The Bulletin of Legal Medicine, 2020; 25 Special Issue: 18-26

The Bulletin of Legal Medicine
Adli Tıp Bülteni

Review

Covid-19 Infection, Postmortem Process and Burial Procedures

Covid-19 Enfeksiyonu, Postmortem Süreç ve Defin İşlemleri

Ümit Ünüvar Göçeoğlu*, Satuk Buğra Yıldırım, Ecesu Ekinci, Yasemin Balcı

Abstract: **Objective**: With the outbreak of COVID-19 infection in China in December 2019, the virus started a rapidly spreading pandemia around the world, causing serious health problems and deaths. As of the beginning of March 2020, it has been reported to be seen in over a hundred countries across the world. In our country, the first COVID-19 case was detected at the beginning of March, and the number of death cases has exceeded tree thousand to May.

In this process, forensic medicine specialists and workers face serious risk of transmission in a possible COVID-19 death. This study is a compilation of the definition and epidemiology of the virus causing Covid-19 disease, how to diagnose of postmortem, postmortem examination and possible risks associated with such a case in the autopsy room and how to reduce these risks. In addition, suggestions regarding burials procedures were also presented in case of suspicion of Covid-19 infection.

Keywords: COVID-19, Forensic Medicine, Postmortem Examination, Autopsy, Death Certificate, Burial Procedures.

Öz: **Amaç**: Çin'de COVID-19 enfeksiyonunun Aralık 2019 tarihinde patlak vermesi ile virüs tüm dünyada hızla yayılan bir pandemi başlatarak, ciddi sağlık sorunları ve ölümlere neden olmuştur. Mart 2020 başı itibariyle Dünya genelinde yüzün üzerinde ülkede görüldüğü bildirilmiştir. Ülkemizde ilk vaka Mart başında saptanmış, Mayıs ayına kadar üçbinin üzerinde ölüm bildirilmiştir.

Bu süreçte adli tıp çalışanları olası bir COVID-19 ölümünde ciddi bulaş riski ile karşı karşıya kalmaktadır. Bu çalışma COVID-19 hastalığına neden olan virusün tanımı ve epidemiyolojisi, ölüm sonrası COVID-19 tanısının nasıl konacağı, ölü muayenesi ve otopsi odasında olası riskler ve bu risklerin nasıl azaltılacağı konularının ortaya konması amacıyla bir derleme niteliğindedir. Ayrıca COVID-19 enfeksiyonu şüphesinde ölü defin işlemleri ve ölüm belgesi düzenleme ile ilgili ülkemizde yaşanan sıkıntılar tartışılmış ve öneriler sunulmuştur.

Anahtar Kelimeler: COVID-19, Adli Tıp, Ölü Muayenesi, Otopsi, Ölüm Belgesi, Defin İşlemleri.

DOI: 10.17986/blm.2020.v25i.1394

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Acknowledgement:

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Financial Support:
The Authors report no financial support regarding content of this article.

Conflict of Interest:
The authors declare that they have no conflict of interests regarding content of this article.

Ethical Declaration
Our study was written in accordance with the Helsinki Declaration, and the ethics committee approval was not obtained because of the review study.

p-ISSN: 1300-865X
e-ISSN: 2149-4533

Introduction

With the outbreak of COVID-19 infection caused by SARSCov-2 virus in China in December 2019, the virus started a pandemic that spread rapidly all over the world, causing serious health problems and deaths.

Forensic medicine workers may face serious transmission risk in a possible COVID-19 death. With the spread of the disease in our country and the existent of deaths, many problems that had not been experienced before have been discussed. Especially, whether the autopsy will be performed or not in those who have died due to COVID 19 infection or suspicion, how to have autopsy procedures in this case, how to protect forensic medicine workers, how to diagnose and what algorithm of burial procedures has been discussed.

Related organizations in China and in England prepared rapidly guidelines (1-4), and the World Health Organization (WHO) rapidly published guidelines containing algorithms (https://www.who.int/emergencies/diseases/novel-coronavirus-2019). In our country, the Ministry of Health (https://covid19bilgi.saglik.gov.tr/tr/) and many medical specialty associations published guidelines (5,6), the Forensic Medicine Institute (ATK) prepared "COVID-19 Postmortem Examinations Checklist" and "COVID- 19 Autopsy Instructions' (7), Forensic Medicine Specialist Association (ATUD) published 'the COVID-19 Information Guidelines for Postmortem Practices" (8).

Recent study is a review of the definition and epidemiology of the virus (SAR SCoV-2) causing COVID-19 disease, how to postmortem diagnose, postmortem examination and possible risks in the autopsy room and how to reduce these risks. In addition, the problems encountered in our country regarding the burial procedures and death certificate in case of suspicion of COVID-19 infection has been discussed and suggestions have been presented.

Definition and Epidemiology

Coronaviruses (CoV) are a large family of viruses that can cause self-limiting mild infection symptoms to more serious forms such as Middle East Respiratory Syndrome (MERS) and Severe Acute Respiratory Syndrome (SARS) (9,10). WHO reported cases of pneumonia of unknown etiology in Wuhan, China, on 31 December 2019. In the south of Wuhan, collective cases have been reported in a wholesale fish and livestock market staff which is selling different animal species. The agent was identified on January 7, 2020 as a new Coronavirus (2019-nCoV) that has not been detected in humans previously, WHO published the name of the disease as COVID-19 disease, and the virus was named SARSCoV-2. The disease has start to outbreak very quickly due to its ability to spread from person to person. The first COVID-19 case in our country was detected on March 11, 2020. It was also reported that it is seen in over 100 countries worldwide since the beginning of March 2020 (9). Until 11.05.2020 in our country, according to the Ministry of Health's data, the total number of cases of Covid-19 infections was 139.771, and total number of deaths was 3841. (https://covid19.saglik.gov.tr/).

Infection and Contamination

Coronaviruses were isolated in camels, cattles, cats and bats. Rarely, animal coronaviruses can infect the humans and then spread among people like MERS-CoV (11). The pathobiology of COVID-19 disease is not completely understood and significant efforts to investigate are ongoing worldwide. The number of deaths increases as the SARS CoV-2 virus continues to spread. The transmission of the virus is thought to be largely by inhalation of respiratory droplets, but it has also been reported to be transmitted through the mouth, nose, eye mucosa and skin by hand contact to the contaminated areas. Fever is usually the first symptom; respiratory symptoms follow that. Although the course of the disease is mild in most of the COVID-19 patients, approximately 20% of them develop a serious disease with a high mortality rate and mortality is associated with advanced age and immunosuppression (2,11). Considering the epidemiological characteristics of the cases in China, it has been observed that the average incubation period is 5- 6 days (2-14 days), and in some cases it may extend up to 14 days. Covid-19 infectious period is not known exactly. It is thought that it starts 1-2 days before the symptomatic period and ends with the disappearance of the symptoms. Coronaviruses are not very resistant to the external environment. There is a residence time that varies according to the humidity and temperature of the environment, the amount of organic substance it is expelled, and the texture of the surface it contaminates. It is generally accepted that it loses its activity within a few hours on inorganic surfaces. When interpreting the activity time on inorganic surfaces, it should be kept in mind that not only the activity of the virus continues, but also the duration of the contamination. It is reported that the virus normally survives outside the host for a few hours, but it can grow up to days in cold and humid conditions (10-12). Currently, long-distance air contamination is unlikely from person to person (2). Considering the evidence of fecal excretion and their viability in conditions that can facilitate fecal-oral transmission, it is thought that it is possible to transmit

SARSCoV-2 in this way (12). The virus is easily neutralized with standard disinfectants such as soap, detergant and ethanol solutions (9). Several guidelines and articles have published on postmortem examinations for morgue workers performing with suspected COVID-19 autopsy from initial detection in December 2019 (2-4). Of course, guidelines and algorithms will be updated with new data and information about the virus in the future.

COVID-19 Infection Agent Within the Category of Hazardous Groups

The 'Hazardous Pathogens' (HG) classification prepared for the staff of clinical and microbiology laboratories has also been adapted to the morgue staff (2). These hazardous agent groups (HG1-4) are grouped according to their risk of infection in humans, their potential for access to treatment and profiling (Table 1) (13).

Table 1. Hazardous Groups Categorization

Hazard Group definitions	
Group 1-HG1	Unlikely to cause human disease.
Group 2- HG2	Can cause human disease and may be a hazard to employees; it is unlikely to spread to the community and there is usually effective prophylaxis or treatment available.
Group 3- HG3	Can cause severe human disease and may be a serious hazard to employees; it may spread to the community, but there is usually effective prophylaxis or treatment available.
Group 4- HG4	Causes severe human disease and is a serious hazard to employees; it is likely to spread to the community and there is usually no effective prophylaxis or treatment available.

While coronaviruses associated with SARS and MERS are both considered HG3 pathogens, most of the other coronaviruses are considered HG2. SARS CoV-2 has been recently categorized as an HG3 pathogen (2,3).

Preperation: When the effective utilisation of universal precautions, the risk of morgue staff dealing with these HG3 organisms will be minimized. The best protection in morgue, when conducting an autopsy on a patient with suspected COVID-19, are as follows; risk assessment, understanding of possible pathogens, universal standard precautions and any standard operating procedures for specific HG3 pathogens. (2,3).

Effective use of universal standard precautions will reduce risks as much as possible. As in standard autopsy, in a case with suspected COVID-19; clinical history should be reviewed, first findings in the event scene should be obtained, information is attained from the patient's clinicians, laboratory records and information from the hospital infection control committee (2-4). If the death is considered to be due to a confirmed COVID-19 infection, an autopsy is not to be necessary and a Medical Certificate of Cause of Death should be given. If the infection is involved in a forensic case, the legal duty is to perform a complete autopsy. However, the guidelines prepared during the pandemic process suggested that post-mortem examination may be limited only to retrieving the samples required to verify COVID-19 infection, or a staged postmortrem (2-4). This decision must be made according to the individual case. A staged postmortem may also be considered. This involves taking only diagnostic samples initially and later considering or a more complete autopsy after the results of these diagnostic tests are available. The guidelines recommend this staged technique (2,3). Limited autopsies (needle biopsy sampling or single cavity organ sampling) may be preferred in personnel and resource shortage. Studies include such minimally invasive autopsies; has shown that sampling of blood, lung, liver and spleen can be reliably diagnosed when systemic infection is suspected by viruses and bacteria (2-4). In general, if a death is believed to be caused by an approved COVID-19 infection, autopsy is not required and a 'Death Certificate' which is stating the cause of the medical death should be issued.

Autopsy Room and Precautions; In all HG3 pathogens related death, autopsies should be performed in an isolated room that separate from the other morgue area. Adequate and negative pressure ventilation system is important. Whole room ventilation with the draught passing from ceiling height down and across the tables, exiting at floor level, is suitable. Electric skull saws all now come with vacuum evacuation into a separate chamber. All necessary equipment must be ready (eg sample containers, culture bottles, etc.) before starting the autopsy and must not leave the work area and re-enter. In all high risk death cases, autopsy should be limited to a team of three people (forensic expert, autopsy technician, circulatory assistant). The participation of inexperienced young personnel such as trainees, assistants, students in risky autopsy should be evaluated by senior personnel, they can take part in HG3 autopsies under sufficient information and supervision. Although there is no particular infection risk to pregnant staffs if standard universal precautions are followed, they may wish to remove themselves from mortuary work. (2-4).

Personal protective equipment (PPE) is vital (4). It is imperative to protect the health and safety of employees in institutions, and the use of the following personal protective equipment is mandatory for all autopsy employees:

- Surgical scrub suit
- Hat to protect hair
- Clean visor to protect the face, eyes and mouth
- Standard surgical mask N95 or FFP3 mask, which effectively filters small particles of infected material
- A waterproof gown to cover the whole body, including the forearms
- Plastic apron on waterproof gown
- Rubber boots with metal-protected toecaps
- Latex or other equivalent material gloves
- Under latex gloves, protective gloves made of kevlar or neoprene, which are cut-resistant in case of potential blood-borne infection.

One of the most important point is that if the morgue is not sufficiently equipped and safe, the case should be directed to another suitably equipped morgue. It is considered that during autopsy dissection and precautions in all autopsies with suspected HG3 infection are reported as follows (2-4);

- To minimize the risk of incision, blunt, round-tipped scissors and PM40 blades should be used.
- Sharp equipment should be kept to a minimum within the autopsy desk and their whereabouts must be known.
- Limit the number of personnel working in the autopsy suit at any given time to minimum number of people necessary to safely conduct the autopsy
- Limit the number of personnel working on the human body at any given time
- In organ dissections, the organs should be fixed on the dissection table with the help of a sponge and sliced.
- Necessary precautions should be taken to protect hands during autopsy.
- It is recommended to open the skull with a vacuum ventilation system. Alternatively, a manual saw can be used.
- After the body fluids are sampled, needles and syringes should be collected in a special container, the needle tips should never be reused.

Collecting of Postmortem Specimens for the diagnosis of Postmortem COVID-19 infection: for serology; 5 mL sample of plain blood (no additive), upper respiratory tract swabs (orhopharingeal-nashopharingeal) and lower respiratory tract samples (bronchoalveolar lavage, sputum or direct lung tissue swab and lung tissue) (16,17). Lung tissue can also be sampled during swab removal, if swaps are negative, it is not necessary to study the tissue. It is recommended to use one swab for the upper airway and another swab for the lower respiratory tract (2,17). It is recommended that standard samples such as respiratory tract swabs and tissue samples are sent to the microbiology laboratory at the same time to detect pathogens in differential diagnosis. A complete organ-tissue histopathological sampling is recommended. Standard formalin fixation neutralizes known coronaviruses and known that SARS CoV-2 is to be similarly affected (18). Respiratory samples can be collected with ready-to-use swabs. Where appropriate, blood, urine and cerebrospinal fluid samples should be taken before opening the body cavity and under sterile conditions as much as possible to reduce contamination.

Postmortem Findings in COVID-19 Infection: Information on pathological findings in COVID-19 infection is still very limited, despite many publications in recent months (18-20). According to the studies, the macroscopic features of COVID-19 may include pleurisy, pericarditis, lung consolidation and pulmonary oedema. Lung weight may be increased above normal. A secondary infection may be superimposed on the viral infection that can lead to purulent inflammation.

It has been reported that microscopic findings are not specific, they will change in the early and late periods. There may be edema in the lungs, pneumocytic hyperplasia, focal inflammation and multinuclear giant cell formation, widespread alveolar damage with exudates, hyalen membrane disease. In one study, inflammation was predominantly lymphocytic and viral inclusions were not reported, but multinuclear giant cells were seen alongside large atypical pneumocytes (19).

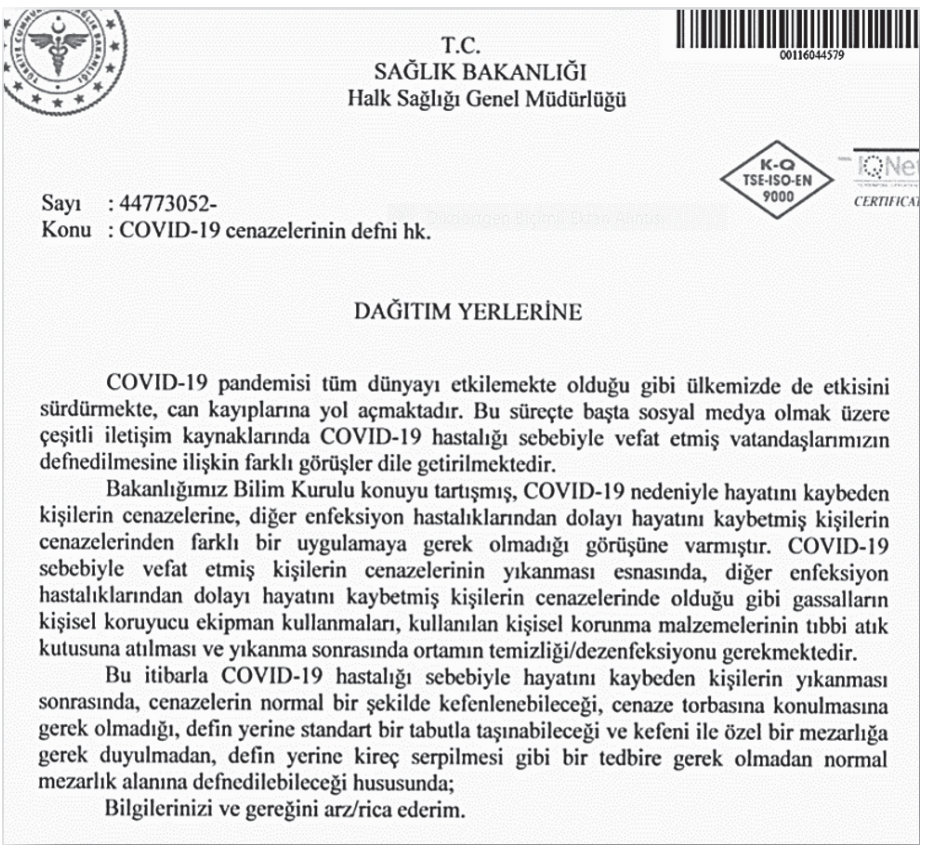
Process in Turkey

The Forensic Medicine Institute published the "COVID-19 Postmortem Examinations Workflow" and "COVID-19 Autopsy Instruction" on 16.03.2020 (7). The Forensic Medicine Specialist Association also published the "COVID-19 Information Guide for Postmortem Forensic Medicine Practitioners", which includes information from the Forensic Medicine Institute documents in April 2020 (8). In the documents belonging to both the Forensic Medicine Institute and the Forensic Medicine Specialist Association, considering the possible case definition of the Ministry of Health, it is recommended to test first when there are possible/suspected COVID-19 cases, and to perform an autopsy after the test result is available. However, with the speed at which the virus spreads, at the point reached, everyone is considered should be a possible case and carrier, even if there are no symptoms or signs. The desire of the funeral relatives to bury their relatives as soon as possible, the demand for intercity transportation, the security of those who will carry the funeral have become a problem. In some districts or provinces, the cases

are sent to forensic medicine units for autopsy in cases of forensic death with the opinion of the Prosecutor's Office and the physician performing the first dead examination at the scene, considering that it is not within the scope of a possible case. This situation increases the risk of infection of forensic experts and employees. On the other hand, in post mortem swabs, the possibility of false negative results is also higher. In this case, all autopsies are carried out with the maximum security measures, assuming an infected COVID-19 or carrier. Although limited autopsy is recommended, cases requiring detailed procedures are encountered according to the case. For example, in a case with a history food/foreign body aspiration, the main bronchi and its branches should be examined in addition to the upper respiratory tract.

In the relevant documents, if COVID-19 test result is positive, and autopsy is required, it is recommended that autopsy be performed in negative pressure rooms, and since the negative pressure autopsy room is not found everywhere in the periphery provinces, the cases are sent to the Istanbul Forensic Medicine Directorate. However, because of the the difficulty of daily rutine procedure, on 23.03.2020, the General Directorate of Public Health of the Ministry of Health reported that '*... if the morque does not have negative pressurized rooms, autopsy can be performed by taking the maximum security measures by providing ventilation conditions*'. Daily practice is likely as recommended. In summary, the algorithms prepared for the first time have become contradictory with each other. According to the COVID-19 Autopsy Instruction written by the Forensic Medicine Institute; "*…if the burial is decided during the dead examination, a detailed external examination and a full body radiological examination are performed. It is reported to the Provincial Health Directorate and the Cemeteries Directorate and the body is transferred to the relevant units for burial procedures*". This is also another problematic practice. Because; there is no possibility to perform a full body radiological examination in perifers. It was thought that this record was related for treated patients in the hospital.

Burial Procedures: From the letter titled "Measures and Precautions for Morgue and Burial Services" sent by the Ministry of Health, General Directorate of Public Health on 18.03.2020, it is understood that those who died due to COVID-19 will not be shrouded, just directly will buried with a corpse bag. However, because of the different ideas, the subject was discussed again in the Scientific Committee and it was stated that; '*...the body could be shrouded by following the precautions, not need to corpse bag, and not require a special cemetery*' (Figure 1).



T.C.
SAĞLIK BAKANLIĞI
Halk Sağlığı Genel Müdürlüğü

00116044579

K-Q TSE-ISO-EN 9000

Sayı : 44773052-
Konu : COVID-19 cenazelerinin defni hk.

DAĞITIM YERLERİNE

COVID-19 pandemisi tüm dünyayı etkilemekte olduğu gibi ülkemizde de etkisini sürdürmekte, can kayıplarına yol açmaktadır. Bu süreçte başta sosyal medya olmak üzere çeşitli iletişim kaynaklarında COVID-19 hastalığı sebebiyle vefat etmiş vatandaşlarımızın defnedilmesine ilişkin farklı görüşler dile getirilmektedir.

Bakanlığımız Bilim Kurulu konuyu tartışmış, COVID-19 nedeniyle hayatını kaybeden kişilerin cenazelerine, diğer enfeksiyon hastalıklarından dolayı hayatını kaybetmiş kişilerin cenazelerinden farklı bir uygulamaya gerek olmadığı görüşüne varmıştır. COVID-19 sebebiyle vefat etmiş kişilerin cenazelerinin yıkanması esnasında, diğer enfeksiyon hastalıklarından dolayı hayatını kaybetmiş kişilerin cenazelerinde olduğu gibi gassalların kişisel koruyucu ekipman kullanmaları, kullanılan kişisel korunma malzemelerinin tıbbi atık kutusuna atılması ve yıkanma sonrasında ortamın temizliği/dezenfeksiyonu gerekmektedir.

Bu itibarla COVID-19 hastalığı sebebiyle hayatını kaybeden kişilerin yıkanması sonrasında, cenazelerin normal bir şekilde kefenlenebileceği, cenaze torbasına konulmasına gerek olmadığı, defin yerine standart bir tabutla taşınabileceği ve kefeni ile özel bir mezarlığa gerek duyulmadan, defin yerine kireç serpilmesi gibi bir tedbire gerek olmadan normal mezarlık alanına defnedilebileceği hususunda;

Bilgilerinizi ve gereğini arz/rica ederim.

Figure 1. Letter of the Ministry of Health, General Directorate of Public Health dated 03.04.2020

Death Certificate

Death data are the most important indicator used to compare and measure health status at national and international. Death documentation is recorded by the physician using a standard electronic form with the codes of the International Classification of Diseases-10 (ICD-10) to reach accurate statistical data. In our country, the Death Report System (ÖBS) created by the Ministry of Health is used.

ÖBS is a web application in a single database that can be managed in corporate hierarchical structure and suitable for expansion to collect faster and better way of death statistics by the relevant units of the Ministry of Health, which enables data exchange between Population and Citizenship Affairs General Directorate and Turkey Statistical Institute. (https://www.saglik.gov.tr/TR,11167/olum-bildirim-sistemiobs-genelgesi.html).

When someone is died in a health facility; the death certificate is document in electronically, in the provinces and districts it is checked and approved within 24 hours by the electronic signature authority at the Public Health Branch Directorates.

In ÖBS, section H is the cause of death section. While filling the 'H-Cause of Death' section; either 'Login with manual' or 'Login with ICD-10 Encoding' should be selected. There is no need to use both. In I. part of the cause of death section; line a) the disease or condition will be reported as a main cause of death. Catastrofic results of death such as asystole, respiratory arrest, cardiorespiratory arrest, cardiac arrest, should not be reported as a cause of death. In the lines b), c), d), the previous reasons will be reported in chronologically.

In the II. part of the cause of death section; other important conditions (not directly related with main cause) will be reported.

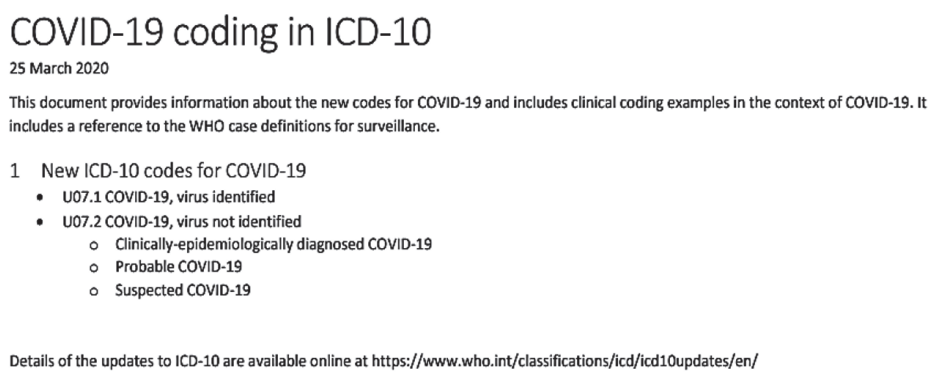
When the Death Certificate is not duly prepared, it is sent back to the physician for correction the issued document by the controllers at the Public Health Branch Directorates. At this stage, the controller should also have stated the reason for the return. (https://obs.saglik.gov.tr/Account/Login).

If the COVID-19 infected patient (laboratory test is positive) died during treatment, for death certificate, a cause of death will be reported with the 'Login with manual' option like as Figure 2.

In terms of "login with ICD-10 encoding"; emergency ICD-10 codes for COVID-19 cases have been determined by World Health Organization on March 25, 2020 (Figure 3) and it was suggested to use these codes in death reports (https://www.who.int/classifications/icd/COVID-19-coding-icd10.pdf?ua=1).

H Bölüm I		Ölüm Nedeni	
(Doğrudan ölüme neden olan hastalık veya durum, Önceki Nedenler, Eğer yukarıda ver			
nan durumlar varsa, altta yatan durum en son belirtilecek.)			
a) Akut respiratuvar distres sendromu			
b) Viral pnömoni			
c) COVİD-19			
d)			
Bölüm II	(Ölümün gerçekleşmesinde etkisi olan fakat ölüme neden olan hastalık		
a) KOAH			
b) Sigara kullanımı			

Figure 2. COVID-19 positive, Death Certificate-H-Cause of Death Section- 'Login with manual'



COVID-19 coding in ICD-10

25 March 2020

This document provides information about the new codes for COVID-19 and includes clinical coding examples in the context of COVID-19. It includes a reference to the WHO case definitions for surveillance.

1 New ICD-10 codes for COVID-19

- U07.1 COVID-19, virus identified
- U07.2 COVID-19, virus not identified
  - Clinically-epidemiologically diagnosed COVID-19
  - Probable COVID-19
  - Suspected COVID-19

Details of the updates to ICD-10 are available online at https://www.who.int/classifications/icd/icd10updates/en/

Figure 3. New ICD-10 codes for COVID-19, WHO

U07.1: COVID-19, virus identified; This code is assigned for cases confirmed by laboratory test (PCR).

U07.2: COVID-19, virus not identified; This code is assigned for cases clinically-epidemiologically diagnosed COVID-19, probable COVID-19, suspected COVID-19. (https://www.who.int/classifications/icd/COVID19/en/).

Similarly, the American Center for Disease Control and Prevention recommends writing "possible COVID-19" to the underlying cause of death for patients diagnosed clinically with COVID-19 (https://www.cdc.gov/nchs/data/ Nvss / vsrg / vsrg03-508.pdf).

We think that in our country, the Ministry of Health, General Directorate of Public Health should urgently update the ICD-10 code system recommended by WHO. There is no standard in the Death Certificates of laboratory test result is negative, even if the patient has clinical and CT findings. This contrasts with the COVID-19 Guideline created by the Ministry of Health. Likewise, In the Ministry of Health COVID-19 Guideline (9); "*Detection of seasonal respiratory virus or bacteria in the samples from the the possible cases does not rule out the presence of SARS-CoV-2. Seasonal respiratory viruses such as HCoV-229E, HCoV-OC43, HCoV-NL63 and HKU1-CoV are different from COVID-19*". In the algorithm created by Istanbul Provincial Health Directorate, it is recommended that if the clinical and CT findings positive, but PCR results negative, viral pneumonia should be recorded as a cause of death.

According to the algorithm published under the name of Death Certificate Arrangement Services; for patients who died in the public / private hospital;

- If the PCR result is negative and the CT result is negative, "infectious disease (natural death) entry will be made through ÖBS, and it will be specified as "viral pneumonia" in ICD-10,
- If the PCR result is negative and the CT result is positive, "infectious disease (natural death) entry will be made through ÖBS, and it will be specified as" viral pneumonia "in ICD-10,
- If the PCR result is positive and the CT result is negative, "infectious disease (natural death)" entry will be made through ÖBS, and the cause of death will be specified as COVID-19 in ICD-10,
- If the PCR result is positive and the CT result is positive, "infectious disease (natural death)" entry will be made through ÖBS, and the cause of death will be specified as COVID-19 in ICD-10".

Scientifically, it has been reported in studies on the subject that the reliability of the PCR test is approximately 60% in determining COVID-19 cases, therefore, it is absolutely necessary thorax CT for diagnosis (17,21). Likewise, the virus has a high affinity for lung cells, when it descends to the lower respiratory tract and creates symptoms, it is known that false negative test results can be obtained from the upper respiratory tract samples. Wang et al. from China (21) reported that in COVID-19 patients, PCR positivity is 32% in pharingeal swaps, 63% in nasal swaps and 93% in bronchoalveolar lavage fluid. Ai et al. (22) reported that in 1014 cases, PCR test performed several times, and results were able to change from positive to negative, or negative to positive, so CT was more reliable in terms of diagnosis and follow-up.

Studies show that in patients diagnosed with COVID-19, PCR tests can give false negative results depending on factors such as sampling techniques and sampled regions. Therefore, clinical diagnosis supported by CT findings becomes important.

There are some reports of death numbers related to COVID-19 infection worldwide, but the real numbers are unknown. However, in the login with manuel in ÖBS, the cause of death is to record "**COVID-19, virus not identified**" as suggested by WHO or "**probable COVID-19**" as suggested by the Centers for Disease Control and Prevention (CDC). In the login with ICD-10 encoding, it would be best to use the **U07.2: COVID-19**, virus not identified' code recommended by WHO. Otherwise;

- It can be claimed that the facts are hidden and covered up.
- Relatives of the deceased may be inattentive to comply with quarantine and other protective measure, thereby it can be risk to public health
- In terms of requirements (mechanical ventilator, intensive care unit, medicine and other materials) in another possible pandemic in the future, therby the recent correct data will be guide for the future.
- The cause of death registered in ÖBS will be an evidence in terms of causality for insurance and medical law. This will be particularly important for healthcare professionals who have clinical and CT findings are positive, but the PCR test result is negative.

The letter written by the Antalya Provincial Health Directorate (Figure 4), to be notified to the physicians who issues Death Certificate, supports what we have written above. In the recent article, the importance of recording presence of infectious disease in death certificate was emphasized in terms of burial procedures of the deceased.

In summary; if there is a clinical finding and the PCR result is positive, the death certificate must be reported as shown in Figure 2. If clinic supports COVID-19 infection, but PCR test result is negative; recomended codes should be used in ÖBS with Login with manuel option; not identified or possible COVID-19 code should be reported as shown in Figure 5.

T.C.
ANTALYA VALİLİĞİ
İl Sağlık Müdürlüğü

Sayı : 67910779-299
Konu : Corona Virüs Tedbir (Cenaze Hizmetleri) hk.

DAĞITIM YERLERİNE

İlgi : 25/03/2020 tarihli ve 37106781-28485 sayılı yazı.

Çin'in Wuhan kentinde başlayarak dünya genelinde görülen ve Pandemi olarak nitelendirilen (Covid-19) salgınının İlimizi ve vatandaşlarımızı korumak, salgının yayılmasını engellemek amacıyla bir takım tedbirler alınmaktadır.

Bu nedenle; Sağlık İşleri Dairesi Başkanlığı Mezarlıklar Şube Müdürlüğü'ne intikal eden ölüm vakalarına, gerekli defin işlemlerinin yapılabilmesi için Defin Ruhsatı düzenleyen hekimin 'Ölüm Belgesi' ***evrakına hastanın Ölüm nedeninin hekimin kaşesi ile birlikte manuel yazılarak bildirilmesi ,*** (bulaşıcı hastalık Covid-19 taşıyıp taşımadığı) önem arz etmektedir. Bu yazının tüm sağlık tesislerindeki Ölüm Belgesi dolduran ilgili hekimlere tebliğ edilmesi hususunda;

Gereğini bilgilerinize arz/rica ederim.

Figure 4. Death Certificate sample recommended by Antalya Provincial Health Directorate.

H **Bu bölüm sadece hekim tarafından doldurulacaktır.**

		Ölüm Nedeni	Hastalığın kadar
Bölüm I			
Doğrudan ölüme sebep olan hastalık veya durum*	a)	**Akut respiratuvar distres sendromu**.....	1 gün
		Bağlı olarak	
Önceki nedenler	b)	**Viral pnömoni**.....	12 gün
		Bağlı olarak	
Eğer yukarıda verilen nedene yol açan ölüm ile sonuçlanan durumlar varsa, altta yatan durum en son belirtilecek	c)	**Olası COVİD-19, virüs tanımlanmamış**.....	12 gün
		Bağlı olarak	
	d)	.....	.....
Bölüm II			
Ölümün gerçekleşmesinde etkisi olan, fakat ölüme neden olan hastalık veya durumla ilgili olmayan diğer önemli durumlar yazılacaktır.		**Diyabet**.....	.....
		Hipertansiyon.....	.....

**Bu bölüme kalp arresti ve solunum yetmezliği gibi ölüm şekilleri değil, ölüme sebebiyet veren hastalık, yaralanma veya komp*

Figure 5. Cause of death sample recommended by WHO in clinically suspected COVID-19 infection

It is also important to fill in the II. part of H. Cause of Death Part in the Death Certificates. Important health problems of individuals such as smoking, alcohol use, cardiac problems, COPD, diabetes, cancers, and diseases affecting immunity should be recorded in the II. part. These records will contribute to identifying accompanying risk factors. On the other hand, even if the PCR result is positive people may die for other reasons. The cases are only carriers and even if viruses are found, this may not contribute to death (eg sudden cardiac deaths). In such cases, COVID-19 should be record in the second part of the death certificate.

It should not be forgotten that the physician is responsible for correct reporting of death certificates. In a possible legal conflict in the future, the physician will be responsible. When the death certificate is not approved by the controllers in the Public Health Branch Directorates and sent back to the physician who issued the document for correction, the controller should also report the reason for the return. All correction requests, rationale and corrections will be registered in the system.

Death Statistics: In the pandemic, the number of deaths (due to COVID-19 infection or the other causes) are increase. Because of the pandemic, people have anxiety and stress and they may postpone their treatment. Scientific data on this subject can be obtained by comparing the death statistics in the pandemic process with the death statistics of the previous and next years.

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