



Title

Magnetoencephalography/Magnetic Source Imaging

Description

Magnetoencephalography (MEG) is a noninvasive functional imaging technique in which the weak magnetic forces associated with the electrical activity of the brain are recorded externally. Using mathematical modeling, the recorded data are then analyzed to provide an estimated location of the electrical activity. This information can be superimposed on an anatomic image of the brain, typically a magnetic resonance imaging (MRI) scan, to produce a functional/anatomic image of the brain, referred to as magnetic source imaging or MSI. The primary advantage of MSI is that while the conductivity and thus the measurement of electrical activity as recorded by the electro-encephalogram (EEG) is altered by surrounding brain structures, the magnetic fields are not. Therefore, MSI permits a high-resolution image.

The technique is sophisticated. Detection of the weak magnetic fields depends on gradiometer detection coils coupled to a superconducting quantum interference device (SQUID) which requires a specialized room shielded from other magnetic sources. Mathematical modeling programs based on idealized assumptions are then used to translate the detected signals into functional images. In its early evolution, clinical applications were limited by the use of only one detection coil requiring lengthy imaging times, which, because of body movement, were also difficult to coordinate with the MRI. However, more recently the technique has evolved to multiple detection coils arranged in an array that can provide data more efficiently over a wide extracranial region.

One clinical application is localization of the pre- and postcentral gyri as a guide to surgical planning in patients scheduled to undergo neurosurgery for epilepsy, brain neoplasms, arteriovenous malformations, or other brain disorders. These gyri contain the "eloquent" sensorimotor areas of the brain, the preservation of which is considered critical during any type of brain surgery. In normal situations, these areas can be identified anatomically by MRI, but frequently the anatomy is distorted by underlying disease processes. In addition, the location of the eloquent functions is variable, even among healthy patients. Therefore, localization of the eloquent cortex often requires such intraoperative invasive functional techniques as cortical stimulation with the patient under local anesthesia or somatosensory-evoked responses on electrocorticography (ECoG). While these techniques can be done at the same time as the planned resection, they are cumbersome and can add up to 45 minutes of anesthesia time. Furthermore, sometimes these techniques can be limited by the small surgical field. A preoperative test, which is often used to localize the eloquent hemisphere, is the Wada test. MEG/MSI has been proposed as a substitute for the **Wada** test.

Another related clinical application is localization of epileptic foci, particularly for screening of surgical candidates and surgical planning. Alternative techniques include MRI, positron emission tomography (PET), or single photon emission computed tomography (SPECT) scanning. Anatomic imaging (i.e., MRI) is effective when epilepsy is associated with a mass lesion, such as a tumor, vascular malformation, or hippocampal atrophy. If an anatomic abnormality is not detected, patients may undergo a PET scan. In a small subset of patients, extended electrocorticography (ECoG) or stereotactic electroencephalography EEG (SEEG) with

implanted electrodes is considered the gold standard for localizing epileptogenic foci. MEG/MSI has principally been investigated as a supplement to or an alternative to invasive monitoring.¹

Note: The **Wada** test is conducted with the patient awake. A barbiturate (which is usually sodium amobarbital) is introduced into one of the internal carotid arteries via a cannula or intra-arterial catheter from the femoral artery. The drug is injected into one hemisphere at a time. The effect is to shut down any language and/or memory function in that hemisphere in order to evaluate the other hemisphere ("half of the brain"). Then the patient is engaged in a series of language and memory related tests. The memory is evaluated by showing a series of items or pictures to the patient so that within a few minutes as soon as the effect of the medication is dissipated, the ability to recall can be tested. The name comes from the physician who first performed it, Dr. Juhn Wada.

When services are covered for commercial products and for Medicare HMO Blue, Medicare PPO Blue, and Blue Medicare PFFS PlusRx

We cover **magnetoencephalography/magnetic source imaging** for the purpose of determining the laterality of language function, as a substitute for the **Wada** test, in patients being prepared for surgery for epilepsy, brain tumors, and other indications requiring brain resection.

When services are not covered for commercial products or for Medicare HMO Blue, Medicare PPO Blue, and Blue Medicare PFFS PlusRx

We do not cover **magnetoencephalography/magnetic source imaging** for all other indications, including localization of seizure focus for patients undergoing evaluation for surgical treatment of intractable seizures.¹

Individual consideration

All our medical policies are written for the majority of people with a given condition. Each policy is based on medical science. For many of our medical policies, each individual's unique clinical circumstances may be considered in light of current scientific literature. For consideration of an individual patient, physicians may send relevant clinical information to:

For services already billed

Blue Cross Blue Shield of Massachusetts
Provider Appeals
PO Box 986065
Boston, MA 02298

Prior to performance of service

Blue Cross Blue Shield of Massachusetts
Case Creation/Medical Policy
One Enterprise Drive
Quincy, MA 02171
Tel: 1-800-327-6716
Fax: 1-888-641-5330

Authorization Information

For Managed Care members:

- Authorization is not required for this service; *see **Managed Care Guidelines** for additional requirements.*

For Indemnity and PPO members:

- Authorization is not required for this service; *see **Indemnity and PPO Guidelines** for additional requirements.*

Managed Care Guidelines

All authorization requirements are determined by the individual's subscriber certificate, explanation of coverage, or summary plan description, however;

- **For Medicare HMO Blue members:** The service must meet the criteria for coverage noted in this policy, be medically necessary, prescribed by a plan physician and provided by a network provider.
- **For Medicare HMO Blue members:** Referrals are required for all visits to a specialist.

- For all other Managed Care plans, any specialist visit requires a referral, except for visits performed by OB/GYN specialists.
- Authorization is required for an inpatient admission.

Indemnity and PPO Guidelines

All authorization requirements are determined by the individual's subscriber certificate, explanation of coverage, or summary plan description, however;

- Authorization is required for an inpatient admission.
- Authorizations are not required for most outpatient services as determined by the individual's subscriber certificate.
- Referrals to a specialist are not required.

Coding information

Procedure codes are from current CPT, HCPCS Level II, Revenue Code, and/or ICD-9-CM manuals, as recommended by the American Medical Association, Centers for Medicare and Medicaid Services and American Hospital Associations. Blue Cross Blue Shield Association national codes may be developed when appropriate.

The following codes are included below for informational purposes. Inclusion or exclusion of a code does not constitute or imply member coverage or provider reimbursement. Please refer to the member's contract benefits in effect at the time of service to determine coverage or non-coverage as it applies to an individual member.

CPT codes:

- **95965:** Magnetoencephalography (MEG), recording and analysis; for spontaneous brain magnetic activity (e.g., epileptic cerebral cortex localization)
- **95966:** for evoked magnetic fields, single modality (e.g., sensory, motor, language, or visual cortex localization)
- **95967:** for evoked magnetic fields, each additional modality (e.g., sensory, motor, language, or visual cortex localization) (list separately in addition to code for primary procedure)

HCPCS code:

- **S8035:** Magnetic source imaging

Policy update history

New policy, effective 9/1/09.

References

References for footnote 1:

1. 2008 TEC Special Report. Magnetoencephalography and Magnetic Source Imaging for the Purpose of Presurgical Localization of Epileptic Lesions—A Challenge for Technology Evaluation.
2. Knowlton RC, Elgavish RA, Limdi N et al. Functional imaging: I. Relative predictive value of intracranial electroencephalography. *Ann Neurol* 2008; 64(1):25-34.
3. Lau M, Yam D, Burneo JG. A systematic review on MEG and its use in the presurgical evaluation of localization-related epilepsy. *Epilepsy Res* 2008; 79(2-3):97-104.
4. 2003 TEC Assessments; Tab 6.
5. Papanicolaou AC, Simos PG, Castillo EM et al. Magnetoencephalography: a noninvasive alternative to the Wada procedure. *J Neurosurg* 2004; 100(5):867-76.
6. Hirata M, Kato A, Taniguchi M et al. Determination of language dominance with synthetic aperture magnetometry: comparison with the Wada test. *Neuroimage* 2004; 23(1):46-53.
7. Ontario Ministry of Health, Medical Advisory Secretariat (MAS). Functional brain imaging. Health Technology Policy Assessment. Toronto, ON: MAS; December 2006. Available online at:

http://www.health.gov.on.ca/english/providers/program/ohtac/tech/reviews/pdf/rev_fbi_012507.pdf. Last accessed November 2008.

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Footnotes

¹ Based on BCBSA policy # 6.01.21, Magnetoencephalography/Magnetic Source Imaging issued 12/08.