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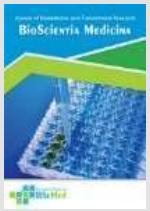

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Early Ischemic Stroke Assessment with ASPECTS: A Case Report Highlighting the Radiologist's Role in a Limited-Resource Setting

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A B S T R A C T

Background: Ischemic stroke is a leading cause of morbidity and mortality globally, particularly in resource-limited settings. Non-contrast computed tomography (NCCT) is often the primary imaging modality available in these settings, and the Alberta Stroke Program Early CT Score (ASPECTS) is a crucial tool for assessing early ischemic changes in NCCT. This case report highlights the importance of ASPECTS in guiding clinical decisions and prognostication in a resource-limited setting. **Case presentation:** A 79-year-old male presented to the emergency unit at Negara General Hospital, a rural facility in Bali, with acute onset of right-sided hemiparesis and speech difficulty. NCCT showed a hypodense lesion with ill-defined margins in the left insular cortex, left caudate nucleus, left internal capsule, and left frontotemporoparietal lobes, consistent with a subacute cerebral infarction in the middle cerebral artery (MCA) territory, with an ASPECTS score of 2. Due to the extensive ischemic burden and the limited availability of advanced treatment options, conservative management was chosen. The radiologist's interpretation of the ASPECTS score played a critical role in guiding the clinical team's decision-making and informing the patient's family about the prognosis. **Conclusion:** ASPECTS is an essential tool for predicting stroke outcomes, with lower scores correlating with larger infarct volumes and poorer prognoses. In resource-limited settings, radiologists play a vital role in interpreting ASPECTS scores to guide clinical management and provide accurate prognostic information to patients and their families.

1. Introduction

Ischemic stroke, a leading cause of mortality and long-term disability worldwide, presents a formidable challenge to healthcare systems globally, particularly in resource-constrained settings. The imperative for early evaluation and treatment is underscored by the strong association between prompt intervention and improved patient outcomes. However, resource-limited environments often lack access to advanced imaging modalities such as magnetic resonance imaging (MRI) or CT perfusion, which are instrumental in comprehensive stroke assessment and treatment planning. In these settings, non-contrast computed tomography (NCCT) frequently serves as the primary imaging modality for the initial diagnosis and evaluation of ischemic stroke severity, especially within the critical early hours of presentation. NCCT's accessibility and rapid acquisition time make it invaluable in resource-constrained environments, where timely assessment is crucial for guiding treatment decisions.[1-4]

The Alberta Stroke Program Early CT Score (ASPECTS) has emerged as a widely adopted and validated scoring system for assessing early ischemic changes on NCCT in patients with acute ischemic stroke. Developed to quantify the extent of ischemic damage in the middle cerebral artery (MCA) territory, ASPECTS assigns a score ranging from 0 to 10, with each point representing an unaffected brain region. Lower ASPECTS scores correlate with more extensive

ischemic involvement, signifying a greater burden of injury and a higher risk of adverse outcomes, including increased disability and mortality. Specifically, patients with ASPECTS scores of 0-2 have been shown to exhibit extensive infarction, a significantly elevated risk of hemorrhagic transformation, and a low likelihood of achieving meaningful functional recovery. This underscores the prognostic significance of ASPECTS, especially in settings where treatment options are limited.[5-7]

In resource-limited settings, the role of radiologists extends beyond the traditional interpretation of images. They play a pivotal role in applying ASPECTS scores to inform clinical decisions, guide treatment strategies, and provide prognostic information to both the clinical team and the patient's family. This is particularly crucial when access to advanced treatment options, such as thrombolysis or endovascular therapy, is limited, and treatment decisions must be carefully weighed against potential risks and benefits.[8-10] This case report focuses on a patient presenting with an ASPECTS score of 2, illustrating the multifaceted role of the radiologist in facilitating informed clinical decisions, communicating prognosis to the healthcare team and the patient's family, and advocating for a patient-centered approach, especially in the absence of advanced treatment options.

2. Case Presentation

A 79-year-old male presented to the emergency department of Negara General Hospital, a rural hospital situated in Bali, Indonesia, with the acute onset of right-sided hemiparesis and speech difficulty. The patient's symptoms had commenced approximately one hour prior to his arrival at the hospital. His medical history was notable for poorly controlled hypertension, a significant risk factor for stroke. Upon admission, the patient was in a drowsy state, with a Glasgow Coma Scale (GCS) score of 12, indicating an altered level of consciousness. His blood pressure was measured at 180/90 mmHg, signifying elevated levels and suggesting a potential hypertensive urgency or emergency in the context of his acute neurological presentation.

A comprehensive neurological examination revealed right-sided hemiparesis, a weakness affecting one side of the body. The patient's muscle power was graded as 2/5 in both the right upper and lower extremities, indicating significant motor impairment. This grading system, commonly used in neurological assessments, ranges from 0 (no movement) to 5 (normal power), with 2 signifying the ability to move the limb but not overcome gravity. The National Institutes of Health Stroke Scale (NIHSS) was employed to further quantify the severity of the patient's stroke. The NIHSS is a standardized tool used to assess neurological deficits in stroke patients, with scores ranging from 0 (no deficits) to 42 (severe deficits). The patient's NIHSS score was 16, placing him in the category of a severe stroke.

In the context of the patient's acute neurological presentation, urgent neuroimaging was performed to assess the presence and extent of cerebral ischemia. Due to the resource limitations of the rural hospital setting, MRI and CT perfusion imaging modalities were unavailable. Therefore, a non-contrast computed tomography (NCCT) scan of the brain was performed as the primary imaging modality.

The NCCT images revealed a hypodense lesion, an area of decreased density suggestive of ischemic tissue injury, with ill-defined margins in several regions of the left cerebral hemisphere. These regions included the left insular cortex, a deep cortical structure involved in sensory processing and motor control; the left caudate nucleus, a component of the basal ganglia involved in motor control and learning; the left internal capsule, a white matter tract carrying motor and sensory fibers; and the left frontotemporoparietal lobes, responsible for higher cognitive functions, motor control, and sensory integration. In addition to these findings, there was a notable narrowing of the left insular ribbon, a subtle but potentially significant finding suggestive of early ischemic changes in this region. An additional hypodense lesion with an ill-defined margin was observed in the right posterior

corona radiata, a white matter tract connecting different brain regions.

The NCCT findings were consistent with a subacute cerebral infarction, an area of tissue death caused by a lack of blood supply, in the left insular cortex, caudate nucleus, internal capsule, and frontotemporoparietal lobes. These regions correlate to the middle cerebral artery (MCA) territory, the most common vascular territory affected in ischemic stroke. The Alberta Stroke Program Early CT Score (ASPECTS) was applied to quantify the extent of early ischemic changes in the MCA territory. ASPECTS is a 10-point scoring system, with each point representing an unaffected brain region. The patient's NCCT findings yielded an ASPECTS score of 2, indicating extensive ischemic involvement and a high burden of injury. A subacute infarction was also noted in the right posterior corona radiata, suggesting the presence of ischemic injury beyond the MCA territory. This finding further underscored the severity of the patient's condition.

Given the low ASPECTS score of 2 and the extensive ischemic burden observed on NCCT, the clinical team determined that the patient had a poor prognosis. The high risk of hemorrhagic transformation, a potentially devastating complication of ischemic stroke, and the limited potential for meaningful recovery, further influenced the clinical decision-making process. Thrombolysis and endovascular interventions, advanced treatment options aimed at restoring blood flow to the affected brain tissue, were considered unsuitable for this patient. The high risk of hemorrhagic transformation and the limited likelihood of achieving significant functional recovery, given the extensive ischemic involvement, led the clinical team to opt for a conservative management approach. The patient's management focused on supportive care and the prevention of complications. This included antihypertensive medications to manage his elevated blood pressure, fluid management to maintain adequate hydration, nutritional support to address his metabolic needs, and preventative measures to mitigate the risk of complications such as deep vein thrombosis and aspiration pneumonia.

Despite the supportive care provided, the patient's neurological deficits persisted throughout his hospital stay. He was discharged on the fifth day of admission with ongoing right-sided hemiparesis and speech difficulty. The functional outcome was poor, consistent with the poor prognosis associated with his low ASPECTS score and the extensive ischemic burden observed on NCCT.

The radiologist played a crucial role in communicating the patient's prognosis to his family and explaining the rationale for the conservative management approach. This communication focused on providing clear and empathetic information about the patient's condition, the limited potential for recovery, and the importance of supportive care in maximizing his quality of life. The radiologist's involvement in the communication process highlights the importance of patient-centered care, especially in challenging clinical situations where treatment options are limited and difficult decisions need to be made.

Table 1 outlines the Alberta Stroke Program Early CT Score (ASPECTS), a critical tool for assessing early ischemic changes in acute stroke patients using non-contrast computed tomography (NCCT). ASPECTS is a 10-point scoring system that helps doctors evaluate the extent of brain damage caused by a stroke. Each point represents a specific region of the brain supplied by the middle cerebral artery (MCA), the most commonly affected artery in stroke. The table lists 10 key regions (M1, M2, M3, etc.) within the MCA territory. These regions include crucial areas like the caudate nucleus, internal capsule, and different parts of the cortex. For each region, the table describes the normal appearance on a CT scan and the changes that occur in the early stages of an ischemic stroke (when blood flow is blocked). These ischemic changes typically involve a decrease in tissue density ("hypoattenuation") that makes the affected area look darker on the CT image. If a region appears normal, it receives a score of 1. If a region shows signs of early

ischemic change, it receives a score of 0. Add up the scores for all 10 regions. The total score ranges from 0 to 10. Higher scores (8-10) indicate a milder stroke with a smaller area of brain injury. Patients with these scores typically have better outcomes and a lower risk of complications. Moderate scores (6-7) suggest more extensive brain involvement and a higher risk of neurological problems. The prognosis is more guarded. Lower scores (3-5) indicate a severe stroke with a high likelihood of significant long-term disability. Very Low scores (0-2) represent extensive brain damage. These patients have a poor prognosis, with a high risk of severe disability or even death. ASPECTS helps doctors determine the best course of treatment. For example, patients with very low scores might not be suitable candidates for certain therapies (like clot-busting medications) due to a higher risk of complications. ASPECTS helps predict the patient's likely recovery and long-term outcome. This information is crucial for counseling patients and their families. ASPECTS provides a standardized way to evaluate stroke severity, allowing for better communication among healthcare professionals and researchers.

Table 1. ASPECTS scoring.

Region	Description	Normal appearance	Early ischemic change	Score (Normal)	Score (Ischemia)
M1	Caudate nucleus	Hyperdense compared to the anterior limb of the internal capsule	Hypoattenuation, loss of density difference with the internal capsule	1	0
M2	Lentiform nucleus	Hyperdense compared to the posterior limb of the internal capsule	Hypoattenuation, loss of density difference with the internal capsule	1	0
M3	Insular cortex	Hyperdense ribbon-like appearance	Hypoattenuation, loss of insular ribbon definition	1	0
M4	Anterior MCA cortex (frontal lobe)	Homogeneous gray-white matter differentiation	Hypoattenuation, loss of gray-white matter differentiation	1	0
M5	Lateral MCA cortex (temporal lobe)	Homogeneous gray-white matter differentiation	Hypoattenuation, loss of gray-white matter differentiation	1	0
M6	Posterior MCA cortex (parietal lobe)	Homogeneous gray-white matter differentiation	Hypoattenuation, loss of gray-white matter differentiation	1	0
IC	Internal capsule	Hyperdense distinct structure	Hypoattenuation, loss of distinction from surrounding structures	1	0
C	Caudate nucleus	Hyperdense compared to the anterior limb of the internal capsule	Hypoattenuation, loss of density difference with the internal capsule	1	0
I	Insular cortex	Hyperdense ribbon-like appearance	Hypoattenuation, loss of insular ribbon definition	1	0
M1	Anterior MCA cortex (frontal lobe)	Homogeneous gray-white matter differentiation	Hypoattenuation, loss of gray-white matter differentiation	1	0

Interpretation: Higher ASPECTS scores (8-10) are associated with milder presentations and better prognoses, indicating a smaller extent of brain injury. Moderate scores (6-7) suggest more extensive involvement and a higher risk of neurological deficits, leading to a more guarded prognosis. Lower scores (3-5) indicate severe stroke with a high probability of significant neurological impairment and a poor functional outcome. Very low scores (0-2) are indicative of extensive infarction and carry a poor prognosis with a high risk of severe disability or mortality.

Table 2 provides a detailed breakdown of how the Alberta Stroke Program Early CT Score (ASPECTS) was applied to a specific case report of acute ischemic stroke. The table focuses on the 10 key brain regions included in the ASPECTS scoring system. Most of the regions evaluated (M1, M2, M3, M4, M5, M6, and IC) show signs of early ischemic change, as indicated by a score of 0. This suggests a significant area of brain tissue is affected by the stroke. Normal Caudate Nucleus and Insular Cortex (C and I) regions received a score of 1, indicating a normal appearance on the CT scan. This suggests that these specific areas were spared from the effects of the stroke. Although not explicitly stated in the table, the total ASPECTS score for this case can be calculated by adding up the scores for all 10 regions. In this case, the total score is 2 (1 + 1 + 0 + 0 + 0 + 0 + 0 + 0 + 0 + 0 = 2). As discussed earlier, a low ASPECTS score (especially 0-2) indicates a severe stroke with a large area of brain damage. Patients with low ASPECTS scores have a higher risk of severe disability or even death. Certain treatments, such as clot-busting medications (thrombolysis), may be less effective or even carry a higher risk of complications in patients with extensive brain damage.

Table 2. Finding ASPECTS score from the case report.

Region	Description	Normal appearance	Early ischemic change	Score	Interpretation
M1	Caudate nucleus	Hyperdense compared to the anterior limb of the internal capsule	Hypoattenuation, loss of density difference with the internal capsule	0	Early ischemic change
M2	Lentiform nucleus	Hyperdense compared to the posterior limb of the internal capsule	Hypoattenuation, loss of density difference with the internal capsule	0	Early ischemic change
M3	Insular cortex	Hyperdense ribbon-like appearance	Hypoattenuation, loss of insular ribbon definition	0	Early ischemic change
M4	Anterior MCA cortex (frontal lobe)	Homogeneous gray-white matter differentiation	Hypoattenuation, loss of gray-white matter differentiation	0	Early ischemic change
M5	Lateral MCA cortex (temporal lobe)	Homogeneous gray-white matter differentiation	Hypoattenuation, loss of gray-white matter differentiation	0	Early ischemic change
M6	Posterior MCA cortex (parietal lobe)	Homogeneous gray-white matter differentiation	Hypoattenuation, loss of gray-white matter differentiation	0	Early ischemic change
IC	Internal capsule	Hyperdense distinct structure	Hypoattenuation, loss of distinction from surrounding structures	0	Early ischemic change
C	Caudate nucleus	Hyperdense compared to the anterior limb of the internal capsule	Hypoattenuation, loss of density difference with the internal capsule	1	Normal
I	Insular cortex	Hyperdense ribbon-like appearance	Hypoattenuation, loss of insular ribbon definition	1	Normal
M1	Anterior MCA cortex (frontal lobe)	Homogeneous gray-white matter differentiation	Hypoattenuation, loss of gray-white matter differentiation	0	Early ischemic change

Figure 1 revealed a low ASPECTS affecting the distribution of left MCA. The non-contrast CT scan of the 79-year-old male patient reveals a low Alberta Stroke Program Early CT Score (ASPECTS) affecting the distribution of the left middle cerebral artery (MCA). A low ASPECTS score is indicative of extensive early ischemic changes, suggesting a significant ischemic burden and a poor prognosis. The involvement of the left MCA territory is consistent with the patient's clinical presentation of right-sided

hemiparesis and speech difficulty, as the MCA supplies blood to the brain regions responsible for motor and language functions. The CT scan findings and the low ASPECTS score played a crucial role in guiding the clinical team's decision-making, leading to the choice of conservative management due to the high risk of hemorrhagic transformation and limited potential for recovery with thrombolysis or endovascular interventions.

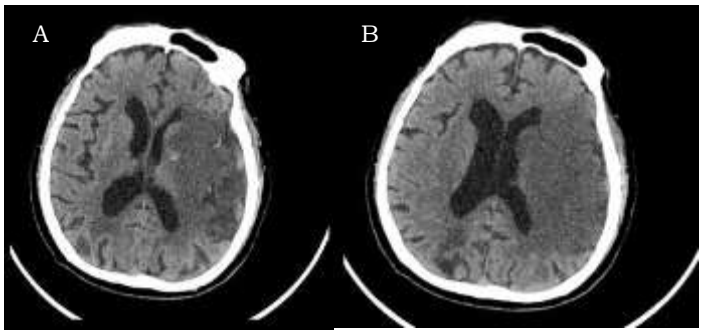

Figure 1. Non-contrast CT of a 79-year-old male revealed low ASPECTS affecting the distribution of left MCA.

3. Discussion

This case vividly illustrates the crucial role of the Alberta Stroke Program Early CT Score (ASPECTS) in evaluating acute ischemic stroke, especially in resource-limited settings where access to advanced imaging and treatment modalities may be constrained. The patient's presentation with severe stroke symptoms, including right-sided hemiparesis and speech difficulty, underscored the need for a rapid and reliable assessment tool to guide clinical decision-making. In this context, ASPECTS emerged as a key tool for evaluating the extent of ischemic damage and predicting the patient's prognosis. The patient's initial neurological examination revealed significant deficits, reflected in a high National Institutes of Health Stroke Scale (NIHSS) score. This score, combined with the clinical presentation, indicated a severe stroke with a potentially significant impact on the patient's functional outcome. However, to further delineate the extent of brain injury and guide treatment decisions, a rapid and reliable imaging assessment was necessary. Non-contrast computed tomography (NCCT) served as the primary imaging modality due to its accessibility and rapid acquisition time, making it particularly valuable in resource-limited settings. The NCCT findings revealed a hypodense lesion, indicative of ischemic tissue injury, affecting multiple regions within the middle cerebral artery (MCA) territory. These regions included the left insular cortex, caudate nucleus, internal capsule, and frontotemporoparietal lobes, all critical areas involved in various neurological functions. The Alberta Stroke Program Early CT Score (ASPECTS) was then applied to quantify the extent of early ischemic changes observed on the NCCT. ASPECTS is a 10-point scoring system that divides the MCA territory into specific regions, with each region receiving a score of 1 if it appears normal or 0 if it shows signs of early ischemic change. The patient's NCCT findings yielded an ASPECTS score of 2, indicating extensive ischemic involvement and a high burden of injury. This low ASPECTS score served as a critical factor in determining the patient's prognosis and guiding the clinical management strategy. Studies have consistently demonstrated that lower ASPECTS scores correlate with larger infarct volumes, higher risks of hemorrhagic transformation, and poorer clinical outcomes. In this case, the patient's score of 2 signaled a poor prognosis with a limited chance of meaningful recovery. The information derived from ASPECTS played a pivotal role in the clinical decision-making process. In resource-limited settings, where access to advanced treatment options such as

thrombolysis or endovascular thrombectomy may be limited, the decision to pursue reperfusion therapies must be carefully weighed against the potential risks and benefits. While these treatments can be effective in restoring blood flow to ischemic brain tissue, they also carry a risk of complications, including hemorrhagic transformation. In patients with low ASPECTS scores, the potential benefits of reperfusion therapies may be outweighed by the increased risk of complications and the limited likelihood of achieving substantial functional improvement. In this case, the patient's low ASPECTS score, combined with the resource limitations of the setting, contributed to the decision to adopt a conservative management approach focused on supportive care and the prevention of complications. The radiologist's expertise in interpreting ASPECTS scores and communicating prognostic information is essential in such situations. In this case, the radiologist played a crucial role in conveying the implications of the low ASPECTS score to the clinical team, contributing to the decision to prioritize supportive care. The radiologist's assessment helped to avoid potentially risky interventions with limited chances of success, focusing instead on maximizing the patient's comfort and preventing further complications. The Alberta Stroke Program Early CT Score (ASPECTS) has been extensively validated as a robust predictor of both functional outcomes and mortality in individuals with acute ischemic stroke. Numerous studies have consistently demonstrated that lower ASPECTS scores are significantly associated with larger infarct volumes, an elevated risk of hemorrhagic transformation, and ultimately, poorer clinical outcomes. In this specific case, the patient's computed tomography (CT) scan revealed a low ASPECTS score of 2, indicating extensive ischemic damage within the middle cerebral artery (MCA) territory. This low score served as a critical prognostic indicator, signaling a poor outlook with a limited chance of meaningful recovery. This information played a pivotal role in guiding the clinical team's decision-making process, particularly in the context of a resource-limited setting. The prognostic significance of ASPECTS stems from its ability to quantify the extent of early ischemic changes within the MCA territory, which is the most common vascular territory affected in ischemic stroke. The MCA supplies blood to critical brain regions responsible for motor control, sensory perception, language, and higher cognitive functions. Therefore, extensive ischemic damage within this territory can lead to significant neurological deficits and functional impairment. ASPECTS divides the MCA territory into 10 distinct regions, each of which is assigned a score of 1 if it appears normal on the CT scan or 0 if it shows signs of early ischemic change. The total ASPECTS score ranges from 0 to 10, with lower scores indicating a greater extent of ischemic involvement and a higher risk of adverse outcomes. Studies have shown that ASPECTS is a strong and independent predictor of functional outcomes after acute ischemic stroke. Patients with low ASPECTS scores are more likely to experience significant neurological deficits and functional limitations, leading to a reduced quality of life and increased dependence on caregivers. The relationship between ASPECTS and functional outcome is particularly relevant in the context of treatment decisions. In patients with very low ASPECTS scores, the potential benefits of reperfusion therapies, such as thrombolysis or endovascular thrombectomy, may be outweighed by the increased risk of complications and the limited likelihood of achieving substantial functional improvement. In addition to predicting functional outcomes, ASPECTS has also been shown to be a significant predictor of mortality after acute ischemic stroke. Patients with lower ASPECTS scores have a higher risk of death within the first few days and weeks after their stroke. The association between ASPECTS and mortality underscores the severity of extensive ischemic damage within the MCA territory. It also highlights the importance of early and accurate assessment of stroke severity to guide treatment decisions and provide prognostic information to patients and their families. In this case, the patient's low ASPECTS score of 2 signaled a poor prognosis with a limited chance of

meaningful recovery. This information was crucial in guiding the clinical team's decision-making process, particularly in the context of a resource-limited setting. The limited availability of advanced treatment options, such as thrombolysis or endovascular thrombectomy, further underscored the importance of the ASPECTS score in this case. The clinical team recognized that the potential benefits of these treatments were likely to be outweighed by the increased risk of complications and the limited likelihood of achieving substantial functional improvement, given the extensive ischemic damage indicated by the low ASPECTS score.[11-13]

This case highlights the significant challenges faced in resource-limited settings when managing acute ischemic stroke. These settings often have restricted access to advanced imaging modalities and treatment options, which can hinder the comprehensive assessment and timely intervention necessary for optimal stroke care. In this particular case, the unavailability of MRI or CT perfusion imaging necessitated reliance on non-contrast computed tomography (NCCT) as the primary diagnostic tool. While NCCT remains a valuable tool for the initial assessment of stroke patients, it may not provide the same level of detail as advanced imaging techniques in evaluating the full extent of ischemic damage and identifying potentially salvageable brain tissue. Advanced imaging modalities, such as MRI and CT perfusion, play a crucial role in the comprehensive evaluation of acute ischemic stroke. MRI offers superior soft tissue contrast and can provide detailed information about the location and extent of ischemic injury. It can also help to differentiate between reversible and irreversible tissue damage, aiding in treatment decisions. CT perfusion, on the other hand, provides valuable information about cerebral blood flow and volume, helping to identify areas of reduced perfusion that may benefit from reperfusion therapies. In resource-limited settings, the lack of access to these advanced imaging modalities can limit the ability to fully assess the extent of ischemic damage and identify patients who might benefit from specific interventions.

In addition to limited access to advanced imaging, resource-limited settings often face restrictions in treatment options. Thrombolysis, a treatment aimed at dissolving blood clots and restoring blood flow to ischemic brain tissue, is not always available or feasible in these settings due to factors such as cost, availability of trained personnel, and limited access to critical care facilities. Similarly, endovascular thrombectomy, a minimally invasive procedure to mechanically remove blood clots, is often unavailable in resource-limited settings due to the need for specialized equipment and expertise. The lack of access to these advanced treatment options can significantly impact the ability to provide timely and effective interventions to stroke patients, potentially leading to poorer outcomes. In the face of these resource limitations, NCCT remains a cornerstone of stroke assessment. Its accessibility and rapid acquisition time make it an invaluable tool for the initial evaluation of stroke patients, particularly in settings where time is of the essence. The Alberta Stroke Program Early CT Score (ASPECTS) further enhances the utility of NCCT by providing a standardized method for quantifying early ischemic changes and predicting clinical outcomes. ASPECTS has been extensively validated as a robust predictor of functional outcomes and mortality in acute ischemic stroke patients. Its ability to provide prognostic information, even in the absence of advanced imaging modalities, makes it a particularly valuable tool in resource-limited settings. This case underscores the urgent need to improve stroke care in resource-limited settings. Efforts to increase access to advanced imaging modalities and treatment options are crucial to ensure that stroke patients receive timely and effective interventions. Additionally, continued research to refine prognostic tools and treatment algorithms for resource-limited settings can help to optimize stroke care and improve patient outcomes. Public health initiatives aimed at raising awareness about stroke risk factors and symptoms can also play a significant role in promoting early detection and intervention. By empowering individuals and

communities with knowledge about stroke, it is possible to encourage timely medical attention and potentially improve outcomes, even in settings with limited resources. In resource-limited settings, the decision to pursue reperfusion therapies, such as thrombolysis or endovascular thrombectomy, for acute ischemic stroke patients must be carefully weighed against the potential risks and benefits. While these treatments can be effective in restoring blood flow to ischemic brain tissue, they also carry a risk of complications, including hemorrhagic transformation (bleeding into the brain). In patients with low ASPECTS scores, the potential benefits of reperfusion therapies may be outweighed by the increased risk of complications and the limited likelihood of achieving substantial functional improvement. Thrombolysis involves the administration of intravenous medications to dissolve blood clots and restore blood flow to the affected brain tissue. While it can be effective in reducing neurological deficits and improving functional outcomes, it also carries a risk of hemorrhagic transformation, which can worsen the patient's condition and even lead to death. In resource-limited settings, the decision to administer thrombolysis must consider several factors, including the availability of trained personnel, the ability to monitor for complications, and the patient's overall health status. Patients with low ASPECTS scores, indicating extensive ischemic damage, may be at a higher risk of hemorrhagic transformation and may not benefit as much from thrombolysis. Endovascular thrombectomy is a minimally invasive procedure that involves the mechanical removal of blood clots from the affected blood vessels in the brain. It has been shown to be highly effective in improving functional outcomes in patients with acute ischemic stroke, particularly those with large vessel occlusions. However, endovascular thrombectomy requires specialized equipment and expertise, which may not be readily available in resource-limited settings. Additionally, it carries a risk of complications, including vessel perforation and bleeding. In patients with low ASPECTS scores, the potential benefits of endovascular thrombectomy may be limited due to the extent of brain damage already present. In situations where reperfusion therapies are not feasible or deemed inappropriate, supportive care becomes the mainstay of management for acute ischemic stroke patients in resource-limited settings. Supportive care focuses on stabilizing the patient's condition, preventing complications, and providing comfort measures. This may include managing blood pressure, maintaining hydration and nutrition, and providing rehabilitation services to optimize functional recovery. The decision to pursue reperfusion therapies or focus on supportive care should be made in consultation with the patient and their family, taking into account their individual circumstances and preferences. The healthcare team should provide clear and comprehensive information about the potential benefits and risks of each treatment option, as well as the expected outcomes. In resource-limited settings, where treatment options may be restricted, it is particularly important to engage in shared decision-making to ensure that the chosen management strategy aligns with the patient's values and goals.[14-16]

The radiologist's expertise extends far beyond simply interpreting images. They play a critical role in patient care, especially in resource-limited settings where their knowledge and skills can significantly impact clinical decision-making and patient outcomes. This is particularly evident in the management of acute ischemic stroke, as demonstrated in this case study. Radiologists possess specialized training and experience in neuroimaging, enabling them to accurately interpret brain imaging studies and identify subtle signs of ischemic damage. Their expertise in applying scoring systems like ASPECTS, which quantifies the extent of early ischemic changes, is essential in determining the severity of a stroke and predicting the patient's prognosis. In resource-limited settings, where access to advanced imaging modalities like MRI or CT perfusion might be restricted, the radiologist's interpretation of NCCT scans becomes even more crucial. They can identify subtle imaging features that

might be indicative of significant ischemic burden, even when these features are not readily apparent to clinicians less experienced in neuroimaging. In this case, the radiologist's assessment of the NCCT scan and interpretation of the ASPECTS score played a pivotal role in guiding the clinical team's decision-making. The radiologist effectively communicated the implications of the low ASPECTS score, indicating extensive ischemic damage and a poor prognosis. This information was crucial in helping the clinical team understand the severity of the stroke and the limited potential for recovery. The radiologist's input contributed significantly to the decision to adopt a conservative management approach. By recognizing the high risk of complications associated with reperfusion therapies in patients with low ASPECTS scores, the radiologist helped to avoid potentially risky interventions with limited chances of success. This ultimately led to a more patient-centered approach focused on supportive care and the prevention of complications. In addition to guiding clinical decision-making, the radiologist also plays a vital role in communicating prognostic information to patients and their families. This involves explaining complex medical concepts in a clear and empathetic manner, helping patients and their families understand the implications of their condition and make informed decisions about their care. In this case, the radiologist likely discussed the patient's prognosis with the family, explaining the limited potential for recovery and the rationale for focusing on supportive care. This communication helped to set realistic expectations and facilitated shared decision-making, ensuring that the patient's care aligned with their values and preferences. In resource-limited settings, the radiologist often serves as a patient advocate, ensuring that patients receive the best possible care despite the challenges posed by limited resources. This may involve advocating for access to advanced imaging or treatment modalities when appropriate, or working with the clinical team to develop a comprehensive care plan that addresses the patient's individual needs and circumstances. In the realm of healthcare, patient-centered communication is a cornerstone of effective care. It involves providing clear and empathetic information to patients and their families, empowering them to make informed decisions about their treatment and management. In the context of radiology, particularly in challenging situations such as acute stroke, patient-centered communication becomes even more crucial. In this case, the radiologist played a vital role in communicating the patient's prognosis to his family. This communication involved providing clear and empathetic information about the patient's condition, the limited potential for recovery, and the rationale for focusing on supportive care. The radiologist's involvement in this process emphasized the importance of patient-centered care, particularly in challenging situations where treatment options are limited and difficult decisions must be made. Effective communication in radiology involves tailoring the information to the patient's level of understanding, addressing their concerns and anxieties, and providing support during difficult times. It also involves actively listening to the patient's perspective and involving them in the decision-making process. In the case of acute stroke, effective communication is particularly important due to the time-sensitive nature of the condition and the potential for significant neurological deficits. Patients and their families need to understand the severity of the condition, the treatment options available, and the potential risks and benefits of each option. Radiologists are uniquely positioned to provide valuable information to patients and their families. They have specialized knowledge and expertise in interpreting imaging studies, which can be crucial in understanding the extent of the stroke and predicting the patient's prognosis. In this case, the radiologist likely explained the findings of the NCCT scan to the patient's family, highlighting the areas of the brain affected by the stroke and the implications for the patient's functional recovery. The radiologist also likely discussed the rationale for the conservative management approach, emphasizing the high risk of

complications associated with reperfusion therapies in patients with low ASPECTS scores. By providing clear and empathetic information, the radiologist helped the patient's family understand the severity of the condition and the reasons for the chosen treatment strategy. This communication fostered trust and facilitated shared decision-making, ensuring that the patient's care aligned with their values and preferences. Patient-centered communication has been shown to have numerous benefits, including improved patient satisfaction, increased adherence to treatment plans, and better health outcomes. In the context of radiology, patient-centered communication can also help to reduce anxiety and fear, enhance patient cooperation during procedures, and improve the overall patient experience.[17,18]

In cases where reperfusion therapies are not feasible or deemed inappropriate, supportive care becomes the cornerstone of management for acute ischemic stroke patients. This includes measures to stabilize the patient's condition, prevent complications, and provide comfort. In this case, the patient received antihypertensive medications, fluid management, nutritional support, and preventative care for complications such as deep vein thrombosis and aspiration pneumonia. Supportive care encompasses a wide range of interventions aimed at optimizing the patient's overall well-being and maximizing their functional recovery. Management of vital signs includes monitoring and controlling blood pressure, heart rate, and oxygen saturation to ensure adequate tissue perfusion and prevent further complications. Maintaining proper hydration and electrolyte balance is crucial for optimal neurological function and overall recovery. Providing adequate nutrition is essential for promoting healing and preventing malnutrition, which can hinder recovery. Prevention of complications includes measures to prevent deep vein thrombosis, aspiration pneumonia, pressure ulcers, and other complications associated with immobility and neurological deficits. Early and intensive rehabilitation is crucial for maximizing functional recovery and improving the patient's quality of life. This may include physical therapy, occupational therapy, speech therapy, and cognitive rehabilitation. Stroke can have a significant emotional and psychological impact on patients and their families. Providing psychosocial support, including counseling and support groups, can help patients cope with the challenges of stroke recovery. While the immediate focus in acute stroke management is on stabilizing the patient and preventing further damage, long-term care and rehabilitation are equally important. This involves addressing the patient's physical, cognitive, and emotional needs to maximize their functional recovery and quality of life. In this case, the patient's persistent neurological deficits at discharge underscore the need for ongoing rehabilitation and support to optimize his long-term outcome. This case also highlights the broader public health implications of stroke, particularly in resource-limited settings. Stroke is a leading cause of morbidity and mortality worldwide, and its impact is disproportionately felt in low- and middle-income countries where access to healthcare may be limited. Efforts to improve stroke prevention, early detection, and management in these settings are crucial to reduce the burden of this devastating condition.[19,20]

4. Conclusion

This case underscores the indispensable role of the Alberta Stroke Program Early CT Score (ASPECTS) in evaluating acute ischemic stroke, particularly in resource-constrained environments. The patient presented with a severe stroke, evidenced by neurological deficits and a high NIHSS score. The ASPECTS score of 2, derived from the NCCT findings, indicated extensive ischemic damage within the middle cerebral artery (MCA) territory. This low score served as a critical factor in determining the patient's prognosis and guiding the clinical management strategy. In resource-limited settings, where access to advanced imaging modalities and treatment options may be restricted, the radiologist's expertise in interpreting NCCT scans and applying ASPECTS becomes even more crucial. Their ability to identify

subtle imaging features and provide accurate prognostic information can significantly impact clinical decision-making and patient outcomes.

5. References

1. Song D, Lee K, Kim EH, Kim YD, Kim J, Song T-J, et al. Value of utilizing both ASPECTS and CT angiography collateral score for outcome prediction in acute ischemic stroke. Int J Stroke. 2015; 10(7): 1018–23.
2. Haussen DC, Dehkharghani S, Rangaraju S, Rebello LC, Bouslama M, Grossberg JA, et al. Automated CT perfusion ischemic core volume and noncontrast CT ASPECTS (Alberta Stroke Program Early CT Score): Correlation and clinical outcome prediction in large vessel stroke. Stroke. 2016; 47(9): 2318–22.
3. Tan BYQ, Wan-Yee K, Paliwal P, Gopinathan A, Nadarajah M, Ting E, et al. Good intracranial collaterals trump poor ASPECTS (Alberta Stroke Program Early CT score) for intravenous thrombolysis in anterior circulation acute ischemic stroke. Stroke. 2016; 47(9): 2292–8.
4. Guillaume M, Lapergue B, Gory B, Labreuche J, Consoli A, Mione G, et al. Rapid successful reperfusion of basilar artery occlusion strokes with pretreatment diffusion-weighted imaging posterior-circulation ASPECTS <8 is associated with good outcome. J Am Heart Assoc. 2019; 8(10): e010962.
5. Ospel JM, Kashani N, Menon B, Almekhlafi M, Singh R, Saposnik G, et al. Abstract TP56: Endovascular treatment decisions in acute ischemic stroke patients with low baseline aspects: Insights from an international multidisciplinary survey. Stroke. 2020; 51(Suppl_1).
6. Diestro JD, Dmytriw A, Broocks G, Kemmling A, Chen K, Phan K, et al. Abstract 145: Endovascular thrombectomy for large vessel ischemic stroke patients with low aspects: a systematic review and meta-analysis. Stroke. 2020; 51(Suppl_1).
7. Kuang H, Qiu W, Najm M, Dowlatshahi D, Mikulik R, Poppe AY, et al. Validation of an automated ASPECTS method on non-contrast computed tomography scans of acute ischemic stroke patients. Int J Stroke. 2020; 15(5): 528–34.
8. She R, Yan Z, Hao Y, Zhang Z, Du Y, Liang Y, et al. Health-related quality of life after first-ever acute ischemic stroke: associations with cardiovascular health metrics. Qual Life Res. 2021; 30(10): 2907–17.
9. Abdulrazzak MA, Sarraj A, Greco J, Azher AI, Qadri S, Shaker F, et al. Abstract P376: ASPECTS decay and functional outcomes in inter-facilities transferred large vessel occlusion acute ischemic stroke. Stroke. 2021; 52(Suppl_1).
10. Lei C, Zhou X, Chang X, Zhao Q, Zhong L. Mechanical thrombectomy in patients with acute ischemic stroke and ASPECTS ≤5. J Stroke Cerebrovasc Dis. 2021; 30(6): 105748.
11. Dittrich TD, Nguyen A, Sporns PB, Toebak AM, Kriemler LF, Rudin S, et al. Large ischemic core defined by visually assessed ASPECTS predicts functional outcomes comparably accurate to automated CT perfusion in the 6-24 h window. Eur Stroke J. 2024; 23969873241286691.
12. Orscelik A, Matsukawa H, Elawady SS, Sowlat MM, Cunningham C, Zandpazandi S, et al. Comparative outcomes of mechanical thrombectomy in acute ischemic stroke patients with ASPECTS 2-3 vs. 4-5. J Stroke Cerebrovasc Dis. 2024; 33(2): 107528.
13. Lin S, Raince A, Byrns K. Abstract TP133: Clot Burden Score correlates best with hypoperfusion volume and predicts final infarct ASPECTS<=3 in anterior circulation ischemic strokes. Stroke. 2024; 55(Suppl_1).
14. Kaveeta C, Alhabli I, Bala F, Horn M, Benali F, Coutts SB, et al. The treatment effect across

ASPECTS in acute ischemic stroke: Analysis from the AcT trial. Int J Stroke. 2024; 17474930241273561.

15. Phuttharak W, Sawanyawisuth K, Sangpetngam B, Tiamkao S. CT interpretation by ASPECTS in hyperacute ischemic stroke predicting functional outcomes. Jpn J Radiol. 2013; 31(10): 701–5.
16. Reidler P, Thierfelder KM, Rotkopf LT, Fabritius MP, Puhr-Westerheide D, Dorn F, et al. Attenuation changes in ASPECTS regions: a surrogate for CT perfusion-based ischemic core in acute ischemic stroke. Radiology. 2019; 291(2): 451–8.
17. Lu S-S, Wu R-R, Cao Y-Z, Xu X-Q, Lin S-S, Liu S, et al. ASPECTS-based net water uptake predicts poor reperfusion and poor clinical outcomes in patients with ischemic stroke. Eur Radiol. 2022; 32(10): 7026–35.
18. Xu X-Q, Chu Y, Shen G-C, Ma G, Lu S-S, Liu S, et al. Prognostic value of ASPECTS on post-treatment diffusion-weighted imaging for acute ischemic stroke patients after endovascular thrombectomy: comparison with infarction volume. Eur Radiol. 2022; 32(12): 8079–88.
19. Wu R-R, Cao Y-Z, Xu X-Q, Jia Z-Y, Zhao L-B, Shi H-B, et al. ASPECTS-based net water uptake outperforms target mismatch for outcome prediction in patients with acute ischemic stroke and late therapeutic window. Eur Radiol. 2023; 33(12): 9130–8.
20. Wei J, Shang K, Wei X, Zhu Y, Yuan Y, Wang M, et al. Deep learning-based automatic ASPECTS calculation can improve diagnosis efficiency in patients with acute ischemic stroke: a multicenter study. Eur Radiol. 2024.