AI IN TELESTROKE: AN EARLY SINGLE-CENTER EXPERIENCE IN EVALUATING THE PERFORMANCE OF AI FOR DETECTION OF ICH, LVO, AND ASPECTS SCORE

Kamran U[1*], Kanwal S[1], Durrani M[1], Yousaf A[1], Abdul Qayum S[2], Ur Rehman A[3], Abbasi W[3]

[1]Department of Radiology, Rawalpindi Institute of Cardiology, Rawalpindi, Pakistan

[2]Department of Neurology, Rawalpindi Institute of Cardiology, Rawalpindi, Pakistan

[3]Department of Cardiology, Rawalpindi Institute of Cardiology, Rawalpindi, Pakistan

***Corresponding author:**
Kamran Ummarah, Department of Radiology, Rawalpindi Institute of Cardiology, Rawalpindi, Pakistan
Email: ummarahkamran1@gmail.com

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ABSTRACT

Background
Stroke represents a critical health crisis, causing significant global mortality and long-term disability. Acute ischemic stroke treatment focuses on timely interventions such as tPA administration and mechanical thrombectomy, but the narrow time window and specialist shortages pose challenges.
Methods
This retrospective study evaluated the efficacy of the Canon Automation Platform software in detecting intracranial hemorrhage (ICH), large vessel occlusion (LVO), and Alberta Stroke Program Early CT Scores (ASPECTS) in 20 stroke patients.
Results
AI demonstrated 100% sensitivity in identifying ICH and LVO, with high specificity and negative predictive value. While the AI matched radiologist findings perfectly in extreme ASPECTS categories (6 and 10), it showed variability in intermediate scores (specifically score 8).
Conclusion
These findings serve as a preliminary proof of concept. AI improves diagnostic speed and triage accuracy, though radiologist confirmation remains essential for intermediate ASPECTS and false-positive mitigation.

Keywords: Artificial intelligence (AI); Deep learning (DL); Intracranial hemorrhage (ICH); Large vessel occlusion (LVO); Machine learning (ML)

INTRODUCTION

The A stroke represents a critical health crisis characterized by the obstruction of blood flow to the brain, depriving it of oxygen and essential nutrients [1]. This condition is a major cause of global mortality and long-term disability, underscoring the need for effective diagnostic and therapeutic strategies [2]. Treatment for acute ischemic stroke focuses on restoring blood flow through medications or procedures within strict time limits. Intravenous thrombolysis with alteplase is most effective within 4.5 hours of symptom onset, while endovascular treatment should occur within 6 hours for large vessel occlusions [3,4].

Due to the narrow diagnostic window and a shortage of specialized medical professionals, innovative approaches are essential. Teleneurology has emerged as a significant advancement, offering remote consultations that enhance recovery rates [5]. Artificial intelligence (AI), specifically through machine learning (ML) and deep learning (DL), presents promising solutions to high workloads and slow assessments [7,8].

The integration of AI, such as the computer-assisted Alberta Stroke Program Early CT Score (ASPECTS), has demonstrated high accuracy in detecting early ischemic changes [14,15]. This retrospective study aimed to assess the effectiveness of the Canon Automation platform in detecting ICH, LVO, and ASPECTS in a clinical telestroke setting.

METHODOLOGY

We conducted a retrospective analysis of patients presenting with stroke symptoms at the RIC Emergency Department between July 2023 and November 2023.

We gathered data from clinical documents, imaging reports, and records from the AI software. We collected information about patients' age, gender and Alberta Stroke Program Early Computed Tomography Score (ASPECTS) for anterior circulation infarcts. The Alberta Stroke Program Early CT Score (ASPECTS) is a numerical rating system ranging from 0 to 10 that is utilized in assessing middle cerebral artery (MCA) stroke cases based on CT scan findings. This scoring method involves dividing the MCA vascular territory into segments, with one point deducted from the total score of 10 for each region affected at both the ganglionic and supraganglionic levels as shown in Table 1 and Figure 1. The inclusion criteria are as follows:

1. Patients with an activated telestroke code.
2. Completion of CTA head and neck scans.
3. Analysis via the automated AI software.
4. Confirmation of findings by radiologists.

The imaging data were processed using the Canon Automation Platform, utilizing the ICH, LVO, and ASPECTS modules. These DL-based algorithms analyze non-contrast CT and CTA scans to flag life-threatening neurovascular conditions. LVO specifically targets occlusions in the Internal Carotid Artery (ICA) and the M1/M2 segments of the Middle Cerebral Artery (MCA). ASPECTS automatically segments the 10 defined regions of the MCA territory to calculate a score based on tissue density changes.

RESULTS AND DISCUSSION

Out of 20 patients, 14 were male and 6 were female (Mean age: 43.11 ± 20.12 years). Significant co-morbidities included diabetes mellitus (79.7%) and hypertension (66.1%).

The AI system demonstrated 100% sensitivity for both ICH and LVO, correctly identifying all cases confirmed by radiologists. For ICH, specificity was 86.7% (2 false positives). For LVO, specificity was 88.2%. Both categories yielded a Negative Predictive Value (NPV) of 100%, confirming the software’s reliability as a rule-out tool.

The AI showed 100% agreement with radiologists for extreme scores of 6 and 10.

However, for the intermediate score of 8, the AI correctly identified only one out of four cases identified by radiologists, indicating lower performance and variability in intermediate ischemic change detection, illustrated in Table 2 and Figures 2-4.

The Diagnosing LVO is crucial for mechanical thrombectomy eligibility. While literature reports AI sensitivity between 86% and 97.5%, our study using Canon Automation Platform,achieved 100% sensitivity. This high sensitivity is vital for mobilizing stroke teams promptly [17,18].

However, our findings regarding ASPECTS indicate that AI performance fluctuates. The drop in accuracy for Score 8 suggests that subtle "gray-sign" changes—such as early loss of the insular ribbon—remain difficult for algorithms to distinguish from normal patient variation or chronic leukoencephalopathy [19].

With a sample size of N=20, these findings serve as a preliminary proof of concept. While results are encouraging, a single case can significantly distort percentages in a small cohort. Future multi-center studies with larger datasets are required to validate these performance metrics. Additionally, infrastructure obstacles such as internet interoperability remain a challenge for real-time AI integration.

CONCLUSION

AI technology in stroke imaging could significantly change future diagnostics. Our observations suggest that automated software like Canon Automation Platform is highly beneficial for rapid triage and LVO detection, especially for non-expert staff. While AI does not currently substitute for an experienced radiologist, its evolution into deep learning suggests it will become an increasingly robust partner in precision medicine.

DATA AVAILABILITY

Further information regarding the data used for this work can be obtained upon reasonable request.

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CONFLICT OF INTEREST:

The authors have no conflicts of interest to declare and is in agreement with the contents of the manuscript.

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FIGURE LEGENDS:

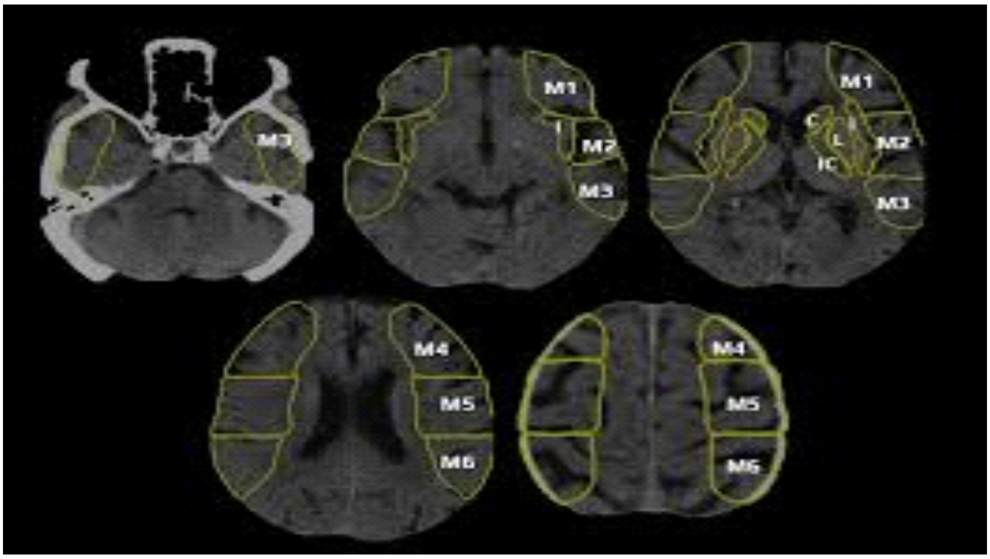

Figure 1: Basal Ganglia and supra ganglionic levels for ASPECT scoring.

Figure 2: Left MCA occlusion correctly identified by AI software.

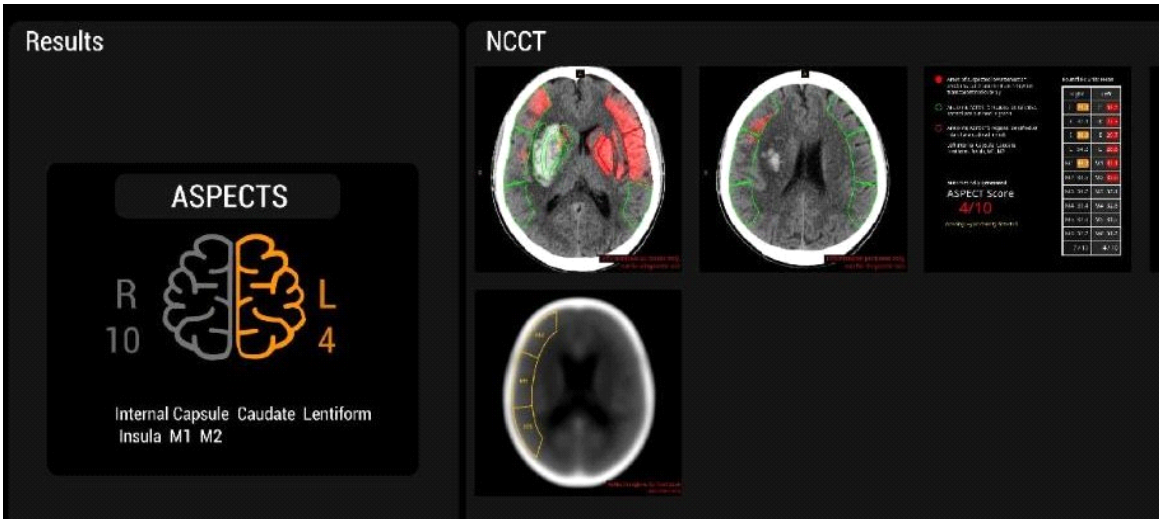

Figure 3: Presence of ICH in right basal ganglia correctly identified by AI software.

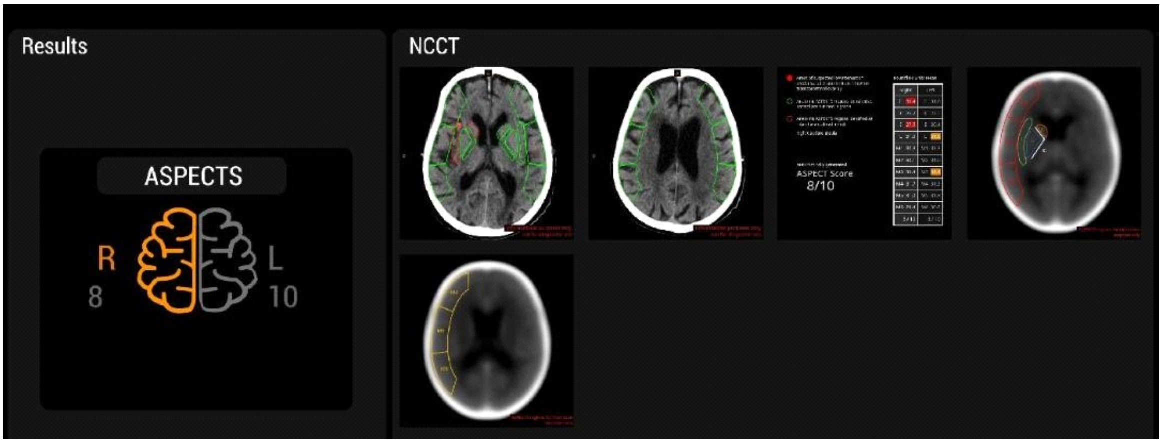

Figure 4: Absence of Bleed and ASPECT score correctly identified by AI software.

TABLE LEGEND:

Table 1: Alberta Stroke Program Early CT Score (ASPECTS) ranging from 0 to 10 for assessing middle cerebral artery (MCA).

Region involved	Points
Ganglionic level:	
Caudate	1
putamen	1
Anterior or posterior limb of Internal capsule	1
Insular cortex	1
M1: cortex corresponding to frontal operculum	1
M2: cortex corresponding to anterior temporal lobe	1
M3: cortex corresponding to posterior temporal lobe	1
Supraganglionic level:	
M4: MCA territory superior to M1	1
M5: MCA territory superior to M2	1
M6: MCA territory superior to M3	1

Table 2: Performance Metrics of AI Systems for ICH, LVO, and ASPECT Scores.

Metric	ICH - AI System	LVO - AI System	ASPECT Scores - AI System (NA, 6, 10)	ASPECT Scores - AI System (8)	ASPECT Scores - AI System (9)
Sensitivity	100% (5/5)	100% (3/3)	100%	N/A	N/A
Specificity	86.7% (13/15)	88.2% (15/17)	100%	N/A	N/A
Positive Predictive Value (PPV)	71.4% (5/7)	60.0% (3/5)	100%	50% (2/4)	100% (3/3)
Negative Predictive Value (NPV)	100% (13/13)	100% (15/15)	100%	N/A	N/A