Can the hemodynamic geographical factors be the cause of concurrent cavernous malformation in the cerebral developmental venous anomaly?

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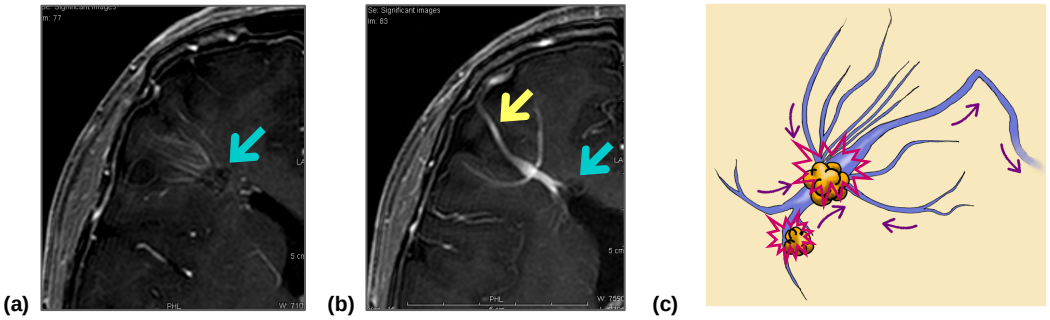
Clinical relevance- Cavernous malformation (CM) with developmental venous anomaly (DVA) is known to be more associated with symptomatic repeated hemorrhage or seizure. There are many theoretical hypotheses that CM can be occurred in DVA by increased pressure elevation within DVA. But, the objective mechanism is not available. To reveal the predisposing factors of concurrent CM is important clinically.

Purpose- To evaluate the hemodynamic geographic factors which can induce concurrent CM in the DVA in patients who present these coexistent vascular malformations in same draining pathway

Methods and materials- From 2006-2007**,** 21 patients with CM in the DVA were reviewed retrospectively (M;F=12;9, mean age= 53.3). Brain HR-MRI with Gadovist® (Schering AG, Berlin, Germany) enhanced SPGR images on a 3T MR scanner (Signa^{R} EXCITE ^{TM} 3.0T, GE Medical Systems, USA) was taken. Three radiologists analyzed the MRI images and investigated the presence of geographic factors which can induce distal hemodynamic stasis,(1) the abrupt angulated course of curved medullary vein, (2) the decreased diameter of draining vein (3) severe venous tortousity and (4) other intravascular factors (thrombosis, infarction, etc.).

Results- Angulation was demonstrated in the 20 cases (95 %) and CM occurred in the position of 90°and more of drained vein in 10 cases. The distal narrow draining vein can be found in the 11 cases (52%), the diameter decrease by 50% and more in 8 cases. And the mean decrease ratio is 56%. Severe venous tortuosity was found in the 15 cases (71%). Intravascular thrombosis (n=3) or focal ischemia (n=2) or focal stenosis (n=3) can be found.

Conclusion- Hemodynamic geographical factors would may be a key factor in leading to cascade of events and subsequent development of a CM in DVA, by causing disturbance of blood flow within the territory DVA, elevation of venous pressure and 3.0 T high resolution MR units would be helpful to depict the find morphological detail of small vascular structures of DVA and CM and find such hemodynamic geographical factors.



(a) **(b)** **(c)**

Figure 1. The decrease in the size of the draining vein in a 66-year-old woman with an incidentally-found DVA (a) 3D SPGR axial MR image with Gadovist enhancement image shows about 8.1x8.8mm concurrent CM (blue arrow) in the central area of DVA (b) Another 4.1x4.9mm CM (blue arrow) in peripheral area of DVA. The diameter of the draining vein is more narrow (1.5mm in diameter, yellow arrow) than that of medullary vein, (3.2mm in diameter). (c) Central portion of DVA is the main area in which CM develops, where small distributes branch out and direction of blood flow changes, suddenly interrupts the venous flow, thus stasis of blood flow and venous hypertension flow can occur.