3D Rotational Angiography

Cerebral angiography, especially three-dimensional rotational angiography (3DRA), allows for acquisition of high-quality images of the cerebral arteries, showing delineation of the aneurysm neck, shape, and relationship to adjacent arteries from multiple directions in order to determine the appropriate working projection for coil embolization.

The choice of catheter 3D angiographic modality and reconstruction kernel has a critical impact on derived aneurysm morphological and haemodynamic analysis. The resultant variability can confound and obscure underlying differences within patient populations and between studies performed at different centres using divergent techniques, compromising the accuracy of quantitative aneurysm analysis [1].

Modern endovascular suites enable rotational angiography, also known as cone-beam CT angiography (CBCT-A), using the full capability of modern C-arm digital angiography systems. This imaging modality offers a superior image quality to current options such as digital subtraction angiography, MRI, or CT angiography. Preoperative planning can be greatly aided by the resolution of angioarchitecture seen in CBCT-A images. Furthermore, these images can be used for intraoperative neuronavigation when integrated with widely used frameless stereotactic systems [2]

Is indispensable for evaluation of intracranial aneurysms, providing infinite viewing angles and defining the aneurysm morphology. Its role in follow-up of clipped aneurysms remains unclear.

In 47 patients harboring 54 clipped aneurysms underwent both 2D DSA and 3D RA. The residual/recurrent aneurysms were classified into five grades and the images of both modalities were compared.

The residual/recurrent aneurysm detection rate was 53.70% (29/54 aneurysms) with 2D DSA and 66.67% (36/54 aneurysms) with 3D RA (P = 0.05). In 12 aneurysms, 3D RA upgraded the residue/recurrence among which nine had been completely not detected on 2D DSA and were found to have grade one or two residual necks on the 3D RA, and, in three cases, a small neck on 2D DSA turned out to be aneurysm sac on 3D RA. In a total of 5 aneurysms, the classification was downgraded by 3D RA.

3D RA picks up more aneurysm residue/recurrence; hence, both 2D DSA and 3D RA should be performed in follow-up evaluation of clipped aneurysms [3].

Intraoperative coregistration of 3D ultrasound data with preoperative 3D Rotational Angiography is possible with high accuracy. It allows the immediate visualization of vessels beyond the microscopic field, as well as parallel assessment of blood velocity, aneurysm and vascular tree configuration. Although spatial resolution is lower than for standard angiography, the method provides an excellent vascular overview, advantageous interpretation of 3D-ioUS and immediate intraoperative feedback of the vascular status. A prerequisite for understanding vascular intraoperative ultrasound is image quality and a successful match with preoperative rotational digital subtraction angiography [4].

see 3D Rotational Venography.

1)

Lauric A, Hippelheuser JE, Malek AM. Critical role of angiographic acquisition modality and reconstruction on morphometric and haemodynamic analysis of intracranial aneurysms. J Neurointerv Surg. 2018 Jan 19. pii: neurintsurg-2017-013677. doi: 10.1136/neurintsurg-2017-013677. [Epub ahead of print] PubMed PMID: 29352062.

2)

Srinivasan VM, Schafer S, Ghali MG, Arthur A, Duckworth EA. Cone-beam CT angiography (Dyna CT) for intraoperative localization of cerebral arteriovenous malformations. J Neurointerv Surg. 2014 Dec 5. pii: neurintsurg-2014-011422. doi: 10.1136/neurintsurg-2014-011422. [Epub ahead of print] PubMed PMID: 25480885.

3)

Kumar S, Gaikwad SB, Mishra NK. 3D Rotational Angiography in Follow-Up of Clipped Intracranial Aneurysms. ISRN Radiol. 2014 Jan 20;2014:935280. doi: 10.1155/2014/935280. eCollection 2014. PubMed PMID: 24967299.

4)

Podlesek D, Meyer T, Morgenstern U, Schackert G, Kirsch M. Improved Visualization of Intracranial Vessels with Intraoperative Coregistration of Rotational Digital Subtraction Angiography and Intraoperative 3D Ultrasound. PLoS One. 2015 Mar 24;10(3):e0121345. doi: 10.1371/journal.pone.0121345. eCollection 2015. PubMed PMID: 25803318.