# MEDICAL POLICY

| MEDICAL POLICY DETAILS | |
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| **Medical Policy Title** | **CT (COMPUTED TOMOGRAPHY) PERFUSION IMAGING OF THE BRAIN** |
| **Policy Number** | **6.01.37** |
| **Category** | **Technology Assessment** |
| **Effective Date** | **12/18/08** |
| **Revised Date** | **12/17/09, 03/17/11, 05/19/11, 05/24/12, 05/23/13, 05/22/14, 06/18/15, 02/18/16, 02/16/17, 02/15/18, 02/21/19, 02/20/20** |
| **Product Disclaimer** | • *If a product excludes coverage for a service, it is not covered, and medical policy criteria do not apply.*<br>• *If a commercial product (including an Essential Plan product) or a Medicaid product covers a specific service, medical policy criteria apply to the benefit.*<br>• *If a Medicare product covers a specific service, and there is no national or local Medicare coverage decision for the service, medical policy criteria apply to the benefit.* |

## POLICY STATEMENT

I. Based upon our criteria and review of the peer-reviewed literature, computed tomography (CT) perfusion imaging for assessing patients suspected of having an acute stroke (less than six hours) or in triaging patients with stroke for interventional revascularization is considered **medically appropriate**.

II. Based upon our criteria and review of the peer-reviewed literature, CT perfusion imaging has not been medically proven to be effective and, therefore, is considered **investigational** for all other indications.

*Refer to Corporate Medical Policy #11.01.03 Experimental or Investigational Services.*

## POLICY GUIDELINES

The Federal Employee Health Benefit Program (FEHBP/FEP) requires that procedures, devices or laboratory tests approved by the U.S. Food and Drug Administration (FDA) may not be considered investigational and, thus, these procedures, devices or laboratory tests may be assessed only on the basis of their medical necessity.

## DESCRIPTION

Perfusion imaging using CT is proposed to provide detailed study of cerebral blood flow (CBF), which may assist in identification of ischemic regions of the brain, especially within the first few hours of an acute stroke. The technique requires either a diffusible inert gas indicator such as xenon (Xe) or a non-diffusible indicator such as an iodinated contrast agent. The CT scanner is then used to capture images as the agent accumulates in cerebral tissues. The technique tracks transient attenuation changes in the blood vessels and brain parenchyma during the first pass of an intravenously injected contrast medium. Results of CT perfusion studies allow calculation of regional cerebral blood volume (CBV), mean transit time (MTT), and regional cerebral blood flow (CBF). Proposed advantages of CT perfusion imaging are that it is less invasive than angiography and more widely available than magnetic resonance imaging (MRI).

Three CT perfusion imaging approaches use different data acquisition and analysis methods. *Whole brain CT perfused blood volume* is assessed by a helical scan through the whole brain with and without contrast. *First pass perfusion CT* (bolus tracking CT perfusion study) acquires repeated images at the same location through a volume of interest during bolus injection and passage of contrast through the region of interest. *Dynamic perfusion CT* acquires a temporal set of images through an extended volume of interest (imaging of tissue beyond the absolute width of the detector array) during a bolus injection of contrast.

## RATIONALE

Several post-processing software packages have received 510(k) marketing clearance from the FDA for use with a CT system, to perform perfusion imaging, e.g., the GE Medical Systems *CT Perfusion 4* (March 2006), the Philips Medical Systems *Brain Perfusion Option* (Feb. 2004) and the Siemens Medical Solutions *syngo Perfusion-CT* (Dec. 2003).

The Agency for Healthcare Research and Quality (AHRQ) published a report on acute stroke in 2005. It addressed multiple issues regarding CT perfusion and also angiography in terms of how these modalities affect the use of thrombolytic therapy for acute ischemic stroke. The report indicated that studies with prospective use of CT perfusion and angiography techniques in patient selection for thrombolysis were not identified.

The American Heart Association (AHA)/American Stroke Association (ASA)/American Academy of Neurology (AAN) published guidelines for Early Management of Adults with Ischemic Stroke in January 2013. The "Early Diagnosis, Brain and Vascular Imaging" section of the guidelines states that it is agreed that emergency, non-contrast-enhanced CT scanning of the brain accurately identifies most cases of intracranial hemorrhage and helps discriminate nonvascular causes of neurological symptoms, such as a brain tumor. That section also states that recent technological advances have led to increased interest in more sophisticated multimodal approaches to acute stroke imaging. Multimodal CT approaches may include non-contrast CT, perfusion CT, and CT angiography (CTA) studies. *Whole brain perfusion CT* provides a map of cerebral blood volume (CBV), and it is postulated that regions of hypoattentuation on these CBV maps represent the ischemic core. Although this technique has the advantage of providing whole-brain coverage, it is limited by its inability to provide measures of cerebral blood flow or mean transit time. *Dynamic perfusion CT* has the potential to provide absolute measures of cerebral blood flow, mean transit time, and CBV. This technique is limited to four to eight brain slices and provides incomplete visualization of all pertinent vascular territories, although newer (320-slice) CT machines can provide whole-brain coverage with this technique.

AHA/ASA (multimodal CT section) concluded that these techniques have the advantage of relatively rapid data acquisition and can be performed with conventional CT equipment. Disadvantages include iodine contrast and additional radiation. The role of perfusion CT and CTA in making acute treatment decision has not yet been established.

The AHA concluded that the usefulness of vascular imaging for predicting responses to treatment before intravenous administration of thrombolytic agents has not been demonstrated. AHA Class I recommendations state that multimodal CT and MR may provide additional information that will improve diagnosis of ischemic stroke. Class II recommendations state that CT perfusion and MRI perfusion and diffusion imaging, including measures of infarct core and penumbra, may be considered for the selection of patients for acute reperfusion therapy beyond the time windows for intravenous fibrinolysis. These techniques provide additional information that may improve diagnosis, mechanism, and severity of ischemic stroke and allow more informed clinical decision-making.

The AHA published Recommendations from Imaging of Acute Ischemic Stroke: A Scientific Statement in 2009, which concluded that, for patients beyond three hours from onset of symptoms, either magnetic resonance-diffusion weighted imaging (MR-DWI) or CTA-SI should be performed, along with vascular imaging and perfusion studies, particularly if mechanic thrombectomy or intra-arterial thrombolytic therapy is contemplated (Class I, LOE: A).

Although current studies consist mainly of small case studies, there is growing evidence that perfusion imaging provides information on the volume of salvageable tissue to allow for treatment decisions beyond the three-hour time window. As results of prospective randomized trials become more available, the indications for perfusion imaging of acute stroke patients will likely increase.

The guidelines published by the AHA and ASA in 2012 for the management of aneurysmal subarachnoid hemorrhage recommend that perfusion imaging with CT or MR can be useful in identifying regions of potential brain ischemia (Class IIa; Level of Evidence B). The guidelines state that there are emerging data that perfusion imaging, demonstrating regions of hypoperfusion, may be more accurate for identification of delayed cerebral ischemia than anatomic imaging of arterial narrowing or changes in blood flow velocity by transcranial Doppler. The guidelines concluded that CT perfusion is a promising technology, although repeat measurements are limited by the risks of dye load and radiation exposure.

The American College of Radiology (ACR) and American Society of Neuroradiology (ASNR)Published an ACR/ASNR practice guideline (October 2012) for performance of CT perfusion in neuroradiologic imaging. The guidelines state that *brain primary indications* for perfusion CT in neuroradiology include, but are not limited to: differentiating salvageable ischemic penumbra from unsalvageable ischemic core, distinguishing benign oligemia from true "at-risk" ischemic penumbra, helping identify patients most likely to benefit from thrombolysis or thrombectomy, predicting hemorrhagic transformation in acute ischemic stroke, and identifying patients with malignant profiles, suspected vasospasm-related cerebral ischemia and infarction and/or delayed cerebral ischemia (DCI) following aneurysmal subarachnoid hemorrhage, and cerebral hemorrhage with secondary local ischemia. *Brain secondary indications* are: follow-up of acute cerebral ischemia or infarction and/or reperfusion in the subacute or chronic phase of recovery, to assist in planning and evaluating the effectiveness of therapy for cervical or intracranial arterial occlusive disease (as an isolated test or in combination with a cerebrovascular reserve challenge) and/or chronic cerebral ischemia, identifying cerebral hyperperfusion syndrome following revascularization, detection of crossed cerebellar diaschisis in acute ischemic stroke, contrast delay as a predictor of new incident infarct, CT perfusion scanning may also be helpful in the setting of acute traumatic brain injury, the setting of acute seizures, and the assessment of neoplastic disease and in patients with contraindication to MRI–based perfusion imaging or with devices or material in or close to the field of view that would result in nondiagnostic MRI scans. *Head and neck primary indications* include: evaluation of the vascular status of solid tumors where MRI is degraded due to susceptibility artifact from air-containing spaces or from surgical clips or dental work. *Head and neck secondary indications* include*:* follow-up of tumor response to therapy.

Perfusion CT in Brain Tumors

The standard for tumor grading is a histopathologic assessment of tissue. Limitations of histologic assessment include sampling error due to regional heterogeneity and interobserver variation. These limitations can result in inaccurate classification and grading of gliomas. Because malignant brain tumors are characterized by neovascularity and increased angiogenic activity, perfusion imaging has been proposed as a method to assess tumor grade and prognosis. Dynamic contrast-enhanced MRI (DCE-MRI) is the preferred technique, because there is no radiation exposure and a good signal-to-noise ratio. Perfusion CT may be an alternative choice for glioblastoma patients with DCE-MRI examination contraindications. Potential advantages, compared with MR perfusion, include the wider availability, faster scanning times, and lower cost. CTP imaging may also be used to distinguish recurrent tumor from radiation necrosis.

## CODES

- *Eligibility for reimbursement is based upon the benefits set forth in the member's subscriber contract.*
- *CODES MAY NOT BE COVERED UNDER ALL CIRCUMSTANCES. PLEASE READ THE POLICY AND GUIDELINES STATEMENTS CAREFULLY.*
- *Codes may not be all inclusive as the AMA and CMS code updates may occur more frequently than policy updates.*

**CPT Codes**

| Code | Description |
|---|---|
| 0042T | Cerebral perfusion analysis using computed tomography with contrast administration, including post-processing of parametric maps with determination of cerebral flood flow, cerebral blood volume, and mean transit time. |



**HCPCS Codes**

| Code | Description |
|---|---|
| No code | |

**ICD10 Codes**

| Code | Description |
|---|---|
| I63.0-I63.9 | Cerebral infarction (code range) |

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*Key Article

## KEY WORDS

Dynamic Perfusion CT, Multimodal CT, PCT, Perfusion CT, Xenon-enhanced CT, XeCT.

## CMS COVERAGE FOR MEDICARE PRODUCT MEMBERS

There is currently no National Coverage Determination (NCD) or Local Coverage Determination (LCD) for CT perfusion imaging.

There is currently a Local Coverage Determination (LCD) for Category III CPT® Codes. Please refer to the following LCD website for Medicare Members: https://www.cms.gov/medicare-coverage-database/details/lcd-details.aspx?LCDId=33392&ver=98&CntrctrSelected=298*1&Cntrctr=298&s=41&DocType=1&bc=AAgAAAQBAAAA&

There is currently a Local Coverage Article (LCA) for Category III CPT® Codes. Please refer to the following LCA website for Medicare Members: https://www.cms.gov/medicare-coverage-database/details/article-details.aspx?articleId=56195&ver=21&LCDId=33392&ContrId=298&ContrVer=1&CntrctrSelected=298*1&Cntrctr=298&s=41&DocType=1&bc=AAgAAAQAgAAA&