MR selective flow-tracking cartography: a postprocessing procedure applied to four-dimensional flow MR imaging for complete characterization of cranial dural arteriovenous fistulas.


Author information: From the Department of Morphologic and Functional Imaging, Université Paris Descartes, INSERM UMR 894, Hôpital Sainte Anne, 1 rue Cabanis, 75014 Paris, France (M.E., P.R., D.T., C. Rodriguez-Régent, J.F.M., O.N., C.O.), Clinical Science Development Group, GE Healthcare, Buc, France (C. Rabrait); and Departments of Medical Physics (K.M.J., O.W., P.T.) and Radiology (P.T.), University of Wisconsin, Madison, Wis.

Abstract

PURPOSE:

To assess the feasibility of a selective flow-tracking cartographic procedure applied to four-dimensional (4D) flow imaging and to demonstrate its usefulness in the characterization of dural arteriovenous fistulas (DAVFs).

MATERIALS AND METHODS:

Institutional review board approval was obtained, and all patients provided written informed consent. Eight patients (nine DAVFs) underwent 3.0-T magnetic resonance (MR) imaging and digital subtraction angiography (DSA). Imaging examinations were performed within 24 hours of each other. 4D flow MR imaging was performed by using a 4D radial phase-contrast vastly undersampled isotropic projection reconstruction pulse sequence with an isotropic spatial resolution of 0.86 mm (5 minutes 35 seconds). Two radiologists independently reviewed images from MR flow-tracking cartography and reported the location of arterial feeder vessels and the venous drainage type and classified DAVFs according to the risk of rupture (Cognard classification). These results were compared with those at DSA. Quadratic weighted $\kappa$ statistics with their 95% confidence intervals (CIs) were used to test intermodality agreement in the identification of arterial feeder vessels, draining veins, and Cognard classification.

RESULTS:

Interreader agreement for shunt location on MR images was perfect ($\kappa = 1$), with good-to-excellent interreader agreement for arterial feeder vessel identification ($\kappa = 0.97$; 95% CI = 0.92, 1.0), and matched in all cases with shunt location defined at DSA. There was good-to-excellent agreement between MR cartography and DSA in the definition of the main feeding arteries ($\kappa = 0.92$; 95% CI = 0.83, 1.0), presence of retrograde flow in dural sinuses ($\kappa = 1$), presence of retrograde cortical venous drainage ($\kappa = 1$), presence of venous ectasia ($\kappa = 1$), and final Cognard classification of DAVFs ($\kappa = 1$, standard error = 0.35).

CONCLUSION:

MR selective flow-tracking cartography enabled the noninvasive characterization of cranial DAVFs.