC diagnosed in advanced stages remains exceedingly poor, with five-year survival of only 17% to 22% for all stages of pediatric HCC (and FL-HCC).Most suspected liver tumors will have ultrasound and tumor markers (AFP, β-HCG, CEA) as initial evaluation.

- Ultrasound may be approved even after MRI or CT imaging in order to allow evaluation for tumor thrombus.
- Once a primary liver mass is discovered, definitive imaging is indicated prior to histologic diagnosis, and may involve any of the following:
  - CT Abdomen/Pelvis with contrast (CPT® 74177)
  - MRIAbdomen and Pelvis without and with contrast (CPT® 74183 and CPT® 72197)
  - Some tumors may require both MRI and CT during initial evaluation
  - MRA (CPT® 74185) or CTA (CPT® 74175) Abdomen are often indicated to evaluate vascular invasion
- CT Chest with (CPT®71260) *or* without contrast (CPT® 71250) is indicated in the initial work-up of all pediatric liver tumors and should be completed prior to anesthesia exposure if possible
- MRI Brain without and with contrast (CPT® 70553) can be approved only for patients with symptoms suggesting CNS metastases
- Nuclear bone scan (See **PEDONC-1.3: Modality General Considerations**) should be used for initial evaluation of bony metastases only in patients with systemic symptoms or bone pain
- PET/CT should only be considered in very rare circumstances for preoperative planning when MRI and CT are insufficient for surgical decision making.
  - PET/CT should not be approved in lieu of biopsy of suspicious lesions
  - These requests require Medical Director review.

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Pediatric HCC Treatment Response:

The majority of hepatocellular carcinoma patients are treated with surgery alone and do not receive adjuvant therapy. Patients with successful upfront gross total resection should be imaged using surveillance guidelines after surgery is completed.

- For patients with disease not completely resected at initial diagnosis, the following can be approved every 2 cycles (~6 weeks) and at the end of planned therapy for all patients:
  - CT Chest with (CPT® 71260) *or* without contrast (CPT® 71250)
  - CT Abdomen/Pelvis with contrast (CPT® 74177) or MRI Abdomen and Pelvis without and with contrast (CPT® 74183 and CPT® 72197)
    - While the majority of patients will require abdomen and pelvis imaging at all time points, the pelvis imaging may be omitted at the discretion of the ordering physician based on the patient's specific clinical situation
    - MRA (CPT® 74185) or CTA (CPT® 74175) Abdomen are often indicated to evaluate vascular invasion
  - Imaging of any metastatic sites with the same modality used during initial staging
- Abdominal ultrasound is indicated if tumor thrombus was detected at initial diagnosis
  - If no tumor thrombus was present, continued ultrasound evaluations are not indicated without a specific reason documented in the clinical records
- PET/CT should only be considered in very rare circumstances for preoperative planning when MRI and CT scans are insufficient for surgical decision making.
  - PET/CT should not be approved in lieu of biopsy of suspicious lesions
  - These requests will be forwarded for Medical Director review.

Pediatric HCC Surveillance Imaging:

- CT Abdomen/Pelvis with contrast (CPT® 74177) can be completed every 3 months for 1 year then every 6 months for 1 year, then annually for 3 years after completion of all therapy
- Chest X-ray or CT Chest with contrast (CPT® 71260) should be every 3 months for 1 year then every 6 months for 1 year, then annually for 3 years after completion of all therapy
- Patients with brain or bone metastases should have surveillance imaging on the same schedule as the primary site imaging with the same modality used during initial staging.
- PET/CT has no documented role in the surveillance evaluation of pediatric hepatocellular carcinoma

End of PEDONC-11.3

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PEDONC-12: Retinoblastoma

PEDONC-12.1: Retinoblastoma – General Considerations

PEDONC-12.2: Retinoblastoma – Imaging

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PEDONC-12.1: Retinoblastoma – General Considerations

Retinoblastoma (RB) is primarily a disease of the infant and young child, and presents with leukocoria (loss of red reflex). About 75% of patients are diagnosed before the age of two years (bilateral RB presents at 12 months of age). Retinoblastoma can occur as heritable (25% of cases) or nonheritable (75%) disease. Heritable RB is associated with a germline mutation in the RB1 gene often resulting typically in bilateral disease. Individuals who carry the RB1 mutation also have increased risk of developing other cancers, such as osteosarcoma, soft tissue sarcomas, or melanoma. For more information on heritable retinoblastoma, see **PEDONC-2.12: Familial Retinoblastoma Syndrome.**

Detailed evaluation by a physician with significant training and/or experience in retinoblastoma (most commonly a pediatric ophthalmologist or pediatric oncologist) is indicated prior to considering advanced imaging.

Retinoblastoma can be unilateral, bilateral, or trilateral (involving the pineal gland). Extraocular spread of retinoblastoma is rare and generally confined to the brain.

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PEDONC-12.2: Retinoblastoma – Imaging

Retinoblastoma Initial Staging

- Tumor biopsy is NOT required prior to imaging
- MRI Orbits (CPT® 70543) and Brain (CPT® 70553) without and with contrast can be approved in the initial work-up of all patients with retinoblastoma
  - Brain imaging may be omitted or deferred at the discretion of the treating ophthalmologist or oncologist
- MRI Spine without and with contrast (Cervical-CPT® 72156, Thoracic-CPT® 72157, Lumbar-CPT® 72158) may be approved if there is evidence of CNS metastasis on:
  - Ophthalmologic exam
  - MRI Brain
  - Lumbar CSF cytology
- CT should generally be avoided in retinoblastoma patients under one year of age or with family history of retinoblastoma (heritable) due to substantially increased risks for secondary malignancy
  - CT Chest (CPT® 71260) and MRI Abdomen and Pelvis without and with contrast (CPT® 74183 and CPT® 72197) can be approved for patients with clinical symptoms to suggest metastatic disease
- CT Orbital (contrast as requested) and orbital ultrasound can be approved if ordered by the treating ophthalmologist for a specified indication
- Nuclear bone scan (See **PEDONC-1.3: Modality General Considerations**) is the preferred imaging modality for patients with systemic bone pain suggestive of bony metastases
- PET has no documented role in the evaluation of retinoblastoma

Retinoblastoma Treatment Response:

- MRI Orbits (CPT® 70543) and/or Brain (CPT® 70553) can be approved every 2 cycles (~ every 6 weeks) and at the end of planned therapy
- For patients with metastatic disease, imaging of known positive areas using the same modality at initial staging can be approved every 2 cycles (~6 to 8 weeks) and at the end of planned therapy

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Retinoblastoma Surveillance:

- The primary method of surveillance in retinoblastoma is examination under anesthesia (EUA), although some older children can be sufficiently evaluated by exam without anesthesia (EWA).
  - Surveillance using advanced imaging is generally not indicated for unilateral retinoblastoma after enucleation or exenteration, but can be approved for evaluation of specific clinical concerns.
  - Patients undergoing ocular salvage treatment approaches can have MRI Orbits (CPT® 70543) and Brain (CPT® 70553) approved every 6 months for 2 years following completion of therapy.
- Patients with bilateral retinoblastoma or germline mutation in RB1 are at increased risk for subsequent pineoblastoma, so MRI Brain without and with contrast (CPT® 70553) can be approved every 6 months for 5 years for the time of diagnosis with retinoblastoma
  - Routine MRI follow up for pineal disease is not currently supported by evidence in unilateral retinoblastoma patients without germline RB1 mutations

End of PEDONC-12.2

References – PEDONC-12

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PEDONC-13: Pediatric Nasopharyngeal Carcinoma

PEDONC-13.1: Pediatric Nasopharyngeal Carcinoma – General Considerations
PEDONC-13.2: Pediatric NPC – Imaging

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PEDONC-13.1: Pediatric Nasopharyngeal Carcinoma – General Considerations

Pediatric nasopharyngeal carcinoma (NPC) is rare in comparison to adult NPC but is responsible for up to 50% of nasopharyngeal cancers in children and has higher rates of aggressive type III EBV-associated histology than adult NPC.

Metastasis frequently occurs in cervical lymph nodes and retropharyngeal space. Distal metastasis usually appears in bones, lungs, mediastinum, and rarely, in the liver. In many patients, the initial presentation is a cervical adenopathy, and diagnosis is made with a lymph node biopsy.

Standard upfront treatment in pediatric NPC consists of 3 to 4 cycles of neoadjuvant chemotherapy followed by definitive chemoradiotherapy. Rare patients with lower stage disease may be treated with radiotherapy alone.

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PEDONC-13.2: Pediatric NPC – Imaging

Pediatric NPC Initial Staging:

Quantitative EBV DNA PCR should be measured at initial diagnosis, as it can serve as an effective tumor marker if elevated at initial diagnosis.

- MRI Brain without and with contrast (CPT® 70553) and MRI Neck without and with contrast (CPT® 70543) is indicated in the initial staging of all pediatric NPC patients
  - CT Head without and with contrast (CPT® 70470), CT Maxillofacial without and with contrast (CPT® 70488) and/or CT Neck with contrast (CPT® 70491) can be approved for patients with documented contraindication to MRI imaging **(avoidance of sedation should not be the sole reason)**
  - Skull base invasion is common in pediatric NPC and has a dramatic impact on prognosis, and is more easily recognized on MRI imaging
- CT Chest with contrast (CPT® 71260) is indicated in initial staging of all patients
- Whole body PET/CT (CPT® 78816) is approvable after histologic confirmation of NPC to evaluate for distant bony metastases
  - Bone scan (See **PEDONC-1.3: Modality General Considerations**) can be used for patients when PET/CT is unavailable

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Pediatric NPC Treatment Response:

- MRI Brain without and with contrast (CPT® 70553) and MRI Neck without and with contrast (CPT® 70543) are indicated for response assessment at the following time points:
  - Following completion of neoadjuvant chemotherapy
  - Following completion of chemoradiotherapy
- CT Chest with contrast (CPT® 71260) and whole body PET/CT (CPT® 78816) or bone scan (See **PEDONC-1.3: Modality General Considerations**) are indicated at the following time points:
  - Following completion of neoadjuvant chemotherapy only if positive at initial diagnosis
  - Following completion of chemoradiotherapy
- PET is generally not indicated during active treatment for recurrent pediatric cancer. In rare circumstances, PET may be appropriate when results are likely to result in a treatment change for the patient, including a change from active treatment to surveillance. These requests will be forwarded for Medical Director review.

Pediatric NPC Surveillance:

- MRI Brain without and with contrast (CPT® 70553) and MRI Neck without and with contrast (CPT® 70543) are indicated every 3 months for 1 year, then every 6 months for 2 years after completion of all planned therapy
- CT Chest with contrast (CPT® 71260) is indicated every 3 months for 1 year, then every 6 months for 2 years after completion of all planned therapy
- Whole body PET/CT (CPT® 78816) or bone scan (See **PEDONC-1.3: Modality General Considerations**) are not indicated for routine surveillance in asymptomatic patients but can be approved in the following situations:
  - Clarification of specified inconclusive findings seen on conventional imaging (should not replace biopsy)
  - Restaging to identify sites of disease when EBV PCR levels are abnormally high and conventional imaging is negative
  - Restaging after histologically confirmed recurrence of NPC
  - These requests will be forwarded for Medical Director review.

End of PEDONC-13.2

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References – PEDONC-13

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PEDONC-14: Pediatric Adrenocortical Carcinoma

PEDONC-14.1: Pediatric Adrenocortical Carcinoma – General Considerations
PEDONC-14.2: Pediatric ACC – Imaging

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PEDONC-14.1: Pediatric Adrenocortical Carcinoma – General Considerations

Pediatric Adrenocortical Carcinoma (ACC) is a rare but aggressive tumor, with fewer than 25 cases diagnosed each year. Most patients are diagnosed because of virilizing symptoms, Cushing syndrome, and rarely with feminization and hyperaldosteronism or detection on screening imaging recommended for specified cancer predisposition syndromes. The mainstay of treatment is surgery. Chemotherapy, adrenal suppression, and radiotherapy typically follow resection. See: **PEDONC-2: Screening Imaging in Cancer Predisposition Syndromes**

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PEDONC-14.2: Pediatric ACC – Imaging

Pediatric ACC Initial Staging:

- CT Abdomen without and with contrast (CPT® 74170) or MRI Abdomen without and with contrast (CPT® 74183) is indicated in the initial staging of all pediatric ACC patients
- CT Chest with contrast (CPT® 71260) is indicated in initial staging of all patients
- Nuclear bone scan (See **PEDONC-1.3: Modality General Considerations**) is indicated to evaluate for bony metastases in all patients at initial diagnosis
- PET has no documented role in the evaluation and treatment of pediatric ACC.

Pediatric ACC Treatment Response:

Many ACC patients are treated with surgery alone and do not receive adjuvant therapy. These patients should be imaged using surveillance guidelines after surgery is completed.

- For patients treated with chemotherapy, CT Abdomen without and with contrast (CPT® 74170) or MRI Abdomen without and with contrast (CPT®74183) is indicated for response assessment every 2 cycles (~6 weeks) during chemotherapy and following completion of all planned chemotherapy
- CT Chest with contrast (CPT® 71260) is indicated every 2 cycles (~6 weeks) during chemotherapy and following completion of all planned chemotherapy
- Nuclear bone scan (See **PEDONC-1.3: Modality General Considerations**) is indicated every 2 cycles (~6 weeks) during chemotherapy only if positive for distant metastases at initial diagnosis, and following completion of chemotherapy
- For patients treated with radiotherapy, CT Abdomen without and with contrast (CPT® 74170) or MRI Abdomen without and with contrast (CPT®74183) is indicated for response assessment at the completion of radiotherapy

Pediatric ACC Surveillance:

- CT Abdomen without and with contrast (CPT® 74170) or MRI Abdomen without and with contrast (CPT® 74183) is indicated every 3 months for 2 years, then every 6 months for 3 years after completion of all planned therapy
- Surveillance CT Chest is not indicated for patients with localized disease at diagnosis
- For patients with metastatic ACC, CT Chest with contrast (CPT® 71260) is indicated every 3 months for 2 years, then every 6 months for 3 years after completion of all planned therapy
- Nuclear bone scan (See **PEDONC-1.3: Modality General Considerations**) is indicated in all patients with suspected bone recurrence

End of PEDONC-14.2

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PEDONC-15: Pediatric Melanoma and Other Skin Cancers

Pediatric melanoma is historically rare, but has a steadily rising incidence, especially in adolescents and young adults (AYAs). Staging is assigned using the American Joint Committee on Cancer (AJCC) staging for adult melanoma. Most cases of melanoma arising in children and AYAs (~75%) are localized at diagnosis, and approximately 90% of patients with pediatric melanoma are amenable to radical excision. The clinical management of adolescents and young adults with melanoma is still challenging and evolving because it is difficult to diagnose, and there is no standard treatment.

Non-melanoma skin cancers (mostly basal cell carcinoma and squamous cell carcinoma) are extremely rare in pediatric patients. In many cases, predisposing factors such as prolonged immunosuppression, radiation therapy, chemotherapy, voriconazole use, or a combination of the factors are present, and established age-specific guidelines for management of these skin tumors do not exist.

Imaging guidelines and treatment approaches are consistent with those used for adults with melanoma and other skin cancers, and these patients should follow the imaging guidelines in section **ONC-5: Melanomas and Other Skin Cancers**.

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PEDONC-16: Pediatric Salivary Gland Tumors

The majority of pediatric salivary gland tumors arise in the parotid gland. Approximately 10 to 15% of tumors arise in the submandibular, sublingual, or minor salivary glands.

Roughly 75% of pediatric salivary gland tumors are benign, most commonly pleomorphic adenoma.

The most common malignant tumors occurring in the salivary glands are mucoepidermoid carcinoma, adenoid cystic carcinoma, acinic cell carcinoma, undifferentiated carcinoma, and rarely adenocarcinoma.

American Joint Committee on Cancer (AJCC) staging is used for pediatric as well as adult salivary gland tumors.

Imaging and treatment guidelines for malignant pediatric salivary gland tumors are consistent with those used for adults with salivary gland tumors, and these patients should follow the imaging guidelines in section **ONC-4: Salivary Gland Cancers**.

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PEDONC-17: Pediatric Breast Masses

Less than 1% of pediatric breast lesions are malignant, and advanced imaging is generally not recommended without histological confirmation of malignancy.

- Ultrasound (CPT® 76641 and CPT® 76642) is the primary and preferred modality used for evaluation of pediatric breast masses
- Mammography has limited utility in pediatric breast mass evaluation due to the high mammographic breast density in this age group, and the risk of the radiation exposure outweighs the benefit of this modality. As a result, mammography is NOT recommended for evaluation of pediatric or adolescent breast masses.
  - BI-RADS classification may overstate the risk of malignancy or need for biopsy in pediatric patients.
- MRI has very limited utility in evaluation of pediatric breast masses prior to biopsy, but may be indicated in rare cases for surgical planning when ultrasound is non-diagnostic.
  - All advanced imaging requests for pediatric breast masses should be forwarded for Medical Director review.
- Pediatric patients with confirmed breast cancer should be imaged according to section **ONC-11: Breast Cancer**.

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PEDONC-18: Histiocytic Disorders

PEDONC-18.1: Histiocytic Disorders – General Considerations
PEDONC-18.2: Langerhans Cell Histiocytosis (LCH)
PEDONC-18.3: Hemophagocytic Lymphohistiocytosis (HLH)
PEDONC-18.4: Non-Langerhans Cell Histiocytoses

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PEDONC-18.1: Histiocytic Disorders – General Considerations

The majority of histiocytic disorders occurring in the pediatric population are either Langerhans Cell Histiocytosis (LCH) or Hemophagocytic Lymphohistiocytosis (HLH).

The Non-Langerhans cell histiocytoses encompass a variety of diseases, and have limited imaging considerations except as specified later in this section.

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PEDONC-18.2: Langerhans Cell Histiocytosis (LCH)

Includes a heterogeneous group of disorders formerly known by other names, including histiocytosis X, eosinophilic granuloma, Letterer-Siwe Disease, Hand-Schuller-Christian Disease, and diffuse reticuloendotheliosis. LCH has a widely variable clinical presentation, ranging from single indolent lesions to disseminated multisystem disease.

Most common sites of involvement are skin, bones, liver, lung, and pituitary, though other sites are possible.

LCH Initial Imaging Studies:

- For all patients:
  - Chest X-ray (CXR)
  - Abdominal ultrasound (CPT® 76700)
  - Skeletal survey
    - PET should not be used to replace skeletal survey in LCH
- MRI Brain without and with contrast (CPT® 70553) for any of the following:
  - Headaches or visual or neurologic disturbances
  - Polyuria/polydipsia or other endocrine abnormalities
  - Skull or craniofacial (including jaw) bone involvement
  - Otorrhea or hearing loss (CT Temporal Bone may be substituted if requested)
  - Other signs or symptoms suggesting intracranial involvement, including neurodegeneration syndrome
- CT Chest with (CPT® 71260) *or* without contrast (CPT® 71250) for any of the following:
  - Abnormal CXR
  - Symptoms of pulmonary involvement and normal CXR
- MRI Abdomen without and with contrast (CPT® 74183) for any of the following:
  - Elevated liver function tests (usually > 5x upper limit of normal)
  - Abnormalities seen on abdominal ultrasound
  - CT Abdomen with contrast (CPT® 74160) can be substituted if requested by ordering physician to avoid general anesthesia
- MRI Spine without and with contrast (Cervical-CPT® 72156, Thoracic-CPT® 72157, Lumbar-CPT® 72158) for any of the following:
  - Vertebral lesions seen on skeletal survey
  - Clinical symptoms (including back pain) suggesting spinal involvement and negative skeletal survey
- Whole body PET/CT (CPT® 78816) for any of the following:
  - Multifocal bone involvement seen on skeletal survey
  - Bone pain and negative skeletal survey
  - Other clinical symptoms suggesting multisite disease
- Whole body Tc-99m bone scan (CPT®78306) can be approved in lieu of PET for the same indications if PET is unavailable

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LCH Treatment Response:

Patients with localized or single site disease are often treated only with local therapies or observed, and should be imaged according to surveillance guidelines

- Patients receiving systemic therapy will usually undergo treatment for ~12 months. Treatment response is assessed using any modalities showing disease at initial diagnosis after ~6 weeks of treatment.
  - Those with persistent measurable disease will usually be evaluated again after week 12 of therapy
    - Once PET/CT shows no remaining FDG-avid lesions, additional PET imaging is not indicated
    - As a general rule, both PET/CT and CT with contrast or MRI without and with contrast should not be approved for simultaneous treatment response evaluation without specific documentation showing that both are necessary
- Following the initial phase, patients can have treatment response evaluation every ~3 months while receiving active treatment.
  - Shorter interval imaging can be approved for documented signs or symptoms concerning for disease progression
- All patients should have the following studies at the end of planned therapy:
  - Chest X-ray (CXR)
  - Abdominal ultrasound (CPT® 76700)
  - Skeletal survey
  - Repeat of all additional imaging studies positive at initial workup (except PET)
- PET is generally not indicated during active treatment for recurrent pediatric cancer. In rare circumstances, PET may be appropriate when results are likely to result in a treatment change for the patient, including a change from active treatment to surveillance. These requests will be forwarded for Medical Director review.

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LCH Surveillance Imaging:

Surveillance imaging is determined by areas of disease involvement.

- Bone involvement
  - Plain x-ray of involved bony areas at 6 weeks, then at 3 and 6 months after completion of therapy
  - Additional films are not necessary unless symptoms suggest new or recurrent disease
  - PET is not indicated for surveillance, but can be considered to evaluate patients with recurrent disease
  - Skull or craniofacial (including jaw) bone involvement at diagnosis are at higher risk for CNS recurrence, and should be imaged according to CNS involvement section below
- Pulmonary involvement
  - CXR every 6 months after completion of therapy
    - CT Chest with (CPT® 71260) *or* without contrast (CPT® 71250) can be approved for new abnormalities on CXR or new pulmonary symptoms with a negative CXR
- CNS involvement
  - CNS LCH has a particularly high rate of refractory and recurrent disease, and requires longer imaging surveillance
  - MRI Brain without and with contrast (CPT® 70553) is indicated for patients with previously documented measurable intracranial lesions at 6 weeks, 3 months, and 6 months after completion of all therapy.
    - If negative at that time, continued surveillance is indicated at 1, 2, 4, 7, and 10 years after completion of all planned therapy
    - If residual measurable intracranial lesions are present at 6 months, imaging can be repeated every 3 months until negative or unchanged on two consecutive studies, at which time the schedule in the previous bullet should begin
  - MRI Brain without and with contrast (CPT® 70553) is indicated for patients with documented hypothalamic-pituitary dysfunction at 1, 2, 4, 7, and 10 years after completion of all planned therapy.
    - MRI can be approved at any time for worsening neurologic symptoms
  - Intraspinal lesions are rare, but should be imaged according to the same guidelines as brain imaging using MRI without and with contrast of all involved spine levels
- Liver involvement
  - Persistent liver involvement is rare, and imaging after completion of LCH therapy will be highly individualized depending on degree of liver dysfunction and plans for supportive therapy or liver transplant
  - Most patients with liver involvement will receive surveillance Abdominal ultrasound (CPT® 76700) every 6 months

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PEDONC-18.3: Hemophagocytic Lymphohistiocytosis (HLH)

Advanced imaging requests for HLH should be forwarded for Medical Director review.

There are no standard imaging studies required for the diagnosis and initial evaluation of HLH. Most cases are diagnosed with a combination of physical findings, laboratory testing, and bone marrow evaluation. Advanced imaging studies may be necessary to assess organ dysfunction as HLH commonly affects the liver, spleen, and bone marrow, and less commonly the kidneys, lungs, and brain

- Common studies that may be indicated in the initial evaluation of HLH include:
  - Abdominal ultrasound (CPT® 76700)
  - CT Abdomen and/or Pelvis (contrast as requested)
  - MRI Abdomen (CPT® 74183) and/or Pelvis (CPT® 72197) without and with contrast
  - CXR
  - CT Chest with contrast (CPT® 71260)
  - MRI Brain without and with contrast (CPT® 70553)

It is NOT required to perform ultrasound or plain film in a stepwise fashion if CT or MRI is planned as patients with HLH can deteriorate rapidly.

- There is no established standard role for PET in the diagnosis or treatment response evaluation of HLH
  - Secondary HLH is very difficult to treat if the primary cause is not concurrently treated
  - In these cases, if conventional imaging has been completed and is unrevealing, whole body PET/CT (CPT® 78816) can be considered for the purpose of identifying a site for tissue diagnosis of a primary source of infection or malignancy
  - If a malignancy is identified as the inciting factor for HLH, additional imaging decisions for that malignancy should be based on the appropriate diagnosis-specific guidelines

End of PEDONC-18.3

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PEDONC-18.4: Non-Langerhans Cell Histiocytoses

Includes diagnoses such as juvenile xanthogranuloma (JXG), sinus histiocytosis with lymphadenopathy (Rosai-Dorfman Disease, RDD), and Erdheim-Chester Disease (ECD).

In general, these are localized cutaneous or nodal disease without need for regular advanced imaging, but important exceptions are listed in this section.

Juvenile Xanthogranuloma (JXG):

- Generally involves only skin or cervical nodes, and involutes spontaneously, imaging of involved nodal areas may be appropriate using CT with contrast of appropriate area
- Systemic JXG is associated with multi-organ involvement and imaging studies may include:
  - MRI Brain (CPT® 70553) and/or Orbits (CPT® 70543) without and with contrast
  - CT Neck (CPT® 70491), Chest (CPT® 71260), and/or Abdomen (CPT® 74160) with contrast
- There is no established role for PET in the diagnosis or treatment of JXG

Rosai-Dorfman Disease (RDD):

Characterized by bulky adenopathy (usually cervical) with frequent systemic involvement

Appropriate imaging studies may include:

- MRI Brain (CPT® 70553) and/or Orbits (CPT® 70543) without and with contrast
- Nuclear bone scan (See **PEDONC-1.3: Modality General Considerations**)
- CT Neck (CPT® 70491), Chest (CPT® 71260) and/or Abdomen/Pelvis (CPT® 74177) with contrast
- There is no established role for PET in the diagnosis or treatment of RDD, but whole body PET/CT (CPT® 78816) may be approved if PET/CT will provide critical information for major treatment decision making that cannot be obtained using conventional imaging or biopsy.
  - Because of the paucity of evidence for PET in RDD, PET/CT should not be used to replace tissue confirmation for any clinical scenario in RDD.
  - These requests will be forwarded for Medical Director review.
- There is no established role for routine surveillance imaging of asymptomatic patients after treatment for RDD, but CT with contrast can be approved for evaluation of new or worsening clinical symptoms suggesting recurrent disease

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Erdheim-Chester Disease (ECD):

An aggressive histiocytic disorder with overall poor prognosis that is characterized by long bone involvement with frequent spread to multiple organs

ECD Initial Imaging Studies:

Appropriate imaging studies at initial diagnosis may include:

- MRI Brain (CPT® 70553) and/or Orbits (CPT® 70543) without and with contrast
- Nuclear bone scan (See **PEDONC-1.3: Modality General Considerations**)
- Whole body PET/CT (CPT® 78816)
- CT Neck (CPT® 70491), Chest (CPT® 71260) and/or Abdomen/Pelvis (CPT® 74177) with contrast
- CTA or MRA of Chest (CPT® 71275 or CPT® 71555) or Abdomen (CPT® 74175 or CPT® 74185) to evaluate vascular tree involvement
- Cardiac MRI without and with contrast (CPT® 75561)

ECD Treatment Response:

- Most patients will receive systemic therapy. Treatment response imaging can be approved every 3 months during active treatment using any modalities showing disease at initial diagnosis, including PET/CT.
  - Once PET/CT shows no remaining FDG-avid lesions, additional PET imaging is not indicated unless conventional imaging studies are inconclusive and acute treatment decisions will be made based on PET results. These requests will be forwarded for Medical Director review.

ECD Surveillance Imaging:

- Surveillance imaging can be approved every 3 months for the first year after completion of treatment, then every 6 months using any modalities showing disease at initial diagnosis.
- PET/CT is not supported for routine surveillance of ECD, but can be approved if conventional imaging is inconclusive for suspected recurrence. These requests will be forwarded for Medical Director review.

End of PEDONC-18.4

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PEDONC-19: Long Term Pediatric Cancer Survivors

PEDONC-19.1: Long Term Pediatric Cancer Survivors – General Considerations
PEDONC-19.2: Cardiotoxicity and Echocardiography
PEDONC-19.3: Second Malignant Neoplasms (SMN)
PEDONC-19.4: Osteonecrosis in Long Term Cancer Survivors

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PEDONC-19.1: Long Term Pediatric Cancer Survivors – General Considerations

This section applies to patients who have passed the end of the surveillance imaging period for their specific cancer, or 5 years after completion of therapy, whichever occurs first.

As these are long term survivors, many patients falling under this guideline section will have reached adult age. However, these guidelines relate specifically to late effects of childhood cancer treatment and should be applied to all long term childhood cancer survivors regardless of current age.

The Children's Oncology Group has published comprehensive guidelines for the management of long-term childhood cancer survivors, and these are available at: http://www.survivorshipguidelines.org.

A summary of cancer treatment should be available for all patients in this category and should generally include, at minimum:

- Type of cancer and stage
- Dates of diagnosis, recurrence, cancer-related surgeries, beginning and end dates of chemotherapy, radiotherapy, and/or stem cell transplant
- Protocol number used for treatment and cumulative chemotherapy drug dose exposures
- Cumulative radiation dose, fraction number, modality, and field exposure

Annual detailed history and complete physical examination is a critical component of cancer survivorship care and along with laboratory testing serves as the primary method of screening for the majority of late effects.

- Advanced imaging for asymptomatic screening is not routinely indicated except as specified in this section.
- Imaging requests related to new clinical signs or symptoms in a long term cancer survivor not explicitly covered in this section should be reviewed according to the guideline for the patient's cancer type or the relevant non-malignant clinical problem.

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PEDONC-19.2: Cardiotoxicity and Echocardiography

Exposure to cardiotoxic anthracycline chemotherapy agents is common in pediatric Oncology due to the high success rate of this drug class in the treatment of pediatric cancers. Screening echocardiography (CPT® 93306, CPT® 93307, or CPT® 93308) for life is indicated after exposure to anthracycline chemotherapy or cardiac exposure to radiotherapy.

Cardiotoxic drugs include the following:

- Doxorubicin
- Daunorubicin
- Idarubicin
- Epirubicin
- Mitoxantrone

Cardiac risk is assessed based on the age of the patient at the time of treatment initiation, the cumulative drug exposure expressed as doxorubicin equivalent mg/m^2, and the presence or absence of radiotherapy exposure to cardiac muscle.

SCREENING ECHOCARDIOGRAM INDICATIONS			
Age at time of Exposure	**Cumulative Doxorubicin Equivalent Dose**	**Cumulative radiation dose to cardiac muscle**	**Echocardiogram frequency**
All ages	None	None	None
0-0.99 years	≥250 mg/m^2	None	Annual
	0-249 mg/m^2	Any dose	Annual
	0-249 mg/m^2	None	Every 2 years
1-4.99 years	≥250 mg/m^2	Any dose	Annual
	0-249 mg/m^2	15+ Gy	Annual
		0-14.99 Gy	Every 2 years
	None	35+ Gy	Annual
		15-34.99 Gy	Every 2 years
		0-14.99 Gy	Every 5 years
5+ years	≥250 mg/m^2	Any dose	Every 2 years
	0-249 mg/m^2	15+ Gy	Every 2 years
		0-14.99 Gy	Every 5 years
	None	35+ Gy	Every 2 years
		15-34.99 Gy	Every 5 years
		0-14.99 Gy	None
All ages with known ventricular dysfunction			Annual

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- Stress echocardiography is not indicated as a screening study for anthracyclines cardiotoxicity in the absence of coronary artery disease symptoms. See **CD-1.4: Stress Testing with Imaging – Indications** for imaging guidelines.
- Female cancer survivors who are pregnant or planning to become pregnant:
  - If any of the following are present, echocardiogram is recommended as a baseline exam, repeated as needed during and immediately following pregnancy:
    - ≥250 mg/m2 cumulative doxorubicin equivalent exposure
    - ≥35 Gy chest radiotherapy
    - Any cardiotoxic drug exposure from the list above AND ≥15 Gy chest radiotherapy

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PEDONC-19.3: Second Malignant Neoplasms (SMN)

SMN—Breast Cancer

Clinical breast exam every 6 months supplemented with:

- Annual Breast MRI (CPT® 77049) and annual mammogram is recommended beginning at age 25 or 8 years after completion of radiotherapy (whichever occurs later) for patients receiving a cumulative radiation exposure of ≥ 20 Gy in the following fields for any pediatric cancer type except Wilms tumor:
  - Chest (thorax)
  - Whole lung
  - Mediastinal
  - Axilla
  - Mini-mantle, mantle, or extended mantle
  - Total (TLI) or subtotal (SLTI) lymphoid irradiation
  - Total body irradiation (TBI)
- Annual breast MRI (CPT® 77049) and annual mammogram is recommended beginning at age 25 or 8 years after completion of radiotherapy (whichever occurs later) for patients receiving ≥ 12 Gy of whole lung radiation for treatment of Wilms tumor

SMN – CNS Tumors

These are associated with radiation exposure to the brain and with neurofibromatosis.

- Routine surveillance of most completely asymptomatic patients with normal neurologic exams is not supported by evidence
  - MRI Brain without and with contrast (CPT® 70553) can be approved every 2 years after completion of radiotherapy for patients with NF1 or NF2
- MRI Brain without and with contrast (CPT® 70553) should be approved if requested for any patient with history of brain radiotherapy and new neurologic symptoms including simple headache
- MRI Cervical (CPT® 72156), Thoracic (CPT® 72157), and Lumbar spine (CPT® 72158) without and with contrast should be approved if requested for any patient with history of spine radiotherapy and new neurologic symptoms including change in quality of pain
  - MRI Spine can be performed with contrast only (Cervical-CPT® 72142, Thoracic-CPT® 72147, Lumbar-CPT® 72149) if being performed immediately following a contrast-enhanced MRI Brain
- For patients with history of brain radiotherapy and persistent neurologic symptoms, annual MRI Brain without and with contrast (CPT® 70553) can be approved
- For patients with history of spine radiotherapy and persistent neurologic symptoms, annual MRI Cervical (CPT® 72156), Thoracic (CPT® 72157), and Lumbar spine (CPT® 72158) without and with contrast can be approved
  - MRI Spine can be performed with contrast only (Cervical-CPT® 72142, Thoracic-CPT® 72147, Lumbar-CPT® 72149) if being performed immediately following a contrast-enhanced MRI Brain

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SMN—Colorectal Cancer

Colonoscopy is recommended every 5 years beginning at age 30 or 5 years after radiation exposure (whichever is later) for patients with ≥ 30 Gy radiation exposure to the following fields:

- Thoracic, Lumbar, Sacral, or Whole Spine
- Abdomen
- Pelvis
- Total Body Irradiation (TBI)

Colonoscopy is also recommended every 5 years beginning at age 30 or 5 years after radiation exposure (whichever is later) for patients with:

- Personal history of ulcerative colitis, GI malignancy, adenomatous polyps, or hepatoblastoma
- Familial polyposis
- Family history of colorectal cancer or polyps in a first degree (parent or sibling) relative

While the American Cancer Society recently added computed tomographic colonography (CTC) (AKA “Virtual Colonoscopy”) as an acceptable option for colorectal cancer screening of average-risk adults, the National Comprehensive Cancer Network and United States Preventive Services Task Force concluded that data was too premature to warrant its use in screening. ***Colonoscopy remains the preferred screening modality for survivors at highest risk of colorectal cancer.***

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PEDONC-19.4: Osteonecrosis in Long Term Cancer Survivors

Osteonecrosis is associated with corticosteroid, chemotherapy, and radiation exposure during treatment for ALL, NHL, and allogeneic HSCT in pediatrics. Osteonecrosis occurs primarily in hips, knees, and ankles and is frequently multifocal.

Osteoradionecrosis of the jaw can occur in patients receiving radiotherapy to the mandible or maxilla; those receiving ≥ 40 Gy are at highest risk. Although unusual, it can also occur in any bone without symptoms. It is rare in other disease types.

- Plain films of symptomatic areas are indicated prior to advanced imaging.
- Routine bone density screening using DEXA or Quantitative CT screening has not been well normalized in the pediatric population, but imaging can be approved for those with symptoms to suggest bone density issues
  - DEXA or Quantitative CT screening is generally not recommended until age 18 unless a specific intervention will be planned based on the imaging results.
- Serial advanced imaging is not indicated in osteonecrosis without specific documentation regarding how the advanced imaging will change current patient management
  - When advanced imaging is necessary for acute management decisions, MRI without contrast of the affected joint(s) can be approved.
  - Surveillance imaging of asymptomatic patients to detect osteonecrosis has not been shown to impact patient outcomes, and it is not standard to alter treatment based on imaging findings alone without symptoms.
    - Follow up MRI of incidentally discovered osteonecrosis findings in asymptomatic patients has not been shown to impact patient outcomes and is not necessary
- See **PEDONC-3.2: Acute Lymphoblastic Leukemia (ALL)** for information on imaging osteonecrosis in ALL patients during active treatment.

End of PEDONC-19.4

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