National Imaging Associates, Inc.	
Clinical guidelines **FUNCTIONAL BRAIN MRI**	**Original Date: June 2007**
CPT Codes: 70554, 70555	**Last Revised Date: ~~May 202~~May 2023**
Guideline Number: NIA_CG_013	**Implementation Date: January 202~~43~~**

GENERAL INFORMATION

- *It is an expectation that all patients receive care/services from a licensed clinician. All 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.*
- *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 FUNCTIONAL BRAIN MRI[1, 2]

Pre-operative/procedural Evaluation[1]

In the following where fMRI may have a significant role in the mapping of a lesion in relation to eloquent cortex (i.e., language, motor, sensory and visual centers) to determine the appropriateness of surgical intervention

- Focal brain lesion (i.e., tumor or vascular malformation) for presurgical planning[3-6]
- Pre-operative evaluation for epilepsy surgery[7, 8]
- Brain tumor for radiation treatment planning[9, 10]

Post-operative/procedural Evaluation

- Therapeutic follow-up. A documented medical reason must clearly explain the medical necessity for follow up (i.e., evaluation of post-treatment eloquent cortex).

BACKGROUND

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Functional MRI (fMRI) of the brain is a non-invasive imaging technique, using radio waves and a strong magnetic field, to image the brain activity of a patient prior to undergoing brain surgery for tumors or epilepsy. It is based on the increase in blood flow to the local vasculature when parts of the brain are activated and helps to determine the location of vital areas of brain function. fMRI images capture blood oxygen levels in parts of the brain that are responsible for perception, cognition, and movement allowing neurosurgeons to operate with less possibility of harming areas that are critical to the patient's quality of life. fMRI is primarily used for presurgical planning, operative risk assessment and therapeutic follow-up.

Task vs Resting-state fMRI

During resting-state fMRI (rs-fMRI), unlike task-based functional MRI, the individual is not required[11-13] to perform any specific task. This is beneficial for patients who have difficulty performing tasks, such as pediatric and certain neurologic or psychiatric patients. This technique has been well-utilized in research, and its clinical use is increasing considerably, especially in presurgical planning (e.g., mapping epileptic foci) and neuropsychiatric diseases. For the above indications, non-tasked based fMRI such as resting state fMRI can also be performed.

fMRI as an Alternative to the Invasive Wada test and Direct Electrical Stimulation – fMRI is considered an alternative to the Wada test and direct electrical stimulation as it is a non-invasive method for location of vital brain areas. The Wada test is used for the pre-operative evaluations of patients with brain tumors and seizures to determine which side of the brain is responsible for vital cognitive functions, e.g., speech and memory. It can assess the surgical risk of damaging the vital areas of the brain. The Wada test is invasive, involving an angiography procedure to guide a catheter to the internal carotid where a barbiturate is injected, putting one hemisphere of the brain to sleep. Direct electrical stimulation mapping is invasive requiring the placement of electrodes in the brain. The electrodes are used to stimulate multiple cortical sites in the planned area of resection to allow the surgeons to identify and mark which areas can be safely resected.[14, 15]

fMRI and Brain Tumors – fMRI may significantly affect therapeutic planning in patients who have potentially resectable brain tumors. Due to its non-invasiveness, its relatively high spatial resolution, and its pre-operative results, fMRI is used before surgery in the evaluation of patients with brain tumors. fMRI may have a significant role in mapping lesions that are located in close proximity to vital areas of brain function (language, sensory motor, and visual). It can determine the precise spatial relationship between the lesion and adjacent functionally essential parenchyma, allowing removal of as much pathological tissue as possible during resection of brain tumors without compromising essential brain functions. fMRI provides an alternative to other invasive tests, such as the Wada test and direct electrical stimulation.[16]

fMRI and Seizures – Brain fMRI can influence the diagnostic and therapeutic decisions of the seizure team, thereby affecting the surgical approach and outcomes. Brain surgery is often the

treatment for patients with refractory epilepsy, especially patients with a single seizure focus. fMRI can be used to image and localize abnormal brain function in patients with seizures. fMRI can help determine brain functions (language, sensory motor, and visual) of areas bordering the lesion, resulting in better outcomes with less neurologic deficit.[8]

fMRI is increasingly being used to evaluate candidates for surgical treatment of intractable epilepsy (Phase 1 evaluation) and can aid in surgical decision-making. It can 1) help to improve functional outcome by enabling surgery that spares functional cortex, 2) guide surgical intervention by revealing when reorganization of function has occurred, and 3) show when abnormal cortex is also functionally active, and hence that surgery may not be the best option[17, 18].

POLICY HISTORY

Date	Summary
March 2023	Updated background and references Added - to determine the appropriateness of surgical intervention Background section regarding non task-based fMRI
May 2022	Updated background and references
February 2021	Updated references
May 2020	• Updated references • Reordered indications
August 2019	• Modified pre-operative/procedural evaluation section to include focal brain lesion for pre-surgical planning, brain tumor for radiation treatment planning AND epilepsy surgery pre-operative evaluation.

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ADDITIONAL RESOURCES

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POLICY HISTORY

Date	Summary
May 2023	• Updated background and references • Added - to determine the appropriateness of surgical intervention • Background section regarding non-task-based fMRI • General Information moved to beginning of guideline with added statement on clinical indications not addressed in this guideline
May 2022	Updated background and references

Reviewed / Approved by NIA Clinical Guideline Committee

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