Figure 2 In post-contrast T1-weighted images homogeneous gadolinium enhancement was observed (A). MR perfusion imaging revealed a prolonged arrival time (measured as time to peak parameter) (B) and a reduced blood volume (C) in the right occipital and parietal lobes being consistent with a hypoperfusion of the affected hemisphere.

postzygotic recombination giving rise to two different cell clones homozygous for either allele have been discussed. We conclude that in our case genetic mosaicism affects growth regulation agents that leads either to hyper- or hypotrophy depending on tissue-specific environmental factors.

Conflict of interest statement

No potential conflict of interest relevant to this article was reported.

References


Figure 1 A T2-weighed MR image, demonstrating intramedullary hyperintensity from medulla oblongata to C7 level without flow voids (A). T1-weighed MR images before (B) and after (C) intravenous administration of gadolinium, demonstrating slight marginal enhancement.

Enhanced MR angiography showed the shunt point on the dura, along the dorsal surface of the craniocervical junction, where a meningeal branch of the vertebral artery communicated with an intradural perimedullary vein (left posterior spinal medullary vein) (Fig. 2A and B), which was confirmed by the subsequent selective right vertebral angiography. The contrast medium slowly flowed down to C7 level without venous aneurysms (Fig. 3). Under the diagnosis of spinal dural arteriovenous fistula (SDAVF), suboccipital craniotomy and C1 laminectomy were performed. Congestive veins were observed on the dorsal surface of the medulla oblongata. Abnormal vessels around the right posterior inferior cerebellar artery were coagulated and sectioned. A dilated draining vein, running more ventrally to the spinal cord, was occluded at the point as close as possible to the fistula. Postoperatively, the intramedullary T2 hyperintensity in the spinal cord was only partially resolved but abnormal vessels were completely disappeared (Fig. 2C and D). Neurological function of the patient was partially restored after the surgery.

SDAVF located in the craniocervical junction is rare but important as a cause of congestive myelopathy and subarachnoid hemorrhage [2,3]. Selective spinal DSA is the gold standard of diagnostic imaging and required for the planning of the treatment of SDAVF, either by surgical obliteration or by intravascular embolization. However, DSA is more inva-

Figure 2 Sagittal (A, B) and coronal (A, D) 3D-TOF FSPGR MR angiography treated in maximum intensity projection. The shunt with direct communication between the meningeal branch of the right vertebral artery and the left posterior spinal medullary vein was observed in the pre-operative MR angiography (A, C, arrow: shunting point). Abnormal vessels were disappeared in the post-operative MR angiography (B, D).

Figure 3 Anterior-posterior (A) and lateral (B) views of selective right vertebral angiography, demonstrating fistula in the craniocervical junction. Contrast medium slowly flowed down to C7 level without venous aneurysms.
Correspondences

sive, time consuming, expensive, and also it needs high skill of operators in comparison with MR angiography. The addition of MR angiography to routine MR imaging may improve sensitivity in the detection of SDAVF and expedite the subsequent DSA to estimate the localization of vertebral level of the fistula [4—6]. The point of our techniques for enhanced MR angiography is slow and continuous administration of gadolinium during the scanning time to avoid missing target vessels, because gadolinium arrival time to the target vessels was unknown in advance. Using sequential k-space sampling, more vessels with different flow rate could be simultaneously caught and higher spatial resolution could be obtained than using centric k-space.

Conflict of interest statement

There is no conflict of interest.

References


