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Trigeminal Amyloidoma: Case Report and Review of the Literature

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Abstract

The authors present a case of amyloid infiltration involving the trigeminal nerve that mimicked a malignant cavernous sinus tumor with perineural tumor infiltration. A 64-year-old man presented with trigeminal nerve numbness. Imaging revealed a plaque-like enhancing lesion along the right lateral cavernous sinus extending anteriorly into Meckel's cave and involving the proximal V2 and V3 trigeminal nerves. The patient underwent extradural frontotemporal craniotomy with middle fossa exposure of the cavernous sinus to diagnose and treat the presumed malignant cavernous sinus tumor. A reddish mass involving the lateral dural wall of the cavernous sinus was resected. There was also enlargement of the gasserian ganglion and second and third divisions of the trigeminal nerve, the latter of which was biopsied. Permanent histopathological studies demonstrated microscopic eosinophilic, amorphous material, which stained positive for Congo red, and absence of neoplastic cells. The final diagnosis was amyloidoma. Thus, amyloidomas may occur from the trigeminal nerve or ganglia and should be considered in the differential diagnosis of a cavernous sinus lesion mimicking a tumor. The few reports of trigeminal amyloidomas are reviewed and the presentation, imaging, and management of this skull base lesion are discussed. Overall, patients may have symptomatic improvement of trigeminal neuropathy with resection of the amyloidoma outside of the nerve capsule that is compressing the nerve, while resection of the lesion from within the capsule may result in permanent trigeminal nerve dysfunction.

Key Words: Gasserian ganglion, trigeminal, amyloidoma,

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Introduction

Amyloidomas of the nervous system are extremely uncommon and are invariably of the amyloid light-chain lambda type.¹ Typically, cerebral amyloidomas present as single or multiple supratentorial masses located in the white matter of the brain parenchyma.¹ Only rarely has amyloid disease been described to involve other nervous tissue, and only 12 cases of amyloid involving the gasserian ganglion or trigeminal nerve have been described previously in the literature.²⁻¹¹ These patients may present with a pattern of trigeminal amyloidosis, starting with trigeminal anesthesia, hypalgesia, or dysesthesia, with progressive face anesthesia and, possibly, weakness or atrophy of the muscles of mastication.¹² It is important to consider amyloidoma, a benign process, in the differential diagnosis when imaging reveals a mass in Meckel's cave, a mass around the gasserian ganglion or trigeminal branches, or a cavernous sinus lesion, in order to select the appropriate management and surgical strategy. We present a patient with progressive trigeminal nerve sensory loss from an amyloidoma of the trigeminal nerve; this patient had a dural-based mass as well as enlargement of the trigeminal nerve that mimicked a malignant cavernous sinus tumor with perineural tumor infiltration. We also review the literature regarding the clinical and radiological presentation and management of trigeminal amyloidomas.

Case Report

A 64-year-old man had a progressive 9-month history of numbness and tingling on the right side of his face without associated pain. He had decreased sensation in the distribution of V2 and V3 of the trigeminal nerve. Magnetic resonance imaging (MRI) demonstrated a plaque-like enhancing lesion along the right cavernous sinus extending anteriorly into Meckel's cave. It involved the proximal V2 and V3 trigeminal nerves, extending to the foramen rotundum and ovale,

respectively, and the vidian nerve; these nerves also appeared enlarged (Figure 1). The preoperative diagnosis of this lesion was malignant cavernous sinus tumor with perineural tumor infiltration, or less likely meningioma or schwannoma.

Chest X-ray, complete blood count (CBC), and serum chemistry test results were within normal limits. Given the progressive trigeminal symptoms, the patient was offered surgery for the purpose of diagnosis and possible resection. He underwent a right frontotemporal craniotomy with middle fossa exposure of the cavernous sinus through an extradural exposure. A reddish mass involving the lateral dural wall of the cavernous sinus was noted. The bone around the foramen rotundum and foramen ovale was drilled to afford decompression of the enlarged second and third divisions of the trigeminal nerve, respectively. After the lateral wall of the cavernous sinus was removed, the trigeminal nerve was inspected. The gasserian ganglion and the second and third divisions of the trigeminal nerve were enlarged and appeared infiltrated, although the fascicular pattern of the nerve was maintained. A biopsy of a fascicle of the third division of the trigeminal nerve at the entrance of the nerve branch through the foramen ovale was performed.

Permanent histopathological studies demonstrated microscopic eosinophilic, amorphous material, which stained positive for Congo red (Figure 2) and thioflavine S. Immunohistochemistry studies displayed staining for lambda light chains. No neoplastic cells were identified, but reactive meningotheial cells were present. The samples from the dural mass and the fascicle of the V3 nerve were identified to contain extensive amyloid deposition consistent with amyloidoma.

The postoperative course was uneventful. The patient demonstrated improved sensation in the lower and middle face following decompression, which has remained stable for over 1 year of follow up. Additional studies revealed no evidence of systemic amyloidosis. Recent MRI at 1 year showed some diminished enhancement of the cavernous sinus.

Discussion

Amyloid is an abnormal insoluble protein that under certain pathological conditions can be deposited in the extracellular space and can involve almost every organ system.¹³ Although amyloid deposition within the brain can take many forms, including cerebral amyloid angiopathy or senile plaques of Alzheimer dementia, tumor-like deposition (amyloidoma) is extremely uncommon.¹³ Amyloidoma is defined as primary solitary amyloidosis where no plasma-cell dyscrasia or abnormal serum proteins are detectable.¹⁴ The source of amyloid protein that forms a tumor in the central nervous system is unclear and is thought either to derive from components that leak from vessels or to be synthesized at the site of deposition from coexistent plasma cells, but the origins of intracerebral plasma cells observed in some cerebral amyloidomas are not understood.^{13,15}

The average age of presentation of patients harboring cerebral amyloidomas is 47.8 years and there is a slight female predominance.¹³ Amyloidomas are located in the brain parenchyma,¹ and patients present with solitary or multiple supratentorial white matter masses that have little or no mass effect on the surrounding anatomy, extend medially to the lateral ventricle ependyma, and have irregular margins.¹³ CT scans typically demonstrate a mass that varies from hypodense to patchy increased density and contrast enhances. MRI of cerebral amyloidomas generally reveals mostly hypointense lesions on T1-weighted images but it can also appear isointense or hyperintense, and mixed high and low signal on T2-weighted images, with lesions demonstrating variable degrees of enhancement.¹³ The clinical course of intracerebral amyloidomas is benign, although these lesions can demonstrate slow growth. Very infrequently it is possible to have a regrowth after resection,^{13,15} but the natural history of this rare lesion is not fully understood because of the low incidence of the disease.

Amyloidomas have also been described affecting other nervous tissue, including spinal roots,¹⁶ the brachial plexus,¹⁷ and peripheral nerves.¹⁸ Rarely, amyloid disease has been described to cause trigeminal neuropathy because of involvement of the gasserian ganglion, and it is not clear why there is a predisposition for this ganglia.²⁻¹¹ Overall, there have been 12 previous reports of patients with trigeminal amyloidomas, beginning with the first case described by Daly et al. in 1957 (Table 1). These patients all presented with some form of trigeminal neuropathy, including trigeminal hypalgesia, dysesthesia, or face anesthesia, and rarely with V3 motor dysfunction with weakness or atrophy of the muscles of mastication. In most cases, the hypalgesia or dysesthesias preceded the onset of facial anesthesia and over time the numbness increased its distribution on the face. The duration of symptoms prior to treatment ranged from 2 months and up to 10 years in one series.³ In two cases, patients had bilateral trigeminal nerve dysfunction from bilateral amyloidomas.^{6,8} Overall, although all patients presented with trigeminal neuropathy and many with continuous facial pain, the symptoms were clearly distinct from trigeminal neuralgia, which has episodes of intense, stabbing, electric shock-like pain and is associated with specific triggers.

With advances in modern imaging it has been possible to better characterize the lesions, and, with increased knowledge of amyloidomas, it may be possible to identify these lesion on imaging before surgery (Table 1). In only one study⁷ did the authors describe the density of the amyloidoma on CT and they found that the tumor was isodense. In contrast to cerebral amyloidomas, on MRI these trigeminal variants commonly appeared isointense on T1-weighted images and hypointensity or mixed intensity (hypointensity and isointensity) on T2-weighted images. It is thought that the mixed signal intensities of amyloidomas on T2-weighted images are due to uneven deposition of amyloid protein.⁷ Several authors have noted that the low signal on T2-weighted imaging, due to increased amyloid deposition, is suggestive of the diagnosis of amyloidoma and differentiates this

lesion from other lesions, including schwannomas.^{10,11} Of note, the most common preoperative diagnosis of this lesion in the 12 previously described amyloidomas was schwannoma. Finally, a common imaging characteristic on MRI was uniform enhancement localized to Meckel's cave with enhancement of the ganglion and or nerve branches.

Most authors took similar approaches to the management of the trigeminal amyloidomas (Table 1). In most cases, the tumor was located exclusively within the nerve capsule and infiltrated in and around the nerve fibers. Many of these patients underwent a craniotomy with incision of the nerve capsule and biopsy of the abnormal tissue without an attempt at further resection. In these cases, follow-up information and imaging was not provided, and thus it is unclear whether the biopsy had an effect on the patients' symptoms or the natural history of the disease. Several cases involved resection of the lesion.^{2-5,7,10} Matsumoto and colleagues⁷ resected an amyloidoma through an extradural skull base approach and found the tumor located between the lateral wall of the cavernous sinus and the second and third divisions of the trigeminal nerve. They noted that the tumor adhered slightly to the trigeminal nerve but was easily resected to obtain a gross total resection. Vorster and coworkers¹⁰ performed a similar surgery, and they were able to resect an amyloidoma located medially to the gasserian ganglion, which was clearly distinguishable from it, but amyloid was also intermingled with the V1, V2, and V3 branches. They reported that the surgical plane was lost where the lesion was intimately involved with these nerves and, thus, a subtotal resection was performed to spare function of the nerves. In contrast to the patient described by Matsumoto et al., their patient suffered increased numbness from the surgery. In another two series,^{2,5} it was difficult to differentiate lesion from the nerve and, although an attempt at a gross total resection was made, both patients had increased sensory loss and weakness after surgery. Finally, the patient described by Daly and coworkers⁴ had an extensive piecemeal resection of all of

the abnormal tissue intermingling with the nerve fibers within the nerve capsule. The patient had complete trigeminal numbness in all distributions and V3 motor weakness after surgery. Overall, decompressive surgery with debulking of tumor outside of the capsule was associated with improvement or resolution of trigeminal pain and numbness, while an extensive resection within the nerve capsule was associated with worse trigeminal dysfunction.^{2,4,5,10}

In the current case, the tumor located outside of the nerve was completely resected through an extradural approach similar to two of the cases above,^{7,10} but the tumor within the nerve capsule involving the nerve fibers was biopsied but not resected. The V2 and V3 trigeminal branches were markedly enlarged, and thus, we decompressed the foramen rotundum and ovale. The tumor within the trigeminal nerve was not resected to preserve function. This surgical strategy offers immediate symptomatic relief from trigeminal pain and dysesthesia without causing increased sensory loss or V3 motor dysfunction. Long-term imaging has not been reported on any of the previous 12 cases to understand the natural history of the disease and whether the lesion has the capacity to regrow and cause symptoms after a subtotal resection. In one paper,³ two patients were followed for 1 and 9 years without a clinical recurrence of symptoms, although both patients had existing deficits after surgery.

This case demonstrates that amyloidoma should be considered as a possibility in the differential diagnosis of a cavernous sinus lesion or a lesion arising from the gasserian ganglion or within Meckel's cave in addition to meningiomas, schwannomas, malignant cavernous sinus tumors, and inflammatory disorders.

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FIGURE 1. A-C. Axial post-contrast T1-weighted imaging through the central skull base. Enhancing tissue representing amyloidoma is evident in the lower Meckel's cave region on the right (arrow, A). Perineural enhancement is present extending into foramen rotundum (arrow, B) and foramen ovale (arrow, C). D-E. Coronal STIR and post-contrast T1-weighted imaging. Amyloid deposition appears as a filling defect in the lateral aspect of Meckel's cave on STIR image (arrow, D). Corresponding enhancement is demonstrated (arrow, E).

FIGURE 2: Photomicrograph. A. Specimen demonstrating deposits of eosinophilic, amorphous material. No significant inflammatory cells or neoplastic cells are present. (H&E staining, original magnification, X100). B. Typical pattern of apple-green birefringence is present in specimen stained with Congo red and viewed with polarized light X40.

Table 1: Review of clinical presentation, imaging characteristics, and management of amyloidomas of the gasserian ganglion

Patient no.	Author	Age	Sex	Symptom	Location per symptoms or imaging	CT	MRI	Tumor location at surgery	Treatment	Follow-up
1	Daly et al. 1957	42	M	V2/V3 trigeminal pain with progressive numbness	Right gasserian ganglion and V2 and V3	NA	NA	Mostly within nerve capsule with small component outside, 50% trigeminal nerve bundles replaced by amyloid	Craniotomy with extensive resection of amyloidoma around nerve fibers	After surgery, resolution of pain with complete numbness of V1, V2 and V3, complete V3 motor weakness
2	Plogsties, 1964	54	M	Numbness and trigeminal pain	Right gasserian ganglion	NA	NA	Within nerve capsule	Craniotomy for biopsy of infiltrated ganglion	NA
3	Borghgi and Tagliabue, 1971	58	F	V1/V2/V3 incomplete numbness, trigeminal pain, and motor weakness	Right Meckel's cave	NA	NA	Lesion at Meckel's cave but ganglion and nerve not identified	Craniotomy for complete tumor resection	At 2 years, complete sensory loss V1-3, complete V3 motor weakness and resolution of pain
4	DeCastro et al., 1976	59	M	Numbness and minimal pain V2 and V3 progressing to V1	Right gasserian ganglion	NA	NA	Lesion with components outside of nerve and within nerve without discrete nerve capsule	Craniotomy for complete tumor resection	After surgery, complete V2 and V3 sensory loss, resolution of pain, transient weakness V3 motor
5	Bornemann et al., 1993	32	F	Numbness and pain V2 and V3, atrophy of muscles of	Left gasserian ganglion	Normal	NA	Lesion within Meckel's cave	Craniotomy for resection without other details	After surgery, resolution of pain, but at 9 years follow-up, sensory and

				mastication						motor deficits were unchanged
6	Bornemann et al., 1993	49	F	V1/V2/V3 numbness and pain	Left Meckel's cave to V2 and V3 branches	Normal	Uniform enhancement	Lesion within Meckel's cave	Craniotomy for resection without other details	After surgery, improvement of pain, but at one year continued numbness and with atrophy of muscles of mastication
7	Bornemann et al., 1993	45	F	V1/V2/V3 numbness	Left Meckel's cave	Enhancement of lesion	Slight marginal enhancement	Lesion within Meckel's cave	Craniotomy for resection with further details	After surgery, pain resolved
8	O'Brien et al. 1994	49	F	*Left decreased sensation V1-V3, weak V3 motor, left V2 trigeminal pain, right V3 numbness	Left gasserian ganglion and trigeminal branches	NA	Uniform enhancement	Within nerve capsule	Craniotomy for biopsy of infiltrated ganglion	NA
9	Kirch et al., 1998	34	M	*Bilateral numbness V1 > V2 or V3, microbial keratitis	Bilateral gasserian ganglion masses	NA	Hypointense on T1-weighted, heterogenous on T2-weighted imaging; uniform enhancement	Within nerve capsule	Craniotomy for biopsy of infiltrated ganglion	NA
10	Vorster et al., 1998	46	F	V2/V3 numbness progressing to trigeminal pain	Right gasserian ganglion and V1, V2, and V3	NA	Isointense on T1-weighted, hypointense T2-weighted imaging; uniform enhancement	Outside and within nerve capsule	Craniotomy for subtotal resection, tumor intermingled with trigeminal branches unable to be resected	At 1 month, complete resolution of pain with complete anesthesia of V1 and V2, normal V3 motor function with minimal V3 anesthesia
11	Matsumoto	41	F	V2/V3	Left	Isodense	Isointense on	Outside of	Craniotomy for	At 2 months,

	et al., 1999			numbness	Meckel's cave		T1-weighted, heterogenous on T2-weighted imaging; uniform enhancement	nerve capsule	total resection	improved sensation
12	Yu and de Tilly, 2004	62	M	Trigeminal pain	Left Meckel's cave	NA	Isointense on T1-weighted, hypointense on T2-weighted imaging; uniform enhancement	Within nerve capsule	Craniotomy for biopsy of infiltrated ganglion	NA
13	Current case, 2006	64	M	V2/V3 numbness	Right lateral cavernous sinus into Meckel's cave and V2 and V3 trigeminal nerves	NA	Isointense on T1-weighted, hypointense on T2-weighted imaging; uniform enhancement	Outside and within nerve capsule	Craniotomy for resection of amyloidoma outside capsule compressing nerve and decompression of foramen	At 2 months, improved sensation

* Bilateral amyloidomas on imaging.

Note: None of these patients had any evidence of systemic amyloidosis, underlying malignancy, or inflammatory disease.



