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REVIEW

Dermatopathology practice in the era of COVID-19

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Abstract
Coronavirus disease 2019 (COVID-19) pandemic has affected almost all aspects of our life including health care services. A lot of dermatopathology laboratories have stopped working during this pandemic. This article aims at reviewing the challenges and effects of COVID-19 on the practice of dermatopathology in view of the current guidelines.

Keywords COVID-19 · Dermatology · Laboratories · Coronavirus disease · Biosafety

Introduction

Dermatopathologists work in collaboration with dermatologists and dermatologic surgeons. Sometimes it is difficult to reach a diagnosis on clinical grounds alone, and it becomes necessary to take a biopsy for histopathological examination. Some cases require additional studies such as immunofluorescence, immunohistochemical, histochemical, ultrastructural, microbiological, and molecular studies.

Coronavirus disease 2019 (COVID-19) has emerged in December 2019 in Wuhan, Hubei province, China. It is an acute disease caused by a novel coronavirus called Severe Acute Respiratory Syndrome Coronavirus-2 (SARS-CoV-2) which is a positive-sense enveloped single-stranded RNA virus [1]. The mode of transmission is mainly through droplet inhalation or by touching droplet-contaminated surfaces then touching the eyes, nose, or mouth. Other modes of transmission are being revealed such as fecal–oral transmission [2]. The viral RNA has been also detected in blood, serum [3], saliva [4], and tears [5] of patients. However, the infectivity of the different body fluids carrying the novel coronavirus is still unknown. Thus, precautions should be fully considered during the handling of skin and mucous-membrane biopsies to avoid contact with potentially infectious tissue fluids.

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Discussion

Preparedness of the laboratory

A dermatopathology laboratory should be adequately prepared to deal with COVID-19 confirmed/suspected patients or potentially infective asymptomatic cases. It is advisable to set up waiting rooms that allow a distance of at least 6 ft between patients. A separate waiting area for suspected cases should be prepared. It is preferable to screen patients at a triage station before entering into the laboratory to limit potential infection. Hand sanitizers and wipes should be available in the waiting room, exam room, bathroom, and reception area. Laboratory workers should wear appropriate personal protective equipment (PPE) when screening patients at the triage station. They should provide masks to all patients presenting with flu-like symptoms or reporting possible COVID-19 infection. If possible, those patients should be given another appointment for biopsy taking after the resolution of symptoms. Telehealth services can be used to determine the priority for biopsy taking, reschedule patients with respiratory symptoms or less urgent conditions irrespective of their symptom or exposure status, limit the number of personnel attending the laboratory with the patient to only those people who are necessary. Laboratory staff should regularly monitor themselves for signs of infection and undergo home isolation if COVID-19 infection is suspected or confirmed. In addition, there should be a record of the laboratory staff who were exposed to a person under investigation (PUI) if testing results are pending. Work restrictions recommended by the public health guidance should be applied if the patient

Table 1 Summary of the additional precautions of WHO when performing aerosol-generating procedures [8]

Wear a particulate respirator at least as protective as a NIOSH certified N95, an EU standard FFP2, or the equivalent
Wear eye protection (i.e. goggles or a face shield)
Wear a clean, non-sterile, long-sleeved gown and gloves
Perform procedures in an adequately ventilated room; i.e. minimum of 6–12 air changes per hour in facilities with a mechanically ventilated room and at least 60 L/S/patient in facilities with natural ventilation
Limit the number of persons present in the room to the absolute minimum required
Perform hand hygiene before and after contact with the patient and his or her surroundings and after PPE removal

NIOSH The National Institute for Occupational Safety and Health, *EU* European Union, *FFP2* Filtering Face piece 2 (protects against solid and liquid irritating aerosols), *PPE* personal protective equipment

proved to be COVID-19 positive or the testing results are delayed more than 72 h [6–8].

Precautions during biopsy taking and specimen handling

The guidelines of the World Health Organization (WHO) recommend considering all specimens as potentially infectious [7]. Standard precautions of WHO for medical procedures should be applied during biopsy taking to ensure safety and reduce the risk of infection. These precautions should be applied for all patients and they include hand hygiene (by soap-and-water hand washing or the use of an alcohol-based hand rub) and the use of PPE to avoid contact with patients' blood and body fluids. In addition, it is advisable to avoid sharps injury and consider safe waste management, disinfection, and sterilization of equipment [9]. In case of dealing with patients with probable or confirmed COVID-19 infection, laboratory staff should wear a medical mask, eye protection (goggles or a face shield), long-sleeved gown, and gloves and they should perform hand hygiene measures before and after contact with the patient and his surroundings, and immediately after removal of PPE. Incomplete application of these measures poses high risk to the laboratory staff and calls for application of work restrictions recommended by the public health guidance [7, 8]. In case of taking a biopsy from the oral mucosa, it is recommended to let the patient perform mouth wash and gargle with an antimicrobial mouthwash such as 0.5–1% hydrogen peroxide, 0.2% povidone–iodine, chlorhexidine gluconate, or cetylpyridinium chloride to reduce the coronavirus load in saliva [9]. All specimens should be associated with adequate clinical information and clear labeling especially if COVID-19 positive/suspicious. Paperless electronic request forms are preferred since the virus can persist on papers for at least 24 h [10].

Fortunately, the routine histopathological preparation process often inactivates many viruses such as the Ebola virus [11]. Chemicals used during processing such as ethanol (78–95%), glutaraldehyde (0.5–2.5%) and formaldehyde (0.7–1%) significantly decrease coronavirus infectivity [12]. Formalin and glutaraldehyde were found to inactivate SARS-CoV in a temperature- and time-dependent manner. At 37 °C or room temperature, formalin inactivated most but not all viruses on day 1, while glutaraldehyde completely inactivated the SARS-CoV by day 2 at 25 °C and by day 1 at 37 °C [13]. A concentration of 0.5–2% formaldehyde is effective in inactivating SARS-CoV-2 after 1 h at room temperature [14]. Moreover, heating at 60, 80 and 100 °C was found to inactivate SARS-CoV and SARS-CoV-2 in 32.5, 3.7 and 0.5 min, respectively [15]. Most laboratories apply a protocol of formalin tissue fixation for 48 h at room temperature and paraffin infiltration at 60–65 °C for 2 h or more [16]. Thus, formalin-fixed paraffin-embedded blocks are suggested to carry a low risk of SARS-CoV-2 infectivity. Conversely, unfixed specimens (e.g., frozen sections, specimens for direct immunofluorescence (DIF) and formalin-free-vacuum-collected specimens) and partially fixed specimens (e.g., specimens that are incompletely immersed in formalin or immersed for a short period) are considered to be potentially infectious and are better avoided. If necessary, laboratories should adhere to the biosafety guidelines while handling such specimens. Aerosol-generating procedures such as frozen section and DIF preparation should be performed in a biological safety cabinet. If not feasible, the additional precautions recommended by the WHO should be applied [9] as shown in Table 1.

Disinfection of the laboratory

Similar to other coronaviruses, SARS-CoV-2 can persist on surfaces for extended periods [17]. Therefore, it is of high importance to disinfect all work surfaces to avoid transmission of infection. This should include all high-touch surfaces in the laboratory such as countertops, chairs, buttons, handles, beds, and tables. Several disinfectants were reported to be effective such as 0.1% sodium hypochlorite, 62–71% ethanol, and 0.5% hydrogen peroxide [12]. The WHO recommends the use of sodium hypochlorite 0.5% for disinfecting large surfaces and ethanol 70% for reusable equipment and small surfaces (e.g., glass slides) [7].

Teledermatopathology

Teledermatopathology represents the application of modern communication services for the diagnosis of skin diseases at distant locations. This can be accomplished by two forms: the dynamic remote manipulation of a robotic microscope or the static store-and-forward transmission of a single file. The static option is fast and easy to use but has the disadvantage of misdiagnosis due to field selection errors. Virtual microscope teledermatopathology has been introduced recently. It involves the transmission of high-resolution images that can be viewed at any site on any computer [19]. The digitalization of slides at high resolution and their electronic transfer maintains the biosafety and avoids the potential risk of transmission of infection. With this technology, the dermatopathologists can do their work without the need to travel to remote sites. It also offers a good opportunity for teleconsultation and tele-education during difficult situations like this pandemic.

In conclusion, the COVID-19 pandemic has posed new challenges to the face of the practice of dermatopathology. It is necessary for dermatopathologists to continuously update their knowledge about the novel virus and its pathophysiology. In addition, they should develop new strategies to benefit from modern technology like teledermatopathology.

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Compliance with ethical standards

Conflict of interest None declared.

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