3D-DSA

DSA is the standard imaging technique for the evaluation of cerebrovascular conditions. However, One drawback is its limitation in depicting a single angiographic phase at a time.

Growing evidence suggests that three-dimensional digital subtraction angiography (3D-DSA) is superior to 2D-DSA in detection of intracranial aneurysm remnants after clipping. With a simple, practical quantitative scale proposed to measure maximal remnant dimension on 3D-DSA, this study provides a rigorous interrater and intrarater reliability and agreement study comparing this newly established scale with a commonly used (Sindou) 2D-DSA scale.

Records of 43 patients with clipped IAs harboring various sized remnants who underwent 2D- and 3D-DSA between 2012 and 2018 were evaluated. Using the 2D and 3D scales, six raters scored these remnants and repeated the scoring task 8 weeks later. Interrater and intrarater agreement for both grading schemes were calculated using kappa (κ) statistics.

Interrater agreement was highly significant, yielding κ-values at 95% CI (p = 0.000) of 0.225 for the first [0.185; 0.265] and 0.368 s [0.328; 0.408] time points for 2D-DSA and values of 0.700 for the first [0.654; 0.745] and 0.776 s [0.729; 0.822] time points for 3D-DSA. Intrarater agreement demonstrated κ-values between 0.139 and 0.512 for 2D-DSA and between 0.487 and 0.813 for 3D-DSA scores.

Interrater and intrarater agreement was minimal or weak for 2D-DSA scores, but strong for 3D-DSA scores. Halter et al. proposed that baseline 3D-DSA characterization may prove more reliable when categorizing clipped IA remnants for purposes of risk stratification and lifelong follow-up [1].

Raz et al. described a new 3D-DSA algorithm, which they call arterial and venous-3D-DSA, which allows the concurrent yet distinct display of the arterial and venous structures, which may be useful for different clinical and educational purposes [2].

3D Rotational Angiography

see 3D Rotational Angiography.

3D DSA is still limited in differentiating or developing anatomical variations of cerebrovascular vessels, thereby causing false-positive results. The use of 3D DSA requires full cooperation from the patient. The guiding effect of the clot accumulation area on aneurysms should be considered during the operation [3].

Case reports

Sejkorová et al., analyzed a case of a ruptured middle cerebral artery aneurysm for which they acquired imaging data at three time points, including at rupture. A patient with an observed MCA

aneurysm was admitted to the emergency department with clinical symptoms of a subarachnoid hemorrhage. During 3D-DSA, the aneurysm ruptured again. Imaging data from two visits before rupture and this 3D DSA images at the moment of rupture were acquired, and computational fluid dynamics (CFD) simulations were performed. Results were used to describe the time-dependent changes of the hemodynamics variables associated with rupture. Time-dependent hemodynamic changes at the rupture location were characterized by decreased wall shear stress WSS and flow velocity magnitude. The impingement jet in the dome changed its position in time and the impingement area at follow-up moved near the rupture location. The results suggest that the increased WSS on the dome and increased low wall shear stress area (LSA) and decreased WSS on the daughter bleb with slower flow and slow vortex may be associated with rupture. CFD performed during the follow-up period may be part of diagnostic tools used to determine the risk of aneurysm rupture [4].

1)
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2)
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