

RESEARCH ARTICLE

Medical ethics during COVID-19 pandemic: An experience with death investigation

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ABSTRACT

Introduction : Medical ethics is a key element in the practice of medicine. This study highlights the application and conceptualization of those principles in the process of death investigation during the COVID-19 pandemic.

Objective : To identify different ethical principles and their application in death investigation during the COVID-19 pandemic.

Methodology: Autopsy information of 41 deaths from 2020-2021, which were referred for inquest with positive Polymerase Chain Reaction (PCR) test or positive rapid antigen test for COVID-19, was analysed. The death investigation process was conceptualized against the ethical principles; justice (time taken for PCR), autonomy (method of disposal and release of the dead body), beneficence, and non-maleficence (duration of illness, cause of death, Cycle threshold value of PCR etc.).

Results : Most deaths (36.59%) were between 71-80 years, with a male-female proportion of 51:48. Majority were home deaths (63.41%), while deaths of non-vaccinated people (80.49%) were predominant. PCR was done in <24 hours after death in 36.59% and within 24-48 hours in 58.54%. Comorbidities were present in 78.05%. Among the 75.61% of cases with a Cycle threshold (Ct) value of less than 30, in 83.87%, the primary cause of death was related to COVID-19 infection while the duration of illness was >3 weeks in 12.9% and 2-3 weeks in 3.23%. About 17.07% cases had a Ct value of more than 30, with COVID-19 infection being a contributory cause of death in 57.14%, while all cases had a duration of illness of <2 weeks.

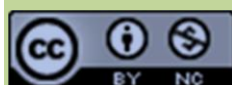
Conclusion: Justice has prevailed in this cohort. The PCR report influences the autonomy in claiming and releasing the bodies to the relatives. A higher Ct value may suggest less infectivity, which may be considered when releasing the body after excluding lung changes in an autopsy. Therefore, more research is needed regarding Ct values and the infectivity of dead bodies.

Keywords: *Death investigation; ethical dilemmas; medical ethics*

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INTRODUCTION

Ethics is a set of standards that helps to lay the foundation for correct behaviour, which enables a person to understand and choose what is right in accordance with human, cultural, and social values¹. Medical or clinical ethics is the use of these standards to guide medical care, treatment, and professional conduct¹. When medical professionals encounter ethical dilemmas with no easy solutions, careful ethical analysis is useful for making decisions. These dilemmas need to be approached using ethical principles, consisting of (1) respect for patient autonomy; (2) beneficence; (3) non-

maleficence; and (4) justice. Respect for patient autonomy means that each individual patient has the right to determine which medical interventions they will accept or refuse, and the decision is made with an understanding of the circumstances and consequences of the decision, with intention, and without undue external influences. Beneficence refers to the duty of medical professionals to act in the best interests of their patients. Non-maleficence refers to the requirement to avoid harming patients. The principle of justice has two components: equity and distributive justice. Equity means the absence of disparities in the quality of medical care given to persons with like medical conditions and circumstances regardless of other nonmedical factors such as wealth and social standing. Distributive justice means that there is a moral obligation to distribute the limited resources fairly among patients². Usually, ethics require a higher standard of behaviour than the law; as one can act within the law, and yet the action could be unethical^{2,3}.

Judicial Medical Officers assist to conduct death investigations and certify the cause and manner of unnatural and unexplained deaths such as homicides, suicides, unintentional injuries, drug-related deaths, and other deaths that are sudden or unexpected. The role of the Judicial medical officers is to decide the scope and course of a death investigation, which includes examining the body, determining whether to perform a full autopsy, and ordering other necessary investigations. Apart from the value in the field of Forensic Medicine, death investigation is emerging as a critically important tool in evaluating the quality of health care and the nation's response to pandemic situations and bioterrorism⁴.

The COVID-19 pandemic caused by the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) turned into a public health emergency of global concern causing extensive morbidity and mortality. This pandemic resulted in unprecedented challenges to governments worldwide due to the transmissibility of the virus and the scale of its impact on morbidity and mortality, healthcare systems, economies, and societies⁵.

SARS-CoV-2 continues to spread, and deaths continue. The mode of transmission of the virus is thought to be largely by inhalation of infected respiratory droplets. Most patients with COVID-19 have a mild disease course. However, some develop severe disease with high mortality, which is often associated with older age, the presence of comorbidities, and immunosuppression⁶⁻⁸.

The COVID-19 diagnosis is by clinical, laboratory, and radiological features. The main diagnostic tool is real-time reverse transcriptase-polymerase chain reaction (rRT-PCR) using respiratory samples⁹. The rRT-PCR uses a fluorescence signal, which increases proportionally to the amount of amplified nucleic acid enabling accurate quantification of RNA in the sample. The cycle threshold (Ct) value; the number of cycles at which fluorescence of the PCR product is detectable over and above the background signal, is used in PCR assays to consider the COVID-19 positivity as the Ct value is thought to be inversely proportional to the viral load¹⁰.

The COVID-19 pandemic has worsened health and social inequities with a greater impact on vulnerable and disadvantaged populations¹¹. Because of the rapid spread of infection, health systems in many countries have been overwhelmed. This challenge has led health care systems to consider healthcare rationing due to scarce resources and crisis capacity^{12,13}.

The death investigation process has also been affected by the COVID-19 pandemic. With the increased number of deaths associated with COVID-19 infection, the medico-legal death investigation system was overburdened^{7,14}. Especially in Sri Lanka, during the initial phase of the pandemic, a circular was released to conduct mandatory inquests and/or postmortem examinations on all the deaths that occurred in lockdown or high-risk areas and during the period of quarantine¹⁵. The whole death investigation process (from history taking to postmortem examination) changed due to the pandemic¹⁶. Consequently, various ethical dilemmas arose within the medico-legal death investigation system during this period.

OBJECTIVE

To identify how the principles of medical ethics (autonomy, justice, non-maleficence, and beneficence) are applied and conceptualized in the process of death investigation during the COVID-19 pandemic.

METHODS

This descriptive cross-sectional study. Autopsy information of 41 deaths brought for inquests to the Judicial Medical Office of the Colombo North Teaching Hospital, Ragama, Sri Lanka from December 2020 to October 2021, with positive rapid antigen tests (RAT) or Polymerase Chain Reaction (PCR) tests for COVID-19 was included for analysis in

this study. The COVID-19 positive deaths involving unidentified individuals were excluded.

The post-mortem reports of these 41 deaths were used to extract data. After removing the personal identifiers, socio-demographic details like age, gender, and profession, and information such as duration of illness, vaccination history, place of death, time of performance of PCR, and Ct values were collected. Further, details regarding the postmortem investigations such as type of death, method of acquisition of clinical history, available documentation of clinical history, type of autopsy conducted, cause of death, and method of conveying the information to the relatives were collected.

In order to conceptualize the application of ethical principles in death investigation, the following details were considered.

- *Justice*: Time interval between the arrival of the body at the mortuary and performance of PCR.
- *Non-maleficence* and *Beneficence*: Type of autopsy, duration of illness before death, cause of death, Ct value of the PCR test, release of body to relatives.
- *Autonomy*: Method of disposal of dead body, method used to convey information to relatives, release of dead body to relatives.

For the purpose of analysis, the cases were divided into three groups according to the Ct values of the PCR tests: Ct values less than 30, Ct values more than 30, and Ct value unknown.

Extracted data were analysed using the statistical package SPSS version 25. These data of the death investigation process of 41 deaths were used to conceptualize the ethical principles: justice, autonomy, beneficence, and non-maleficence.

RESULTS

Socio-demographic details

A total of 41 deaths were analysed. The results of the socio-demographic details like age, gender, and other information such as comorbidities, duration of illness, vaccination history, and place of death are presented.

- *Age and gender*

Most COVID-19 positive deaths have occurred in the age groups between 71-80 years (36.6%, n=15), and 61-70 years (22%, n=9). It was infrequently seen in ages between 30-50 years (n=5). None of the

deaths were aged below 30 years. A less gender disproportion was seen among the cases, where males and females were almost equally distributed (male:51.2%, n=21; female:48.8%, n=20).

- *Comorbidities*

A significant number of people had comorbidities (78.05%) such as Diabetes Mellitus (39.02%), hypertension (26.8%), heart disease (12.2%), chronic kidney disease (9.8%), and malignancy (9.76%) as single or combination of diseases. Diabetes Mellitus, hypertension, heart diseases, and malignancy each were present as single comorbidities among 7 (17.1%), 1 (2.4%), 1 (2.4%), and 2 (4.9%) cases respectively, and in combination with other diseases among 9 (22.0%), 10 (24.4%), 4 (9.8%), and 2 (4.9%) cases respectively. The other comorbidities present were, cerebrovascular accidents (n=3; 7.3%), chronic live cell disease (n=1; 2.4%), Systemic Lupus Erythematosus (n=1; 2.4%), Myelofibrosis (n=1; 2.4%), respiratory diseases (e.g.: Tuberculosis, asthma) (n=3; 7.3%), and psychiatric illnesses (e.g.: Schizophrenia, depression) (n=3; 7.3%).

- *Place of death*

Deaths most commonly occurred at home (n=26, 63.41%). This was followed by hospital (n=10, 24.4%), and other places (n=5, 12.2%) such as on the way to the hospital.

- *Vaccination history*

Among the 41 deaths, a majority were non-vaccinated (n=33, 80.49%), 9.76% had received only one dose and 4 had received the 2nd dose (A two dose vaccination programme was available during that period).

Justice

To conceptualize the application of justice in death investigation, the time interval between the arrival of the body at the mortuary and performance of PCR was considered to identify any breach of equity among the cases.

- *Performance of PCR and Ct value*

After arrival at the mortuary, PCR test was done on the dead bodies in less than 24 hours, within 24-48 hours, and in more than 72 hours after death in 15 (36.59%), 24 (58.54%), and 1 (2.44%) case respectively. In only one case Rapid Antigen Test (RAT) has been performed to check for positivity. About half of the cases, the Ct value was between 11-20 (n=22, 53.7%), while 2.4% (n=1), 19.5% (n=8), and 17% (n=7) had Ct values between 1-10, 11-20, and 31-40 respectively. The remaining two deaths, which underwent PCR tests and became positive, didn't have Ct values.

Non-maleficence and beneficence

Non-maleficence and beneficence were applied in death investigation by considering the type of the autopsy, cause of death, duration of illness before death, Ct value of the PCR test of the dead body, and the release of the body to the relatives.

• *Type of autopsy:*

Due to the COVID-19 positivity in the dead bodies, the process of postmortem examination was changed during this period, where the main method of conducting the autopsy was a verbal autopsy. The verbal autopsy only was conducted in 65.85% of cases and 9.76% underwent verbal autopsy together with an external examination. In 21.95% a partial autopsy and external examination were performed. A full autopsy was conducted in only one case (Table 1).

Table 1: Type of autopsies conducted

Type of autopsy	Frequency (Percentage)
Verbal autopsy only	27 (65.8%)
Both verbal autopsy and external examination	4 (9.75%)
Both partial autopsy and external examination	9 (21.95%)
Both complete autopsy and external examination	1 (2.4%)
Total	41

• *Cause of death and duration of illness:*

Death directly due to COVID-19 infection was the cause of death in 63.4% of cases, while death was contributed by COVID-19 infection in 26.8%. There were 9.75% of deaths in which the COVID-19 positivity was found as an incidental finding. In 70.7% (n=29) of cases, the duration of the disease was less than two weeks, and among those cases, the majority (21.96%) had the illness for only 4-5 days before the death. There was only one case that had the illness for 2-3 weeks, and about 17.1% had suffered from the disease for more than three weeks before the death (Table 2).

• *Ct value of PCR test vs duration of illness, cause of death, comorbidities*

Studies have shown that PCR assays use 30 as the cut-off for Ct value to consider a patient positive^{16,17}. In this study, there were 75.6%, 17.07%, and 7.31% of cases with Ct values less than 30, more than 30, and unknown values respectively. Within the Ct value less than 30 group, 83.87% were deaths

directly due to COVID-19 infection, 9.67% of deaths had COVID-19 infection as a contributory cause and 6.45% had COVID-19 infection as an incidental finding. In this group, the illness duration was less than two weeks in 67.74%, between 2-3 weeks in 3.23%, and more than 3 weeks in 12.9% of cases. The group with a Ct value of more than 30 had COVID-19 infection being a contributory cause of death in 57.14%, while all had less than 2 weeks of illness duration (Table 2).

Table 2: Ct values vs duration of illness and cause of death

	CT Value <30	CT Value >30	Unknown	Total
Total Frequency	31 (75.6%)	7 (17.07%)	3 (7.31%)	41
Duration of Illness				
Less than 1 day	1 (3.2%)	3 (42.9%)	1 (33.3%)	5 (12.2%)
2-3 days	4 (12.9%)	2 (28.6%)	0	6 (14.6%)
4-5 days	8 (25.8%)	2 (28.6%)	0	10 (24.4%)
6-7 days	2 (6.5%)	0	0	2 (4.9%)
1-2 weeks	6 (19.4%)	0	0	6 (14.6%)
2-3 weeks	1 (3.2%)	0	0	1 (2.4%)
>3 weeks	5 (16.1%)	0	2 (66.7%)	7 (17.1%)
Not Known	4 (12.9%)	0	0	4 (9.8%)
Cause of death				
Death due to COVID-19 infection	26 (83.9%)	2 (28.6%)	2 (66.7%)	30 (73.2%)
Death contributed by COVID-19 infection	3 (9.7%)	4 (57.1%)	0	7 (17.1%)
COVID-19 infection was an incidental finding	2 (6.5%)	1 (14.3%)	1 (33.3%)	4 (9.8%)

Numerous studies have shown that the presence of comorbidities increases the severity of the disease⁸. In our study, 7 cases (17.1%) didn't have any comorbidities and in 3 people (7.3%) presence of comorbidities was not known. More than two comorbidities were present in 39.0% (n=16), and among these, 3 (18.8%) and 4 (25.5%) cases died in less than 1 day and within 2-3 days respectively since the diagnosis. The Ct value showed values less

than 30 in 10 (62.6%) and more than 30 in 6 (37.4%) cases. Patients with only one comorbidity were 36.6% (n=15), of which 86.6% (n=13) had Ct values

less than 30 with a majority (n=7; 46.7%) having 4-5 days of duration of illness.

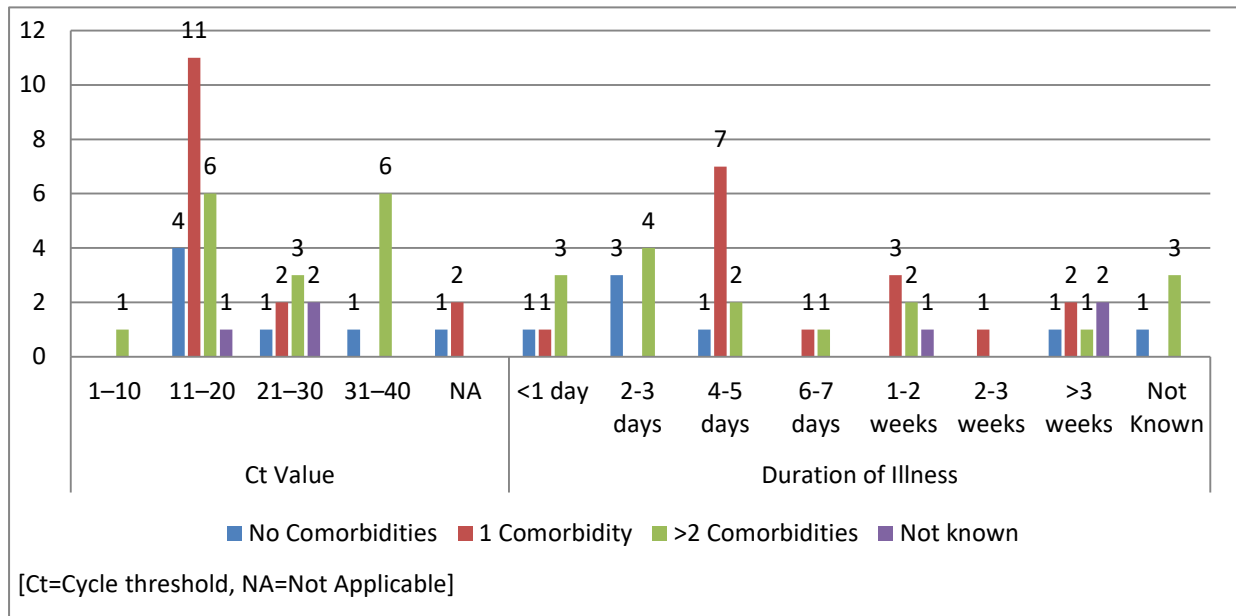


Fig. 1: Number of comorbidities vs Ct value and duration of illness

Among the Ct value less than 30 group (n=31; 75.6%), the commonest comorbidity was Diabetes Mellitus (n=10; 32.3%) as a single (n=7) or in combination (n=3) with other diseases such as hypertension, ischaemic heart diseases, malignancy, CKD etc. Most people with only Diabetes Mellitus had a duration of illness of 4-5 days (n=3; 30.0%) while when it was in combination, all had a duration of illness of 2-3 days. Only 4 people had a duration of illness for more than three weeks and among these, two (6.5%) had malignancy and ischaemic heart disease (Fig. 2).

Among the Ct value less than 30 group (n=7; 17.1%), three (42.9%) patients have had Diabetes Mellitus and hypertension together as comorbidities. All patients had a duration of illness of fewer than 5 days, while three patients (42.9%) died on the first day after the diagnosis, who had comorbidities such as Diabetes Mellitus, hypertension, end-stage renal disease, and Malignancy in combination (Fig. 3).

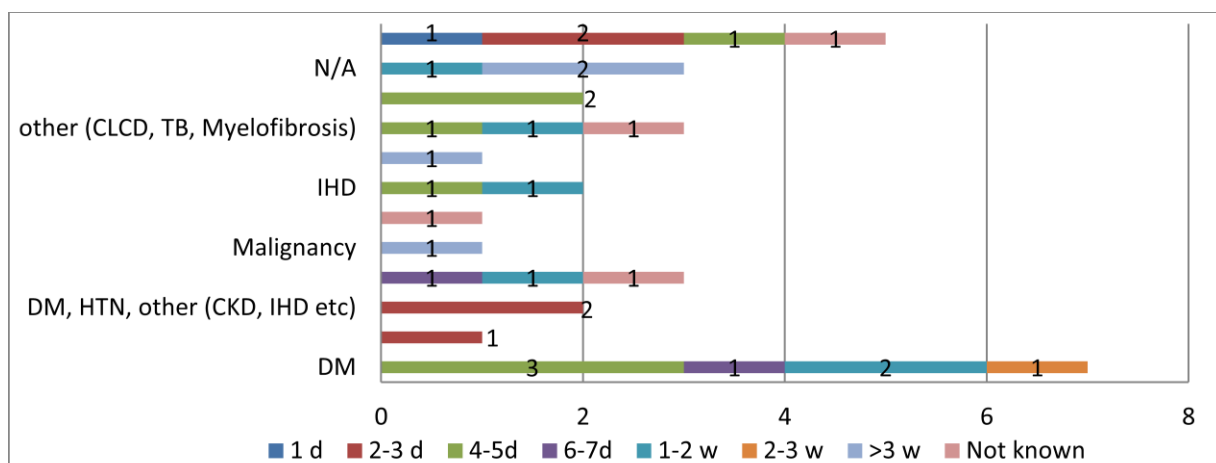
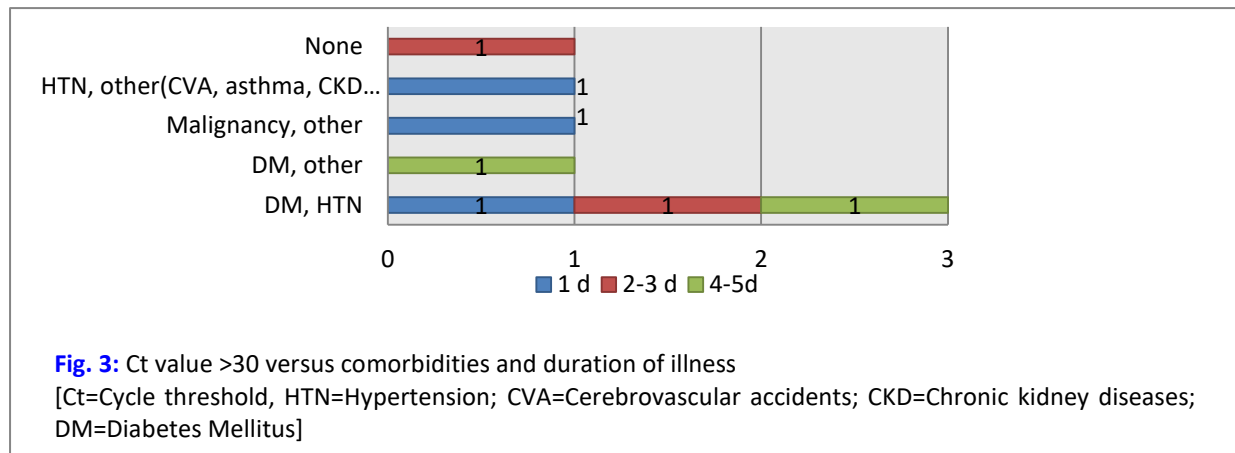


Fig. 2: Ct value <30 versus comorbidities and duration of illness

[Ct=Cycle threshold; N/A=Not known; CLCD=Chronic Liver Cell Disease; IHD=Ischaemic heart disease; HTN=Hypertension; CVA=Cerebrovascular accidents; CKD=Chronic kidney diseases; DM=Diabetes]



Autonomy

Conceptualization of application of autonomy in death investigation was considered with the factors such as method of disposal of the dead body, the method used to convey information to the relatives, and the release of the dead body to the relatives. When considering the method used to convey information about the autopsy to the relatives, 53.7% (n=22) were done over the telephone since the close relatives of the deceased were quarantined, while 43.9% (n=18) were via face-to-face communication. The dead was disposed with the assistance of the Medical Office of Health as a mandatory requirement as cremation in 92.7% (n=38), while burial was done in only one case. None of the bodies were directly released to their relatives.

DISCUSSION

Ethics is one of the vital components of health and medical care in general. Medical ethics, in which clinical ethics is also included, is the application of ethical theories, principles, rules, and guidelines in clinical situations in medicine². The primary goal of the application of clinical ethics is to provide the best possible care for the patient while maintaining the integrity and accountability of the treatment providers^{2,19}. However, when dealing with various clinical situations, issues arise frequently, which may progress to ethical dilemmas. Possible resolutions of these dilemmas may carry both benefits and tribulations requiring careful ethical analysis of the situation². The COVID-19 pandemic caused serious and distinct medical ethical issues and dilemmas in clinical practice, due to overwhelmed health systems in the countries, subsequent worsening of the health and social inequities, and health care

rationing due to scarce resources and crisis capacity¹¹⁻¹³.

Similar to clinical practice, the medico-legal death investigation system also is subjected to ethical dilemmas, which became profound during the COVID-19 pandemic. Challenges have been raised when dealing with the dead bodies of the deceased who have been suspected or confirmed cases of COVID-19 as it imposes a series of precautions that must be taken to stop the spread of the virus among health workers, relatives of the deceased and the community. Adhering to the ethical principles; justice, autonomy, non-maleficence and beneficence, was put to test during this pandemic and in the medico-legal death investigation.

During the past couple of years, due to the COVID-19 pandemic, Judicial Medical Officers were assigned a duty to perform risk assessments in every postmortem examination for the safety of the workers⁷. In Sri Lanka, this risk assessment included the performance of rt-PCR in the dead bodies to exclude the infection. In the medico-legal context, one of the ethical principles; justice, could be applied during the performance of risk assessment in postmortem examinations, where the rt-PCR is performed on every deceased person brought to the mortuary. Justice means treating patients in a fair way². The rt-PCR facilities were available in limited quantity and the time taken to perform the PCR testing may influence the time period the body was kept at the mortuary without releasing it. This affects the justice for the deceased and the relatives. In the current study, it was observed that the mandatory PCR testing of the dead bodies before post-mortem examination has been conducted in all the bodies received to the mortuary suggesting absence of discrimination. About 95.1% of the cases were tested within 48 hours after their

arrival at the mortuary. Therefore, most of the cases had received the same quality and equity during the distribution of post-mortem service, allowing justice to prevail in this cohort.

Non-maleficence is to do no harm and beneficence means to act in the best interests of the patients, professional staff, and the community²⁰. The infectivity status of a COVID-19 infected body poses serious implications for these two ethical principles. Studies have reported that the dead bodies of the SARS-CoV-2 infected persons should be considered potentially infective, where the infectivity is dependent on the time interval between initial disease symptoms and the occurrence of death, virus strain, and viral load^{21,22}. Thus, in this study, the conceptualization of the ethical principles; non-maleficence and beneficence in application of death investigation was done by considering the infectivity of the dead bodies. The duration of the infection prior to death is one of the decisive factors for the infectivity status²². According to studies, the peak of the SARS-CoV 2 viral load occurs around symptom onset persisting for about 10 days and declines within one to three weeks^{5,9}. In this study, the duration of illness was taken from the day of diagnosis of COVID-19 infection by PCR or RAT tests until the death. The duration of illness prior to death in 70.7% of cases was less than 2 weeks and in 17.1% of cases more than 3 weeks. Hence, if the duration of illness was considered, the cases, in which the COVID-19 was diagnosed more than 3 weeks later, could be less infectious. Cell culture studies have reported a correlation between the viral load and the infectivity, where the samples from bodies with a Ct value less than 30 resulted in positive cell culture, whilst at a Ct value of more than 34, culture was negative²². In 50 % of cases, viral infection was detected in samples with a Ct value of approximately 29.5²². A decrease in the viral load has been shown over time during the disease phase as well. Studies have shown that the probability of culturing the virus declines to 8% in samples with a Ct value of more than 35 and to 6%, 10 days after the onset of symptoms⁹. In the current study, contrasting observations were made, where cases with a Ct value of more than 30 had a duration of illness less than two weeks, while the Ct value of less than 30 group had 67.7% with less than two weeks and 12.9% with more than three weeks. Thus, it is with caution that the Ct value and the duration of the illness should be assessed when the infectivity of a COVID-19-infected dead body is considered, as these can influence the principles of non-maleficence and beneficence with regard to relatives, professionals, and the community.

During initial periods of the pandemic, there was reluctance to perform autopsies considering the difficulty in assessing the risk of infection posed by bodies, severe shortages of personal protective equipment (PPE), and a lack of biosafety-approved mortuary facilities^{7,21}. In Sri Lanka, during this period, all the deaths that occurred in a lockdown or high-risk areas and during the period of quarantine underwent mandatory inquests and/or postmortem examinations, where post-mortem investigation methods which were different to the routine process were applied; such as no examination, external examinations, verbal autopsy or partial autopsy.^{15,16} In the current study, verbal autopsy alone was done in 65.9% of cases, external examination and partial autopsy in 22% and a full autopsy was performed in one case.

Funeral procedures of potentially infected bodies imposed particular concerns on the authorities regarding safety of the individual and the community, where adherence on non-maleficence and beneficence were considered in a difficult decision-making process. Open casket burials, ritual washing, and embalming of the deceased, which are common in some cultures and religions were not permitted in many countries, and in some countries, the preferred method for disposal was cremation by electrical or CNG (Compressed natural gas)-run crematoria^{21,23}. Similarly, in Sri Lanka, during the initial period, the government issued a circular restricting the release of the COVID-19 infected bodies to relatives and the burial of the bodies, leading to mandatory cremation.¹⁶ Accordingly, in this study, it was observed that 92.7% of the bodies were disposed of by means of cremation, and only one body had undergone burial due to acceptable reasons. Further, in the current study sample, none of the bodies were released to the relatives to be taken home to conduct the funeral procedures as they wished limiting autonomy of the individuals.

Restrictions placed by authorities on visiting and release of dead bodies to their relatives, burial procedures, and funeral procedures, was to safeguard the community from the possible infectiousness of the COVID-19 infected bodies, adhering to the ethical principles of non-maleficence and beneficence. However, it often conflicts with the ethical principle of autonomy of the patient and the relatives, as they also have the freedom, to decide for themselves, and receive the body of their loved one. Thus, one of the ethical dilemmas in this situation is to balance respect for individual freedom and right, in this context the relatives' autonomy, and liberty with the responsibility of authorities to provide their citizens with some degree of

protection, which amounts to non-maleficence and beneficence²⁴.

In the course of time, the release of a body to relatives was allowed in Sri Lanka, even with a positive PCR test, based on the duration of illness from the initial diagnosis²⁵. This was allowed during the evolution of the death investigation process in a pandemic situation considering the less infective status of the human body with prolonged illness and to address the concerns of the relatives of the deceased, under strict health guidelines. Considering the observations made by the current study, even with more than 3 weeks of illness, the Ct value could be less than 30 indicating a high viral load, posing an uncertainty in the infectiousness of the dead body. However, the most recent guidelines allow the PCR positive bodies to be cremated or buried at a place of choice by the relatives under strict health guidelines allowing autonomy, beneficence, and non-maleficence to fairly prevail within the community²⁶.

The application of ethical principles in death investigation is a formidable challenge during pandemic situations. Health authorities in any country take a lead to formulate guidelines considering the best interest of their citizens in disposing of the dead. Multidisciplinary teamwork, sharing of experiences among each other in managing the dead, and validating the investigative procedures are some of the recommendations the authors would like to propose for the future.

In this study, only the experience of investigators at one medico-legal unit is used limiting the generalization of the results. The Ct values of the PCR tests may show differences based on the sampling technique, transportation, investigative procedure, and equipment, and the Ct values which were more than 30 were not cross-checked in all cases with lung findings to confirm or exclude pneumonic changes.

CONCLUSION

Justice has prevailed in the study sample with regard to PCR testing of dead bodies. Contrasting observations concerning infectivity were made in majority, influencing the non-maleficence and beneficence. The Ct values of more than 30 were not supported with longer than 3 weeks of duration of illness, while some cases had cause of death relating to COVID-19 infection with less than 30 Ct value and longer than 3 weeks of illness duration. Thus, the ethical principles of non-maleficence, beneficence and autonomy with regard to receiving

of the bodies by relatives was practiced with caution. Consequently, multiple factors need to be addressed to satisfy the ethical principles in death investigation during pandemic states.

CONFLICT OF INTEREST

There are no conflicts of interest.

ETHICAL ISSUES

The postmortem reports considered were of cases investigated by the authors of this study and data was extracted and analysed by trained assistants. The data of individuals especially concerning identity was never recorded or stored at any stage of this study.

SOURCES OF SUPPORT

None

AUTHOR CONTRIBUTIONS

JMYKJ: Acquisition and analysis of work, interpretation of data for the work; drafting the work or revising it critically for important intellectual content; final approval of the version to be published; **JAGKJ:** Acquisition and analysis of work, interpretation of data for the work; drafting the work or revising it critically for important intellectual content; final approval of the version to be published; **WNSP:** Conception or designing of the work, acquisition of work, interpretation of data for the work; drafting the work or revising it critically for important intellectual content; final approval of the version to be published; **PP:** Conception or designing of the work, acquisition of work, interpretation of data for the work; drafting the work or revising it critically for important intellectual content; final approval of the version to be published.

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