

# Evaluation of CT Scan and MRI Findings of Pathologically Proved Gliomas in an Iranian Population

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## Abstract

**Purpose:** The aim of this study was to report the main CT scan and MRI findings of gliomas in a group of Iranian patients.

**Material and Methods:** The MRI and CT scan of 96 pathologically proven patients of gliomas were retrospectively evaluated in a period of five years in our university affiliated hospital. We included all cases who had both CT scan and MRI in our study.

**Results:** Among our patients, 60 (62.5%) were male and 36 (37.5%) were female. The mean age of our patients was  $41.8 \pm 19.3$  (7-78). The most common location of tumor was in the parietal lobes (54.2%) followed by the temporal lobes (52.1%), and the frontal lobes (39.6%). The most common subtype was glioblastoma multiform in 42 patients (43.8%). Edema, cystic formation, and hemorrhage were more frequently found in MRI in comparison with CT scan, while CT scan showed calcification better than MRI.

**Conclusion:** In contrast to many other studies, the most common site of gliomas in our patients was parietal lobes.

**Keywords:** glioma, magnetic resonance imaging, computerized tomography

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## Introduction

About two thirds of all brain tumors are primary intra-axial neoplasms. [1]

Gliomas are among the most common tumors of the brain, varying histologically from low grade to high grade. [2]

The incidence rate of gliomas is 1.22 cases per 100/000 person-years for adults. [1]

Imaging is an important component for clinical evaluation of brain tumors and is used for diagnosis, treatment planning and following response to therapy.

Some studies have concluded that imaging properties of gliomas such as necrosis and edema are associated with survival [3-5]. The tumor usually arises from the white matter and is typically a single, relatively large, irregularly shaped abnormality [6].

Non-invasive imaging modalities that are used for the diagnosis and characterization of gliomas include Computed Tomography (CT) and Magnetic Resonance Imaging (MRI).

By using a contrast media for CT or MRI, we can predict regions of disruption of the blood brain barrier and leakage of the contrast agent. [6]

To the best of our knowledge, there are no other published reports on the MRI and CT scan characteristics of these tumors in Iran.

The aim of this study was to report the MRI and CT scan findings of gliomas in a group of Iranian population.

## Materials and Methods

In this cross section study, we evaluated 96 patients with gliomas who had undergone Computed Tomography scan and Magnetic Resonance Imaging (MRI), with and without Gadolinium injection in a period of five years between 2001 and 2006 in Lohmane-Hakim university affiliated hospital.

The presence of gliomas was confirmed by surgical resection or biopsy. All tumors were graded according to the World Health Organization (WHO) grading system [7]. All cases had a history of brain space occupying lesion and both CT scan and MRI were ordered for them. T1 and T2-weighted sagittal, axial, and coronal Magnetic Resonance images were taken for all cases and contrast MRI studies using intravenous Gd-DTPA (Magnevist, 0.2 mmol/Kg; Schering, Germany) were performed in all cases.

CT Scans were done using sequential techniques (collimation 10 mm, spacing 10mm) with Shimatzo CT Scanner (Japan).

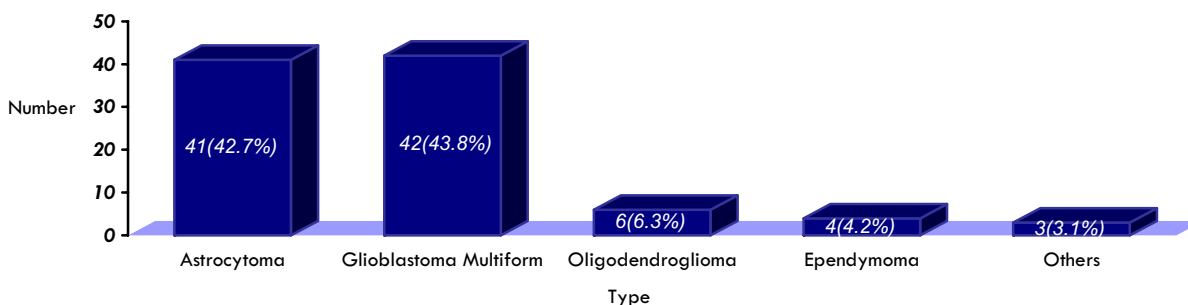


Figure 1: Frequency of Different Tumor Types

The MRI studies were reviewed by one radiologist and analyzed for tumor location, signal intensity, extent of contrast enhancement, and degree of peritumoral edema, calcification, cystic formation, hemorrhage, midline shift, mass effect, hydrocephalus, and collapse.

Statistical analysis was performed using SPSS ver. 11.5. Statistical significance was set at  $P < 0.05$ .

### Results

Among 96 patients enrolled in this study, 60 (62.5%) were male and 36 (37.5%) were female with a mean age of  $41.8 \pm 19.3$  (7-78).

The histologic diagnosis was glioblastoma

multiform in 42 patients (43.8%) and astrocytomas in 41 patients (42.7%). (Figure 1)

Among these, 89 tumors (92.7%) arose from supra-tentorial region while seven (7.3%) arose from infra-tentorial region.

The tumors were located in the parietal, temporal, frontal, occipital, basal ganglia, and interventricular region in 52 (54.2%), 50 (52.1%), 38 (39.6%), 10 (10.4%), six (6.3%), and five (5.2%) patients, respectively.

Forty two tumors (43.8%) were located in the right side, 39 (40.6%) in the left side, eight (8.3%) in the midline, three (3.1%) in both sides, and three (3.1%) of them were mixed (right or left plus midline).

Table 1: Characteristics of patients with brain gliomas according to CT scan findings:

Characteristics	Number	Percent
<b>Calcification</b>		
Focal	11	11.5
Diffuse	4	4.2
<b>Edema</b>		
Mild	47	49
Severe	15	15.6
<b>Enhancement</b>		
Mild	35	36.5
Moderate	25	26
Severe	16	16.7
<b>Cystic Formation</b>	24	25
<b>Hemorrhage</b>		
Focal	3	3.1
Diffuse	1	1
<b>Midline Shift</b>		
Transtentorial	1	1
Subfalscial	55	57.3
Both of Them	1	1
<b>Nodule</b>	2	2.1

Table 2: MRI findings of patients with gliomas:

Findings	Number	Percent
<b>T1 Signal</b>		
Iso	16	16.7
Hypo	52	54.2
Hyper	1	1
Mix	27	28.1
<b>T2 Signal</b>		
Hyper	83	86.5
Mix	13	13.2
<b>Calcification</b>		
Focal	5	5.2
Diffuse	1	1
<b>Edema</b>		
Mild	49	51
Severe	15	15.6
<b>Cystic formation</b>		
	30	31.3
<b>Hemorrhage</b>		
Focal	7	7.3
Diffuse	1	1
<b>Midline Shift</b>		
Transtentorial	1	1
Subfalscial	56	58.3
Both of Them	1	1
<b>Mass Effect</b>		
	72	75
<b>Ventricular Effect</b>		
Hydrocephalus	21	21.9
Collapse	22	22.9
Combine Form	32	33.3

According to tumor density in CT scan, we found seven isodense (7.3%), 49 hypodense (51%), 10 hyperdense (10.4%), five heterogeneous (5.2%), and 25 mix (26%) tumors in our study.

Characteristics of patients according to their CT scan findings are summarized in table 1.

Among 81 enhanced tumors in MRI, enhancement ring, homogenous enhancement, non-homogenous enhancement, and combined form enhancement were seen in 25 (26%), 12 (12.5%), 25 (26%), and 19 (19.8%) cases, respectively.

Mild enhancement was seen in 37 (38.5%) patients, moderate in 25 (26%), and severe in 18 (18.8%) patients.

MRI findings of our patients are shown in table 2.

## Discussion

Approximately 60% of primary brain tumors diagnosed in the USA are gliomas. [8-10]

Glioblastoma multiform occurs most frequently in the subcortical white matter of the brain hemispheres.

Brain CT scan and MRI (with and without contrast) are useful in the management and grading of gliomas. [11, 12]

In high grade gliomas and anaplastic astrocytomas, partial enhancement is common. These tumors are commonly isointense on T1- weighted images but hyperintense on T2- weighted images.

Most high grade gliomas in contrast with low-grade tumors enhance with paramagnetic contrast agents. [11, 12]

Glioblastoma multiform typically shows an enhancing ring on T2- weighted images and a broad surrounding site of edema on T2- weighted images. The central hypodense zone represents necrosis. Gliomas are heterogeneous neoplasms with different survival rates. [13-15]

MRI is considered as the choice method for diagnosis of these tumors, but CT scan may be helpful in some cases like such as acute settings or when MRI is contraindicated.

On CT scan, Low grade gliomas are homogeneous, low density masses, usually without contrast enhancement, although slight enhancement, calcification, or cystic changes may be present in the course of the disease.

Male to female ratio in our cases was 1.6 that is similar to many other studies. [16-20]

The most common subtype of gliomas in our patients was glioblastoma multiforme (43.8%). This is very close to a report by Laryavaara et al that found glioblastomas as the most common subtype of brain tumors with an incidence rate of 47%. [21]

In a study on 987 glioblastomas in Zurich, the most common site was temporal lobe (31%) and parietal, frontal, and occipital lobes were affected in 31%, 24% and 16% of cases, respectively. Also combined frontotemporal lesion is common, and less common sites are brain stem (often seen in children), cerebellum, and spinal cord. [8-10]

The most frequent site of tumors in our study was parietal lobe, followed by temporal and frontal lobes. This is in contrast with many other reports that found frontal lobe as the most common site of gliomas. [5, 19, 20, 22]

In the study by Laryavaara et al, the most frequent location of gliomas was the frontal lobe (40%), and only 14% of tumors were located in the parietal lobe, that is in contrast with our study. [21] We have no comment on this difference between our study and many other previous reports.

Edema, cystic formation, and hemorrhage were more frequently found in MRI in comparison with CT scan, while CT scan showed calcification better than MRI.

One limitation of this study was that all images were reported by one radiologist so that we did not have an inter-observer error.

In conclusion, in contrast with many other studies, the most common site of gliomas in our patients was parietal lobes.

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