International Journal of Life Sciences, Biotechnology and Pharma Research Vol. 13, No. 8, August 2024 Online ISSN: 2250-3137
Print ISSN: 2977-0122

DOI: 10.69605/ijlbpr_13.8.2024.9

**ORIGINAL RESEARCH**

# The role of CT scan in the etiology of headache: A retrospective study

Dr. Pinki Kumari

Associate Professor, Department of Radiology, Ram Krishna Medical College Hospital and Research Centre Bhopal, M.P., India

**Corresponding author**
Dr. Pinki Kumari
Associate Professor, Department of Radiology, Ram Krishna Medical College Hospital and Research Centre Bhopal, M.P., India

Received Date: 23 June, 2024 Accepted Date: 27 July, 2024

## ABSTRACT

**Background**: Headache is a common and disabling symptom with a high prevalence in the population. It is also among the most prevalent complaints in patients presenting to the emergency department. In this study, we correlated role of CT scan in the etiology of various types of Headache. CT scan play extremely crucial role in the etiology of Headache. Sometimes the headache of a small proporation of patients results from serious intracranial disorders such as tumors or intracranial hemorrhage. **Materials and Methods**: A retrospective study was conducted among 201 patients of headache, soft tissue window and bone algorithms with wide window settings was studied to visualize any positive results for headaches and the gathered Data was analyzed using Statistical Package for the Social Science (SPSS) software. **Results**: The typical age for headache cases underwent to CT scan was the age above 60 years old which constituted (24%) of total cases. The most common associated symptom of headache underwent to CT scan is dizziness which constituted 52% of total cases. 131 out of 201 cases are associated with normal CT scan appearance (65.17) and 70 out of 201 cases are associated with abnormal CT scan appearance (34.83%). The most common positive findings are brain involutional changes where 25 (12.5%) of cases had brain involutional changes followed by ischemia by 18 (9%) of cases. Age groups are significantly correlated with CT findings (P value < 0.05). The majority of CT abnormal findings were found in the age group above 60 years old. **Conclusion:** The majority of CT abnormal findings were found in the age group above 60 years old taking into consideration most of the positive findings may be considered normal for age. CT scan for headache cases is a useful screening modality either to identify or rule out structural abnormalities.

**Key Words**: Computed tomography (CT), Dizziness; Headache; Ischemia



## INTRODUCTION

Headache is a common and disabling symptom with a high prevalence in the population.[1] There is a huge awareness in a lot of countries that headache constitutes a major public health problem. About 90% of individuals have at least one episode of headache each year and severeheadache is reported to happen at least 1 annually in 40 % of the population.[2] Population-basedestimates suggest that roughly 4% of adults have daily or near-daily headache.[3,4] The most important approaches for diagnosing and determining the headache type are neurological examinations and obtaining a detailed history of the patient's symptoms.[5] However, in this study, we correlated role of CT scan in the etiology of various types of Headache. CT scan play extremely crucial role in the etiology of Headache. Sometimes the headache of a small proportions of patients results from serious intracranial disorders such as tumors or intracranial hemorrhage. These must be accurately diagnosed without exposing the many patients who have a benign headache to expensive and possibly harmful over-investigation. In clinical practice using the red flags of headache is accepted in requesting a CT scan for looking about secondary headache.[6,7] The red flags signs and symptoms include headache in a patient over 50 years old, headache associated vomiting, changes in behavior, conscious level, headache with seizure, new-onset neurological deficit, headache precipitated by coughing, sneezing or exercise, associated with visual disturbance, or jaw claudication, immunosuppressed or history of malignancy, atypical aura, headache with signs and symptoms of glaucoma, headache associated with signs of systemic illness e.g. neck rigidity, rash, fever, and headache after head injury .[8] CT scan is responsible for 40% of total medical diagnostic radiation.[9] So, the use of CT imaging has to be balanced against the radiation dose. The comparison between the negative and positive results were

DOI: 10.69605/ijlbpr_13.8.2024.9

documented in this study. headache can be secondary such as stroke, head and/or neck trauma, brain tumor, cranial cervical vascular illnesses, subdural hematoma (SDH), abscess or hydrocephalus, etc.[10] and these can be diagnosed by using a CT scan because the CT scan is sensitive and specific for the detection of intracranial diseases.[11-14] The international guideline published in 2013 reported brain imaging to be useful for patients aged >50 years with new-onset headaches .[15]

This study aims to study and correlate the role of CT scan in the etiology of headache.

## MATERIALS AND METHOD

Present retrospective study was conducted at our research centre among 201 patients presenting with headaches in departments of radiology were examined by advanced GE'sRevolution ACTs Expert Edition 32 Slice CT Scanner. Simple random sampling technique was used for sample collection from 2023 to 2024. Soft tissue window and Bone algorithms with wide window settings was studied to visualize any positive results for headaches. In each patient, Variables such as patient age and gender, principal presenting complaints, etiology of headache, and findings of the Radiologists, were documented. All the data gathered and analyzed using Statistical Package for the Social Science (SPSS) software.

## RESULTS

Table 1 show out of 201 cases included in this study 86 (42.8%) were male while females constituted 115 (57.2%) showing female preponderance in headache cases underwent to CT scan. Figure 1 showed the typical age for headache cases underwent to CT scan according tothis study was the age above 60 years old which constituted (24%) of cases followed by age between 41 to 50 years old which constituted (21.5%) of cases and other age groups are shown in Figure below. Table 2 show the distribution of different associated symptoms is shown, where the most common associated symptom of headache underwent to CT scan is dizziness which constituted 52% of total cases followed by vomiting and numbness each one separately which constituted 9.5%, blurred vision 9%, high blood pressure 7%, weakness 4% and loss of consciousness 3.5% and other associated symptoms as shown in table. Table 3 show 131 out of 201 cases are associated with normal CT scan appearance (65.17%) and 70 out of 201 cases are associated with abnormal CT scan appearance (34.83%). Table 4 show Distribution of the positive findings in headache cases underwent toCT scan is shown, where 25 (12.5%) of cases had brain involutional changes followed by ischemia by 18 (9%) of cases then arteriolosclerotic leucoencephalopathy which constituted 12 (6%) of total cases, infarction constituted 11 (5.5%), sinusitis 10 (5%) and basal ganglia calcification 4 (2%) and other positive findings as shown in table. Table 5 show Distribution of the CT scan result for the gender group, shows 52 CT negative finding and 33 CT positive findings in male while shows 79 CT negative findings and 36 CT positive findings in female, Consequently the null hypothesis can't be rejected, in another way, there is no significant relationship between CT findings and gender (P value > 0.05). Table 6 show the relationship between CT scan findings and age group, the result shows 31 CT scan positive and 17 CT scan negative in the age group above 60 years old, 12 positive findings and 19 negative findings in the age group between 51 to 60 years old, 12 positive findings and 31 negative findings in the age group between 41 to 50, 6 positive findings and 23 negative findings in the age group between 31 to 40, 5 positive findings and 29 negative findings in the age group between 21 to 30, 3 positive findings and 12 negative findings in the age group between 10 to 20, Consequently the null hypothesis will be rejected, in another way, there is a significant relationship between CT findings and age groups (P value < 0.05).

**Table 1: Gender wise distribution of study subjects**

| Gender | Frequency |
|---|---|
| Males | 86(42.8%) |
| Females | 115(57.2%) |

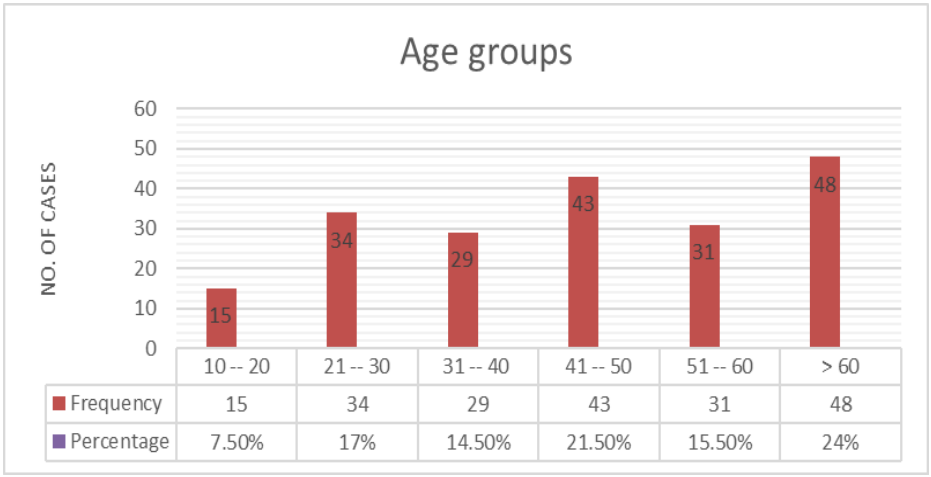


**Figure 1: Age group wise distribution of study subjects**

DOI: 10.69605/ijlbpr_13.8.2024.9

**Table 2: Distribution of associated symptoms**

| Symptoms | Frequency | Percentage |
|---|---|---|
| **Dizziness** | 105 | 52% |
| **Vomiting** | 19 | 9.5% |
| **High blood pressure** | 14 | 7% |
| **Numbness** | 19 | 9.5% |
| **Blurred vision** | 18 | 9% |
| **Loss of consciousness** | 7 | 3.5% |
| **Convulsion** | 2 | 1% |
| **Photophobia** | 2 | 1% |
| **Slurred speech** | 3 | 1.5% |
| **Nausea** | 4 | 2% |
| **Weakness** | 8 | 4% |

**Table 3: Distribution of CT findings**

| CT findings | frequency | percentage |
|---|---|---|
| **Normal CT** | 131 | 65.17% |
| **Abnormal CT** | 70 | 34.83% |
| **total** | **201** | **100%** |

**Table 4: distribution of CT positive findings**

| Positive findings | Frequency | Percentages of total positive findings | Percentages of total cases |
|---|---|---|---|
| **Sinusitis** | 10 | 10% | 5% |
| **Infarction** | 11 | 10.6% | 5.5% |
| **Ischemia** | 18 | 17.3% | 9.0% |
| **Cyst** | 3 | 2.9% | 1.5% |
| **Encephalomalacia** | 1 | 0.9% | 0.5% |
| **Vitreous Hemorrhage** | 1 | 0.9% | 0.5% |
| **Brain Involutional changes** | 28 | 24% | 14.0% |
| **Arteriolosclerotic leucoencephalopathy** | 12 | 11.5% | 6% |
| **Subarachnoid hemorrhage** | 2 | 1.9% | 1% |
| **(SAH)** | | | |
| **Enlarged Sella Turcica** | 1 | 0.9% | 0.5% |
| **Vein Calcification** | 1 | 0.9% | 0.5% |
| **Subdural hemorrhage (SDH)** | 1 | 0.9% | 0.5% |
| **Cerebral Small Vessel Disease** | 2 | 1.9% | 1% |
| **Maxillary Polyp** | 1 | 0.9% | 0.5% |
| **Basal Ganglia Calcification** | 4 | 3.8% | 2% |
| **Mega Cisterna Magna** | 1 | 0.9% | 0.5% |
| **Concha Bullosa** | 1 | 0.9% | 0.5% |
| **Hydrocephalus** | 2 | 1.9% | 1% |
| **Intracerebral bleed** | 1 | 0.9% | 0.5% |
| **Partial Empty Sella** | 2 | 1.9% | 1% |
| **Intraventricular Hemorrhage (IVH)** | 1 | 0.9% | 0.5% |
| **Asymmetry of Frontal Horn** | 1 | 0.9% | 0.5% |
| **Total positive findings** | **105** | **100%** | |

**Table 5: Shows the relationship between CT scan results and gender group**

| CT findings | Gender | | Frequency | Percentage |
|---|---|---|---|---|
| | **Male** | **Female** | | |
| **Negative** | 52 | 79 | 131 | 65.17% |
| **Positive** | 34 | 36 | 70 | 34.83% |
| **Total** | 86 | 115 | 201 | 100% |
| | **P value = 0.271** | | | |

DOI: 10.69605/ijlbpr_13.8.2024.9

**Table 6: Shows the relationship between CT scan results and age group**

| Age groups | CT findings | | | |
|---|---|---|---|---|
| | Positive | Negative | Frequency | Percentage |
| **10 - 20** | 3 | 12 | **15** | **7.5%** |
| **21 - 30** | 5 | 29 | **34** | **17%** |
| **31 - 40** | 6 | 23 | **29** | **14.5%** |
| **41 - 50** | 12 | 31 | **43** | **21.5%** |
| **51 - 60** | 12 | 19 | **31** | **15.5%** |
| **Above 60** | 32 | 17 | **49** | **24.5%** |
| **Total** | **70** | **131** | **201** | **100 %** |
| **P value = 0.001** | | | | |

## DISCUSSION

In the present study of 201 headache cases that underwent CT scans revealed a female preponderance, with 57.2% of cases being female. The typical age group for headache cases was above 60 years old, accounting for 24% of cases, followed by the 41-50 year old age group, which made up 21.5% of cases. In terms of associated symptoms, dizziness was the most common, occurring in 52% of cases, followed by vomiting, numbness, blurred vision, high blood pressure, weakness, and loss of consciousness. The CT scan results showed that 65.17% of cases had normal appearances, while 34.83% had abnormal appearances. The most common positive findings were brain involutional changes, ischemia, and arteriolosclerotic leucoencephalopathy, occurring in 12.5%, 9%, and 6% of cases, respectively. The study found no significant relationship between CT findings and gender, but did find a significant relationship between CT findings and age groups, with older age groups having more positive CT findings. Overall, the study suggests that headache cases undergoing CT scans are more common in females, particularly in older age groups, and are often associated with dizziness and brain involutional changes.

Although the majority of patients who present with chronic or recurrent headache in OPD of any general practitioner or hospital without any neurological deficit, many of them use to undergo neuroimaging with CT or MR imaging to exclude any serious intracranial pathology.[16] Previous studies have demonstrated that CT is of extremely low yield in patients who undergo imaging for chronic headache without neurologic abnormality[17] Our study shows 34.83% abnormal scans out of all the cases who underwent CT scans for headache. According to our study, there is no significant relationship between gender group and CT results, So, the gender group can't be taken into consideration in requesting a CT scan for a patient with headache. And this result is similar to study conducted by Rawal S.[18] When comparing an MRIwith a CT scan in the evaluation of patients with headaches, the MRI is not a first line imaging technique for the evaluation of patients who presented with chronic or recurrent headaches with normal neurological signs. One study was conducted at Gunma University Hospital of Japan, to evaluate the efficiency of MRI in the diagnosis of an abnormality in patients suffering headaches without any neural deficit, out of a total of 306 patients, 169 patients (55.2%) had no abnormality in the CT/MRI scan, 135 patients (44.1%) had a minor associated abnormality while only two patients (0.7%) have intracranial pathology which may be the cause of headache.[19] In this study, the rate of detection of positive CT findings in terms of frequency was noticed highest in the age group above 60 years old with abnormality found in 31 out of 48 cases, and this result similar to several studies. one study conducted from 2013 to 2014 shown abnormal CT findings were detected highest in age group >60 years old[l.18] One study conducted by Khan CE over three years similar to this study where the rate of detection of positive CT findings was higher in the older age group compared to younger.[20] Another study conducted by Carrera GF presented increasing age to be strongly related to positive CT findings in patients with a history of chronic headaches.[21] In this study showed 131 out of 201 cases are associated with normal CT scan appearance (65.17%) and 70 out of 201 cases are associated with abnormal CT scan appearance (34.83%), obviously, this study shows negative CT scan preponderance in headache cases underwent to CT scan, and this result is similar to study was conducted at Chitwan medical college [22,23] In our retrospective study, findings were similar to the studies done in past. Still studies with larger sample size and for longer period is required.

Thus, physicians who evaluate patients with headache in the outpatient setting frequently facethe question of whether or not it is necessary to perform a neuroimaging test to confirm or rule out a secondary pathology. Neuroimaging is usually normal in a very high percentage of cases in patients with headache (relevant alterations between 0.5 and 3% of patients, depending on the previous studies consulted).In some cases in which alterations are observed, the pathophysiological relationship of the findings with the appearance of headache is uncertain or null .[24-26] Various studies have been conducted in different regions of the world at different times to assess the utility of CT and neuroimaging techniques in patients with headaches[27-28] However, the secondary causes constitute only about 10% of patients with headache.[29] For example, a brain tumor is secondary cause of the

DOI: 10.69605/ijlbpr_13.8.2024.9

headache and constitutes less than 0.1% of lifetime prevalence of headache.[30] The international guideline published in 2013 reported brain imaging to be useful for patients aged >50 years with new-onset headaches.[15] And this recommendation is matching to our study where our study indicates that the age groups are significantly correlated with CT findings (P-value < 0.05) in table 6, Consequently, the age group can be taken into consideration in requesting a CT scan for patients with headache.

## CONCLUSION

Our study found that Age groups are significantly correlated with CT findings. Consequently, age groups can be taken into consideration in requesting a CT scan for patients with headache. Majority of CT abnormal findings were found in the age group above 60 years old. Gender group is not correlated with CT findings. Majority of results for patients with headache underwent to CT scan is negative. There is no relationship between CT results and headache associated symptoms. CT scan for headache cases is a useful screening modality either to identify or rule out structural abnormalities. large studies with a large number of samples and longer periods is required. Limitations of presented study was limited sample volume and lesser time period. So, large studies with a large number of samples and longer periods may be necessary to support our present study.

## REFERENCES

1. Stovner LJ, Zwart JA, Hagen K, Terwindt GM, Pascual J. Epidemiology of headachein Europe.Eur J Neurol 2006;13: 333-45
2. Macdonald G. Harrison's Internal Medicine, 17th edition. - by A. S. Fauci, D. L. Kasper, D. L. Longo, E. Braunwald, S. L. Hauser, J. L. Jameson and J. Loscalzo. Intern Med J. 2008;38(12):932–932.
3. Kavuk I, Yavuz A, Cetindere U, Agelink MW, Diener HC. Epidemiology of chronic daily headache. Eur J Med Res. 2003;8(6):236–40.
4. Stovner K, Hagen R, Jensen Z, et al. The global burden of headache: a documentation of headache prevalence and disability worldwide. Cephalalgia. 2007;27 (3):193–210.
5. Sandrini G, Friberg L, Coppola G, Jänig W, Jensen R, Kruit M, et al. Neurophysiological tests and neuroimaging procedures in non- acute headache (2nd edition). Eur J Neurol. 2011;18(3):373–81.
6. Almalki ZA, Alzhrani MAG, Altowairqi AT, Aljawi YA, Fallatah SA, Assaedi LM, et al. Prevalence of Migraine Headache in Taif City, Saudi Arabia. J Clin Med Res. 2018;10(2):125–33.
7. Frishberg BM. The utility of neuroimaging in the evaluation of headache in patients with normal neurologic examinations.Neurology1994; 44:1191-1197.
8. Clinch CR. Evaluation of acute headaches in adults. Am Fam Physician. 2001;63(4):685-92.
9. Garvey CJ, Hanlon R. Computed tomography in clinical practice. BMJ: British Medical Journal. 2002;324(7345):1077.
10. Headache Classification Subcommittee of the International Headache Society The International Classification of Headache Disorders: 2nd edition. Cephalalgia. 2004;24(Suppl 1):9–160.
11. Lannsjö M, Backheden M, Johansson U, af Geijerstam JL, Borg J. Does head CT scan pathology predict outcome after mild traumatic brain injury? Eur J Neurol. 2013;20(1):124–9.
12. Kim JJ, Gean AD. Imaging for the Diagnosis and Management of Traumatic Brain Injury. Neurotherapeutics. 2011;8(1):39–53.
13. Wildermuth S, Knauth M, Brandt T, Winter R, Sartor K, Hacke W. Role of CT angiography in patient selection for thrombolytic therapy in acute hemispheric stroke. Stroke. 1998;29(5):935–8.
14. Wasay M, Kheleani BA, Moolani MK, Zaheer J, Pui M, Hasan S, et al. Brain CT and MRI findings in 100 consecutive patients with intracranial tuberculoma. J Neuroimaging. 2003;13(3):240–7.
15. Beithon J, Gallenberg M, Johnson K, Kildahl P, Krenik J, Liebow M, et al. Diagnosis and Treatment of Headache. Bloomington (MN): Institute for Clinical Systems Improvement (ICSI); 2013.
16. Steiner TJ, Fontebasso M. Headache. Clinical review. BMJ 2002; 325: 881-886.
17. Dumas MD, Pexman JH, Kreeft JH. Computed tomography evaluation of patients with chronic headache. Can Med Assoc J.1995; 152:158.
18. Rawal S, Mukhi S, Subedi S, Maharjan S. Role of Computed Tomography In Evaluation of Patients With History of Chronic Headache. J Univers Coll Med Sci. 2015;3(4):6–9.
19. Tsushima Y, Endo K. MR Imaging in the Evaluation of Chronic or Recurrent Headache. Radiology. 2005;235(2):575-79.
20. Kahn CE, Sanders GD, Lyons EA, Kostelic JK, MacEwan DW, Gordon WL. Computed tomography for nontraumatic headache: current utilization and cost-effectiveness. Can Assoc Radiol J. 1993 Jun;44(3) 189-193.
21. Carrera GF, Gerson DE, Schnur J, McNeil BJ. Computed tomography of the brainin patients with headache or temporal lobe epilepsy: findings and cost-effectiveness. J Comput Assist Tomogr. 1977 Apr;1(2) 200-203.
22. Nepal P, Shrestha A, Ghimire N. Evaluation of CT Scan Findings in Patients Presenting with Headache. Journal of Chitwan Medical College. 2014;3(4): 9-12.
23. Lemmens CM, Van der Linden MC, Jellema K. The value of cranial CT imaging in patients with headache at the emergency department. Frontiers in Neurology. 2021 May 10;12:663353.
24. Young NP, Elrashidi MY, McKie PM, Ebbert JO. Neuroimaging utilization and findings in headache outpatients: Significance of red and yellow flags. Cephalalgia 2018; 38: 1841- 8.
25. Holle D, Obermann M. The role of neuroimaging in the diagnosis of headhache disorders. Ther Adv Neurol Disord 2013; 6: 369-74.
26. Callaghan BC, Kerber KA, Pace RJ, Skolarus L, Cooper W, Burke JF. Headache neuroimaging: routine testing when guidelines recommend against them. Cephalalgia 2015; 35: 1144-52.
27. Aygun D, Bildik F. Clinical warning criteria in evaluation by computed tomography the secondary neurological headaches in adults. European Journal of Neurology. 2003;10(4):437-42.

DOI: 10.69605/ijlbpr_13.8.2024.9

28. Lateef TM, Grewal M, McClintock W, Chamberlain J, Kaulas H, Nelson KB. Headache in young children in the emergency department: use of computed tomography. Pediatrics. 2009;124(1):e12-17.
29. Perkins AT, Ondo W. When to worry about headache; Head pain as a clue to intracranial disease. Postgrad Med 1995;98:197–208.
30. Goadsby PJ. To scan or not to scan in headache. Editorial. BMJ 2004; 329: 469–70.