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.[3-4] 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.[3] 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.[13] 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. | Side | Duration (days) | Visual acuity | Pupils | Ophthalmoparesis | Proptosis | Globe angle (in degrees) | Proptosis (in mm) | Radiological findings (orbits) | Definitive therapy | Vision salvage | Life salvage | Cause of death |
|----------|------|----------------|---------------|--------|------------------|-----------|--------------------------|-----------------|--------------------------------|------------------|---------------|-------------|----------------|
| 1        | Left | 6              | Absent PL     | Nonreactive | Complete   | Present   | 85                       | 6.1             | Orbital inflammation, enlarged extraocular muscles, Orbital fat stranding and focal collection, Swollen optic nerve, Superior ophthalmic vein thrombosis | ISZ, nasal and sinus debridement, exenteration, palatal resection, and maxillectomy | No            | No          | Sepsis, multiorgan dysfunction |
| 2        | Left | 7              | Absent PL     | Nonreactive | Complete   | Present   | 129                      | 4.5             | Orbital inflammation, Enlarged extraocular muscles, Orbital fat stranding and focal collection, Swollen optic nerve | LAMB nasal and sinus debridement, exenteration, palatal resection | No            | No          | No            |
| 3        | Left | 2              | Absent PL     | Nonreactive | Complete   | Present   | 100                      | 6.8             | Orbital inflammation, Enlarged extraocular muscles, Orbital fat stranding, Swollen optic nerve | LAMB nasal and sinus debridement, exenteration, maxillectomy | No            | No          | No            |
| 4        | Left | 3              | Absent PL     | Nonreactive | Complete   | Present   | 94                       | 7.5             | Orbital inflammation, Enlarged extraocular muscles, Orbital fat stranding, Swollen optic nerve | ISZ              | No            | No          | No            |
| 5        | Right | 2             | Absent PL     | Nonreactive | Complete   | Present   | 113                      | 8.2             | Orbital inflammation, Enlarged extraocular muscles, Orbital fat stranding and focal collection, Swollen optic nerve, Superior ophthalmic vein thrombosis | ISZ, POS nasal and sinus debridement, exenteration, palatal resection, and maxillectomy | No            | No          | No            |
| 6R       | Right | 1             | Absent PL     | Nonreactive | Complete   | Present   | 107                      | 79              | Orbital inflammation, Enlarged extraocular muscles, Orbital fat stranding and focal collection, Swollen and stretched optic nerve, Superior ophthalmic vein thrombosis | ISZ, nasal and sinus debridement | No            | No          | No            |
| 6L       | Left  | 1             | Absent PL     | Nonreactive | Complete   | Present   | 79                       | -               | -                               | -                | No            | No          | No            |

ISZ=Isuvaconazole, 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
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.

**References**

1. Dalley RW, Robertson WD, Rootman J. Globe tenting: A sign of increased orbital tension. AJNR Am J Neuroradiol 1989;10:181-6.
2. Theoret J, Sanz GE, Matero D, Guth T, Erickson C, Liao MM, et al.

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**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.

**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.

The “guitar pick” sign: A novel sign of retrobulbar hemorrhage. CJEM 2011;13:162-4.
3. Indiran V. “Guitar pick sign” on MRI. Indian J Ophthalmol 2019;67:1737.
4. Sen M, Honavar SG, Bansal R, Sengupta S, Rao R, Kim U, et al. Study on Mucormycosis in COVID-19 (COSMIC) Study Group. Epidemiology, clinical profile, management, and outcome of COVID-19-associated rhino-orbital-cerebral mucormycosis in 2826 patients in India-Collaborative OPAI-IJO study on mucormycosis in COVID-19 (COSMIC), report 1. Indian J Ophthalmol 2021;69:1670-92.
5. Vasudevan B, Hazra N, Shijith KP, Neema S, Vendhan S. Mucormycosis: The scathing invader. Indian J Dermatol 2021;66:393-400.
6. Manchanda S, Semalti K, Bhalla AS, Thakar A, Sikka K, Verma H. Revisiting rhino-orbito-cerebral acute invasive fungal sinusitis in the era of COVID-19: Pictorial review. Emerg Radiol 2021;28:1063-72.
7. Nguyen VD, Singh AK, Altmeyer WB, Tantiwongkosi B. Demystifying orbital emergencies: A pictorial review. Radiographics 2017;37:947-62.
8. Reddy YM, Parida S, Reddy SB, Tourani V, Murthy JMK. A new-found cause of “guitar pick sign”: IGG4 related disease. Acta Neurol Belg 2021. doi: 10.1007/s13760-021-01844-6. Online ahead of print.
9. Malhotra HS, Gupta P, Mehrrota D, Dandu H, Kohli N, Verma V, et al. COVID-19 associated mucormycosis: Staging and management recommendations (Report of a multi-disciplinary expert committee). J Oral Biol Craniofac Res 2021;11:569-80.
10. Lindsay RA, Weiss AH, Kelly JP, Anderson VC, Lindsay TH, Cabrera MT. Clinical outcomes in children with orbital cellulitis and radiographic globe tenting. Ophthalmic Plast Reconstr Surg 2018;34:329-32.