Magnetic Resonance Spectroscopy

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Services Are Considered Investigational
Coverage is not available for investigational medical treatments or procedures, drugs, devices or biological products.

Based on review of available data, the Company considers magnetic resonance spectroscopy (MRS) to be **investigational.***

Background/Overview

MRS is a noninvasive technique that can be used to measure the concentrations of different chemical components within tissues. The technique is based on the same physical principles as magnetic resonance imaging (MRI) and the detection of energy exchange between external magnetic fields and specific nuclei within atoms. With MRI, this energy exchange, measured as a radiofrequency signal, is then translated into the familiar anatomic image by assigning different gray values according to the strength of the emitted signal. The principal difference between MRI and MRS is that in MRI, the emitted radiofrequency is based on the spatial position of nuclei, while MRS detects the chemical composition of the scanned tissue. The information produced by MRS is displayed graphically as a spectrum with peaks consistent with the various chemicals detected. MRS may be performed as an adjunct to MRI. An MRI image is first generated, and then MRS spectra are developed at the site of interest, termed the voxel. While an MRI provides an anatomic image of the brain, MRS provides a functional image related to underlying dynamic physiology. Magnetic resonance spectroscopy can be performed with existing MRI equipment, modified with additional software and hardware, which are provided with all new MRI scanners. Imaging time in the scanner is increased by 15 to 30 minutes.

MRS has been studied most extensively in a variety of brain pathologies. In the brain, both 1-H (i.e., proton) and 31-P are present in concentrations high enough to detect and thus have been used extensively to study brain chemistry. For example, proton MRS of the healthy brain reveals 6 principal spectra:

- Arising from *N*-acetyl groups, especially *N*-acetylaspartate (NAA)
  NAA is an amino acid that is generated by mitochondria and is present almost exclusively in neurons and axons in the adult central nervous system (CNS). NAA intensity is thought to be a marker of neuronal integrity and is the most important proton signal in studying CNS pathology. Decreases in the NAA signal are associated with neuronal loss, damage to neuronal structures, and/or reduced neural metabolism.
- Arising from choline-containing compounds (Cho), such as membrane phospholipids (eg, phosphocholine and glycerophosphocholine). An increase in Cho is considered a marker of pathologic proliferation/degradation of cell membranes and demyelination. Choline levels can

increase in acute demyelinating disease, but an increase in Cho levels is most commonly associated with neoplasms. Cho levels can also be affected by diet and medication.

- Arising from creatine and phosphocreatine
  In the brain, creatine is a relatively constant element of cellular energetic metabolism and thus is sometimes used as an internal standard.
- Arising from myo-Inositol. Myo-Inositol is a polyalcohol that is present at high concentration in glial cells. An increase in the ratio of myo-Inositol to NAA suggests gliosis and regional neuronal damage.
- Arising from lipid
- Arising from lactate
  Normally this spectrum is barely visible, but lactate may increase to detectable levels when anaerobic metabolism is present. Lactate may accumulate in necrotic areas, in inflammatory infiltrates, and in brain tumors.

Different patterns of the above spectra and others, such as myoinositol and glutamate/glutamine, in the healthy and diseased brain are the basis of clinical applications of MRS. The MRS findings characteristically associated with non-necrotic brain tumors include elevated Cho levels and reduced NAA levels. The International Network for Pattern Recognition using Magnetic Resonance (Available online at: http://azizu.uab.es/INTERPRET/index.html) has developed a user-friendly computer program for spectral classification and a database of 300 tumor spectra with histologically validated diagnoses to aid radiologists in MRS diagnosis.

All the findings reported in this policy refer to proton MRS, unless otherwise indicated.

One of the limitations of MRS is that it provides the metabolic composition of a given voxel, which may include more than one type of tissue. For some applications, the voxels are relatively large (e.g., greater than 1 cm^3), although they may be somewhat smaller using a (3 Tesla) 3T MRI machine versus a 1.5T magnet. The 3T technique creates greater inhomogeneities, however, which require better shimming techniques. There are two types of MRS data acquisition: single voxel or simultaneous multivoxel, also called chemical shift imaging. Reliable results are more difficult to obtain from some areas, e.g., close to the brain surface or in children with smaller brains because of the lipid signal from the skull. Some techniques are used to deal with these issues; various MRS techniques continue to be explored as well. A combination of MRS is often used with other MRI techniques, including diffusion-tensor imaging, susceptibility-weighted imaging, etc., and possibly other types of imaging such as positron emission tomography (PET).

Peripheral applications of MRS include the study of myocardial ischemia, peripheral vascular disease, and skeletal muscle. Applications in non-CNS (central nervous system) oncologic evaluation have also been explored. Nomograms for prostate cancer are being developed that incorporate MRI and MRS results.

FDA or Other Governmental Regulatory Approval

U.S. Food and Drug Administration (FDA)

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Multiple software packages for performing proton MRS have received clearance by the FDA through the 510(k) process since 1993. Single-voxel MRS is available on all modern magnetic resonance scanners. FDA product code: LNH.

Centers for Medicare and Medicaid Services (CMS)
In January 2004, Medicare issued a decision memorandum for MRS for brain tumors that reaffirmed its national noncoverage determination. After reviewing updated literature, a technology assessment it commissioned from the Agency for Healthcare Research and Quality, and the BCBSA TEC Assessment, Medicare found that there was not adequate evidence to conclude that MRS is reasonable and necessary for the diagnosis of brain tumors.

Rationale/Source

Assessment of a diagnostic technology typically focuses on 3 categories of evidence: (1) its technical reliability (test-retest reliability or interrater reliability); (2) clinical validity (sensitivity, specificity, and positive [PPV] and negative predictive values [PPV]) in relevant populations of patients; and (3) clinical utility (demonstration that the diagnostic information can be used to improve patient outcomes).

MRS has been investigated in a wide variety of clinical situations, for cancer and noncancer conditions. We evaluate the clinical utility of MRS separately for each indication.

BRAIN TUMORS

Clinical Context and Test Purpose

The purpose of MRS in patients with brain tumors is to differentiate malignant from nonmalignant tumors, evaluate tumor grade, and distinguish metastatic from primary brain tumors.

The question addressed in this evidence review is: Does MRS improve the net health outcome of patients with brain tumors?

The following PICOTS were used to select literature to inform this review.

Patients
The relevant population of interest is patients who are being evaluated for brain tumors.

Interventions
The intervention of interest is MRS.

Comparators
The comparator of interest is standard evaluation with MRI.

Outcomes
The outcomes of interest are sensitivity and specificity and the impact of diagnosis on health outcomes.

Timing
The time of interest is at biopsy or surgical resection or clinical follow-up.

Setting
The setting is tertiary neuro-oncology centers.

A TEC Assessment was completed in 2003 evaluated MRS for suspected brain tumors. The Assessment concluded that the overall body of evidence at that time did not provide strong and consistent evidence regarding the diagnostic test characteristics or clinical utility of MRS for any condition.

In 2014, Wang et al reported a meta-analysis of 24 studies (615 cases, 408 controls) on the diagnostic performance of MRS for detecting or grading of brain tumors. Twenty-two studies assessed gliomas, and 2 studies assessed ependymomas and primitive neuroectodermal tumors. Seven studies evaluated recurrence, nine evaluated the grade of tumor, five evaluated the detection of tumors, one evaluated residual tumor, and two assessed tumor metastases. The meta-analysis found the overall sensitivity and specificity of MRS were 80.1% and 78.5%, respectively. The area under the receiver operating characteristics curve was 0.78.

Diagnosis of Pediatric Brain Tumor Type
Pediatric brain tumors are histologically more diverse than adult brain tumors and include tumor types such as embryonal tumors, germ cell tumors, pilocytic astrocytoma, and ependymomas. Combined MRI and MRS to diagnose the type of pediatric brain tumor was reported in 2015 from multiple children's hospitals in the United States. MRI and MRS were performed in 120 pediatric patients as part of the usual presurgical workup, followed by biopsy or resection. For the first 60 patients (from 2001 to 2004), MRS was performed, but was considered experimental and not used for diagnosis. For the next 60 patients (2005 to 2008), radiologists used information from both MRI and MRS. The percentage of correct diagnoses was reported for the first 60 patients using only MRI (63% correct). MRI scans were re-evaluated at the time of the study (71% correct), and the diagnosis at the second MRI reading did not differ significantly from the first MRI reading. These results were compared with blinded diagnosis using MRI plus MRS (87% correct, $p<0.05$). For the second group of 60 patients who were diagnosed using MRI plus MRS, tumor type was correctly identified in 87% of patients ($p<0.005$ vs initial diagnosis with MRI alone). Together, the results indicated an improvement (from 71% to 87% correct) in the diagnosis of tumor type when MRS was combined with MRI.
In 2013, Vicente et al reported on a multicenter study that evaluated the ability of MRS to differentiate 78 histologically confirmed pediatric brain tumors (29 medulloblastomas, 11 ependymomas, 38 pilocytic astrocytomas). Significant metabolic differences in tumor types were identified by MRS when results from short and long echo times were combined, suggesting that MRS might provide noninvasive diagnostic information. MRS has also been evaluated as a prognostic tool. A 2013 study reported on single voxel, proton MRS to predict survival in 115 patients with pediatric brain tumors who were followed for a median of

35 months. Poor survival was associated with lipids and scyllo-inositol while glutamine and *N*-acetylaspartate (NAA) were associated with improved survival ($p<0.05$).

Differentiating Glioma Recurrence From Radiation Necrosis
A 2014 systematic review of the use of MRS for the differential diagnosis of glioma recurrence from radiation necrosis included 18 studies (total N=455 patients). Only 3 studies were prospective. Fourteen of the studies used both pathology and clinical plus radiologic follow-up as the reference standard. Twelve studies examined the choline (Cho)/creatine (Cr) ratio, 9 studies calculated the ratio of Cho/NAA, 5 studies calculated the NAA/Cr ratio, and 3 studies calculated the ratio of Cho/CR. Meta-analysis showed moderate diagnostic performance for MRS using the Cho/Cr and Cho/NAA ratios.

The largest prospective study included in the review was a 2012 report by Amin et al. This study compared MRS with single-photon emission computed tomography (SPECT) in the identification of residual or recurrent glioma vs radiation necrosis in 24 patients treated with surgery and radiotherapy. MRS and SPECT results differed in 9 cases of recurrence and were more accurate with SPECT. The specificity and PPV were 100% in both MRS and SPECT; however, the sensitivity was 61.1% vs 88.8%, and NPV was 46.2% vs 75%, respectively. The use of a single voxel rather than multiple voxels was noted as a limitation in interpreting the MRS results in this study.

Differentiating High-Grade From Low-Grade Glioma
In 2016, Wang et al reported a systematic review of 30 studies (total N=228 patients) on the diagnostic performance of MRS to differentiate high- from low-grade gliomas. Articles were included that used pathology or clinical follow-up as the reference standard for the identification of high-grade gliomas. Only 5 studies were prospective, sample sizes ranged from 7 to 160 patients, and there was considerable variability in the thresholds used to identify high-grade gliomas. There was evidence of publication bias. The pooled sensitivity and specificity in the meta-analysis were 75% and 60% for the Cho/Cr ratio, 80% and 76% for Cho/NAA ratio, and 71% and 70% for NAA/Cr ratio. The area under the receiver operating characteristic curve were 0.83, 0.87, and 0.78, respectively. Thus, MRS had moderate diagnostic accuracy in distinguishing high-grade from low-grade gliomas in the published studies.

Gauging Treatment Response
The possibility of using MRS to track treatment response and failure has been explored. A small (N=16), preliminary study (2008) of tamoxifen treatment for recurrent gliomas found MRS patterns differed between responders and nonresponders. Serial MRS demonstrated that metabolic spectra stabilized after initiation of therapy among responders and then changed in advance of clinical or radiologic treatment failure. In other words, MRS might help predict imminent treatment failure. However, there are relatively few studies with small sample sizes assessing this possible use of MRS. Additionally, other types of imaging are being evaluated for the same use, including dynamic contrast-enhanced (DCE) MRI (DCE-MRI), diffusion-weighted MRI, and fluorine 18 fluorodeoxyglucose positron emission tomography. Other studies are needed, including those comparing modalities or evaluating multimodalities.

Section Summary: Brain Tumors
Several systematic reviews have evaluated the performance of MRS for diagnosis and evaluation of brain tumors. A number of small studies have assessed detection, characterization, grading, prognosis, and differentiation of tumor recurrence vs necrosis. Most studies included in the meta-analyses were small, retrospective, and used various ratios of MRS spectra. The largest prospective study found that combining MRS with MRI resulted in a greater percentage of correct diagnoses of pediatric brain tumor type. This report offered limited information on the specific MRS spectra associated with the different tumor types. Additional study is needed to define better the spectra associated with tumor characteristics, to evaluate the diagnostic accuracy, and to determine the effect on health outcomes.

BREAST CANCER

Clinical Context and Test Purpose
The purpose of MRS in patients with breast cancer is to improve the specificity of MRI of the breast, which has a high false-positive rate.

The question addressed in this evidence review is: Does MRS improve the net health outcome of patients with breast cancer?

The following PICOTS were used to select literature to inform this review.

Patients
The relevant population of interest is patients who are being evaluated for breast cancer.

Interventions
The intervention of interest is MRS.

Comparators
The comparator of interest is standard evaluation with MRI.

Outcomes
The outcomes of interest are sensitivity and specificity and the effect on health outcomes.

Timing
The time of interest is following mammography to evaluate for suspicious lesions.

Setting
The setting is MRI facilities.
In 2013, Baltzer et al conducted a systematic review and meta-analysis of 19 studies on MRS for detecting benign vs malignant breast lesions. The total number of patients in the studies reviewed was 1183 and included 452 benign and 773 malignant lesions. In the pooled estimates, the sensitivity of MRS was 73%

(556/761; 95% confidence interval [CI], 64% to 82%) and the specificity was 88% (386/439; 95% CI, 85% to 91%). The area under the receiver operating characteristic curve for MRS detecting breast cancers vs benign lesions was 0.88. There was significant heterogeneity between studies and evidence of publication bias, limiting interpretation of findings.

PROSTATE CANCER

Clinical Context and Test Purpose

The purpose of MRS in patients with prostate cancer is to improve the evaluation of prostate cancer. There are several potential applications of MRS for prostate cancer, including diagnosis, recurrence assessment, and localization for biopsy and treatment planning.

The question addressed in this evidence review is: Does MRS improve the net health outcome of patients with prostate cancer? The specific clinical context of each test is described briefly in the following sections. The following PICOTS were used to select literature to inform this review.

Patients

The relevant population of interest is patients who are being evaluated for prostate cancer.

Interventions

The intervention of interest is MRS.

Comparators

The comparator of interest is standard evaluation with MRI.

Outcomes

The outcomes of interest are sensitivity and specificity and the effect on health outcomes.

Timing

The time of interest is the initial evaluation, prior to biopsy, and following treatment for prostate cancer.

Setting

The setting is MRI facilities.

In a 2013 health technology assessment, Mowatt et al systematically reviewed 51 studies to evaluate image-guided prostate biopsy with MRS and other enhanced MRI techniques (ie, dynamic contrast-enhanced MRI and diffusion-weighted MRI) compared with T2-MRI and transrectal ultrasound. In these studies, the patients had with suspicion of prostate cancer due to elevated prostate-specific antigen levels, despite a previous negative biopsy. MRS had the highest sensitivity in the meta-analysis of individual tests (92%; 95% CI, 86% to 95%), with an estimated specificity of 76% (95% CI, 61% to 87%). The transrectal ultrasound-guided biopsy had the highest specificity (81%; 95% CI, 77% to 85%).

A single-institution randomized controlled trial published in 2010 compared a second randomly selected biopsy (group A) with a biopsy selected partly based on MRS and DCE-MRI results (group B). The participants were selected from 215 consecutive men with an elevated prostate-specific antigen (between 4 ng/mL and 10 ng/mL), an initial negative biopsy result, and a negative digital rectal examination; 180 patients participated in the study. Cancer was detected in 24.4% of group A patients and 45.5% of group B participants. Fifty patients from group A with 2 negative biopsy results agreed to undergo biopsy a third time using MRS and DCE-MRI results; 26 more cancers were found. Overall, 61.6% of the cancers detected had Gleason scores 7 (4+3) or more. The cancers detected after using MRS and DCE-MRI imaging also lined up with the suspicious areas detected on imaging. The sensitivity and specificity of MRS were 92.3% and 88.2%, respectively; adding DCE-MRI increased the sensitivity to 92.6%, and the specificity to 88.8%. Limitations of the study included its single-center design, analysis confined to the peripheral zone of the prostate gland, and greater sample volume from group B patients (12.17 cores) than from group A patients (10 cores). Furthermore, given the concerns about potential overtreatment among patients with early-stage prostate cancer, the benefits of detecting these additional cancers need to be evaluated by examining clinical outcomes for these patients.

In a similar report from the same institution and author group, 150 patients with a negative prostate biopsy, despite prostate-specific antigen elevations, were randomized to MRS or MRS plus DCE-MRI to locate prostate cancer foci for a second targeted biopsy (see also Panebianco et al [2012]). The addition of DCE-MRI to MRS yielded increased sensitivity and specificity over MRS alone (93.7% and 90.7% vs 82.8% and 91.8%, respectively). Pedrona et al (2013) also reported on the combined use of MRS and DCE-MRI for assessing prostate cancer in 106 patients in a prospective cohort study. The authors reported that combined MRS and DCE-MRI results yielded unacceptably low PPV of 19%. The NPV was 91%. Sensitivity was 71%, and specificity was 48%. The authors indicated the combined MRS and DCE-MRI may be useful for avoiding biopsy, because the NPV was 91%; however, further study is needed.

Section Summary: Prostate Cancer
Although a number of studies have examined the use of MRS for localizing prostate cancer for biopsy and for monitoring of patients with prostate cancer, the cumulative evidence remains uncertain. Data comparing the diagnostic accuracy of MRS with alternative imaging strategies is limited. Additionally, the impact of MRS imaging compared with other imaging strategies on clinical management and health outcomes is unknown.

Noncancer Indications
Clinical Context and Test Purpose
The purpose of MRS in patients with noncancer indications is to improve the diagnosis and management of a variety of conditions.

The question addressed in this evidence review is: Does MRS improve the net health outcome of patients with noncancer indications?

The specific clinical context of each test is described briefly in the following sections. The following PICOTS were used to select literature to inform this review.

Patients
The relevant populations of interest are patients being evaluated for dementia, liver disease, multiple sclerosis, or other noncancer indications.

Interventions
The intervention of interest is MRS.

Comparators
The comparators of interest are observation for patients with dementia or multiple sclerosis and liver biopsy for patients with liver disease.

Outcomes
The outcomes of interest are sensitivity and specificity and the effect on health outcomes.

Timing
The time of interest is in the initial evaluation.

Setting
The setting is in MRI facilities.

Dementia
Research continues on the use of MRS to identify dementia, especially in its early stages. In 2013, Tumati et al conducted a systematic review and meta-analysis of 29 studies on MRS for mild cognitive impairment (MCI). Included in the analysis were 607 MCI patients and 862 healthy controls. Patterns in metabolite concentration, including NAA, Cr, Cho, and myo-inositolin, were identified in various regions of th brain; these were associated with MCI. For example, levels of Cr were found to be significantly lower in the hippocampus and paratrigonal white matter. NAA was found to be most associated with MCI, but other markers including myo-inositolin, Cho, and Cr may also contribute to MCI. In a 2014 review, Zhang et al identified 30 studies since 2007 on low-field (<1.5 Tesla) MRS and 27 studies on high-field (>3.0 Tesla) MRS that compared results from patients with Alzheimer disease, MCI, and healthy controls. While metabolite changes are heterogeneous across brain regions, most of these studies focused on detecting changes in individual metabolites or their ratios. Reviewers concluded that to characterize Alzheimer disease–associated neurochemical changes effectively, future approaches should interactively analyze multiple quantifiable metabolites from different brain regions.

Section Summary: Dementia
Although a number of studies have examined the use of MRS for identifying and monitoring cognitive impairment and dementia, the cumulative evidence does not support any role for MRS outside of the

research setting. There are no clear criteria for diagnosing cognitive impairment or dementia with MRS, and there are insufficient data on diagnostic comparators. Additionally, the impact of MRS imaging on clinical management and health outcomes is unknown.

Liver Disease
MRS has been evaluated as a noninvasive alternative to liver biopsy in the diagnosis of hepatic steatosis. It has been compared with other noninvasive imaging procedures such as computed tomography, DGE-MRI, and ultrasonography; liver biopsy was the reference standard, and a 3 Tesla MRI machine was used. In a prospective study of 161 consecutive potential living liver donors, DGE-MRI was reported to be the most accurate test for diagnosing hepatic steatosis. While DGE-MRI and MRS were similar for hepatic steatosis 5% or greater, DGE-MRI outperformed MRS for hepatic steatosis 30% or greater (especially regarding specificity) and on quantitative estimates (see also Taouli et al, 2009). In a systematic review of imaging liver fat in children, Awai et al (2014) reviewed 5 MRI studies and found varying methodologies for measuring liver fat by MRI or MRS.

Section Summary: Liver Disease
The available evidence does not support the utility of MRI or MRS for assessment of hepatic steatosis in children.

Multiple Sclerosis
Multiple sclerosis is a chronic disease with a variable prognosis and clinical course. Predictors of future disease course might help select patients who would benefit most from disease-modify treatments. In 2014, Llufriu et al published a study assessing use of MRS in a preliminary data set of 59 patients with multiple sclerosis and 43 healthy controls, and in a confirmatory independent data set of 220 patients. Change in brain volume and measures of disability were obtained annually. The myo-inositolin:NAA ratio in normal-appearing white matter was found to be a predictor of brain volume change over 4 years (p=0.02) and of clinical disability (eg, a decrease in the Multiple Sclerosis Functional Composite evolution scale of -0.23 points annually, p=0.01). Effect sizes in this study were low, indicating that the measure is not sufficiently reliable to predict the future disease course in individual patients.

Section Summary: Multiple Sclerosis
Future studies are needed that include larger cohorts with progressive multiple sclerosis, serial measurements of outcomes, and complementary measures of disease activity.

Other Indications
MRS has also been evaluated for other uses, such as tracking disease changes among patients with systemic lupus erythematosus, assessing carotid plaque morphology and identifying biomarkers of traumatic brain injury, and predicting long-term neurodevelopmental outcome after neonatal encephalopathy (see also Wilkinson [2010], van Laerhoven et al [2013]). MRS has also been used to evaluate pediatric patients with seizures, and other applications in children. Additional evidence on these

applications is needed. MRS has also been studied in a variety of psychiatric disorders in the research setting, but no studies on the clinical use of MRS for the treatment of psychiatric disorders were found.

SUMMARY OF EVIDENCE

For individuals who have brain tumors who receive MRS, the evidence includes a number of small studies and systematic reviews. Relevant outcomes are test accuracy, change in disease status, morbid events, and functional outcomes. Small studies have evaluated detection, characterization, grading, prognosis, and differentiation of tumor recurrence vs necrosis. Most studies included in the meta-analyses were small, retrospective, and used various ratios of MRS spectra. The largest prospective study found that combining MRS with magnetic resonance imaging resulted in a greater percentage of correct diagnoses of pediatric brain tumor type. This report had limited information on the specific MRS spectra associated with the different tumor types. Additional study is needed to define better the spectra associated with tumor characteristics, to evaluate the diagnostic accuracy, and to determine the effect on health outcomes. The evidence is insufficient to determine the effects of the technology on health outcomes.

For individuals who have breast cancer, prostate cancer, dementia, liver disease, or multiple sclerosis who receive MRS, the evidence includes prospective studies on diagnostic accuracy and systematic reviews. Relevant outcomes are test accuracy, change in disease status, morbid events, and functional outcomes. A number of studies have examined the use of MRS for localizing prostate cancer for biopsy and for monitoring of patients with prostate cancer. However, the cumulative evidence remains uncertain. Data comparing the diagnostic accuracy of MRS with alternative imaging strategies is limited. A systematic review of MRS to identify dementia concluded that to characterize Alzheimer disease–associated neurochemical changes effectively, future approaches need to analyze interactively multiple quantifiable metabolites from different brain regions. A study of MRS as a noninvasive alternative to liver biopsy indicates that dual-gradient echo magnetic resonance imaging outperforms MRS. Data on use of MRS in multiple sclerosis has indicated that the measure is not sufficiently reliable to predict the future disease course. The evidence is insufficient to determine the effects of the technology on health outcomes.

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Policy History

Original Effective Date: 02/19/2009
Current Effective Date: 05/14/2018

02/04/2009	Medical Director review
02/19/2009	Medical Policy Committee approval. New policy.
02/04/2010	Medical Policy Committee approval
02/17/2010	Medical Policy Implementation Committee approval. Coverage eligibility unchanged.
02/03/2011	Medical Policy Committee review
02/16/2011	Medical Policy Implementation Committee approval. Coverage eligibility unchanged.
02/02/2012	Medical Policy Committee review
02/15/2012	Medical Policy Implementation Committee approval. Coverage eligibility unchanged.
02/07/2013	Medical Policy Committee review
02/20/2013	Medical Policy Implementation Committee approval. Coverage eligibility unchanged.
02/06/2014	Medical Policy Committee review
02/19/2014	Medical Policy Implementation Committee approval. Coverage eligibility unchanged.
02/05/2015	Medical Policy Committee review
02/18/2015	Medical Policy Implementation Committee approval. Coverage eligibility unchanged.
02/04/2016	Medical Policy Committee review
02/17/2016	Medical Policy Implementation Committee approval. Coverage eligibility unchanged.
01/01/2017	Coding update: Removing ICD-9 Diagnosis Codes
02/02/2017	Medical Policy Committee review
02/15/2017	Medical Policy Implementation Committee approval. Coverage eligibility unchanged.
02/01/2018	Medical Policy Committee review
02/21/2018	Medical Policy Implementation Committee approval. Coverage eligibility unchanged.

Next Scheduled Review Date: 02/2019

Magnetic Resonance Spectroscopy

Policy # 00226
Original Effective Date: 02/19/2009
Current Effective Date: 05/14/2018

Coding

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Codes used to identify services associated with this policy may include (but may not be limited to) the following:

Code Type	Code
CPT	76390
HCPCS	No codes
ICD-10 Diagnosis	All related diagnoses

*****Investigational – A medical treatment, procedure, drug, device, or biological product is Investigational if the effectiveness has not been clearly tested and it has not been incorporated into standard medical practice. Any determination we make that a medical treatment, procedure, drug, device, or biological product is Investigational will be based on a consideration of the following:

A. Whether the medical treatment, procedure, drug, device, or biological product can be lawfully marketed without approval of the FDA and whether such approval has been granted at the time the medical treatment, procedure, drug, device, or biological product is sought to be furnished; or
B. Whether the medical treatment, procedure, drug, device, or biological product requires further studies or clinical trials to determine its maximum tolerated dose, toxicity, safety, effectiveness, or effectiveness as compared with the standard means of treatment or diagnosis, must improve health outcomes, according to the consensus of opinion among experts as shown by reliable evidence, including:
    1. Consultation with the Blue Cross and Blue Shield Association technology assessment program (TEC) or other nonaffiliated technology evaluation center(s);
    2. Credible scientific evidence published in peer-reviewed medical literature generally recognized by the relevant medical community; or
    3. Reference to federal regulations.

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