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Risk Assessment and Vital Safety Measures for Working with Biological Exhibits in the Forensic Biology Laboratory in the Era of COVID-19

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Abstract

The outbreak of severe acute respiratory syndrome (SARS)-CoV-2 was first recognized with unknown etiology of pneumonia in Wuhan, China, in December 2019. After its first incident disease grasp the whole world, and this infection has been declared a pandemic. Consequently, the scientific community is working hard to development of specific therapeutics as well as vaccines but till date there is no specific vaccine or drug is available to contain the disease. At present lockdown and personal protective equipment is only way to reduce transmission of disease. A front-line worker includes health care workers, police and forensic laboratory personals are at high risk to develop the disease due to profession. Thus, this short commentary aims to analyze the risk assessment and personal safety measures require reducing the exposure of COVID-19 infection during the handling of biological specimen. Appropriate strategy require minimizing the risk of infection in individuals handling the blood and other body fluids of deceased persons infected with 2019 novel coronavirus (2019-nCoV) or suspected are immediately needed. To prevent this, risk assessment forms should be available to workers, so they are aware what dangers are associated with the exhibits that they are handling. These dangers that are associated with biological exhibits of diseased and suspects persons could infect during working with biological samples that pose health threats. All risks to health are to be considered and appropriate action should be taken to prevent these from happening on all stages of biological specimen handling.

Keywords: SARS-CoV-2; nCOV-19; Corona; Risk assessment; Health care worker; Forensic; Personal safety

Introduction

In 2019, as the whole world was competing with each other for good economic growth, good health facility and infrastructure for their people, a mysterious disease first emerged in Wuhan, China that develops pneumonia of unknown aetiology and later on confirmed as a novel corona virus (nCOVID-19) [1]. With the onset of the pandemic caused by COVID-19, as of August 7, 2020 the number of confirmed COVID-19 cases had reached 18,854,287 confirmed cases of COVID-19, including 708,639 deaths, reported Globally [2]. The infectious disease had a wide range of symptoms reported ranging from mild symptoms to severe illness. Symptoms may appear 2-14 days infection. The virus infected people develop a variety of symptoms these may include fever or chills, Cough, Shortness of breath or difficulty breathing, Fatigue, Muscle or body aches, Headache, loss of taste or smell, Sore throat, Congestion or runny nose, Nausea or vomiting and Diarrhea [3]. SARS-CoV-2 seems highly infectious and lethal and the evidence suggests that disease transmission occurs through direct, indirect contact, or close contact with infected people via coughing and sneezing. These include saliva, respiratory secretions, or secretion droplets and recently it's thought to be an airborne transmission. After its first outbreak in China disease grasps the Europe and infected 216 countries all around the globe in a very short time of span and emerged as the disease of century [2]. In the era of SARS-CoV-2 pandemic front line warriors such as health care worker, forensic laboratory staffs and policemen are on high risk due to their profession and public dealing. Therefore, there is always risk associated to catch the infection from the infected person and its biological materials. In the forensic science especially forensic biology laboratory deals with the biological samples such as s blood, semen, saliva, viscera, nails, tears, vaginal secretions, organs, flesh, hairs, leaves, fruits, etc. While Non-biological exhibits includes fibres, weapons, papers, glass, metals, documents, paint, firearms, petroleum products, narcotic drugs, oils, explosives and other chemicals [4]. Handling of these forensic

evidentiary materials potential source of COVID-19 and it poses a serious risk to the forensic laboratory professional associated with the handling such exhibits. Numerous research studies proved that the SARS-CoV-2 virus can be spotted in throat swab, nasal swab, perianal swab, blood, viscera sections, cloths used by an infected person [5,6]. Simultaneously, studies proved that COVID-19 virus can be sustained on various surfaces for a long time such as on metal surfaces, plastic surface and steel surface ranging from hours to days [7]. Apart from these this deadly virus can survive on cart board for 24 hours, while on the copper surface it can survive only about four hours [8,9]. Such, survivability, direct and indirect contact and air-born transmission make them more deadly and responsible for the rapid transmission of COVID-19. Therefore, the forensic laboratory scientist and staff associated with the handling of such materials are at high risk to catch the infection from biological exhibits in current pandemic just like other medical professionals. Thus, during the pandemic, when infectious disease outbreak on the peak, forensic laboratory professional cannot avoid being exposed to biological exhibits from victims/offenders with confirmed or suspected SARS-CoV-2 infection. Although, there is a lack of scientific data about how to tackle the biological exhibits of SARS-CoV-2 infected and suspected victims to achieve the self-protection from the transmission of COVID-19. Thus, the short commentary here is based on the current understanding of SARS-CoV-2 to achieve the maximum protection of forensic laboratory professionals from the COVID-19 during the handling of biological samples.

Forensic Laboratory Routine Practices in the Light of COVID-19 Pandemic

Forensic science laboratories are the designated laboratory that includes various divisions like Forensic Biology, Physics, Chemistry, Ballistic, Serology, Documents, Finger Prints, Forensic Psychology, Photo, Computer Forensic Science & Scientific Aids divisions with the addition of state-of-the-art laboratories for Computer Forensics and DNA profiling. Where different types of evidential materials were collected from the crime scene or materials used in the commencement of an offence and biological samples present at the crime site. These evidentiary materials processed by the forensic scientist in different laboratory in accordance with nature of specimen to generate the scientific evidence, required for criminal justice in the modern-day. However, in current pandemic collection and processing of such biological and non-biological evidentiary materials pose a serious risk of COVID-19 infection. Thus, special care is needed during the handling of biological exhibits in each division of forensic science laboratory in the current pandemic of SARS-CoV-2.

Laboratory Acquired Infection

Laboratory acquired infection most associated with inappropriate handling of biological specimen. Laboratory workers often get infected through until now unexpected modes of transmission due to the frequent exposure and their profession. The first laboratory-acquired infection of Severe Acute Respiratory Syndrome (SARS) was first reported in Singapore in 2004, when a Microbiology laboratory professional got infected 4 months after SARS epidemic [10]. Laboratory that deals in the handling of the biological specimen is a potential source of unknown infections agents such as bacteria, viruses, fungi, and parasites that are associated with a wide variety disease. Although, the particular risk of infection after exposure with biological materials not well-defined, surveys of laboratory-acquired infections suggest that Brucella species, Shigella species, Salmonella species, Mycobacterium tuberculosis, and Neisseria meningitidis are the most common causes. Infections due to the blood borne pathogens (hepatitis B virus, hepatitis C virus, and human immunodeficiency virus) remain the most common reported viral infections, since the dimorphic fungi are responsible for the greatest number of fungal infections [11]. Above reported data suggest that the handling of biological material is a potential source of various disease, thus in the Forensic laboratory professionals are always at high risk to get the blood born and other laboratory-acquired infection just like clinical laboratory practitioner due to professional similarity. Therefore, there is an instant need of risk assessment policy and appropriate safety measure to avoid the infectious disease during the working.

Risk Assessments of Biological Exhibits

Risk assessment is an important factor to decide the infectivity index of the biological materials and it is of two types qualitative and quantitative risk assessment. Biological agents are not constant chemical moieties for which well advanced and easy-to-perform assays are available. Biological material composed thousands of macro and micro molecules such as proteins, lipids, carbohydrates, nucleic acids and their building blocks joint into separate elements and capable to reproduce themselves in the host's cells, tissues, and body fluids. There are numerous types of infectious agents such as bacteria, rickettsia, viruses, yeasts, moulds, uni- cellular and multicellular parasites etc. however the most prominent feature of an infectious agent is infectivity and ability to replicate the host cells [12]. In the case of forensic biological samples, the qualitative risk assessment is essentially required because throughout the pandemic, forensic laboratory scientist and co-workers have faced direct/indirect occupational exposure. Since we do not know whether biological exhibits have COVID-19 in the biological samples or not. Apart from these, asymptomatic people are another threat and they can also become a source of infection [13].

Qualitative Risk Assessment of Biological Exhibits in Era of SARS-CoV-2

Risk assessment of biological exhibits is most importantly needed especially in the case of forensic biological samples. Victims/offenders/Suspects medical history is must needed documents with the biological exhibit and it may help to find the disease status which is essentially required to reduce the risk of

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laboratory acquire SARS-COV-2 infection by adopting appropriate safety measures. A, medical history document may have to be the epidemiological data of victims/offender/suspects that include the travel history or residence history in hot spot region or surrounding cities or communities reporting the confirmed case, any close contacts of persons with COVID-19 (with positive results after nucleic acid testing), exposure history to patients with fever or respiratory illness. Such medical history of will be helpful in current pandemic to confirm whether the diseased, offender and suspect was a confirmed infection or suspected cases of SARS-CoV-2 document is an essential document that may include the epidemiological data like the day of travel history or residence history in hot spot region or surrounding cities or communities reporting the confirmed case, any close contacts of persons with COVID-19 (with positive results after nucleic acid testing), exposure history to patients with fever or respiratory illness. Such medical history of victims/offender/suspects/criminals might be helpful in current pandemic to confirm whether the diseased, offender and suspect was a confirmed infection or suspected cases of SARS-CoV-2 [14,15]. Because risk factors, such as type of infection, disease severity, transmission modes, and availability of prophylactic measures, are critically important in determining the biosafety level. These risk factors are important to take additional protective measures during the collection and processing of biological exhibits. Such risk assessment importance is increased especially when an infectious disease outbreak is on top world-wide and specific treatment is not available to contain the disease. Therefore, in the present pandemic of SARS-CoV-2 risk assessment and case history of biological exhibits is utmost important because there is specific preventive therapy is available to contain the COVID-19. Meanwhile, hand hygiene, social distancing and personal protective equipment (PPE) is the only way to reduce the transmission of disease.

What Should be the Forensic Laboratory Infection Management Plan During the SARS-CoV-2 Pandemic?

Forensic biology laboratory professional deal in biological exhibits some time it may have infectious agents you never know and in the current pandemic of SARS-CoV-2 special care is utmost important for personal safety. Therefore, there it is important to forensic laboratory professional may adhere with appropriate safety guidelines of biological samples to avoid the unwanted exposure. Based on the current knowledge of COVID-19 it is important to adopt the proper personal protective equipment during the handling of biological exhibits in the laboratory. Before collecting biological samples on-site, a sample receiving area should be disinfected with 75% alcohol, and the specimen's parcels may subject to ultraviolet radiation for 30 min. The biological samples were then packaged in multi-layer zip lock bags [16]. Before the biological exhibits sent to the processing laboratory, it should be disinfected first by placing the biological evidence in a fume hood first and then the thermostat was set to 56 °C for 30-40 min. Afterword's biological exhibits should be labelled as "sterilized". The sample handler should wear proper Personal Protective Equipment, N-95 mask, Full sleeve water-proof gown, face-shield etc. Upon entry of the sample processing room, the working table should be cleaned with 5% hypochlorous acid and at the time of opening of case exhibit parcel, each layer should be sprayed 75% alcohol and wiped with cotton to clean the surface of parcel box/packets. Relevant hand hygiene is utmost important in the forensic laboratory "wash hands with water and soap after taking off gloves and then after alcohol-based sanitizing gels should be applied as stronger disinfection. Take necessary measures to avoid the damage of biological exhibits during the cleaning and inspection of the biological samples.

Conclusion

COVID-19 poses a serious challenge not only the health care professional but also to the forensic laboratory professionals due to the similar profession. Thus, the risk assessment biological exhibits and personal protective measures are key to for forensic laboratory workers who had involved in the handling of the biological sample during the COVID-19 pandemic. Appropriate protective measures and hand hygiene could be useful in reducing the risk of infection. It only has a way at present to reduce SARS-CoV-2 transmission. Local authority and laboratory in-charge may also assure the time to time vaccination for the infectious disease to forensic laboratory professional just like medical health professionals to avoid the unwanted exposure.

Ethical Standards

This article does not contain any studies with human participants or animals performed by the authors.

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