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CASE REPORT - BRAIN TUMORS

Surgical treatment of a gauzoma with associated obliterative arteriopathy and review of the literature

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Abstract

We report a case of a 50-year-old woman whose 0.5 mm middle cerebral artery (MCA) aneurysm was treated with gauze wrapping at an outside facility. She returned 9 months later with seizures and an inflammatory process in the region of the prior aneurysm. Surgical re-exploration at that time was aborted. Two years later, she presented with a gauzoma associated with local inflammatory response and severe narrowing of the MCA. A common carotid artery to MCA bypass was performed, followed by surgical removal of the gauze and inflammatory material. Over a 3-month period, she recovered with significant improvement in her preoperative neurological deficits.

Keywords Intracranial aneurysm · Microsurgical wrapping · Gauzoma · Extracranial-intracranial bypass

Abbreviations

MCA	middle cerebral artery
PCommA	left posterior communicating artery
MRI	magnetic resonance imaging
STA	superior temporal artery
CCA	common carotid artery
CT	computed tomography
FLAIR	fluid-attenuated inversion recovery
ICA	internal carotid artery

Aneurysms that are not amenable to endovascular treatment or surgical clipping because of their broad bases can be treated by microsurgical muslin- or gauze wrapping or combined clip-wrapping as an alternative to parent artery sacrifice or aneurysmectomy with relatively good outcomes [15, 10]. However, muslin- or gauze wrapping can induce a local inflammatory response, which, in severe cases, may result in reactive changes in adjacent tissues with clinical manifestations [4, 5]. We report a case of a gauzoma with secondary edema and severe narrowing of the MCA that was successfully managed with extracranial-intracranial bypass and foreign body removal. A literature review of cases of adverse reactions to gauze wrapping was completed as well.

Case report

In 2011, a 48-year-old woman presented to an outside facility with a 6-mm aneurysm on her left posterior communicating artery (PCommA) and a 0.5-mm aneurysm at the bifurcation of her left middle cerebral artery (MCA; see Fig. 1), both unruptured. Both aneurysms were repaired surgically; the PCommA aneurysm was clipped, while the MCA aneurysm was wrapped with surgical gauze.

Although the patient recovered from the surgery without immediate sequelae, 9 months following surgery, she began experiencing complex partial seizures. Magnetic resonance imaging (MRI) showed inflammation in the left temporal lobe, while magnetic resonance angiography showed decreased flow through the left MCA. The original surgeon performed surgical re-exploration, during which he found an encapsulated and scarred mass. Because of the extent of the scarring, he did not explore further within the scarred tissue and made no major intervention before closing.

In 2014, approximately 2 years following the second craniotomy, the patient presented to the National Brain Aneurysm Center with progressive neurological deficits,

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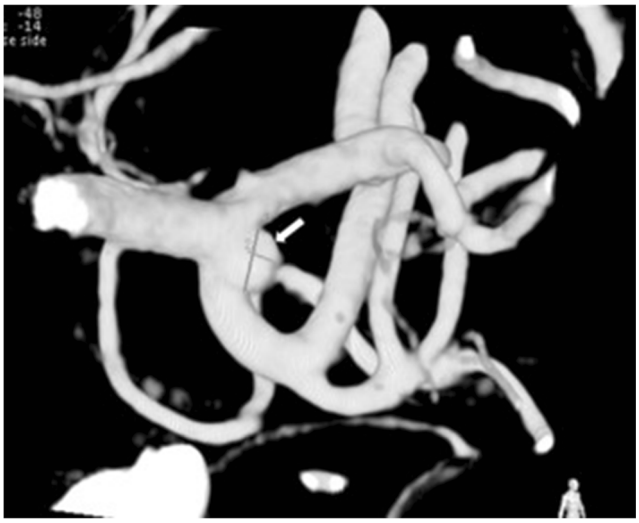

Fig. 1 Pre-operative 3D angiography of 0.5 mm left MCA bifurcation aneurysm (arrow)

including right side hemiparesis, speech trouble, and seizures. Repeat MRI demonstrated edema associated with a ring-enhancing mass that we identified as a gauzoma (Fig. 2). Catheter angiographic examination revealed near-complete occlusion of the M1 segment of the left MCA with multiple collateral channels, that had developed to partially reconstitute distal flow, were visible, consistent with Moyamoya disease (Figs. 2b and 3) [26]. Collateral flow from the anterior cerebral artery had also developed to partially reconstitute flow. The patient was started on dexamethasone at a dose of 4 mg every 6 h, which was tapered over 2 weeks to 2 mg every 8 h. This was then switched to a maintenance dose of prednisone for 6 weeks. This resulted in a reduction in inflammation on MRI, but the patient reported severe water retention and weight gain and began experiencing steroid-psychosis. Prednisone treatment was therefore discontinued, and a trial of azathioprine was undertaken. However, after 2 weeks, the patient reported that side effects continued at an intolerable level.

At this point, based on persistent symptoms of hemiparesis, dysphasia, and headache, and given the progressive inflammation and restriction of the MCA, we performed a long saphenous vein graft and exploratory surgery. The previous surgeon had sacrificed the patient's ipsilateral superior temporal artery (STA); therefore, we performed a long saphenous vein graft from the common carotid artery (CCA) to the MCA to ensure adequate distal blood flow before exploring the inflammatory tissue. We were concerned that during exploration and removal of the granuloma, we might interrupt the fine

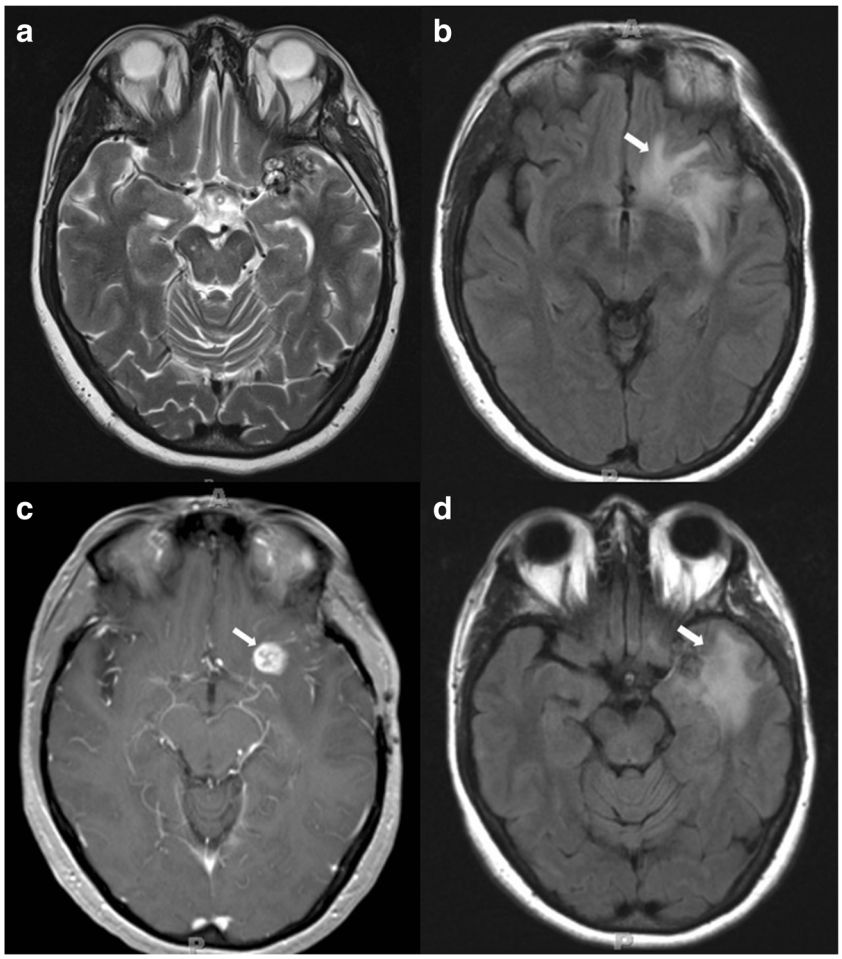

Fig. 2 **a** Axial T2-weighted MRI demonstrates heterogeneous signal in the region of the left MCA. There is apparent abrupt termination of the proximal M1 segment. There is apparent hemosiderin staining and a possibility of hypertrophy of small vessels in expected area of MCA trifurcation. **b** Axial Fluid-attenuated inversion recovery (FLAIR) MRI showing diffuse weight matter hyperintensity (arrow) compatible with vasogenic edema with some mass effect. The enhancing region is isointense to gray matter. **c** T1-weighted MRI with contrast showing evidence of prior craniotomy in left temple region with pronounced focal area of enhancement (arrow) in inferior frontal lobe. **d** Inferior FLAIR MRI at the level of the insula showing vasogenic edema (arrow) in the anterior temporal white matter with some mass effect

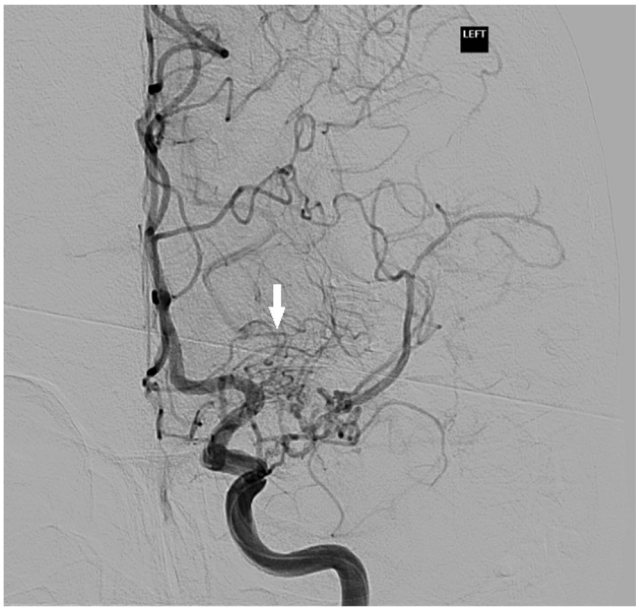

Fig. 3 Pre-operative left internal carotid artery (ICA) injection angiogram showing abnormality in M1 segment of MCA (arrow) with impaired flow and "neovascularization" collaterals at the level of gauzoma

collateral channels that had developed to reconstitute the distal MCA potentially resulting in a severe ischemic injury. Using an orbitocranial approach, we were able to complete the bypass and then expose and completely remove a mass of dense, fibrous tissue surrounding a cluster of gauze fragments (Fig. 4).

Postoperatively, the patient was managed with a rapid dexamethasone taper. She made significant improvements over her preoperative deficits, and at 3-month follow-up, her hemiparesis, dysphasia, and headache syndrome had resolved. She reported mild residual "clouding of her thinking," but this represented a significant improvement over her preoperative status. MR imaging after 3 months demonstrated dramatic improvement in the local edema, complete resection of the

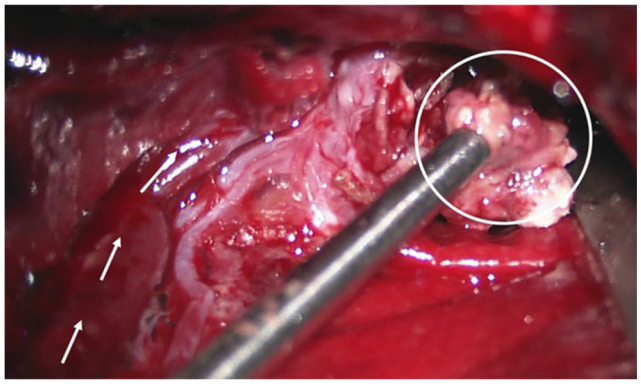

Fig. 4 Intraoperative image of gauzoma (white circle) resection with adjacent saphenous vein graft between distal portion of common carotid and MCA (white arrows)

gauzoma (Fig. 5a), and patency of the saphenous vein graft (Fig. 5c).

Discussion

In this case report, we highlight the presentation and treatment options for patients suffering from gauzoma formation following intracranial aneurysm surgery. This report is notable because symptoms related to adjacent inflammation and scarring, specifically partial complex seizures, occurred relatively early after surgery. Progressive symptoms, delayed for 2 more years, resulted from not only the parenchymal inflammation but also from a profound arterio-obliterative process that resulted in near-complete occlusion of the M1 segment. We also demonstrate the potential utility of saphenous vein graft bypass for gauzoma-caused parent artery narrowing accompanying surgical removal of the gauze wrappings. This was determined to be necessary based on rapid progression of edema and deteriorating neurological condition secondary to ischemia.

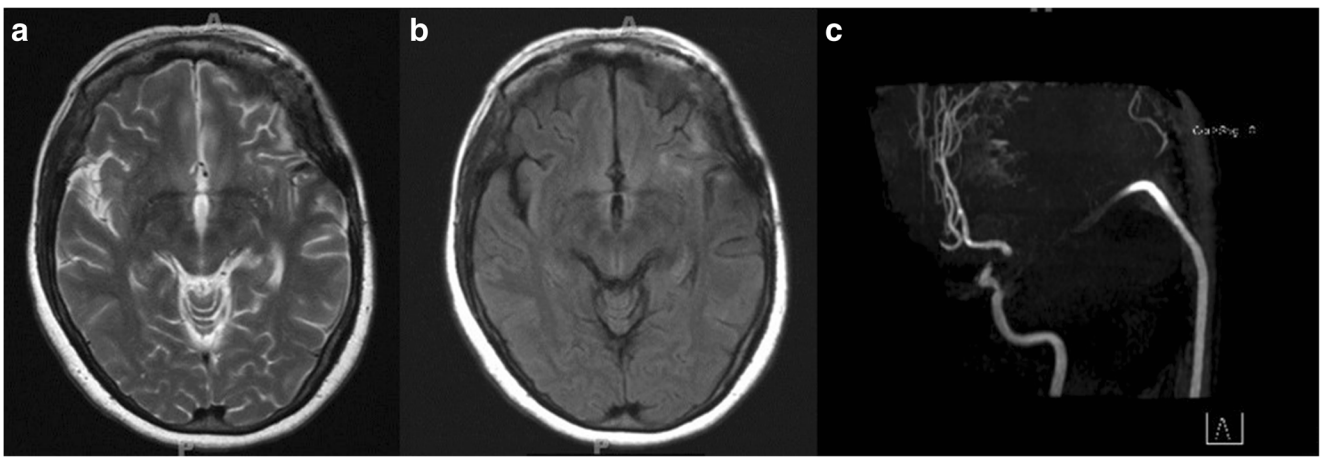

Fig. 5 **a** Three-month follow-up T2 MRI showing complete resection of gauzoma. **b** Three-month follow-up FLAIR MRI showing complete resection of gauzoma. **c** Three-month follow-up MRA demonstrating patency of MCA bypass

Table 1 Literature Review of Gauzoma/Muslinoma Cases

Author, date	Age/ sex	Initial treatment	Second presentation symptoms[a]	Second presentation treatment	Outcome
Carney et al. 1983 [7]	44/F	Clipping, gauze wrapping	Headache, blurred vision	No treatment pursued	Partial temporal field defect
Repka et al. 1984 [24]	32/M	Clipping, muslin wrapping	Optic neuropathy	Exploratory surgery, removal of abscess	Asymptomatic
Tomsak 1985 [30]	62/F	Clipping, muslin wrapping	Vision loss, pupillary defect, optic atrophy	Decadron, exploratory surgery and scar removal	Vision stabilized
Marcus et al. 1986 [19]	24/F	Clipping, muslin wrapping	Blurred vision, diplopia, bitemporal hemianopia	Surgical removal of lesions, dipyridamole, dexamethasone, and cyclophosphamide	Asymptomatic
Chambi et al. 1990 [8]	63/F	Gauze wrapping	Headache, nausea, vomiting	Clipping of unruptured MCA aneurysm, surgical removal of shredded gauze wrapping	Recurrent blindness, hydrocephalus diagnosis; death after cardiac arrest
Case 2	39/F	Clipped and gauze wrapped	Headache, low-grade fever, vision loss	No treatment pursued	Partial visual field deficit
Case 3	71/F	Clipped and gauze wrapped	Headache, fever, right painless ptosis, loss of consciousness	Diphenylhydantoin sodium treatment	Persistent third nerve palsy
Case 4	31/F	Clipped and gauze wrapped	Epileptic events, olfactory hallucinations	Intravenous cloxacillin and cefotaxime, later diphenylhydantoin sodium and carbamazepine	Asymptomatic
Case 5	65/F	Gauze wrapping	Lethargy, confusion, fever, fatigue, headache, photophobia, blurred vision	Treated with intravenous ceftazidime, vancomycin, and tobramycin	Asymptomatic
Case 6	35/F	Gauze wrapping	Olfactory hallucinations, visual defect, visual hallucinations	Diphenylhydantoin sodium	Treatment for oligomenorrhea supervened, visual status stable
Haisa et al. 1990 [14]	56/F	Muslin wrapping	Visual field defect	Mass removed during craniotomy	Visual field defect and acuity unchanged
McFadzean et al. 1991 [20]	53/M	Clipping, gauze wrapping	Vision loss in left eye, blurring in right eye	Dexamethasone	Improvement in vision, left visual field deficit remained
Onoue et al. 1992 [21]	44/F	Failed muscle wrapping, gauze wrapping	Diplopia	Mass removed and aneurysmal neck barely clipped	Asymptomatic
Felsberg et al. 1993 [11]	42/F	Muslin wrapping	Headache, decreasing visual acuity	Surgical removal of muslin, abscess drained	Right visual acuity significantly improved
Prabhu et al. 1994 [23]	53/F	Pterional craniotomy, gauze-wrapping	Blindness, optic atrophy	Dexamethasone	No improvement
Case 2	47/F	Clipping, wrapping	Contraction of visual field	No treatment pursued	No improvement
Kirollos et al. 1997 [16]	47/F	Muslin wrapping	Headache, vision loss, visual field defect	Exploratory surgery, bacterial species found in abscess cavity; flucloxacillin	Visual field deficit
Case 2	59/F	Clipping, wrapping	Deteriorating vision, right homonymous hemianopia	Treated with hydrocortisone, surgical removal of abscess	Deteriorating visual field deficit
Lee et al. 1997 [18]	61/F	Clipping, gauze wrapping	Recurrent visual field loss	Two surgical decompressions of optic nerve, removal mass	Partial recovery of visual function
Bhatti et al. 2000 [4]	33/F	Frontal craniotomy, muslin wrapping	Visual field defect, right eye pain	No treatment pursued	Small inferonasal defect in the right visual field
Case 2	63/F	Muslin wrapping	Vision loss	Oral corticosteroids	Significant improvement in left and right visual acuity
Berger et al. 2003 [3]	69/M	Supraorbital access, muslin wrapping	Vision loss	Methyl-prednisolone	Slight visual improvement in the left eye
	64/M		Vision loss, visual field defect		

Table 1 (continued)

Author, date	Age/ sex	Initial treatment	Second presentation symptoms[a]	Second presentation treatment	Outcome
Brochert et al. 2003 [6]		Clipping, muslin wrapping		Corticosteroids, eventual surgery with lysis of adhesions & dissection	Stable, no improvement to vision
Fujimura et al. 2003 [12]	50/F	Clipping, gauze wrapping	Right temporalgia, decreased visual acuity	Steroid pulse therapy, surgical removal of mass	Residual left hemianopsia in the right eye
Goldsberry et al. 2004 [13]	43/F	Endovascularly coiled, Ray-Tec wrapped	Headache, right eye pain, vision loss	Surgical decompression of optic nerve	Patient's vision had deteriorated to no light perception
Subramanian et al. 2005 [28]	61/F	Unsuccessful endovascular, clipping, gauze wrapping	Left homonymous hemianopia, right optic neuropathy	Dexamethasone	Slight visual improvement
Taravati et al. 2006 [29]	52/M	Clipping, gauze wrapping	Blurred vision	Oral prednisone	Episodic bitemporal visual field loss
Andres et al. 2007 [1]	67/F	Clipping, gauze wrapping	Left side hemiparesis, gait disturbance	Ceftriaxone, ornidazole, vancomycin, exploratory surgery, mass removal	Asymptomatic
Yoon et al. 2010 [31]	51/M	Pterional craniotomy, gauze-wrapping	Visual field defect	No treatment pursued	Asymptomatic
Case 2	53/M	Pterional craniotomy, gauze-wrapping	Headache	Conservative steroid therapy	Asymptomatic
Case 3	64/M	Pterional craniotomy, gauze-wrapping	Right side hemiparesis, headache	Dexamethasone, clopidogrel, and heparin	Partially improved right side hemiparesis, headaches
Case 4	52/F	Pterional craniotomy, gauze-wrapping	Decreased visual acuity	Conservative steroid therapy	Persistent optic neuropathy
Case 5	58/F	Pterional craniotomy, gauze-wrapping	Headache	Conservative steroid therapy	Asymptomatic
Slater et al. 2014 [27]	53/F	Muslin wrapping	Asymptomatic	No treatment pursued	Asymptomatic; abnormal peri-aneurysmal T2 signal, vascular narrowing, ring-enhancing mass
Case 2	70/F	Muslin wrapping	Asymptomatic	No treatment pursued	Asymptomatic; abnormal peri-aneurysmal T2 signal, ring-enhancing mass
Present case	51/F	Gauze wrapping	Right side hemiparesis, dysphasia, seizures	Decadron, CCA-MCA bypass and surgical removal of gauze	Significant improvement of all symptoms

[a] All secondary conditions listed here were progressive at presentation. *CCA-MCA* common carotid artery-middle carotid artery

Case series that did not provide individual patient symptoms, treatments, and outcomes were not included in this review

The inflammation and mass formation caused by gauzomas have been associated with reduced cerebral blood volume in past cases [17], though none has reported complete occlusion of the parent artery. Combined with the risk to the parent artery in microsurgical removal of the gauze wrapping, this makes bypass a useful method of addressing parent artery narrowing and prophylactically ensuring distal flow. Bypass, especially STA-MCA bypass, is also a recommended treatment for Moyamoya disease regardless of its etiology [9]. The patency of our patient's CCA-MCA bypass at follow-up indicates that, even after the gauzoma was removed, the MCA was inadequately able to deliver the requisite blood volume.

Dense, localized scar tissue formation has been considered a beneficial reaction to contact with cotton or gauze-wrapping surgeries, in that it strengthens the walls of the aneurysm [4, 25]. However, both the scar tissue and inflammation can cause complications or parent artery narrowing in 3.5–5% of patients and granuloma formation in 1.5% of patients treated with gauze wrapping [22, 2], and in our case, the scar tissue made surgical removal of the shredded gauze more difficult.

Table 2 Treatments based on patient presentation

	Treatment					
Symptoms	No treatment	Steroids	Anti-seizure[a]	Antibiotics[b]	Surgical removal	Surgical decompression
Headache	2 (28.6%)	3 (30.0%)	1 (33.3%)	2 (66.7%)	3 (23.1%)	1 (50.0%)
Vision loss/visual field deficit	5 (71.4%)	7 (70.0%)	0 (0.0%)	1 (33.3%)	11 (84.6%)	2 (100.0%)
Hallucinations	0 (0.0%)	0 (0.0%)	2 (66.7%)	1 (33.3%)	0 (0.0%)	0 (0.0%)
Seizure/palsy	0 (0.0%)	0 (0.0%)	2 (66.7%)	1 (33.3%)	1 (7.7%)	0 (0.0%)
Hemiparesis	0 (0.0%)	1 (10.0%)	0 (0.0%)	0 (0.0%)	2 (15.4%)	0 (0.0%)
Fever	1 (14.3%)	0 (0.0%)	0 (0.0%)	1 (33.3%)	0 (0.0%)	0 (0.0%)
Loss of consciousness/fatigue	0 (0.0%)	0 (0.0%)	1 (33.3%)	1 (33.3%)	0 (0.0%)	0 (0.0%)
Asymptomatic	2 (28.6%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
Total patients ($n = 36$)	7	10	3	3	13	2

Patients with multiple symptoms were counted in all relevant categories. Percentages are given based on treatment category

[a] One patient was treated with antibiotics and then anti-seizure medication and was counted in both categories

[b] One patient was treated surgically and then given antibiotics to treat an infection found during surgery and was counted in both categories

These potential drawbacks, as well as the risk of both infection and ischemia [2], should be considered before aneurysm wrapping.

In our literature review of muslinoma and gauzoma patients (Table 1), presentation of patients with muslinomas or gauzomas was relatively consistent, meaning that knowledge of the patient's surgical history can combine with their symptoms to provide consistent diagnostic criteria. The majority of patients presented with vision loss, visual field deficits, and/or optochiasmatic arachnoiditis (26/36, 72.2%). Other common symptoms included headache (12/36, 33.3%), visual (1/36, 2.8%) and olfactory hallucinations (2/36, 5.6%), seizures (4/36, 11.1%), and hemiparesis (3/36, 8.3%). For symptoms based on treatment chosen, see Table 2. The imaging used to demonstrate the gauzoma was mostly computed tomography (CT) (18/36, 50%) or MRI (17/36, 47.2%). MRI was recommended by Bhatti et al. based on its capacity to enable easier mass identification [4].

Given that most patients in our review were stable upon presentation with gauzoma, treatment with steroids was pursued in ten cases (27.8%). In the case of steroid treatment, outcomes included diminished symptoms (6/10, 60.0%), persistent neurological defect (2/10, 20.0%), and a total lack of symptoms (2/10, 20.0%). Surgical decompression was used to lower intracranial pressure in two cases (5.6%), resulting in subsided symptoms for one patient (50.0%). In seven of the 36 cases (19.4%), no treatment was pursued. Exploratory surgery and removal attempts were undertaken in the plurality of cases (13/36, 36.1%), usually because of rapid worsening of symptoms, although gauzoma location also influenced treatment decisions. At follow-up, five of the 13 patients (38.5%) who had undergone surgical removal had their symptoms subside, four (30.8%) were asymptomatic, three (23.1%) experienced a persistent neurological defect, and one (7.7%) died of cardiac arrest. Otherwise, if the patient showed active signs of infection in the affected area, antibiotics were prescribed. For full data concerning patient outcomes, see Table 3.

Table 3 Outcomes based on treatment methods

	Treatment					
Outcome	No treatment	Steroids	Anti-seizure[a]	Antibiotics[b]	Surgical removal	Surgical decompression
Asymptomatic	3 (42.9%)	2 (20.0%)	1 (33.3%)	2 (66.7%)	4 (30.8%)	0 (0.0%)
Symptoms subsided	2 (28.6%)	6 (60.0%)	2 (66.7%)	1 (33.3%)	5 (38.5%)	1 (50.0%)
Persistent neurological deficit	2 (28.6%)	2 (20.0%)	0 (0.0%)	0 (0.0%)	3 (23.1%)	1 (50.0%)
Death	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	1 (7.7%)	0 (0.0%)
Total patients ($n = 36$)	7	10	3	3	13	2

[a] One patient was treated with antibiotics and then anti-seizure medication and was counted in both categories

[b] One patient was treated surgically and then given antibiotics to treat an infection found during surgery and was counted in both categories

Our patient had also had previous exploratory surgery, which should be taken into account as a cause of further scarring that may not be seen in other cases. However, the parent artery narrowing we observed is a common consequence of gauze-wrapping. Therefore, cerebral revascularization should be considered as a potential treatment if inflammation limits parent artery blood flow. Lastly, despite a limited pool of cases, surgical excision has a good prognosis for patients with progressive vision loss and inflammation in the case that steroids do not resolve the patient's symptoms.

Conclusion

The symptoms of gauzomas are relatively consistent, and our case demonstrates that disabling edema and parent artery narrowing can be addressed with cerebral revascularization and removal of scar tissue with good neurological outcome. This demonstrates the necessity of considering surgical options when steroids do not resolve the symptoms of inflammation.

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Compliance with ethical standards

Disclosures The authors report no conflict of interest concerning the materials or methods used in this study or the findings specified in this paper.

Conflict of interest The authors declare that they have no conflict of interest.

Ethical approval All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. For this type of study, formal consent is not required.

Informed consent Informed consent was obtained from all individual participants included in the study.

References

1. Andres RH, Guzman R, Weis J, Schroth G, Barth A (2007) Granuloma formation and occlusion of an unruptured aneurysm after wrapping. Acta Neurochir 149:953–958; discussion 958. https://doi.org/10.1007/s00701-007-1260-8
2. Beitzke M, Leber KA, Deutschmann H, Gattringer T, Poltrum B, Fazekas F (2013) Cerebrovascular complications and granuloma formation after wrapping or coating of intracranial aneurysms with cotton gauze and human fibrin adhesives: results from a single-center patient series over a 5-year period. J Neurosurg 119:1009–1014. https://doi.org/10.3171/2013.6.jns1373
3. Berger C, Hartmann M, Wildemann B (2003) Progressive visual loss due to a muslinoma—report of a case and review of the literature. Eur J Neurol 10:153–158
4. Bhatti MT, Holder CA, Newman NJ, Hudgins PA (2000) MR characteristics of muslin-induced optic neuropathy: report of two cases and review of the literature. AJNR Am J Neuroradiol 21:346–352
5. Bilginer B, Yavuz K, Agayev K, Akbay A, Ziyal IM (2007) Existence of cotton granuloma after removal of a parasagittal meningioma: clinical and radiological evaluation—a case report. Kobe J Med Sci 53:43–47
6. Brochert A, Reynolds T, Baker R (2003) MRI in a case of muslin-induced granuloma. Neuroradiology 45:82–84. https://doi.org/10.1007/s00234-002-0896-6
7. Carney PG, Oatey PE (1983) Muslin wrapping of aneurysms and delayed visual failure. A report of three cases. J Clin Neuro-Ophthalmo 3:91–96
8. Chambi I, Tasker RR, Gentili F, Lougheed WM, Smyth HS, Marshall J, Young I, Deck J, Shrubb J (1990) Gauze-induced granuloma ("gauzoma"): an uncommon complication of gauze reinforcement of berry aneurysms. J Neurosurg 72:163–170. https://doi.org/10.3171/jns.1990.72.2.0163
9. Deng X, Gao F, Zhang D, Zhang Y, Wang R, Wang S, Cao Y, Zhao Y, Pan Y, Liu X, Zhang Q, Zhao J (2017) Direct versus indirect bypasses for adult ischemic-type moyamoya disease: a propensity score-matched analysis. J Neurosurg:1–7. doi:https://doi.org/10.3171/2017.2.jns162405
10. Deshmukh VR, Kakarla UK, Figueiredo EG, Zabramski JM, Spetzler RF (2006) Long-term clinical and angiographic follow-up of unclippable wrapped intracranial aneurysms. Neurosurgery 58:434–442; discussion 434-442. https://doi.org/10.1227/01.neu.0000199158.02619.99
11. Felsberg GJ, Tien RD, Haplea S, Osumi AK (1993) Muslin-induced optic arachnoiditis ("gauzoma"): findings on CT and MR. J Comput Assist Tomogr 17:485–487
12. Fujimura M, Nishijima M, Umezawa K, Hayashi T, Mino Y, Sakuraba T, Midorikawa H (2003) Optochiasmal arachnoiditis following cotton wrapping of anterior communicating artery aneurysm treated by surgical removal of granuloma. J Clin Neurosci: Off J Neurosurg Soci Australasia 10:254–257
13. Goldsberry DH, Ross IB, Dhillon G, Corbett JJ (2004) Visual dysfunction caused by gauze wrapping of an intracranial aneurysm. J Neuro-Ophthalmol: Off J North Am Neuro-Ophthalmol Soc 24:42–45
14. Haisa T, Matsumiya K, Yoshimasu N, Kuribayashi N (1990) Foreign-body granuloma as a complication of wrapping and coating an intracranial aneurysm. Case report. J Neurosurg 72:292–294. https://doi.org/10.3171/jns.1990.72.2.0292
15. Kim YB, Hong CK, Chung J, Joo JY, Huh S-K (2014) Long-term clinical and angiographic outcomes of wrap-clipping strategies for unclippable cerebral aneurysms. Yonsei Med J 55:401–409. https://doi.org/10.3349/ymj.2014.55.2.401
16. Kirollos RW, Tyagi AK, Marks PV, van Hille PT (1997) Muslin induced granuloma following wrapping of intracranial aneurysms: the role of infection as an additional precipitating factor. Acta Neurochir 139:411–415. https://doi.org/10.1007/bf01808876
17. Kumar R, Nadarajah J, Kumar A, Gamanagatti S (2016) Misery of neurosurgeon: gauzoma causing foreign body granuloma-role of radiologist. Asian J Neurosurg 11:74–75. https://doi.org/10.4103/1793-5482.165797
18. Lee AG, Cech DA, Rose JE, Goodman JC, Haykal HA (1997) Recurrent visual loss due to muslin-induced optochiasmatic arachnoiditis. Neuro-Ophthalmology 18:199–204. https://doi.org/10.3109/01658109709014422
19. Marcus AO, Demakas JJ, Ross HA, Duick DS, Crowell RM (1986) Optochiasmatic arachnoiditis with treatment by surgical lysis of adhesions, corticosteroids, and cyclophosphamide: report of a case. Neurosurgery 19:101–103

20. McFadzean RM, Hadley DM, McIlwaine GG (1991) Optochiasmal arachnoiditis following muslin wrapping of ruptured anterior communicating artery aneurysms. J Neurosurg 75:393–396. https://doi.org/10.3171/jns.1991.75.3.0393
21. Onoue H, Abe T, Tashibu K, Suzuki T (1992) Two undesirable results of wrapping of an intracranial aneurysm. Neurosurg Rev 15:307–309
22. Perrini P, Montemurro N, Caniglia M, Lazzarotti G, Benedetto N (2015) Wrapping of intracranial aneurysms: single-center series and systematic review of the literature. Br J Neurosurg 29:785–791. https://doi.org/10.3109/02688697.2015.1071320
23. Prabhu SS, Keogh AJ, Parekh HC, Perera S (1994) Optochiasmal arachnoiditis induced by muslin wrapping of intracranial aneurysms. A report of two cases and a review of the literature. Br J Neurosurg 8:471–476
24. Repka MX, Miller NR, Penix JO, Trant JH 3rd (1984) Optic neuropathy from the use of intracranial muslin. J Clin Neuro-Ophthalmol 4:147–150
25. Sachs E Jr (1972) The fate of muscle and cotton wrapped about intracranial carotid arteries and aneurysms. A laboratory and clinico-pathological study. Acta neurochirurgica 26:121–137
26. Scott RM, Smith ER (2009) Moyamoya disease and Moyamoya syndrome. N Engl J Med 360:1226–1237. https://doi.org/10.1056/NEJMra0804622
27. Slater LA, Chandra RV, Holt M, Danks A, Chong W (2014) Long-term MRI findings of muslin-induced foreign body granulomas after aneurysm wrapping. A report of two cases and literature review. Interv Neuroradiol 20:67–73. https://doi.org/10.15274/inr-2014-10010
28. Subramanian PS, Miller NR, Renard V, Tamargo RJ (2005) Delayed progressive visual loss following wrapping of bilateral clinoidal aneurysms: recovery of vision and improvement in neuroimaging during corticosteroid treatment. Br J Ophthalmol 89:1666–1668. https://doi.org/10.1136/bjo.2005.078626
29. Taravati P, Lee AG, Bhatti MT, Lewis SB (2006) That's a wrap. Surv Ophthalmol 51:434–444. https://doi.org/10.1016/j.survophthal.2006.04.006
30. Tomsak RL (1985) Muslin optic neuropathy. J Neuroophthalmol 5:71
31. Yoon MA, Kim E, Kwon BJ, Kim JE, Kang HS, Park JH, Sohn CH, Kim JH, Lee DH (2010) Muslinoma and muslin-induced foreign body inflammatory reactions after surgical clipping and wrapping for intracranial aneurysms: imaging findings and clinical features. J Neurosurg 112:640–647. https://doi.org/10.3171/2009.7.jns081625

Comments

This is an instructive case report, well-documented and presented, of a gauze ball that developed and became highly symptomatic around a miniscule unruptured MCA aneurysm. There are several educational points that we can take away.

1. The placement of extravascular foreign material is not always benign. In this case, a 6 mm PCoA UIA was clipped electively (I would agree with this), and a minuscule (0.5 mm) MCA blip was layered with gauze at the same operation. I freely admit that I have done this too, many years past. In light of current data, however, we must question whether anything at all should have been done at the MCA location, especially in consideration of the consequences to this patient, who developed seizures and hemiparesis and had three major craniotomies, all when she never had any SAH or clinical problem at all. Foreign material is just that we usually get away with it, but the strategy of prophylactic aneurysm wrapping is not benign, as we can see here.

2. The patient had an aggressive revascularization strategy based on vessel imaging. I understand that she had hemiparesis and that her STA was surgically absent. For my part, however, the clinical workup and the justification for saphenous vein bypass would have been strengthened by the acquisition of perfusion data, which is not presented here. This would improve the value of this case report as well.

It is, in sum, an interesting case and illustrates well that no good deed goes unpunished.

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