



Corporate Medical Policy

Magnetoencephalography/Magnetic Source Imaging

File Name: magnetoencephalography_magnetic_source_imaging
Policy Number: RAD5102
Origination: 3/2002
Last Review: 5/2008
Next Review: 5/2010

Description of Procedure or Service

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 on the scalp. 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 (MSI). The primary advantage of MSI is that while the conductivity and thus measurement of electrical activity as recorded by the electroencephalogram (EEG) is altered by surrounding brain structures, the magnetic fields are not. Therefore, MSI permits a high resolution image.

This 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.

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. 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. Alternate techniques include MRI, PET or SPECT scanning. Anatomic imaging 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 or stereotactic electroencephalography 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.

Policy

BCBSNC will provide coverage for Magnetoencephalography/Magnetic Source Imaging when it is

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determined to be medically necessary because the medical criteria and guidelines shown below have been met.

Benefits Application

Please refer to Certificate for availability of benefits. This policy relates only to the services or supplies described herein. Benefits may vary according to benefit design, therefore certificate language should be reviewed before applying the terms of the policy.

When Magnetoencephalography/Magnetic Source Imaging is covered

Magnetoencephalography may be considered medically necessary for the purpose of determining the lateral-ity of language function, as a substitute for the Wada test, in patients undergoing diagnostic workup for eval-uation of surgery for epilepsy, brain tumors, and other indications requiring brain resection.

When Magnetoencephalography/Magnetic Source Imaging is not covered

Magnetoencephalography and magnetic source imaging are considered investigational for all other indica-tions, including localization of seizure focus for patients undergoing evaluation for surgical treatment of intractable seizures.

Policy Guidelines

Localization of Seizure Focus

Based on a 2008 TEC Special Report, MEG for the purpose of seizure localization is considered investiga-tional. Numerous studies have shown associations between MEG findings and other noninvasive and inva-sive diagnostic tests and between MEG findings and surgical outcomes, however, such studies do not allow any conclusions regarding whether MEG added incremental information to aid the management of such patients, and whether patients' outcomes were improved as a result of the additional diagnostic information. Deficiencies in the literature, primarily due to the fact that studies have ascertainment and selection biases because MEG findings were used to select and deselect patients in the diagnostic pathway, make it difficult to determine whether use of MEG for the purpose of seizure localization improved patient outcomes.

Localization of Eloquent and Sensorimotor Areas

Several studies have shown high concordance between the Wada test and MEG. Preoperative mapping by MEG might aid in determining the suitability of the patient for surgery, or for assisting in the planning of other invasive testing. Similar to the situation for localization of epilepsy focus, the literature is problematic in terms of evaluating the comprehensive outcomes of patients due to ascertainment and selection biases. Studies tend to be limited to correlations between MEG and intraoperative mapping. Several of the studies evaluated in the BCBSA 2003 TEC Assessment showed a good to high concordance between MEG findings and intraoperative mapping.

Billing/Coding/Physician Documentation Information

This policy may apply to the following codes. Inclusion of a code in this section does not guarantee that it will be reimbursed. For further information on reimbursement guidelines, please see Administrative Policies on the Blue Cross Blue Shield of North Carolina web site at www.bcbsnc.com. They are listed in the Cate-

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gory Search on the Medical Policy search page.

Applicable codes: 95965, 95966, 95967, S8035

BCBSNC may request medical records for determination of medical necessity. When medical records are requested, letters of support and/or explanation are often useful, but are not sufficient documentation unless all specific information needed to make a medical necessity determination is included.

Policy Key Words

Key Words: RAD5102, Magnetoencephalography, MEG, Magnetic Source Imaging, MSI, Brain, Epilepsy, Head Trauma, Brain Plasticity, Language, Memory, Cognition, Wada test

Medical Term Definitions

Wada test

unilateral internal carotid injection of amobarbital to determine the laterality of speech; injection on the dominant side causes transient aphasia or mutism; used prior to surgical treatment of epilepsy

Scientific Background and Reference Sources

BCBSA Medical Policy Reference Manual, 2/15/2002; 6.01.21.

Specialty Matched Consultant Advisory Panel - 8/2002

BCBSA Medical Policy Reference Manual [Electronic Version]. 6.01.21, 7/17/03

BCBSA TEC Assessment [Electronic Version]. August 2003.

Specialty Matched Consultant Advisory Panel - 7/2004

BCBSA Medical Policy Reference Manual [Electronic Version]. 6.01.21, 8/17/05

Baumgartner C & Pataria E (2006). Revisiting the role of magnetoencephalography in epilepsy. *Current Opinion in Neurology*, 19:181-186.

Knowlton RC, Elgavish R, Howell J, Blount J, Burneo JG, Faught E, et al. (May 2006). Magnetic source imaging versus intracranial electroencephalogram in epilepsy surgery: a prospective study. *Annals of Neurology*, 59:835-842.

Papanicolaou AC, Pataria E, Billingsley-Marshall R, Castillo EM, Wheless JW, Swank P, et al. (August 2005). Toward the substitution of invasive electroencephalography in epilepsy surgery. *Journal of Clinical Neurophysiology*. 22:231-237.

Ontario Ministry of Health, Medical Advisory Secretariat (MAS). Ontario Health Technology Advisory Committee (OHTAC). Recommendation Functional Brain Imaging. Toronto, ON: MAS; January 25, 2007. Retrieved 2/19/08 from http://www.health.gov.on.ca/english/providers/program/ohtac/tech/reviews/pdf/rev_fbi_012507.pdf

BCBSA Medical Policy Reference Manual [Electronic Version]. 6.01.21, 12/12/06

BCBSA 2008 TEC Special Report. Magnetoencephalography and Magnetic Source Imaging for the Purpose of Presurgical Localization of Epileptic Lesions-A Challenge for Technology Evaluation.

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BCBSA Medical Policy Reference Manual [Electronic Version]. 6.01.21, 12/11/08

Policy Implementation/Update Information

- 3/02 Original policy issued.
- 9/02 Specialty Matched Consultant Advisory Panel - 8/2002
- 1/03 Code S8035 added to Billing/Coding section. System coding changes.
- 5/04 Benefits Application and Billing/Coding sections updated for consistency.
- 8/26/04 Specialty Matched Consultant Advisory Panel review 7/15/2004 with no changes to policy criteria. References added.
- 6/5/06 Rationale added to Policy Guidelines to support Investigational status. Policy number added to Key Words. References updated. Specialty Matched Consultant Advisory Panel 5/3/2006 with no changes to policy coverage criteria.
- 6/16/08 References updated. Specialty Matched Consultant Advisory Panel review 5/15/08. No change in policy statement.
- 3/30/09 Description of procedure expanded for clarity. Policy statement changed, magnetoencephalography/Magnetic Source Imaging is covered when the medical necessity criteria are met. Statement in the When MEG/MSI is Covered section changed to read, "Magnetoencephalography may be considered medically necessary for the purpose of determining the laterality of language function, as a substitute for the Wada test, in patients undergoing diagnostic workup for evaluation of surgery for epilepsy, brain tumors, and other indications requiring brain resection." Statement in the When MEG/MSI is Not Covered revised to read, "MEG and MSI are considered investigational for all other indications, including localization of seizure focus for patients undergoing evaluation for surgical treatment of intractable seizures." References updated.

Medical policy is not an authorization, certification, explanation of benefits or a contract. Benefits and eligibility are determined before medical guidelines and payment guidelines are applied. Benefits are determined by the group contract and subscriber certificate that is in effect at the time services are rendered. This document is solely provided for informational purposes only and is based on research of current medical literature and review of common medical practices in the treatment and diagnosis of disease. Medical practices and knowledge are constantly changing and BCBSNC reserves the right to review and revise its medical policies periodically.