Investigation of an acute surge of COVID-19 associated mucormycosis (CAM) cases reported to a tertiary health care institution in Bihar, India

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ABSTRACT

Introduction: Acute surge in coronavirus disease-2019 (COVID)-associated mucormycosis (CAM) cases was reported during mid-May 2021, which was later declared an epidemic in various states of India including Bihar. Objective: We carried out a rapid investigation of CAM cases to describe the epidemiological and clinical profiles and find plausible predictors to guide the initiation of public health actions. Methods: A team of public health specialists contacted all the CAM cases reported to our hospital to collect relevant information using a case-investigation-form. In addition, the team visited the Flu Clinic and Ear, Nose, and Throat (ENT) outpatient department (OPD) to capture CAM cases on daily basis during the period of the acute surge of CAM cases. Results: About 88% of 130 CAM cases reported during the period of the acute surge were in the advanced stage of mucormycosis. The majority of the CAM cases were younger (less than 60 years) [76.2%], diabetics [65.4%], un-vaccinated [86.9%], and had used steroids for management of COVID-19 [64.6%]. Other findings of public health importance were summarized and possible public health actions were recommended for the prevention of outbreaks in future. Conclusion: Optimum management of diabetes including screening for each COVID case, rational use of steroids only when necessary, strict adherence to COVID appropriate behavior by health professionals as well as the public, increasing COVID vaccine coverage, CAM awareness, and setting up a CAM surveillance mechanism may be the key to prevent and control CAM outbreaks in future.

Keywords: COVID-19, COVID-19-associated mucormycosis, outbreak investigation, SARS CoV-2

Introduction

COVID-19, caused by SARS CoV-2 and first reported from the Wuhan city of Hubei province, China, in December 2019, has resulted in a global pandemic with multiple waves. India is one of the worst affected countries with more than one wave of COVID-19 pandemic, resulting in about 4 lakh cases and over 4,000 deaths on daily basis during the peak of the second wave. The symptoms profile of COVID-19 varies from mild symptoms such as cold, cough, and fever to severe symptoms such as life-threatening pneumonia associated with secondary bacterial and fungal infections. COVID-19 patients with associated co-morbidities (such as diabetes mellitus, asthma, and chronic...
obstructive pulmonary disease (COPD)) and immunocompromised states (such as indiscriminate steroid use, prolonged steroid use) are more at risk of developing opportunistic fungal infections such as mucormycosis, invasive pulmonary aspergillosis, and candidiasis.\[8\] The prevalence of mucormycosis in India has been reported to be 14 per 100,000 population and is on a rising trend due to a high number of uncontrolled diabetes.\[8\] COVID-19 with associated immunocompromised conditions provides a suitable environment for the development of mucormycosis.\[3,4,6–8\] The COVID-19 management guidelines during the second wave recommended the use of steroids in moderate and severe cases, and also mild cases who remain symptomatic (cough) after 7 days of treatment with other drugs. The use of steroids in COVID-19 has been lifesaving. However, injudicious use of steroids not only affects the blood glucose level but also suppresses the immune function, resulting in higher risk of contracting opportunistic infections.\[6\] Isolated reports and case series of CAM have been reported toward the tail end of the first wave of COVID-19.\[3,4,6–8\] High fatality among CAM has also been reported by a few.\[8\]

Empirical observations have shown an acute surge of CAM during the second wave of COVID-19 in India during May 2021 and have resulted in an epidemic.\[8–11\] With the increase in CAM, the MoHFWS, GoI has urged states to declare CAM as an epidemic. The states/Union Territories of India have declared CAM as an epidemic and notifiable disease. Experience from the first wave indicates that CAM develops during the second week of COVID-19 infection, especially among immunocompromised patients or patients with uncontrolled blood glucose levels.\[9] The CAM has been reported to affect the eyes, nose, brain, and lungs resulting in various complications including death.\[6,8,9\] During the second wave of the COVID-19 pandemic, the Government of Bihar declared CAM an epidemic due to an increase in the number of cases reported from various parts of the state. There is a dearth of information on probable risk factors for CAM and transmission dynamics of CAM. Hence, this investigation of the acute surge in cases of CAM reported to a tertiary health care institution was planned to understand the transmission dynamics of CAM so that appropriate public health measures can be formulated to prevent further spread and control of CAM epidemic. The objectives of the investigation were, first, to describe the clinicoepidemiological and risk factors profile of CAM and, second, to assess plausible predictors events, leading to CAM among COVID-19 patients admitted at tertiary health care institutions in Patna, Bihar. We also formulated a hypothesis to be tested for future public health action and policy.

Methodology

Study context

On May 13, 2021, first case of CAM was reported from Bihar who was treated at Indira Gandhi Institute of Medical Sciences (IGIMS), Patna. The first case of CAM was reported to the All India Institute of Medical Sciences (AIIMS), Patna, on May 17, 2021. With the report of more than 100 cases of CAM from various hospitals, the Government of Bihar declared CAM an epidemic. Four tertiary health care institutions, AIIMS, Patna, Patna Medical College and Hospital Patna, and Nalanda Medical College and Hospital Patna, were declared designated centers for the management of CAM cases.

Study design

We adopted a descriptive study design to investigate the acute surge in cases of CAM reported to our institution.

Study setting and period

The investigation was carried out at our institution, which is one of the four designated centers in Bihar for the management of CAM. During the period from May 24 to June 13, 2021, 130 confirmed cases of CAM were investigated. The post-COVID CAM cases had been admitted to inpatient wards of the Department of Ear, Nose, and Throat (ENT), Ophthalmology, and General Medicine. The CAM cases with active COVID-19 disease were admitted to COVID-19 wards through the flu clinic. The post-COVID CAM cases were admitted through mucormycosis outpatient department (OPD) services run by the ENT department. A separate mucormycosis ward was created in our institution to cater to post-COVID CAM cases. We also screened all COVID-19 patients already admitted to the COVID ward and under treatment for the presence of CAM. We used the CAM definition released by AIIMS, New Delhi,\[12\] to screen the admitted COVID-19 patients. The CAM definition checklist is given as supplementary material [Box 1] in this study. None of the in-house COVID-19 patients in our institution during the investigation period was screened to be having CAM. All CAM cases were referred and confirmed ones.

Investigating team

The investigating team comprises junior residents (JRs), senior residents (SRs), and faculty members from the Department of...
Community and Family medicine, Department of Microbiology, and Department of ENT of our institute. A case investigation form was developed following the published literature on CAM and in consultation with epidemiologists, experts from ENT and ophthalmology, and advisory issued by AIIMS, New Delhi. The investigating team was thoroughly briefed and trained on the case investigation form. The data collection and data entry were carried out by SRs and JRs under the supervision of a faculty from the Department of Community and Family Medicine.

**Detailed investigation of CAM cases**

The Flu Clinic and Mucormycosis ward maintain a register for CAM with active COVID and post-COVID cases, respectively. JRs and SRs were divided into teams and visited the mucormycosis ward and flu clinic on daily basis during the investigation period.

The team visiting the mucormycosis ward collected information as per the case investigation form from already admitted CAM patients and thereafter newly admitted patients on a daily basis. Once mucormycosis ward capacity was full, further cases were referred to other designated centers for the management of CAM. We deployed two team members at the mucormycosis ENT OPD to capture information from those referred CAM cases. The team visiting the Flu clinic initially screened all COVID cases admitted to different COVID wards for signs and symptoms of CAM. The screening was done by collecting information from incharge doctors of the COVID ward telephonically regarding CAM signs and symptoms developed by patients. The CAM register maintained at the Flu Clinic was checked for entry of active COVID-19 patients with CAM. The patient was traced to the ward by the team members, and relevant information was collected using the case investigation form. Every 3-4 days incharge doctors of COVID wards were contacted for patients with new-onset signs and symptoms of CAM. During the period of investigation, no in-house active COVID-19 patient was found to have signs and symptoms of CAM.

The case investigation form developed for the collection of relevant information had five sections. The first section included information on the general characteristics of CAM patients. The information on possible risk factors for CAM was collected in the second section. We collected information on details of COVID-19, its treatment history, and COVID-appropriate behaviors during treatment in the third section. Post-COVID preventive measures adopted by the patient were noted in section four and the details of CAM were noted in section five.

The Institute Research Committee and Institute Ethics Committee had been informed about the investigation. The letter of approval has been obtained from the Institute Ethics Committee.

**Statistical analysis**

The information using the case information sheet was collected by face-to-face interview and entered in Epicollect5. The data were retrieved into Microsoft Excel from Epicollect5, and the analysis was performed using SPSS version 20. Data are presented as mean (standard deviation) for quantitative variables and as the proportion for categorical variables. The COVID appropriate behaviors, housing environment were narrated in the result section.

**Results**

Out of 130 CAM patients, maximum patients (38.5%) were aged less or equal to 45 years. The median age of the patients was 50 years (range: 23 years to 83 years). The majority of the patients were male (70%) and about one-fourth had no formal education. About 87% of the patients had not taken even a single dose of the COVID vaccine. Three-quarters of the patients had chronic co-morbidities and nearly two-third were known diabetics. Of the CAM patients with diabetics, blood sugar was controlled in 66% cases, uncontrolled in 29% cases, and status unknown in 5% cases. About 65% and 55% of the patients had a history of taking steroids and zinc for the management of COVID-19 [Table 1].

Sample collection using a nasopharyngeal swab was done to diagnose SARS CoV-2 in 72% of the patients. In 10%, patients reported no use of sterile swabs to collect samples. Nearly 25% and 75% of patients reported that the sample collector did not change the gloves and did not sanitize hands before sample collection. About a quarter of patients reported that the swab was kept open for a few minutes before collecting the sample. The majority of the patients were home-treated for COVID-19. Nearly 55% of the patients treated at home had used steroids for the management of COVID-19, of whom 60% had been advised by doctors. Only 5 persons had required oxygen supplementation during home treatment. The majority of the home-treated patients had steam inhalation with frequency ranging from one to five times (median twice). Nearly 71% of the patients treated at a health facility had been administered steroids. Two-third of the patients treated at the hospital facility had been administered oxygen and only two of them (2 out of 42) were from industrial grade cylinders. In 44% of cases, distilled water was used for humidification. Nearly half of the patients at the hospital had taken steam inhalation with frequency ranging from one to five (median 3 times). Eight and four out of 62 patients had been administered immunosuppressive therapy and were transferred to the intensive care unit (ICU), respectively [Table 2]. Post recovery from COVID, only 66% of the patients reported using masks always while stepping out of the home [Figure 1].

The majority (58.5%) of the CAM patients had moderately advanced disease. The distribution pattern of the severity of CAM is similar across age groups, gender, diabetics and non-diabetics, and steroid use status. Severe CAM appears twice more common among those who are unvaccinated compared to vaccinated (31% vs. 17.8) [Table 3]. Headache (90%) followed by pain over the face (83%) was the commonest symptom among CAM patients. About a quarter of patients had eye swelling (76%) and eye pain (72%). Throbbing headaches and new-onset squint
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were present in 28.5% and 5.4% of the patients. Half the CAM cases were diagnosed using imaging techniques, and so far, no death has been reported among CAM patients [Table 4].

**Other information of public health importance**

No pattern of clustering (based on residence) of CAM cases was observed.

None of the patients reported more similar illnesses in their locality. Only three patients had reported one similar case in their locality.

Only 12 (9.2%) patients reported dampness in their houses and 8 (6.2%) patients reported ongoing constructions near their house.

**Hypothesis generated**

The acute surge in cases of CAM could be due to low immunity conferred as a result of diabetes and rampant, inadvertent use of steroids for the management of COVID-19 during the second wave of the pandemic.

The majority of the patients were not vaccinated so the acute surge in cases of CAM could also be due to lowering of immunity by newer variants of SARS-CoV-2 per se and the same was compounded by the presence of diabetes and rampant use of steroids for management of COVID-19 during the second wave of the pandemic.

**Discussion**

Mucorales are ubiquitous and generally do not cause diseases of concern in human beings. However, humans get affected once their immunity is compromised.[5,13,14] The current pandemic has given rise to situations leading to an immunocompromised state in affected individuals. The COVID-19 pandemic has resulted in the diagnosis of new diabetics, the unmasking of hidden diabetics, and the exacerbation of many controlled diabetics.[15,16] Steroid was recommended for the management of COVID-19 based on the evidence that outcomes are better in moderate-to-severe cases of COVID-19.[17] Steroid use has its deleterious effects.[18] Despite the demerits, the use of steroids in the management of COVID-19 was rampant and inadvertent during the second wave of the COVID-19 pandemic in India.
Though mucormycosis is present in India for a long time, adequate attention was not paid till the COVID-19 pandemic. Despite devastating health effects, it was never been in the public health priorities. The acute surge in cases of CAM added a new direction to the public health agenda of India. Here, through this investigation, we described the clinicoepidemiological details of CAM and presented the possible public health solutions to prevent the further surge of CAM cases.

The majority of the CAM cases were presented in the advanced stage of the diseases. Nearly two-thirds of cases had diabetes and a history of steroid use for the management of COVID-19. More than 85% of the cases have not been vaccinated even with a single dose of the COVID vaccine. Many patients reported breaches in maintaining sterility of nasopharyngeal swabs during sample collection. Post recovery strict adherence to using masks was not followed by many patients.

Nearly 90% of CAM cases were presented to our institute at the advanced stage of the disease. Lack of awareness about mucormycosis among the general public could be the reason. Mucormycosis is not on the priority list of the public health agenda in most of the countries including India. Fungal diseases, especially mucormycosis, have always been reported as a concealed infection secondary to other diseases such as HIV, cancer, diabetes, or other immunocompromised states. Hence, research priorities and information, education, and communication (IEC) activities in the general are less evident.

As a consequence, the general public is probably unaware of the symptoms of mucormycosis, leading to late health-seeking behavior. Disease progression of mucormycosis is rapid once angio-invasion has set in.

We observed that patients less than 60 years of age accounted for about three-fourth of CAM cases reported. This may be

| Table 2: Details of diagnosis and management of COVID-19 of CAM patients |
|---------------------------------------------------------------|
| **Parameters** | **Frequency (n)** | **Percentage** |
| Nasopharyngeal swab taken | Yes | 93 | 71.5 |
| Sterility of nasopharyngeal swab | Use of sterile swab | 84 | 90.3 |
| | Hand gloves changed by the sample collector | 71 | 76.3 |
| | Sanitization of hands done by the sample collector | 32 | 24.6 |
| | Swab kept open | 25 | 26.88 |
| Place of treatment | Home | 68 | 52.2 |
| | Hospital | 44 | 33.8 |
| | Both | 18 | 13.8 |
| Steroid use during home treatment (n=86) | Yes | 47 | 54.7 |
| Person who has prescribed steroid (n=47) | Doctor | 28 | 59.6 |
| | Relatives | 2 | 4.2 |
| | Couldn’t recall | 17 | 36.2 |
| Zinc use during home treatment (n=86) | Yes | 43 | 50 |
| Use of oxygen during home treatment (n=86) | Yes | 5 | 5.8 |
| Steam inhalation during treatment at home (n=86) | Yes | 46 | 53.5 |
| Sources of water for steam inhalation at home (n=46) | Water from household tap | 20 | 43.5 |
| | Underground water stored in vessel | 12 | 26.1 |
| | Distilled water | 8 | 17.4 |
| | Couldn’t recall | 6 | 13.0 |
| Type of hospital where treated for COVID-19 (n=62) | Government | 39 | 62.9 |
| | Private | 20 | 32.3 |
| | Both | 3 | 4.8 |
| Steroid administration at hospital treatment (n=62) | Yes | 44 | 70.9 |
| Oxygen administration at hospital (n=62) | Yes | 41 | 66.1 |
| Sources of oxygen (n=41) | Piped oxygen supply | 21 | 51.2 |
| | Medical grade cylinder | 12 | 29.3 |
| | Industrial grade cylinder | 2 | 4.9 |
| | Don’t know | 6 | 14.6 |
| Source of water for humidifier at hospital (n=41) | Distilled water | 18 | 43.9 |
| | Tap water | 5 | 12.2 |
| | Don’t know | 7 | 17.1 |
| | No response | 11 | 26.8 |
| Steam inhalation at hospital (n=62) | Yes | 29 | 46.8 |
| Zinc administration at hospital (n=62) | Yes | 34 | 51.6 |
| Immunosuppressants at hospital (n=62) | Yes | 5 | 8.1 |
| ICU transfer at hospital treatment (n=62) | Yes | 4 | 6.5 |
| Post COVID steam inhalation (n=130) | Yes | 34 | 23.1 |
due to vaccination effects. In India, the COVID vaccine was administered to healthcare workers, frontline workers, and the elderly in the initial two phases. Sub-analysis of vaccination versus age group also revealed that the majority of the elderly were vaccinated, whereas the majority of the young population was not vaccinated. However, further research is required to understand this properly.

The majority of the patients reported the use of zinc during COVID management. Zinc is required for various cellular functions. Zinc chelators have been proposed as a therapeutic addendum in the management of mucormycosis.\[^{22,23}\]

Post-COVID recovery continued zinc consumption without any indication need to be discouraged.

Nearly two-thirds of the patients had diabetes and about 30% of them had uncontrolled diabetes. Diabetes has been well established with opportunistic infections due to immunity-lowering effects. Steroids are also well established for immunity-lowering effects. Mucormycosis, being an opportunistic infection, is more common among individuals with compromised immunity. CAM case reports and case series published from India also recorded diabetes, both controlled and uncontrolled, as well as the use of steroids for the management of COVID-19.\[^{3,4,6,8}\]

Importance for family physicians
The COVID-19 pandemic is not yet over. There is a possibility of the emergence of subsequent waves with newer variants of SARS-CoV-2 and with varying degrees of severity. The omicron variant (B.1.1.529) first detected in South Africa in November 2021 has spread to several countries including India.\[^{24,25}\]

The median time interval between tested positive for SARS-CoV-2 and the diagnosis of mucormycosis was 25 days and ranged from 0 days (CAM in active COVID patients) to 65 days. The most common symptoms among investigated CAM cases were headache, pain over the face, eye swelling, localized facial puffiness, eye pain, persistent nasal obstruction not responding to medicines, loss of sensation over the face, drooping of eyelids, nasal crusting, and eye redness. The general population needs to be aware of these common signs and symptoms of CAM and the recovered patients need to be counseled to watch these symptoms for nearly 2 months post-recovery.

| Variables | Relatively early disease [n (%)] | Moderately advanced disease [n (%)] | Very advanced disease [n (%)] |
|-----------|---------------------------------|------------------------------------|-----------------------------|
| All patients | 16 (12.3) | 76 (58.5) | 38 (28.2) |
| Age (in years) | | | |
| ≤45 | 4 (8.0) | 32 (64.0) | 14 (28.0) |
| 46-59 | 8 (16.3) | 24 (49.0) | 17 (34.7) |
| ≥60 | 4 (12.9) | 20 (64.5) | 7 (22.6) |
| Gender | | | |
| Male | 11 (12.1) | 56 (61.5) | 24 (26.4) |
| Female | 5 (12.8) | 20 (51.3) | 14 (35.9) |
| Vaccination | | | |
| No | 13 (11.5) | 65 (57.5) | 35 (31.0) |
| Yes | 3 (17.7) | 11 (64.6) | 3 (17.7) |
| Diabetes mellitus | | | |
| No | 5 (11.1) | 25 (55.6) | 15 (33.3) |
| Yes | 11 (12.9) | 51 (60.0) | 23 (27.1) |
| Steroid use during the treatment of COVID-19 | | | |
| No | 4 (8.7) | 28 (60.9) | 14 (30.4) |
| Yes | 12 (14.3) | 48 (57.1) | 24 (28.6) |
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Important findings
• Maximum (87%) of CAM patients had not taken even a single dose of COVID-19 vaccine
• Around three-fourth of the CAM patients had chronic comorbidities and nearly two-third were known diabetic.
• Nearly two-thirds (65%) of patients had a history of taking steroids for the management of COVID-19
• Post recovery from COVID-19, only 66% of the patients reported using masks always while stepping out of the home.
• Severe CAM appears twice more common among those who are unvaccinated compared to vaccinated (31% vs. 17.8)
• Headache (90%) followed by pain over the face (83%), eye swelling (76%), and eye pain (72%) were common symptoms reported among the CAM patients.
• The median time interval between tested positive for SARS-CoV-2 and the diagnosis of mucormycosis was 25 days and ranged from 0 days (CAM in active COVID patients) to 65 days.

Recommendation based on observation
Public health prevention measures
a. Aseptic swab collection: Aseptic process like that of the precision of a surgery steps need to be followed for nasopharyngeal sample collection. The staff needs to be trained on that aspect and if required additional staff needs to be deployed in case of heavy rush.
b. Ensuring a safe and clean environment for home-isolated COVID cases. Due to the inadequate capacity of the healthcare system, asymptomatic and mild cases of COVID-19 without any co-morbid conditions are home isolated. A visit to the house of the patient and educating the family to prevent dampness will reduce the chance of CAM.
c. Discouraging inadvertent and unsupervised steroid use: The casual use of steroids in the management of

| Variable                                                                 | Frequency (n) | Percentage |
|--------------------------------------------------------------------------|---------------|------------|
| Relatively early disease (involvement of nose and nasal sinuses)         |               |            |
| Headache                                                                 | 117           | 90.0       |
| Pain on face                                                             | 108           | 83.1       |
| Localized facial puffiness                                              | 98            | 75.4       |
| Persistent nasal obstruction not responding to medicine                 | 87            | 66.9       |
| Loss of sensation over the face                                          | 75            | 57.7       |
| Nasal crusting                                                           | 70            | 53.8       |
| Brownish or blood-tinged discharge from nose                            | 57            | 43.8       |
| Loosening of teeth                                                      | 41            | 31.5       |
| Discoloration/ulceration of palate                                       | 37            | 28.8       |
| Discoloration of the skin of the face                                    | 36            | 27.7       |
| Moderately advanced disease (eye/orbit involvement)                     |               |            |
| Eye swelling                                                             | 99            | 76.2       |
| Eye pain                                                                 | 93            | 71.5       |
| Drooping eyelids                                                         | 75            | 57.7       |
| Eye redness                                                             | 70            | 53.8       |
| Double vision                                                           | 41            | 31.5       |
| Loss of vision                                                           | 35            | 26.9       |
| Very advanced disease (intracranial extension)                          |               |            |
| Throbbing headache                                                      | 37            | 28.5       |
| New-onset squint                                                        | 7             | 5.4        |
| Hemiplegia/hemiparesis                                                  | 0             | 0          |
| Diagnosis of CAM                                                         |               |            |
| Imaging (CT/MRI)                                                        | 66            | 50.8       |
| KOH mount                                                               | 42            | 32.3       |
| Biopsy and HPE                                                          | 16            | 12.3       |
| Current modality of treatment (undergone/planned)                       |               |            |
| Medical management                                                      | 89            | 68.5       |
| Both medical and surgical management                                    | 41            | 31.5       |
| Outcomes                                                                |               |            |
| Completely cured                                                        | 2             | 1.5        |
| Cured with disability                                                   | 2             | 1.5        |
| Undertreatment                                                          | 126           | 97.0       |
| Death                                                                   | 0             | 0          |
COVID-19 should be stopped. Every case of steroid use should be rationalized. Over-the-phone prescription of steroids by health personnel, generally done for mild cases unplanned, should be discouraged. The public should be educated to prevent over-the-counter use of steroids for the management of home-isolated COVID cases with adequate and appropriate information on the consequences of unprescribed, unsupervised use of steroids.

d. Screening of patients for diabetes: Opportunistic infections such as CAM are more common among diabetics. Though diabetes screening is done during the management of COVID in hospital settings at secondary and tertiary levels, the same is often not followed for home isolated cases and in primary health care levels. Screening for diabetes should be made mandatory in every case of reverse transcriptase - polymerase chain reaction (RT-PCR) positive for SARS-CoV-2.

e. Surveillance for signs and symptoms and, disease: CAMs need to be on the priority list of public health agenda in the current situation. With the third wave of the COVID-19 pandemic expected shortly, surveillance measures are to be in place to screen, detect, and manage CAM cases early to prevent disability and death. Each COVID-19 patient needs to be educated about the signs and symptoms of CAM at the time of discharge. Surveillance mechanisms need to develop to track the health of COVID-19 patients at least 2 months post-recovery from COVID-19. This can be done by developing a Mobile Application (Mob App), where the recovered patient can register and indicate symptoms. The monitoring team, which happens to be the care provider of the patient, can monitor this App to screen and detect CAM in the early stage. This can help minimize the burden of CAM (disability and death).

Conclusion

Screening and control of diabetes and rational use of steroids only under medical supervision for the management of COVID-19 are key to preventing the occurrence of CAM cases. In addition, strictly following the COVID-19 prevention guidelines including increasing the coverage of COVID vaccination can help check the emergence of CAM cases. CAM awareness among the general public and health personnel as well as setting up a CAM surveillance mechanism will be useful to avoid CAM-related disability and death.

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Data availability statement

Data are available with the author for correspondence and will be accessible on request.

- Risk factors for CAM are diabetes, use of steroid, and no COVID-19 vaccination
- Awareness on signs and symptoms by patient as well as health functionaries is important to detect CAM in an early stage
- Headache, pain over face, eye swelling, eye pain, nasal discharge not responding to medications are early signs and symptoms
- Post recovery the screening of CAM should be done for at least 2 months.

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Conflicts of interest

There are no conflicts of interest.

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