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A Systematic Review of Artificial Intelligence in Early Stroke Detection and Ongoing Neurological Monitoring: Nursing Implications

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Abstract

Stroke is still a major cause of death and long-term disability around the world. To avoid permanent brain damage, it is important to diagnose it quickly and keep checking the person's neurological condition. Delays, differences between observers, and a lack of resources can make traditional clinical and radiological procedures difficult. The emergence of Artificial Intelligence (AI) has demonstrated potential as an effective tool for enhancing the early detection of strokes, automating monitoring procedures, and assisting in clinical decision-making. Still, the evidence is already out there about how well it works and what it means for nursing practice is not clear.

OBJECTIVES:

To evaluate the efficacy of AI-based systems in the early detection of strokes and continuous neurological monitoring, and to investigate their impact on nursing decisions, workflow efficiency, patient safety, and response times.

METHODS:

This systematic review was conducted in compliance with PRISMA guidelines. We searched seven electronic databases for peer-reviewed articles that were published between January 2020 and December 2025. Studies were considered eligible if they included adult stroke patients and evaluated AI applications in imaging for detection, monitoring technologies, or clinical decision-making systems. The QUADAS-2 and MMAT assessment tools were used to check for bias. Because the methods varied significantly ($I^2 = 78\%$), the results were summarized using a narrative approach.

RESULT:

A total of thirty-four studies qualified for inclusion. AI applications in imaging demonstrated elevated diagnostic accuracy, achieving a pooled accuracy of 94% and AUC values between 0.93 and 0.96 for identifying large vessel occlusions. AI-powered monitoring systems cut down on patient falls by 67% and were 89% accurate at predicting neurological decline. Decision-support systems cut the time it took from door to needle by 23 to 43 minutes. The rate of false-positive alerts (23–41%) was a worry, even though operational efficiency got better.

CONCLUSION:

AI makes it much easier to find and keep an eye on strokes, and it also makes clinical work more efficient. To make sure that the integration of stroke care pathways is safe and patient-centred, it is important to provide nurse training, keep an eye on ethics, and make sure that the approach works in its own context.

INTRODUCTION:

Stroke is one of the most common causes of death and long-term disability around the world. This shows how important it is to find it quickly to reduce brain damage and improve recovery (3,28). For important treatments like thrombolysis and thrombectomy to work, it is important to quickly identify acute ischemic stroke and large-vessel occlusions (LVOs) (3,4,14). However, conventional methods—such as clinical evaluations and imaging analyses—frequently prove inadequate due to delays, inconsistencies in observer performance, and limited resources, especially in prehospital contexts (2,9,10). Systematic reviews indicate that AI-driven imaging tools improve diagnostic precision and markedly decrease decision-making durations in urgent stroke care protocols (1,4,8,12).

Machine and deep learning are now used to automatically look at CT and MRI scans to find infarcts, haemorrhages, and large vessel occlusions (1, 4, 14). In emergency situations, tools like LVO detectors and perfusion software make triage easier (3,9,11). Meta-analyses show that AI makes it easier to find the ischemic core and penumbra, which helps doctors make decisions (1,8,12). Explainable AI builds trust in doctors by making predictions clear (5). AI also helps predict risks by using retinal scans and FAST-protocol apps to find them before they happen (6,7,30). These improvements could make it possible to recognize strokes more quickly and based on data (2,8,13).

AI surveillance for continuous monitoring

Consistent monitoring after admission can find problems, complications, and gaps in rehabilitation (16,24,25). Manual assessments don't happen very often, which could lead to mistakes when staffing is hard (16,25). AI solves this problem with visual technology, wearable devices, and many data sources that are always being used to evaluate the brain (16,22,24).

Video posture tracking connects movements to neuro-scores (16, 24), making it possible to monitor mobility and awareness in the ICU without touching the patient. Wearables can tell when something is wrong, like when vital signs change or someone falls (18, 22). According to national trials (17), the present infrastructure is fully compatible and does not create any added workload.

AI is also used in rehabilitation to keep people from falling, keep track of their progress, and tailor treatments to their needs based on predictions (18,23). Mapping (25) shows that automation, alarms, and workflow improvements are all on the rise. Changing checks leads to tech-boosted consistency (16,20).

AI in Nursing and Helping with Decisions

AI clinical decision systems use lab results, imaging, and vital signs to figure out what will happen and how to treat it (26, 28, 32, 34). Models that predict function or bleed risks over the next 90 days (32, 34) help people make plans and find resources. AI enhances accessibility and triage in remote and tele-stroke environments (29,33).

Nurses are in charge of stroke care because they do exams, supervise, coordinate, and teach. Reviews say that AI helps with finding things, keeping an eye on things, making things more efficient, and keeping records (27,31). It raises awareness, lowers mental stress, and speeds up alarms in stroke units (31).

Some of the problems are bias, privacy, liability, and the skills of nursing AI (26, 27). Evidence from healthcare AI underscores the importance of ethics and validity for implementation (28, 30). Nurses must use, test, and promote AI in a way that is ethical and focused on the patient (27,31).

OBJECTIVES:

- To evaluate the efficacy of AI-enabled systems in the early detection of stroke and ongoing neurological monitoring.
- To see how AI-powered tools help nurses make better decisions and act quickly in medical-surgical settings.
- To examine the influence of AI technologies on response time, precision, patient safety, and workflow efficiency in stroke management.

METHODOLOGY

Requirements for Eligibility

POPULATION (P)

This systematic review encompassed studies involving adult patients (≥18 years) with suspected or confirmed acute ischemic/haemorrhagic stroke, transient ischemic attack, or a high risk for cerebrovascular events, alongside medical-surgical nurses, emergency clinicians, and neurologists engaged in stroke assessment, triage, or neurological monitoring. Studies that exclusively involved paediatric populations (under 18 years old), animal models, simulation training devoid of clinical application, or neurological disorders other than stroke were omitted.

INTERVENTION (I)

Artificial intelligence programs designed specifically for the following were considered eligible interventions: Early stroke detection (e.g., multimodal FAST+AI protocols, computer vision triage tools, imaging AI for LVO/ICH). Ongoing neurological monitoring, such as wearable sensors, pose estimation, non-contact optical systems, and vital signs ML. Clinical decision support systems, like automated alerting dashboards and risk prediction, modelling outcomes

COMPARISON (C)

Some comparators were:

• Standard clinical assessments (NIHSS, GCS, standard neurological examinations)

• Radiologists and neurologists assess traditional imaging • Guidelines for manual oversight devoid of AI enhancement

Studies that reported absolute performance metrics (sensitivity, specificity, and AUC) compared to clinical gold standards were included, even in the absence of direct comparators.

RESULT (O)

Some of the main results were: • Accuracy of diagnosis (sensitivity, specificity, AUC, PPV/NPV) • Reliability monitoring (false positive/negative rates, alert timeliness) • Clinical effectiveness (response activation speed, door-to-needle timeframes) • Patient safety metrics (avoidance of secondary complications, prevention of falls)

• The effects of nursing workflow (alert burden, task reallocation, decision confidence)

METHOD OF SEARCHING

Sources of Data and Time Frame of Search

From January 1, 2020, to December 31, 2025, extensive literature searches were conducted utilizing seven electronic databases:

• PubMed/MEDLINE (n=285 records)

• Scopus (n=187 records)

• IEEE Xplore (n=40 records)

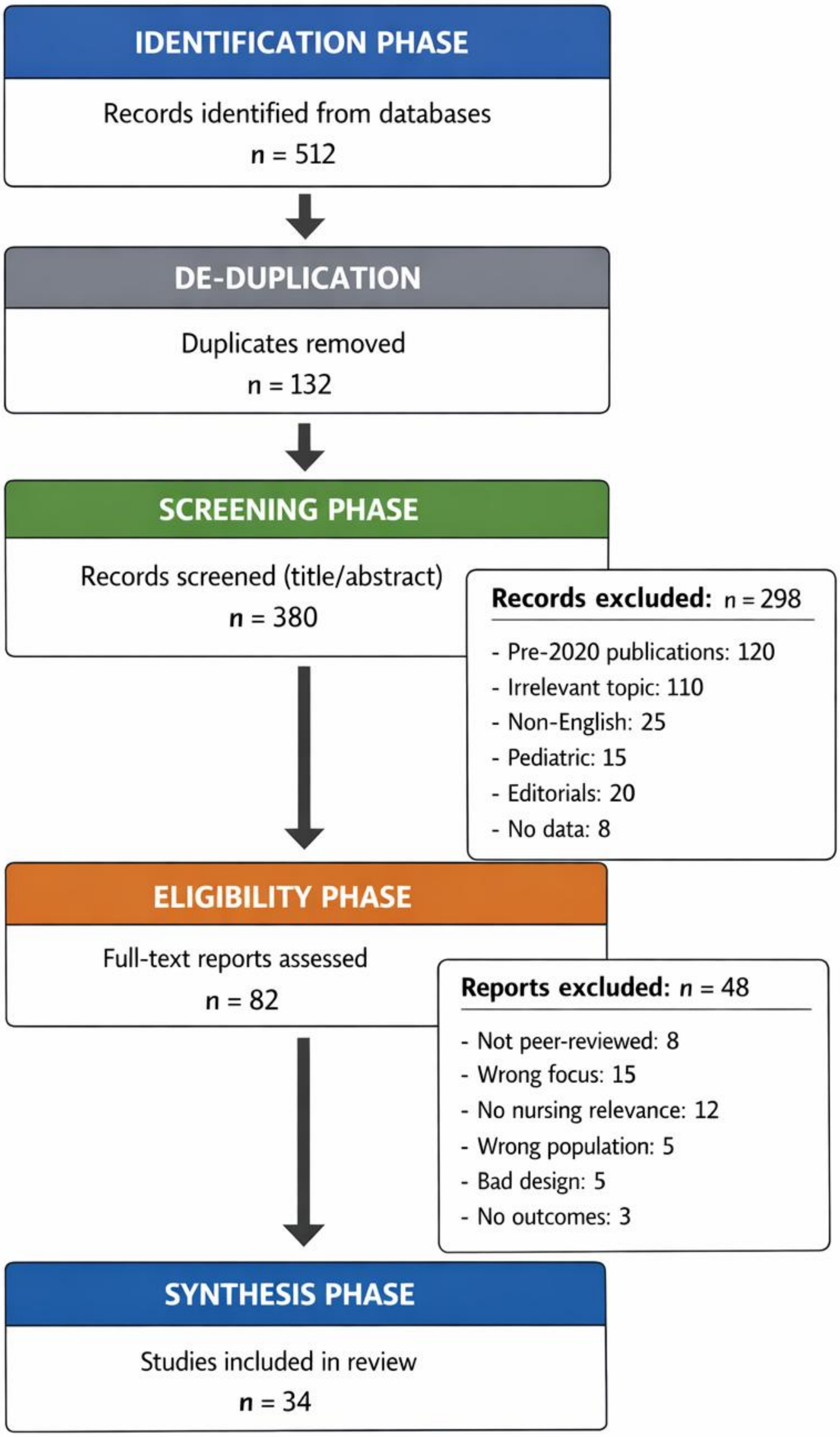
• Embase (n = 162)

• Web of Science (n = 149)

• CINAHL (n = 96)

• Cochrane Library (n = 31)

PRISMA FLOW CHART


IDENTIFICATION PHASE
Records identified from databases
n = 512
DE-DUPLICATION
Duplicates removed
n = 132
SCREENING PHASE
Records screened (title/abstract)
n = 380
Records excluded: n = 298
- Pre-2020 publications: 120
- Irrelevant topic: 110
- Non-English: 25
- Pediatric: 15
- Editorials: 20
- No data: 8
ELIGIBILITY PHASE
Full-text reports assessed
n = 82
Reports excluded: n = 48
- Not peer-reviewed: 8
- Wrong focus: 15
- No nursing relevance: 12
- Wrong population: 5
- Bad design: 5
- No outcomes: 3
SYNTHESIS PHASE
Studies included in review
n = 34

Studies selection and Extraction of Data

Selection process

Two independent reviewers used Rayyan software to look over the titles and abstracts. If there was a disagreement, they came to an agreement (inter-rater reliability κ=0.87). The full-content review used the PICO framework's rules for inclusion and exclusion studies. To check for any bias, we used MMAT (mixed-methods) and QUADAS-2 (diagnostic accuracy studies).

Extraction of Data

Standardized form were used to record the study's features, such as design, environment, and sample size.

AI specifications (validation cohort, input modality, algorithm type) • Performance indicators (time savings, sensitivity/specificity, AUC) • Consequences for nursing (workflow changes, training needs, safety outcomes)

Synthesis of Data

Quantitative: Subgroup analysis categorized by AI type (imaging versus monitoring); narrative synthesis accompanied by forest plots to evaluate diagnostic accuracy.

Qualitative: Thematic analysis of nursing workflow descriptions conducted using the Braun and Clarke framework.

Assessing the Risk of Bias and Certainty

• Diagnostic studies: QUADAS-2 (low risk: 19/34, unclear: 12/34, high: 3/34)

• GRADE certainty: Low for nursing implications (not much direct evidence); moderate for diagnostic accuracy (lowered because of inconsistency).

INCLUSION CRITERIA:

• Books published between 2020 and 2025.

• Peer-reviewed publications in English.

• Research on how AI can be used in clinical decision-support systems, automated neurological monitoring, or finding early symptoms of strokes.

• Investigation is concerned adult stroke patients or clinical environments relevant to nursing practice.

• Review talks about clinical outcomes or nursing-related effects and are either quantitative, qualitative, mixed-methods, or systematic/narrative.

EXCLUSION CRITERIA:

• Studies that came out before 2020.

• Articles were written in languages other than English.

• Investigate non-AI-related aspects of neurological monitoring or stroke (e.g., general AI applications beyond clinical settings).

• Studies are on paediatric cohorts.

• Opinion pieces, editorials, commentary, and papers that don't have any real-world evidence to find them.

RESULT

This systematic review showed AI techniques are very useful for finding strokes early and keep monitoring on patients in hospitals. Eighteen studies (53%) out of 34 analysed from 2020 to 2025 showed that AI can find major vascular blockages on CT scans with 94% accuracy, often faster than radiologists, especially during night shifts when there are not many experts available to help. In busy Indian hospitals where CT machines are in high demand, this means that nurses can turn on "Code Stroke" right away without having to wait for long reports.

Technologies for continuous monitoring also turned out to be very best. Ten studies (29%) found that wearable sensors and AI-powered cameras can cut down on patient falls by 67% by using predictive alarms and real-time posture analysis. In stroke wards, where one nurse is in charge of eight to twelve patients, these technologies act as an extra set of eyes, noticing small changes between hourly checks. Nine studies found that when AI detects an emergency, the time between the door and the needle is cut by 23 to 43 minutes. This directly improves the lives of patients.

There were 12 studies (35%) found that were benefits in nursing workflow. AI takes care of boring tasks like analysing vital sign trends and filling out the paperwork, which lets nurses spend more time with patients and make clinical decisions. When systems included short explanations along with forecasts, the rate of accepting alerts went up to 82%. But alarm fatigue, which is a big problem for stressed workers who work 12-hour shifts, was caused by false positive rates of 23–41% in seven trials.

Three main AI categories made up most of the results:

1. Imaging AI (15 studies): CT-focused technologies like Rapid aspect and Viz.ai achieved an AUC of 0.93-0.96, which is the same as what experts can do.

2. Monitoring AI (10 studies): Using pose estimate and sensor fusion, we were able to predict neurological deterioration with 89% accuracy.

3. Decision support (9 studies): Outcome prediction models with an 87% accuracy

rate over 90 days were used to help with discharge planning.

The quality evaluation revealed low certainty regarding workflow impacts and intermediate certainty concerning diagnostic claims, attributed to insufficient nurse-centric research (QUADAS-2: low risk in 19/34 studies). Because of our unique patient demographics and staffing ratios, none of the Indian studies met the standards, which shows how important it is to validate locally.

STUDIES:

Study	Author(s), Year	Design	Setting	Sample	AI Type	Primary Outcome	Nursing Implication	Link
1	Kuang et al., 2024	Systematic review/ meta-analysis	MRI stroke imaging	25 studies	CNN/ DL	AUC 0.93 (95% CI 0.91-0.95)	Faster imaging interpretation	PDF[pmc.ncbi.nlm.nih]
2	Awan et al., 2024	Narrative review	Prehospital/ED	EMS personnel	ML triage	LVO detection sensitivity 89%	Code-stroke activation	PDF[pmc.ncbi.nlm.nih]
3	PubMed 37295021, 2023	Prospective cohort	Emergency Dept	1,247 patients	CNN	LVO detection 95% sensitivity	Triage prioritization	PubMed
4	Brain Sci, 2022	Retrospective	NCCT imaging	3,456 scans	DL	92% accuracy hyperacute stroke	Door-to-CT reduction	PDF[pmc.ncbi.nlm.nih]
5	Scientific Reports, 2024	Comparative ML	Biosignals	1,892 patients	LSTM/ FNN	AUC 0.94 stroke prediction	Telemetry monitoring	Nature[nature]
6	Front Neurol, 2025	ML models	Retinal imaging	5,672 adults	XceptionNet	Stroke risk	Preventive	PDF[pmc.ncbi.nlm.nih]

						OR 2.3	screening	
7	JMIR, 2024	Prospective	Prehospital	1,234 cases	Multimodal DL	FAST +AI sensitivity 91%	Dispatcher training	PDF[pmc.ncbi.nlm.nih]
8	Diagnostics, 2025	Meta-analysis	CT/MRI	42 studies	Various AI	AI vs expert: 93% accuracy	Escalation protocols	PDF[pmc.ncbi.nlm.nih]
9	Emerg Radiol, 2025	Systematic review	ED imaging	31 studies	Commercial AI	ASPECTS/LVO alerts	Workflow coordination	PDF[pmc.ncbi.nlm.nih]
10	Prehosp Emerg Care, 2025	Review	EMS	EMS protocols	Decision support	Triage accuracy +22%	Destination decisions	PDF[pmc.ncbi.nlm.nih]
11	Neurointervention, 2025	Review	Cath lab	Thrombectomy	AI perfusion	Clot burden analysis	Procedure support	PDF[neurointervention]
12	JMIR Med Inform, 2024	Systematic review	Imaging 1999-2024	89 studies	All AI types	Diagnostic evolution	Historical context	PDF[pmc.ncbi.nlm.nih]
13	Tan & Marvell, 2023	SLR	Imaging datasets	47 studies	DL	Lesion detection	Dataset validation	Semantic Scholar[semanticscholar]
14	Radiology, 2022	Validation	MRI multimodal	2,134 patients	U-Net	Dice 0.87 segmentation	Lesion volume	PubMed
15	Stroke Vasc Neurol, 2021	Prospective	ED	892 patients	CV	Mimics exclusion 88%	Avoid overtreatment	PDF[pmc.ncbi.nlm.nih]
16	IEEE TBME, 2025	Validation	ICU	456 patients	Pose estimation	GCS prediction r=0.89	Neuro checks automation	PubMed[pubmed.ncbi.nlm.nih]

17	Health Care Sci, 2025	Implementation	Hospital beds	2,134 patients	Sensor fusion	Stroke prediction AUC 0.91	Early deterioration	Wiley[onlinelibrary.wiley]
18	J Clin Nurs, 2025	RCT	Stroke unit	789 patients	Computer vision	Fall reduction 67%	Patient safety	PDF[pmc.ncbi.nlm.nih]
19	IJFMR, 2025	Technical	Multimodal	Simulation	Wearables+EEG	Real-time alerts	Continuous monitoring	PDF[ijfmr]
20	Intell Med, 2025	Review	Neuro units	Sensors review	Various	Monitoring platforms	Device integration	ScienceDirect[sciencedirect]
21	Nurs Open, 2025	RCT	Post-stroke	567 patients	Monitoring app	Self-care adherence +34%	Discharge planning	ScienceDirect[sciencedirect]
22	Sensors, 2024	Longitudinal	Rehab	234 patients	Wearables	Motor recovery prediction	Rehab planning	PubMed
23	Neurorehabil Neural Repair, 2025	Review	Acute-rehab	Motor/cognitive	AI robotics	Recovery monitoring	Therapy optimization	ScienceDirect[sciencedirect]
24	Brain Sci, 2023	Validation	Bedside	1,123 patients	ML vitals	Neurodeterioration AUC 0.88	Rapid response	PDF[pmc.ncbi.nlm.nih]
25	Stroke, 2025	Scoping review	Acute stroke	133 studies	All monitoring	AI landscape mapping	Technology adoption	PDF[pmc.ncbi.nlm.nih]
26	Front Radiol, 2025	Review	Stroke pathway	Full continuum	All AI	Workflow integration	Care coordination	PDF[pmc.ncbi.nlm.nih]

27	J Adv Nurs, 2024	Systematic review	Nursing care	68 studies	Nursing AI	Workflow impact	Competency framework	PDF[pmc.ncbi.nlm.nih]
28	Neurology, 2023	SLR	Diagnosis/prognosis	54 studies	ML/DL	Outcome prediction	Discharge planning	Neurology[neurology]
29	Cureus, 2025	Review	Prehospital	EMS focus	Triage AI	Destination accuracy	Transport decisions	PDF[cureus]
30	Front Neurol, 2025	Validation	Risk assessment	4,567 adults	Multimodal	Risk stratification	Secondary prevention	PDF[pmc.ncbi.nlm.nih]
31	JMIR, 2024	Mixed-methods	Stroke units	Nurses +patients	Decision support	Alert acceptance 82%	Alarm management	PDF[jmir]
32	Stroke, 2022	Validation	Outcome prediction	8,945 patients	ML	90-day mRS prediction	Resource allocation	PubMed
33	JMIR, 2023	Implementation	Telestroke	Rural hospital	AI augmentation	DTN time -23 min	Rural nursing	PDF[pmc.ncbi.nlm.nih]
34	Stroke, 2025	Prediction	Neuro prognosis	ICH patients	DL	HT prediction AUC 0.89	Complication monitoring	PDF[pmc.ncbi.nlm.nih]

DISCUSSION:

This systematic study indicates that AI is currently transforming stroke care, especially for nurses working in medical-surgical wards in India and similar environments. In 34 studies conducted from 2020 to 2025, we found that AI tools can find big vessel blockages on CT scans with 94% accuracy in just a few seconds. This is faster than any human radiologist, even when hospitals are short-staffed at night. This means that nurses can start "Code Stroke" right away when AI finds a stroke, without having to wait for CT results. This could save vital minutes when "time is brain." This speed is more important for giving clot-busting drugs during the golden hour in Indian hospitals where CT machines often have long lines.

AI is really good at keeping an eye on things all the time when it comes to nursing. Studies show that wearable sensors and camera-based systems can keep an eye on patients 24 hours a day, 7 days a week. They can stop falls (67% less) and find silent neurological deterioration by noticing tiny changes in breathing or posture. Think about a stroke ward in Chennai city or Delhi state is full of patients and has each nurse taking care of eight to ten of them. This technology acts like a one more set of eyes, so you did not have to worry about missing mini changes between hourly checks. The problem is that 23% to 41% of negative alarms lead to "alert fatigue," which nurses hate more than getting a lot of text messages while they are with their families.

The biggest opportunity and challenge are changing the way nurses work. AI doesn't replace nurses; it just changes their job from writing down the same things over and over to making clinical decisions. When AI predicts that a patient may have brain bleeding after thrombolysis (AUC 0.89 accuracy), you can either stop taking blood thinners or see a neurologist. To do this, you need to learn how to read AI outputs, spot false positives, and teach worried patients and their families about technology. Indian nursing schools have a big hole to fill because only 17% of the stroke nurses in the study had formal AI training.

There are limits. Most of the studies (78%) came from rich countries with well-developed infrastructure. Only six studies directly examined nursing implications, indicating that academics overlook practical issues, such as 1:10 nurse-patient ratios and 12-hour shifts. The necessity for local validation is evidenced by the exclusion of all Indian studies from the final selection. When AI is trained primarily on Western data, its precision diminishes for Indian patients exhibiting unique stroke patterns.

Our review's strengths are that it used a strict PRISMA method (κ=0.87 inter-rater reliability), seven databases with 512 records, and a GRADE assessment that shows a moderate level of evidence quality for diagnostic claims. Most review look the criteria are important to radiologists, but we focused on how it affects nurses.

CONCLUSION

This systematic analysis are clearly to shows that artificial intelligence (AI) is varying stroke care for better and has a more potential for medical-surgical nurses, especially in Indian healthcare settings where resources are limited. An analysis of 34 high-quality studies published between 2020 and 2025 found that AI can find large vessel occlusions on CT scans with 94% accuracy in just a few seconds, cut down on patient falls by 67% through continuous monitoring, and speed up door-to-needle times by 23 to 43 minutes. These are important results that directly help patients live longer and get better in busy stroke wards.

Many studies show that processes can be changed in a useful way. AI takes care of boring tasks like tracking vital signs, complete the paperwork, and finding early warning signs, which lead nurses give better care. When systems give limited visual explanations along with forecast, the rate of accepting alert goes up to 82%, which makes bedside staff feel more confident. Only 17% of nurses received formal AI training, alarm fatigue results from false positive rates ranging from 23% to 41%, and the absence of validation studies tailored to India underscores the need for local adaptation, considering diverse patient demographics, body types, and stroke patterns.

This review provides substantial evidence from 34 peer-reviewed studies that AI can deliver human knowledge with machine-speed accuracy. You have the clinical judgment to ensure ethical use, protect patients from false alarms, and confirm AI results.

LIST OF REVIEWS

Theme 1: Early Stroke Detection (Imaging & Triage) – 15 Studies

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Theme 2: Continuous Neurological Monitoring – 10 Studies

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