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Endovascular treatment of a ruptured radiation-induced aneurysm in a patient previously treated by Yttrium-90 brachytherapy

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Introduction

The injury to intracranial arteries is a possible complication of external radiation therapy with development of secondary Moyamoya syndrome (1, 2, 3, 4, 5). Radiation-induced arterial injury may result in aneurysm formation (6, 7), as described on internal carotid artery (ICA) (8), however there are no reports on patients developing posterior circulation aneurysms after brachytherapy for sellar tumors. We report a patient who had subarachnoid hemorrhage from the rupture of left posterior cerebral artery (PCA) aneurysm 21 years after the treatment of craniopharyngioma by intrasellar placement of Yttrium-90 isotope.

Case report

23-year old female patient was admitted to our institution for angiographic evaluation and endovascular treatment of a ruptured left PCA aneurysm. The patient had previous surgeries for craniopharyngioma at the age of 9 and 18 months, and at the age of 2 years Yttrium-90 was stereotactically placed in the tumor region. After the treatment she gradually developed visual deficit and in the further course of the disease epilepsy and spastic tetraparesis.

4 weeks before the admittance to our institution she lost consciousness and was transported to the emergency service of a county hospital where a head CT scan showed acute left thalamo-mesencephalic hematoma with intraventricular and subarachnoid hemorrhage. The large tumor with hypertrophic calcifications occupied sellar and suprasellar region. CT angiography revealed a small fusiform aneurysm of left PCA. After several complications including aspiration pneumonia, and after ventriculostomy for hydrocephalus, the patient gradually stabilized and was transferred to our institution for endovascular treatment of the aneurysm.

Endovascular treatment

After right femoral puncture, 4-vessel cerebral angiography revealed bilateral occlusions of ICAs at the level of ophtalmic segments. Collateral network of both external carotid arteries was revascularizing the brain mainly through ophtalmic and middle meningeal arteries. Hypertrophic dural arteries originating from C4 segments of both ICAs were partly revascularizing middle cerebral arteries. An irregular fusiform aneurysm, 5 mm in size, originated from P1/P2 junction of left PCA, with irregular stenotic lesions of P1 segment on the left side and P2 segments of both PCAs, with diminished distal flow (Fig. 1A, B, C).

Microcatheter (Tracker Excel-14; Boston Scientific, Natick, MA, USA) with the use of 0,008 inch guidewire (Steel; BALT Extrusion, Montmorency, France) was then placed through 6 French guiding catheter (Guider Softip, Boston Scientific, Natick, MA, USA) in P1 segment of the left PCA, just proximal to the aneurysm. This thin microguidewire was used in order not to perforate the narrow, irregular and presumably vulnerable lumen of the PCA proximal to the aneurysm. However, this approach did not allow for safe distal passage of the guidewire to microcatheterize the vessel for other therapeutic option, so we decided to occlude the artery proximal to the aneurysm. Through the microcatheter we slowly injected 0,3 ml of Glubran 2 (GEM Srl, Viareggio, Italy) in a 60% mixture with Lipiodol (Guerbet, Aulnay-sous-Bois, France), with occlusion of artery and the aneurysm (Figure 1 D). Proximal P1 segment of PCA was preserved. The artery occlusion was well tolerated by the patient, and her postprocedural course was uneventful.

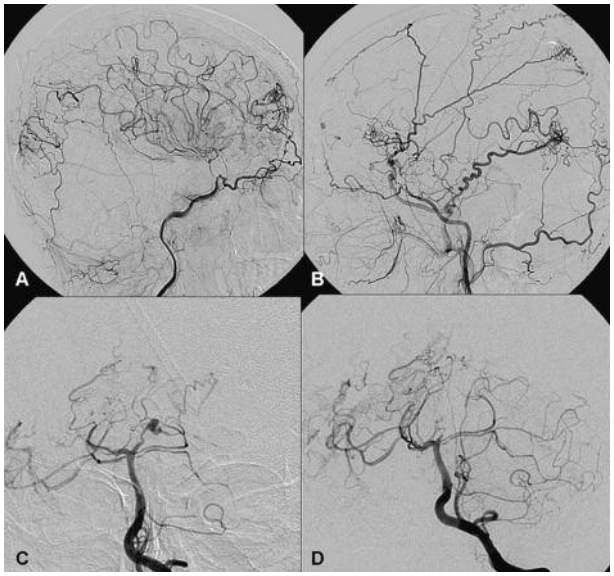

FIG. 1. Digital subtraction angiography images.
A and B: Right and left carotid artery injections display ICA occlusions just distal to the origin of ophtalmic arteries with collateralization of intracranial flow through ophtalmic, middle meningeal and occipital arteries.
C: Irregular aneurysm of P1/P2 junction of left PCA with kinks and stenotic portions of both PCAs and diminished distal flow.
D: Post-embolization angiogram shows occlusion of left PCA and the aneurysm.

Discussion

Occlusion of large intracranial arteries and prominent collateral revascularization network has been described in patients who underwent previous cranial radiation therapy, both external and internal (2, 3, 4, 9, 10, 11). The occurrence of radiation-induced aneurysms is rare, and they are reported exclusively at ICAs and after external radiation therapy, rarely after brachytherapy (3, 7, 8, 12, 13).

We present a rare case of a 23-year old patient who presented with acute subarachnoid hemorrhage due to the rupture of posterior cerebral artery aneurysm, 21 years after intratumoral radiation treatment of craniopharyngioma. Regarding the relatively uncommon location of the aneurysm, irregularities of PCA lumen and the aneurysm shape, it is our opinion that both the arteritis and the aneurysm were attributed to the brachytherapy.

To our knowledge, this is the first reported patient with an aneurysm in posterior circulation after intrasellar radiation treatment.

Post-irradiation injury of arterial wall is usually limited to 3-4 millimeter wide zone around the Yttrium implants, sparing the lateral wall of cavernous segments of ICAs (9), while the site of the aneurysm in our patient was somewhat more distant. Large vessel injury is considered a less often encountered complication of radiation therapy than damage to small caliber arteries and capillary network (2, 3). Since the PCA is a significantly smaller artery than cavernous ICA, it may be more vulnerable to radiation treatment; therefore a small difference in the proximity of these arteries to the radioactive material may be negligible. Aneurysms at this site may be associated with other conditions, such as dissection and other vascular anomalies (14, 15). We also cannot exclude the relation of the aneurysm to the increased flow in posterior circulation as a result of ICA occlusions.

This case highlights the risk of aneurysm development and rupture after sellar/parasellar intratumoral radiation, not only at ICAs, but also in other locations. The unfavorable morphology of such aneurysms may demand an aggressive treatment such as parent artery occlusion, which was safely achieved by endovascular glue. Such an approach holds a risk of migration of embolic material, compared to coils or a detachable balloon which may provide better operator control. It is especially required in patients with Moyamoya disease and extensive collaterals. Nevertheless, in tortuous arteries with radiation injury, aggressive attempts to achieve microcatheterisation of the aneurysm may pose a significant risk to perforation of the artery. Cautious artery occlusion by endovascular glue may then be the only available option to occlude a ruptured aneurysm.

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