Section: Radiodiagnosis

Original Research Article

CLINICAL AND DEMOGRAPHIC PREDICTORS OF ABNORMAL HEAD CT FINDINGS IN NON-TRAUMATIC PATIENTS: A PROSPECTIVE STUDY IN A SEMI-RURAL INDIAN POPULATION

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ABSTRACT

Background: Non-contrast computed tomography (NCCT) is frequently requested for non-traumatic neurological presentations, yet its diagnostic yield in resource-limited Indian settings is under-reported. **Materials and Methods:** We prospectively enrolled 150 consecutive adults (≥ 18 y) who underwent NCCT head for headache, altered mental status, focal neurological deficit, stroke-like event, seizure or vertigo at a tertiary centre in western Uttar Pradesh (May 2023 – Nov 2024). Scans were reviewed independently by two blinded radiologists; multivariate logistic regression identified clinical predictors of positive findings. **Result:** Eighty-six patients (57.3 %) showed abnormal CT. Acute infarct (39.5 %), intracranial haemorrhage (25.6 %) and mass lesion (14.0 %) were most common. Yield rose to 73.1 % in those > 60 years and 77.6 % in those with focal deficits. Age > 60 y (adjusted odds ratio [aOR] 2.1), focal neurological deficit (aOR 3.8), lower socioeconomic class (aOR 1.9) and illiteracy (aOR 2.4) independently predicted positivity. **Conclusion:** More than half of non-trauma head CTs revealed actionable pathology—chiefly ischaemic stroke and haemorrhage. Simple bedside factors such as older age, focal deficit and socioeconomic disadvantage can refine imaging algorithms and curb unnecessary radiation and cost in similar low-middle-income settings.

INTRODUCTION

In the emergency setting non-contrast computed tomography (NCCT) of the head is the work-horse investigation, prized for its speed, ubiquity and high sensitivity for intracranial haemorrhage, hydrocephalus and large-territory infarction.[1,2] Yet the very ease of access that makes NCCT invaluable has also driven a sharp escalation in its use among non-trauma patients—fuelled by defensive medicine, patient expectations and round-the-clock scanner availability.[3,4] This trend carries a double cost: spiralling expenditure on advanced imaging and growing concern about the carcinogenic potential of cumulative ionising radiation, especially when scans fail to alter management.[5]

Large Western series find clinically significant abnormalities in as few as 8 – 15 % of non-trauma head CTs, but robust data from low- and middle-income countries (LMICs) are scarce and heterogeneous 6. Western Uttar Pradesh, a semi-rural region with limited health resources and a rising stroke burden, offers a pragmatic arena to examine the true diagnostic yield of NCCT and to explore whether simple bedside variables—age, focal neurological deficit, socioeconomic status—can reliably stratify patients before imaging.

Aim and Objectives

1. To determine the incidence of positive CT findings in patients presenting with non-traumatic symptoms at our institute.
2. Determine the determine the incidence of various abnormalities detected on positive CT scan.
3. Identify clinical determinants likely to predict positive CT scans by correlating the presenting symptoms and patient demographics with abnormal findings.
4. To compare our findings with other studies done in India and abroad.

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MATERIALS AND METHODS

This prospective, cross-sectional study was carried out in the Department of Radiodiagnosis, GS Medical College & Hospital, Pilkhuwa, Uttar Pradesh, over 15 months (May 2023 – November 2024) after obtaining Institutional Ethics Committee approval and written informed consent from every participant. A minimum sample of 150 consecutive adults who underwent non-contrast CT (NCCT) head for non-traumatic neurological complaints was targeted, the size being derived from the formula $3.84 \times P (1 – P) / d^2$ with an expected prevalence of positive scans of 30 % and precision of 8 %.

Source of data: Eligible patients were those ≥ 18 years presenting with headache, altered mental status, focal neurological deficit, stroke-like symptoms, seizure or vertigo. Exclusions comprised refusal of consent, prior head trauma, pregnancy, inadequate clinical records, motion-degraded scans and history of neurosurgery.

CT technique: All studies were performed on a 16-slice Revolution ACTs scanner (Wipro-GE; serial no. 46726BG4). Axial NCCT was acquired from skull base to vertex with 5 mm slices at 120 kVp and Auto-mA; rotation time 1 s; pitch 0.9–1.0; FOV 22–25 cm; matrix 512 × 512. Thin (1.25–2.5 mm) reconstructions and coronal/sagittal multiplanar reformats were generated when indicated. Standard window settings were brain 80–100/30–40 HU, bone 2000–4000/400–700 HU and subdural 200–300/50–100 HU. Quality control followed ALARA principles; markedly motion-affected scans were repeated or excluded.

Image interpretation: Two consultant radiologists (> 10 years' experience), blinded to clinical details, independently reviewed all images. Abnormalities were classified as infarct, haemorrhage, mass, infection, dural venous thrombosis, hydrocephalus or other. Discrepancies were resolved by consensus, and a scan was labelled positive if any clinically relevant abnormality was detected.

Data Collection: Demographic data, presenting symptoms, educational level and Kuppuswamy socioeconomic class were recorded on a structured proforma; findings were cross-verified by senior radiologists and neurologists for accuracy.

Statistical Analysis: Data were processed with IBM SPSS v27. Continuous variables are reported as mean ± SD; categorical variables as number and percentage. Associations between clinical variables and CT outcome were tested with the χ^2 test; variables with $p < 0.10$ entered backward stepwise logistic regression. Adjusted odds ratios (aOR) with 95 % confidence intervals (CI) were calculated, and $p < 0.05$ was considered statistically significant.

RESULTS

Demographic profile: The study enrolled 150 adults (mean age 54.2 ± 15.8 y). The 41 – 60 y bracket predominated (48 %), followed by 18 – 40 y (28 %); patients > 60 y contributed 24 % of the cohort. Males marginally out-numbered females (55.3 % vs 44.7 %), a difference that was not statistically significant. Socio-educational status: Illiteracy was common (38.7 %), while only 10 % were graduates. Socio-economic stratification by the Kuppuswamy scale placed most participants in the upper-lower (35.3 %) and lower-middle (25.3 %) classes; just 8 % belonged to the upper class. Both education level ($p = 0.01$) and socio-economic class ($p = 0.04$) showed significant heterogeneity across the sample.

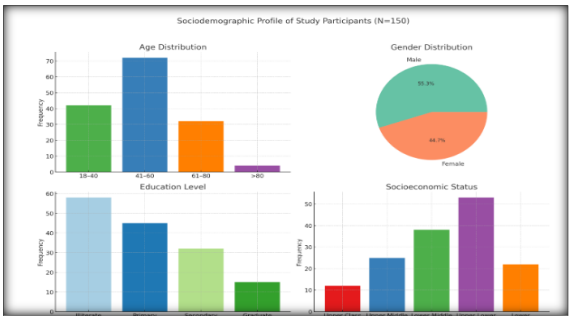

Figure 1: Sociodemographic profile of study participants (n=150)

Clinical presentation: Headache (59.3 %) was the commonest symptom, followed by focal neurological deficit (44.7 %), stroke-like presentation (30.0 %) and altered mental status (22.7 %). Focal deficit ($p < 0.001$), altered mentation ($p = 0.03$) and stroke symptoms ($p < 0.001$) correlated significantly with abnormal CT, whereas isolated headache, vertigo or seizures did not.

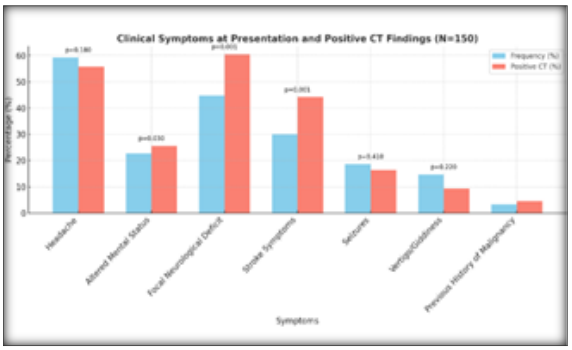

Figure 2: Clinical symptoms at presentation and positive CT finding (n=150)

Overall CT yield: Non-contrast CT was positive in 86 patients (57.3 %) and normal in 64 (42.7 %).

Spectrum of abnormalities: The leading findings on positive scans were acute infarct (39.5 %), intracranial haemorrhage (25.6 %) and mass lesion (14.0 %). Less frequent were chronic infarct (9.3 %), hydrocephalus (7.0 %), dural venous thrombosis (4.7 %), neurocysticercosis (5.8 %) and tuberculoma (7.0 %). Acute infarct, haemorrhage and mass lesions each showed strong statistical significance (all $p \leq 0.03$).

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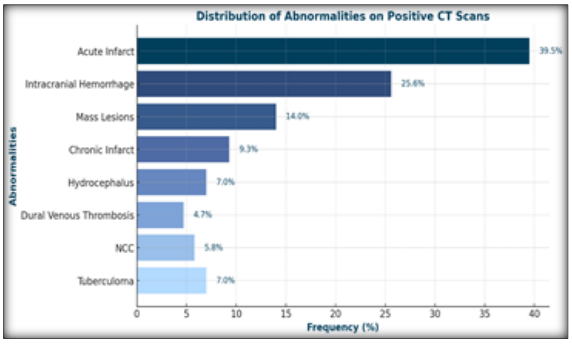

Figure 3: Distribution of Abnormalities on positive CT scans

Haemorrhage profile: Among 22 haemorrhages, intraparenchymal bleed dominated (63.6 %), followed by subarachnoid (18.2 %), subdural (13.6 %) and intraventricular (4.5 %) components; the first two subtypes were statistically significant ($p < 0.001$ and 0.03, respectively).

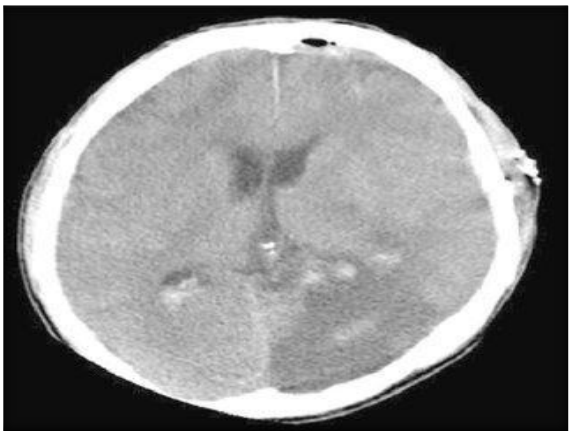

Figure 4: Cerebral Infarction

Ischaemic strokes: Of 34 infarcts, 70.6 % involved the anterior circulation and 23.5 % the posterior; lacunar infarcts comprised 5.9 %.

Mass lesions and other entities: Gliomas were the commonest mass (33.3 %), out-numbering metastases and meningiomas (each 25 %); obstructive tumours accounted for half of hydrocephalus cases. All four dural venous thrombosis cases presented with headache; two also had seizures.

Predictors of positive CT: Multivariate logistic regression identified four independent predictors: age > 60 y (adjusted OR 2.1, 95 % CI 1.3 – 3.4; $p = 0.01$), focal neurological deficit (OR 3.8, 2.1 – 6.9; $p < 0.001$), lower socio-economic class (OR 1.9, 1.1 – 3.2; $p = 0.02$) and illiteracy (OR 2.4, 1.4 – 4.0; $p = 0.003$).

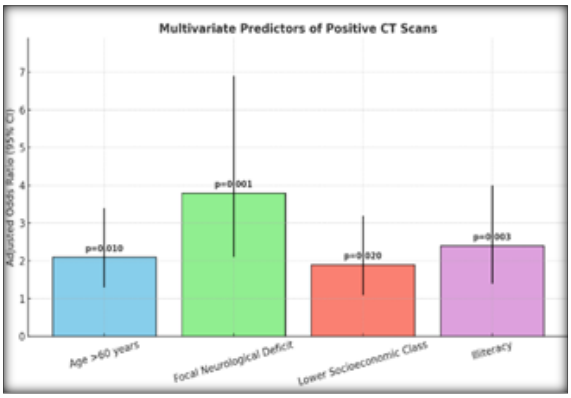

Figure 5: Multivariate predictors of positive CT scans

Table 1: Regression Analysis Table for Predictors of Positive CT Findings in Non-Trauma Patients (N=150)

Variable	Unadjusted OR (95% CI)	p-value	Adjusted OR (95% CI)	p-value
Age >60 years	2.1 (1.1–3.9)	0.03*	2.1 (1.3–3.4)	0.01*
Focal Neurological Deficit	5.0 (2.5–10.0)	<0.001*	3.8 (2.1–6.9)	<0.001*
Lower Socioeconomic Class	1.6 (1.1–2.3)	0.01*	1.9 (1.1–3.2)	0.02*
Illiteracy	1.7 (1.1–2.8)	0.02*	2.4 (1.4–4.0)	0.003*
Stroke Symptoms	4.2 (2.0–8.8)	<0.001*	-	-
Altered Mental Status	1.9 (1.1–3.4)	0.03*	-	-

More than half of non-trauma patients demonstrated actionable CT abnormalities, with acute infarct and haemorrhage comprising two-thirds of positive scans. Older age, focal neurological deficit and socio-economic disadvantage substantially increased the diagnostic yield of imaging.

DISCUSSION

In this prospective series more than one-half of non-trauma adults undergoing NCCT head harboured clinically significant abnormalities, a yield (57 %) that sits marginally above the 54 % reported by Bhat et al,[7] and the 53 % noted by Narayanan et al,[8] yet parallels the 59 % figure of Rehani et al.[9] The consistency across Indian centres underscores the persistent challenge of rational imaging in emergency departments.

Clinical presentation remained the strongest determinant of scan positivity. Focal neurological deficit almost quadrupled the odds of an abnormal study (adjusted OR 3.8), echoing Bent's adjusted OR 3.08 and Harden's observation that cranial CT altered management in up to 17 % of patients with focal signs. Age > 60 years (OR 2.1) and illiteracy (OR 2.4) also retained significance after adjustment, aligning with Wang's report that low health literacy and advanced age heighten imaging yield. Notably, lower socioeconomic class independently predicted abnormality (OR 1.9), a finding mirrored by Rehani who linked repetitive CT use to disadvantaged backgrounds. Together these data suggest that simple bedside variables—age, focal deficit and

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socioeconomic status—can refine imaging decisions in resource-limited settings.

The lesion spectrum mirrored global patterns: acute infarct (39.5 %) and intracranial haemorrhage (25.6 %) predominated, figures that shadow Bhat's 35.8 % and 27.1 % respectively, and West's dominance of anterior-circulation strokes. Anterior-circulation infarcts accounted for 70 % of strokes, virtually identical to the 68–73 % range in recent Indian literature Gliomas emerged as the commonest mass (33 %), again concordant with Bhat (30 %) and Rehani (36 %), emphasising CT's pivotal triage role where MRI access is limited.

Our study is limited by its single-centre design, modest sample and absence of outcome follow-up; nevertheless, consecutive enrolment and double-blinded reporting strengthen internal validity. Future multi-centre work should validate a pragmatic clinical score built on the four independent predictors identified here.

In summary, NCCT head remains a high-yield investigation for non-trauma neurological presentations in semi-urban India, but yield can be maximised—and unnecessary radiation curtailed—by prioritising imaging in older, socio-economically disadvantaged patients who present with focal deficits.

CONCLUSION

Non-contrast CT of the head yielded clinically actionable findings in 57 % of non-trauma adults, dominated by acute infarction and intracranial haemorrhage. Advanced age, focal neurological deficit, illiteracy and lower socioeconomic class emerged as independent predictors of positivity. Incorporating these easily captured variables into emergency-department triage algorithms could rationalise scan utilisation, curb unnecessary radiation exposure and reduce costs in resource-limited Indian settings.

Acknowledgments

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Conflict of Interest Statement

No conflict declared.

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