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ACR PRACTICE GUIDELINE FOR THE PERFORMANCE OF CEREBRAL SCINTIGRAPHY FOR BRAIN DEATH

PREAMBLE

These guidelines are an educational tool designed to assist practitioners in providing appropriate radiologic care for patients. They are not inflexible rules or requirements of practice and are not intended, nor should they be used, to establish a legal standard of care. For these reasons and those set forth below, the American College of Radiology cautions against the use of these guidelines in litigation in which the clinical decisions of a practitioner are called into question.

The ultimate judgment regarding the propriety of any specific procedure or course of action must be made by the physician or medical physicist in light of all the circumstances presented. Thus, an approach that differs from the guidelines, standing alone, does not necessarily imply that the approach was below the standard of care. To the contrary, a conscientious practitioner may responsibly adopt a course of action different from that set forth in the guidelines when, in the reasonable judgment of the practitioner, such course of action is indicated by the condition of the patient, limitations on available resources or advances in knowledge or technology subsequent to publication of the guidelines. However, a practitioner who employs an approach substantially different from these guidelines is advised to document in the patient record information sufficient to explain the approach taken.

The practice of medicine involves not only the science, but also the art of dealing with the prevention, diagnosis,

alleviation and treatment of disease. The variety and complexity of human conditions make it impossible to always reach the most appropriate diagnosis or to predict with certainty a particular response to treatment. It should be recognized; therefore, that adherence to these guidelines will not assure an accurate diagnosis or a successful outcome. All that should be expected is that the practitioner will follow a reasonable course of action based on current knowledge, available resources, and the needs of the patient to deliver effective and safe medical care. The sole purpose of these guidelines is to assist practitioners in achieving this objective.

I. INTRODUCTION

Cerebral scintigraphy, using radiopharmaceuticals that localize in either the intracranial blood pool or the brain tissue itself, is a proven and useful procedure for confirming the clinical diagnosis of brain death in adult and pediatric patients. An understanding of the procedure, together with correlation with established clinical and legal criteria of brain death as prescribed by state law, is necessary. Adherence to the following guideline should maximize the diagnostic benefit of cerebral scintigraphy performed to evaluate brain death.

Application of this guideline should be in accordance with the [ACR Technical Standard for Diagnostic Procedures Using Radiopharmaceuticals](#).

(For pediatric considerations see Section V.)

II. GOAL

The goal of cerebral scintigraphy for brain death is to determine if there is cerebral blood flow.

III. INDICATIONS

Cerebral scintigraphy for brain death may be used to confirm the presence or absence of cerebral blood flow in the following situations:

1. As part of a standardized institutional protocol for establishing brain death.
2. In situations in which hypothermia or coma caused by barbiturates or other medication impedes evaluation by other modalities.
3. In other situations in which the referring and interpreting physicians agree that evidence for cerebral blood flow would be helpful.

Cerebral scintigraphy for brain death must not be used alone for diagnosis of brain death (see Section VIII).

IV. QUALIFICATIONS AND RESPONSIBILITIES OF PERSONNEL

See the [ACR Technical Standard for Diagnostic Procedures Using Radiopharmaceuticals](#).

V. SPECIFICATIONS OF THE EXAMINATION

A. Radiopharmaceuticals

1. Brain-avid agents: Technetium-99m hexamethyl propylene amine oxime (exametazime) (HMPAO) or technetium-99m ethyl cysteinate dimer (ECD), in an administered activity of up to 30 millicuries (1,110 MBq) for adults, is used. Administered activity for children and infants should be reduced based on weight or body surface area; the minimum administered activity is 3 millicuries. Careful adherence to package insert and quality control instructions with HMPAO and ECD is particularly important to ensure optimal image quality.
2. Agents excluded by a normal blood-brain barrier: Technetium-99m as pertechnetate, diethylenetriamine penta-acetic acid (DTPA) or glucoheptonate. Administered activities of up to 25 millicuries (925 MBq) are used for adults. Administered activity for children should be reduced as specified in V. A.1.

B. Patient

Prior to setting up the scintillation camera, the team performing the study should evaluate a number of patient factors. If the bed or patient must be moved, the team must avoid placing undue tension or compression on life support lines. Caution must be taken when placing the camera head to avoid compromising any of those lines or transcalvarial cerebrospinal fluid pressure monitors. Injection of the radiopharmaceutical must be made directly into a vein or through an intravenous (IV) line that is not being used for infusion of vasoactive medications or transfusion of blood. If available, a central venous line is preferable for injection. A tourniquet may be placed around the scalp from the supra orbital to occipital regions.

C. Examination

1. Agents excluded by a normal blood-brain barrier: Preinjection confirmation of proper positioning of the patient's head, X-Y orientation of the camera head, pulse height analyzer energy and window settings, CRT intensity, formatter sequencing, and readiness of the film cassette and/or computer settings is recommended. Patency of the IV line should also be checked using a saline flush.

After the position of the patient, the camera, the orientation, and the patency of the IV line are checked, the dose of the radiopharmaceutical is administered in a small volume followed by a saline push. The computer is set for at least a one-minute dynamic acquisition at one second per frame. The dynamic acquisition is started immediately following the injection of the radiopharmaceutical in a bolus form. A static anterior image of the head is obtained for 300,000-500,000 counts immediately thereafter. Lateral, posterior, and submental vertex images may be obtained.

2. Brain-avid agents: Dynamic flow as described above is optional for brain-avid agents. Imaging beginning 15-60 minutes after injection for 500,000-1,000,000 counts in the anterior view is recommended. Lateral and posterior images are obtained as needed. Single-photon emission computed tomography (SPECT) imaging may be useful if clinically indicated.

VI. EQUIPMENT SPECIFICATIONS

Instrument: Any gamma camera equipped with a low-energy, all-purpose/general all-purpose (LEAP/GAP) or

high-resolution collimator may be used. Computer acquisition of data allows salvage of an examination if errors of film density or framing occur.

VII. DOCUMENTATION

Reporting should be in accordance with the [ACR Practice Guideline for Communication: Diagnostic Radiology](#).

VIII. OTHER CONSIDERATIONS

The President's Council on Brain Death (1982) determined that of the four examinations available to establish the presence or absence of brain death, two (clinical examination and properly performed four-vessel cerebral angiography) are diagnostic and two (electroencephalography and cerebral scintigraphy) are confirmatory. Thus, one may confirm but not diagnose brain death with cerebral scintigraphy.

A technically adequate study is mandatory for interpretation. In the case of the blood-flow study, absence of demonstrable intracranial arterial perfusion on a technically adequate study confirms the clinical diagnosis of brain death.

For studies performed with brain-avid agents, absence of demonstrable radionuclide activity within the brain confirms the clinical diagnosis of brain death.

IX. QUALITY CONTROL AND IMPROVEMENT, SAFETY, INFECTION CONTROL, AND PATIENT EDUCATION CONCERNS

Policies and procedures related to quality, patient education, infection control, and safety should be developed and implemented in accordance with the ACR Policy on Quality Control and Improvement, Safety, Infection Control, and Patient Education Concerns appearing elsewhere in the ACR Practice Guidelines and Technical Standards book.

Equipment performance monitoring should be in accordance with the [ACR Technical Standard for Medical Nuclear Physics Performance Monitoring of Nuclear Medicine Imaging Equipment](#).

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