IFAA best practice guidelines for body donation programmes during the novel Coronavirus pandemic

Human dissection has long been the 'gold standard' for teaching and research in the anatomical sciences. Anatomists rely on the altruism of individuals to donate their bodies so that health sciences professionals in training can continue to be privileged by experiencing the structural details of the human body. We thus continue to be extremely grateful to those individuals who donate their bodies. For the process of body donation to be accepted by the donors and the public, it is imperative that high ethical standards prevail. Under these conditions, numerous body donor programmes have been achieved around the world. The best practice guidelines of the IFAA (www.ifaa.net) present recommendations for the ethical sourcing and use of human bodies.

During outbreaks of infectious diseases, the sourcing of bodies and continuance of donor programmes comes under stress. Numerous guidelines have been produced by organisations and governments during the present novel coronavirus pandemic, which will be of great use to anatomists who facilitate donor programmes. The IFAA has summarised current information on important aspects of the handling of bodies during the coronavirus pandemic in order to provide information to its constituent members. It stresses the importance of scientific evidence, which should be the guiding principle wherever available.

The following refers to the handling of the dead body in the context of anatomy. As for the contact of staff with living donors and/or with donors' family members, the general safety rules regarding possible Covid-19 infection apply. It is recommended that all such contact is made via telephone, mail or internet for the time being. Whether the general activities of running of a body donation programme should be suspended depends on the local situation and the guidelines of the local authorities regarding workplace safety in times of the pandemic.

The COVID-19 virus is mainly transmitted through large respiratory droplets by inhalation or contact with mucosal surfaces, but other modes of transmission have been suggested (airborne, faeco-oral (Hindson, 2020), contact with contaminated surfaces (WHO, 2020a)). There is no evidence so far that the virus is transmitted through contact with the skin of a deceased person, but as the virus is known to persist on surfaces for hours or days, depending on the nature of the surface (Kampf et al., 2020), this mode of transition cannot be ruled out. The risk of transmission likely increases with direct contact with bodily fluids, and certainly increases with invasive handling of the cadaver, as in autopsy procedures, if it produces droplets or aerosols (ECDC 2020a, Finegan 2020).

The following are of particular importance for anatomists with body donor programmes:

- No evidence has been found so far of individuals who have become infected from exposure to the bodies of persons who have died from

COVID-19 (WHO 2020b).

- In general, the "potential risk of transmission related to the handling of bodies of deceased persons with suspected or confirmed COVID-19 is considered low" (ECDC 2020a).

- While there is no evidence yet that the COVID-19 virus is specifically inactivated in a preserved body donor, the commonly used preservatives, formaldehyde and ethanol, appear to be efficient against the virus (Shidham et al., 2020).

Safety and well being of staff

- In general, the safety precautions applied in the basic handling of any human cadaver should cover the risk of a Covid-19 infection. As in any given case, if no infection (including HIV, Tbc) can be confidently ruled out, any cadaver should be treated as potentially infectious. In the absence of a test for COVID-19, this also applies to the risk of a COVID-19 infection. Suitable precautions are recommended based on the nature of the task to be undertaken (see below).

- All staff responsible for the collection, transportation and preparation of bodies infected, or suspected of being infected, with COVID-19, must be trained specifically for their tasks, including the use of personal protective equipment (PPE) (Finegan et al., 2020). (For further details on PPE see CDCP, 2019a).

- The safety and health of those individuals handling the unembalmed body (mortuary staff, other personnel) should be the most important priority. Managers should thus ensure that the necessary PPE supplies are available to those staff responsible for accepting, collecting, transporting and preparing of the bodies.

- Mortuary staff and personnel who are responsible for the collection, transportation and preparation of bodies must use appropriate PPE. Minimum requirement for any handling of the body includes an impermeable disposable gown [or disposable gown with impermeable apron], gloves and face protection such as goggles and a fluid-resistant medical mask (Finegan et al. 2020, WHO 2020b). A long-sleeved water-resistant gown is recommended by the ECDC (2020a). Adequate ventilation of laboratories where bodies are handled is also important. Finegan et al. (2020, pages 4 and 5) supply detailed technical information for those staff who will be handling bodies.

- It is recommended that with any significant manual handling of the body, an FFP2 or FFP3 mask should be worn in addition to the above (Finegan et al. 2020, RCP 2020b)

- If at all possible, any invasive procedures on the unembalmed body (as in standard pathology autopsies) should be avoided. In particular, this

includes procedures generating aerosols, like use of an oscillating saw. If such procedures are necessary, full protection with PPE including a FFP3 mask is necessary (Finegan et al. 2020, RCP 2020b).

- Appropriate PPE should also be supplied to cleaning and waste management staff (ECDC, 2020a).

- Mortuary staff must be trained in, and apply, standard precautions for hand hygiene (for further details on hand hygiene see CDCP, 2019a) and the possible inclusion of shower facilities for those staff handling the embalming of bodies.

Surface decontamination

The human coronaviruses is said to remain infectious on surfaces for up to 9 days (Kampf et al., 2020). Under experimental conditions, the COVID-19 virus has been detected after up to 72 hours following application to certain surfaces (van Doremalen, 2020). Therefore, cleaning of the environment exposed to COVID-19-infected bodies is crucial.

- It is not presently known whether a route of infection for COVID-19 is from the skin surface (RCP, 2020a)

- The ECDC (2020a) recommend regular cleaning followed by disinfection of all surfaces with hospital disinfectants. Should hospital disinfectants not be available then the use of a decontaminant such as 0.1% sodium hypochlorite (dilution 1:50 if household bleach at an initial concentration of 5% is used) or 70% ethanol is suggested. Prior to the use of the decontaminant, a neutral detergent should be used. However, currently there is no information available on the effectiveness of this approach [EDCD, 2020b).

- All waste should be regarded as infectious and handled as Category B waste (WHO, 2012; ECDC 2020a).

Transportation of bodies

- While body bags are said not to be necessary for transportation (WHO 2020b), they should be used in case of body fluid leakage (WHO 2020b). However, the ECDC (2020) and the NSW Health (2020) recommend the use of two body bags (double-bagging). Possible contamination of the outside of the bag should be managed by decontamination procedures.

- Transport equipment and vehicles can be of the standard type (WHO, 2012; WHO, 2020b) but decontamination after use should be ensured.

Embalming of bodies infected with the novel coronavirus

Embalming of bodies infected by the novel coronavirus is not recommended by the WHO (2020b) but this is in the context of advice for funeral homes. In the case of anatomy departments, embalming cannot be avoided. The reason provided by the WHO (2020b) and the NSW Health authority for not recommending embalming is in order to minimize manipulation of the body and thus the possible generation of aerosol. The Department of Health of South Africa (2020) asserts that embalming of a body infected with the novel coronavirus does not pose a risk. However, forced inflation of the lungs, which may occur during fixation, may generate aerosol (RCP, 2020b). Thus any aerosol generating procedures and splashes of contaminated fluids should be avoided during embalming. The use of PPE as described above applies during all embalming procedures.

Protocols used for histopathology "have almost always been effective in inactivating a broad range of viruses, even Ebola" (Rossi et al. 2020). The same is true for most standard embalming procedures used in gross anatomy (Demiryürek et al. 2002). A series of studies have demonstrated that formalin and glutaraldehyde are able to inactivate SARS-CoV in a temperature-dependent and time dependent manner (Darnell, 2004; Henwood 2018 ; Kampf et al 2020; Rossi et al., 2020; Xu et al., 2020). As the standard embalming procedures with these chemicals have been safe for all other infective agents (except prions) in the past, it is therefore relatively safe to assume that a standard embalming procedure with formalin and/or ethanol inactivates the COVID-19 virus. Extended periods of fixation in formalin are recommended for tissues for histology (Rossi et al., 2020). Whether extended periods of preservation before use of bodies fixed in formalin for dissection should be recommended for bodies carrying the COVID-19 virus will need further evidence.

Recently, an *in vitro* cytotoxicity assay by Quondomatteo et al. (2021) demonstrated that a wide range of embalming solutions inactivates the SARS-COV-2 virus. The authors concluded from their findings: "thereby facilitating the safe resumption of body donation programmes and cadaveric anatomy teaching". Anatomists wishing to apply the results of this article should ensure that the dilution of the solution and the protocol used correspond to that suggested by Quondomatteo et al. (2021).

The IFAA recommends adhering to the guidelines produced by various organisations such as the WHO (2014; 2020b,c); Finegan et al., 2020 (for the International Committee of the Red Cross), ECDC (2020a, b) and the New South Wales Health authority (2020). Regular updates to this document are welcome from anatomists and Anatomical Associations.

While these Guidelines have been produced in good faith for anatomists who wish to continue their dissection programmes during the pandemic, the IFAA cannot attest to the completeness, reliability or accuracy of the information supplied in this document. Any action taken in relation to these guidelines is at your own risk and the IFAA is not responsible for any negative outcomes.

Contributors to the Guidelines: Beverley Kramer, Brendon Billings, Bernard Moxham and Andreas Winkelmann

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