

Dual Volume Versus Single Volume Three-Dimensional Reconstruction for Follow-Up Evaluation of Treated Intracranial Aneurysms

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Introduction

Three-dimensional reconstruction of digital subtracted angiography (DSA) has become an indispensable complementary technique for evaluation of aneurysms, in addition to the standard two-dimensional DSA. The conventional single-volume reconstruction (SVR) can be effectively used before aneurysm treatment via coil embolization. However, the follow-up imaging can be marred by artifacts. The dual-volume reconstruction (DVR) technique, in which two acquired data volumes are reconstructed separately and then fused together, was developed to avoid artifacts and show more detail, regarding parent vessel, aneurysms, coils and side branches.

Methods

Four cerebrovascular neurosurgeons independently and blindly reviewed randomly-selected 20 SVR and 20 DVR images demonstrating cerebral aneurysms treated with primary coil embolization (n = 4), stent-assisted coil embolization (n = 11), or coiling and Pipeline Embolization device (n = 5). Five scans of each modality (single and dual volume) were repeated for intra-rater reliability assessment. Seven factors were assessed by the reviewers, including location of the aneurysm, occlusion status, position of the residual in relation to the coil mass, status of the parent artery, status of the nearby branches, coil migration, and presence of assistive devices device. Interclass correlation coefficient (ICC) was calculated as a measure of overall agreement on the variables between the four raters. Cohen's kappa (?) was used to assess repeat measurement consistency for each rater.

Results

Overall inter-rater agreement using SVR was 0.75 compared to 0.81 using DVR. Overall Intra-rater consistency was 0.64 using SVR and 0.79 using DVR. Overall agreement between SVR and DVR was 0.32. DVR gave better agreement rates in assessing location (0.86 vs 0.84), occlusion status (0.58 vs 0.55), position of residual (0.51 vs 0.3), status of nearby branches (0.55 vs 0.32), and presence of assistant devices (0.19 vs 0.02). SVR gave better agreement rates in assessing status of parent artery (0.32 vs -0.03) and presence of coil migration (0.09 vs 0).

Conclusions

Three-dimensional reconstruction is an important complementary imaging technique in evaluating the shape of the aneurysms and its relation to the surrounding vessels. DVR provides the advantage of visualizing the coil mass within the aneurysm, with better assessment on follow-up images.

Learning Objectives

To compare the effectiveness of dual volume versus single volume reconstruction imaging in evaluation of treated aneurysms

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