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CASE REPORT

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Recurrence in a different location of a cerebral arteriovenous malformation in a child after radiosurgery

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Abstract The case of a 9-year-old girl with a right parietal arteriovenous malformation (AVM) of the brain obliterated after gamma knife (GK) radiosurgery with subsequent regrowth in a different site is reported. As far as we know, this is the first reported case of regrowth of an AVM in a different location after radiosurgery in a child. This situation has to be considered within the context of causes of unsuccessful treatment of AVMs with radiosurgery and justifies angiographic monitoring of pediatric patients until they reach adulthood.

Keywords Arteriovenous malformation · Recurrence · Radiosurgery · Childhood

Introduction

Radiosurgery with the gamma knife is a safe and effective procedure for the treatment of an arteriovenous malformation (AVM). In approximately 80% of patients obliteration is attained by this means, depending on different features such as volume, localization and angioarchitecture [1, 8, 10]. Recanalization of an AVM nidus after prior sterotactic radiosurgery, incomplete nidus recognition on angiography and radioresistance are factors associated with incomplete obliteration of AVM.

We describe the appearance of a new AVM nidus in a pediatric patient after obliteration of a previous AVM in the periphery following radiosurgery with the gamma knife. In our opinion, this situation is a new cause that should be considered along with the factors already known to be associated with nonachievement of cure of AVM after radiosurgery, especially in the infant population.

Case report

A 9-year-old girl without previous illness was admitted to the hospital because of sudden epileptic seizures. Her neurological examination on admission was normal. A CT scan and MRI showed a right parietal lesion. Angiography demonstrated an AVM located on the right parietal convexity and fed by branches of the right middle cerebral artery, with venous drainage through superficial convexity veins to the superior sagittal sinus (Fig. 1).

First radiosurgical procedure

On 18 February 1994 the patient was treated using a 201-source cobalt-60 gamma knife type B (Elekta Instruments, Stockholm, Sweden). The treatment isodose, the dose to the AVM margin, and the maximum dose were jointly determined by a medical physicist, a radiation oncologist and a neurosurgeon. The volume assumed for calculation of the treatment isodose was 2.7 ml. Two isocenters were used, the maximum dose was 33.3 Gy, the nidus of the AVM was exposed to a 25-Gy dose at 75%. The patient was followed up by neurological examination and MRI every 6 months. Two years later, the AVM treated appeared to be occluded on MRI, but there were signs suggestive of another AVM. An angiography was performed and confirmed occlusion of the original AVM, but a new malformation was observed. This new AVM was also fed by branches of the right middle cerebral artery; it had a deeper and more medial location than the previous AVM and extended to the lateral ventricle (Fig. 2).

Second radiosurgical procedure

On 16 1996 April a new treatment with radiosurgery was performed. The volume used as a basis for the treatment isodose at the time was 4.5 ml. The maximum dose was 38 Gy, and the dose to the AVM margin was 19 Gy at 50%; six isocenters were used in that occasion. Nine months later, the patient suffered headache and epileptic seizures, and edema was observed surrounding the region

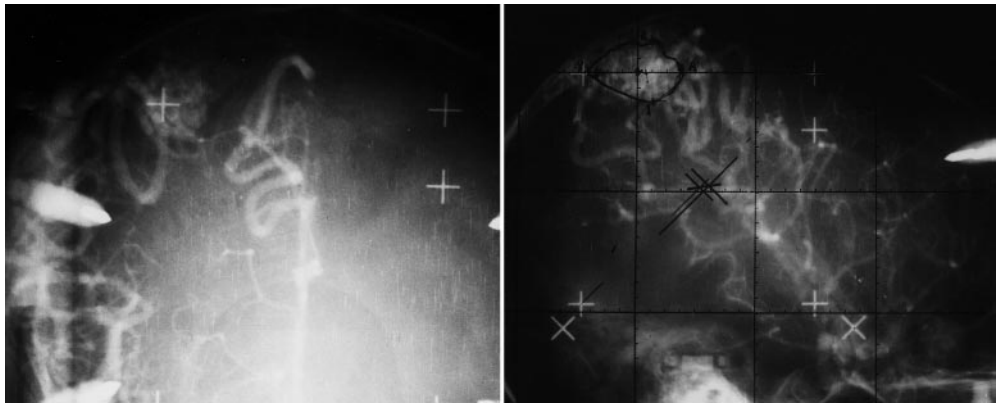

Fig. 1 Anteroposterior (*left*) and lateral (*right*) right internal carotid stereotactic angiogram demonstrating the parietal arteriovenous malformation (AVM)

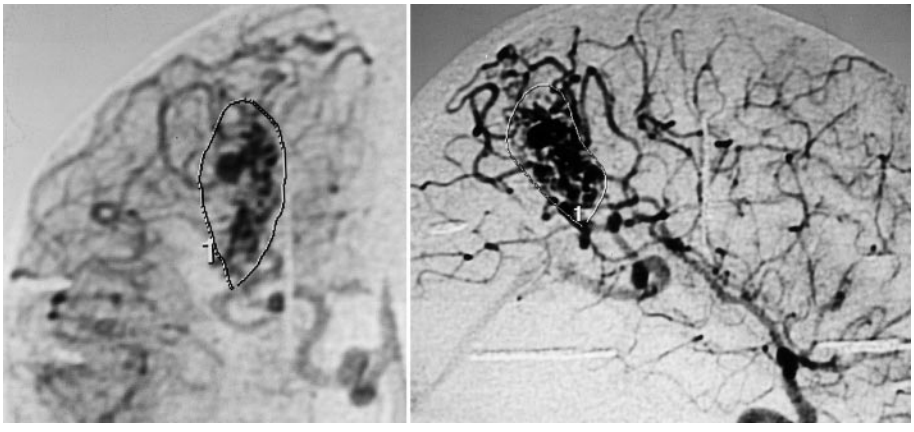

Fig. 2 Anteroposterior (*left*) and lateral (*right*) right internal carotid stereotactic angiogram after radiosurgery confirming obliteration of first nidus and showing another AVM located medial to the first

treated. For this reason steroids were added to the anticonvulsive therapy and she improved.

The patient still takes anticonvulsive therapy, but she has remained symptom free during the last year and the latest MRI shows no sign of AVM. An angiography will be done in 1 year.

Discussion

Stereotactic radiosurgery is an effective therapy for selected AVMs. Current reports on AVM series treated radiosurgically give obliteration rates of 70–95% after 3 years of follow-up or more [3, 4, 11]. It is generally accepted that angiography is the procedure of choice to evaluate AVMs obliteration in adults [5]. Kader et al. [6] have reported recurrence of AVMs in children after successful surgery followed by angiographic evidence of obliteration, and Kondziolka et al. [7] have reported another two cases.

Regrowth of childhood AVMs may be related to the development of an original abnormal vasculature; it has been postulated that an AVM arises from a fistula between a primitive artery and a large vein overlying the developing cerebral cortex [2, 9]. The reduced resistance to blood flow in such fistulas may cause the abnormal arteries to dilate. Immature vessels left in the surgical bed may be angiographically invisible while still retaining the ability to regrow and form a new AVM in the same location. Recanalization of thrombosed vessels, which can occur after radiosurgery or embolization, may also play a part in the local regrowth of AVM [4]. In our patient, the AVM regrowth in the periphery of the previous malformation occurred after radiosurgery without preoperative embolization. We consider that the redistribution of blood flow after progressive occlusion of the AVM may act by way of immature vessels surrounding the malformation giving rise to another AVM.

This is the first case of a pediatric patient reported to have been treated solely by radiosurgery with regrowth of an AVM in the periphery. Repeat angiography at the beginning of adult life has to be considered for successful and consistent exclusion of any recurrence of AVMs successfully treated by radiosurgery in pediatric patients.

References

1. Colombo F, Pozza F, Chierego G, Casentini L, De Luca G, Francescon P (1994) Linear accelerator radiosurgery of cerebral arteriovenous malformations: an update. Neurosurgery 34:14–21
2. Drake CG (1979) Cerebral arteriovenous malformations: considerations for and experience with surgical treatment in 166 cases. Clin Neurosurg 26:145–208
3. Friedman WA, Bova FJ, Mendenhall WM (1995) Linear accelerator radiosurgery for arteriovenous malformations: the relationship of size to outcome. J Neurosurg 82:180–189
4. Gallina P, Merienne L, Meder JF, Schlienger M, Lefkopoulos D, Merland JJ (1998) Failure in radiosurgery treatment of cerebral arteriovenous malformations. Neurosurgery 42:996–1004
5. Jomin M, Lesoin F, Lozes G (1985) Prognosis for arteriovenous malformations of the brain in adults based on 150 cases. Surg Neurol 23:362–366
6. Kader A, Goodrich JT, Sonstein WJ, Stein BM, Carmel PW, Michelsen WJ (1996) Recurrent cerebral arteriovenous malformations after negative postoperative angiograms. J Neurosurg 85:14–18
7. Kondziolka D, Humphreys RP, Hoffman HJ, Hendrick EB, Drake JM (1992) Arteriovenous malformations of the brain in children: a forty-year experience. Can J Neurol Sci 19:40–45
8. Lunsford LD, Kondziolka D, Flickinger JC, Bissonette DJ, Jungreis CA, Maitz AH, Horton JA, Coffey RJ (1991) Stereotactic radiosurgery for arteriovenous malformations of the brain. J Neurosurg 75:512–524
9. Padget DH (1956) The cranial venous system in man in reference to development, adult configuration, and relation to the arteries. Am J Anat 98:307–355
10. Steiner L, Lindquist C, Adler JR, Torner JC, Alves W, Steiner M (1992) Clinical outcome of radiosurgery for cerebral arteriovenous malformations. J Neurosurg 77:1–8
11. Yamamoto Y, Coffey RJ, Nichols DA, Shaw EG (1995) Interim report on the radiosurgical treatment of cerebral arteriovenous malformations. The influence of size, dose, time, and technical factors on obliteration rate. J Neurosurg 83:832–837