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ORIGINAL RESEARCH ARTICLE

STUDY ON SPECTRUM OF COMPUTED TOMOGRAPHY FINDINGS IN FOCAL SEIZURES

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ABSTRACT

BACKGROUND

Seizures are among the most frequent health-care issues worldwide, and there is reason to believe that their prevalence is growing. A computed tomography (CT) brain scan with or without contrast remains the primary examination for accurate diagnosis and treatment.

Aims and Objectives

To evaluate morphological changes on CT brain study in patients who present with focal seizures and to study their etiological factors.

MATERIALS &METHODS

This prospective study was conducted amongst 90 clinically diagnosed seizure patients, referred for CT brain to department of Radiology, wherein those patients underwent CT scan & requisite evaluation to render a diagnosis & provide adequate treatment to manage the condition.

RESULTS

Mean age of our study subjects was 34.53 years with majority of subjects were aged 21-40 years, accounting for 35 (38.9%) subjects; with 50 (55.6%) subjects being males. We had 75 (83.3%) SPS & 15 (16.7%) CPS type of seizures; with 23 (25.6%) had solitary lesions and 17 (18.9%) had multiple lesions. 18 (20.0%) left side, 15 (16.7%) right side and 2 (2.2%) both sides involvement was noted amongst subjects with the most commonly involved lobe being: 15 (16.7%) frontal, 11 (12.2%) parietal, 9 (10.0%) temporal and 7 (7.8%) occipital.

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CONCLUSION
The majority of our study subjects were males with a slightly higher predominance of left side involvement. CT helped in identifying various types of pathologies such as neurocysticercosis, tuberculoma, PC, Mets, meningioma & SDH. CT helps in screening patients with focal seizures in order to identify patients with structural abnormalities with majority of patients presenting with classical findings on CT and undergo prompt treatment.

KEYWORDS
Computed Tomography, Imaging, Seizures, Pathology.

INTRODUCTION

Seizures are the most prevalent neurological condition in India.[1] Epilepsy is defined by repeated, spontaneous seizures. In affluent countries, the prevalence of epilepsy is 24-53 per 1,000 individuals. There are a few studies in undeveloped nations, but none of which are prospective, with rates ranging from 49.3 to 190 per 1,000 people.

Seizures are caused by various factors in India alongside other developing countries than in the industrialized world.[2] Although generalized tonic-clonic seizures occur throughout life, partial seizures appear increasingly prevalent in children and the elderly.[1]

The computed tomography (CT) scan is critical in the radiological assessment of patients with seizures.[3] CT can detect brain structural abnormalities (calcifications, bleeding, cysts, and tumors), ventricular diseases, infections, infarctions, and lesions with that underlies calcification.[4] The sensitivity of a CT scan for diagnosing intracranial structural pathology in epileptics is around 30-40%. Focal seizures are most likely more sensitive.[5]

CT scans of the brain in infants reveal aberrant discoveries in up to 58% of cases, including infective lesions, localized and vascular lesions.[6] Despite the prevalence of Magnetic Resonance Imaging (MRI), CT scans remain important in emergency circumstances due to their relative ease of use.[7]

Our study was designed to investigate how Computed Tomography scan results align with the probable causes of focal seizures.

Aims and Objectives

- To highlight CT scan findings in the context of focal seizures.
- To investigate how CT scan results align with the probable causes of these patients symptoms.

MATERIALS AND METHODS

The study was conducted at R L Jalappa Hospital and Research Centre, attached to Sri Devaraj Urs medical college, Tamaka, Kolar. The study was conducted over a period of 3 months from June 2024 to August 2024, in the age group of 5 – 80 years.

The study design was presented in front of the Institutional Ethics Committee & any recommendations which enhanced the study were incorporated after a detailed review. Further, other requisite approvals were obtained from their respective organizations.

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The study protocol was explained to the patient/guardian in detail, after which an informed consent was obtained from them, depicting the individual's willingness to participate in the study.

Inclusion Criteria

- All patients with clinically diagnosed focal seizures who had abnormalities on CT scan of brain, in the age group of 5 – 80 years.
- Patients consenting to be a part of our study.

Exclusion Criteria

- Altered renal function test (Serum creatinine > 1.4 mg/dL)
- Patients with multi-factorial disease
- Patients not consenting to be a part of our study

This prospective observational study was designed & conducted amongst 90 clinically diagnosed seizure patients who were referred for CT brain to department of Radiology, wherein those patients underwent CT scan & requisite evaluation to render a diagnosis & provide adequate treatment to manage the condition.

A detailed clinical history and CT findings were recorded using a pre-designed proforma.

Parameters

All the patients underwent CT brain (plain ± contrast study) with SIEMENS® SOMATOM go TOP CT 128-slice scanner.

Standard brain (axial scan)

- kV - 130.0
- mAs - 270
- Effective dose [mSv] - 3.84
- Slice thickness - 5 mm

CT images of the brain were performed at 5mm intervals starting with the orbito-metatal line up to the vertex in axial planes aligned to the orbito-metal line. A 1.0-mm segment underwent post-study rebuilding in the axial plane. Standard techniques were used to achieve multi-planar sagittal and coronal reconstruction as needed.

CT diagnosis was confirmed by one or more of the following:

- MRI
- CSF analysis.
- Surgery and histopathological findings
- Typical findings such as metastases in patients known to have primary malignancy elsewhere in the body.

Statistical Analysis

Assuming 95% confidence interval, with precision of 10%, the minimal required sample size was calculated to 90 subjects.

Data were entered into Microsoft excel data sheet and analyzed using SPSS 22 version software. Categorical data will be represented in the form of Frequencies and proportions.

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Chi-square was used as test of significance. Continuous data were represented as mean and standard deviation. Independent t test was used as test of significance to identify the mean difference. P value <0.05 was considered as statistically significant.

RESULTS

The mean ± S.D age of our study subjects was 34.53 ± 19.8 years. Majority of the subjects were aged 21-40 years, accounting for 35 (38.9%) subjects, trailed by 0-20 years with 27 (30.0%) subjects, 41-60 years with 17 (18.9%) subjects, with the least being >60 years with 11 (12.2%) subjects (Table no 1).

Characteristic	**Mean (S.D)**
Age in yrs	34.53 (19.8)
Age groups (in yrs)	**N (%)**
0-20	27 (30.0)
21-40	35 (38.9)
41-60	17(18.9)
>60	11 (12.2)
Table 1: Distribution of the participants based on age. (n=90)	

Majority of the subjects were males, accounting for 50 (55.6%) subjects, whereas 40 (44.4%) subjects were females **(Table no. 2);** with 75 (83.3%) SPS & 15 (16.7%) CPS seizures **(Table no. 3).**

Gender	**N (%)**
Male	50 (55.6)
Female	40 (44.4)
Table 2: Distribution of the participants based on gender. (n=90)	

Types of seizures	**N (%)**
CPS	15 (16.7)
SPS	75 (83.3)
Table 3: Distribution of the participants based on types of seizures. (n=90)	

Majority of the subjects had no lesions, while 23 (25.6%) had solitary lesions and 17 (18.9%) had multiple lesions, which was statistically insignificant **(Table no.4).**

No of lesions (N=40)	**N (%)**
Solitary	23 (25.6)
Multiple	17 (18.9
None	50 (55.6)
Table 4: Distribution of the participants based on number of lesions. (n=90)	

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In majority of the subjects (61.1%), no sides were involved, however 18 (20.0%) left side, 15 (16.7%) right side and 2 (2.2%) both sides involvement was noted amongst subjects, which was statistically insignificant (Table no.5).

Side of brain involved	N (%)
Right	15 (16.7)
Left	18 (20.0)
Both	2 (2.2)
None	55 (61.1)

Table 5: Distribution of the participants based on side of the brain involved. (n=90)

We found the most commonly involved lobe to be 15 (16.7%) frontal, 11 (12.2%) parietal, 9 (10.0%) temporal and 7 (7.8%) occipital, with no lobar involvement in 48 (53.3%%) subjects which was found to be statistically insignificant (Table no.6).

Lobe Involved	N (%)
Frontal	15 (16.7)
Parietal	11 (12.2)
Temporal	9 (10.0)
Occipital	7 (7.8)
None	48 (46.7)

Table 6: Distribution of the participants based on the lobe of the brain involved. (n=90)

We found the following diagnosis as per CT findings 47 (52.2%) normal, 10 (11.1%) neurocysticercosis, 9 (10.0%) tuberculoma, 4 (4.4%) PC, 6 (6.7%) Mets, 4 (4.4%) meningioma, 2 (2.2%) SDH & 8 (8.9%) being others (Table no. 7).

CT findings	N (%)
NCC	10 (11.1)
Tuberculoma	9 (10.0)
Mets	6 (6.7)
PC	4 (4.4)
SDH	2 (2.2)
Meningioma	4 (4.4)
Normal	47 (52.2)
Others	8 (8.9)

Table 7: Distribution of the participants based on the diagnosis in CT findings. (n=90)

DISCUSSION

Individuals with focal seizures may exhibit a range of CT abnormalities, contingent upon the underlying reason. CT can diagnose and locate anomalies with high accuracy, allowing for effective management planning. We had 90 clinically diagnosed seizures patients who were confirmed with a CT scan and the necessary evaluation for subsequent treatment and follow-up.
CT scans play a crucial role in the evaluation of focal seizures for several reasons:

- First-line imaging tool in emergency situations

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- Identifying Structural Abnormalities
- Acute Assessment
- Preoperative Evaluation
- Accessibility and Speed

The mean ± S.D age of our study subjects was 34.53 ± 19.8 year, wherein majority of the subjects were aged 21-40 years, accounting for 35 (38.9%) subjects. However, Singh A et al.,[8] reported that 47% of 446 focal seizures patients were between the ages of 1 and 20, which was accounting to only 30.0% in our study.

In terms of gender, we found a clear male predominance wherein 50 (55.6%) subjects were recorded, whereas 40 (44.4%) subjects were females, which was almost in agreement with the results of that of Kafle DR et al.,[9] who reported that 57.1% of them were male patients in their study.

We discovered that single lesions were more common than numerous lesions; accounting for 23 (25.6%) solitary lesions and 17 (18.9%) multiple lesions. Nevertheless, Garg RK et al.,[10] reported an inverse ratio, wherein amongst 101 patients, they had 48.5% solitary lesion patients.

In terms of location, the majority of the subjects (61.1%) reported that neither of any sides of the brain were involved; with remaining 38.9% showing a distributive pattern of 18 (20.0%) left side, 15 (16.7%) right side and 2 (2.2%) both sides involvement. Also, we found the frontal lobe to be the most common location for lesions, accounting for 16.7%, trailed by 11 (12.2%) parietal, 9 (10.0%) temporal and 7 (7.8%) occipital lobe involvement.

Almost similar findings were reported by Pandey J et al.[4] who discovered a similar finding, with more than 31% found in the frontal lobe.

In our study, CT diagnosis revealed that approximately 47 (52.2%) subjects were normal with no findings, which was similar in comparison to that observed by other researchers.

It has been put forward by many researchers that approximately 40-50% of seizure patients present with visible CT aberrations, which has been found to project upward to 64% by some researchers.[1,11]

Our CT findings revealed 10 (11.1%) neurocysticercosis (NCC), 9(10.0%) tuberculoma, 6 (6.7%) Mets, 4 (4.4%) PC, 4 (4.4%) meningioma, 2 (2.2%) SDH cases, which are consistent with those of Singh S et al.[12] who examined 44 cases of focal seizures and found NCC in 7 patients (15.91%) and tuberculoma in 4 patients (9.1%).Trentin AP et al.[13] found that NCC was the most common abnormality (37.4%) in 330 cases of focal seizures in Brazil. Cultural and socioeconomic differences between these locations, as well as food habits, may explain this disparity.

Yashodhara P et al.,[14] who detected NCC in 24 (60%) of 40 cases, followed by tuberculoma in 8 (20%), neoplasms in 5 (12.5%), along with calcified granuloma, arachnoid cyst, and brain abscess in one patient (2.5%).

Del Bruttoet al.,[15] indicated that a ring-enhancing lesion with scolex is the absolute diagnostic criterion for (NCC). Also, Chandy MJ et al.,[16] in a research investigation of 30 patients and Garg RK et al.,[10] in a study of 151 patients, who discovered NCC to be their most prevalent etiology. In a study by Gauchan E et al,[17] & Bhattacharjee S et al,[18] they had 89 (81.6%) & 37 (71.1%) single lesion cases.

Welchman JM et al.,[19] characterized the CT appearance in 14 cases of tuberculoma as a large lesion with iso-dense brain material surrounded by an intensive ring on contrast enhancement.

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In a study of 14 cases of intracerebral tuberculoma, Zhang SR et al.,[20] found 9 cases with leptomeningeal enhancement. In our analysis of 9 tuberculoma cases, six had a single lesion and three had multiple lesions. In seven of the individuals, the lesion or biggest lesion measured 20 mm or more. All lesions exhibited uneven enhancement and significant perilesional edema. They also put forward that the majority of tuberculomas can be reduced in size or entirely cured with appropriate antituberculous treatment**.**

Rajshekar et al,[21] demonstrated that out of 31 ring-enhancing lesions, 25 had been cysticerci and 6 tuberculomas. All cysticercus granulomas were smaller than 20 mm, whereas tuberculomas were larger than 20 mm. Furthermore, 5 out of 6 tuberculomas had irregular shapes**.**

In our research, majority of the patients with tubercular lesions recovered after ATT. Our findings are consistent with those reported by Tandon PN et al.,[22] in an investigation of 50 patients using intracranial tuberculomas who received ATT, who discovered that the majority of the small and medium-sized lesions had totally resolved**.**

Vengsarkar US et al.,[23] concluded that the introduction of CT had a significant impact on the diagnosis and treatment of intracranial tuberculomas.

Few researchers have looked into the contribution of MRI and computed tomography (CT) in focal seizures. When magnetic resonance imaging is not accessible, the International League in opposition to Epilepsy's neuroimaging study suggests CT in people with seizures.

It also recommended that patients experiencing intractable seizures get an MRI evaluation if their CT scan is normal.[7] This demonstrates that CT can be utilized as an early screening tool to evaluate focal seizures

CONCLUSION

The majority of our study subjects were males with a slightly higher predominance of left side involvement. CT helped in identifying various types of pathologies such as neurocysticercosis, tuberculoma, PC, Mets, meningioma & SDH. CT helps in screening patients with focal seizures in order to identify patients with structural abnormalities with majority of patients presenting with classical findings on CT and undergo prompt treatment. Nevertheless, minority of patients may require further evaluation such as MRI, and CSF analysis. Thus, easy availability and affordability makes CT the primary investigation modality of choice in evaluation of seizures.

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