



CIGNA MEDICAL COVERAGE POLICY

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**Subject Cerebral Perfusion Analysis
Using Computed Tomography**

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Coverage Policy Number 0442

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Coverage Policy

CIGNA covers cerebral perfusion analysis using computed tomography (CT) as medically necessary for the emergent evaluation of suspected acute stroke when thrombolytic therapy is being considered.

CIGNA does not cover cerebral perfusion analysis using CT for any other indications because they are considered experimental, investigational or unproven.

General Background

An urgent brain computed tomography (CT) or magnetic resonance imaging (MRI) scan is widely recommended for all patients with suspected acute stroke or transient ischemic attack. Non-contrast CT is most commonly used for this purpose because this imaging modality is more widely accessible and available than MRI. It is considered to be the gold standard for excluding intracranial hemorrhage in the acute setting. Combined multimodal parenchymal, perfusion and vascular imaging with CT and MRI are proposed to identify patients with an ischemic penumbra that might be amenable to acute reperfusion therapies.

Perfusion CT allows qualitative and quantitative evaluation of cerebral perfusion by generating maps of cerebral blood flow (CBF), cerebral blood volume (CBV), and mean transit time (MTT). Specifically, CT perfusion imaging has been proposed as a method of evaluating patients suspected of having an acute stroke with the goal of

distinguishing infarcted tissue from the penumbra. The latter tissue may be salvageable with the administration of thrombolytic agents, while irreversibly damaged tissue will not benefit from reperfusion and may be at increased risk of hemorrhage after thrombolytic therapy. Conventional unenhanced head CT remains the primary imaging modality used to evaluate patients presenting with stroke symptoms, to help exclude intracranial hemorrhage and detect signs of brain ischemia. Other proposed indications for perfusion CT include for evaluation of vasospasm after subarachnoid hemorrhage, head injury and intracranial neoplasm. Digital subtraction angiography is still considered the gold standard for the diagnosis of subarachnoid hemorrhage and vasospasm. Other techniques to measure cerebral perfusion include xenon CT, SPECT, PET, and perfusion-weighted MR imaging. A current disadvantage of perfusion CT is restricted anatomic coverage. MRI offers whole brain coverage. However, the many contraindications to MRI in acute stroke patients, such as difficulty scanning patients on monitors or ventilators, presence of pacemakers or implantable defibrillators, aspiration with long periods supine, and inability to obtain a history to rule out metallic implants, do not exist with CT.

U.S. Food and Drug Administration (FDA)

Perfusion CT post-processing software packages are FDA approved as Class II devices. They are “accessory to computed tomography system” devices.

Literature Review

Suspected Acute Stroke: Evidence in the published, peer-reviewed scientific literature suggests that cerebral perfusion imaging such as CT and MRI can assist in diagnosing stroke and distinguishing between infarct and penumbra or tissue at risk, thus targeting optimal patients for reperfusion therapies (Lin, et al., 2009; Tan, et al., 2007; Wintermark, et al., 2007; Parsons, et al., 2007; Thomalla, et al., 2006; Furlan, et al., 2006; Murphy, et al., 2006; Wintermark, et al., 2006a; Schaefer, et al., 2006; Albers, et al., 2006; Wintermark, et al., 2005; Hacke, et al., 2005; Wintermark, et al., 2002a; Wintermark, et al., 2002b; Lev, et al., 2001, Klotz and König, et al., 1999). Compared with follow-up imaging (obtained a median of four days after initial imaging) as the gold standard, perfusion CT is reported to have an accuracy of 92.9% and non-enhanced CT an accuracy of 80.6%, in diagnosing acute stroke (Tan, et al., 2007). Normal appearing regions on non-enhanced CT when assessed with perfusion CT may be: irreversibly ischemic (reduced CBV); or be hypoperfused and at risk of progression to infarction (normal or increased CBV); or not hypoperfused at all. For this reason, perfusion CT provides improved predictive accuracy over non-enhanced CT alone. Quantitative perfusion CT assessment may allow stratification of the risk of infarction from almost certain (hypoperfused with reduced CBV) to zero (no hypoperfusion). In between these extremes, there is tissue at risk of progression to infarction, and the level of risk depends both on CBV level and whether subsequent major reperfusion occurs (Parsons, et al., 2007).

Suspected Vasospasm After Subarachnoid Hemorrhage (SAH): Transcranial Doppler ultrasonography (TCD) is routinely used to diagnose vasospasm. The measurement of CBF may identify patients at risk for cerebral ischemia by guiding therapeutic decisions and monitoring response to therapy. Various methods have been studied to measure cerebral perfusion, including perfusion CT, PET, SPECT, and xenon CT. Studies in the published, peer-reviewed, scientific literature are in the form of small case series and small observational studies and they do not demonstrate that cerebral perfusion CT improves long-term patient outcomes compared to the current diagnostic work-up methodology of TCD and conventional digital subtraction angiography (DSA) (Binaghi, et al., 2007; Wintermark, et al., 2006b; Sviri, et al., 2006a; Sviri, et al., 2006b).

Head Injury: The use of perfusion CT is not extensively investigated in traumatic head injury. The potential impact of perfusion CT on the care of patients with severe head trauma has not been determined. Currently, there is insufficient evidence in the published, peer-reviewed scientific literature to support the use of perfusion CT in patients with head trauma (Wintermark, et al., 2004).

Tumor: Perfusion CT has been proposed for patients with neoplasms to measure the permeability surface product area. Studies in the peer-reviewed, scientific literature are limited, and consist of small case series that do not demonstrate the accuracy or clinical utility of cerebral perfusion CT in the diagnosis or management of oncology patients (Jain, et al., 2007; Ding, et al., 2006).

Professional Societies/Organizations

American Heart Association (AHA): The AHA Scientific Statement on Imaging of Acute Ischemic Stroke (Latchaw, et al., 2009) recommends:

- For a patient within a 3-hour time period from onset of symptoms, either NECT or MRI is recommended before intravenous tPA administration to exclude ICH (absolute contraindication) and to determine whether CT hypodensity or MRI hyperintensity of ischemia is present (Class I, LOE: A*)
*See Appendix A
- For patients beyond three hours from onset of symptoms, either diffusion-weighted MRI or source imaging CTA should be performed along with vascular imaging and perfusion studies, particularly if mechanical thrombectomy or intra-arterial thrombolytic therapy is contemplated (Class I, LOE: A).
- Perfusion-Derived Values: Quantitative thresholds of tissue that is dead or destined to die versus tissue that is still living and may be salvageable are the goal of all perfusion techniques. Although the performance of such studies may be considered to identify and differentiate the ischemic penumbra and infarct core, their accuracy and usefulness have not been well established (Class IIb, LOE: B).
- Clinical Role of Perfusion Imaging: The admission volumes of infarct core and ischemic penumbra may be significant predictors of clinical outcome, possibly exceeding the prognostic value of admission NIHSS score (Class IIb, LOE: B). There is increasing but as yet indirect evidence that even relatively imprecise measures of core/penumbra mismatch may be used to select patients for treatment beyond a strict 3-hour time window for intravenous thrombolysis. Together with vascular imaging, these approaches may determine suitability for other therapies such as mechanical clot retrieval and intra-arterial thrombolysis, as well as provide a surrogate marker for treatment efficacy (Class IIb, LOE: B).

AHA Guidelines for the Early Management of Adults with Ischemic Stroke (Adams, et al., 2007) state that multimodal CT (including non-contrast CT, perfusion CT, and CT angiography studies) and MRI may provide additional information that will improve diagnosis of ischemic stroke (Class I, LOE: A).

American College of Radiology (ACR)/American Society of Neuroradiology (ASNR): The ACR/ASNR Practice Guideline for the performance of CT Perfusion in Neuroradiologic Imaging (October, 2007) stated that indications for perfusion CT in neuroradiology include, but are not limited to:

- Brain primary indications: acute neurological change suspicious for stroke, suspected vasospasm following subarachnoid hemorrhage, cerebral hemorrhage with secondary local ischemia, and intracranial tumors.
- Brain secondary indications: follow-up of acute cerebral ischemia or infarction in the subacute or chronic phase of recovery; to assist in planning, and evaluating the effectiveness of, therapy for arterial occlusive disease; and in patients with contraindication to magnetic resonance imaging (MRI) or with devices or material in or close to the field of view that would result in nondiagnostic MRI scans. Perfusion CT scanning may also be helpful in the setting of acute trauma.
- Head and neck primary indications: 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: Follow-up of tumor response to therapy.
- Prior documented major allergic reaction to iodinated contrast material is an absolute contraindication.

Summary

A non-enhanced computed tomography (CT) scan is regarded as an important diagnostic tool in the urgent assessment of patients with a suspected acute stroke to exclude hemorrhage and demonstrate early infarct signs. Studies suggest that additional perfusion imaging techniques may provide information to differentiate patient subgroups that will be more likely to benefit from early reperfusion from those who are unlikely to benefit or may be harmed. Perfusion studies also suggest a significant association between early reperfusion and favorable clinical outcomes.

Large, well-designed prospective clinical studies are needed to determine the clinical value of CT perfusion imaging over standard non-enhanced computed tomography and other modalities in the assessment of individuals with other diagnoses, such as following subarachnoid hemorrhage or head injury.

Coding/Billing Information

Note: This list of codes may not be all-inclusive.

Covered when medically necessary:

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

ICD-9-CM Diagnosis Codes	Description
433.01	Occlusion and stenosis of basilar artery with cerebral infarction
433.11	Occlusion and stenosis of carotid artery with cerebral infarction
433.21	Occlusion and stenosis of vertebral artery with cerebral infarction
433.31	Occlusion and stenosis of multiple and bilateral precerebral arteries with cerebral infarction
433.81	Occlusion and stenosis of other specified precerebral artery with cerebral infarction
433.91	Occlusion and stenosis of unspecified precerebral artery with cerebral infarction
434.01	Cerebral thrombosis, with cerebral infarction
434.11	Cerebral embolism, with cerebral infarction
434.91	Cerebral artery occlusion, unspecified, with cerebral infarction

Experimental/Investigational/Unproven/Not Covered:

ICD-9-CM Diagnosis Codes	Description
	All other codes

*Current Procedural Terminology (CPT®) ©2010 American Medical Association: Chicago, IL.

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Appendix A

American Heart Association Classification of Recommendations

Class I: Conditions for which there is evidence for and/or general agreement that a procedure or treatment is beneficial, useful, and effective

Class II: Conditions for which there is conflicting evidence and/or a divergence of opinion about the usefulness/efficacy of a procedure or treatment

Class IIa: Weight of evidence/opinion is in favor of usefulness/efficacy

Class IIb: Usefulness/efficacy is less well established by evidence/opinion

Class III: Conditions for which there is evidence and/or general agreement that a procedure/treatment is not useful/ effective and in some cases may be harmful

American Heart Association Levels of Evidence

A: Data derived from multiple randomized clinical trials or meta-analyses

B: Data derived from a single randomized trial or nonrandomized studies

C: Only consensus opinion of experts, case studies, or standard-of-care

Policy History

<u>Pre-Merger Organizations</u>	<u>Last Review Date</u>	<u>Policy Number</u>	<u>Title</u>
CIGNA HealthCare	2/15/2008	0442	Cerebral Perfusion Analysis Using Computed Tomography

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