Cone Beam CT Angiography in Neurovascular Care :
Protocol Insights and Diagnostic Advantages Over Standard CTA

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Introduction

Intravenous Cone Beam CT Angiography (IV CBCTA) is an advanced neurovascular imaging technique offering high-resolution, 3D, time-resolved visualization of cerebral vessels. It offers a rapid detailed 3D vascular imaging in peri- and post-operative setting with reduced contrast and radiation exposure advantages compared to standard CTA, making it a potentially valuable tool in neurovascular care.

Objective

This review presents our most recent institutional experience, focusing on proctoling insights and advantages of IV CBCTA over standard CTA.

Material & Methodology

We retrospectively analyzed all IV CBCTA cases performed from June 2024 to June 2025 in our institution. Imaging protocols were evaluated and illustrative cases were selected to demonstrate its strengths and limitations.

Preparation and Protocol

Contrast injection protocol

20%-30% dilated contrast

Typical flow rate: 3-7 mL/s

Volume: 5-20mL
(depends on target vessel)

* May vary based on the specific vascular territory, device, or pathology.

Acquisition Timing

- Bolus tracking trigger
- Test bolus

Delay time varies for different specific areas (reported to be 2 seconds for cervical, and 45 seconds for cerebral vasculature)

Image Reconstruction

Use voxel sizes between 0.2–0.5mm for high-resolution vascular detail.

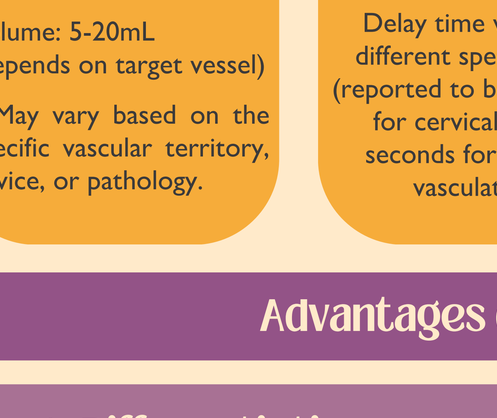
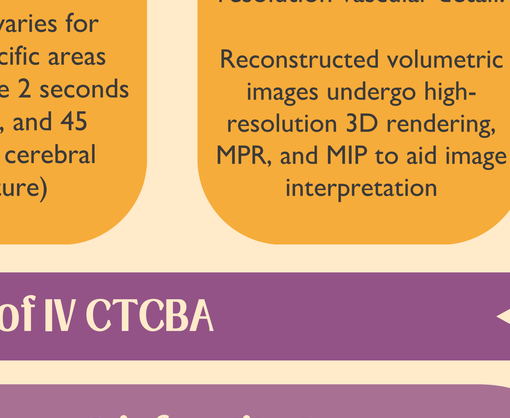
Reconstructed volumetric images undergo high-resolution 3D rendering, MPR, and MIP to aid image interpretation

Advantages of IV CTCBA

1. Differentiating aneurysm & infundibulum

IV CBCTA's superior spatial resolution enables clearer visualization of branch vessels arising from arterial outpouching, aiding distinction of infundibula from aneurysms.

Case 1: F/27, incidental note of suspected left opthalmic ICA infundibulum and right terminal ICA aneurysm in standard CTA. IV CBCTA was arranaged.

Captured images from IV-CBCTA performed.
Fig. 1 (left): Left opthlamic ICA outpouching (red arrow), with left opthalamic artery (yellow arrow) clearly seen arising from the anterior base of the outpouching, in favour of an aneurysm.
Fig. 2 (right): Right terminal ICA outpouching (red arrow), with Right PCoA (yellow arrow) clearly seen arising from the apex of the outpouching, in favour of an infundibulum.

2. Detection of residual necks after coiling

With superior spatial resolution and ability to reduce beam-hardening artifact, IV CBCT offers enhanced residual neck detection.

Case 2: F/74, history of ruptured right ICA aneurysm with coiling performed. Follow-up MRA shows suspected recurrent aneurysm, which was not detected in prior standard CTA. IV CBCTA was arranaged.

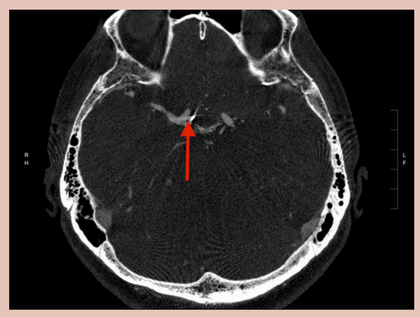


Fig. 3 (left) and Fig. 4 (middle) : A 2mm residual neck (red arrows) is seen at the superior aspect of coil mass in IV CBCTA. Reduced beam-hardening artefact in CBCT over standard CT aids detection. Fig. 5 (right): Residual neck was confirmed in subsequent diagnostic DSA.

Case 3: F/69, history of ruptured right PCoA aneurysm with coiling performed.

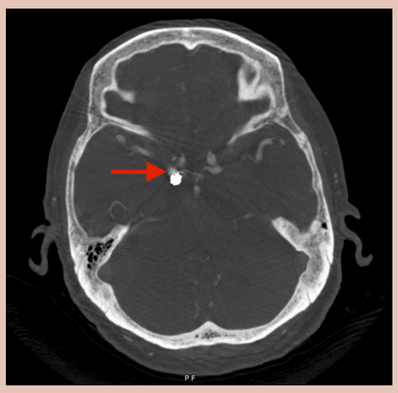



Fig. 6 (left): Due to marked beam hardening artefact by coil mass, no definite residual neck is detected in standard CTA.

Fig. 7 (right): With reduced beam hardening artefact, IV CBCTA successfully shows a 4mm residual neck, which was confirmed in DSA (not shown).

3. In-stent luminal assessment

IV CBCTA provides superior imaging of intracranial stents, enhancing evaluation of in-stent status over standard CT.

Case 4: M/73, history of flow diverter placement for right ophthalmic ICA aneurysm.

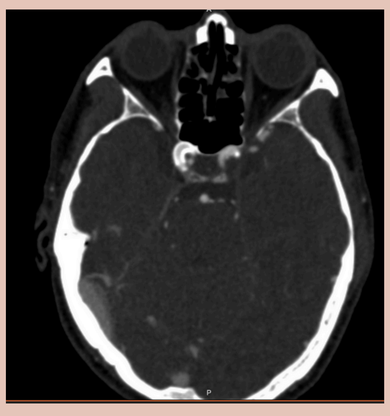




Fig. 8 (left) Standard CTA; Fig. 9 (middle) Standard CTA with metallic artefact reduction software employed; Fig. 10 (right) IV CBCTA with curved MPR. Stent strut artefact is seen the least pronounced in IV CBCTA, hence increaseing accuracy of in-stent status assessment.

Limitation of IV CTCBA

Despite reduction of beam-hardening artefact, small residual/ recurrence within coil masses can still be obscured and missed in IV CBCTA.

Case 5: F/65, history of stent-assisted coil embolization of left MCA M2 aneurysm



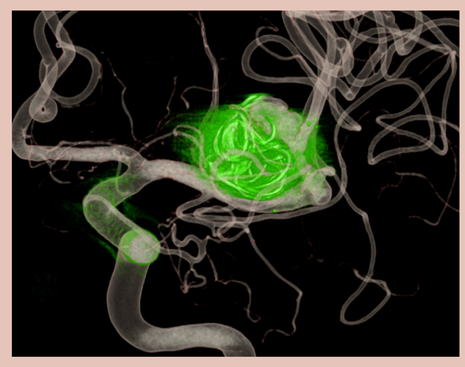


Fig. 11 & 12 (left, middle): IV CBCTA shows no contrast opacification within the left M2 coil mass. Fig 13 (right): Subsequent diagnostic DSA shows presence of flow within the coil mass.

Conclusion

IV CBCTA significantly advances neurovascular imaging and outperforming standard CTA in many aspects. However, awareness of metal artifact limitations and careful protocol design are critical for optimal clinical use.

References

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