Original Article

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Noncontrast Computed Tomography for Differentiating Between Nonhemorrhagic Stroke Mimics and Acute Ischemic Stroke

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Abstract:

Objective: To determine the efficacy of noncontrast computed tomography (NCCT) for diagnosing stroke mimics in acute settings to promote confident decision-making and avoid unnecessary treatments and procedures.

Material and Methods: We enrolled patients presenting with clinical stroke-like symptoms within 6 hours who underwent NCCT at our institution between 2020 and 2021. Each NCCT scan was independently reviewed by 2 radiologists with consensus. Scans were classified as either stroke or stroke mimic patterns. Our study compared demographic data, clinical characteristics, and CT imaging patterns between the 2 groups. We used statistics to assess the performance of NCCT in diagnosing stroke mimics, in comparison with diagnosed ischemic strokes.

Results: The study cohort comprised 559 patients. The results demonstrated excellent interobserver reliability in imaging interpretation. Stroke mimics were identified in approximately 57% of patients, predominantly in older adults (median age: 64.1 years, p-value=0.002), females (51.6%, p-value=0.038), and patients with malignancies (17.9%, p-value<0.001). The most prevalent clinical presentation among stroke mimics was seizures (33.5%). Major etiologies of stroke mimics included idiopathic seizures (20.3%). The most common NCCT finding in stroke mimics was a negative scan (79.7%), with positive findings in only 20.3% of cases. NCCT exhibited a high specificity of 95% and a high positive predictive value of 97% in diagnosing stroke mimics.

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Conclusion: NCCT is a reliable adjunctive diagnostic tool for differentiating stroke mimics, especially in acute settings. Its high specificity and positive predictive value enhance the accurate distinction between ischemic stroke and other conditions with similar presentations, facilitating appropriate treatment.

Keywords: acute Ischemia, brain CT, diagnostic procedure, stroke mimics

Introduction

Acute ischemic stroke is a critical emergency requiring prompt diagnosis and intervention, as intravenous thrombolysis is most effective within 4.5 hours of symptom onset. However, this treatment can lead to adverse effects, such as symptomatic intracranial hemorrhage, potentially prolonging hospital stays and increasing associated healthcare costs[1-3]. Additionally, there is a risk of allergic reactions to intravenous thrombolysis, particularly angioedema, which can significantly affect the pharyngeal airway[4].

Mechanical thrombectomy has become the standard of care for acute ischemic stroke presenting within 6 hours, especially in cases of large vessel occlusion in the anterior circulation. However, this procedure carries the risk of life-threatening complications, including intracranial hemorrhage, emboli, and device-related issues[5]. Therefore, avoiding unnecessary treatments and procedures is crucial in stroke management.

A stroke mimic is a nonischemic disorder that replicates the clinical symptoms of a stroke. Studies indicate that stroke mimics account for 20%–50% of suspected stroke admissions[4]. Common stroke mimics include seizures, migraine headaches, and brain tumors. These conditions often lead to the misdiagnosis of acute ischemic stroke owing to nonspecific laboratory findings and the challenges physicians face in accurately assessing patients[1,4]. Consequently, patients may receive overaggressive treatment, resulting in unnecessary complications, extended hospital stays, and increased medical expenses. Therefore, minimizing the risk of overtreatment is essential without compromising the timely treatment of acute ischemic stroke.

Imaging plays a crucial role in diagnosing stroke mimics, with techniques like computed tomography (CT) or magnetic resonance imaging (MRI) displaying distinct patterns that help differentiate these conditions from actual strokes[1,6-11]. Although MRI is the most sensitive imaging modality for confirming the diagnosis of acute ischemic stroke or stroke mimics, NCCT is more routinely used as an initial imaging method owing to its lower cost and greater availability in most hospitals[1,4,9,12-16]. CT can produce high-quality images much faster than MRI, making it appropriate for emergencies where timing is critical[17]. Additionally, NCCT can exclude hemorrhagic stroke, which may require different management approaches, such as surgery[15]. Therefore, evaluating the efficacy of NCCT is useful and efficient for decision-making in emergency settings. This study aimed to assess the effectiveness of NCCT in diagnosing acute stroke mimics and nonvascular disorders presenting with stroke-like symptoms.

Material and Methods

Patient selection

This retrospective study was approved by our Institutional Human Ethics Research Committee. A total of 650 patients aged ≥15 years, presenting with the clinical symptoms of stroke within 6 hours, underwent immediate NCCT brain scans within 30 minutes of arrival at the emergency department between January 1, 2020, and December 31, 2021. Among them, 91 patients were excluded from the study owing to either having a hemorrhagic stroke or incomplete/nondiagnostic quality CT brain scans. Ultimately, 559 eligible patients were included for CT interpretation. Patient's demographic data, including age at the examination date, sex, underlying diseases (such as hypertension, cardiovascular disease, cancer, diabetes mellitus, and brain tumors), blood pressure (systolic and diastolic), duration from clinical onset to CT scanogram (CTS), and stroke severity score assessed by the National Institutes of Health Stroke Scale (NIHSS), were extracted from medical records in the Hospital Information System. Clinical presentations were categorized into altered levels of consciousness, amnesia, aphasia, ataxia, disorientation, dizziness, dysarthria, headache, hemiparesis, isolated facial palsy, isolated limb weakness, paresthesia, seizure, spasm, visual disturbance, and vomiting. The final diagnosis of stroke mimics was established through a comprehensive evaluation, including history taking, physical examination, imaging, and further investigations such as electroencephalography, blood sugar level assessment, and other relevant tests.

Imaging protocol

Three CT machines were utilized for brain imaging: two 160-slice CT scanners (Aquilion Prime; Toshiba Medical Systems, Tochigi, Japan) and a 512-slice CT scanner (Revolution CT; GE Healthcare, Waukesha, WI, USA). During the scanning process, patients were positioned supine and head-first, with the scanning field encompassing the area from the foramen magnum to the vertex and a tilt angle parallel to the orbitomeatal line. Following the CTS, NCCT scans were performed with 4-mm slice thickness and reconstructed in 3 standard anatomical planes: axial, sagittal, and coronal. Subsequently, all images were automatically transferred to a Picture Archiving and Communication System (PACS) for further analysis and evaluation.

Imaging analysis

CT brain scans related to stroke and stroke mimics were evaluated using a stroke window setting with a window level of 35 Hounsfield units (HUs) and a window width of 40 HUs. This specific configuration was chosen to optimize the visualization of brain tissue and facilitate the identification of distinct imaging patterns[18]. Two radiologists, N.S. and P.C., with 13 and 5 years of experience, respectively, retrospectively reviewed all CT images with blinded data and in random case order. Discordant CT findings between the 2 radiologists were resolved through a consensus discussion. Various imaging characteristics indicative of stroke were identified, including hypodense lesions, corresponding to specific vascular territories (Figure 1), dense arteries (Figure 2), sulcus effacement, loss of gray-white matter differentiation, and the presence of an insular ribbon sign. Stroke mimics exhibited different imaging features, such as nonspecific hypodensity (Figure 3), mass-like appearance, intraparenchymal hyperdensity (Figure 4), subdural or epidural collections, and other distinct features. The definitions of the identified imaging findings were as follows: 1. Loss of gray-white matter differentiation: loss of distinction between cerebral and cerebellar white matter and gray matter[19]. 2. Dense arteries: arterial attenuation higher than that of any other visualized artery or vein[19]. 3. Loss of insular ribbon: decreased precision in delineation of the gray-white matter interface at the lateral margin of the insula[19]. 4. Sulcal effacement: reduced contrast and imprecise delineation of the gray-white interface at the margins of cortical sulci[19]. 5. Mass-like appearance: displaced the soft tissue of the brain or changes in hemisphere volume, excluding those caused by stroke[20]. 6. Subdural collection: a supratentorial extra-axial collection or hematoma that may cross suture lines but generally does not extend beyond dural attachments[21]. 7. Epidural collection: an extra-axial collection or hematoma that can cross dural

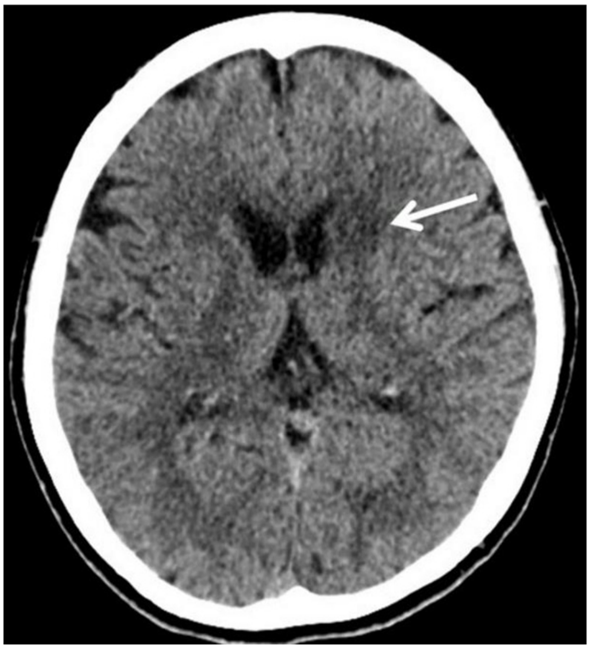

Figure 1 Ischemic stroke: In a patient with underlying chronic kidney disease, axial NCCT imaging reveals an ill-defined hypodense lesion in the left caudate nucleus and anterior limb of the left internal capsule (arrow), compatible with the vascular supply from the lenticulo-striate arteries

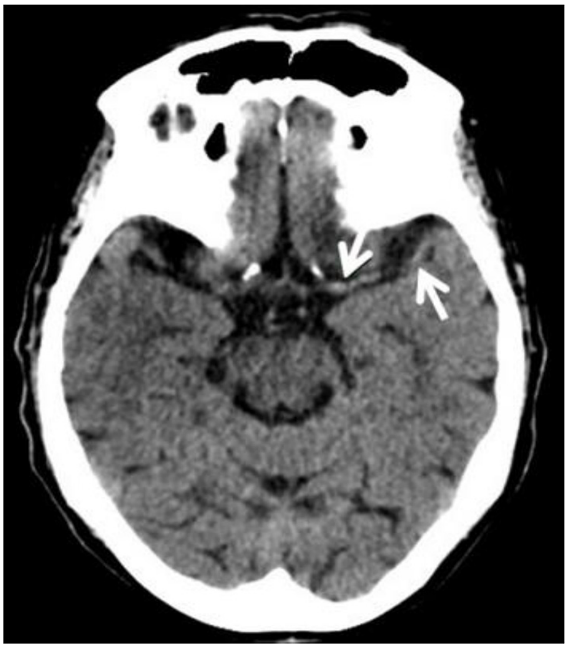

Figure 2 Ischemic stroke: In a patient with underlying hypertension, axial NCCT imaging reveals a dense artery of the left middle cerebral artery (MCA) (arrows), suggestive of hyperacute ischemic stroke

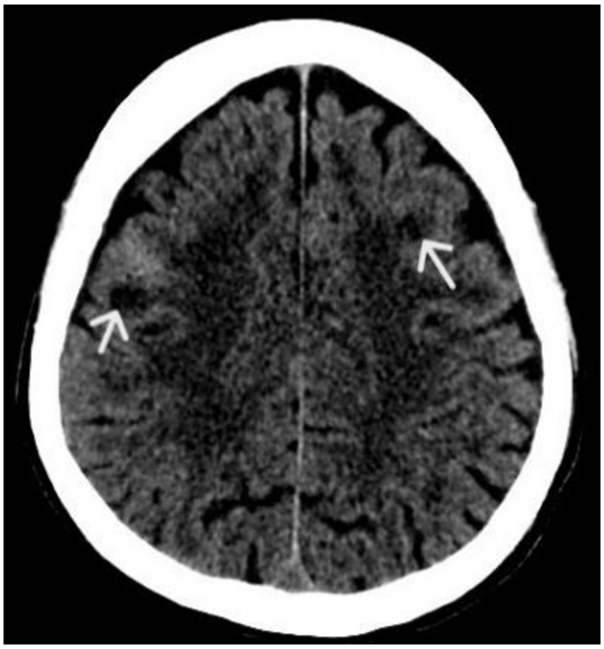

Figure 3 Stroke mimics: In a patient with a history of lung cancer, axial NCCT imaging reveals few hypodense lesions without a specific vascular distribution involving the grey-white matter junction of the bilateral frontal lobes (arrows), consistent with brain metastases

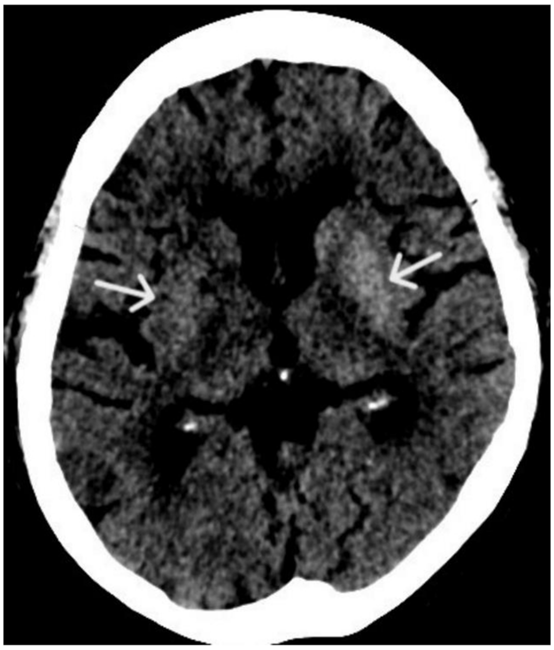

Figure 4 Stroke mimics: In a patient with a history of poorly controlled diabetes mellitus, axial NCCT reveals a hyperdense in bilateral putamen and caudate nuclei (arrows), with a more pronounced effect on the left side, suggesting a diagnosis of non-ketotic hyperglycemic hemichorea (NHH)

attachment sites but cannot cross cranial sutures[22]. 8. Nonspecific hypodensity: increased hypodensity of brain structures compared to other parts of the same structures or their contralateral counterparts without a specific vascular distribution[19]. This excludes changes associated with small vessel disease in the periventricular, deep white matter, and space-occupying lesion. 9. Intraparenchymal hyperdensity: an area within the brain parenchyma that has increased attenuation compared to the adjacent normal brain tissue, excluding hemorrhage and calcification. 10. Serpiginous-like lesion: a wavy or irregularly shaped intraparenchymal lesion that may include areas of partial calcification, representing an arteriovenous malformation (AVM).

Statistical analysis

Analysis was performed using R software version 4.2.3 (R Foundation for Statistical Computing, Vienna, Austria). Quantitative data are expressed as means with standard deviations (SDs) for normally distributed data and as medians with interquartile ranges (IQRs) for skewed data. The Wilcoxon rank-sum test was utilized to compare the differences between the stroke and stroke mimic groups. Qualitative data are presented as absolute numbers and percentages, with comparisons made using either Pearson's chi-square test or Fisher's exact test, as appropriate.

Receiver operating characteristic (ROC) curves were employed to evaluate the diagnostic efficacy of CT in identifying stroke mimics among acute patients. Sensitivity, specificity, accuracy, positive predictive value (PPV), negative predictive value, and 95% confidence interval (CI) were calculated and reported. Statistical significance was set at p-value<0.05, and the agreement between the 2 radiologists was assessed using kappa statistics.

Results

A total of 559 patients were included in this study. Clinical stroke mimics were identified in approximately 57% (316 patients) of cases, while ischemic stroke accounted for about 43% (243 patients). The median age was 64.1 years in the stroke mimic group and 66.6 years in the ischemic stroke group. The female group was significantly more prevalent in the stroke mimic group (51.6%, p-value=0.038). Malignancies and benign brain tumors were significantly more common in the stroke mimic group (17.9%, p-value<0.001 vs. 4.7%, p-value=0.002). In contrast, hypertension was significantly more prevalent among patients with ischemic stroke (57.6%, p-value=0.01), which can be implied from higher systolic and diastolic blood pressure levels (p-value<0.001). The median NIHSS score at presentation was relatively low, at 1, in the stroke mimic group, and significantly lower than that in the ischemic stroke group (p-value=0.015). The demographic data and clinical characteristics of patients with stroke mimics and ischemic stroke are summarized in Table 1.

The most common clinical presentation of stroke mimics was seizures (33.5%), followed by altered levels of consciousness (18.9%), and dizziness (16.9%). Common causes of stroke mimics included idiopathic seizures (20.3%), metabolic disease (11.7%), and peripheral vertigo (10.4%) (Table 2). The most common etiology of metabolic disease was hyponatremia, accounting for approximately 27% (10/37). The remaining causes included hyperglycemia, hypomagnesemia, hypoglycemia, hypokalemia, hyperammonemia, metabolic acidosis, hyperkalemia, hypernatremia, and hypocalcemia. Most brain tumors were brain metastases, accounting for about 35.7% (10/28). The others included gliomas, meningiomas, astrocytomas, vestibular schwannomas, and lymphomas. The most common cause of the infected condition was urinary tract infection, accounting for 37.5% (6/16), followed by sepsis of unknown origin (18.8%, 3/16), and infective diarrhea (12.5%, 2/16). The remaining conditions are aspiration pneumonia, chronic sinusitis, cellulitis, herpes encephalitis, and acute febrile illness. An intriguing stroke-

Table 1 Demographic data and clinical characteristics

	Total (n=559)	Stroke mimics (n=316)	Ischemic stroke (n=243)	p-value
Age at examination date (years)+	65.1 (55,74.8)	64.1 (47.8,74)	66.6 (59.1,75.6)	0.002
Sex				
Male	293 (52.4)	153 (48.4)	140 (57.6)	0.038
Female	266 (47.6)	163 (51.6)	103 (42.4)	0.038
Underlying disease				
Malignancy	70 (12.5)	53 (17.9)	17 (7.1)	<0.001
Benign brain tumor	14 (2.5)	14 (4.7)	0 (0)	0.002
Hypertension	273 (48.8)	136 (45.9)	137 (57.6)	0.01
Cardiovascular disease	77 (13.8)	40 (13.5)	37 (15.5)	0.589
Diabetes mellitus	145 (25.9)	77 (26)	68 (28.6)	0.574
None	87 (18.8)	52 (16.4)	35 (14.4)	0.585
Blood pressure (mmHg)				
Systolic pressure+	159 (140,181)	145.5 (127,170)	159 (140,181)	<0.001
Diastolic pressure+	87 (76.5,100)	82.5 (71,95)	87 (76.5,100)	<0.001
Onset (hour)+	2 (1,3)	2 (0.8,3)	2 (1,3)	0.084
NIHSS score+	3 (2,7)	1 (1,1)	3 (2,7)	0.015

Data are presented as numbers with percentages in parenthese, +data are presented as medians with interquartile ranges in parentheses. NIHSS=national institutes of health stroke scale

Table 2 Final diagnosis of stroke mimics

Conditions	Values
Idiopathic seizure	64 (20.3)
Metabolic disease	37 (11.7)
Peripheral vertigo	33 (10.4)
Primary headache	31 (5.6)
Brain tumor	28 (8.9)
Hypertensive urgency	17 (3.0)
Infection	16 (5.1)
Substance abuse	14 (2.5)
Psychosis	7 (2.2)
Inconclusive diagnosis	20 (6.3)
Others	49 (24)

Data are presented as numbers with percentages in parentheses

mimicking condition identified in this study was substance abuse (2.5%), presenting as seizures or alterations in consciousness.

In the final diagnosis of stroke mimics (Table 2), a variety of other conditions were identified. The most common causes were dizziness (1.1%, 6/316) and food poisoning (0.9%, 5/316). Other frequent causes included hypoxemia, hypoxic-ischemic encephalopathy, myofascial pain syndrome, and peripheral numbness. Rarer conditions included acute dystonia from unknown cases, Bell's palsy, nasopharyngeal cancer, central cord syndrome, claudication, carbon dioxide retention, cobra bite, fibromyalgia, functional neurologic disorder, radiculopathy pain from degenerative spine, muscle spasm, and ST-segment elevation myocardial infarction.

The NCCT imaging patterns upon admission are shown in Table 3. The most common NCCT finding was a negative scan, observed in 79.7% (252/316) of stroke mimics and 72.0% (175/243) of ischemic stroke. Nonspecific hypodensity and mass-like appearance from a space-occupying lesion were the most frequently observed positive findings on CT for the diagnosis of stroke mimics (11.5% vs. 7.5%), in parallel with hypodensity-associated vascular territory in the diagnosis of ischemic stroke (20.4%). NCCT was interpreted as a positive CT finding in only 20.3%

Table 3 CT imaging patterns for stroke mimics and ischemic stroke

Imaging categories	Value* (n =559)	Sensitivity (95% CI) (%)	Specificity (95% CI) (%)	Accuracy (95% CI) (%)
Positive CT findings				
Stroke mimic	64 (20.3)			
Non-specific hypodensity	35 (11.5)	49.3 (37.2–61.4)	100.0 (93.4–100.0)	71.2 (62.4–78.9)
Mass-like appearance from a space-occupying lesion	23 (7.5)	32.4 (21.8–43.5)	100.0 (93.4–100.0)	61.6 (52.5–70.2)
Intraparenchymal hyperdensity	4 (1.3)	7.1 (2.3-15.7)	100.0 (93.3-100.0)	47.2 (38.2-56.3)
Serpiginous-like lesion without mass effect	4 (1.3)	4.2 (0.9-11.9)	100.0 (93.4-100.0)	45.6 (36.7-54.7)
Hydrocephalus	4 (1.3)	7.0 (2.3-15.7)	100.0 (93.4-100.0)	47.2 (38.2-56.3)
Bony lesion	2 (0.7)	2.8 (0.3-9.8)	100.0 (93.3-100.0)	44.8 (35.9-53.9)
Extra-axial lesion without mass effect	2 (0.7)	1.4 (0.1-7.6)	1.4 (0.1-100.0)	44.0 (0.1-53.2)
Extensive parenchymal calcification	2 (0.7)	2.8 (0.3-9.8)	100.0 (93.4-100.0)	44.8 (35.9-53.9)
Subdural/epidural collection	1 (0.3)	1.4 (0.1-7.6)	100.0 (93.4-100.0)	44.0 (35.1-53.2)
Ischemic stroke	68 (28.0)			
Hypodensity-associated vascular territory	52 (20.4)	77.8 (64.4–88.0)	85.9 (75.6–93.0)	82.4 (74.6–88.6)
Hyperdense artery sign	8 (3.1)	13.0 (5.3–24.9)	98.6 (92.4–99.9)	61.6 (52.5–70.2)
Insular ribbon sign	7 (2.7)	9.3 (3.1–20.3)	97.2 (90.2–99.7)	59.2 (50.1–67.9)
Loss of grey-white matter differentiation	6 (2.4)	7.4 (2.1–17.9)	97.2 (90.2–99.7)	58.4 (49.2–67.1)
Sulcal effacement	4 (1.6)	7.4 (2.1–17.9)	100.0 (94.9–100.0)	60.0 (50.9–68.7)
Gyral hemorrhage	1 (0.4)	-	-	-
Equivocal lesion	2 (0.8)	-	-	-
Negative CT findings				
Stroke mimic	252 (76.7)	-	-	-
Ischemic stroke	175 (72.0)	-	-	-

*Data are numbers with percentages in parentheses, 95% CI=95% confidence interval, CT=computed tomography

(64/316) of patients with stroke mimics and 28.0% (68/243) of patients with ischemic stroke. Excellent interobserver reliability (kappa=0.95) was achieved for NCCT imaging interpretation between the 2 radiologists. The diagnostic performance of NCCT for stroke mimic diagnosis is summarized in Table 4, showing a high specificity of 95% (95% CI, 85%–99%) and a high PPV of 97% (95% CI, 93%–99%). Most patients with stroke mimics did not undergo further imaging. The frequency of contrast-enhanced CT, follow-up NCCT, MRI, and CT venography (CTV) in the stroke mimic group was approximately 6.6% (21/316), 5.1% (16/316), 2.5% (8/316), and 0.3% (1/316), respectively. No CTA brain studies were performed in this group. In contrast, 65.8% (160/243) of patients with ischemic stroke underwent MRI for confirmation, 11.1% (27/243) had CTA brain studies, and 0.8% (2/243) underwent contrast-enhanced CT.

Table 4 The diagnostic performance of the NCCT in the diagnosis of stroke mimics

Statistics	Stroke Mimics
Sensitivity (95% CI)	0.20 (0.16–0.25)
Specificity (95% CI)	0.95 (0.85–0.99)
Accuracy (95% CI)	0.55 (0.51–0.59)
Positive predictive value (PPV) (95% CI)	0.97 (0.93–0.99)
Negative predictive value (NPV) (95% CI)	0.49 (0.49–0.54)
Area under the curve (AUC)	60.1

NCCT=noncontrast computed tomography, 95% CI=95% confidence interval

Discussion

The well-established purpose of NCCT for patients suspected of stroke in an acute setting is to exclude intracranial hemorrhage[9]. This study provides further insight into the imaging patterns of conditions that mimic stroke. The prevalence of stroke mimics in our population was 57%, significantly higher than the 20%–30% typically reported in previous studies[23-26]. We posit that the variation in the frequency of stroke mimics may be influenced by the level of experience and exposure of primary care providers, as most initial assessments are performed by doctors in primary care settings, whose diagnostic accuracy and decision-making processes can significantly impact the recognition and management of stroke mimics. Although baseline demographic data, including underlying hypertension or high blood pressure, and NIHSS scores showed a significant correlation with actual strokes, consistent with previous findings, these factors remain valuable for excluding patients with stroke mimics[26].

Notably, stroke mimics were predominantly identified in elderly patients, with a higher prevalence in females. Idiopathic seizures were the most common clinical presentation in stroke-mimicking cases, aligning with previous research indicating that epilepsy is a prevalent neurological condition among females, especially as aging in women is associated with reproductive hormonal fluctuations. Estrogen and progesterone have both pro- and anticonvulsant effects[27], potentially increasing the susceptibility of older women to seizures.

Exactly, some patients presenting with symptoms of seizure have post-stroke seizures, showing a gliotic change on NCCT[28]. This can lead to misclassification and the erroneous diagnosis of stroke mimics instead of actual stroke. This misdiagnosis may result in inappropriate treatment and management strategies. However, among the stroke cases in this study, 3 patients presented with seizures, all of whom experienced their first seizure episode. This finding suggests that individuals with their first episode of seizure are more likely to be classified as stroke rather than stroke mimics.

After idiopathic seizures, metabolic abnormalities were the next most common condition in stroke mimics, significantly influencing the manifestation of seizures. It has been reported that women often experience higher rates of obesity and have a higher body fat composition, leading to poorer metabolic control in conditions such as diabetes mellitus[29]. Specifically, sex hormones in women substantially influence various physiological processes, including energy metabolism, body composition, vascular function, and inflammatory responses[29]. These reasons may explain why metabolic changes present with clinical features like those of stroke mimics. Peripheral vertigo, characterized primarily by dizziness, was the third most frequent stroke mimic observed in this study. Benign paroxysmal positional vertigo is the most common cause of peripheral vertigo and is associated with perimenopause status from osteoporosis and estrogen deficiency[30]. Therefore, it is reasonable to conclude that stroke mimics are frequently identified in menopausal women or the elderly population.

Additionally, we found that patients presenting with headaches often mimicked stroke conditions. The headaches could be due to various causes, such as primary headaches or secondary headaches, including brain tumors. A previous study revealed that 11.1% of participants classified as stroke mimics presented with headaches, though primary headaches cannot be evaluated with NCCT alone[31]. Conversely, headache is the most common clinical presentation of a brain tumor[32]. The clinical presentations of patients with brain tumors also resemble those of patients with ischemic stroke, including seizures, dizziness, altered consciousness, and focal neurological deficits. This misdiagnosis is due to space-occupying lesions with specific tumor localization mimicking infarcts within vascular territories[32]. Although these patients are often clinically misdiagnosed as having a stroke, our study revealed that NCCT can detect most brain tumors. They can also be identified using NCCT scans, revealing hypodense lesions unrelated to vascular territories and often exhibiting mass effects.

The interobserver agreement in this study was excellent, with a kappa statistic of approximately 0.95. This high level of agreement suggests that NCCT is a reliable tool for the evaluation of stroke mimics when used by less experienced radiologists and general physicians.

Because most NCCT imaging findings in this study were negative, we explored the performance of NCCT in diagnosing stroke mimics in cases where acute ischemic stroke was clinically suspected. Our findings revealed a low sensitivity but high specificities of 20% and 95%, respectively. This discrepancy is likely due to the difficulty in detecting stroke mimics using NCCT[33]. NCCT provides a lower detailed assessment and sensitivity for evaluating soft-tissue properties compared to MRI in both stroke and stroke mimics conditions[1,12-14,34]. However, NCCT is often selected as the initial imaging modality owing to its availability and the need for prompt treatment commencement. NCCT is primarily used in clinical stroke settings to exclude intracranial hemorrhage, which contraindicates intravascular thrombolysis or thrombectomy, and to identify other acute neurological conditions that require urgent management. NCCT can detect gross structural malformations, large tumors, and calcified lesions, highlighting its limitations in detecting subtle abnormalities.

NCCT is recommended as an adjunctive diagnostic tool for stroke mimics, particularly in emergency settings. Its straightforward nature as an uncomplicated imaging modality makes it a valuable asset for early management by various healthcare providers, including general radiologists and physicians. The high specificity and positive predictive value of NCCT in diagnosing stroke mimics typically enable the exclusion of ischemic stroke from other conditions that resemble a stroke, thereby facilitating appropriate treatment.

An intriguing stroke-mimicking condition identified in this study was substance abuse, which is often characterized by seizures or alterations in consciousness (2.5%). This condition predominantly affects younger patients without underlying diseases, consistent with findings from previous studies[35-37]. Therefore, it is crucial to inquire about medication or narcotic use history, particularly in teenagers and young adults.

This study had some limitations, which include its retrospective design and the absence of additional superior or follow-up imaging to confirm the accuracy of the initial imaging category of stroke mimics. Diagnosing stroke and stroke mimics can be challenging when small-vessel disease obscures true lesions, such as lacunar infarctions. This study identified 45 patients with severe small vessel disease, prompting the recommendation for additional MRI evaluations in such cases. However, only 29% of patients (160/559) underwent further MRI confirmation, and all these patients were diagnosed with stroke. Furthermore, discordant opinions among clinicians can complicate the determination of the final diagnosis. Despite these challenges, we consistently prioritized the conclusion of neurologists over emergency physicians owing to their greater experience in managing patients with stroke and stroke-mimicking conditions.

Conclusion

NCCT exhibits low sensitivity for diagnosing stroke mimics. Therefore, obtaining a comprehensive medical history, conducting a thorough physical examination, and performing additional investigations are essential for a definitive diagnosis. Conversely, the high specificity of NCCT in diagnosing stroke mimics can assist clinicians in making decisions regarding the necessity of intravenous thrombolysis or mechanical thrombectomy, potentially avoiding unnecessary interventions.

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Conflict of interest

There are no potential conflicts of interest to declare.

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