Pediatric Nuclear Medicine Procedures Check List

The nuclear medicine team works to assure that studies are conducted using the lowest radiation exposures that will ensure a proper examination with the maximum diagnostic yield. Not all the steps below may be applicable or possible in each case, depending on patient size, equipment, type of procedure and clinical situation.

- **General procedure checklist**

  - Ensure that all imaging equipment and radiopharmaceutical quality controls meet appropriate standards.

  - NM physician and the certified NM technologist verify that the patient problem and the requested nuclear medicine procedure are correctly aligned and that the study is justified. Verify that the side of the body of concern is indeed the correct side and location for study.

  - At the time of scheduling, determine if patient would require sedation for the procedure and make arrangements for appropriate personnel and facilities in advance.

  - Provide procedure explanation brochures to patients, families and referring physicians that can be mailed, placed in waiting rooms and, or posted on the hospital’s website. This will help familiarize the patients and families with procedures, prior to arriving to the nuclear medicine unit.

  - Determine if the patient requires any special precautions. Patient’s family or the inpatient floor is contacted in advance to provide instructions on appropriate procedure preparations (fasting, length of procedure, intravenous injection, bladder catheterizations, other routes of administration, medications, anticipated waiting time, etc.).

  - Technologist greets and properly identifies the patient according to hospital policy. He or she explains the procedure in detail and offers to answer any questions.

  - Review patient’s history including recent medications, previous imaging procedures, prior administration of radiopharmaceuticals, contrast materials, prior therapy including surgery and laboratory tests.

  - For all female patients in the reproductive age group, pregnancy and lactation status should be determined according to institutional policies.
If there are questions regarding radiation exposure or radiation risk, the nuclear medicine physician and/or medical imaging physicist should be available to answer any questions or concerns prior to the study.

The physician may see the patient and talk to the family to obtain additional clinical history as needed. The physician may do a limited, directed physical exam and verify that side of the body of concern is indeed the correct side and location for study to appropriately direct the imaging.

The patient is weighed and his or her height measured for the preparation of the appropriate radiopharmaceutical administered dose.

The quantity of radioactivity to be administered must be assayed. If specifically permitted by state or NRC regulations, facilities receiving diagnostic radiopharmaceuticals as unit administered activity (“unit dose”) need not perform direct measurement of the radioactivity but should perform a decay correction.

2014 Update of North American Consensus Guidelines for Pediatric administered Radiopharmaceutical activities. A physician may chose to prescribe a higher or lower dose depending on certain specific clinical circumstances.

For labeled blood products such as $^{99m}$Tc-RBC and $^{99m}$Tc-WBC, strict measures must be in place to ensure that the labeled blood is re-injected into the same patient from whom the blood was withdrawn.

The technologist and physician review the procedure to be performed and implement any patient/problem specific adaptations as needed.

Radiation safety checklist

During radiopharmaceutical handling and administration the technologist, assistive personnel and the physician should wear gloves and appropriate protective clothing (face mask as needed) and eyeglasses in case of unanticipated spraying or spillage of radiopharmaceuticals.

At all times, technologists and any assisting personnel should follow appropriate radiation safety practices (If necessary, consult Institutional Radiation Safety Manual).
At all times, all personnel dealing with radiopharmaceuticals should wear personnel radiation monitors including ring badges.

The radiopharmaceutical is prepared, assayed for radioactivity in the dose calibrator, placed in an appropriately shielded container (or a shielded syringe holder) and appropriately labeled with patient’s name, radiopharmaceutical name, volume, dose of activity and date and time of preparation.

Radiopharmaceuticals and any other substance given to the patient must be appropriately labeled on the syringe or container with the agent’s name, dose, volume, patient’s name, date, time and documented in the patient’s medical record. Documentation should include patient’s name, age, gender, weight, height, radiopharmaceutical dose, volume, route of administration, date and time of preparation, and any exceptions.

The radiopharmaceutical dose should be placed on a tray lined with absorbent material in case of unanticipated spillage. Such tray should contain any other materials that may be needed for radiopharmaceutical administration (saline syringe, alcohol swabs, gauze, tape, tubing, etc.).

Following tracer administration, the residual amount of tracer in the syringe (or container) should be measured in the dose calibrator. This value should be subtracted from the initial reading to determine the actual amount of activity given to the patient, which should be appropriately documented.

Following the procedure, the imaging room, imaging table, and equipment, should be checked for any radioisotope contamination and cleaned appropriately.

All materials should be disposed appropriately in radioactive waste and medical waste containers ensuring the sharps are also appropriately discarded.

Technologists and assistive personnel should monitor themselves for any radioactive contamination and decontaminate as needed.

Imaging checklist

Nuclear medicine imaging includes:
  - Static planar imaging
  - Dynamic planar imaging
☐ Single photon emission computed tomography (SPECT) or
☐ Positron emission computed tomography (PET)

☐ Prior to imaging ensure that the patient does not have any metallic objects on him or her or their clothing that can produce imaging artifacts.

☐ The radiopharmaceutical should be administered via the appropriate route of administration (intravenous, oral, catheter infusion, intradermal, inhalation, etc.).

☐ If needed, the patient should be supported with appropriate materials (sandbags, Velcro strips, etc.) to assist the patient in staying still during imaging.

☐ Determine if the study is a static, dynamic, SPECT or PET (see imaging specific check list below).

☐ The patient is taken to an injection room for static imaging or an imaging room for dynamic imaging.

☐ Once the study is completed, the technologist verifies that the study meets procedure standards and is of good quality (patient positioning, no motion artifacts, etc.).

☐ The physician reviews the study before the patient is discharged from the nuclear medicine unit to determine if the information obtained is sufficient to answer the clinical question. The physician may request additional imaging as necessary.

☐ The physician interprets the study and renders an appropriate report to the referring physician. The report should contain patient’s identification information, reason for the referral (indication of the study), radiopharmaceutical and other agents administered, administered activity, route of administration, explanation of the procedure, interpretation of results and impression.

☐ Planar imaging
  ☐ The scintillation camera should be peaked correctly

  ☐ When using two radionuclides in sequential studies, images from the lowest energy radionuclide should be obtained first.

  ☐ Select appropriate collimator.
Avoid the use of electronic magnification, as this does not increase image spatial resolution. If magnification is needed, consider a converging or pinhole collimator.

During dynamic imaging, the time per frame should be selected depending on the temporal resolution needed for the process being studied.

SPECT/SPECT CT imaging

- Acquisition matrix size should be at least 64 x 64 and preferably 128 x 128.

- For radiopharmaceuticals excreted primarily by the kidneys, the patient should be encouraged to void before image acquisition.

- Total imaging time should be less than 30-45 min to minimize patient motion.

- The number of stops or views should be equal to or greater than 60 (64)
  - for single head cameras when acquiring a 360-degree acquisition. At least
  - 30 (32) views should be obtained for 180 degree imaging. For high-resolution images, 120 (128) views would be used for a 360-degree acquisition and 60 (64) views would be used for 180-degree acquisition.

- Appropriate SPECT reconstruction using filtered back projection or preferably iterative reconstruction with resolution recovery.

- Employ attenuation correction whenever possible.

- Depending on the clinical task, the CT component of a SPECT/CT examination can be performed either for attenuation correction and attenuation correction/anatomic localization or as an optimized diagnostic CT scan.

- For optimal imaging of the body, the arms should be elevated over the head as tolerated. Important: carefully position the arms to avoid brachial nerve damage especially in sedated patients. For optimal imaging of the head and neck, the arms should be positioned along the sides.
- **18F-FDG PET or PET/CT imaging**
  - Check for fasting status and blood glucose level prior to injection of 18F-FDG. Glucose levels should be <200 mg/dl. If glucose is higher than 200mg/dl, consider rescheduling the study or employ methods to bring glucose level lower than 200mg/dl.

  - Place patient in a room at 25 degrees centigrade for 30 minutes prior to tracer administration to reduce brown adipose tissue uptake of FDG. Keep patient in this room at the same temperature after tracer injection and before imaging.

  - Inject patient in a quiet and dimly lit room with no talking/limit activity. Avoid aural and visual stimulation especially in brain studies.

  - Encourage patient to void prior to imaging. Imaging babies and young patients may require bladder catheterization in order to optimize imaging of the pelvis.

  - The CT component of a PET/CT examination can be performed either for attenuation correction, attenuation correction/anatomic localization or as an optimized diagnostic CT scan.

  - For optimal imaging of the body, the arms should be elevated over the head as tolerated. Important: carefully position the arms to avoid brachial nerve damage especially in sedated patients. For optimal imaging of the head and neck, the arms should be positioned along the sides.