ABSTRACT Mucormycosis is an angioinvasive disease caused by fungi of the order Mucorales like Rhizopus, Mucor, Rhizomucor, Cunninghamella and Absidia. The prevalence of mucormycosis in India is approximately 0.14 cases per 1000 population, about 80 times the prevalence in developed countries (1). Mucormycosis is a potentially fatal opportunistic infection that can manifest in many different clinical forms, including a rhinocerebral form, in the pulmonary system, central nervous system, gastrointestinal system, and other parts of the body. Rhinocerebral mucormycosis is subdivided into 3 groups: rhinomaxillary, rhino-orbital, and rhino-orbito-cerebral mucormycosis. Extensive forms of the disease include ophthalmia and cranial nerve involvement. Mucormycosis is more often seen in immunocompromised individuals, and complications of orbital and cerebral involvement are likely in diabetic ketoacidosis and with concomitant use of steroids. The most common risk factor associated with mucormycosis is diabetes mellitus in India. Hence, early diagnosis of this potentially life-threatening disease and prompt treatment is of prime importance in reducing the mortality rate. Recently, several cases of mucormycosis in people with COVID-19 have been increasingly reported worldwide, particularly in India. We, hereby, report 4 cases of clinically diagnosed orbital mucormycosis with concurrent COVID-19 illness at our institute over the last 2 months (May and June 2021).

KEYWORDS Pandemic, covid-19, diabetes mellitus, mucormycosis

Introduction

Mucormycosis is an angioinvasive disease caused by fungi of the order Mucorales like Rhizopus, Mucor, Rhizomucor, Cunninghamella and Absidia. The prevalence of mucormycosis in India is approximately 0.14 cases per 1000 population, about 80 times the prevalence in developed countries (1). Mucormycosis is a potentially fatal opportunistic infection that can manifest in many different clinical forms, including a rhinocerebral form, in the pulmonary system, central nervous system, gastrointestinal system, and other parts of the body. Rhinocerebral mucormycosis is subdivided into 3 groups: rhinomaxillary, rhino-orbital, and rhino-orbito-cerebral mucormycosis (2). Extensive forms of the disease include ophthalmia and cranial nerve involvement (3). Mucormycosis is more often seen in immunocompromised individuals, and complications of orbital and cerebral involvement are likely in diabetic ketoacidosis and with concomitant use of steroids. The most common risk factor associated with mucormycosis is diabetes mellitus in India (4). Hence, early diagnosis of this potentially life-threatening disease and prompt treatment are important in reducing the mortality rate.

Several cases of mucormycosis in people with COVID-19 have been increasingly reported worldwide, particularly in India. We, at this moment, report 4 cases of clinically diagnosed orbital mucormycosis with concurrent COVID-19 illness at our institute over the last 2 months (May and June 2021). All of these patients were known people with diabetes mellitus and were being treated for the same in our hospital. Potassium hydroxide (KOH) wet mount and fungal culture/sensitivity were done from biopsy obtained during debridement or from nasal swab obtained during diagnostic nasal endoscopy. Microbiological diagnosis of mucormycosis was proven in three patients. All patients in our series were known people with dia-
betes and were receiving intravenous steroids, broad-spectrum antibiotics and remdesivir as a part of the treatment of COVID-19. All patients in our series had received intravenous dexamethasone for COVID-19 disease as per The National Institute of Health recommendations(5). The use of steroids, monoclonal antibodies, and broad-spectrum antibiotics to manage COVID-19 illness can increase the chances of new-onset fungal infection or exacerbate a preexisting one. (6)

**Case 1**

A 72-year-old diabetic female patient presented with severe unilateral right-sided headache with ipsilateral eye ache for two days, relieved by analgesics. On examination on day 1, visual acuity was 6/12 in the right eye, mild ptosis (<2 mm), proptosis(<22 mm), mild periorbital oedema, and upper lid erythema were noticed. There was no restriction of ocular motility in the right eye. Visual acuity in the left eye was 6/24. No other significant findings except for lenticular changes were seen. CE MRI showed bilateral pansinusitis with multiple T2 hypointense non-enhancing areas, likely suggestive of fungal aetiology with narrow focal oedema in the right frontal bone with a small subdural leptomeninges involvement in the right frontal region with peripheral inflammation of the right orbit. KOH smear showed no growth. Diagnostic Nasal Endoscopy showed no discoloration but pus discharge in the middle meatus. On Day 3, the patient had severe ptosis (>4mm), severe proptosis, periorbital oedema, conjunctival chemosis and restricted ocular motility in all gazes. Treatment with Amphotericin B was initiated, and Bilateral FESS was performed.

**Case 2**

A 55-year-old diabetic male patient presented with a painful loss of vision and swelling in the left eye with blackish discolouration around the left eye. On examination of the left eye, visual acuity showed no PL. The patient had severe ptosis (>4mm), severe proptosis, periorbital oedema, conjunctival chemosis and sub-conjunctival haemorrhage in the right eye. Ocular motility was completely restricted in all positions of gaze. Diagnostic Nasal Endoscopy revealed black necrotic tissue in inferior turbinate, inferior meatus, middle septum up to skull base with right-sided DNS. Histopathological examination and radiological imaging were consistent with mucormycosis. The patient was started on initial treatment with Amphotericin B, following which Right maxillectomy was performed with Weber’s Fergusson approach.

**Case 3**

Fifty-eight-year-old diabetic male patient, known case of CKD, k/c/o reactive arthritis, with severe anaemia presented with sudden, painful diminution of vision and swelling of the right eye for two days. On examination of the right eye, visual acuity was PL+, PR + in all quadrants. The patient had mild ptosis, proptosis, periorbital oedema, conjunctival chemosis and sub-conjunctival haemorrhage in the right eye. Ocular motility was restricted in all directions of gaze. Diagnostic Nasal Endoscopy showed black necrotic tissue in inferior turbinate, inferior meatus, middle septum up to skull base with right-sided DNS. KOH smear was positive for aspergillus. Histopathological examination and radiological imaging were consistent with mucormycosis. The patient was started on treatment with Amphotericin B, following which Right maxillectomy was performed with Weber’s Fergusson approach.

**Case 4**

82-year-old male patient, k/c/o T2DM, hypertension, hyperthyroid and post-TURP presented pain and diminution of vision in the right eye, drooping of the right upper lid, and right-sided facial swelling. On examination, light perception and projection of rays were present. The patient had ptosis, proptosis, and periorbital oedema of the right eye. A mid dilated fixed pupil with absent light reflex was seen in the right eye. Ocular motility was restricted in all directions of gaze. In the left eye, visual acuity was PL+/PR+. Periorbital oedema, conjunctival chemosis, and congestion were seen in the left eye with restricted ocular motility in all gaze directions. KOH mount of Deep Nasal swab showed aseptate broad-based, ribbon-like hyphae suggestive of muco. Imaging with contrast suggested features of rhino orbital mucormycosis, and the patient was put on treatment accordingly.
Table 1 Demographic and clinical profile of patient along with major symptoms.

| S.no | Age/sex | Eye involved | Visual acuity | Eye ache | Headache | Ptosis | Proptosis | Conjunctival chemosis | Ophthalmoplegia |
|------|---------|--------------|---------------|----------|----------|--------|-----------|----------------------|----------------|
| 1.   | 72/F    | Rt           | 6/12          | +        | +        | +      | +         | -                    | +              |
| 2.   | 55/M    | Lt           | NPL           | +        | -        | +      | +         | +                    | +              |
| 3.   | 58/M    | Rt           | PL+           | +        | +        | +      | +         | +                    | +              |
| 4.   | 82/M    | Rt           | PL+           | +        | +        | +      | +         | -                    | +              |

Rt= Right, Lt=Left, NPL= No perception of light, PL= light perception present

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Conflict of Interest
There are no conflicts of interest to declare by any of the authors of this study.

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