



CIGNA MEDICAL COVERAGE POLICY

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Subject Functional Magnetic Resonance Imaging (fMRI), Brain

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Coverage Policy

CIGNA covers functional magnetic resonance imaging (fMRI) as medically necessary when it is being used as part of a preoperative evaluation for a planned craniotomy AND is required for localization of eloquent areas of the brain such as those responsible for speech, language, motor function, and senses, which might potentially be put at risk during the proposed surgery.

CIGNA does not cover functional magnetic resonance imaging (fMRI) of the brain for any other indication because it is considered experimental, investigational, or unproven.

General Background

Localizing specific areas of the brain responsible for particular critical functions, such as thought, speech, movement and sensation, as well as white matter tracts connecting critical areas, is an essential component of the presurgical planning process when treating brain disorders (e.g., brain tumors, vascular lesions, and epilepsy). Neurofunctional testing and functional imaging are tools that are used together to localize and map motor, sensory, language, and memory areas in brain surgery patients. Functional images of the brain are taken

while a patient is asked to perform a number of small tasks, such as tapping the thumb of one hand against each of the fingers of that hand, or answering simple questions. The protection of functions that may be at risk during surgery is facilitated by functional mapping of critical eloquent areas.

Numerous tools allow convergent evidence from multiple brain mapping techniques to bear on pre- and intraoperative decision-making. Some examples of observational techniques include functional magnetic resonance imaging (fMRI), positron emission tomography (PET), anisotropic diffusion tensor imaging (DTI) and somatosensory evoked potential. Some examples of inhibition and activation techniques include intracarotid amytal test (IAT) (i.e., Wada test) and electrocortical stimulation (ECS). The gold standard for identifying eloquent areas of the brain to be avoided in resections remains direct ECS.

Functional Magnetic Resonance Imaging (fMRI)

Functional MRI, similar to other brain mapping tests, is performed to map motor, sensory, language, and memory areas in neurosurgical patients. Because it is noninvasive, it does not carry the same level of risk as invasive mapping procedures (e.g., Wada test, ECS). Unlike standard clinical neuroimaging modalities (computerized tomography, single-photon emission computerized tomography, and positron emission tomography or structural MRI), fMRI is highly user-dependent and requires active participation from both the patient and the investigators throughout the process. There are several fMRI methods available, but the one most widely used is blood oxygenation level dependent (BOLD). BOLD fMRI takes advantage of the close relationship between local neuronal activity and blood flow (neurovascular coupling). When neuronal activity increases locally, local blood flow also increases, leading to an increase in oxygenated blood that is disproportionate to the increased need for oxygen for neuronal activity (Smits, et al., 2006; Vincent, et al., 2005; Kim, et al., 2003; Maldjian, et al., 2002).

Literature Review

The majority of published studies regarding clinical application of fMRI evaluate its use in presurgical planning. Specifically, studies demonstrate its application in identifying the language system, which is more variable across individuals than visual and motor systems. Studies involving language fMRI primarily address its use in presurgical planning for epilepsy, arteriovenous malformations (AVMs), and brain tumors.

Evidence in the published, peer-reviewed scientific literature indicates a good correlation between fMRI and invasive mapping for defining eloquent brain region and the portion of the brain to be resected (Yetkin, et al., 1997; Fitzgerald, et al., 1997; Yetkin, et al., 1998; Woermann, et al., 2003; Häberg, et al., 2004). The gold standard for identifying eloquent areas of the brain to be avoided in resections is direct ECS. The majority of comparative studies support the use of both fMRI and invasive mapping for pre-surgical brain mapping. Retrospective and prospective case series indicate that preoperative fMRI provides additional information, aiding in determining the probable margin between the eloquent brain region and the portion of the brain to be resected, that influences clinical decision-making (Lee, et al., 1999; Pouratian, et al., 2002; Wilkinson, et al., 2003; Roux, et al., 2003; Sabsevitz, et al., 2003; Cannestra, et al., 2004; Medina, et al., 2005; Petrella, et al., 2006; Zijlmans, et al., 2007; Amiez, et al., 2008).

Results were reported by Talacch et al. (2010) in a retrospective case series. Talacch et al. reviewed facility specific supratentorial malignant gliomas operated on, identifying those (n=170) with preoperative motor impairment or with tumors one centimeter or less from motor pathways. Talacch et al. reported that use of fMRI to guide navigation contributed to the rate of total removal (71%) compared with 40% total removal rate in those treated without any functional mapping aids. This difference was noted to be statistically significant. Additionally, use of functional mapping aids including fMRI impacted overall survival (four-month follow-up) compared with overall survival of patients who did not use functional mapping aids. These findings cannot be generalized as the study was limited by retrospective design and only evaluated use in individuals with malignant gliomas.

Functional MRI of the brain is being utilized in a research setting for several other conditions. Although fMRI is sometimes used as an investigational tool, it has no established clinical role in the diagnosis or treatment of dementia, Alzheimer's disease, Parkinson's disease, Huntington's disease, behavioral health disorders, or the treatment of chronic pain (learning cognitive control over pain; pain medication development/pharmaceutical trials; or, as a functional targeting method for motor cortex stimulation in refractory neuropathic pain).

Professional Societies/Organizations

The American College of Radiology (ACR) Practice Guideline for the Performance of Functional Magnetic Resonance Imaging of the Brain (fMRI) (2007) states that fMRI using BOLD technique is a proven and useful tool for the evaluation of eloquent cortex in relation to a focal brain lesion, such as a neoplasm or vascular malformation. fMRI should be performed only for a valid medical reason. Primary indications for fMRI include, but are not limited to, the following:

- Assessment of Intracranial Tumoral Disease:
 - Presurgical planning, Assessment of eloquent cortex (e.g., language, sensory motor, visual) in relation to a tumor.
 - Surgical planning (biopsy or resection), Use of fMRI data for surgical guidance or resection procedure.
 - Therapeutic follow-up, Evaluation of preserved eloquent cortex.
- Assessment of Language Functions for Epilepsy Surgery (ACR, 2007).

Summary

Evidence in the published, peer-reviewed scientific literature demonstrates a good correlation between fMRI pre-surgical brain mapping and invasive pre-surgical brain mapping. It is unknown whether fMRI can replace invasive brain mapping techniques such as intraoperative electrocortical stimulation and the Wada test because the evidence indicates that the sensitivity and specificity of fMRI are not comparable to these established invasive procedures. However, studies suggest that fMRI may be a valuable adjunct tool when used in conjunction with other brain mapping techniques because fMRI provides information preoperatively that can assist the surgical team in pre-surgical planning. Preliminary evidence now suggests this may translate into improved surgical outcomes such as quality of resection and improved patient health outcomes in the short term, such as survival in the early months following surgery.

Additional studies need to clarify the role and utility of fMRI in conjunction with other invasive and non-invasive neurofunctional tests, as well as address the impact of fMRI on complication rates and long-term outcomes.

Coding/Billing Information

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

Covered when medically necessary:

CPT* Codes	Description
70554	Magnetic resonance imaging, brain, functional MRI; including test selection and administration of repetitive body part movement and/or visual stimulation, not requiring physician or psychologist administration.
70555	Magnetic resonance imaging, brain, functional MRI; requiring physician or psychologist administration of entire neurofunctional testing.

ICD-9-CM Diagnosis Codes	Description
191.0-191.9	Malignant neoplasm of brain
198.3	Secondary malignant neoplasm of brain and spinal cord
225.0	Benign neoplasm of brain
225.2	Benign neoplasm of cerebral meninges
237.5	Neoplasm of uncertain behavior of brain and spinal cord
239.6	Neoplasm of unspecified nature, brain
345.00-345.91	Epilepsy and recurrent seizures
747.81	Anomalies of cerebrovascular system
780.39	Other convulsions

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Policy History

<u>Pre-Merger Organizations</u>	<u>Last Review Date</u>	<u>Policy Number</u>	<u>Title</u>
CIGNA HealthCare	7/15/2008	0478	Functional Magnetic Resonance Imaging (fMRI), Brain

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