




Original Article

Diagnostic validity and reliability of BT-RADS in the management of recurrent high-grade glioma

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Highlights

- BT-RADS showed high diagnostic accuracy in detecting the recurrence of HGG.
- BT-RADS provide a great help in assessment of post treatment response of HGG.
- BT-RADS improved radiologists' reports performance with no ambiguous terms.

Abstract

Background and purpose

BT-RADS is a new framework system for reporting the treatment response of brain tumors. The aim of the study was to assess the diagnostic performance and reliability of the BT-RADS in predicting the recurrence of high-grade glioma (HGG).

Materials and Methods

This prospective single-center study recruited 81 cases with previously operated and pathologically proven HGG. The patients underwent baseline and follow-up contrast-enhanced MRI (CE-MRI). Two neuro-radiologists with ten years-experience in neuroimaging independently analyzed and interpreted the MRI images and assigned a BT-RADS category for each case. To assess the diagnostic accuracy of the BT-RADS for detecting recurrent HGG, the reference standard was the histopathology for BT-RADS categories 3 and 4, while neurological clinical examination and clinical follow up were used as a reference for BT-RADS categories 1 and 2. The inter-reader agreement was assessed using the Cohen's Kappa test.

Results

The study included 81 cases of HGG, of which 42 were recurrent and 39 were non-recurrent HGG cases based on the reference test. BT-RADS 3B was the best cutoff for predicting recurrent HGG with a sensitivity of 90.5 % to 92.9 %, specificity of 76.9 % to 84.6 %, and accuracy of 83.9 % to 88.9 %, based on both readers. The BT-RADS showed a substantial inter-reader agreement with a K of 0.710 ($P = 0.001$).

Conclusions

The BT-RADS is a valid and reliable framework for predicting recurrent HGG. Moreover, BT-RADS can help neuro-oncologists make clinical decisions that can potentially improve the patient's outcome.

Introduction

Gliomas are the most common primary brain tumors. These tumors are graded into four grades (grade I-IV) depending on the predicted clinical course.^{1,2} The glioblastoma is the commonest and the most aggressive primary brain tumor.³ High-grade gliomas (HGG) represent 60 % of the primary tumors.¹

Neuroimaging has a crucial role in the diagnosis and follow-up of a suspected brain tumor, in addition to assessing post-treatment response. Magnetic resonance imaging (MRI) is the imaging modality of choice for assessing such tumors.^{4,5}

Treatment of malignant brain tumors should be decided by a multidisciplinary team (MDT) consisting of an oncologist, a radiation oncologist, and a neurosurgeon. The treatment options include surgery, chemotherapy, radiotherapy, or a combination.⁶ Other medical therapies may be used, such as new angiogenic treatment, immunotherapy, steroids, anticoagulants, and anticonvulsants.^{7, 8, 9} Given the typically bad prognosis, low survival rates, high recurrence, and relative treatment resistance, close follow-up is crucial.¹⁰

Reporting the treatment response of brain tumors is essential for management, and it mainly depends on the tumor appearance in the radiological images.⁴ The change in the tumor size is the mainstay for deciding the response to therapy.^{11,12} The response assessment criteria for brain tumors were introduced early in 1977 by Levin et al.,¹³ followed by Mac Donald et al., who introduced the widely accepted response assessment criteria in 1990.¹⁴ A better understanding of brain tumor biology and advances in therapy and medical imaging led to numerous revisions of these old response criteria. In 2010, Response Assessment in Neuro-Oncology criteria (RANO) was introduced.¹⁵ RANO criteria resolved many limitations of the previously used Mc Donalds criteria, such as lack of definition of measurable and non-measurable disease and failure to identify post-chemo-radiotherapy pseudo-progression and pseudo-response resulting from newly merged angiogenic agents such as bevacizumab.¹⁵

Recently, classical radiological reports have been widely replaced by a standardized reporting system. The most commonly used structured systems are BIRADS¹⁶ and TIRADS.¹⁷ These widely used systems resolve the misunderstanding between the referring clinicians and the radiologists because of the difference in writing styles and languages.^{16,17} The proliferation of Reporting and Data System (RADS) in recent years led to the development of many other reporting and data systems. Additionally, it inspired a group of scientists to develop a structured reporting system for evaluating the treatment response of brain tumors, which is called the Brain Tumor Reporting and Data System (BT-RADS).^{18,19}

BT-RADS is a management-based, standardized, simplified system for the classification of treatment response of brain tumors with structural reporting. The system depends mainly on the MRI appearance of the tumors in conventional images, clinical picture, and the therapy time. BT-RADS categorizes the treatment response into five categories, ranging from 1 to 4.¹⁹ BT- RADS categories were structured based on the previous workup of

RANO and McDonald's criteria. However, it has many advantages over the previously applied systems; (a) It is a management-based system; (b) It provides standardized reporting, which helps better communication between the radiologists and the clinicians; (c) The reliance on the measurements was minimized in this system; (d) It depends on basic simple MRI sequences which are not vulnerable for artifacts or variability; (e) The confusing terms, such as pseudo-progression or pseudo-regression were avoided in BT-RADS framework.^{19,20}

This study aimed to assess the diagnostic accuracy and reliability of the BT-RADS in managing recurrent HGG.

Section snippets

Study design and population

This single-center prospective study recruited consecutive 101 patients between May 2022 and February 2023. They were referred from the Neuro-oncology Department to the Radiology Department. The local institutional review board (IRB) approval was obtained (No: 9559). Informed consent was signed from all participants. The study followed the Declaration of Helsinki's principles and the STARD guidelines for reporting a diagnostic test accuracy study.²¹

Inclusion criteria were (i) Patients who...

Results

The current study included 81 patients (45 males and 36 females) with previously operated HGG and were receiving chemo-radiotherapy and/or medications. The mean age of the studied patients was 55.43 ± 9.5 years. The median (IQR) of the time interval between completion of the radiotherapy and follow-up MRI scan was 16 (8) weeks. Fifty-nine patients underwent histopathological examination (40 positive and 19 negative cases), while 22 patients underwent neurological evaluation and imaging...

Clinical significance

The current study attempts to contribute to the literature on the clinical impact of the standardized framework reporting system for treatment response in high-grade glioma. This standard classification system increases the consistency of the radiological reports. It avoids uncertainty and previously reported ambiguous terms, such as pseudo-progression and pseudo-response. Accurate discrimination between recurrent and non-recurrent high-grade glioma (HGG) is crucial for better decision-making...

Conclusions

BT-RADS provides a useful framework for improving MRI reports regarding HGG treatment response. It shows high diagnostic validity and reliability. Therefore, it can be adopted in clinical practice to achieve better patient outcomes....

Data availability statement

All relevant data is contained within the article: The original contributions presented in the study are included in the article, further inquiries can be directed to the corresponding author....

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CRediT authorship contribution statement

Noha Yahia Ebaid: Conceptualization, Methodology, Software, Data curation, Writing – original draft. **Rasha Nadeem Ahmed:** Data curation, Writing – original draft. **Mostafa Mohamad Assy:** Supervision. **Mohamed Ibrahim Amin:** Software, Validation. **Ahmed Mohamad Alaa Eldin:** Visualization, Investigation. **Ahmed Mohamed Alsowey:** Writing – review & editing. **Rabab Mohamed Abdelhay:** Visualization, Investigation....

Declaration of competing interest

The authors declare that they have no known competing financial or personal relationships that could be viewed as influencing the work reported in this paper....

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References (26)

A.H. Jacobs *et al.*

[Imaging in neurooncology](#)

NeuroRx (2005)

E.A. Eisenhauer *et al.*

[New response evaluation criteria in solid tumours: revised RECIST guideline \(version 1.1\)](#)

Eur J Cancer (2009)

R.Y. Huang *et al.*

[Response assessment in neuro-oncology criteria and clinical endpoints](#)

Magnetic Resonance Imaging Clin (2016)

F.N. Tessler *et al.*

[ACR thyroid imaging, reporting and data system \(TI-RADS\): white paper of the ACR TI-RADS committee](#)

J Am Coll Radiol (2017)

B.D. Weinberg *et al.*

[Management-based structured reporting of posttreatment glioma response with the brain tumor reporting and data system](#)

J Am Coll Radiol (2018)

A. Gore *et al.*

Institutional implementation of a structured reporting system: our experience with the brain tumor reporting and data system

Acad Radiol (2019)

J. Zhang *et al.*

Diagnostic performance of increased signal intensity within the resection cavity on fluid-attenuated inversion recovery sequences for detection of progression in patients with glioma

World Neurosurg (2018)

Q.T. Ostrom *et al.*

CBTRUS statistical report: primary brain and other central nervous system tumors diagnosed in the United States in 2011-2015

Neuro Oncol (2018)

H. Ohgaki *et al.*

The definition of primary and secondary glioblastoma definition of primary and secondary glioblastomas

Clinical cancer research (2013)



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Cited by (0)

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