

Goals and Objectives in the management of Brain Arteriovenous Malformations

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Decisions pertaining to endovascular treatment of [brain arteriovenous malformations](#) (BAVMs) require complete information with respect to the clinical circumstances and the imaging characteristics including the angioarchitecture of the AVM as well as the brain. With these factors in mind a clinico-morphological analysis can be made to formulate the best plan for therapy, which might include embolization as well as other modalities. The angioarchitecture of the AVM will determine both the approach to the lesion and the expected chances of reaching the therapeutic goal. The various treatment modalities and treatment skills available may change in time, whereas the original objective, as determined by clinical and angioarchitectural features, will likely remain the same.

Indications for Treatment of BAVMs

The discovery of a BAVM in a patient does not represent an automatic indication for treatment. Various attempts have been made to devise decision analysis programs to determine the risks of conservative vs. active treatment of BAVMs. All are based on the ability to deal with the lesion from a purely surgical viewpoint. They did not consider the role of embolization as a preoperative adjunct, a sole mode of treatment (when complete obliteration of the malformation is obtained with a permanent agent), or as part of a combination of treatments.

While some surgical investigators have started to realize that not all BAVMs carry the same risk for future hemorrhage the recommendation for management has continued to be the same. Obliterate (remove) the AVM and use a method that has the highest chance of accomplishing that in one setting: surgery. Limiting factors being surgical accessibility (AVM size, location, etc.), and therefore anticipated surgical morbidity and mortality associated with the treatment. Such strategy fails to act upon growing evidence in both surgical and endovascular literature that all BAVMs are not the same and do not carry a similar risk for future symptoms and therefore the risk of treatment should be less than the natural history of that particular lesion.

Targeted embolization is a viable, safe and effective means of therapy in appropriate circumstances. At the same time when building a rationale for management strategy based upon data from the literature one would realize that many of the reports are necessarily biased because of referral patterns. Although such data (hemorrhagic presentation rate, natural history, etc.) may very well support their recommendations for treatment strategy of their referred group of patients, it may not apply for a different (population based or other) referred group of BAVM patients. In addition when a treatment strategy is to be considered it should take into account the local expertise available (endovascular, neurosurgical and radiosurgery) as well as their treatment record of BAVM patients. Their treatment data should be known and compared to standards published and from time to time be reassessed.

An incidentally (during screening) discovered cortical micro BAVM in an older patient with HHT disorder does not have the same prognosis as a large thalamic AVM in a young patient presenting with progressive neurological deficit and therefore their management should be different. Yet the former can easily be cured with low morbidity and no mortality while the latter can only be partially embolized; treatment strategy should not be based on our capacity of achieving cure but rather on the post therapeutic clinical benefit expected over time and its related price in terms of risks.

We therefore recommend that in addition to the clinical information great care be given to the analysis of the imaging studies and in particular the angioarchitecture. The angiogram is performed with the aim of obtaining a complete study of the vascular system: the supply to the AVM, the angioarchitecture of the malformation, its venous drainage, associated or additional vascular lesions, the status of the collateral circulation and the venous drainage of the normal brain.

The information obtained by the angiographic investigation will play a key role in deciding the need for treatment. The latter will be based on the demonstration of evidence of weakness in the angioarchitecture, which may point to a potential instability. This information is then analyzed in conjunction with other factors such as the age of the patient and the location of the lesion.

The presence of an associated arterial aneurysm or pseudoaneurysm on the feeding pedicle, or in the nidus, venous thrombosis, outflow restriction, venous hyperpressure, venous pouches or dilatations, will all be factors favoring active intervention. But when the risk of total elimination of the malformation (by embolization, microsurgery, or combination of therapies), is prohibitive, then a different management strategy will need to be considered such as partial targeted embolization.

Patient Education and Follow-Up

An important part of the management of incidentally discovered BAVMs is to educate the patient. It is important to provide them with information regarding the natural history as it may apply to their particular situation, as well as the treatment options and associated risks that are known to exist in the local treatment environment. If no significant weaknesses are demonstrated in the angioarchitecture then a treatment strategy can be proposed to not treat the patient at this time, and to reassure the patient that he is expected to lead a normal productive life without restrictions. Yet the evolution is not linear and biological events may produce unexpected changes which may remain for a long time infra clinical. Follow up is therefore crucial in all the patients including of those for which a decision not to treat was chosen. Follow up is usually clinical and with imaging (MRI), but if clinical or imaging changes are noted then repeat angiography may be indicated.

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