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Case Report

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Recurrent Ischaemic Episodes Linked to Carotid Plaque Ulceration: A Multidisciplinary Diagnostic and Management Approach

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Abstract

Background: Identifying the aetiology of ischemic stroke can be challenging, especially when critical findings are overlooked. Stroke assessment often relies on standardised guidelines, primarily focused on carotid stenosis severity (>50%) as an intervention criterion. However, this approach may neglect high-risk plaque features. This case report highlights the importance of integrating diagnostic findings with clinical presentation to guide management.

Case presentation: A 68-year-old male presented with sudden-onset transient right arm weakness. Initial imaging, including MRI and CT angiography, revealed a subtle diffusion-weighted imaging (DWI) abnormality in the left hemisphere and moderate carotid atherosclerosis (<50%) that did not meet guideline criteria for endarterectomy. Despite antiplatelet and anticoagulant therapy, the patient experienced multiple recurrent ischemic episodes. Due to the persistence of symptoms, the multidisciplinary team (MDT) recommended advanced vessel wall MRI, which identified intraplaque haemorrhage and plaque ulcerations in the left internal carotid artery—critical findings missed on conventional imaging. This led to a decision to perform carotid endarterectomy. Histology confirmed atheromatous disease with intraplaque haemorrhage. Following surgery, the follow-up scans showed no new infarcts with no clinical recurrence.

Discussion: This case underscores the limitations of relying solely on carotid stenosis degree in stroke management and highlights the importance of identifying high-risk plaque characteristics. Advanced vessel wall imaging proved instrumental in guiding treatment, while MDT collaboration ensured a tailored approach. The findings emphasise the need to prioritise carotid stenosis characteristics over stenosis degree alone when guiding clinical decisions to optimise outcomes in ischemic stroke management.

Keywords

recurrent stroke, atherosclerosis, carotid endarterectomy, magnetic resonance imaging

Introduction

Atherosclerosis of major arteries is a common aetiology for strokes, leading to plaque formation, ulceration, and rupture. These processes generate emboli that can occlude cerebral vasculature, causing transient or permanent focal neurological deficits.[1] Transient ischemic attacks (TIAs) and minor strokes often serve as warnings for impending major strokes, necessitating prompt and thorough evaluation to identify embolic sources and prevent recurrence.[2]

However, identifying the precise aetiology of stroke can be challenging, particularly when subtle but critical findings go unnoticed. This highlights the need to interpret investigations within the context of each patient's presentation rather than relying solely on standardised guidelines. Current stroke management often prioritises carotid stenosis degree (>50%) as a criterion for intervention, which can lead to the under-

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recognition of high-risk plaque characteristics,[3,4] such as haemorrhage and ulceration, that significantly influence outcomes. Advances in imaging techniques, particularly MR vessel wall imaging, have greatly enhanced the ability to detect these subtle vascular abnormalities, providing critical insights that influence treatment decisions and improve clinical outcomes.

Here, we report a case of recurrent minor strokes associated with carotid plaque ulceration, successfully managed using advanced imaging and multidisciplinary decision-making. This case shows the importance of state-of-the-art diagnostic tools and collaborative approaches in preventing recurrent embolic episodes.

Case Presentation

Initial Presentation, Investigation, and Management

A 68-year-old male presented with sudden-onset left-sided headache and right arm weakness. The weakness partially resolved by the time of presentation, though numbness persisted in the right little and ring fingers. There was no associated speech, visual, or balance disturbance.

Initial brain MRI was interpreted as normal, but subsequent neuroradiology review identified a subtle diffusion-weighted imaging (DWI) abnormality in the left hemisphere (Figure 1A). A CT angiogram (CTA) of the head and neck demonstrated mild bilateral calcified atherosclerotic disease in the carotid arteries and a hypoplastic right vertebral artery (Figure 1B).

Carotid Doppler revealed plaques at the origin of the right internal carotid artery (ICA) causing less than 40% stenosis and plaques in the left ICA causing 40%-50% stenosis. The right vertebral artery was not visualised, while the left vertebral artery was patent with antegrade flow.

The patient was discharged on clopidogrel (75 mg daily) and atorvastatin (80 mg daily). Transthoracic echocardiography and cardiac monitoring were arranged to investigate potential cardioembolic sources.

Follow-Up and Recurrence of Symptoms

A follow-up in May 2023 identified brief episodes of atrial tachycardia, each lasting less than 30 seconds on cardiac monitoring. Multidisciplinary discussions involving vascular neurologists, neuroradiologists, stroke physicians, and cardiologists concluded that the embolic stroke observed on MRI was significant. Consequently, clopidogrel discontinued and dabigatran (150 mg twice daily) was initiated.

In August 2023, the patient presented again with 2 further episodes of right arm weakness and numbness on the same day. The first episode lasted approximately 3 hours, while the second episode which began in the afternoon was not fully resolved by the time of presentation to the ED. Repeat brain MRI identified a new infarct in the left parietal region (Figure 1C). A repeat CTA showed no significant changes, with findings of stable hypoplastic right vertebral artery and mild calcified atherosclerotic disease in the carotids. The ongoing recurrence of symptoms caused the patient severe mental anxiety, where he anticipated a major stroke, significantly impacting his quality of life and well-being.

Additional investigations, including transthoracic echocardiography, antiphospholipid and autoantibody screening, Fabry disease screening, and PET imaging for occult malignancy, yielded normal results. The MDT decided to continue him on dabigatran.

In January 2024, the patient experienced another transient right arm weakness lasting approximately 1 hour. Repeat imaging revealed no new infarcts. A transoesophageal echocardiogram detected a small patent foramen ovale (PFO) without

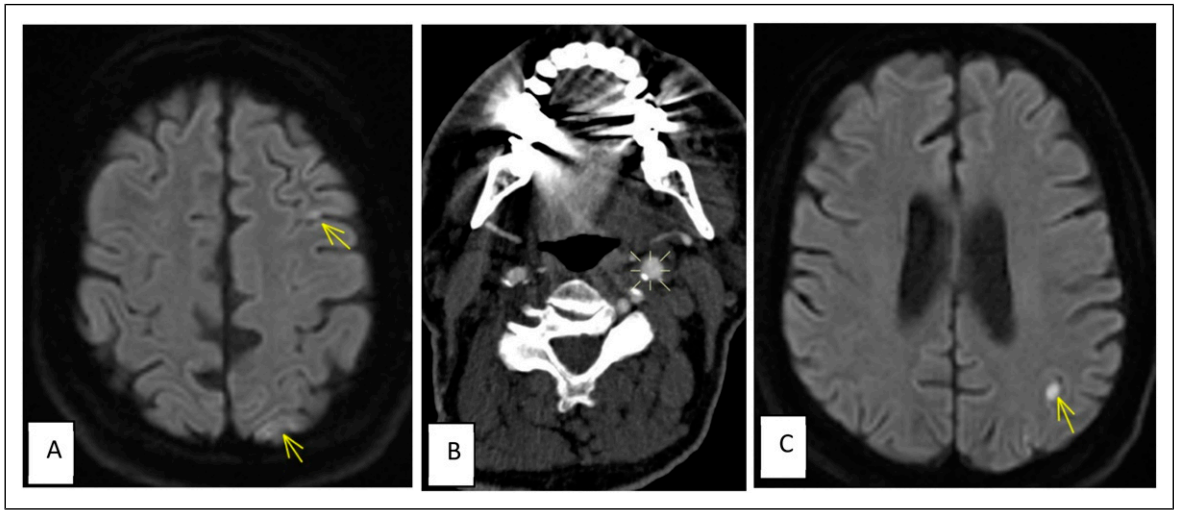

Figure 1. (A) The First Diffusion-Weighted Imaging (DWI) MRI Scan, (B) The CT Angiogram Showing Bilateral Calcified Atherosclerotic Disease in the Carotid Arteries, (C) The Second Diffusion-Weighted Imaging (DWI) MRI Scan

an associated atrial septal aneurysm. Following MDT discussions and consideration of patients' preferences, dabigatran was discontinued, and ticagrelor (90 mg twice daily) was initiated.

Advanced Imaging and Surgical Management

Due to the mono-hemispheric nature of his symptoms an MRI vessel wall imaging was performed at a regional neurology centre to further evaluate the underlying cause of the recurrent embolic events. This identified significant findings in the left carotid artery, including intraplaque haemorrhage involving two-thirds to three-fourths of the circumference of the left ICA posteriorly and plaque ulcerations at the left common carotid artery (CCA) bifurcation and within the left ICA (Figure 2A). The plaques caused 35%–40% narrowing of the left ICA with mild narrowing was also noted at the right CCA bifurcation. Serial CTAs performed during follow-up consistently demonstrated stable plaque morphology with no evidence of progression. However, these studies did not reveal high-risk features such as intraplaque haemorrhage or ulceration, which were only detected on vessel wall MRI. Given the advanced imaging findings and recurrent nature of the ischaemic episodes, the patient underwent a left carotid endarterectomy in August 2024. Histopathological analysis of the excised material confirmed atheromatous disease with intraplaque haemorrhage (Figure 2B).

The patient's postoperative course was uneventful, he continues to experience unresolved weakness in his right

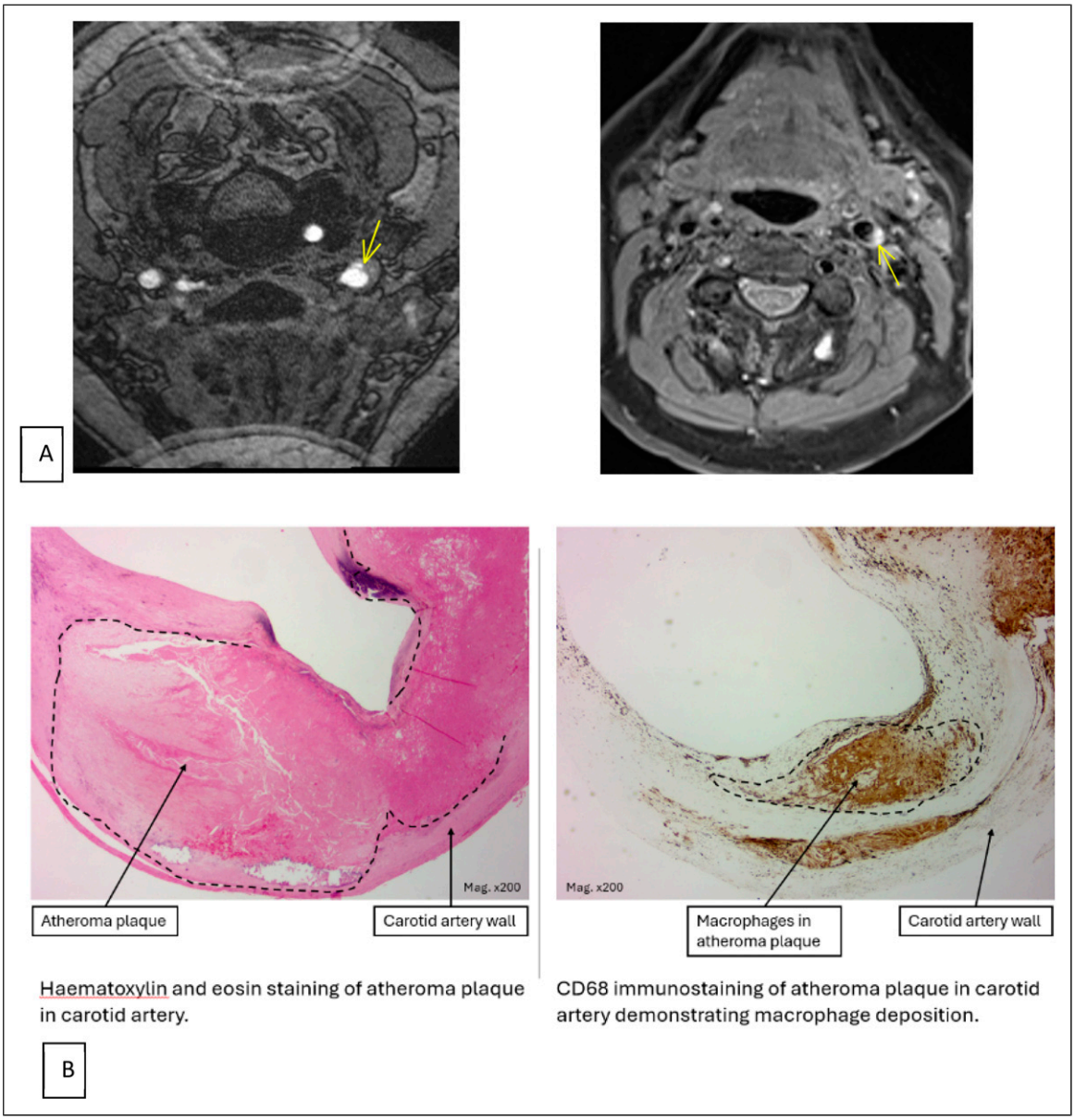

Figure 2. (A) The MRI Vessel Wall Imaging, (B) Histopathological Analysis of the Excised Plaque

hand, and his balance remains adversely impacted. Follow-up imaging 3 months later showed no new infarcts. Post-operatively, his ticagrelor was switched to clopidogrel.

Discussion

This case highlights the critical role of advanced imaging and multidisciplinary approach in the diagnosis and management of recurrent minor strokes linked to carotid plaque ulceration. Despite initial standard imaging revealing only mild carotid atherosclerosis, the patient continued to experience recurrent ischaemic events. This demonstrates the challenges of identifying subtle but clinically significant findings and shows the limitations of relying solely on carotid stenosis degree as a criterion for intervention.

Advanced imaging techniques, particularly vessel wall MRI, played an essential role in this case. Unlike conventional imaging methods, vessel wall MRI allowed the identification of high-risk plaque features, such as intraplaque haemorrhage and plaque ulceration, that were not apparent on earlier CT angiography or Doppler studies. These findings significantly influenced clinical decision-making, enabling a targeted intervention. Previous studies have demonstrated the superiority of vessel wall MRI in detecting high-risk plaques, particularly in patients with cryptogenic stroke or recurrent ischaemic episodes.[5,6]

High-resolution vessel wall MRI, particularly T1-weighted black-blood/MPRAGE shows high diagnostic accuracy for intraplaque haemorrhage (IPH) against histology (typical sensitivity 80%-90% and specificity 90%-97%).[7] By contrast, conventional colour duplex ultrasound has lower accuracy for IPH, while CTA's performance for IPH is variable.[8]

For plaque ulceration, studies referenced to histology show CTA outperforms duplex ultrasound (CTA sensitivity 93%, specificity 98% vs duplex sensitivity 37%, specificity 91%).[9,10] MRI also characterises other high-risk features (lipid-rich necrotic core, fibrous-cap status) better than lumen-based techniques and is recommended in expert consensus statements for plaque risk stratification beyond stenosis severity.[11] In line with our case report, these findings highlight that vessel wall MRI provided the crucial diagnostic information that conventional ultrasound and CTA did not, ultimately guiding the decision to intervene.

This case further supports the growing consensus in the literature that advanced imaging, such as vessel wall MRI, be integrated into the diagnostic algorithm for patients with recurrent embolic episodes.[12,13] While carotid endarterectomy (CEA) has traditionally been reserved for patients with symptomatic stenosis ≥50%, emerging evidence suggests that patients with symptomatic <50% stenosis but high-risk plaque features may also benefit from surgery. Recent evidence suggested that CEA in this subgroup can reduce recurrent stroke risk, particularly in the presence of intraplaque haemorrhage, ulceration, or unstable morphology.[14,15]

The successful management of this patient also highlight the importance of an MDT approach. Collaborative discussions between vascular neurologists, neuroradiologists, stroke physicians, cardiologists, and surgeons ensured a comprehensive evaluation of potential embolic sources and appropriate tailoring of therapy. Multidisciplinary decision-making has been widely recognised as a cornerstone of modern stroke care.[16] This approach is particularly valuable in cases involving recurrent embolic episodes, where diagnostic and therapeutic strategies often span multiple specialties.

Despite the successful outcome, this case has limitations. First, the findings are based on a single case, which limits generalisability. Second, vessel wall MRI availability remains limited in many centres. Future research should focus on validating the role of advanced imaging modalities in larger cohorts and exploring their cost-effectiveness in routine clinical practice. Additionally, further studies are needed to refine the indications for carotid endarterectomy in patients with high-risk but non-stenotic plaques.

Conclusion

This case highlights the critical importance of advanced imaging, particularly vessel wall MRI, in detecting high-risk plaque features that may be missed on conventional imaging. It also demonstrates that carotid endarterectomy can be valuable for patients with high-risk plaques, even in the absence of significant stenosis. Multidisciplinary input helped ensure the diagnosis was accurate and the treatment strategy appropriate. Future research should aim to validate these approaches in larger patient cohorts and establish evidence-based guidelines for the use of advanced imaging and surgical intervention in similar scenarios.

Learning Points

1. Recurrent ischaemic episodes involving single hemisphere may require advanced imaging to identify subtle embolic sources.
2. MRI vessel wall analysis is valuable for diagnosing intraplaque haemorrhage and ulceration.
3. Multidisciplinary collaboration is essential in complex stroke cases.
4. Surgical intervention can prevent recurrence when conservative therapy is insufficient.

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Consent to Participate

An informed consent was obtained from the patient for the use of their information and materials in this case report.

Author Contributions

K.C: Conceptualisation, Methodology, Project administration, Resources, Writing – original draft, Writing – review and editing.
A.S: Validation, Methodology, Project administration, Writing – review and editing.
A.H: Validation, Methodology, Project administration, Writing – original draft, Writing – review and editing.
M.B: Methodology, Project administration, Writing – review and editing.
A.B: Methodology, Project administration.

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