AmeriHealth Caritas Louisiana

National Imaging Associates, Inc.*	
Clinical guidelines **BRAIN (HEAD) MRS**	**Original Date: April 2007**
CPT Codes: 76390, +0698T	**Last Revised Date: May ~~February~~ 2022~~1~~**
Guideline Number: NIA_CG_003	**Implementation Date: January 2023~~2~~**

INDICATIONS FOR BRAIN MRS[1]
~~(ACR, 2019)~~

- For the evaluation of a recurrent or residual brain tumor from post-treatment changes, e.g., radiation necrosis[2] ~~(Chuang, 2016)~~
- For further evaluation of a brain lesion to distinguish a brain tumor from other non-tumor diagnoses (e.g., abscess or other infectious or inflammatory process)[3,4] ~~(Alam, 2011; Majós, 2009)~~

BACKGROUND[3,5]
~~(Alam, 2011; Hellström, 2018)~~

Magnetic resonance spectroscopy (MRS) is a noninvasive imaging technique that determines the concentration of brain metabolites, such as N-acetylaspartate, choline, creatine, and lactate, within the body tissue examined. Radiofrequency waves are translated into biochemical composition of the scanned tissue; the resulting metabolic profile is useful in identifying brain tumors, e.g., differentiating neoplastic and non-neoplastic brain lesions. In selected cases, MRS may be a valuable supplement to MRI. It is sensitive, but nonspecific. This modality should be considered as an adjunct to conventional imaging rather than replacement for histopathological evaluation.

In terms of brain tumor evaluation and classification, carefully designed multi-center trials complying with criteria of evidence-based medicine have not yet been completed ~~(Horská, 2010)~~.[6]

Tumor Recurrence vs. Radiation Necrosis – Differentiation between recurrent brain tumors and treatment related injury, e.g., radiation necrosis, is difficult using conventional MRI. The typical appearance of radiation necrosis is similar to that of recurrent brain tumors. MRS is a quantitative

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approach, measuring various brain metabolic markers, to help in the differentiation of recurrent tumors and radiation necrosis. This differentiation is important as additional radiation can benefit recurrent disease but can be detrimental to radiation necrosis. MRS may help in determining treatment options and in preventing unnecessary surgery. In addition, a tumor recurrence diagnosed by MRS allows the surgeon to begin treatment early instead of having to wait for symptoms of recurrence or biopsy confirmation ~~(Barajas, 2009; Chuang, 2016; Smith, 2009)~~.[2,7,8] However, no consensus exists regarding the value of this in clinical decision making, and no approach has yet been validated to be sufficiently accurate ~~(Chuang, 2016; Sundgren, 2009; Walker, 2014)~~.[2,9,10]

Glioma – MRS has been proposed for pre-operative grading of gliomas and differentiating high-grade gliomas (HGGs) from low-grade gliomas. It has been found to have moderate diagnostic value and should be combined with other advanced imaging techniques to improve accuracy. Currently, the data is limited; more research is needed for a definite conclusion for the utility of MRS for this indication. Therefore, it remains experimental/investigational ~~(Abrigo, 2018; Wang, 2016)~~.[11,12]

MRS in other diseases ~~– –~~A role for MRS has been suggested in the management of neurodegenerative disease, epilepsy, and stroke. **MRS can also be applied in conjunction with MRI in the evaluation of pediatric neurodegenerative disease, traumatic brain injury and neonatal hypoxia-ischemia.**[13,14,15] However, to better define ~~this~~ **these role**s, it will be necessary to standardize the MRS methodology, as well as the collection, analysis, and interpretation of data so it can be consistently translated to the applicable clinical settings. Currently, these potential applications remain experimental/investigational ~~(Oz, 2014)~~.[15]

POLICY HISTORY

Date	Summary
May ~~February~~ **2022**	**Updated references and background section**
November 2021	Added +0698T
February 2021	Updated background information and references
May 2020	Updated references
July 2019	Deleted: • ~~-~~therapeutic f/u indication Added: • ~~-~~tumor versus non tumor indication Updated: • background info and refs

REFERENCES

Abrigo JM, Fountain DM, Provenzale JM, et al. Magnetic resonance perfusion for differentiating low-grade from high-grade gliomas at first presentation. *Cochrane Database Syst Rev*. 2018 Jan 22; 1(1):CD011551.

Alam MS, Sajjad Z, Hafeez S, et al. Magnetic resonance spectroscopy in focal brain lesions. *J Pak Med Assoc.* 2011 Jun; 61(6):540-3.

American College of Radiology (ACR). ACR–ASNR–SPR practice parameter for the performance and interpretation of magnetic resonance spectroscopy of the central nervous system. Revised 2019. Accessed August 3, 2021. https://www.asnr.org/wp-content/uploads/2019/06/MR-Spectroscopy-1.pdf.

Barajas RF, Chang JS, Sneed PK, et al. Distinguishing recurrent intra-axial metastatic tumor from radiation necrosis following gamma knife radiosurgery using dynamic susceptibility-weighted contrast-enhanced perfusion MR imaging. *AJNR Am J Neuroradiol*. 2009; 30:367-372. doi: 10.3174/ajnr.A1362.

Chuang MT, Liu YS, Tsai YS, et al. Differentiating radiation-induced necrosis from recurrent brain tumor using MR perfusion and spectroscopy: A meta-analysis. *PLoS One*. 2016 Jan 7; 11(1):e0141438.

Hellström J, Romanos Zapata R, Libard S, et al. The value of magnetic resonance spectroscopy as a supplement to MRI of the brain in a clinical setting. *PLoS One*. 2018 Nov 15; 13(11):e0207336.

Horská A, Barker PB. Imaging of brain tumors: MR spectroscopy and metabolic imaging. *Neuroimaging Clin N Am*. 2010; 20(3):293–310.

Majós C, Aguilera C, Alonso J, et al. Proton MR spectroscopy improves discrimination between tumor and pseudotumoral lesion in solid brain masses. AJNR Am J Neuroradiol. 2009 Mar; 30(3):544-51. Epub 2008 Dec 18.

Oz G, Alger JR, Peter B, et al. Clinical proton MR spectroscopy in central nervous system disorders. *Radiology*. March 2014; 270(3):658-679.

Smith EA, Carlos RC, Junck LR, et al. Developing a clinical decision model: MR spectroscopy to differentiate between recurrent tumor and radiation change in patients with new contrast-enhancing lesions. *Am J Roentgenol*. 2009; 192(2):W45-52. doi: 10.2214/AJR.07.3934.

Sundgren PC. MR spectroscopy in radiation injury. *AJNR Am J Neuroradiol*. 2009; 30:1469-1476. http://www.ajnr.org/content/30/8/1469.full.

Walker AJ, Ruzevick J, Malayeri AA, et al. Postradiation imaging changes in the CNS: How can we differentiate between treatment effect and disease progression? *Future Oncol*. 2014; 10(7):1277–1297.

~~Wang Q, Zhang H, Zhang J, et al. The diagnostic performance of magnetic resonance spectroscopy in differentiating high-from low-grade gliomas: A systematic review and meta-analysis. *Eur Radiol*. 2016; 26(8):2670-2684.~~

~~**Reviewed / Approved by NIA Clinical Guideline Committee**~~

~~**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.~~

1.

American College of Radiology, American Society of Neuroradiology, Society for Pediatric Radiology. ACR–ASNR–SPR practice parameter for the performance and interpretation of magnetic resonance spectroscopy of the central nervous system. American College of Radiology. Updated 2019. Accessed December 21, 2021. https://www.asnr.org/wp-content/uploads/2019/06/MR-Spectroscopy-1.pdf

2. Chuang MT, Liu YS, Tsai YS, Chen YC, Wang CK. Differentiating Radiation-Induced Necrosis from Recurrent Brain Tumor Using MR Perfusion and Spectroscopy: A Meta-Analysis. *PLoS One*. 2016;11(1):e0141438. doi:10.1371/journal.pone.0141438

3. Alam MS, Sajjad Z, Hafeez S, Akhter W. Magnetic resonance spectroscopy in focal brain lesions. *J Pak Med Assoc*. Jun 2011;61(6):540-3.

4. Majós C, Aguilera C, Alonso J, et al. Proton MR spectroscopy improves discrimination between tumor and pseudotumoral lesion in solid brain masses. *AJNR Am J Neuroradiol*. Mar 2009;30(3):544-51. doi:10.3174/ajnr.A1392

5. Hellström J, Romanos Zapata R, Libard S, et al. The value of magnetic resonance spectroscopy as a supplement to MRI of the brain in a clinical setting. *PLoS One*. 2018;13(11):e0207336. doi:10.1371/journal.pone.0207336

6. Horská A, Barker PB. Imaging of brain tumors: MR spectroscopy and metabolic imaging. *Neuroimaging Clin N Am*. Aug 2010;20(3):293-310. doi:10.1016/j.nic.2010.04.003

7. Barajas RF, Chang JS, Sneed PK, Segal MR, McDermott MW, Cha S. Distinguishing recurrent intra-axial metastatic tumor from radiation necrosis following gamma knife radiosurgery using dynamic susceptibility-weighted contrast-enhanced perfusion MR imaging. *AJNR Am J Neuroradiol*. Feb 2009;30(2):367-72. doi:10.3174/ajnr.A1362

8. Smith EA, Carlos RC, Junck LR, Tsien CI, Elias A, Sundgren PC. Developing a clinical decision model: MR spectroscopy to differentiate between recurrent tumor and radiation change in patients with new contrast-enhancing lesions. *AJR Am J Roentgenol*. Feb 2009;192(2):W45-52. doi:10.2214/ajr.07.3934

9. Walker AJ, Ruzevick J, Malayeri AA, et al. Postradiation imaging changes in the CNS: how can we differentiate between treatment effect and disease progression? *Future Oncol*. May 2014;10(7):1277-97. doi:10.2217/fon.13.271
10. Sundgren PC. MR spectroscopy in radiation injury. *AJNR Am J Neuroradiol*. Sep 2009;30(8):1469-76. doi:10.3174/ajnr.A1580
11. Wang Q, Zhang H, Zhang J, et al. The diagnostic performance of magnetic resonance spectroscopy in differentiating high-from low-grade gliomas: A systematic review and meta-analysis. *Eur Radiol*. Aug 2016;26(8):2670-84. doi:10.1007/s00330-015-4046-z
12. Abrigo JM, Fountain DM, Provenzale JM, et al. Magnetic resonance perfusion for differentiating low-grade from high-grade gliomas at first presentation. *Cochrane Database Syst Rev*. Jan 22 2018;1(1):Cd011551. doi:10.1002/14651858.CD011551.pub2
13. Schneider JF. MR spectroscopy in children: protocols and pitfalls in non-tumorous brain pathology. *Pediatr Radiol*. Jun 2016;46(7):963-82. doi:10.1007/s00247-014-3270-z
14. Rossi A, Biancheri R. Magnetic resonance spectroscopy in metabolic disorders. *Neuroimaging Clin N Am*. Aug 2013;23(3):425-48. doi:10.1016/j.nic.2012.12.013
15. Oz G, Alger JR, Barker PB, et al. Clinical proton MR spectroscopy in central nervous system disorders. *Radiology*. Mar 2014;270(3):658-79. doi:10.1148/radiol.13130531

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