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Imaging of the Contour Neurovascular System with Photon-counting CT Angiography

CASE REPORT

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ABSTRACT

The Contour Neurovascular System (CNS) is an intrasaccular flow-disrupting device for treating intracranial aneurysms. Conventional follow-up imaging of the CNS with MR angiography or conventional CT angiography often suffers from significant artifacts. Photon-counting CT angiography (PCCTA) is a novel technique offering superior spatial resolution and reduced beam-hardening artifacts. We report one of the first cases of a patient in their 40s with an anterior communicating artery aneurysm treated with a CNS who underwent follow-up imaging with PCCTA. The examination provided markedly artifact-reduced images, enabling clear visualization of the CNS, complete aneurysm occlusion, and adjacent vessel patency. Compared with MR angiography, PCCTA offered substantially improved depiction of the device itself, highlighting its unique value for precise, non-invasive follow-up of intracranial neurovascular implants and its potential as an alternative for detailed post-procedural assessment of the CNS.

KEYWORDS

contour neurovascular system, intracranial aneurysm, intracranial vascular implant, neurovascular imaging, photon-counting CT angiography

INTRODUCTION

The CNS (Stryker, USA) is an intrasaccular flow-disrupting device designed for the treatment of intracranial aneurysms. Its efficacy and safety have been well documented in recent publications [1–4]. The device has a disc- to cup-like configuration and consists of a double layer of fine nitinol wires with a platinum core, connected by a marker band [1]. Besides digital subtraction angiography (DSA), which remains the gold standard for post-treatment evaluation, magnetic resonance angiography (MRA) offers a valuable non-invasive alternative for follow-up imaging of endovascularly treated aneurysms, although it is prone to significant artifacts when imaging the CNS [5,6]. Conventional computed tomography angiography (CTA) can also be utilized for follow-up; however, the CNS similarly produces substantial artifacts on standard CTA imaging [6,7].

Photon-counting computed tomography is a novel imaging modality that enables superior spatial resolution and a reduction in beam hardening artifacts compared to conventional CT systems employing energy-integrating detectors, by directly detecting individual X-ray photons [8,9]. To the best of our knowledge, we report the first case of a patient treated with a CNS who underwent follow-up imaging with PCCTA.

CASE PRESENTATION

In a patient in their 40s with no risk factors, MRA revealed an incidental unruptured, broad-based, irregular saccular anterior communicating (Acom) artery aneurysm, later confirmed by DSA. The aneurysm measured 6.7 mm in height, 9.0 mm in width, and had a 4.0 mm neck (Figure 1).

After interdisciplinary case discussion, the decision was made to implant a CNS (9 mm). The DSA and following interventional procedure were performed on a biplanar angio-suite (Allura Xpert FD, Philips, Amsterdam, The Netherlands). The intervention was conducted in general anesthesia by using a triaxial setup with a 90 cm 6 French sheath (Envoy, Codman Neuro, Raynham, MA, USA), intermediate catheters (Sofia 5 F, Terumo Neuro, Aliso Viejo, CA, USA; Synchro 14, Stryker Neurovascular, Kalamazoo, MI, USA), and microcatheters (Phenom 21, Medtronic, Minneapolis, MN, USA; Traxcess 14, Terumo Neuro, Aliso Viejo, CA, USA). The procedure resulted in successful occlusion of the Acom artery aneurysm (Figure 2).

Final imaging with flat-panel rotational angiography in the angiography suite confirmed the absence of residual aneurysm perfusion and preservation of the anterior cerebral artery bilaterally. The patient was extubated immediately following the procedure and, after an uneventful recovery in the intensive care unit, was transferred to the neurosurgical ward. On the second post-interventional day, follow-up imaging was performed using the photon counting CT "NAEOTOM Alpha" (Siemens Healthineers, Erlangen, Germany) at our institute. The PCCTA demonstrated

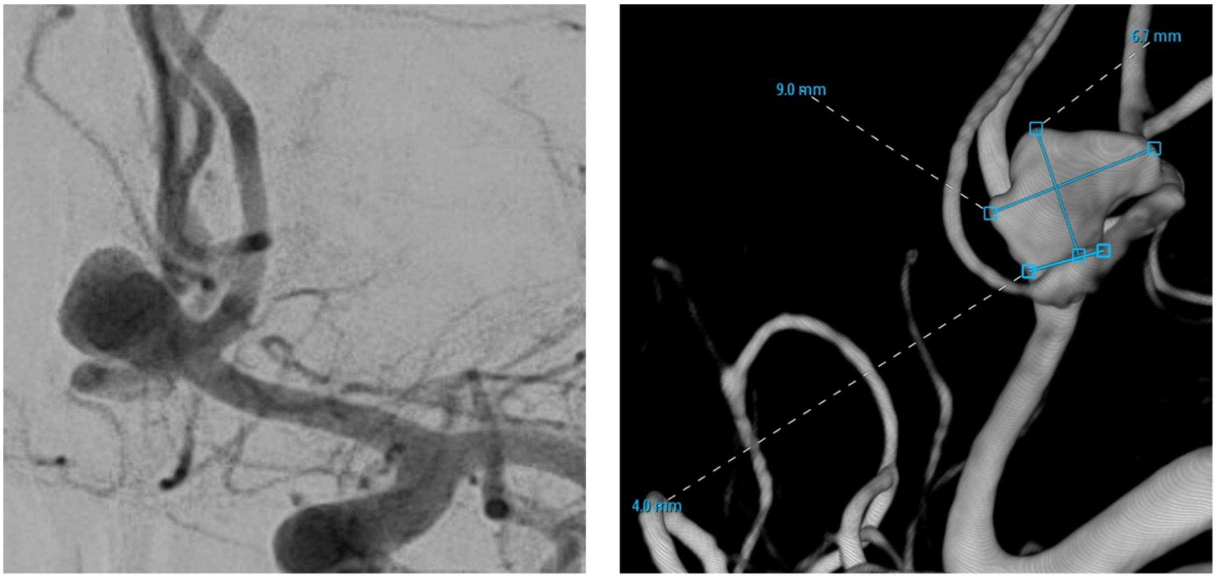

FIGURE 1. The figure shows a broad-based, irregular, saccular-shaped anterior communicating artery aneurysm in a patient in their 40s on digital subtraction angiography.

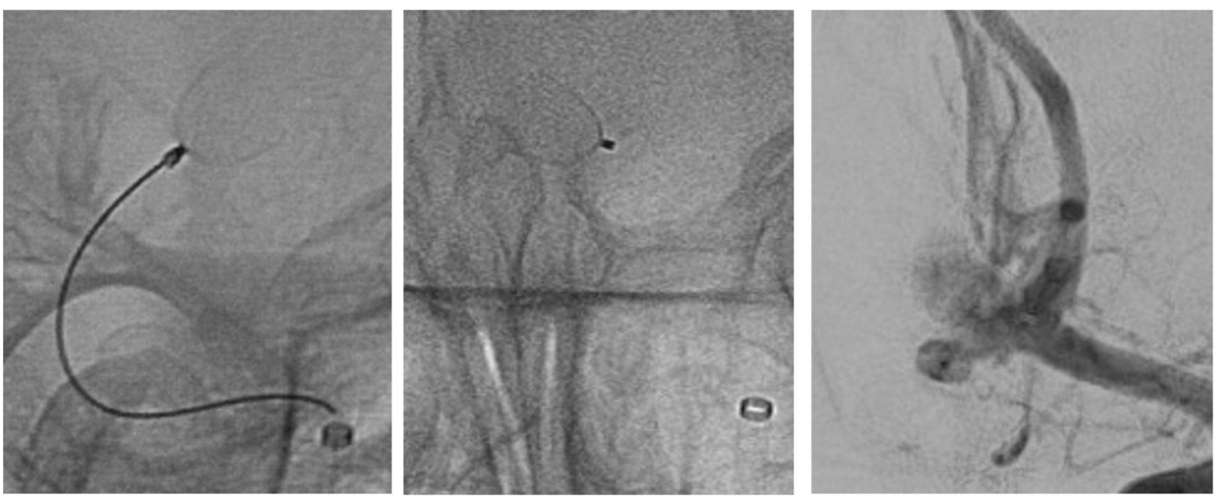

FIGURE 2. The figure demonstrates periprocedural digital subtraction angiography images of contour device implantation.

very high image quality with low beam-hardening artifacts, allowing a clear assessment of the complete aneurysm occlusion as well as the patency of the adjacent anterior cerebral arteries. Figure 3 shows key images from the PCCT and PCCTA examination. Figure 4 illustrates the follow-up MRI of the same patient performed the next day, highlighting impaired visualization of the CNS due to susceptibility artifacts.

DISCUSSION

This initial clinical case underscores the potential of PCCTA to improve image quality and diagnostic confidence in intracranial implant imaging by providing precise and nearly artifact-free visualization of the CNS. In this case, visualization of the CNS was subjectively superior to that achieved with MRI in the same patient. This improvement may be particularly beneficial in patients with multiple sources of metal-induced artifacts, where both conventional CT and MRI frequently suffer from substantial image degradation [7]. Alternative approaches to enhance visualization of the CNS include the application of specialized metal suppression algorithms within spectral CT protocols, which have shown promise in mitigating artifacts associated with intracranial devices [7].

Although this report is based on a single clinical experience and thus does not permit generalization, it serves as a proof of concept for the potential clinical utility of PCCTA in patients treated with the CNS and possibly other intrasaccular devices. Further systematic investigations are warranted to comprehensively evaluate the diagnostic performance, clinical value, and limitations of PCCTA in this setting. Despite its advantages, PCCTA is currently limited in availability and associated with higher costs compared to conventional CTA, which may constrain its broader adoption. Moreover, while PCCTA substantially reduces metal artifacts, residual artifacts from the CNS may still be present and can affect image interpretation in certain cases.

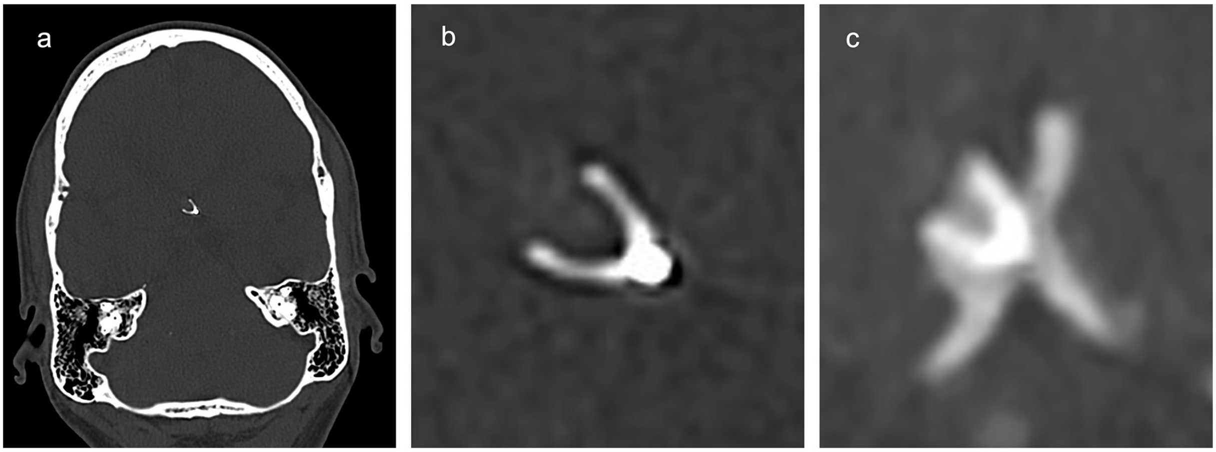

FIGURE 3. (a) Visualization of the contour device on non-contrast photon-counting CT (bone window). (b) Magnified view of (a) highlighting the device. (c) Photon-counting CT angiography demonstrating near artifact-free visualization of the contour device.

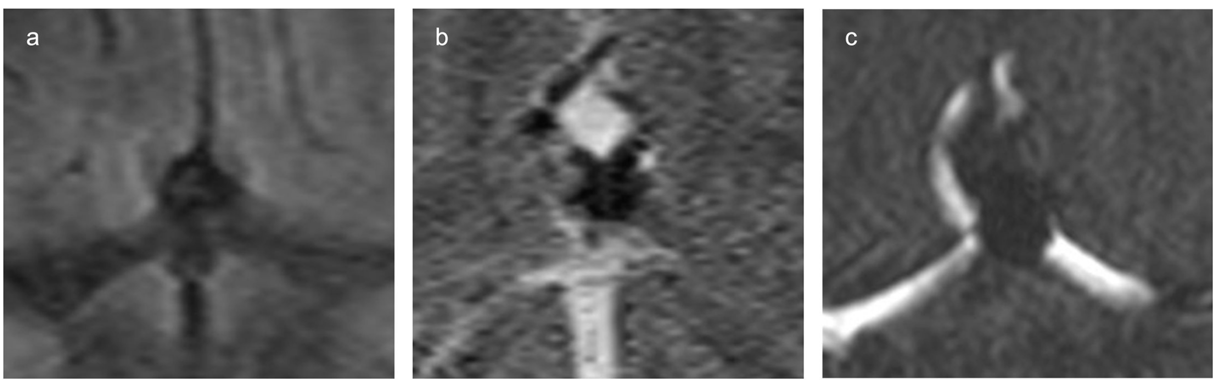

FIGURE 4. Follow-up MRI performed the next day demonstrates impaired visualization of the Contour Neurovascular System due to susceptibility artifacts: (a) FLAIR, (b) T2-weighted turbo spin-echo (TSE), (c) Time-of-flight MR angiography.

CONCLUSION

PCCTA represents a valuable follow-up imaging modality after implantation of the CNS. This novel and rapid imaging technique may serve as a non-invasive alternative to DSA for the post-treatment evaluation of patients with CNS, offering the additional benefit of reduced metal-induced artifacts with high image quality.

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Authors' Contributions

D.R. and C.D. conceptualized the study, acquired and analyzed the data, and drafted the original manuscript. All authors critically reviewed previous versions and approved the final manuscript.

Competing Interests

The authors have no competing interests to declare that are relevant to the content of this article.

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Data Availability Statement

The data are not openly available due to reasons of sensitivity and are available from the corresponding author upon reasonable request.

Ethics Statement

As confirmed by the local Ethics Committee of the Medical Faculty of the University of Duisburg-Essen, Germany, the requirement to obtain patient consent was waived in view of the retrospective nature of the study and all the procedures being performed were part of the routine care (May 5, 2025/ 25-12475-BO).

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