

*National Imaging Associates, Inc.*	
Clinical guidelines	Original Date: August 2008
CEREBRAL PERFUSION CT	
CPT Codes: 0042T	Last Revised Date: May 2022 May 2023
Guideline Number: NIA_CG_015	Implementation Date: January 20243

#### **GENERAL INFORMATION**

- It is an expectation that all patients receive care/services from a licensed clinician. All
   <u>appropriate supporting documentation, including recent pertinent office visit notes, laboratory
   data, and results of any special testing must be provided. If applicable: All prior relevant imaging
   results and the reason that alternative imaging cannot be performed must be included in the
   documentation submitted.

  </u>
- Where a specific clinical indication is not directly addressed in this guideline, medical necessity determination will be made based on widely accepted standard of care criteria. These criteria are supported by evidence-based or peer-reviewed sources such as medical literature, societal guidelines and state/national recommendations.

#### INDICATIONS FOR CEREBRAL PERFUSION CT<sup>1</sup>

# In the following settings after initial CT and/or MRI has been performed or when MRI is contraindicated:

- Pre-operative evaluation of cerebral blood flow in patients at high risk for developing cerebral hyperperfusion after carotid revascularization<sup>2</sup>
- For assessment of cerebrovascular reserve by using acetazolamide challenge in individuals with intracranial vascular stenosis who are potential candidates for bypass surgery or neuroendovascular treatment<sup>3, 4</sup>
- For the assessment of microvascular permeability in individuals with intracranial neoplasms<sup>5</sup>
- A follow-up study may be needed to help evaluate an individual's progress after treatment, procedure, intervention, or surgery. Documentation requires a medical reason that clearly indicates why additional imaging is needed for the type and area(s) requested
- In the acute setting:<sup>1</sup>

<sup>\*</sup> National Imaging Associates, Inc. (NIA) is a subsidiary of Magellan Healthcare, Inc.

- For early detection of acute cerebral ischemia and infarct to determine the appropriateness of an intervention or procedure<sup>6-10</sup>
- o Prediction of hemorrhagic transformation in acute ischemic stroke
- Differentiating post-ictal paralysis or other stroke mimics from acute stroke after MRI has been completed or is contraindicated and will guide treatment<sup>6</sup>
- For noninvasive evaluation of suspected vasospasm related cerebral ischemia/infarction and/or delayed cerebral ischemia after subarachnoid hemorrhage when transcranial Doppler cannot be done or is indeterminate<sup>111, 11</sup>
- For the assessment of cerebral blood flow after carotid revascularization in individuals with severe carotid artery stenosis or signs/symptoms of cerebral hyperperfusion<sup>2, 11</sup>

## BACKGROUND

Cerebral perfusion computed tomography (CT) or CT perfusion (CTP) is an imaging technique that provides quantitative evaluation of cerebral perfusion by generating maps of cerebral blood flow, cerebral blood volume, and mean transit time after passage of an IV contrast bolus through the region of interest. The technique is not widely used for any indication, especially in outpatients. It is useful in specific scenarios after initial CT and/or MR imaging has been obtained for assessment of, not only patients with acute stroke, but also a wide range of patients with other cerebrovascular diseases. It can provide critical information needed to determine the most effective procedure or treatment. In evaluating acute stroke, CTP is usually performed in specialized research centers and is not recommended for screening of these patients in the community setting.<sup>12</sup> It may assist in differentiating the unsalvageable core infarct and salvageable ischemic regions of the brain that may benefit from thrombectomy or thrombolysis.<sup>7</sup>

## OVERVIEW

Acute Cerebral Ischemia (Stroke) – Cerebral perfusion CT can quantitatively distinguish the extent of irreversibly infarcted brain tissue (infarct core) from the severely ischemic but salvageable tissue (penumbra), providing a basis for the selection of acute stroke patients that are most likely to benefit from thrombolytic treatment.<sup>13</sup>

Cerebral Ischemia and Infarction and Evaluation of Vasospasm after Subarachnoid

**Hemorrhage (SAH)**<sup>14, 15</sup> – Cerebral perfusion CT measures cerebral blood flow, cerebral blood volume, and mean transit time which can be useful in identifying patients at risk for cerebral ischemia or infarction and for evaluation of vasospasm after subarachnoid hemorrhage. This information may be useful in identifying urgent medical or endovascular treatment. Catheter angiography is the gold standard for detecting vasospasm. Screening for vasospasm can be performed with TCD US (transcranial doppler ultrasound) and has high sensitivity and negative predictive value. CTA, CT perfusion or MRA may be useful in the setting of indeterminate TCD.

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CT or MR perfusion can help differentiate patients with vascular narrowing but normal perfusion due to the presence of collateral circulation from those without adequate collaterals.<sup>15</sup>

**Carotid Artery Stent Placement/Revascularization** – Cerebral perfusion CT provides a quantitative evaluation of cerebral perfusion and helps in the assessment of the hemodynamic modifications in patients with severe carotid stenosis. Pre-operatively, CTP may help identify patients at high risk of developing hyperperfusion syndrome after carotid revascularization. The syndrome may result in fatal outcomes. Presenting symptoms include "...throbbing frontotemporal or periorbital headache, confusion, macular oedema [*sic*], visual disturbances, seizures, or focal neurological deficits".<sup>2</sup> "The presence of internal carotid artery (ICA) stenosis  $\geq$ 90% is a main risk factor for the development of HPS. Other important risk factors include severe contralateral ICA disease, poor collateral flow, hypertension, and recent stroke or ischaemia [*sic*]".<sup>2</sup> Post-operatively CTP provides valuable information for a more thorough assessment in the follow-up of patients after they have undergone carotid revascularization, especially when there is concern for hyperperfusion syndrome.<sup>13</sup>

**Temporary Balloon Occlusion (TBO)** – Balloon occlusion testing is utilized prior to a planned endovascular or surgical procedure that will disrupt blood supply to a part of the brain. Quantitative analysis of cerebral blood flow may be useful in identifying patient who may not tolerate permanent or prolonged occlusion. Due to the significant failure to predict strokes after sacrifice of the carotid artery, there is a vast number of monitoring techniques and protocols during preoperative test occlusion. As CTP monitoring of BTO entails carotid occlusion times ranging from 15-30 minutes and the need to transfer the patient with a catheter in place to the angiography suite, other methods with 60-90 second occlusion times are generally preferred.<sup>3, 4</sup>

**Cerebrovascular Reserve** – Cerebral perfusion CT, in conjunction with acetazolamide challenge in patients with intracranial vascular stenosis, can evaluate cerebrovascular reserve capacity and help in estimating the potential risk of stroke. It may help to identify candidates for bypass surgery and endovascular treatment to increase cerebral blood flow.

**Intracranial tumors** – Cerebral perfusion CT generates permeability measurements in images of brain tumors depicting areas of different blood flow within tumors and the surrounding tissues. This may allow for diagnosis and grading of tumors and may help to monitor treatment.

## **POLICY HISTORY**

Date	Summary
March 2023	<ul> <li><u>Updated references</u></li> <li><u>Added Prediction of hemorrhagic transformation in acute</u></li> <li><u>ischemic stroke</u></li> </ul>

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<del>May 2022</del>	Updated background and references
	Reorganized indications
	Clarified:
	<ul> <li>"For noninvasive evaluation of suspected vasospasm related</li> </ul>
	cerebral ischemia/infarction and/or delayed cerebral ischemia
	after subarachnoid hemorrhage when transcranial Doppler
	cannot be done or is indeterminate"
February 2021	Updated background information references
	Added to determine the appropriateness of an intervention or
	<del>procedure</del>
	<ul> <li>Added or other stroke mimics and will guide treatment</li> </ul>
<del>May 2020</del>	Updated background information references
	<ul> <li>Reordered indications and background information</li> </ul>
	<ul> <li>Changed – "after carotid stent placement" to "after carotid</li> </ul>
	revascularization" in patients with severe carotid artery stenosis
	and added "or signs/symptoms of cerebral hyperperfusion"
<del>June 2019</del>	Removed:
	<ul> <li>diagnosis of cerebral ischemia and infarction</li> </ul>
	<ul> <li>evaluation of patients undergoing temporary balloon</li> </ul>
	occlusion to assess collateral flow and cerebrovascular
	reserve
	Added:
	<ul> <li>Specified for vasospasm after subarachnoid hemorrhage</li> </ul>
	'when transcranial Doppler cannot be performed or is
	indeterminate'
	<ul> <li>A f/u study may be needed to evaluate progress after</li> </ul>
	treatment, procedure, intervention, or surgery.
	Documentation requires a medical reason indicating why
	additional imaging is needed.
	Updated background information and references



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## **POLICY HISTORY**

<u>Date</u>	Summary
<u>May 2023</u>	Updated references
	<ul> <li><u>Added - Prediction of hemorrhagic transformation in acute</u> <u>ischemic stroke</u></li> </ul>
	General Information moved to beginning of guideline with added
	statement on clinical indications not addressed in this guideline
<u>May 2022</u>	Updated background and references
	Reorganized indications
	<u>Clarified:</u>
	<ul> <li>"For noninvasive evaluation of suspected vasospasm related</li> </ul>
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Reviewed / Approved by NIA Clinical Guideline Committee

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