Pediatric cerebral arteriovenous malformation treatment

The management of pediatric bAVMs is particularly challenging. In general, the treatment options are conservative treatment, microsurgery, endovascular therapy (EVT), gamma knife radiosurgery (GKRS), proton-beam stereotactic radiosurgery (PSRS), or a combination of the above.

In 2019 Meling et al., performed a systematic review, according to the PRISMA guidelines, with the result that none of the options seem to offer a clear advantage over the others when used alone. Microsurgery provides the highest obliteration rate, but has higher incidence of neurological complications. EVT may play a role when used as adjuvant therapy, but as a stand-alone therapy, the efficacy is low and the long-term side effects of radiation from the multiple sessions required in deep-seated pediatric bAVMs are still unknown. GKRS has a low risk of complication, but the obliteration rates still leave much to be desired. Finally, PSRS offers promising results with a more accurate radiation that avoids the surrounding tissue, but data is limited due to its recent introduction. Overall, a multi-modal approach, or even an active surveillance, might be the most suitable when facing deep-seated bAVM, considering the difficulty of their management and the high risk of complications in the pediatric population [1)].

In 2016 El-Ghanem et al., published a Review of the Existing Literature:

Microsurgical resection remains the gold standard for the treatment of all accessible pediatric AVMs. Embolization and radiosurgery should be considered as an adjunctive therapy. Embolization provides a useful adjunct therapy to microsurgery by preventing significant blood loss and to radiosurgery by decreasing the volume of the AVM. Radiosurgery has been described to provide an alternative treatment approach in certain circumstances either as a primary or adjuvant therapy [2)].

Stereotactic Radiosurgery

A systematic literature review was performed to identify studies that reported the outcomes of SRS for AVMs in pediatric patients. Data pertaining to variables such as obliteration rate, post-SRS new hemorrhage rate, post-SRS new neurological deficit rate, and mortality rate were extracted and analyzed using meta-analysis techniques.

Based on pooled data from 20 studies with 1212 patients, single-session SRS resulted in complete obliteration in 65.9% (95% confidence interval [CI], 60.5%-71.1%; I2 = 66.5%) patients. Overall complication rate (including new hemorrhage, new neurodeficit, and mortality) was 8.0% (95% CI, 5.1%-11.5%; I2 = 66.4%). Post-SRS new neurological deficit rate was 3.1% (95% CI, 1.3%-5.4%; I2 = 59.7%), and post-SRS hemorrhage rate was 4.2% (95% CI, 2.5%-6.3%; I2 = 42.7%). There was no significant difference between studies disaggregated by treatment method (Gamma Knife [Elekta AB] vs other), treatment year (before year 2000 vs after year 2000), median AVM volume reported (≥3 vs <3 cm3), median dose reported (≥20 vs <20 Gy), or follow-up period (≥36 vs <36 mo).

Single-SRS is a safe treatment alternative that achieves high obliteration rates and acceptable complication rates for AVMs in pediatric patients [3].

1)

Meling TR, Patet G. What is the best therapeutic approach to a pediatric patient with a deep-seated brain AVM? Neurosurg Rev. 2019 Apr 13. doi: 10.1007/s10143-019-01101-8. [Epub ahead of print] Review. PubMed PMID: 30980204.

2)

El-Ghanem M, Kass-Hout T, Kass-Hout O, Alderazi YJ, Amuluru K, Al-Mufti F, Prestigiacomo CJ, Gandhi CD. Arteriovenous Malformations in the Pediatric Population: Review of the Existing Literature. Interv Neurol. 2016 Sep;5(3-4):218-225. Epub 2016 Sep 1. Review. PubMed PMID: 27781052; PubMed Central PMCID: PMC5075815.

3)

Börcek AÖ, Çeltikçi E, Aksoğan Y, Rousseau MJ. Clinical Outcomes of Stereotactic Radiosurgery for Cerebral Arteriovenous Malformations in Pediatric Patients: Systematic Review and Meta-Analysis. Neurosurgery. 2019 Oct 1;85(4):E629-E640. doi: 10.1093/neuros/nyz146. PubMed PMID: 31131849.