The COVID-19 pandemic: pathologist's support to clinical infectious team

Antonio Ieni* and Giovanni Tuccari

Department of Human Pathology in Adult and Developmental Age "Gaetano Barresi", Section of Pathology, University of Messina, 98125 Messina, Italy.

Correspondence: Ieni A & Tuccari G, Department of Human Pathology in Adult and Developmental Age "Gaetano Barresi", Section of Pathology, University of Messina, Via Consolare Valeria 1, 98125 Messina, Italy (aieni@unime.it; tuccari@unime.it)

Abstract

In the management of COVID-19 affected patients, the pathologist is involved in many diagnostic steps together with the clinical infectious team. In particular, cytological and histopathological procedures as well as autoptic findings may represent an useful tool to better understand the pathobiology of the disease as well as to correctly define causes of patient’s death. Moreover, in COVID-19 pandemic, pathologists have been forced to reconsider the usual laboratory workflow and to introduce adequate guidelines against virus diffusion, requiring high biosafety level.

Keywords. COVID-19; SARS-CoV2; pathologist; cytopathology; histopathology; autopsy
Introduction

The severe acute respiratory syndrome Coronavirus 2 (SARS-CoV-2) virus produced a worldwide diffusive disease (COVID-19), defined by the World Health Organization as a pandemic on March 2020. Consequently, many governments have adopted a series of public health measures in order to promote the social distancing and to reduce the spread of COVID-19; therefore, cultural and political meetings have been cancelled, schools, universities and gyms have been closed, smart working from home has been recommended, frequency of bars and restaurants as well as discretionary travel among different countries have been considered to be avoided. However, analyzing the clinical course of COVID-19, the WHO considered 3% of cases as critical requiring intensive care, 15% as severe needing hospitalization and 82% as mild being sufficient quarantine and home therapy (Yang et al., 2020; Vetter et al., 2020).

Safety in pathology laboratory

There is no doubt that in all health-care operators, pathologists have to be included, mainly because they are involved in many diagnostic steps, such as cytology and histopathology process, until the autopsy of COVID-19 affected cases in order to better understand the pathobiology of the disease as well as to correctly define causes of patient’s death. Therefore, in the present pandemic, laboratories of pathology have to reconsider the usual workflow, introducing adequate guidelines against virus diffusion among staff personnel and also requiring typical biosafety level 2 (Barbareschi et al., 2020; Carpenito et al., 2020; Kaufer et., 2020; Pambuccian et al., 2020). Nevertheless, it should be reminded that in laboratory pathology the main fixatives utilized are represented by alcohol solutions >70% and formalin, both considered extremely effective to destroy COVID-19. Obviously, protective equipment and additional measures (hand-washing with sanitizers, wearing gloves…) have to be respected together with decontamination of all working surfaces (Centers for Disease Control and Prevention, 2020).
Cytology procedures

The first impact for pathologists concerning COVID-19 patients has been represented by the cytological approach. In fact, sputum and broncho-alveolar lavage fluid (BAL) should represent the first relevant laboratory step, especially when nasopharyngeal/oropharyngeal swabs have been already performed with negative results. Nevertheless, cytological findings encountered in the above mentioned cytological samples are generally unspecific, reflecting the lung’s injuries; therefore, the presence of macrophages, frequently in aggregates, with characteristic foamy cytoplasm and ground glass nuclei, together with a variable component of granulocytic neutrophils, multinucleated cells, damaged alveolar elements and squamous metaplastic bronchial epithelium, has been repeatedly reported (Damiani et al., 2020; Parada et al., 2020; Reusken et al., 2020; Vasquez-Bonilla et al., 2020). However, although the cytological features are inconclusive for the diagnosis of COVID-19 disease, it must be greatly stressed that some fixatives characterized by a weaker alcohol concentration utilized in thin preparations (PreservCyt, CytoLyT, SurePath,…) may probably not adequate to inactivate virus and then a great caution is mandatory to be applied in cytology laboratory (Pambuccian et al., 2020).

Histopathology approach

It is well known that SARS-CoV-2 determines histologic changes in lungs, producing acute respiratory distress syndrome and presenting a diffuse alveolar damage (DAD) (Al Nemer, 2020; Damiani et al., 2020). In detail, DAD is associated with edema, vascular congestion, proteinaceous exudates constituting hyaline membranes as well as inflammatory infiltration of various entity, with the presence of fibrin thrombi and vascular injuries as well as a various degree of fibroblastic organized plugs (Konopka et al., 2020; Polak et al., 2020). Moreover, by electron microscopy, viral particles have been detected in type I and II pneumocytes, in tracheal biopsies and in bronchial mucus (Bradley et al., 2020; Prieto-Pérez et al., 2020). Additionally, other relevant pathologic
findings COVID-19 induced have documented outside of the respiratory tract, including some organs such as heart, liver, kidney and central nervous system; the characteristics of these lesions came from autopic postmortem examinations (Damiani et al., 2020; Vasquez-Bonilla et al., 2020). Consequently again, the central role of the pathologist to ascertain this peculiar kind of diffusive pathology is furtherly stressed.

**Autopsy information**

For suspected or affected COVID-19 patients a specific autopsy protocol should be applied taking into consideration measures provided by governments, ministry of health and local regional advices; in any case, the autopsy room as well as the procedures of internally manage biological samples needs a safety level 3, as designed by CDC (Centers for Disease Control and Prevention, 2020). In detail, the autopsy room need to be at a negative pressure, considering minimum of 6-12 air change for hour for existing or new structures, respectively, and having an efficient adequate particulate filter (Centers for Disease Control and Prevention, 2020). Although the details about technical execution of autopsy is out of scope of the present commentary, it may be signaled that any COVID-19 affected or suspected deceased patient should be preliminary investigated by a swab for molecular detection of SARS-CoV-2 by PCR (Carpenito et al., 2020; Centers for Disease Control and Prevention, 2020). Moreover, an early performed autopsy has been suggested, specifically before the routine 16 or more hours expected after death, in order to avoid postmortem phenomena and likewise to obtain biological samples of high quality to perform immunohistochemical, ultrastructural and biomolecular investigations (Carpenito et al., 2020).

Many series of autopsies concerning patients affected by COVID-19 coming from different countries have been reported and all of them have stressed the viral cytopathic effect not only in lungs, but also in different organs and parenchyma (Ackermann et al., 2020; Calabrese et al., 2020; Pesaresi et al., 2020). From many of these reports it can be argued that SARS-CoV-2 infection represents a multiorgan pathology, in which together with DAD some additional lesions have been encountered in heart (lymphocytic myocarditis, thrombotic vascular occlusion), brain (encephalitis,
ischemic or hemorrhagic infarcts, vasculitis), kidney (tubular injury, arterionephrosclerosis), liver (steatosis, lymphatic lobular infiltration), lymph nodes and bone marrow (histiocytosis, hemophagocytosis) (Calabrese et al., 2020; Damiani et al., 2020; Vasquez-Bonilla et al., 2020). Therefore, all the reported postmortem findings again suggested a central role for pathologists in order to better understand and explain the pathological impact of SARS-CoV-2 infection.

Conclusions

The knowledge of pathological lesions in different organs as well as the analysis of their peculiar tissue characteristics may greatly contribute to critically examine the interactions between human host and virus, addressing a more accurate therapeutic approach against symptoms and complications during COVID-19 pandemic.

Declaration of interests

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Conflict of interest

None declared.

Ethical Approval

Not Applicable.

Funding

None.

REFERENCES


Centers for Disease Control and Prevention. Interim guidance for community transmission through a convenience sample of healthcare workers, the Netherlands, 0613. doi: 10.1136/bmj.m1470.


Centers for Disease Control and Prevention. Interim guidance for community transmission through a convenience sample of healthcare workers, the Netherlands, 0613. doi: 10.1136/bmj.m1470.