

Decoding “guitar pick sign” in COVID-19-associated mucormycosis: A case series

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“Guitar pick sign,” also referred to as posterior globe tenting, is a radiological surrogate marker of tense orbit and profound vision loss. It is seen commonly in traumatic retrobulbar hemorrhage and carotico-cavernous fistula and less frequently in orbital cellulitis, subperiosteal abscess, and invasive fungal infections. We report a case series of Coronavirus disease-19-associated rhino-orbito-cerebral mucormycosis with guitar pick sign, of which none survived, and discuss the causative pathomechanisms, severity grade, and the clinical relevance of this unique radiological finding.

Key words: Coronavirus disease-19, guitar pick sign, non-salvageable vision loss, orbital mucormycosis, posterior globe tenting

“Guitar pick sign,” also called posterior globe tenting, is a radiological sign spotted in acute or subacute orbital pathologies and a helpful forewarning indicator of impending profound vision loss.^[1] It is commonly described in traumatic retrobulbar hemorrhage.^[2] It is also reported frequently in orbital infections such as bacterial orbital cellulitis and subperiosteal abscess, and rarely in invasive fungal infections.^[1-3] India has witnessed an exponential increase in fungal infections, especially mucormycosis, during the coronavirus disease 19 (COVID-19) pandemic caused by highly infectious severe acute respiratory syndrome coronavirus 2. Rhino-orbito-cerebral form of mucormycosis is the most common and lethal, treatment of which is aimed to preserve vision and life.^[4]

Although the guitar pick sign has been reported in a few reports of COVID-19-associated rhino-orbital mucormycosis (C-ROCM), there are scant details about the ocular vital signs, the severity of globe tenting, and visual

outcomes.^[5-7] We report a case series of C-ROCM with the guitar pick sign and the related outcomes here.

Case Reports

Of the 31 patients of C-ROCM who were admitted to the Department of Neurology between April 2021 and June 2021, we found seven orbits from six patients having the guitar pick sign. All of them had diabetes, and four had renal dysfunction. Four had diabetic ketoacidosis at presentation. All of them presented within a week of symptom onset. Complete ophthalmoplegia, proptosis, and absent perception of light in the affected eye were consistent findings in the whole cohort. Four underwent orbital exenteration and extensive debridement of the nasal cavity and paranasal sinuses. While one died awaiting surgery, the family made a shared decision against surgical intervention in the patient with bilateral global tenting. None of the patients survived. We measured the posterior globe angle and degree of proptosis on T2-weighted magnetic resonance imaging (MRI) axial sections of the orbit. The posterior globe angle was measured between the tangents drawn along the medial and lateral margins of the posterior globe at the optic nerve insertion. Proptosis was measured as the difference (in millimeters) in the posterior aspect of the affected and unaffected eyeball relative to the interzygomatic line at the lenticular level [Fig. 1].^[7] The clinical and radiological details are shown in Table 1. Globe tenting of all the cases is shown in Figs. 1 and 2. Institutional Ethics Committee (IEC) approval was obtained. Consent waiver was approved by IEC.

Discussion

Posterior globe tenting was first described in 1989 by Dalley *et al.*^[1] in diverse disease conditions such as orbital cellulitis, subperiosteal abscess, hemorrhage into a lymphangioma, orbital varix, traumatic carotico-cavernous fistula, thyroid orbitopathy, IgG4-related disease, and multiple epithelial implantation cysts.^[8] In 2011, Theoret *et al.*^[2] described a similar phenomenon on orbital ultrasonography in an elderly patient of traumatic retrobulbar hemorrhage and named it the guitar pick sign due to the resemblance of the posterior globe to a guitar pick. Indiran *et al.*^[3] first reported this sign in a 60-year-old man with orbital aspergillosis.

The common denominator in all these conditions is the acutely increased intraorbital pressure. Orbital invasion by *Mucorales* sp., either by contiguous or perineural route, causes a precipitous rise in intraorbital pressure owing to accompanying intraorbital inflammation, swelling of the extraocular muscles, retro-orbital fat stranding, focal collections, thrombosis of the superior ophthalmic vein with or without cavernous sinus, and invasion of orbital apex

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Table 1: Clinical and radiological characteristics of the cohort

Case no.	1	2	3	4	5	6R	6L
Age (in years) and gender	60/Male	54/Male	25/Male	30/Male	45/Male	48/Male	
Comorbidities	Diabetes, renal dysfunction	Diabetes	Diabetes, renal dysfunction	Diabetes, renal dysfunction	Diabetes, renal dysfunction	Diabetes	
Symptoms	Ocular pain, swelling, and vision loss	Vision loss, swelling, and redness	Headache, ocular pain, and vision loss, right hemiparesis	Facial numbness, ocular pain, swelling, and loss of vision	Facial and ocular swelling with vision loss	Bilateral loss of vision and ocular swelling	
Side	Left	Left	Left	Left	Right	Right	Left
Duration (days)	6	7	2	3	2	1	1
Visual acuity	Absent PL	Absent PL	Absent PL	Absent PL	Absent PL	Absent PL	Absent PL
Pupils	Nonreactive	Nonreactive	Nonreactive	Nonreactive	Nonreactive	Nonreactive	Nonreactive
Ophthalmoparesis	Complete	Complete	Complete	Complete	Complete	Complete	Complete
Proptosis	Present	Present	Present	Present	Present	Present	Present
Globe angle (in degrees)	85	129	100	94	113	107	79
Proptosis (in mm)	6.1	4.5	6.8	7.5	8.2	†	
Radiological findings (orbits)	Orbital inflammation enlarged extraocular muscles Orbital fat stranding and focal collection Swollen optic nerve Superior ophthalmic vein thrombosis	Orbital inflammation Enlarged extraocular muscles Orbital fat stranding and focal collection Swollen optic nerve	Orbital inflammation Enlarged extraocular muscles Orbital fat stranding Swollen optic nerve	Orbital inflammation Enlarged extraocular muscles Swollen optic nerve	Orbital inflammation Enlarged extraocular muscles Swollen optic nerve Superior ophthalmic vein thrombosis	Orbital inflammation Enlarged extraocular muscles Swollen and stretched optic nerve	Orbital inflammation Enlarged extraocular muscles Orbital fat stranding and focal collection Swollen and stretched optic nerve Superior ophthalmic vein thrombosis
Definitive therapy	ISZ, nasal and sinus debridement, exenteration, palatal resection, and maxillectomy	LAMB nasal and sinus debridement, exenteration, palatal resection	LAMB nasal and sinus debridement, exenteration, maxillectomy	ISZ	ISZ, POS nasal and sinus debridement, exenteration, palatal resection, and maxillectomy	ISZ, nasal and sinus debridement	
Vision salvage	No	No	No	No	No	No	No
Life salvage	No	No	No	No	No	No	
Cause of death	Sepsis, multiorgan dysfunction	Myocardial infarction	Cerebral infarction, sepsis	Cerebral infarction, sepsis, and Diabetic Ketoacidosis	Cerebral infarction, sepsis	Sepsis, multiorgan dysfunction	

ISZ=isavuconazole, LAMB=liposomal amphotericin-B, PL=perception of light, POS=posaconazole. †Comparative measurement not done as proptosis is bilateral

and superior and inferior orbital fissures.^[9] All these events result in anterior globe displacement and tethering due to the limited capacity of optic nerve stretching, narrowing the posterior globe angle and lengthening the globe. As a result, the posterior globe assumes a conical shape with the optic nerve at the apex, giving it a characteristic appearance of a guitar pick. It is not seen in all the cases of orbital mucormycosis, probably due to a variable degree of redundancy of the optic nerve.^[1] Guitar pick sign can be appreciated on MRI, computed tomography, and orbital ultrasonography.^[2] T2-weighted axial MRI sequence of the orbits is the best modality for visualization, and

ultrasonography has the advantage of being easy to do, convenient, and repeatable. Normal posterior globe angle measures 150°. It is graded as mild if between 120° and 130° and severe if <120°.^[1]

The severity of posterior globe tenting is of substantial clinical relevance. Dally *et al.*^[1] showed severe globe tenting to be associated with dismal visual recovery. All but one orbit showed severe posterior globe tenting in our series. As shown in our series, reasons for vision loss in C-ROCM include one or more of the processes culminating into the development of guitar pick sign. Additional contributing factors include invasion of the

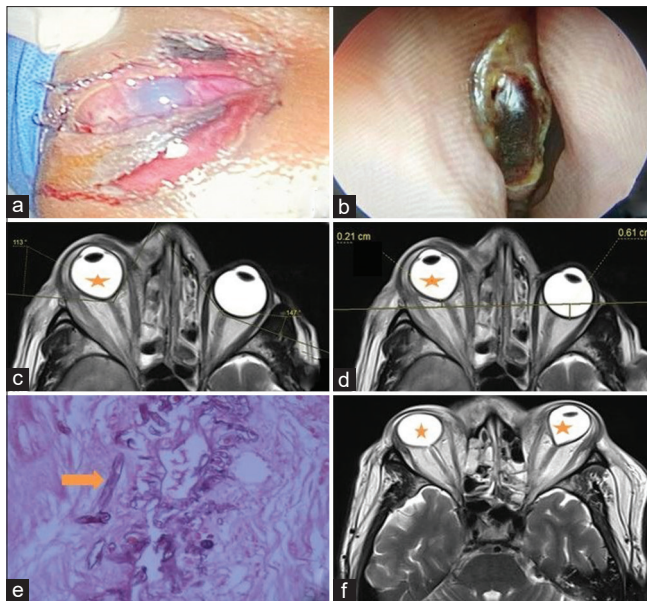


Figure 1: (a-f): Clinical photographs of case 5 (a), black fungal material (b), T2-weighted orbital MR axial images showing “guitar pick sign” (brown star) with posterior globe angle (c) and proptosis measurements (d), sinus mucosa histopathology showing (brown arrow) *Mucor* sp. (e) Bilateral guitar pick sign in case 6 (f) MR = magnetic resonance

optic nerve, ophthalmic artery, and cavernous and ophthalmic internal carotid artery segments by the fungal elements.^[4] Therefore, vision salvage is near impossible in the eyes with a guitar pick sign and orbital mucormycosis. Older age and longer time interval between the symptom onset and treatment were also shown to have poor visual outcomes despite intervention.^[10]

Conclusion

In conclusion, the guitar pick sign is a notable radiological finding which flags non-salvageable vision in C-ROCM. This finding is presumably independent of the COVID-19 association.

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Conflicts of interest

There are no conflicts of interest.

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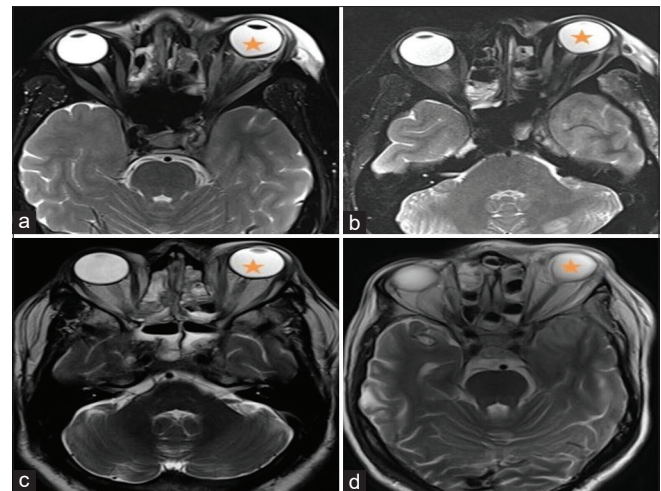


Figure 2: (a–d): T2-weighted orbital MR axial images of case 1 (a), case 2 (b), case 3 (c), and case 4 (d), showing “guitar pick sign” in the left-sided globe (brown star) MR = magnetic resonance

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