

diagnosis of Covid-19 was 13 (9–22.5) days. Uncontrolled diabetes was defined as fasting blood sugar >130 mg/dl or post-prandial blood sugar >180 mg/dl or HbA1c >7% according to the glycaemic recommendations given by the American Diabetes Association.<sup>2</sup>

We also included detailed data on the timing of medical and surgical intervention after the diagnosis of mucormycosis. All patients were treated with amphotericin B deoxycholate (conventional) at dosages of 0.7–1 mg/kg/day and 4 patients underwent immediate surgical intervention. Median (IQR) duration of antifungal therapy was 45 (20–45) days and was continued until clinical and radiological resolution of active disease, which was assessed after surgical intervention. Timely surgical intervention could not be done in 2 patients due to haemodynamic instability. These 2 patients died within 6 weeks of the onset of illness. One had AKI, the other had AKI on CKD and they died while being on dialysis. Of the remaining 3 patients, one was on dialysis as a result of ESRD, 2 had AKI on CKD. Serum creatinine of both these patients returned to baseline on discharge. One of these 2 patients had followed up after 3 months of illness and had stable kidney function, whereas the other was lost to follow-up.

This study emphasizes that renal failure is an important risk factor for Covid-19-associated mucormycosis (CAM). Severe metabolic acidosis and uraemia, which is associated with impaired neutrophil chemotaxis, impaired activation of helper T cells make this group of patients a vulnerable population for acquiring this fungal infection. Our patients had uncontrolled diabetes, hypoxaemia and received high-dose steroids which were concurrent with the results of Patel *et al.*,<sup>3</sup> who reported that high-dose steroids and hypoxaemia were independently associated with the development of mucormycosis. The majority of our patients were managed with a combination of surgery and antifungal therapy. Mortality in 2 patients was possibly due to an inability to do and a delay in surgical intervention, respectively. These results were similar to that from the existing literature,<sup>3</sup> which reported that the combination of surgery and antifungal therapy was associated with better survival.

To conclude, a high degree of suspicion of mucormycosis is required in patients with Covid-19 and renal failure with an immediate medical and surgical intervention being necessary to reduce mortality.

## REFERENCES

- 1 Mahase E. Covid-19: One dose of vaccine cuts risk of passing on infection by as much as 50%, research shows. *BMJ* 2021;**373**:n1112.
- 2 Glycemic Targets: Standards of medical care in diabetes—2021. *Diabetes Care* 2020;**44** (Suppl 1):S73–S84.
- 3 Patel A, Agarwal R, Rudramurthy SM, Shevkani M, Xess I, Sharma R, *et al.* Multicenter epidemiologic study of coronavirus disease-associated mucormycosis, India. *Emerg Infect Dis* 2021;**27**:2349–59.

Ankita Patil, Nikhil Rao, Kruteesh Kumar,  
Tulsi Modi, Chintan Gandhi, Satarupa Deb,  
Sreyashi Bose, Nikhil Saxena, Abhinav Katyayal,  
Sayali Thakare, Atim E Pajai, Divya Bajpai, Tukaram E. Jamale  
*Department of Nephrology  
Seth G.S. Medical College and K.E.M. Hospital  
Ward 34A, Old building third floor, K.E.M. Hospital campus  
Parel, Mumbai, Maharashtra, India  
anki3patil@gmail.com*

[To cite: Patil A, Rao N, Kumar K, Modi T, Gandhi C, Deb S, *et al.* Covid-19-associated mucormycosis in patients with renal failure [Correspondence]. *Natl Med J India* 2022;**35**:187–9.]

## Awareness of surgical smoke risks and assessment of safety practices during the Covid-19 pandemic

Cases of pneumonia of unknown aetiology occurred in the Wuhan city of China in December 2019.<sup>1</sup> It was revealed that the pathogenic agent of pneumonia in these patients was ‘severe acute respiratory syndrome coronavirus 2’ (previously known as 2019-nCoV).<sup>2</sup> In February 2020, this disease was identified by the WHO as coronavirus disease 2019 (Covid-19).<sup>3</sup> The pandemic was declared on 11 March 2020, as the disease continued to spread rapidly and began to appear in the USA, and in parts of Europe. Covid-19 was a new virus and little was known about it. Guidelines were updated in the light of new information and experiences gained everyday. Further updates have continued in the coming months and years.

Operating theatres are high-risk areas with airway or potential splash and contact contamination. In patients with possible or definitive Covid-19, publications related to safe surgical algorithms appeared.<sup>4</sup>

Smoke is a harmful by-product produced using heat-producing tools such as electrocautery, laser, ultrasonic tools, high-speed drills, saws used for surgical smoke, haemostasis, excision and dissection. In the literature, it has been stated that surgical smoke contains dead and living cellular materials, blood particles, bacteria, viruses, toxic gases, vapours (benzene, toluene, carbon monoxide, etc.), and particles that damage the lung.<sup>5</sup>

Surgical smoke threatens the health of both patients and operating room employees due to the harmful substances it contains.<sup>5</sup> Many international organizations, associations and institutes whose field of study is the safety of employees and patients have included surgical smoke and smoke protection in their core business activities. The Occupational Safety and Health Administration of the US Department of Labour states that approximately 500 000 operating room employees are exposed to surgical smoke every year and emphasizes that surgical smoke should be removed from the operating room properly.<sup>6</sup> Guidelines developed by organizations such as the Association of Perioperative Registered Nurses, the American National Standards Institute, the Emergency Care Research Institute state that precautions should be taken to protect humans from surgical smoke.

In the literature, there is no evidence yet that Covid-19 can be transmitted through surgical smoke. However, previous studies have shown the presence of different viruses in surgical smoke including *Corynebacterium*, human papillomavirus (HPV), poliovirus, human immunodeficiency virus and hepatitis B virus.<sup>7</sup> Although the possibility of disease transmission through surgical smoke exists in humans, few cases have been documented.<sup>8</sup> Most commonly, HPV transmission has been reported during anogenital surgery. This is probably due to direct contact of the infected area with the electrocautery.<sup>8</sup>

These cases occurred in specialists performing gynaecological surgery without additional risk factors for the disease. In another study, it was revealed that 1 of 5 surgeons and 3 of 5 nurses were positive for HPV after laryngeal and urethral papilloma surgeries, and the detected HPV genotypes were the same as those of the patients.<sup>9</sup> This suggests that viruses in the blood may be present in surgical smoke. Although the transmission of Covid-19 is currently thought to be mainly through respiratory droplets, there is a theoretical risk of virus aerosolization during surgery.<sup>10</sup>

The operating room ventilation system is not the only method of smoke extraction; protection from surgical smoke can also be achieved by local extraction at the site of the surgery or using personal filtration masks. Surgical masks are standard equipment used to protect against microorganisms and aerosol body fluids during the procedure. However, it can only block large droplets or particles larger than 5µ. However, it is known that surgical masks do not protect against surgical smoke because the particle size in surgical smoke is less than 0.1µ. The Covid-

19 virus is 0.06–0.14 μm in size, and its aerosol particle sizes range from 3–100 nm.

The use of a filtering face piece level 3 mask and face protection was recommended by the WHO for respiratory aerosol-generating procedures (AGPs) such as intubation in a Covid-19 environment. The advice for surgical AGPs, such as the use of high-speed power instruments in the operating room, was not available till the UK Public Health England released their report (PHE) on 27 March 2020. Working in a Covid-19 environment, surgeons should wear level 4 surgical gowns, face shields or goggles, double gloves and FFP2-3 or N95-99 respirator masks. A motorized air-purifying respirator is an alternative to the mask, face shield and goggles, especially if the surgeons fail the mask fit test or are doing a lengthy procedure. However, these devices have a high cost and limited availability. Due to a porous top for air intake, currently available surgical helmets and toga systems may not be the solution. During the current Covid-19 outbreak, it appears that telemedicine may be used as an electronic personal protective equipment (PPE) by minimizing the number of physical contacts and hence the danger of contamination.<sup>11</sup>

Infection with Covid-19 causes direct mortality and morbidity. During the present pandemic, it is especially important to be safe from electrosurgery-related smoke. This surgical smoke evacuation device/system is simple to operate and provides a practical and effective means of smoke evacuation during open surgery as well as all cauterization procedures.<sup>12</sup>

In conclusion, it is believed that the ventilation of surgical rooms and surgical masks are not enough to protect from surgical smoke. For this reason, we suggest that individual and institutional awareness should be raised regarding the use of high-filtration masks and smoke evacuation devices in operating rooms.

*Conflicts of interest.* None declared

## REFERENCES

- 1 Yin W, Mao C, Luan X, Shen DD, Shen Q, Su H, *et al.* Structural basis for inhibition of the RNA-dependent RNA polymerase from SARS-CoV-2 by remdesivir. *Science* 2020;**368**:1499–504.
- 2 Guo YR, Cao QD, Hong ZS, Tan YY, Chen SD, Jin HJ, *et al.* The origin, transmission and clinical therapies on coronavirus disease 2019 (COVID-19) outbreak—An update on the status. *Mil Med Res* 2020;**7**:11.
- 3 Cucinotta D, Vanelli M. WHO declares COVID-19 a pandemic. *Acta Biomed* 2020;**91**:157–60.
- 4 Givi B, Schiff BA, Chinn SB, Clayburgh D, Iyer NG, Jalisi S, *et al.* Safety recommendations for evaluation and surgery of the head and neck during the COVID-19 pandemic. *JAMA Otolaryngol Head Neck Surg* 2020;**146**:579–84.
- 5 Hahn KY, Kang DW, Azman ZA, Kim SY, Kim SH. Removal of hazardous surgical smoke using a built-in-filter trocar: A study in laparoscopic rectal resection. *Surg Laparosc Endosc Percutan Tech* 2017;**27**:341–5.
- 6 Michaels D, Barab J. The occupational safety and health administration at 50: Protecting workers in a changing economy. *Am J Public Health* 2020;**110**: 631–5.
- 7 Zheng MH, Boni L, Fingerhut A. Minimally invasive surgery and the novel coronavirus outbreak: Lessons learned in China and Italy. *Ann Surg* 2020;**272**: e5–6.
- 8 Liu Y, Song Y, Hu X, Yan L, Zhu X. Awareness of surgical smoke hazards and enhancement of surgical smoke prevention among the gynecologists. *J Cancer* 2019;**10**:2788–99.
- 9 Ilmarinen T, Auvinen E, Hiltunen-Back E, Ranki A, Aaltonen LM, Pitkäranta A. Transmission of human papillomavirus DNA from patient to surgical masks, gloves and oral mucosa of medical personnel during treatment of laryngeal papillomas and genital warts. *Eur Arch Otorhinolaryngol* 2012;**269**:2367–71.
- 10 WHO. Modes of transmission of virus causing COVID-19: Implications for IPC Precaution Recommendations. Available at [www.who.int/news-room/commentaries/detail/modes-of-transmission-of-virus-causing-covid-19-implications-for-ipc-precaution-recommendations](http://www.who.int/news-room/commentaries/detail/modes-of-transmission-of-virus-causing-covid-19-implications-for-ipc-precaution-recommendations) (accessed on 30 Mar 2020).
- 11 Hirschmann MT, Hart A, Henckel J, Sadoghi P, Seil R, Mouton C. COVID-19 coronavirus: Recommended personal protective equipment for the orthopaedic and trauma surgeon. *Knee Surg Sports Traumatol Arthrosc* 2020;**28**:1690–8.
- 12 Eki B. Easy-to-use electrocautery smoke evacuation device for open surgery under the risk of the COVID-19 pandemic. *J Int Med Res* 2020;**48**: 300060520949772.

Huriye Erbak Yilmaz  
Department of Biochemistry  
University of Katip Celebi University Atatürk Education and  
Research Hospital,  
Izmir Biomedicine and Genome Centre, University of Dokuz Eylul

Murat Yilmaz  
Department of Neurosurgery  
University of Dokuz Eylul,  
School of Medicine Izmir  
Turkey

Venkata A.A.S.K. Tangirala  
School of Medicine, Western Sydney University

Kevin Spring  
Department of Medical Oncology  
Ingham Institute for Applied Medical Research,  
School of Medicine, Western Sydney University  
and SWS Clinical School, UNSW,  
Sydney, NSW  
Australia  
[muratan@yahoo.com](mailto:muratan@yahoo.com)

[To cite: Yilmaz HE, Yilmaz M, Tangirala VAASK, Spring K. Awareness of surgical smoke risks and assessment of safety practices during the Covid-19 pandemic [Correspondence]. *Natl Med J India* 2022;**35**:189–90.]