Dynamic MR imaging of peripheral vascular malformations

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PURPOSE: To assess the usefulness of dynamic contrast-enhanced MR imaging in distinguish vascular malformations with arterial component (high-flow type) from venous malformations (low-flow type) that do not need angiography for treatment.

MATERIALS AND METHODS: From September 2001 to January 2003, sixteen consecutive patients with peripheral vascular malformation (6 vascular malformations with arterial component and 10 venous malformations) underwent dynamic contrast-enhanced MR imaging and conventional MR imaging. The dynamic contrast-enhanced images were continuously obtained every 5 sec for 120 sec. The time interval between start of arterial enhancement and onset of lesion enhancement (arterial-lesion enhancement time) and the time interval between onset of lesion enhancement and maximal lesion enhancement (maximal lesion enhancement time) were measured. The diagnosis of peripheral vascular malformations was based on those of angiography or venography.

RESULT: The time-signal intensity curves with each type of vascular malformations on dynamic contrast-enhanced MR imaging are illustrated in Figure 1. Three of six high-flow vascular malformations showed flow voids on conventional MR imaging. All of the venous malformations did not show flow voids. The mean arterial-lesion enhancement time of high-flow vascular malformations (Figure 2) was 3.3 sec (0-5 sec). The mean arterial-lesion enhancement time of low-flow vascular malformations was 8.8 sec (0-20 sec). The mean arterial-lesion enhancement time of high-flow vascular malformations was significantly smaller than that of low-flow vascular malformations (Mann-Whitney; $P<0.05$). The mean maximal lesion enhancement time of high-flow vascular malformations (Figure 2) was 5.8 sec (5-10 sec). The mean maximal lesion enhancement time of low-flow vascular malformations was 88.4 sec (50-100 sec). The mean maximal lesion enhancement time of high-flow vascular malformations was significantly smaller than that of low-flow vascular malformations (Mann-Whitney; $P<0.01$).

The sensitivity of flow voids for differentiating high-flow and low-flow malformations was 50% (3/6), with specificity of 100% (10/10). Use of a threshold arterial-lesion enhancement time of 5 sec would result in a 100% (6/6) sensitivity and a 60% (6/10) specificity for differentiation of high-flow malformations from low-flow malformations. Use of a threshold maximal lesion enhancement time of 30 sec would result in a 100% (6/6) sensitivity and a 100% (10/10) specificity for differentiation of high-flow malformations from low-flow malformations.

CONCLUSION: Dynamic contrast-enhanced MR imaging is useful for distinguishing high-flow vascular malformations from low-flow vascular malformations.

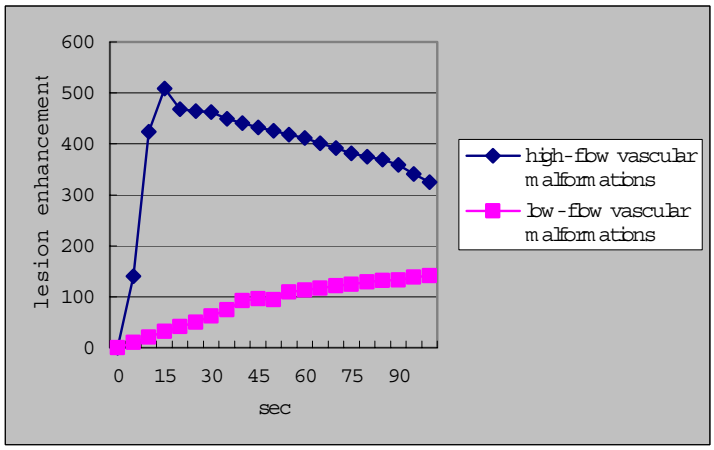
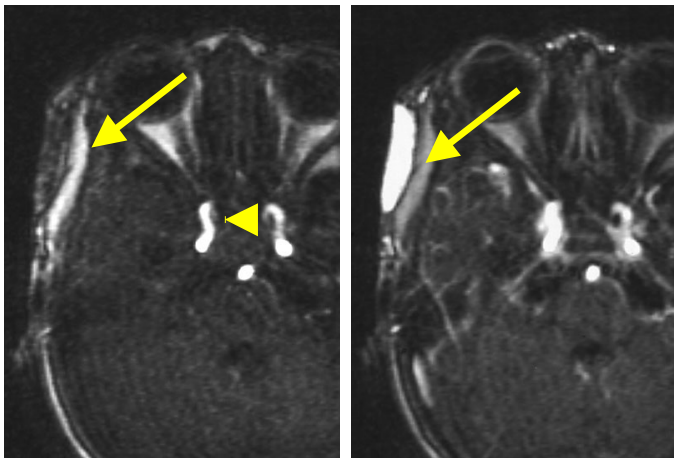


Figure 1. Graph shows changes in the mean lesion enhancement ratio with each type of vascular malformations on dynamic contrast-enhanced MR imaging.
The mean lesion enhancement ratio of high-flow vascular malformations increases rapidly and decreases gradually. The mean lesion enhancement ratio of low-flow vascular malformations increases gradually. Note. - lesion enhancement ratio = (contrast-enhancement signal intensity – unenhanced signal intensity)/unenhanced signal intensity ×100%.



(a) **(b)**

Figure 2. Two-year old boy with peripheral high-flow vascular malformation.
(a) Dynamic contrast-enhanced subtraction MR image shows start of arterial enhancement (arrowhead) and no lesion enhancement (arrow) after 15 sec from the start of IV bolus of gadopentetate dimeglumine.
(b) Dynamic contrast-enhanced subtraction MR image, obtained at the same level as (a) but 5 sec later, shows immediate and intense lesion enhancement (arrow).