

Unveiling CT Brain Patterns: Insights into Adult-Onset Seizures

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Abstract : Objectives: This study aims to evaluate the CT brain findings in adults presenting with the first episode of seizures.

Methods: This descriptive-analytical study was conducted on 150 patients presented with the first episode of seizures at Maharajah's Institute of Medical Sciences between March 2022 and December 2023.

Results: The mean age of the patients was 51.3 years, and the male-to-female ratio was 1:0.8. Generalized seizures were more prevalent among patients than focal seizures. Of the 150 patients, 70 (46.6%) revealed abnormal findings. Out of these 70 patients, vascular pathology stands as the most prevalent, making up 28.6 %, followed by infective pathology, which accounts for 15%, and the least common was neoplastic pathology (7.7%).

Conclusion: A significant number of abnormal findings on CT brain scans were observed in adult patients experiencing their first seizures, endorsing the necessity of prompt CT brain imaging for patients displaying specific clinical risk factors.

Keywords: CT Brain, seizures, adults, first episode.

Introduction :

Globally, approximately 2% of visits to medical emergency departments involve adults with seizures, and among these cases, around 25% are attributed to new-onset seizures. The estimated occurrence of seizures in the general population throughout their lifetime is between 5% to 10%.^[1]

A seizure is a temporary neurological condition caused by abnormal electrical activity in a cluster of neurons within the brain's cortex. Seizures can be either generalized or focal.^[2]

There are many causes for seizures, where cerebrovascular diseases stand as the predominant cause. At the same time, additional factors encompass head injuries, primary or metastatic brain tumors, infections of the central nervous system, and metabolic abnormalities.^[3]

Brain CT (computed tomography) scanning is a non-invasive approach that has enabled the diagnosis of various neurological disorders.^[4]

In cases of emergency and for patients needing ongoing monitoring of disease progression, computed tomography is usually the first choice for imaging due to its practicality, especially in emergency situations.^[5]

Magnetic resonance imaging (MRI) can be employed as additional imaging when CT results are inconclusive or for further characterization.^[6]

Methods :

This descriptive-analytical study was conducted on 150 adults who presented with first episode of seizures at Maharajah's Institute of Medical Sciences, Nellimarla between March 2022 and December 2023. The study received approval from the Hospital Ethical Board.

Inclusion criteria :

- Patients of both sexes who presented with the first episode of seizure.

Exclusion criteria :

- Seizures in pregnancy.
- Patients with head trauma.

Clinical details, which include patient age, gender, and seizure classification (generalized, focal, or status epilepticus) were obtained.

Results :

The study comprised 150 patients, 80 of whom were males (53.3%) and 70 of whom were females (46.7%). The ages of the patients ranged from 18 to 75 years, with a mean age of 46.5 years. Focal seizures were seen in 45.2% of patients whereas generalized seizures were seen in 54.8% of patients.

The CT scan results revealed a standard CT in 80 cases. In the remaining 70 cases, the causes for the CT abnormalities were categorized as vascular(28.6%), infective (15%), and neoplastic (7.7%).

Table 1: Frequency and Percentage of Abnormalities in Brain CT Scan of Patients :

Neuroimaging findings	Frequency (n = 150)	Percentage
Normal	80	53.3
Abnormal	70	46.7

Table 2 : Pathological categories

Vascular	43	28.6
Infective	22	15
Tumors	5	7.7

Of the 43 vascular cases, infarcts were seen in 26 (60.5%) cases, intracerebral hemorrhage in 13 (30.2%) cases, dural venous sinus thrombosis in 3(7%) cases, and vascular malformation in 1 (2.3%) case.

Table 3 : Vascular causes

Vascular causes	Frequency	Percentage
Infarcts	26	60.5
Intracerebral hemorrhage	13	30.2
Dural venous sinus thrombosis	3	7
Vascular malformation	1	2.3

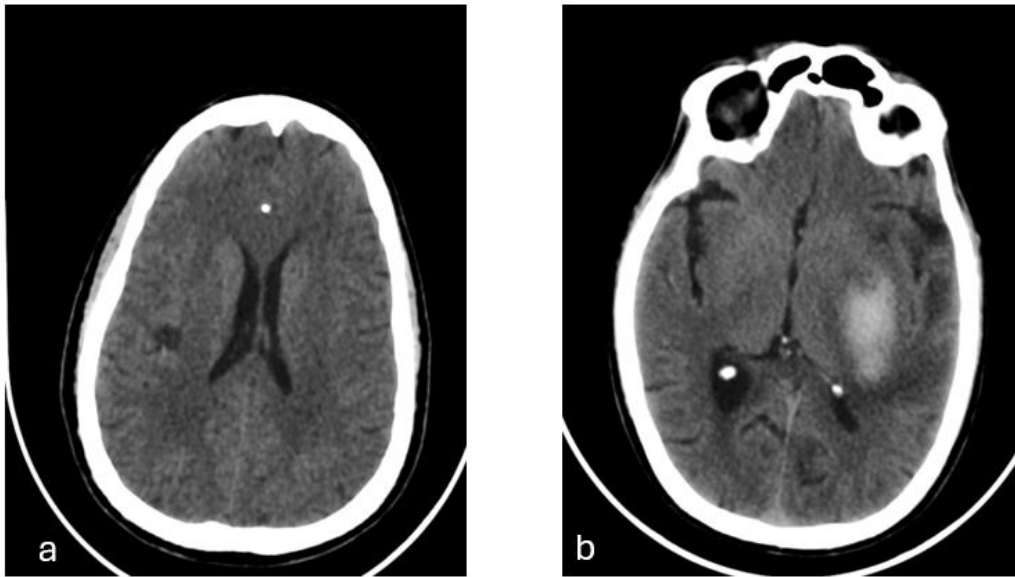


Fig 1 : Vascular pathology as a cause of new-onset seizures. (a) Axial NECT showing acute infarct in the right parietal cortex and subcortical white matter. (b) Axial NECT showing intracerebral hemorrhage in the left capsule-ganglionic region with surrounding perilesional edema.

Out of the 22 infective cases, Meningitis was seen in 13 (59.2%) cases, Pyogenic abscess in 5 (22.7) cases, Neurocysticercosis in 3 (13.6%) cases and Toxoplasmosis in 1 (4.5%) case and Tuberculoma in 1(4.5%) case.

Table 4: Infective causes

Infective causes	Frequency	Percentage
Meningitis	12	54.5
Pyogenic abscess	5	22.9
Neurocysticercosis	3	13.6
Toxoplasmosis	1	4.5
Tuberculoma	1	4.5

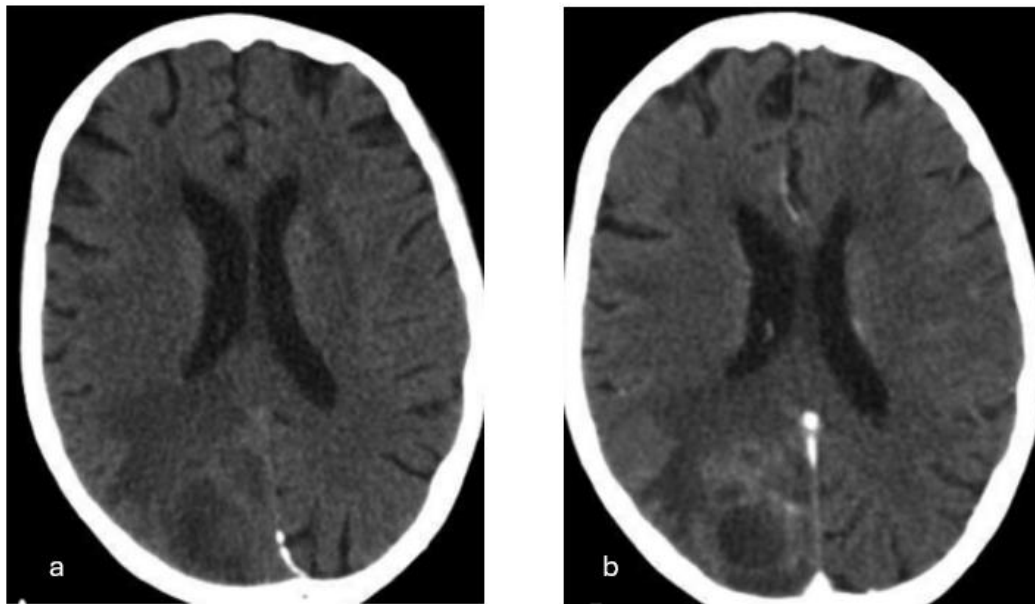


Fig 2 : Infective pathology as a cause of new-onset seizures. (a) Axial NECT showing ill-defined hypodense lesion in the right occipital lobe. (b) On contrast administration, the lesion shows peripheral rim enhancement consistent with Cerebral abscess.

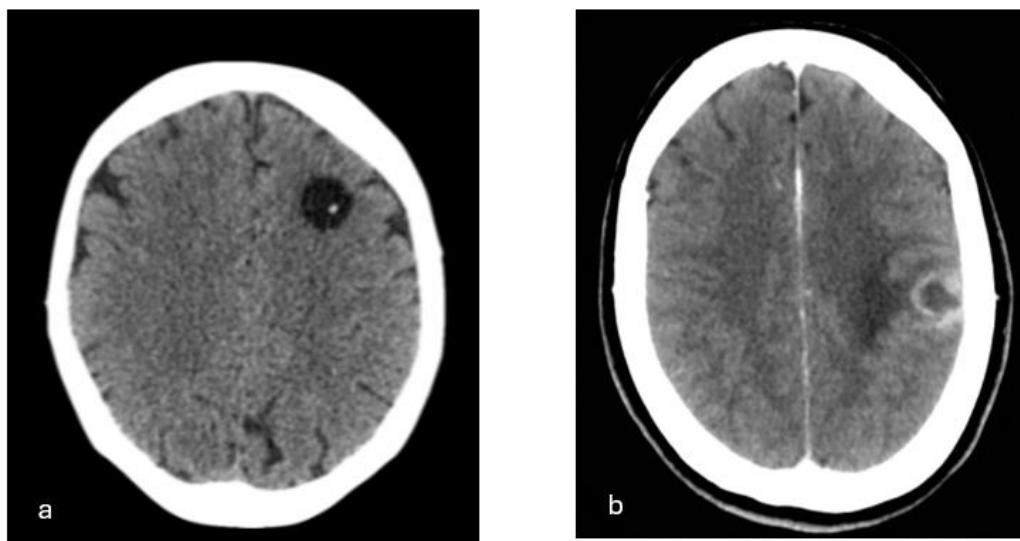


Fig 3 : Infective pathology as a cause of new-onset seizures. (a) Axial NECT showing a cystic lesion with scolex inside in the left frontal lobe indicating Neurocysticercosis. (b) Axial CECT showing hypodense lesion with peripheral ring enhancement in the left parietal region consistent with Toxoplasmosis in an HIV positive patient.

Tumors were detected in 5 patients comprising 7.7% of total cases. Of these 4 (80%) were primary CNS neoplasms and 1 (20%) was secondary CNS neoplasm.

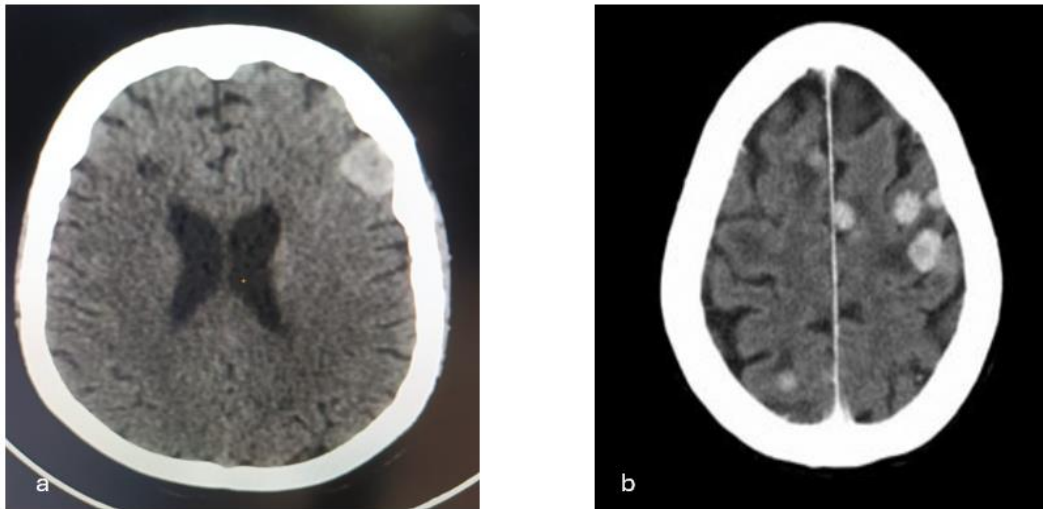


Fig 4 : Neoplastic pathology as a cause of new-onset seizures. (a) Axial NECT showing hyperdense extra-axial mass lesion in the left frontal region, suggesting Meningioma. (b) Sagittal CECT showing multiple significantly enhancing cerebral metastases in the bilateral cerebral parenchyma in a patient with a known history of lung carcinoma.

Discussion :

The mean age of the patients in this study was 51.3 years. There was a slight male predominance with a male-to-female ratio of 1:0.8, similar to the studies done by Zarmehri et al.^[7]

Focal seizures were seen in 45.2 % of patients whereas generalized seizures were seen in 54.8% of patients in the present study. In the research done by Smith et al., it was discovered that the most frequent type of seizures were generalized seizures, constituting 86.7% of their patient group.^[8]

There were 46.7% abnormal CT brain findings in this study. Vascular pathology accounted for 28.6% of abnormal CT brain findings. This is similar to the survey by Kaur et al., where stroke was the most common cause of abnormal CTB findings in India, accounting for 23%.^[9]

Infective pathology comprised 15% of abnormal CTB findings and was observed more frequently in younger patients and those infected with HIV. There was a notable prevalence of infective pathology in the parietal lobe, possibly due to a higher occurrence of hematogenous sources of cerebral infection, which may also involve the middle cerebral arterial territory. A review by Patel et al. indicated that hematogenous spread contributed to 9% – 43% of cerebral abscesses.^[10]

Neoplastic pathology accounted for 7.7% of the abnormal CTB findings, predominantly occurring in older patients with an average age of 57.6 years.

Conclusion :

Our study concludes that as significant number of abnormal findings on CT brain scans were observed in adult patients experiencing their first seizures, brain CT scans should be standard practice for evaluating all patients presenting with their first seizure. Because CT scans are more readily accessible and cost-effective compared to MRI, they are the preferred neuroimaging modality.

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