Case Report

Glioblastoma multiforme presenting with an open ring pattern of enhancement on MR imaging

Merritt D. Kinon, Aleka Scoco, Joaquim M. Farinhas, Andrew Kobets, Karen M. Weidenheim, Reza Yassari, Patrick A. Lasala, Jerome Graber

Department of Neurological Surgery, Albert Einstein College of Medicine, Montefiore Medical Center, New York, USA

E-mail: *Merritt D. Kinon - mkinon@montefiore.org; Aleka Scoco - ascoco@montefiore.org; Joaquim M. Farinhas - jfarinha@montefiore.org; Andrew Kobets - akobets@montefiore.org; Karen M. Weidenheim - kweidenh@montefiore.org; Reza Yassari - ryassari@montefiore.org; Patrick A. Lasala - plasala@montefiore.org; Jerome Graber - jerome.graber@swedish.org

*Corresponding author

Received: 24 January 17  Accepted: 06 March 17  Published: 13 June 17

Abstract

Background: Intracerebral ring enhancing lesions can be the presentation of a variety of pathologies, including neoplasia, inflammation, and autoimmune demyelination. Use of a precise diagnostic algorithm is imperative in correctly treating these lesions and minimizing potential adverse treatment effects.

Case Description: A 55-year-old patient presented to the hospital with complaints of a post-concussive syndrome and a non-focal neurologic exam. Imaging revealed a lesion with an open ring enhancement pattern, minimal surrounding vasogenic edema, and minimal mass effect. Given the minimal mass effect, small size of the lesion, and nonfocal neurological exam, we elected to pursue a comprehensive noninvasive neurologic workup because our differential ranged from inflammatory/infectious to neoplasm. Over the next 8 weeks, the patient’s condition worsened, and repeat imaging showed marked enlargement of the lesion with a now closed ring pattern of enhancement with satellite lesions and a magnetic resonance (MR) spectroscopy and perfusion signature suggestive of neoplasm. The patient was taken to surgery for biopsy and debulking of the lesion. Surgical neuropathology examination revealed glioblastoma multiforme.

Conclusion: The unique open ring enhancement pattern of this lesion on initial imaging is highly specific for a demyelinating process, however, high-grade glial neoplasms can also present with complex and irregular ring enhancement including an open ring sign. Therefore, other imaging modalities should be used, and close follow-up is warranted when the open ring sign is encountered.

Key Words: Glioblastoma, incomplete peripheral rim enhancement, open-ring sign, radiographic image enhancement, tumefactive demyelination, tumefactive demyelinating lesion

This is an open access article distributed under the terms of the Creative Commons Attribution-NonCommercial-ShareAlike 3.0 License, which allows others to remix, tweak, and build upon the work non-commercially, as long as the author is credited and the new creations are licensed under the identical terms.

For reprints contact: reprints@medknow.com

How to cite this article: Kinon MD, Scoco A, Farinhas JM, Kobets A, Weidenheim KM, Yassari R, et al. Glioblastoma multiforme presenting with an open ring pattern of enhancement on MR imaging. Surg Neurol Int 2017;8:106.

http://surgicalneurologyint.com/Glioblastoma-multiforme-presenting-with-an-open-ring-pattern-of-enhancement-on-MR-imaging/
INTRODUCTION

Intracerebral ring enhancing lesions can be a presentation of neoplasia (including metastases, lymphoma, and gliomas), infections, or autoimmune demyelination mimicking neoplasia (tumefactive demyelination), thus posing a diagnostic and management dilemma.[1] While neoplastic lesions require surgical intervention for diagnosis and sometimes resection, tumefactive demyelination responds well to corticosteroids without the need for surgery. However, use of corticosteroids can mask lymphomas and should be avoided when a tissue diagnosis is required. Incomplete peripheral enhancement, also referred to as an “open-ring” enhancement is thought to be highly specific for tumefactive demyelinating lesions (TDLs), yet can also represent malignancy – we present such a case and underscore the need for close follow-up of patients presenting with open-ring lesions.

CASE HISTORY

A 55-year-old man presented to an outside institution for treatment of a concussion which he sustained after a fall from a ladder while working in his yard. Initial neurologic examination and magnetic resonance imaging (MRI) of the brain were normal. The patient continued to have concussive symptoms and headache 4 months later. Neurologic exam was still normal, however, repeat MRI revealed a right posterior temporal cystic lesion measuring 1.5 × 1.5 cm with incomplete peripheral enhancement characteristic of an open ring sign [Figure 1a], with mild surrounding vasogenic edema [Figure 1b], minimal mass effect, no midline shift, and no restriction on diffusion. Because the differential diagnosis included infectious/inflammatory process, cavernoma, and neoplasm, the decision was made to follow the lesion with a comprehensive, noninvasive neurologic workup. Two months later, the patient began having acute, intermittent confusional episodes, culminating in a witnessed generalized seizure. Repeat MRI showed a 5.3 × 4.2 cm lesion with significant mass effect and surrounding vasogenic edema [Figure 2a]. The mass had a more defined central cystic component, did not show restriction on diffusion and a closed ring pattern of peripheral enhancement, as well as satellite lesions along its posterior aspect [Figure 2b]. MR spectroscopy was performed and showed an increased choline-to-creatine ratio with a decreased NAA signature suggestive of a neoplasm [Figure 3]. MR perfusion showed increased relative blood volume compared to contralateral tissue, strongly suggesting neoplasia [Figure 4].

The patient was taken to surgery for a right-sided temporal craniotomy for resection of the mass. Intraoperatively, the lesion was noted to be hemorrhagic with areas of necrosis and thrombosed vessels suggestive of a malignant glial neoplasm. Surgical neuropathology examination showed the lesion to be an infiltrating...
glioblastoma multiforme. When trying to identify MR and CT features that distinguish TDLs from glioma or lymphoma, Kim et al. found 4 out of the 13 tumor patients exhibiting focal rim enhancement to have incomplete rings on MR. In this case, there was no head CT done concurrently with the MR demonstrating open-ring enhancement to correlate. Another study investigating MR findings of primary CNS lymphoma patients reported 2 out of 26 studied cases demonstrating open-ring enhancement. They note thick and non-uniform quality of the rings when compared to the primarily thin and uniform open-ring sign in TDLs. Nonetheless, the present case shows a thin, uniform pattern of incomplete rim enhancement. When presented with open-ring enhancing lesions, there is necessity to correlate with other features suggestive of TDL to rule out neoplasm. Such features include T2-weighted iso- and hyperintensity of enhanced regions, absence of mass effect, low relative perfusion, absence of cortical involvement, and CT hypodensity of MR enhanced regions. MR imaging of TDLs may also show necrosis and cystic degeneration. In this case, MR spectroscopy demonstrated the characteristic glioma spectrum consisting of elevated choline with suppressed levels of NAA, however, these can also be mimicked by TDLs. The presence of other lesions typical of demyelination or oligoclonal bands in the cerebrospinal fluid are also suggestive of demyelination rather than neoplasia, but not absolute and were absent in our case. Patients with features suggestive of TDL may be
managed acutely with a short course of high dose steroids and if a good clinical and radiographic response was observed a diagnosis of a demyelinating process would be supported. However, because all of these features can be seen in neoplasia, close follow up is required.

CONCLUSION

Open-ring pattern of enhancement is reported to be highly specific for demyelinating lesions, rather than neoplasia. However, high grade glial neoplasms can also present with complex and irregular ring enhancement including an open ring sign. Therefore, other imaging modalities should be used and close follow-up is warranted when the open ring sign is encountered.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

REFERENCES

1. Faehndrich J, Weidauer S, Pilatus U, Oszvald A, Zanella FE, Hattingen E. Neuroradiological viewpoint on the diagnostics of space-occupying brain lesions. Clin Neuroradiol 2011;21:123-39.
2. Fallah A, Banglawa S, Ebrahim S, Paulseth JE, Jha NK. Tumefactive demyelinating lesions: A diagnostic challenge. Can J Surg 2010;53:69-70.
3. Given CA, Stevens BS, Lee C. The MRI Appearance of Tumefactive Demyelinating Lesions. Am J Roentgenol 2004;182:1959.
4. Javalkar V, Manix M, Wilson J, Nanda A. Open ring enhancement in atypical brain demyelination. J Clin Neurosci 2012;19: 910-2.
5. Kim DS, Na DG, Kim KH, Kim JH, Kim E, et al. Distinguishing tumefactive demyelinating lesions from glioma or central nervous system lymphoma: Added value of unenhanced CT compared with conventional contrast-enhanced MR imaging. Radiology 2009;251:467-75.
6. Kimura N, Kumamoto T, Hanaoka T, Hasama Y, Nakamura K, Okazaki T. Monofocal large inflammatory demyelinating lesion, mimicking brain glioma. Clin Neurol Neurosurg 2009;111:296-9.
7. Massderu JC, Quinto C, Oliveira C, Tenner M, Leslie D, Visintainer P. Open-ring imaging sign: Highly specific for atypical brain demyelination. Neurology 2000;54:1427-33.
8. McAdam LC, Blaser SI, Banwell BL. Pediatric tumefactive demyelination: Case series and review of the literature. Pediatr Neurol 2002;26:18-25.
9. Medeiros FC, de Albuquerque LAF, de Pittella JEH, de Souza RB, de Gomes Neto AP, Christo PP. Open-Ring Enhancement in Pseudotumoral Multiple Sclerosis: Important Radiological Aspect. Case Rep Neurol Med 2014;2014:1-5.
10. Report C, Akimoto J, Fukuhara H, Suda T, Nagai K, Hashimoto R, et al. Disseminated cerebellar hemangioblastoma in two patients without von Hippel – Lindau disease. Surg Neurol Int 2014;5:145.
11. Riva D, Chiapparini L, Pollo B, Balestrini MR, Massimino M, Milani N. A Case of Child Neurology A Case of Pediatric Tumefactive. J Child Neurol 2008;23:944-7.
12. Siddiqui A, Sahni A, Khadilkar S. The open-ring sign. Neurol India 2005;53:253-4.
13. Shinha M, Garg R, Bhatt M, Chandra A. Tumefactive demyelinating lesion: Experience with two unusual patients. J Postgrad Med 2010;56;5:146.
14. Zhang D, Hu LB, Henning TD, Ravarani EM, Zou LG, Feng XY, et al. MRI Findings of Primary CNS Lymphoma in 26 Immunocompetent Patients. Korean J Radiol 2010;11:269.