

## Association between intracranial meningiomas and aneurysms: Is it a coincidence?

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**Abstract:** Intracranial aneurysms and meningiomas are rarely associated. We review the concerned literature, and report a patient operated for an anterior communicating artery aneurysm, found at surgery to harbour a small ipsilateral meningioma at the lesser wing of the sphenoid. We also review the proposed causes of such an association. Factors related to the meningioma are usually thought to be behind the development of associated aneurysms. Considering the size of the meningioma in our patient, we believe that both lesions form concomitantly under the effect of certain genetic or systemic factors, influenced by local circulatory changes. These factors are to be determined with more basic science research. (p87-91)

**Key words:** Meningioma, intracranial aneurysm and subarachnoid haemorrhage

### Introduction

Association between an intracranial aneurysm and a meningioma is a rare occurrence. There have been several hypothesis on the cause of such an association, but none seem satisfactory.

We report a patient with an anterior communicating artery aneurysm, who presented with subarachnoid haemorrhage and found at surgery to have an associated small meningioma, not seen on preoperative imaging.

We review the reported cases in the literature and discuss the clinical spectrum of this association along with its possible causes and treatment.

### Case Report

**History and physical examination:** A 47-year-old female

complaining of headaches that had started suddenly five days prior to presentation. There was no loss of consciousness, but photophobia and vomiting. Aside from moderate neck rigidity, her neurological examination was unremarkable. She was admitted for further investigation.

**Radiological findings:** A non-contrast enhanced MRI showed a gyrus rectus haematoma on the right side along with hyperintense sulci on the flair images indicating a meningeal process, most likely subarachnoid haemorrhage (Fig. 1). A four vessel angiogram demonstrated an 8 mm anterior communicating artery aneurysm, pointing to the right side and associated with moderate spasm of the anterior cerebral arteries (Fig. 2). The left A1 vessel was dominant.

**Management:** Endovascular coiling of the aneurysm was attempted, but failed due to the sharp angles of the anterior circulation. A left pterional craniotomy was performed one week later to clip the aneurysm. During dissection and exposure, a small 2-3 mm fleshy mass was seen at the dural reflection on the lesser wing of the sphenoid, overlying the left optic nerve and just lateral to the tuberculum sellae. The aneurysm was exposed and then clipped, the small mass removed and sent to pathology. Pathological examination revealed a meningotheliomatous meningioma, with cells arranged in a whorly pattern and psammoma bodies (Fig. 3). There were no malignant features. The patient did well and was later discharged. Retrospective review of the MRI could not demonstrate the small meningioma.

### Discussion

The association between brain tumours and intracranial

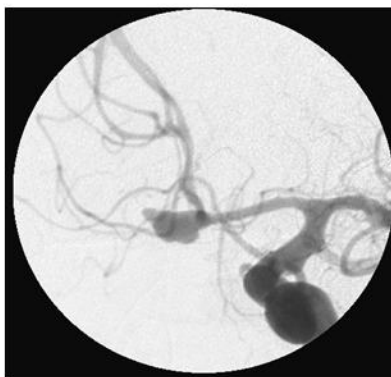
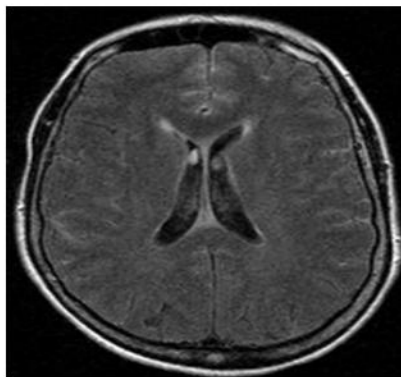
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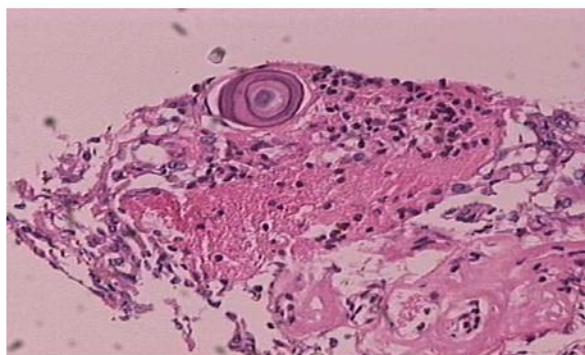
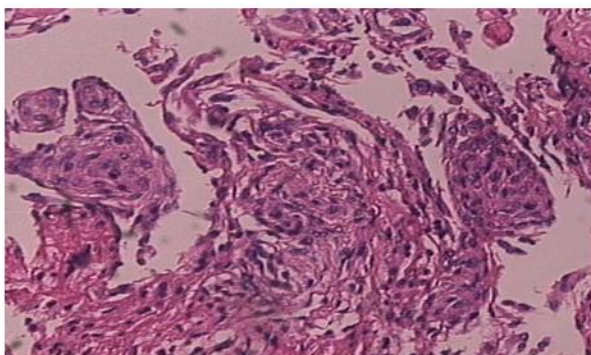
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**Figure 1** - Axial flair MRI image of the brain showing hyperintense sulci and indicating a meningeal process (subarachnoid haemorrhage)

**Figure 2** - Oblique view of the left internal carotid on angiography showing an 8 mm anterior communicating artery aneurysm pointing to the right



**Figures 3a and b** - H&E stain slide of the small mass showing a meningotheliomatous meningioma with cells arranged in a whorly pattern and psammoma bodies

aneurysms is a known but rare entity.<sup>3</sup> The most common associated intracranial tumour is meningioma. The earliest reported was that of Arieti in 1944, where an aneurysm was reportedly associated with multiple meningiomata.<sup>1</sup> After cases reported by Miller & Newell, Taylor reviewed 9 cases of aneurysms associated with various tumours and reported one patient where delayed postoperative haemorrhage occurred after resection of a middle fossa meningioma.<sup>15</sup> Two ipsilateral saccular aneurysms were demonstrated on post mortem examination and it was suggested that decompressive tumour surgery might accelerate some of the pathological processes involved in aneurysmal dilation and later bleeding.<sup>15</sup> Raskind then reported an intracranial aneurysm associated with a recurrent meningioma, arising from a vessel not visualised at first surgery.<sup>10</sup> Later, Levin et al reviewed the literature on the subject and added two cases in 1966.<sup>6</sup> Several reports followed, and a more extensive review was performed by Pia, et al in 1972, though the most comprehensive review was that by Scamoni, et al in 1997.<sup>8,11</sup> Spallone, et al reported the simultaneous occurrence of an aneurysm and multiple meningiomata in a Klippel-Trenaunay patient and in 1998, Tancioni, et al published the first report of an intra-tumoural aneurysm associated with a meningioma.<sup>12,14</sup> Thus, a total of 95

cases, including our case, are reported in the literature on the association of aneurysms and meningiomas. However, no agreement exists on the cause of such an association. The reported cases are summarised in Table 1.<sup>1-15</sup>

Most of the patients presented with symptoms related to the tumour rather than the aneurysm (74/95 patients, 78%). Those presenting with aneurysmal symptoms were around 22%, with few presenting with both. The patient age range was from 7 - 75 years, with a mean of 50.3 years. The sex prevalence, as expected in meningiomas, was for females (3:1). The aneurysm was located on the same side in 89% and on the opposite side in 10.8%. This high frequency of ipsilateral lesions has been reported in all series.<sup>2,5,8,14,15</sup> This may be due to the unilateral angiography usually performed in lateral brain tumours. Panangiography was recommended by some authors.<sup>2,6,9</sup>

Although the most common meningiomas were convexity tumours, and most common aneurysms were ACoA aneurysms, MCA aneurysms are felt by several authors to be more associated with convexity meningiomas, whereas in basal meningiomas there is a predominance of ICA and ACoA aneurysms.<sup>3,5,7,8</sup> In the cases reviewed, 11 patients with convexity meningiomas had MCA aneurysms,

Table 1 - Summary of the reported cases of the association between cerebral artery aneurysms and meningiomas

Author	Age	Sex	Presentation	Tumour	Aneurysm
Arieti, 1944	49	M	T	Multiple	L MCA
Miller, 1948	38	F	A	R	R ICA
Newell, 1958	57	M	T	Tuberculum sellae	L ICA
Taylor, 1961	38	F	T	L Temporal	L PCoA+BA
	NA	NA	A	R Parasagittal	Bil MCA
Stenvers, 1962	NA	NA	NA	L Parietal	L PCoA
Love, 1963	48	F	A	R Sphenoid ridge	R ICA, 3
Czernobilsky, 1965	66	F	A	L Parietal	R ICA
Pecker, 1965	57	F	T	Olfactory groove	ACoA
Raskind, 1965	44	M	T	L Frontal	L ACA
Levin, 1966	51	M	T	R Frontal	ACoA
	67	F	T	L Sylvian	L MCA
Jimenez, 1971	28	F	T	R Multiple	R ICA
	44	M	T	L Multiple	L ICA
Arutiunov, 1972	35	NA	T	Sphenoid ridge	L ICA-Opth
	30	NA	T+A	Olfactory groove	ICA
Boldrey, 1972	42	NA	T	R Sphenoid ridge	R ICA
Dickmann, 1972	NA	F	T	R Cerebellar	R ICA
Frowein, 1972	55	F	T	L Frontal	L ICA
Gillingham, 1972	54	NA	A	Frontal	R MCA+BA
Kraus, 1972	49	NA	T	3 <sup>rd</sup> Ventricle	ACA
	49	NA	A	Temporal	MCA
Kristiansen, 1972	60	NA	T	Occipito-temporal	MCA
Lanigan, 1972	46	NA	A	Sphenoid ridge	L MCA
Lougheed, 1972	37	F	T	R Sphenoid ridge	R ICA
	63	F	NA	R Rolandic	ACoA
	48	F	A	L Frontal	L PCoA
	56	F	A	L Frontal	L MCA+ACA
	42	M	A	L Sphenoid ridge	L PCoA
MacCarty, 1972	65	F	T	L Sylvian	L MCA
Nordenbos, 1972	44	NA	T	Parietal	ACA
Obrador, 1972	67	F	T	L Sphenoid ridge	L MCA
Pampus, 1972	55	F	T	Suprasellar	LMCA
Romanodov, 1972	30	NA	T	R Sphenoid ridge	R MCA
Strohmeir, 1972	55	F	T	R Frontal	ACA
Voris, 1972	35	F	T	R Frontal	L MCA
Welch, 1972	NA	NA	T	NA	ICA
Arseni, 1973	30	M	T	L Sphenoid ridge	BA
	37	M	T	L Olfactory groove	ACoA
Scarfò, 1976	61	F	T	Olfactory groove	L ICA-Opth
Handa, 1976	39	F	A	R Frontal	Multiple
Fukawa, 1977	36	M	T	R Parasagittal	L ICA+AVM
Probst, 1980	30	M	T	Tentorium	R TOA, 2
Czochra, 1980	39	F	T	R Sphenoid ridge	R MCA
Nishijima, 1980	21	M	T	L Parieto-occipital	L MCA
Nakao, 1981	67	F	T	Frontal basal	R Multiple
Okamura, 1981	33	F	T	Falx	R Multiple
	54	F	T	L Frontal	L PCoA+R ICA
	35	F	T	Olfactory groove	R ICA-Opth
	65	F	A	Tuberculum sellae	L PCoA
Sanz, 1982	59	M	T	R Frontal	R MCA
	75	F	T	R Sphenoid ridge	R ICA
Ishibashi, 1984	62	F	T	Olfactory groove	ACoA
Punto, 1984	26	F	T	Multiple	L MCA
Yazargil, 1984	63	F	T	R Convexity	R PCoA
	55	F	T	R Sphenoid wing	R MCA
	45	F	T	L Frontal	L ICA+Opth
	57	F	T	L Sphenopet.cliv.	L ICA
	66	F	T	R Sphenopet.cliv.	L ACoA
	47	F	A	L Parietal	L MCA
Takahashi, 1985	60	F	A	L Parietal	L ICA+PCA
	47	F	T	R Sphenoid ridge	R MCA
Tokuda, 1985	73	F	T+A	L Occipital	L MCA+BA
Kandel, 1986	7	F	T	L Frontotemporal	L MCA
Licata, 1986	60	M	A	Parietofrontal	ACoA
	52	F	A	Parietofrontal	ACoA

	52	F	A	Parietofrontal	ACoA
	67	F	A	L Frontal	ACoA
	71	F	A	L Frontal	Multiple
	62	F	T	L Sphenoid ridge	L ICA
	44	F	T	L Occipital + L Temporoparietal	L ICA
	68	M	T	Tuberculum sellae	R ICA
Plangger, 1986	53	F	T	Olfactory groove	L Peric.
Bloomgarden, 1987	65	F	T	L Cavernous sinus	L ICA
Seo, 1987	56	F	T	R Frontoparietal	R ICA-PCoA
Yokoi, 1987	50	M	T	L Occipital	RA2+BA+ L AVM
Bazowsky, 1989	49	F	T	L Sphenoid ridge	L MCA
Serova, 1989	NA	F	T	Multiple	RICA-Opth
Delfini, 1990	61	F	T	Olfactory groove	L ICA-Opth
	53	F	T	Olfactory groove	L ICA-Opth
	68	F	T	R Frontotemporal	RICA-Opth
Landau, 1990	59	M	T+A	Ophthalmic nerve	R ICA
Edner, 1991	44	F	A	L CPA	L+R MCA
Shigemori, 1991	49	M	T	L Frontal	L MCA
Simoës, 1991	56	F	T	Olfactory groove	ACoA
Maiuri, 1992	37	F	T	Olfactory groove	Multiple
Preul, 1992	72	M	T	Olfactory groove	Multiple
Iwanowski, 1994	33	F	NA	R CPA	L PICA
Stevenson, 1994	48	M	T	Multiple	Multiple
Wei, 1994	33	F	T	Sphenoid ridge	MCA
Spallone, 1995	28	F	T	R ICA- cav	Multiple
Scamoni, 1996	67	F	T	Olfactory groove	LICA-PCoA
	50	F	T	L Petroclival	LICA-Opth
Dolenc, 1998	50	M	T+A	Tuberculum sellae	ACoA
Tancioni, 1998	48	F	T	L Temporal	R+L MCA
Najjar, et al(current)	47	F	A	L Sphenoid wing	ACoA

whereas 8 had ICA aneurysms and 3 ACA aneurysms. All olfactory groove and tuberculum sellae meningiomas were associated with ACoA and ICA aneurysms. Sphenoid ridge meningiomas were mostly associated with MCA and ICA aneurysms.

As for the cause for such as association, some authors believe that the development of an aneurysm may be related to increased regional blood flow influenced by the tumour, supported by the observation that most of the associations were ipsilateral.<sup>8,11,14</sup> A local circulatory change due to the presence of the tumour is also suggested.<sup>8,11</sup> This theory may account to the formation of aneurysms in several of the cases reported, but does not offer an explanation in our case, where the tumour is too small to effect an increase in regional blood flow.

A genetic link is suggested by some authors, whereas other authors believe that aneurysm development is influenced by certain hormonal or systemic factors.<sup>11,13</sup> Others believe that this condition may be due to chance alone.<sup>1,14</sup> Most authors, however, describe the affiliation in the context of the meningioma causing the aneurysm. It seems in our patient that the meningioma occurred after the formation of the aneurysm, or they may have formed together. This points to a common pathophysiological cause or the fact that it might be pure

coincidence. The proximity of the lesions, and their ipsilaterality argue against chance and for possible local circulatory factors.

### Conclusion

Meningiomas associated with aneurysms is a known but rare occurrence. It has been usual to consider that factors related to meningiomas may cause the development of the associated aneurysms. We think that certain genetic or systemic factors account for the formation of both pathologies concomitantly, influenced by certain local circulatory changes. Such factors are still to be determined and studied with more basic research.

### References

1. Arieti S: Multiple meningioma and meningiomas associated with other brain tumours. *Neuropathol Exp Neurol* 1944, 3: 255-270
2. Delfini R, Domenicucci M, Ferrari M: Association of intracranial meningiomas and aneurysms. Report of three cases and review of the literature. *J Neurosurg Sci* 1990, 34: 51-56
3. Dolenc VV, Pregelj R, Slokan S, Škrbec M: Anterior communicating aneurysm associated with tuberculum sellae meningioma. *Neurol Med Chir (Tokyo)* 1998, 38: 485-488
4. Edner G: One-session operation via bilateral craniotomies for multiple aneurysms after subarachnoid haemorrhage. *Br J Neurosurg* 1991, 5: 55-60
5. Handa J, Matsud I, Handa I: Association of brain tumors and intracranial aneurysms. *Surg Neurol* 1978, 8: 25-29
6. Levin P, Gross LV: Meningioma and aneurysm in the same patient. *Arch Neurol* 1966, 15: 629-632
7. Maiuri F, Iaconetta G, Gallicchio B, Sirabella G, Tecame S: Olfactory groove meningioma and multiple aneurysms. *Acta Neurol (Napoli)*

- 1992, 14: 1-5
8. Pia HW, Obrador S, Martin JG: Association between brain tumours and arterial intracranial aneurysms. *Acta Neurochir* 1972, 27: 189-204
  9. Preul M, Tampieri D, Leblanc R: Giant aneurysm of the distal anterior cerebral artery: associated with an anterior communicating artery aneurysm and a dural arteriovenous fistula. *Surg Neurol* 1992, 38: 347-352
  10. Raskind R: An intracranial arterial aneurysm associated with a recurrent meningioma. *J Neurosurg* 1965, 23: 622-625
  11. Scamoni C, Dorizzi A, Dario A, Marra A, Pozzi M: Intracranial meningioma associated with cerebral artery aneurysm. Report of two cases and review of the literature. *J Neurosurg Sci* 1997, 41: 273-281
  12. Spallone A, Tcherekayev V: Simultaneous occurrence of aneurysm and multiple meningioma in Klippel-Trenaunay patients. *Surg Neurol* 1996, 45: 241-244
  13. Stevenson JC, Choksey MS, McMahon J, Crawford PJ: Multiple cerebral aneurysms, multiple meningiomas and multiple subcutaneous angioliipomas. *Br J Neurosurg* 1994, 8: 477-481
  14. Tancioni F, Egitto MG, Tartara F: Aneurysm occurring within a meningioma. *Br J Neurosurg* 1998, 12: 588-591
  15. Taylor P: Delayed postoperative hemorrhage from intracranial aneurysm after craniotomy for tumour. *Neurol* 1961, 11: 225-231

## GENTLE REMINDER

### Involvement of the cranial nerves at the base of the brain with meningiomas at different sites in the skull base

