International Journal of Current Science Research and Review
ISSN: 2581-8341
Volume 09 Issue 04 April 2026
DOI: 10.47191/ijcsrr/V9-i4-38, Impact Factor: 8.048
IJCSRR @ 2026
www.ijcsrr.org

Evaluation of Brain Masses Using Magnetic Resonance Diffusion-Weighted Imaging (DWI)

Elrayh Alnour[1], Hussein A. Hassan[2]
[1]Karary University, college of Graduate Studies, Sudan.
[2]College of Medical Radiologic Sciences, Karary University, Sudan

ABSTRACT
Background: Diffusion-weighted imaging (DWI) is a valuable MRI technique that provides information about tissue cellularity and helps differentiate various brain lesions.
Objective: To evaluate the role of DWI and apparent diffusion coefficient (ADC) values in the characterization of brain masses.
Methods: A descriptive cross-sectional hospital-based prospective study was conducted between January 2019 and May 2024 at the MRI Department of Aliaa Specialist Hospital, Khartoum, Sudan. Thirty patients with suspected brain tumors on CT were included. All patients underwent conventional MRI, contrast-enhanced MRI, DWI, and ADC measurement. Histopathological confirmation was obtained in all cases.
Results: Brain lesions included gliomas, metastases, meningiomas, schwannomas, abscesses, epidermoid cysts, hemangioblastomas, and medulloblastomas. ADC values varied among lesion types, with lower values generally observed in high-grade and highly cellular tumors.
Conclusion: DWI and ADC measurements are valuable tools in differentiating brain masses, particularly in distinguishing benign from malignant lesions.

KEY WORDS: Brain Masses, Magnetic Resonance, Diffusion-Weighted Imaging (DWI)

1. INTRODUCTION

Magnetic Resonance Imaging (MRI) plays a crucial role in the evaluation of brain tumors. Diffusion-weighted imaging (DWI) is an advanced MRI technique that reflects the mobility of water molecules within tissues, providing insight into tumor cellularity and microstructure. The apparent diffusion coefficient (ADC) quantitatively measures diffusion restriction and helps in differentiating tumor types and grades.

2. MATERIALS AND METHODS

2.1 Materials

The current study was a descriptive cross-sectional hospital-based prospective study conducted between January 2019 and May 2024. The study was carried out at the MRI Department of Aliaa Specialist Hospital, Khartoum State, Sudan.

2.1.1 Study Population: A total of 30 patients (20 males and 10 females) aged between 2 and 73 years (mean age: 43.5 ± SD) with suspected brain tumors based on CT findings were included. Patients were referred from the Neurosurgery Department and presented with symptoms such as headache and vomiting; all patienst with a brain mass detected by CT or clinically suspected were included.

2.1.2 Equipment: MRI examinations were performed using a 1.5 Tesla Toshiba MRI scanner (Japan, 2011) equipped with an 8-channel head coil.

2.2 Methods:

2.2.1 MRI Technique: All patients underwent:
Conventional MRI, Post-contrast MRI Diffusion-weighted imaging (DWI)
ADC value measurement, MRI examinations were performed prior to surgery or biopsy, and histopathological confirmation was obtained in all cases.

2.2.1.1 MRI Protocol: A standard brain MRI protocol included:
T1-weighted imaging

International Journal of Current Science Research and Review
ISSN: 2581-8341
Volume 09 Issue 04 April 2026
DOI: 10.47191/ijcsrr/V9-i4-38, Impact Factor: 8.048
IJCSRR @ 2026
www.ijcsrr.org

Plane: Axial
Sequence: Fast Spin Echo (FSE)
Purpose: Anatomical overview
T2-weighted imaging
Plane: Axial
Sequence: Fast Spin Echo (FSE)
Purpose: Evaluation of ventricles, cisterns, and edema
FLAIR
Plane: Axial
Purpose: Assessment of white matter abnormalities
DWI
Plane: Axial
b-values: 0 and 1000 s/mm²
ADC maps generated
Purpose: Assessment of diffusion restriction

2.2.2 Image Analysis: MRI images were interpreted independently by two experienced radiologists (20 and 25 years of experience) who were blinded to histopathological results.

Qualitative Analysis: Lesion site, Size and shape, Signal intensity, Enhancement pattern ,Mass effect and extension ,Diffusion characteristics (restricted vs facilitated)

Quantitative Analysis: ADC values were measured for all lesions.

2.2.3 Data Analysis: Data were analyzed using SPSS (Statistical Package for Social Sciences). Results were presented in tables and figures.

2.3 Ethical Considerations

Ethical approval was obtained from the institutional review committee. Verbal informed consent was obtained from all patients. Patient confidentiality was strictly maintained.

3. RESULTS

A total of brain lesions were identified as follows:
13 gliomas (5 high-grade, 8 low-grade). 10 metastatic tumors. 9 meningiomas
7 schwannomas , 3 abscesses , 3 epidermoid cysts , 3 hemangioblastomas
2 medulloblastomas

3.1 ADC Values

ADC values varied across lesion types:

Tumor Type	No	Age Range (years)	ADC Range ($\times 10^{-3}$ mm²/s)	Mean ADC
High-grade glioma	5	11–64	1.012–1.315	1.193
Low-grade glioma	8	12–62	1.090–1.788	1.342
Metastasis	10	33–72	0.565–1.064	0.833
Meningioma	9	39–63	0.720–1.14	0.874
Schwannoma	7	24–60	0.877–1.320	1.039
Hemangioblastoma	3	18–48	0.978–1.429	1.220
Medulloblastoma	2	7–18	0.511–0.861	0.686
Epidermoid cyst	3	33–50	0.797–0.984	0.910
Abscess	3	2–41	0.425–0.603	0.503

3.2 Comparative Analysis

High-grade gliomas showed lower ADC values compared to low-grade gliomas.

International Journal of Current Science Research and Review
ISSN: 2581-8341
Volume 09 Issue 04 April 2026
DOI: 10.47191/ijcsrr/V9-i4-38, Impact Factor: 8.048
IJCSRR @ 2026
www.ijcsrr.org

Metastases demonstrated relatively low ADC values due to high cellularity.
Medulloblastomas and abscesses showed marked diffusion restriction (lowest ADC values).
Benign lesions such as hemangioblastomas showed higher ADC values.
A positive correlation was observed between ADC values and tumor grade, with lower ADC values associated with higher tumor cellularity.

4. DISCUSSION

DWI plays a significant role in differentiating brain lesions based on water molecule diffusion. Highly cellular tumors such as high-grade gliomas, metastases, and medulloblastomas exhibit restricted diffusion and low ADC values. In contrast, benign and cystic lesions tend to show higher ADC values due to increased extracellular space.
The findings of this study are consistent with previous literature, confirming the utility of DWI in non-invasive tumor characterization.

5. CONCLUSION

Diffusion-weighted imaging and ADC measurement are essential tools in the evaluation of brain masses. They provide valuable information for differentiating tumor types and grading, aiding in diagnosis and treatment planning.

6. RECOMMENDATIONS

Routine inclusion of DWI in brain MRI protocols
Use of ADC values as a quantitative biomarker for tumor characterization
Further studies with larger sample sizes for validation

REFERENCES

1. Le Bihan D, Mangin JF, Poupon C, Clark CA, Pappata S, Molko N, et al. Diffusion tensor imaging: concepts and applications. Radiology. 2001;220(2):335–49.
2. Le Bihan D. Diffusion MRI: what water tells us about biological tissues. Radiology. 2003;227(2):318–36.
3. Guo AC, Cummings TJ, Dash RC, Provenzale JM. Lymphomas and high-grade astrocytomas: comparison of water diffusibility and histologic characteristics. AJNR Am J Neuroradiol. 2002;23(5):902–7.
4. Stadnik TW, Chaskis C, Michotte A, Shabana WM, van Rompaey K, Luypaert R, et al. Diffusion-weighted MR imaging of intracerebral masses: comparison with conventional MR imaging and histologic findings. Radiology. 2001;220(2):429–36.
5. Kono K, Inoue Y, Nakayama K, Shakudo M, Morino M, Ohata K, et al. The role of diffusion-weighted imaging in patients with brain tumors. Radiology. 2001;219(3):849–54.
6. Hygino da Cruz LC Jr, Rodriguez I, Domingues RC, Gasparetto EL, Sorensen AG. Diffusion-weighted imaging of the brain: beyond stroke. Neuroimaging Clin N Am. 2011;21(2):353–73.
7. Yamasaki F, Kurisu K, Satoh K, Arita K, Sugiyama K, Ohtaki M, et al. Apparent diffusion coefficient of human brain tumors at MR imaging. Radiology. 2005;235(3):985–91.
8. Tozer DJ, Jäger HR, Danchaivijitr N, Benton CE, Tofts PS, Rees JH, et al. Apparent diffusion coefficient histograms may predict low-grade glioma grade. Radiology. 2007;243(2):537–44.
9. Chang SC, Lai PH, Chen WL, Weng HH, Ho JT, Wang JS, et al. Diffusion-weighted MRI features of brain abscess and necrotic brain tumors. Clin Imaging. 2002;26(4):227–36.
10. Castillo M, Smith JK, Kwock L. Correlation of apparent diffusion coefficient values and histologic findings in intracranial tumors. AJNR Am J Neuroradiol. 2001;22(9):1641–8.

Cite this Article: Alnour, E., Hassan, H.A. (2026). Evaluation of Brain Masses Using Magnetic Resonance Diffusion-Weighted Imaging (DWI). International Journal of Current Science Research and Review, 9(4), pp. 2089-2091. DOI: https://doi.org/10.47191/ijcsrr/V9-i4-38