



Steroids Induced Black Fungus Infection in India During the May 2021 COVID-19 Outbreak

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Abstract India was at the center of the attention of global media for the outbreak of COVID-19 infection in May 2021, because of the large total number of daily new cases and fatalities not expressed as a fraction of the total population. In addition to the alleged more infective and fatal variant delta, the emergence of particularly lethal fungal infections in between those that have been infected was also reported. Here we comment as while the specific numbers for India, for both new cases and fatalities, were everything but dramatic, with other countries such as the United Kingdom has experienced much worse outcomes, the incidence of black fungus minimally affected the COVID-19 fatalities. First better care, and the use of intravenous antifungals, and then the use of better therapies in the early stages of infection to prevent more serious outcomes, reduced the burden of this fungal infection.

Keywords Fungal infection · COVID-19 · India

May 2021 Black Fungus Infection

It was reported in May 2021 of COVID-19 variants spreading rapidly in India, linked to a surge in infections [1, 2]. There was evidence of one variant being more transmissible and slightly better at evading immunity [1, 2]. The rise in fatalities, still small if considered relative to the population when compared to countries such as the

United Kingdom, made the international headlines. Cases-per-million peaked at 283.534 about May 9, 2021, fatalities-per-million peaked at 3.00 on May 22, 2021 [3]. The United Kingdom had 881.31 on January 9, 2021, and 18.46 on January 26, 2021, respectively [3]. A comparison of the COVID-19 outbreak in India and the United Kingdom is proposed in Fig. 1. The number of cases is biased by unequal testing, as evidenced by the share of positive cases. The undetected cases weigh on the case fatality rate. Vaccinations have been effective in lately reducing the case fatality rate in the United Kingdom, but not the number of infections. Presently, the United Kingdom has more than double the number of new cases per million, as well as the about same number of new fatalities per million, as India at the peak of the outbreak.

The present new cases per million of the United Kingdom are about 60 times the present new fatalities per million of India (646.96 vs. 10.70). The present new fatalities per million of the United Kingdom are about 10 times the present new fatalities per million of India (2.13 vs. 0.37). Despite the much higher percentage of fully vaccinated, the outlook for the United Kingdom is much worse than the outlook for India.

It was reported as the fatalities of India were also caused by bacterial and fungal infections [2, 4, 5]. It was previously found that 33% of critical COVID-19 patients in India had bacterial infections [5]. It was then reported as an epidemic of “black fungus” cases [2, 4] was a further driver of fatalities. Mucormycosis [6–9], a normally rare infection, has a huge case-fatality rate of ~50% [10], much larger than the about 1.15% case-fatality-rate at the time for COVID-19 in India. Very few cases were reported of an extremely rare, but even more deadliest “white fungus” [4].

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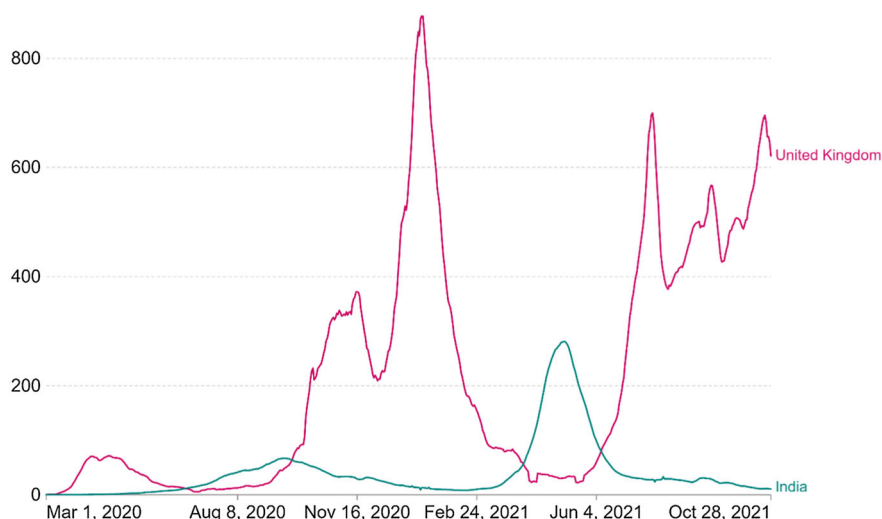
Fig. 1 COVID-19 data in India and the United Kingdom.

a Daily new cases of COVID-19 infection. **b** Daily new deaths of COVID-19 infection. **c** Share of the population fully vaccinated. Images from [3]

Daily new confirmed COVID-19 cases per million people

Shown is the rolling 7-day average. The number of confirmed cases is lower than the number of actual cases; the main reason for that is limited testing.

Our World
in Data



Source: Johns Hopkins University CSSE COVID-19 Data

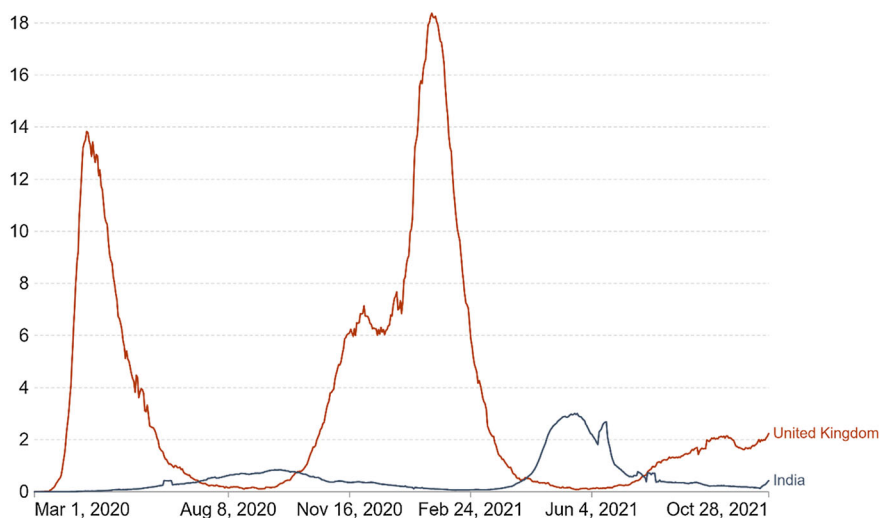
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(a)

Daily new confirmed COVID-19 deaths per million people

Shown is the rolling 7-day average. Limited testing and challenges in the attribution of the cause of death means that the number of confirmed deaths may not be an accurate count of the true number of deaths from COVID-19.

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Source: Johns Hopkins University CSSE COVID-19 Data

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(b)

Bacterial infections are everything but uncommon also in the United Kingdom. Different is the case of mucormycosis, practically unknown in the United Kingdom. There have been thousands of cases of mucormycosis affecting COVID-19 patients in India, also after recovery. The growing number of cases are linked with the steroids being used to treat COVID-19, with diabetics or severely immunocompromised individuals, such as cancer patients or people with HIV/Aids, at particular risk [2, 4].

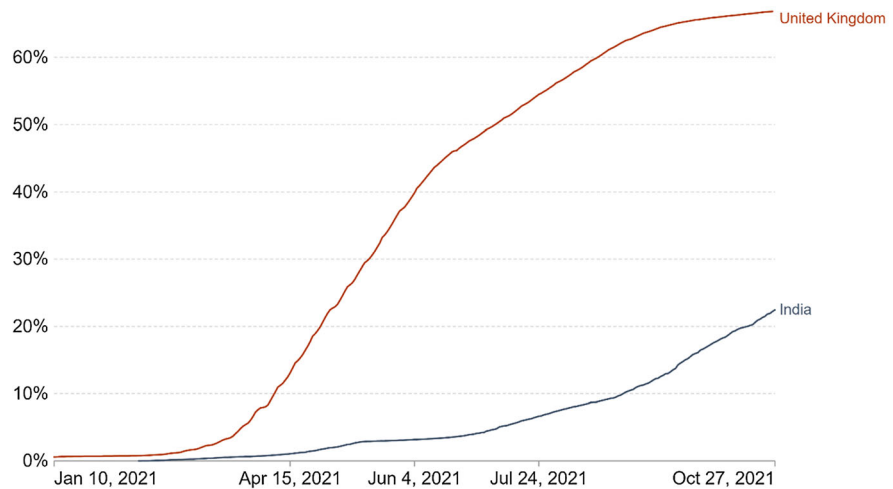
The excessive use of steroids for COVID-19 patients was likely the cause of the upsurge of this otherwise very rare fungal disease. The infection originates from the reduced capacity to naturally clear the spores because of the COVID-19 infection and reduced immune response as a result of the steroids used to limit the immune system's overreaction to infection [11]. It was argued that immunosuppressive drugs and supportive oxygen favor the biosynthesis of ergosterol which is a key component of

Fig. 1 continued

Share of the population fully vaccinated against COVID-19

Total number of people who received all doses prescribed by the vaccination protocol, divided by the total population of the country.

Our World
in Data



Source: Official data collated by Our World in Data. Alternative definitions of a full vaccination, e.g. having been infected with SARS-CoV-2 and having 1 dose of a 2-dose protocol, are ignored to maximize comparability between countries.
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(c)

fungal cell membranes [12]. As previously written, the infection was particularly dangerous in patients with diabetes [10, 13, 14], with specific explanations elusive.

The numbers of black fungus infections (or COVID-19 infection) of India must be put in the correct perspective, as the absolute numbers in a country of 1366 M people may appear incredibly high in countries with a dramatically smaller population such as the United Kingdom.

On May 28, 2021, there were recorded almost 12,000 cases of the “black fungus” infection in India [11], 27.37 M cases of COVID-19, and 315,235 COVID-19 fatalities. In 2019, there were about 7.27 deaths per 1,000 inhabitants in India, or 9.93 M. The major causes of death in India in 2019 in order of relevance were Ischemic heart disease, Chronic obstructive pulmonary disease (COPD), Stroke, Diarrheal diseases, Neonatal disorders, Lower respiratory infect, Tuberculosis, Diabetes, Cirrhosis, Falls, Road injuries and Self-harm [15].

While the black fungus infection does not affect in a sizeable way the case-fatality rate of COVID-19 infection, that is not the main cause of fatality in India, still, it was certainly a reason for relative concern [16], not only for India but also for other South Asian countries.

Prevention was the first measure to adopt [9, 16]. This required improving hygiene in hospitals, as well as in residential settings. The use of steroids to prevent cytokine storms in COVID-19 patients was then rationalized [16] for what is possible. More care was exercised especially with

those in the risk categories (for example those with diabetes) [16]. Then, better treatment should be provided, including appropriate intravenous antifungal products, leaving surgical intervention to attempt to resolve the worse cases [16].

Measures such as the adoption of the extremely effective Uttar Pradesh Ivermectin-based COVID-19 home treatment kit [17, 18], which dramatically affected the number of daily new cases and fatalities, contributed to a reduced need for steroids and therefore a reduced incidence of Black fungus infection presently negligible. The use of an antiviral such as Ivermectin in early stages [19–21], coupled to one antibacterial, plus vitamins and minerals, has been the best therapeutical approach against COVID-19 infection and indirectly against the Black fungus infection.

Thus, while the numbers of black fungus infections in India considered not in isolation, but within the context of the normal mortality of a country of 1366 M people, were not particularly dramatic, the issue was properly addressed by the Indian health authorities, same as the COVID-19 infection issue, not certainly in a way worse than the way the pandemic was addressed in the United Kingdom. There is a clear need to urgently addresses the current downfalls of the media subjectively attributing excellency or disvalue to the proponents of health policies including pharmaceutical and non-pharmaceutical measures, no matter which are the objective outcomes of these policies.

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Declarations

Conflicts of interest The authors declare that they do not have any conflict of interest.

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