Risk Assessment of Autopsy-Acquired Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2; Coronavirus Disease 2019)

To the Editor.—We read with concern the article by Davis and Williamson[1] on the risk of coronavirus disease 2019 (COVID-19) transmission during autopsy, wherein the authors report a low risk (1:675) for autopsy-acquired COVID-19. The analysis is deeply flawed.

The authors report data with an unusual leniency of detail. The authors report "at least 225 autopsies" with "1–6 persons" per autopsy, where "at least 102" had brain removal. The authors do not inform on the duration, response rate, or bias assessments of their survey. There is no information on whether COVID-19–positive status was confirmed at autopsy (plausibly some patients had cleared their COVID-19 infection and died of secondary complications). Most importantly, there is no information on the frequency, duration, or method of monitoring of exposed personnel, or what proportion of personnel underwent laboratory testing.

The authors' calculations and comparisons are creative, conflate risks and rates, and are not corrected for time or geography.[2] The risk of COVID-19 acquisition from autopsy cannot be calculated or approximated as 1:675 if the infection is not considered to be autopsy acquired. The tenuously calculated supposed "risk" cannot be compared with the aggregate incidence rate of the US population. The population incidence rate of 1:201 is a measure of the incidence of laboratory-confirmed COVID-19 in all 50 US states for the full 5-month duration of the pandemic. The authors' data do not even overlap with respect to time; also, their data are drawn from only 14 states. Furthermore, the risk of transmission of COVID-19 from autopsy should be compared with the risk of transmission of COVID-19 from *not* performing COVID-19–positive autopsies. The latter is zero.

The authors' conclusion that a risk of 1:675 is "exceedingly little" is subjective and not factual. Risk is assessed as acceptable or not using a frequency-severity matrix, which balances the probability and severity of harm with potential benefits. "High risk" becomes societally and individually acceptable when something of higher value is at stake; for example, physicians accept the risk for COVID-19 infection and treat/assess COVID-19–infected patients because a patient's life hangs in the balance. In contrast, one would not accept even a much lower risk, if, for example, a mouse's life hung in the balance.

Autopsies are critical to understand the pathobiology of a novel emerging disease, to inform management strategies, and for tissue acquisition for research toward prevention and cure. This report serves to undermine the value of the autopsy by glibly ascribing a "low risk" to autopsy-acquired COVID-19. This report also has the unfortunate potential for harm to trainees, who report being threatened by directors with no/poor recommendations should they refuse to participate in COVID-19–positive autopsies. At the moment, we have no concrete data to inform on the risk of COVID transmission at autopsy.

Vinita Parkash, MBBS, MPH[1]; Stephen M. Smith, MD[2]

[1] Department of Pathology, Yale University School of Medicine, New Haven Hospital, New Haven, Connecticut; [2] Department of Laboratory Medicine and Pathobiology, University of Toronto College of Medicine, Toronto, Ontario, Canada

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In Reply.—We never conceived our letter to the editor as a formal epidemiologic study.[1] Instead, we were sending a dispatch from the front lines of autopsy work during the early weeks of the coronavirus disease (COVID-19) pandemic. We do not consider exposure in the general population equivalent to exposure in morgue workers during an autopsy; we were simply providing a simple comparison to help readers understand that the risk of a properly protected morgue worker contracting COVID-19 from autopsy is slight. We agree with the authors that autopsy is an essential component of understanding this new disease. We continue to advocate for the value of autopsy in elucidating the pathobiology of COVID-19, ensuring accurate public health information for managing the pandemic, and procuring and preserving important specimens for research to learn more about COVID-19. The only way to realize these 3 benefits of autopsy is to perform autopsies. We wrote our letter to reduce confusion in a time of uncertainty and to encourage appropriately cautious autopsy pathologists to engage in their important work on patients who died with COVID-19 infection—provided that the pathologists and their staff have the necessary facility, equipment, supervision, and experience to safely and effectively conduct such autopsies. The pathologists involved in this autopsy work at academic centers should include residents in training.[2] As tomorrow's pathologists will be expected to help manage the next infectious disease pandemic, it is imperative that today's pathology residents engage in all aspects of their institution's response to COVID-19, including participating in the performance of autopsies when they are conducted.

Gregory G. Davis, MD, MSPH[1,2]; Alex K. Williamson, MD[3,4]

[1] Forensic Division, Department of Pathology, University of Alabama at Birmingham; [2] Jefferson County Coroner/Medical Examiner Office, Birmingham, Alabama; [3] Department of Pathology & Laboratory Medicine, Zucker School of Medicine at Hofstra/Northwell, Hempstead, New York; [4] Department of Pathology, LIJ Medical Center/Northwell, New Hyde Park, New York

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Testicular Changes Associated With Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2)

To the Editor.—It has been established that severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), also known as coronavirus disease 2019 (COVID-19), primarily infects cells of the respiratory tract,[1] leading to diffuse alveolar damage, pulmonary vascular injury, and thrombosis.[2] However, characterization of its effects on testes is still not well defined. Here, we present our analysis of the morphologic features seen in testes obtained from patients with COVID-19.

We analyzed testes and epididymis specimens from a series of 10 autopsies of patients with proven SARS-CoV-2 infection who died at our institution. Autopsies were conducted according to published US Centers for Disease Control and Prevention guidelines.[3]

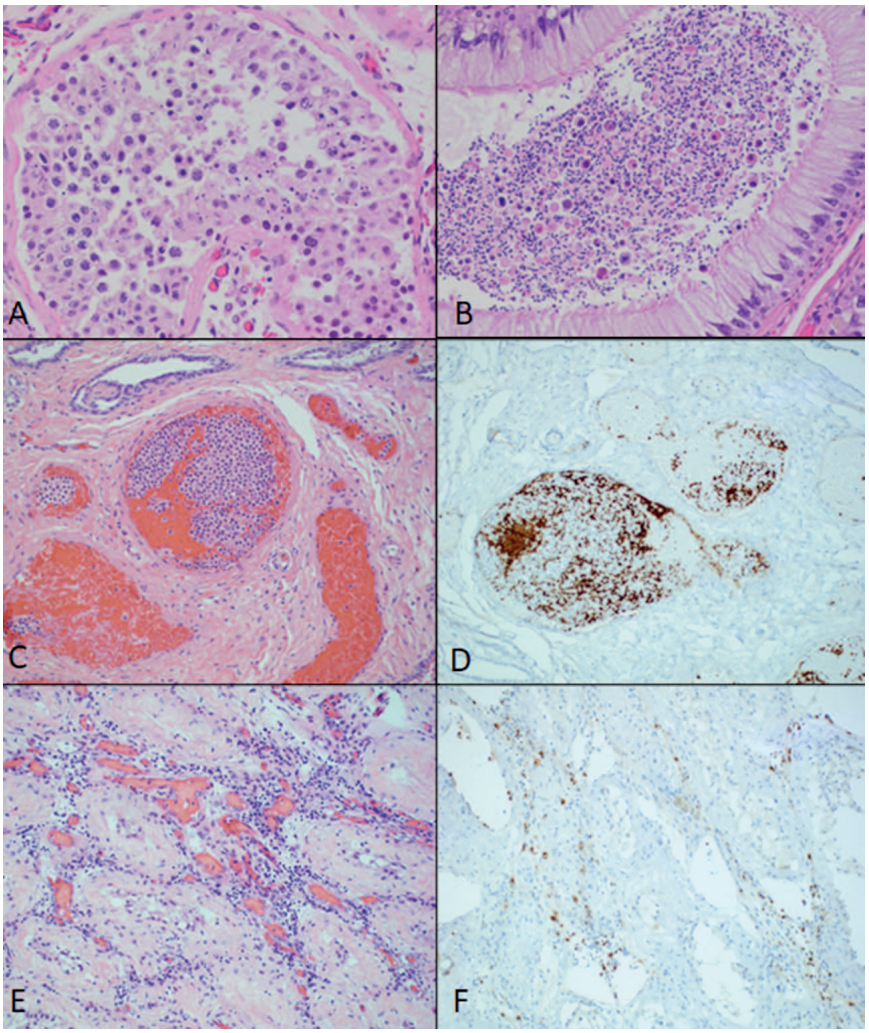
Six testes samples were tested by reverse transcription–polymerase chain reaction for 3 regions of the COVID-19 virus gene, *ORF1abb*, *N* gene, and *E* gene.

The median age was 49.5 years (range, 22–83 years). All cases tested positive for SARS-CoV-2 by nasopharyngeal swab at time of hospital admission. The median duration from admission to death was 15 days (range, 7–27 days). Patients had multiple reported preexisting comorbidities (median, 3; range, 0–6), the most frequent being type 2 diabetes mellitus and hypertensive disease.

At autopsy COVID-19 was detected in the respiratory tracts of all patients; however, all testicular samples tested for COVID-19 were negative.

A total of 7 of 10 cases showed morphologic alterations attributable to oxidative stress, seen at different stages of the spermatocyte cycle, including chromatin condensation, acidophilic cytoplasm, and nuclear fragmentation. Sloughing of spermatocytes into the tubular lumen and accumulation in the head of epididymis was seen. Elongation of spermatids and swelling and vacuolization of the Sertoli cells were also noted (Figure, A and B). These changes were similarly observed in the orchiectomy specimen from 1 living patient presenting with testicular cancer. Total loss of intratubular cell mass and tubular basement thickening were seen in cases with longer course. A notable finding was the presence of multifocal microthrombi in 2 cases. A CD61 stain highlighted increased platelets in testicular vessels associated with cluster and occasional thrombus formation (Figure, C and D). One case showed increased mononuclear inflammatory infiltrate ($CD8^+$ dominant) in the interstitial space, compatible with orchitis (Figure, E and F).

In this analysis, evidence of acute testicular injury is seen and is particularly related to oxidative stress, which has previously been reported in animal models in association with type 2 diabetes mellitus.[4] We compared our findings to a control group of 7 testes obtained during autopsy from patients who had similar comorbidities and



A, Changes associated with seminiferous tubule injury include chromatin condensation, acidophilic alteration of the cytoplasm of spermatocytes, and swelling with vacuolization of the Sertoli cells. B, Accumulation of sperm and immature spermatocytes in the epididymis. C, Multifocal platelet aggregation and microthrombi. D, CD61 immunostain highlights platelet clusters within testicular vessels. E, Mononuclear inflammatory infiltrate in the testicular interstitium, atrophic seminiferous tubules consistent with orchitis. F, Immunohistochemical studies reveal a predominant $CD8^+$ infiltrate (hematoxylin-eosin, original magnifications ×400 [A and B] and ×200 [C and E]; CD61, original magnification ×200 [D]; CD8, original magnification ×200 [F]).