

Through the Lens of StrokeInsights

Understanding Stroke, Imaging, and AI



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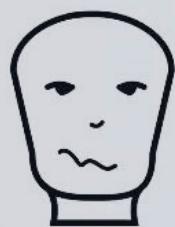
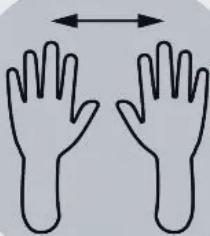
F**face
drooping****A****arm
weakness****S****speech
difficulty****T****time to call
emergency**

Image credits - <https://neuroinjurycare.com/what-is-a-stroke-understanding-the-symptoms-diagnosis-and-treatment/>

Executive Summary

Stroke remains one of the leading causes of disability and mortality worldwide, posing significant challenges to timely diagnosis and effective management. This white paper offers a concise yet comprehensive overview of stroke, including its underlying causes, demographic trends, and the critical role of diagnostic imaging in clinical decision-making. Additionally, it introduces the transformative potential of artificial intelligence (AI) in enhancing diagnostic accuracy and streamlining workflows. This paper aims to empower clinicians and healthcare professionals with insights into emerging innovations that can improve patient outcomes and revolutionize stroke care by bridging knowledge gaps.



**Pioneering AI
in diagnostic
imaging**

Purpose and Objectives

→ Purpose

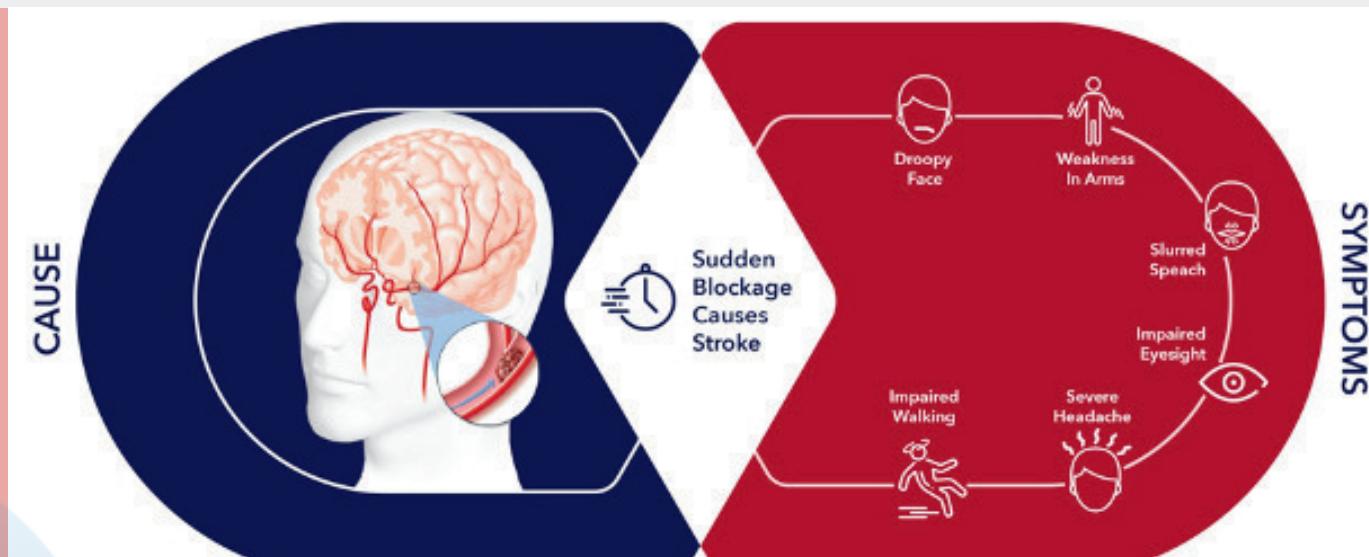
To provide a concise overview of brain stroke, emphasizing its clinical and diagnostic significance.

→ Objectives

1. Summarize critical clinical details about stroke, including causes, risk factors, and demographics.
2. Highlight the diagnostic challenges and management gaps in current practices.
3. Introduce emerging innovations, including AI, in stroke diagnosis and care.

Introduction

- The brain is the body's control centre, responsible for movements, memory, thoughts, emotions, language, and vital functions like breathing and digestion. It operates seamlessly through a complex network of neurons, all fuelled by oxygen-rich blood delivered via arteries. This steady supply of oxygen is crucial for brain cells to function and survive.¹
- A stroke, often referred to as a "brain attack," is a Medical Emergency that occurs when this blood flow is disrupted. It happens either because a blood vessel supplying the brain becomes blocked (ischemic stroke) or bursts (hemorrhagic stroke). When blood flow is interrupted, brain cells begin to die within minutes due to a lack of oxygen, leading to potentially irreversible damage.^{2,3} Understanding what happens during and after a stroke is essential for recognizing its urgency and the critical need for timely intervention to minimize its devastating effects.^{4,5}



The Global Burden of Stroke

Stroke is a leading global health challenge, with over 12.2 million new cases reported annually. It is a significant cause of neurological disability and the second leading cause of death worldwide. Strikingly, one in four people over the age of 25 experience a stroke during their lifetime.⁴ Ischemic stroke is the most common type, accounting for over 62% of strokes globally, with 7.6 million new cases each year. In contrast, intracerebral haemorrhage (ICH) constitutes more than 28% of global strokes, with 3.4 million new cases annually.⁶ According to the World Stroke Organization's (WSO) Global Stroke Fact Sheet, women experience stroke more frequently than men, accounting for 53% of cases compared to 47%. This highlights the importance of targeted awareness and prevention strategies for both sexes.⁶ With 6.5 million deaths annually attributed to stroke, its impact on public health is profound, emphasizing the urgency for innovative advancements in prevention, diagnosis, and management strategies to reduce its devastating toll.⁷

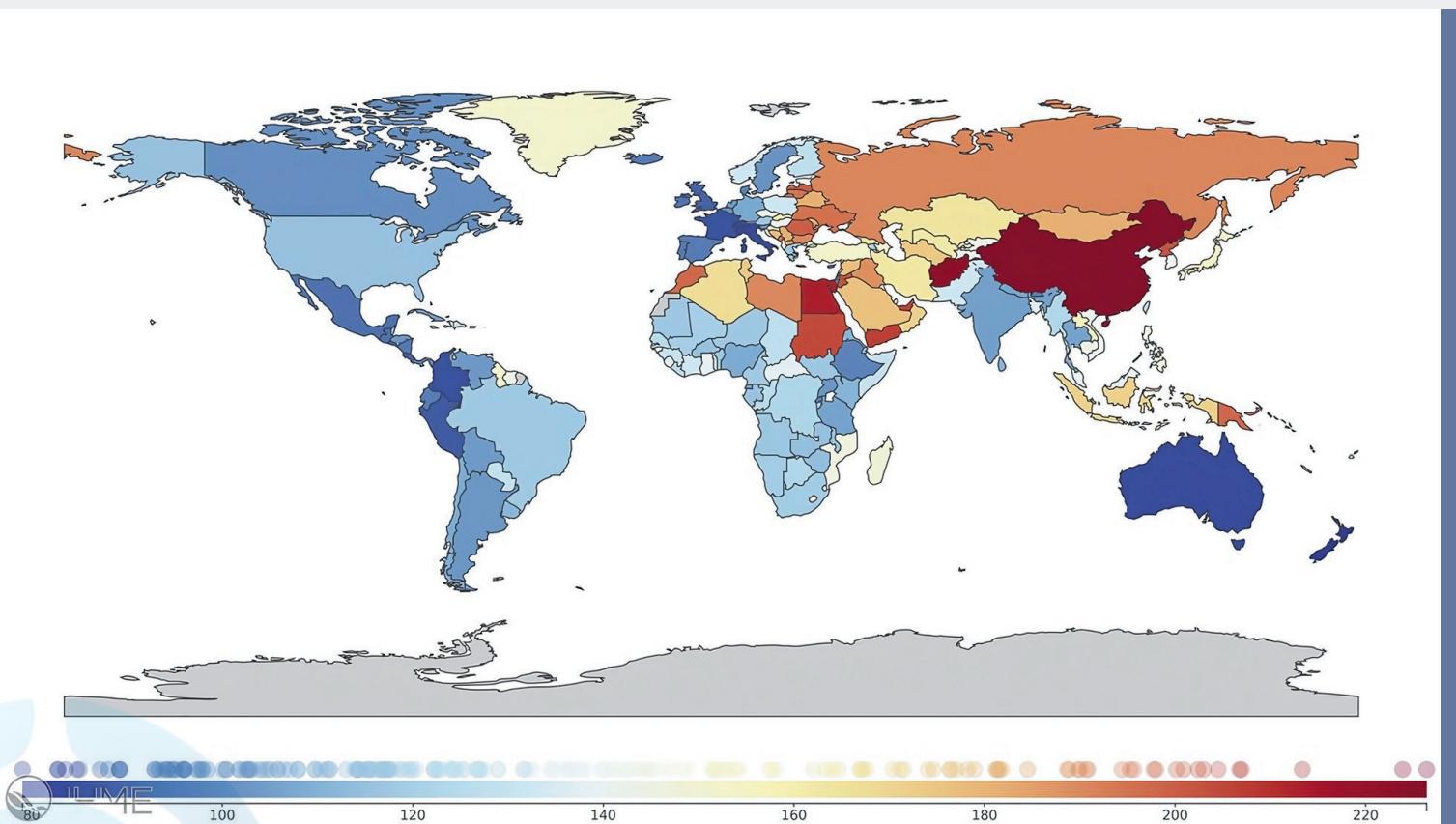


Image source - Institute for Health Metrics and Evaluation; vizhub.healthdata.org/gbd-compare. University of Washington, Seattle; 2015

Causes and Types of Stroke

A stroke occurs when the blood flow to the brain is either blocked or suddenly disrupted due to bleeding. This interruption deprives brain cells of oxygen and nutrients, leading to their damage. Strokes are classified into two main types based on the underlying cause:

→ Ischemic Stroke (Blocked Blood Flow):

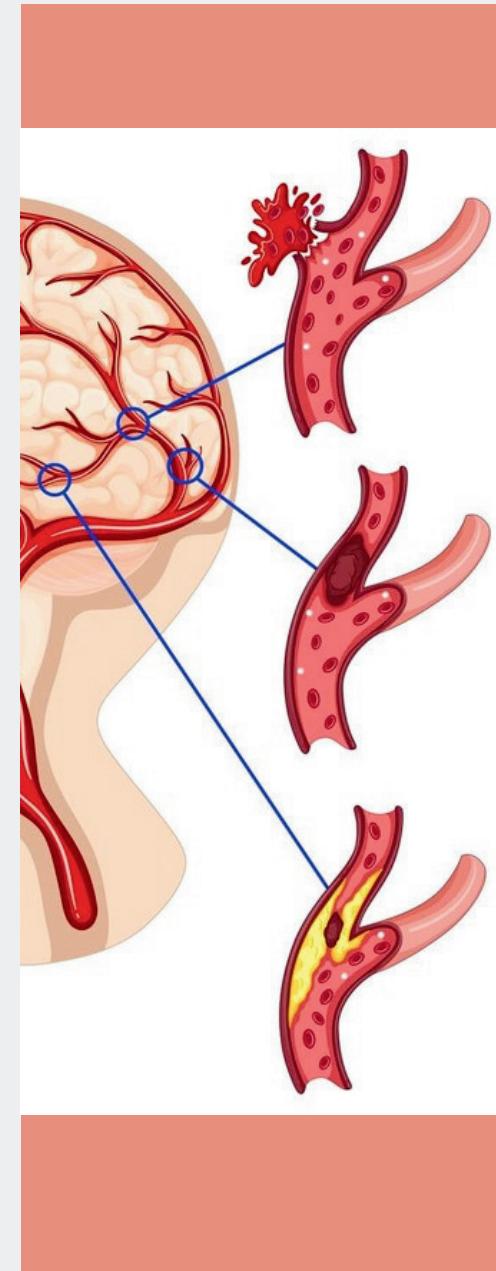
Ischemic strokes account for more than 80% of all strokes and are caused by a blockage in a blood vessel, often due to a clot or plaque buildup.⁴

- **Thrombosis:** A blood clot forms locally in a brain vessel, blocking flow.
- **Embolism:** A clot or plaque fragment travels to the brain, obstructing an artery.
- **Acute Ischemic Stroke (AIS):** The most common type (85%), caused by arterial blockages cutting blood supply to the brain.
- **Large Vessel Occlusion (LVO):** A blockage in a major brain artery, occurring in about one-third of AIS cases.

→ Hemorrhagic Stroke (Bleeding in the Brain):

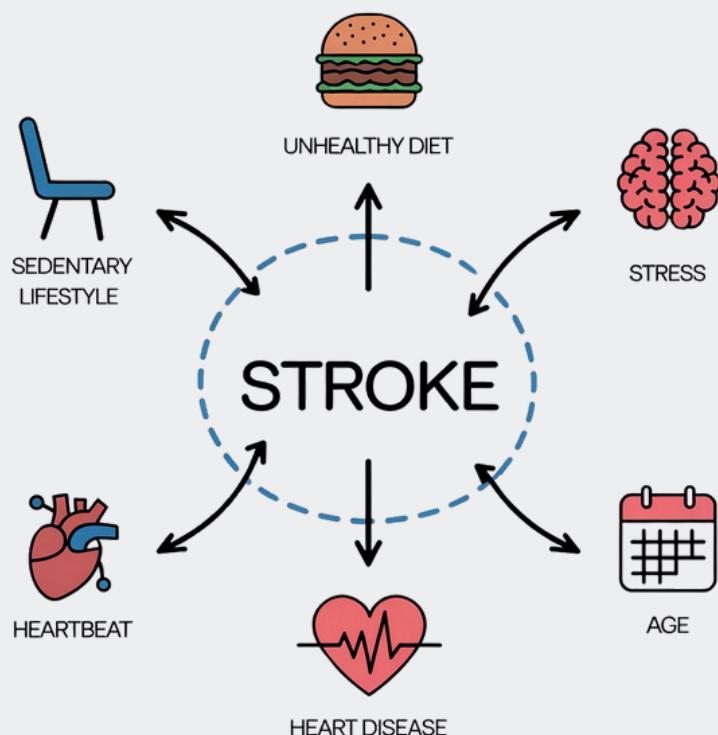
Hemorrhagic strokes occur when a blood vessel in the brain bursts, leading to bleeding that increases pressure on surrounding brain cells and damages them. They account for about 15% of all strokes.²

- **Intracranial Hemorrhage (ICH):** Bleeding within the skull, representing around 10% of stroke cases.
- **Subarachnoid Hemorrhage (SAH):** Bleeding between the brain and its protective membranes, accounting for around 3% of stroke

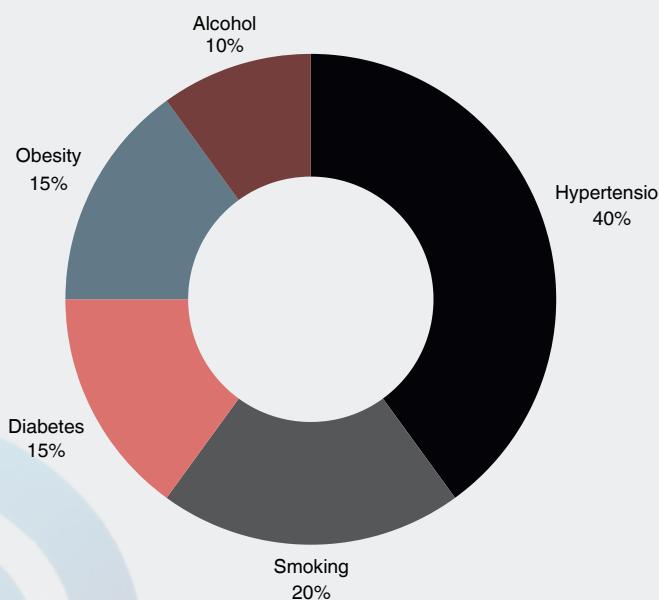


Stroke at a Glance: Key Insights and Statistics

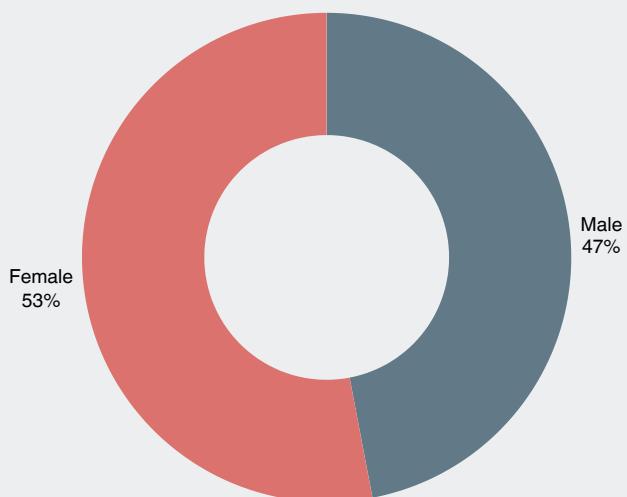
→ Contributing Factors



→ Risk Factors



→ Gender Vs Stroke



Imaging Tests for Stroke Diagnosis

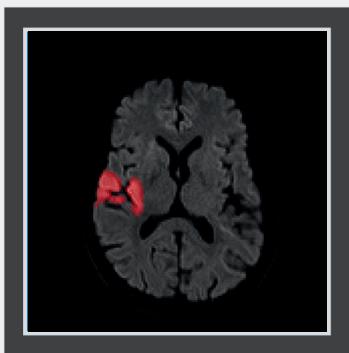


Computed Tomography (CT) Scan

A first-line diagnostic tool to detect brain hemorrhages and rule out stroke mimics.

CT scans are quick and effective for hemorrhages but less sensitive than MRI for early ischemic changes.

CT Angiography (CTA): Maps large vessel occlusions and helps in selecting patients for endovascular therapy.



Magnetic Resonance Imaging (MRI):

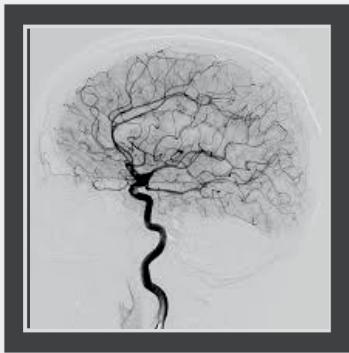
MRI provides more detailed images and is useful for detecting early ischemia and infarction.

Useful for acute diagnosis, long-term monitoring, and follow-up care.

Diffusion-Weighted Imaging (DWI): Detects early ischemic changes within minutes.

Perfusion MRI (pMRI): Evaluates cerebral blood flow and helps to identify the ischemic penumbra.

FLAIR-DWI Mismatch: Assesses strokes with unknown onset times, such as wake-up strokes.⁵



Other Imaging Tests:

Digital Subtraction Angiography (DSA): Detailed images of blood vessels (aneurysms/arteriovenous malformations)

Positron Emission Tomography (PET): Provides insights into cerebral metabolism and tissue viability.

Carotid Ultrasound: Assesses narrow or blocked carotid arteries.¹⁰



Challenges in Stroke Diagnosis

- **Human Expertise Dependence:** Stroke diagnosis often requires specialized interpretation by neurologists and radiologists, which can lead to delays in facilities with adequate resources or expertise.
- **Shortage of Neurologists:** According to the WSO Global Fact Sheet, the shortage of neurologists worldwide is alarming, particularly in low- and middle-income countries like India. India also falls significantly short of the WHO-recommended ratio of one neurologist per 100,000 population, with rural areas especially underserved.
- **Workload and Burnout:** Increasing stroke incidence and population growth add to neurologists' burdens, with some attending to over 80 patients daily, resulting in high stress and burnout rates.
- **Imaging Challenges:** Diagnosing early ischemic changes, distinguishing stroke subtypes, and analyzing complex imaging like perfusion MRI are intensive tasks requiring expert judgment.
- **AI as a Solution:** AI-based automation can enhance diagnostic speed, accuracy, and accessibility, alleviating clinician workload and addressing gaps in stroke care.



AI in Brain Stroke Imaging



Artificial Intelligence(AI) is transforming stroke care by serving as a decision support tool for diagnosis, prognosis, and treatment follow-up. Stroke management heavily relies on timely and accurate imaging, and AI offers significant advancements in this domain, particularly for ischemic and hemorrhagic strokes.¹⁴

AI algorithms automate critical yet intricate tasks, including detecting infarcts and hemorrhages, segmenting affected brain regions (e.g., bleed or ischemic penumbra), classifying stroke subtypes, and performing volumetric analyses. These capabilities enhance precision, speed, and consistency in stroke imaging, empowering clinicians to make informed, timely decisions.¹⁵ Techniques like the Alberta Stroke Program Early CT Score (ASPECTS) grading can be enhanced with AI, ensuring consistent and precise evaluation. Additionally, AI supports prognostication by analyzing imaging biomarkers and predicting long-term functional outcomes.¹⁶

Beyond detection, AI aids in volumetric analysis of stroke lesions, ischemic penumbra assessment, and perfusion imaging. These capabilities are pivotal in individualizing treatment strategies, such as selecting patients for thrombolysis or endovascular therapy. The integration of AI in neuroimaging workflows addresses limitations like delays due to human interpretation, inconsistencies in scoring, and unequal access to expert radiologists. By providing rapid, standardized, and accurate evaluations, AI can significantly reduce morbidity, improve outcomes, and support decision-making in stroke care.^{17,18}



StrokeInsight: Revolutionizing Stroke Diagnosis with AI



- **About StrokeInsight:** An AI-powered platform by Genzailabs designed to accelerate and enhance stroke diagnosis through faster, more accurate assessments.
- **Impact**

Reduces clinician workload, empowers healthcare teams, and improves patient outcomes by enabling timely and precise stroke care.
- **Integration & Features**

Seamlessly integrates with hospital systems, supports plane and perfusion imaging, and generates comprehensive stroke reports.
- **Key Benefits**

Improves workflow efficiency, reduces diagnostic errors, and aids in informed clinical decision-making.
- **Technical Advantages**

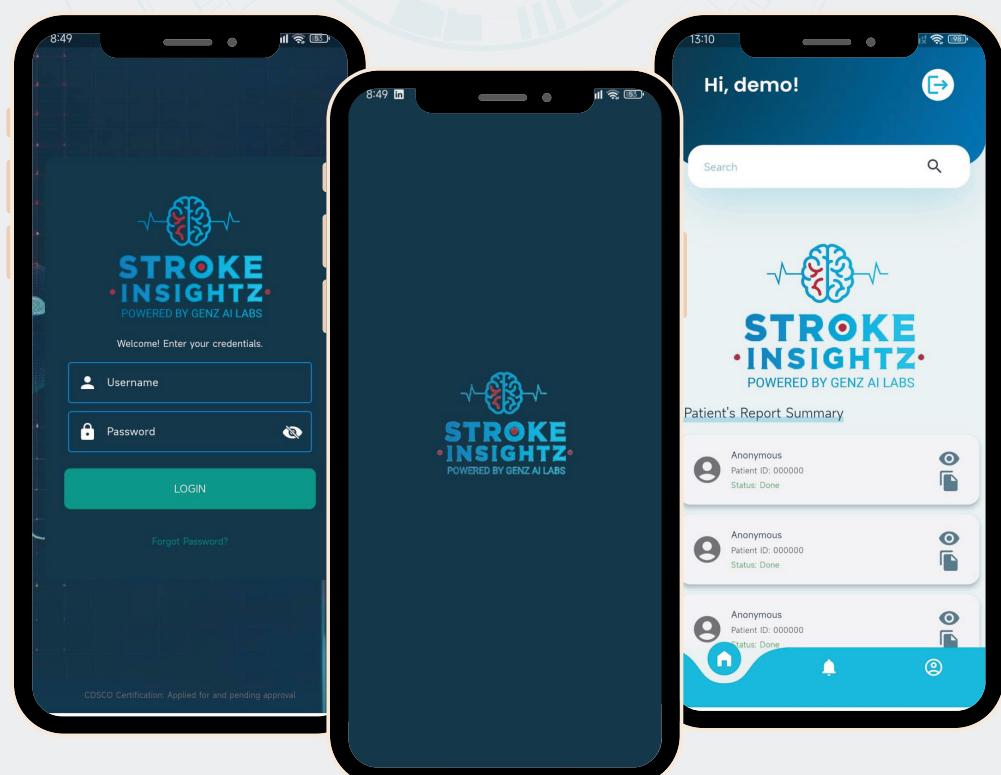
Compatible with DICOM and NIfTI imaging formats, with deployment options for both cloud and on-premise setups.

Empowering Stroke Diagnosis

→ **Stroke Insightz** is a mobile application designed to bring the power of AI-driven stroke diagnostics to the fingertips of doctors and healthcare professionals.

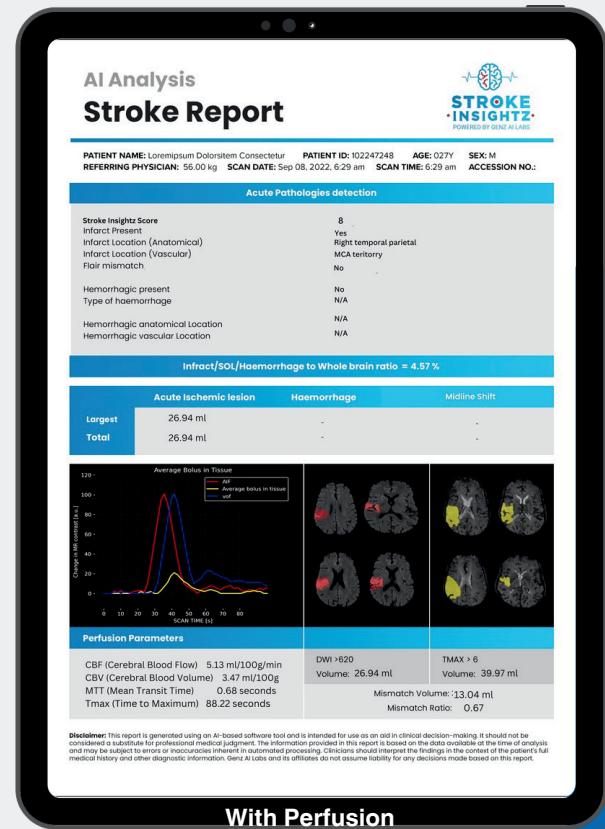
→ Key Features

- 1 Report Access
- 2 User-Friendly Interface
- 3 Secure Login
- 4 Real-Time Updates



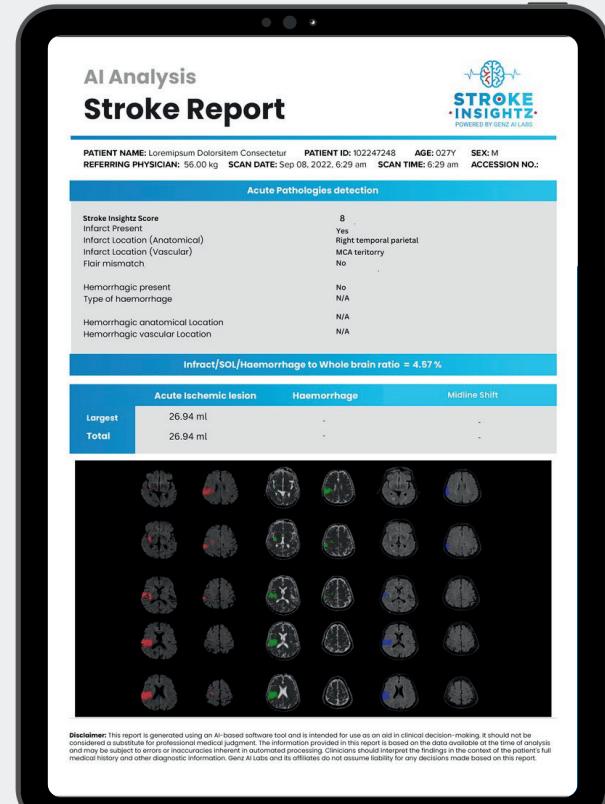
Reports Generated by Strokeinsightz

- **With Perfusion Study:**
1. Detailed analysis of CBF, CBV, MTT and Tmax.
 2. Provides Tmax DWI mismatch volumes and ratios to assess salvageable brain tissue.
 3. Graph for average bolus contrast over time.
 4. Includes perfusion maps for blood flow abnormalities along with infarction areas.



- **Without Perfusion Study:**

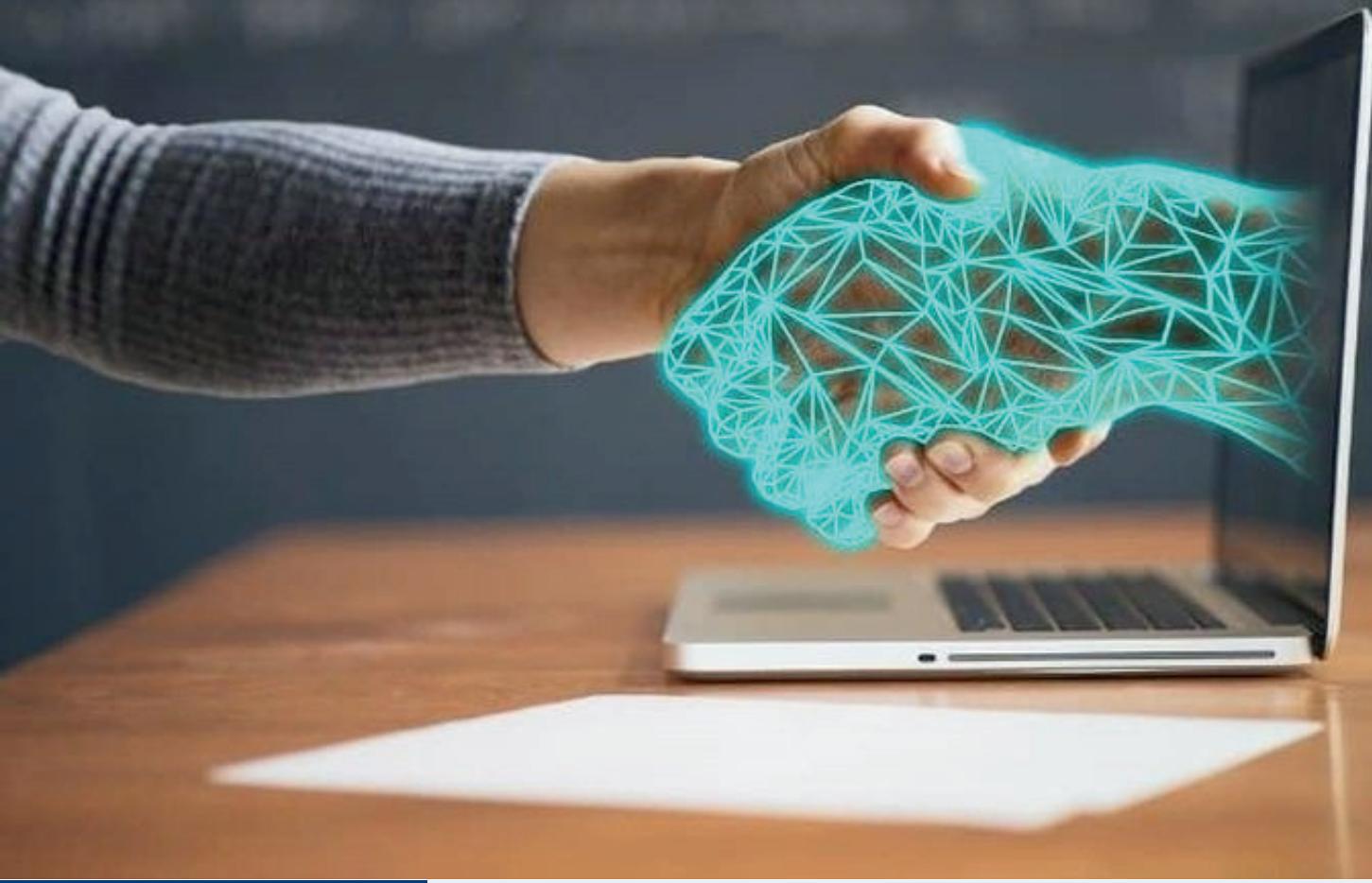
1. Focused on ischemic lesion detection without blood flow parameters.
2. Infarct presence, location, and basic pathology detection.
3. Flair mismatch analysis.
4. Quantitative analysis of infarct.
5. Comparative analysis
6. Hemorrhage presence, location, and basic pathology detection.



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Let's Work Together



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