

Examining Serological Manifestations and Cardiopulmonary Radiology Images in Patients Involved in Infectious Problems and Nursing and Medical Procedures in them

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Abstract

Familiarity with the common imaging findings in patients and especially the radiological manifestations of complications caused by primary infection is of fundamental importance in order to carry out appropriate treatment measures and prevent or reduce the mortality rate in patients. In this review study, some of the most important serological manifestations and cardiopulmonary radiology images in patients with infectious problems and nursing and medical procedures in them are discussed and the common radiological patterns related to them are investigated. The respiratory disease caused by the 2019 corona virus, or the Covid-19 disease, is highly contagious and mainly causes inflammatory lesions in the lungs. Radiology is one of the best diagnostic methods for diagnosing corona and determining the extent of lung involvement. It can also cause damage to the intestines and liver. Epidemiological data show that person-to-person transmission is the main way of

spreading this disease, and the rapid spread of the corona virus has created complex challenges for the public health of the world. Currently, timely diagnosis, quarantine and appropriate treatment are the most effective ways to prevent and control it. The current gold standard method for the diagnosis of Covid-19 is to identify the nucleic acids of the corona virus with the help of RT-PCR test. However, lung imaging (radiography and CT scan) plays an important role in diagnosing lung lesions, classifying and determining the stage of the disease, evaluating treatment strategies and differentiating between mixed infections.

Keywords: COVID-19, Inflammatory Lesions in the Lung, Primary Infection, Radiography and CT scan.

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Introduction

The emergence of the Covid-19 disease caused by the infection with the new corona virus quickly led to the declaration of a pandemic [1-3]. Although the disease often recovers after passing through different clinical phases, many short-term or long-term complications of different body organs have also been reported with this disease [4-6].

Lung involvement has been identified as the main cause of death. Complications such as lung fibrosis, secondary bacterial or fungal infections, heart involvement (myocarditis and pericarditis) and vascular complications such as pulmonary embolism have been reported frequently [7-9].

Various imaging methods, especially CT scan of the chest, not only play an important role in the initial diagnosis of the disease, but are widely used during the treatment process and in order to follow up, diagnose and treat possible secondary complications. Abnormal imaging at the end of treatment was seen especially in a significant percentage of patients [10].

Abnormal findings at the end of treatment were more common in smear-positive patients than in smear-negative patients. Familiarity with the different radiographic findings of pulmonary tuberculosis is an effective help in early diagnosis and timely treatment of this disease, which will prevent the occurrence or at least reduce the complications of the disease. Corona viruses (coronaviruses) are a large family of viruses, from the common cold to SARS. and include MERS. New cases of "unknown viral pneumonia" broke out in a seafood wholesale market in Wuhan, China in December 2019. Scientists have named this new corona virus COVID-19. Pneumonia caused by Covid-19 is considered a severe infectious disease, and its outbreak has been declared a public health emergency by the World Health Organization [11-13].

This new coronavirus has symptoms similar to colds and flu, and most patients are accompanied by fever and dry cough. After identifying the symptoms and complications of Covid-19 pneumonia, specialized medical groups developed guidelines (specialized reference) and criteria for the prevention, diagnosis and treatment of this disease [14].

Among the various radiological methods, CT scan of the chest is a common imaging method for diagnosing pneumonia (Figure 1). In CT scan of the lung, the speed of creating high-quality

images of the lung tissue is high, and the radiologist can quickly determine the degree of involvement of the lung with the corona virus. CT scan of the lung clearly characterizes the common radiological features in patients with pneumonia due to Covid-19 [15]. The diagnostic power and sensitivity of CT scan is very important in the diagnosis and management of patients with coronavirus. The role of CT scan in the diagnosis of the new corona disease, Covid-19, is even higher than PCR [16].

The diagnostic power of CT scan in detecting corona disease and lung involvement is about 98%. Meanwhile, the diagnostic sensitivity of PCR is about 70%. The low sensitivity of PCR can have several reasons. For example, the sampling of the patient may not have been done correctly, or the virus load on the sample may not be high enough to make the test positive.

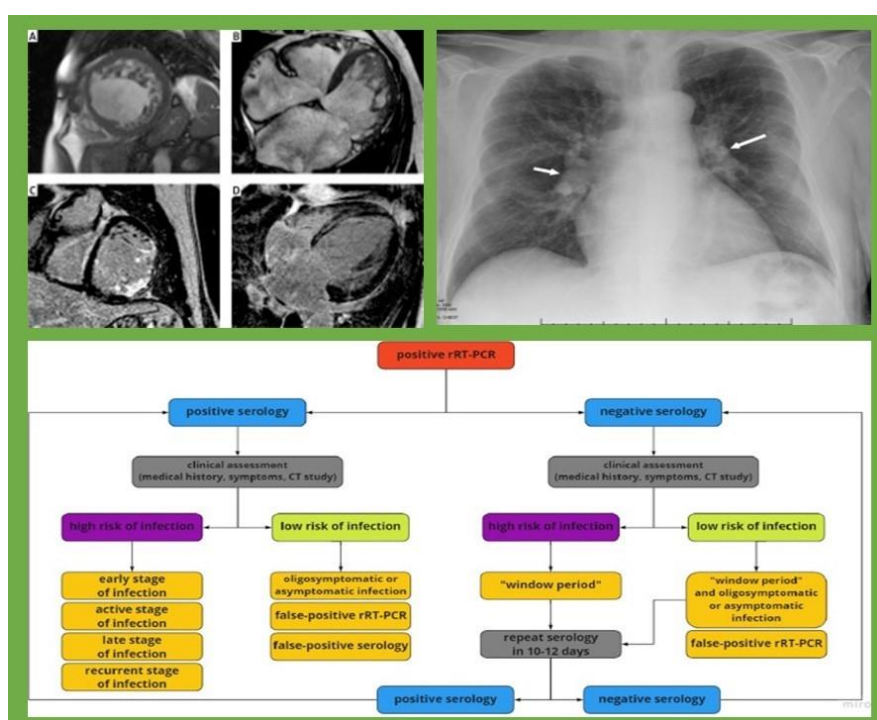


Figure 1. Chest radiograph. Posteroanterior (PA) chest radiograph

Another issue is related to laboratory kits that may have errors in responding. Ground glass opacity (GGO) densities are very common in CT scans of corona virus patients. GGOs usually appear bilaterally, but they may first be unilateral and then become bilateral [17-19]. These findings usually involve the back and the periphery of the lung, and with the severity of the disease, they can progress towards dense consolidation (Figure 2). These findings are one of the most common manifestations in CT scan images of corona patients. Linear opacities and crazy-paving opacities may also be seen in CT scan images of patients with coronavirus [20].

Usually, patients with more severe CT scan manifestations are worse. But the CT scan does not necessarily match the patient's clinical symptoms. A CT scan may show severe lung involvement, but the patient's clinical symptoms are normal [21]. CT scan is very important in the diagnosis of

Examining Serological Manifestations and Cardiopulmonary Radiology Images in Patients Involved in Infectious Problems and Nursing and Medical Procedures in them corona disease, but even if the findings of CT scan show a lot of involvement in the lung, but it is not associated with severe clinical symptoms and the general condition of the patient is good, there is no need to admit the patient to the hospital and stay at home and receive medicine (Figure 3).

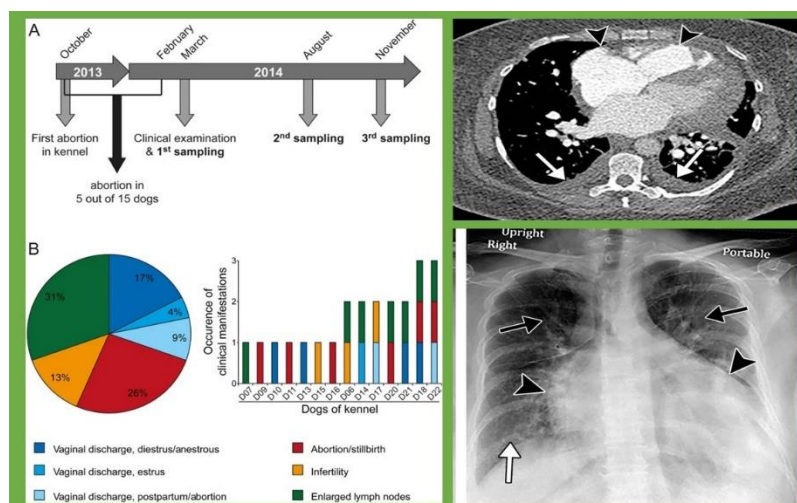


Figure 2. Cardiac magnetic resonance findings in coronavirus disease 2019

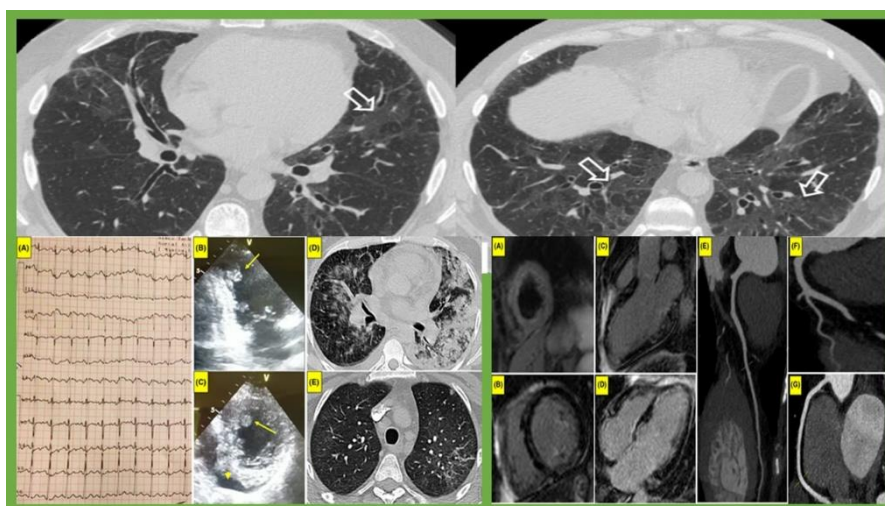


Figure 3. Axial HRCT images of an NSIP pattern in a patient with rheumatoid arthritis.

Patients who are sent home for treatment do not have severe shortness of breath and their blood oxygen levels are above 90%. These patients usually receive Chlorospinel and Tamiflu drugs. If the patient's CT scan symptoms are mild, but he has severe shortness of breath and his blood oxygen level is below 90%, he should be admitted to the hospital and receive respiratory and drug support. In general, patients who are over 50 years old, have underlying diseases such as diabetes and blood pressure, or suffer from kidney diseases, are at risk of contracting a more severe type of corona, and the complications of corona disease are more severe in them [22]. Also, patients who have a history of taking chemotherapy drugs, or have previously taken coronet, are also in high-

risk groups in terms of contracting severe coronavirus. In cases where there are no symptoms such as cough and shortness of breath in the person carrying the disease, CT scan is not able to diagnose corona disease. At this stage, other laboratory tests should be used to diagnose the corona virus. Simple x-ray has low sensitivity in diagnosing corona virus and patients who are suspected of having corona virus are better to undergo CT scan first.

Death may occur in patients with the corona virus for several reasons, the most important of which are as follows:

1. The virus directly attacks the heart muscle, which in severe cases causes myocarditis (inflammation of the heart muscle) and death of the patient [23].
2. The virus leads to respiratory distress syndrome or respiratory distress syndrome (ARDS), which fills the lung alveoli with fluid and causes severe shortness of breath. Finally, the amount of oxygen in the blood drops drastically and the blood supply to the body is disturbed and the patient dies [24].
3. In addition to viral infection, bacterial infection may also double the disease and cause sepsis (infection in the blood) and finally the death of the patient [25].

Chest X-ray

A chest X-ray produces images of the heart, lungs, blood vessels, airways, and bones of the chest and spine. A chest X-ray can reveal fluid in or around the lungs or air around the lungs. If you go to the doctor with chest pain, chest injury or shortness of breath, you will first have a chest X-ray taken [26]. By using these images, the doctor can determine the presence of problems (Figure 4) such as heart problems, pneumonia, airways, broken ribs, emphysema, cancer or any other conditions. Chest radiography is a common method for diagnosing diseases [27].

This method can also be used to determine the effectiveness of a particular treatment. Some people take a series of chest x-rays over a period of time to determine if the problem is getting better or worse. A chest X-ray helps the doctor diagnose problems in the heart and lungs. A chest X-ray is a common type of test. If your doctor suspects heart or lung disease, a chest X-ray is one of the first procedures you will undergo. This type of test is also used to check how the body responds to a certain treatment. Chest X-ray can detect various things inside the body [28].

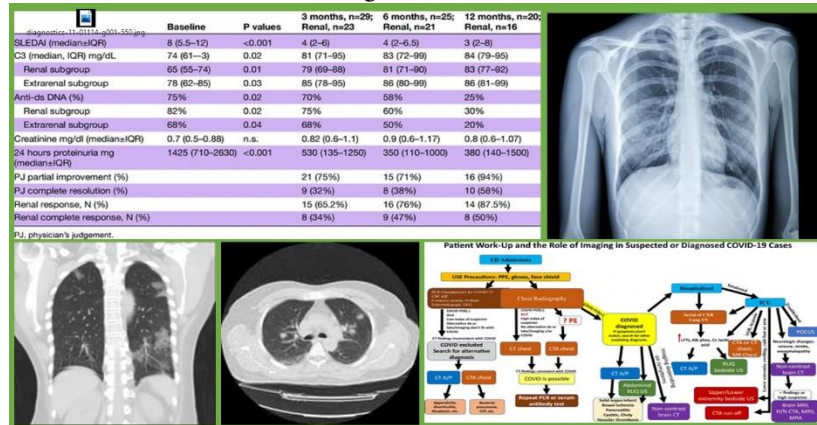


Figure 4. Chest X-ray

Search strategy and selection of articles

Search in Scopus, Google scholar, PubMed databases and by searching with keywords such as "Examining Serological Manifestations" and "Cardiopulmonary Radiology Images" and "Medical Procedures" to obtain articles related to the selected keywords [29]. Case report articles, editorials, and articles that were not published or only an introduction of them were available, as well as summaries of congresses and meetings that were in languages other than English, were ignored. Only the original research articles that evaluated the effectiveness of different drugs in the treatment of COVID-19 using standard methods were studied (figure 5).

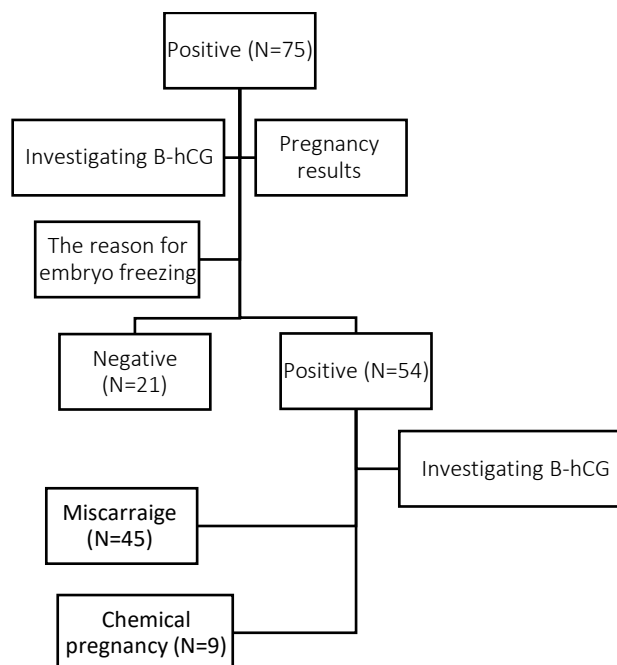


Figure 5. Flow chart of included subjects

Application of chest radiography

➤ **Determining the condition of the lungs**

A chest X-ray can detect cancer, infection, or air trapped in the space around the lung. Also, this test is used to show chronic lung conditions such as emphysema or cystic fibrosis and complications related to these conditions [30].

➤ **Pulmonary problems related to the heart**

A chest X-ray can detect changes or problems in the lungs caused by heart problems. For example, fluid in the lungs (pulmonary edema) can be the result of congestive heart failure.

➤ **Determining the size and outline of the heart**

Changes in the size and shape of the heart may indicate heart failure, fluid around the heart (pericardial effusion), or heart valve problems [31].

➤ **Blood vessels**

Because the outline of the large vessels near the heart (aorta and pulmonary artery) can be seen on a chest X-ray, it can identify an aortic aneurysm, other blood vessel problems, or congenital heart disease [32].

➤ **Calcium deposition**

Chest X-ray can determine the presence of calcium in the heart and blood vessels. The presence of calcium deposits may indicate damage to the heart valves, coronary arteries, heart muscle, or pericardial sac. Calcium deposits in the lungs are often due to an old, untreated infection [33].

➤ **Fracture**

Rib and spine fractures or other bone problems may be visible on a chest X-ray.

➤ **Post-operative changes**

Chest X-ray is very useful for checking the patient's recovery after chest surgery such as heart, lung or esophagus surgery. The doctor can look at any lines or tubes that are placed during surgery to check for air leaks or areas of fluid or air accumulation [34].

➤ **Pacemaker, cardiac electroshock or catheter**

Pacemaker and defibrillator have a wire that connects to the heart and makes sure that the heartbeat and rhythm are normal. A catheter is a very small tube that is used to deliver medicine or for dialysis. Chest X-ray is usually done after placing medical devices to ensure their correct placement [35].

➤ Risks of chest radiography

You may be concerned about being exposed to X-rays, especially if you have these done on a regular basis. But the amount of radiation from X-rays is very low, this amount is even lower than the amount of radiation that enters you from the surrounding environment. Although the benefits of this x-ray outweigh the risks, you may be given a protective apron. If you are pregnant or think you may be pregnant, you must inform your doctor. The procedure can be done in ways that protect your abdomen from radiation [36].

➤ Work before radiography

Before the chest x-ray, you usually have to take off your clothes from the waist up and put on special clothes. You should also remove your jewelry. Clothing and jewelry can interfere with X-ray images [37].

➤ The results of radiography

A chest X-ray produces a black-and-white image of the chest organs. Structures that block radiation appear in white, and structures that allow radiation to pass appear in black.

Corona diagnosis methods

1. RT-PCR

The definitive test to identify the novel coronavirus (SARS-CoV-2), abbreviated as RT-PCR or reverse transcription polymerase chain reaction test. This test is believed to be highly specific, and according to meta-analyses, its sensitivity is 89% [38]. Therefore, there is a possibility of false negative in it. In this test, samples are taken from the throat or nasal cavity with the help of a swab, and then with the help of a laboratory kit and RT-PCR machine, nucleic acids of the corona virus are detected (Figure 6).

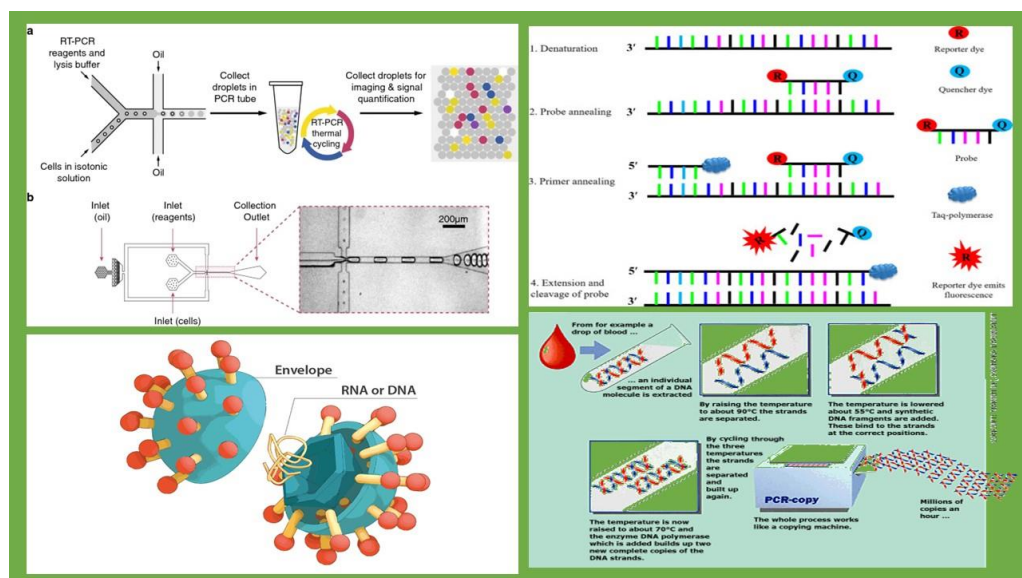


Figure 6. RT-PCR

2. Serological tests

Serological tests may play an important role in diagnosis, especially when RT-PCR testing is negative in people suspected of having Covid-19. But still their role to detect antibody in individual's serum, to check current and previous cases of Covid-19 is controversial [39].

The things that can be seen in the blood sample of a person suspected of corona include the following:

- Lymphopenia (decrease in the number of blood lymphocytes);
- Thrombocytosis (increase in the number of blood platelets);
- Increased prothrombin time (PT);
- Increased lactate dehydrogenase

Other abnormalities that are commonly identified include:

- Slight increase in inflammatory markers (CRP and ESR);
- High D-dimer;
- Slight increase in serum amylase;
- Increase in alanine aminotransferase (ALT) and aspartate aminotransferase (AST);
- Slight increase in bilirubin.

But usually the levels of alkaline phosphatase (ALP) and gamma glutamyl transferase (GGT) are normal [40].

3. Lung imaging

Imaging of the lung in the form of radiography and CT scan is used as a diagnostic/auxiliary screening tool for Covid-19.

Lung imaging

In respiratory diseases such as Covid-19, the lungs are the main affected organ, and one of the ways to diagnose the extent of the lesion is lung imaging. Lung imaging in various ways, such as X-ray imaging or radiography, CT scan, bronchoscopy, positron emission tomography or PET scan, and magnetic resonance imaging or MRI; is done [41]. In the following, the details of the two methods of radiography and CT scan of the lung, which are currently commonly used to diagnose and determine the condition of patients with Covid-19, are mentioned.

CT scan of the lung

X-rays are also used in the CT scan imaging method, but with the addition of computer technology, precise images of the lung can be obtained. Currently, with the advent of high-resolution computed tomography (HRCT) imaging, the accuracy of images has greatly increased [42].

Lung radiography

Lung radiography or lung radiology is a type of imaging method in which x-rays used in the chest are used to produce images of the lungs and its surroundings [43]. This procedure can reveal abnormalities, such as inflamed (or enlarged) lymph nodes or the presence of a granuloma. It is also called X-ray imaging.

Radiology to diagnose corona

Performing lung radiology is very important in diagnosing lung lesions caused by the 2019 corona virus and evaluating their size, density and evolution. Lung radiography is convenient and fast, and its necessity has been proven in the diagnosis of other diseases caused by the corona virus, such as acute respiratory syndrome (SARS) and Middle East respiratory syndrome (MERS) [44]. However, its sensitivity and specificity are relatively low for mild type patients. For this reason, it is not recommended for the process of diagnosing patients in the initial stage of the disease of Covid-19 [45]. But a CT scan of the lung can show almost all abnormalities, including early exudative lesions. CT scan is currently the most valuable imaging tool for clinical diagnosis of patients in the initial stage of Covid-19; Especially in the early part of the pandemic when there were not enough PCR test kits. The presence of numerous small and speckled shadows and interstitial changes in the lower region of the lungs are common features in lung radiology images of most Covid-19 patients. As the disease progresses, these shadows may appear as a patchy distribution. In severe forms of Covid-19, multifocal or diffuse irritation in both lungs is seen as "white lung".

Discuss

Covid-19 is a respiratory disease that specifically affects the patient's respiratory system, which includes the lungs. Covid-19 can cause a wide range of respiratory problems, from mild to severe. In a group of people, the corona virus is associated with the development of lung nodules in the corona, which causes pulmonary complications to appear in the affected person. These complications and damages to the lung may cause the destruction of lung function. Of course, lung nodules are benign masses at the beginning and are non-cancerous, but they may also be the cause of cancer [46].

In people suffering from lung nodules, the lungs are severely inflamed and a lot of fluid accumulates in them, and the accumulation of fluid in the lung is associated with breathing problems for the person. In this disease, the respiratory system is severely damaged and the person will need to be admitted to the hospital and use oxygen or artificial respiration [47-49]. Lung nodules in Corona can involve both lungs and the air sacs in the lungs are filled with pulmonary nodules. These nodes limit the flow of oxygen and cause complications such as shortness of breath, cough and lethargy for the person (Figure 7 & 8). Lung nodules develop from mild to severe stages, and even after the person recovers, lung damage may still remain. Lung nodules are benign if they are formed in the lung fissure and their size is less than 5 mm, and there is a very good chance of recovery. Older adults and people with various other physical illnesses, such as heart disease, cancer, and diabetes,

may experience more serious and acute symptoms. This is what the corona virus has done to the lungs of patients and it has various effects on the lungs.

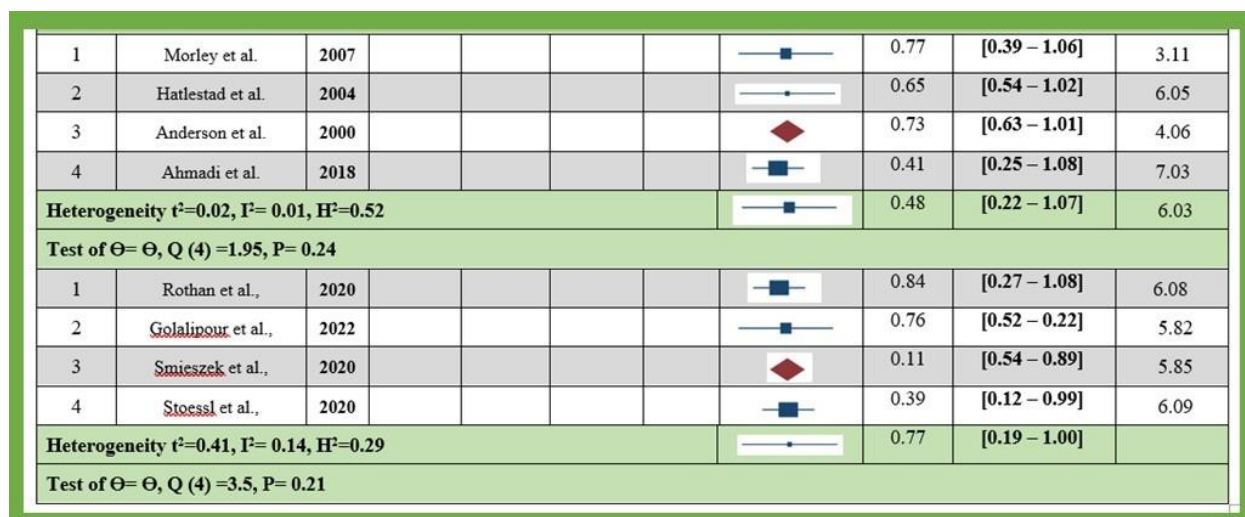


Figure 7. Forest plot showed Heart rate

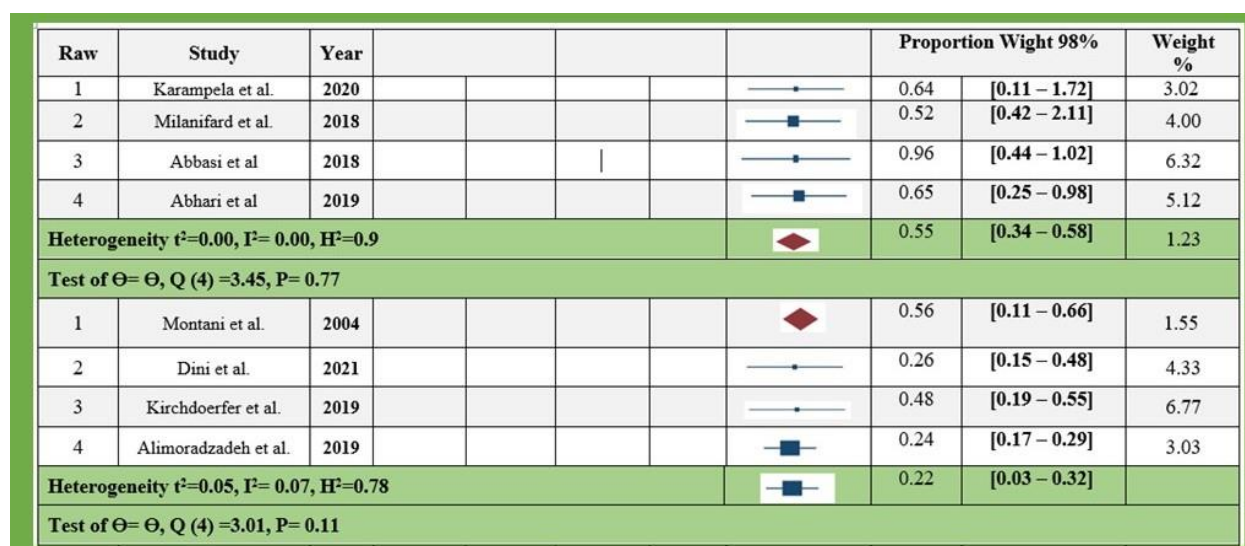


Figure 8. Forest plot showed Body temperature

Lung nodule

Once the Covid-19 disease spread, people who suffered lung injuries needed special care. Also, lung patients who were at risk of lung cancer need special treatments and eye care. Following the Corona epidemic, the screenings that were considered for lung cancer patients were postponed for 3 to 6 months [50]. But unfortunately, the period of corona virus lasted more than 6 months and doctors were forced to start screening for lung nodule patients. But this time, the screening instructions were changed to control people's infection with the corona virus.

Undoubtedly, the infection of this group of people with the corona virus caused irreparable damage to them, and in many cases, unfortunately, the person suffering from lung cancer dies. Screenings in patients with lung nodules increased the possibility of being exposed to the Covid-19 virus, so

decisions were made so that these patients would receive special care to prevent them from contracting the Covid-19 virus [51]. In some people who were suffering from lung nodule disease and were in serious condition due to Covid-19, we have unfortunately seen death in this category of people. Because of this, patients with lung nodules in Corona need more special care than normal people who undergo cancer treatment using chemical drugs and radiation therapy. These types of treatments are considered a big obstacle to deal with Corona, because the person undergoing chemotherapy has a weakened immune system and will not be ready to receive other viruses such as Covid-19.

How nodules form in the lungs of corona patients

The SARS-CoV-2 virus that causes COVID-19 is part of the coronavirus family. When the virus enters a person's body, it comes into contact with the mucous membranes that line your nose, mouth, and eyes. In this way, it enters the lung and causes the formation of lung nodules by abnormal proliferation of cells, as mentioned, nodules may be benign or malignant.

The virus enters a healthy cell and uses the cell to make new parts of the virus, but its reproduction is illegal and excessive. The virus multiplies and new viruses infect the nearby cells, this is how many nodules are formed in the lung. Think of your respiratory system as an upside down tree. The tree trunk is like your trachea. Your lungs divide into smaller and smaller branches. At the end of each branch there are small air sacs called alveoli. This is where oxygen enters people's blood and carbon dioxide leaves it. Corona virus can infect the upper or lower part of the human respiratory system and passes through its airways.

What are the factors affecting lung nodules?

Pulmonary nodules usually do not have clinical symptoms and are identified through lung imaging. Coronary patients may find out about the presence of nodules by visiting a doctor and taking lung imaging.

Factors that contribute to the occurrence of lung nodules in people with Covid-19 include the following:

➤ **Disease rate**

If the severity of the disease is high, the lung tissue is damaged and the person suffers from lung problems. But if the disease is mild, it will not affect the lungs.

➤ **Safety system**

Also, good health helps to make a person less likely to develop lung problems if the lungs are already damaged and diseased before contracting Covid-19. He will have a weaker immune system than a healthy person, and as a result, he will suffer more damage in the lung area.

Covid-19 is a new disease, and scientists are learning more every day about what it can do to the lungs through various studies. They believe that its effects on the human body are similar to two

Are lung nodes dangerous for corona patients?

In critical cases of COVID-19, which comprise about 5% of all cases, the infection can damage the walls and linings of the air sacs in the patient's lungs. As the body tries to fight it, the person's lungs become more inflamed and filled with fluid. This can make it more difficult for patients to exchange oxygen and carbon dioxide, resulting in difficulty breathing.

The presence of lung nodules in affected people makes the situation more difficult and may require surgery to treat it. A lung nodule or lung nodule in Corona is defined as a spot on the lung that usually has a diameter of about 3 cm or less.

In the CT scan of the lung, these nodules are clearly defined and measurable. If the lung nodule is more than three centimeters in X-ray, it is known as a cancerous mass and the affected person should start treatment against lung cancer. CT scan of the chest in people with corona virus is a definite thing that the diagnosis of lung nodule from corona damage is done by a specialist. The patient may also develop severe pneumonia or acute respiratory distress syndrome (ARDS).

In the most critical cases, the patient's lungs need the help of a device called a ventilator to properly perform their tasks and work. There is evidence that 20-30% of critically ill patients develop pulmonary nodules, clots in the lungs, heart, brain, and legs, some of which are life-threatening and even fatal.

What are the symptoms associated with lung nodules in the body of patients?

In general, when the corona virus enters the lungs and its cells multiply in it, the surface proteins of Covid-19 are first attached to the lung cells.

This connection causes the genetic material of the coronavirus to enter the lung and damage its tissue. The signs and symptoms of lung nodules in Corona depend on the number of lung nodules, the condition of the person and the strength of his immune system. But in general, in cases where a person's lungs have a lung nodule, it may have one or more symptoms.

These symptoms include the following:

- Feeling short of breath;
- Having a dry cough;
- Difficulty breathing and inability to breathe normally;
- Nosebleed.

The mentioned symptoms appear about five days after the person is infected and they differ according to the number and intensity of the nodules. This period, which is the latent period of Corona, is very sensitive and it will be very difficult to diagnose lung damage in this period.

The best course of action after contracting the corona virus is for a person to perform a CT scan of the lungs on the fifth day of contracting the disease. In the investigations by the lung specialist,

the extent of lung damage after contracting the corona virus and the presence of pulmonary nodules are determined, and lung involvement with Covid-19 is also investigated. The lung of a healthy person is very different from the lung of a person who has been damaged or has nodules due to Covid-19, and the doctor measures the severity of the disease by examining the CT scan results, in patients with high lung involvement, hospitalization and the use of the device It is respiratory.

Also, people are under special care so that they can breathe easily and receive the necessary treatments. Although it is possible that a person suffering from Covid-19 will have a benign or non-cancerous lung nodule, specialized treatments in this field are considered by a lung specialist.

Is there a way to prevent lung nodules?

According to the recommendations and research done by experts in this regard, patients can take measures to reduce the possibility of lung nodules. For this purpose, it is necessary for a person to measure his health condition, if he has a background disease or injuries from the past, they should treat it. If they have lung problems such as lung infection or are used to being exposed to tobacco smoke, they need to avoid exposure to polluted environments, especially work environments that contain toxins, and reduce lung sensitivities.

Also, solve superficial lung problems that need medicine or specialized treatments. In most cases, when the person recovers from the corona virus, the nodules disappear by themselves and about 60% of them are benign. People who have diabetes or heart disease should follow their medications and medical orders well. Also, other factors are effective in preventing the lung diseases of corona Covid-19 that can prevent this issue. Consuming healthy and energy-rich foods and drinking enough fluids will make the respiratory system and lungs work well and be in perfect health.

When the lungs are in ideal condition, they are more resistant to infection and tissue damage. About 14 percent of cases of COVID-19 are severe, causing an infection that affects both of the patient's lungs and worsens the disease. In about 5% of all cases, the infection can damage the walls and linings of the air sacs in the patient's lungs.

Reversibility rate of lung damage of Covid-19

Maybe this question concerns your mind, do patients with Covid-19 who have suffered lung injuries experience lung failure or lung diseases again after some time? When a person gets infected with Covid-19 and then the lungs suffer damage and failure [52-54].

It takes a long time for the lung function to return to the previous post, it may take a month to a year for the lungs and the damaged tissue to heal and repair does not have this virus in the body, there is no possibility of lung damage again, even if a person is infected with corona disease again, the lungs may not be damaged, on the other hand, the lungs may be damaged and become damaged and weakened again, and the recovery of the lung after getting infected with corona will be very difficult and unpleasant [55-57]. According to the recommendations and research done by experts in this regard, patients can take measures to reduce the possibility of lung damage. For this purpose,

it is necessary for a person to measure his health conditions, if he has a background disease or injuries from the past, they should treat it. If they have lung problems such as lung infection or are used to being exposed to tobacco smoke, they need to avoid exposure to polluted environments and reduce lung sensitivities. Also, solve the superficial problems of the lung that need medicine or specialized treatments [58]. People who have diabetes or heart disease should follow their medications and medical orders well. Also, other factors are effective in preventing the lung diseases of corona Covid-19 that can prevent this issue. Consuming healthy and energy-rich foods and drinking enough fluids will make the respiratory system and lungs work well and be in perfect health. When the lungs are in ideal conditions, they will be more resistant to infection and tissue damage [59].

Reversibility rate of lung damage of Covid-19

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Conclusion

The symptoms of the new corona virus, like most upper respiratory viral diseases, are non-specific and may cause flu-like or cold-like symptoms in patients. In about 82% of cases, the corona virus causes mild symptoms and in the rest of the cases it leads to illness. The World Health Organization shows that more than 55,000 people infected with the corona virus in China until March 1, 2020 (February 20, 2020) had the following symptoms and signs: The most common symptom is fever, which in 88% of patients It is seen first. 68% of patients have dry cough and 38% have fatigue.

Other symptoms in order of prevalence are: phlegm (33%), shortness of breath (19%), muscle and joint pain (15%), sore throat (14%), headache (14%), chills (11%), nausea and Vomiting (5 percent). Maybe you can add the loss of sense of taste and smell to these cases. In most patients, the activity of the corona virus starts from the lungs and ends there. With the progress of the disease, severe pneumonia, respiratory failure and suffering, blood infection, blood pressure drop

due to the increase of infection in the body and failure of body organs such as heart and lungs and finally death may occur.

After the involvement of the lungs, the immune system comes into action. The body is stimulated by the presence of a viral invader, and immune cells are used in the lung to repair the damage and repair the lung tissue. When this inflammatory process has its normal function, it is only limited to infected areas. But sometimes the immune system gets out of control and destroys all the cells in its path, including healthy tissues. Therefore, instead of reducing the damage, the immune system aggravates it and accumulates more waste materials in the lungs, and the pneumonia worsens and can gradually lead to respiratory failure. According to the report of the World Health Organization, SARS disease (from the family of corona viruses) creates holes in the lungs that make the lungs look like a beehive, and these lesions are also seen in people infected with the new corona virus.

When this happens, a ventilator (artificial breathing machine) must often be used to help the patient breath. Meanwhile, inflammation causes the membrane between the air sacs and the blood vessels to become more permeable, and this can lead to the lungs filling up with fluid, resulting in the inability of the lungs to deliver oxygen to the blood. In severe cases, the lungs fill with fluid and breathing becomes impossible. In a small part of patients, there are digestive problems such as nausea and vomiting (5%). Doctors have seen signs of liver and intestinal damage in patients with SARS, MERS and the novel coronavirus, which have often been mild, although in severe cases the disease has led to severe liver damage and even liver failure. In most patients, the corona disease starts from the lungs and ends there. But in addition to the lungs, other organs such as the liver, intestines and kidneys may also be affected.

References

- [1]. M Eshagh, E Ahangari, Compare coping styles and marital satisfaction in the patients with the bipolar disorder with the normal people , SRPH Journal of Medical Sciences and Healthcare Management, 2020; 2(3), 1-9
- [2]. S Abbasian, M Kargar Moghaddam, B Nazari; The Effect of High-Intensity Treadmill Training on Motor Function in Patients with a Stroke, SRPH Journal of Medical Sciences and Healthcare Management, 2022; 4(1), 1-3
- [3]. EUA Yarahmadi, K Kamrava, A Shafee, M Milanifard, M Aghajanpour, et al., Investigation of Olfactory Function Following Septorhinoplasty in Iranian Population by Rapid Smell Test (RST), J Pharm Res Int, 2017, 1-6
- [4]. Abadi TSH, Askari M, Miri K, Nia MN. Depression, stress and anxiety of nurses in COVID-19 pandemic in Nohe-Dey Hospital in Torbat-e-Heydariyeh city, Iran. J of Military Med 2020; 22 (6): 526-33.
- [5]. Abbasi, M. Nakhostin, A. Namdar F. Chiniforush, N. Hasani Tabatabaei, M. The Rate of Demineralization in the Teeth Prepared by Bur and Er:YAG Laser, J Lasers Med Sci, 2018, 9(2):82-86.

- [6]. Alipour A, Ghadami A, Alipour Z, Abdollah Zadeh H. Preliminary Validation of the Corona Disease Anxiety Scale (CDAS) in the Iranian Sample. *J of health psychology* 2020; 8 (4): 163-75.
- [7]. Alrabadi N, Shawagfeh S, Haddad R, Muktesh T, Abu Hammad S, Al-rabadi D, et al. Medication errors: a focus on nursing practice. *J of Pharmaceutical Health Services Research* 2021; 12 (1): 78-86.
- [8]. Aminzadeh M, Mohebi far R, Azamines Y, Faraji M. The Frequency of Medication Errors and Factors Influencing the Lack of Reporting Medication Errors in Nursing at Teaching Hospital of Qazvin University of Medical Sciences, 2012. *J of Health* 2015; 6 (2): 169-79.
- [9]. Asadi N, Salmani F, poorkhajuie s, mahdavifar m, royani z. Investigating the Relationship Between Corona Anxiety and Nursing Care Behaviors Working in Coronary Referral Hospitals. *IJPCP* 2020; 26 (3): 306-19.
- [10]. B Mahmoodiyeh, S Etemadi, A Kamali, S Rajabi, M Milanifard, Evaluating the Effect of Different Types of Anesthesia on Intraoperative Blood Glucose Levels in Diabetics and Non-Diabetics Patients: A Systematic Review and Meta-Analysis, *Annals of the Romanian Society for Cell Biology*, 2021, 2559–2572
- [11]. B Shakiba, N Torabi, R Alimoradzadeh, R Maghsoudi, Medical Workplace Civility Watch: An Attempt to Improve the Medical Training Culture, *Journal of Iranian Medical Council*, 2022, 5 (1), 227-228
- [12]. B Shakiba, N Torabi, R Alimoradzadeh, R Maghsoudi, Medical Workplace Civility Watch: An Attempt to Improve the Medical Training Culture, *Journal of Iranian Medical Council*, 2022, 5 (1), 227-228
- [13]. Barzideh M, Choobineh A, Tabatabaei S. Job stress dimensions and their relationship to general health status in nurses. *Occupational Medicine* 2012; 4 (3): 17-27.
- [14]. Beachboard, D.C., J.M. Anderson-Daniels, and M.R. Denison, Mutations across murine hepatitis virus nsp4 alter virus fitness and membrane modifications. *J Virol*, 2015. 89(4): p. 9-2080.
- [15]. Borba MGS, Val FFA, Sampaio VS, Alexandre MAA, Melo GC, Brito M, et al. Effect of high vs low doses of chloroquine diphosphate as adjunctive therapy for patients hospitalized with severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) infection: a randomized clinical trial. *JAMA network open*. 2020;3(4): e208857-e.
- [16]. F Afkar, S Golalipour, M Akanchi, SM Sajedi, A Zandi Qashghaie, Systematic Reviews of Different Types of Drug Delivery in the Treatment and Prevention of Oral and Dental and Cardiorespiratory Diseases in Patients and Animals Involved, *NeuroQuantology*, 2022, 20 (8), 632-642
- [17]. F Zabihi, MA Abbasi, R Alimoradzadeh, The Association of Serum Albumin Level with Cognition and Daily Function in Patients Undergoing Hemodialysis, *Annals of the Romanian Society for Cell Biology*, 2021, 2573–2579
- [18]. Furuta Y, Gowen BB, Takahashi K, Shiraki K, Smee DF, Barnard DL. Favipiravir (T-705), a novel viral RNA polymerase inhibitor. *Antiviral research*. 2013;100(2):446-54.

- [19]. Gadlage, M.J., et al., Murine hepatitis virus nonstructural protein 4 regulates virus-induced membrane modifications and replication complex function. *J Virol*, 2010. 84(1): p. 280-90.
- [20]. Ghaibi E; Soltani Manesh MR; Bushra M; Gilani Z; Salimi Nabi K; Zarif F., Comparison of Organizational Citizenship Behavior and Job Creativity between Male and Men's Education Personnel 1 Ahwaz, *Eurasian Journal of Chemical, Medicinal and Petroleum Research*, 1(2), 2022, 49-57
- [21]. Ghaibi E; Soltani Manesh MR; Jafari Dezfouli H; Zarif F; Jafari Z; Gilani Z., Comparison of Marital Satisfaction, Emotional Divorce and Religious Commitment among Nurses and Staff of Ahvaz Government Hospitals, *Eurasian Journal of Chemical, Medicinal and Petroleum Research*, 1(1), 2022, 33-39
- [22]. H Alizadeh Otaghvar, K Afsordeh, M Hosseini, N Mazhari, M Dousti, Causes of wound dehiscence in trauma patients with penetrating and non-penetrating abdominal wound in Rasool Akram Hospital within 2017-2020, *Journal of Surgery and Trauma*, 2020, 8 (4), 156-160
- [23]. H Alizadeh Otaghvar, S Moghaddam, A Molaei, et al., Pharmacological and Medical Effect of Modified Skin Grafting Method in Patients with Chronic and Severe Neck Burns, *Journal of Medicinal and Chemical Sciences*, 2021, 369-375
- [24]. H Mirfakhraee, S Golalipour, F Ensafi, A Ensafi, S Hajisadeghi, Survival rate of Maxillary and Mandibular Implants used to Support Complete-arch Fixed Prostheses & Investigation of internal and Neurological manifestations, *NeuroQuantology*, 2022, 20 (6), 5118-5126
- [25]. H Mirjalili, H Amani, A Ismaili, MM Fard, A Abdolrazaghnejad, Evaluation of Drug Therapy in Non-Communicable Diseases; a Review Study, *Journal of Medicinal and Chemical Sciences*, 2022, 5 (2), 204-214
- [26]. HA Otaghvar, R Rezapour-Nasrabad, MA Ebrahimzadeh, M Yaghoubi, et al., The effects of Feijoa sellowiana fruit extract on wound healing in rats: a stereological and molecular study, *Journal of Wound Care*, 2022, 31 (Sup8), S36-S44
- [27]. Hosseini Khalili AR, Thompson J, Kehoe A, Hopkinson NS, et al. Angiotensin-converting enzyme genotype and late respiratory complications of mustard gas exposure. *BMC Pulm Med*. 2008;8(1):15.
- [28]. Johnson A., Investigation of Network Models Finite difference Method, *Eurasian Journal of Chemical, Medicinal and Petroleum Research*, 2(1), 2023, 1-9
- [29]. Kalantari H, Tabrizi AHH, Foroohi F. Determination of COVID-19 prevalence with regards to age range of patients referring to the hospitals located in western Tehran, Iran. *Gene reports*. 2020;21: 100910.
- [30]. Lo Han K., Investigation of Heavy Polyethylene Catalytic Pyrolysis, *Eurasian Journal of Chemical, Medicinal and Petroleum Research*, 1(2), 2022, 64-70
- [31]. Lo Han K., Investigation of Network Models as a Numerical Method for Solving Groundwater Equations, *Eurasian Journal of Chemical, Medicinal and Petroleum Research*, 1(1), 2022, 1-9

- [32]. M Abbasi, Afrooz Nakhostin, Fatemeh Namdar, Nasim Chiniforush, Masomeh Hasani Tabatabaei, The Rate of Demineralization in the Teeth Prepared by Bur and Er: YAG Laser, J Lasers Med Sci, Spring 2018;9(2):82-86.
- [33]. M Milanifard, G Hassanzadeha, Anthropometric study of nasal index in Hausa ethnic population of northwestern Nigeria, J Contemp Med Sci], 2018, 4 (1), 26-29
- [34]. M Yavari, SE Hassanpour, HA Otaghvar, HA Abdolrazaghi, AR Farhoud, The incidence of ossified superior transverse scapular ligament during nerve transfer through posterior shoulder approach, Archives of Bone and Joint Surgery, 2019, 7 (3), 258
- [35]. Mahmoodi S, Hesabi M, Emami sigaroudi A, Kazemnejad leili E, Monfared A. General health and related factors in employed nurses in Medical-Educational Centers in Rasht. JHNM 2015; 25 (1): 63-72.
- [36]. MB Abhari, PF Afshar, R Alimoradzadeh, H Mirmiranpour, Comparing the effect of including omega-3 to treatment regimen in elderly patients with ulcerative colitis with placebo: A randomized clinical tria, Immuno pathologia Persa, 2019, 6(1), e10-e10
- [37]. Mileski M, Pannu U, Payne B, Sterling E, McClay R. The impact of nurse practitioners on hospitalizations and discharges from long-term nursing facilities: a systematic review. Healthcare 2020; 8 (2): 114-34.
- [38]. MM Fard, Effects of Micronutrients in Improving Fatigue, Weakness and Irritability, GMJ Med. 2021, 5 (1): 391 395
- [39]. N Shahkarami, M Nazari, M Milanifard, R Tavakolimoghdam, A Bahmani, The assessment of iron deficiency biomarkers in both anemic and non-anemic dialysis patients: A systematic review and meta-analysis, Eurasian Chemical Communications 4 (6), 463-472
- [40]. N Shahkarami, M Nazari, M Milanifard, R Tavakolimoghdam, A Bahmani, The assessment of iron deficiency biomarkers in both anemic and non-anemic dialysis patients: A systematic review and meta-analysis, Eurasian Chemical Communications, 2022, 4 (6), 463-472
- [41]. N Zaimzadeh, S Ziaie, N Mohammadzadeh, H Alizadeh Otaghvar, et al., The study of dietary intake of micronutrients in four phenotypes of polycystic ovary syndrome separately based on Rotterdam criteria, Razi Journal of Medical Sciences, 2018, 25 (3), 59-68
- [42]. N Zaimzadeh, S Ziaie, N Mohammadzadeh, H Alizadeh Otaghvar, et al., Comparison of vitamin D dietary intake among four phenotypes of polycystic ovary syndrome and its association with serum androgenic components, Razi Journal of Medical Sciences, 2018, 25 (2), 87-96
- [43]. Najafi F, Kerjasama F, Gangoozehi E. The Relationship between General Health and Quality of Work Life of Nurses Working in Zahedan Teaching Hospitals. Iranian J of Rehabilitation Research in Nursing 2018; 4 (2): 53-9.
- [44]. Nazardani SZ; Nourizadeh Dehkordi SH; Ghorbani A., A comprehensive evaluation of the Sports Physiotherapy curriculum. Eurasian Journal of Chemical, Medicinal and Petroleum Research, 2(1), 2023, 10-16

- [45]. Nurmeksela A, Mikkonen S, Kinnunen J, Kvist T. Relationships between nursing management, nurses' job satisfaction, patient satisfaction, and medication errors at the unit Level: A correlational study. *Research Square* 2020; 1 (1): 1-22.
- [46]. P Dini, B Shakiba, R Alimoradzadeh, N Torabi, MWC Watch, Impaired mental health status and uncivil workplace behavior's: An egg and chicken problem, *Journal of affective disorders*, 2021, 281, 502
- [47]. R Alimoradzadeh, H Mirmiranpour, P Hashemi, S Pezeshki, SS Salehi, Effect of Memantine on Oxidative and Antioxidant Indexes Among Elderly Patients with Prediabetes and Mild Cognitive Impairment, *Journal of Neurology & Neurophysiology*, 2019, 10 (1), 1-5
- [48]. R Alimoradzadeh, M Mokhtare, S Agah, Comparing the prevalence of constipation risk factors in the elderly with and without constipation in Hazrat-e Rasoul (PBUH) Hospital, *Iranian Journal of Ageing*, 2017, 12(1), 78-89
- [49]. R Alimoradzadeh, MA Abbasi, F Zabihi, H Mirmiranpour, Effect of Anesthetics on Oxidant and Antioxidant Parameters After Inguinal Hernia Surgery in Older Patients, *Iranian Journal of Ageing*, 2021, 15(4), 524-533
- [50]. Rebout F., Effect of Polymers on Transient Reynolds Number Change in Pipe Flow and Reduction of their Coefficient of Friction, *Eurasian Journal of Chemical, Medicinal and Petroleum Research*, 1(1), 2022, 20-32
- [51]. Rebout F., Friction Coefficient Pressure Gradient in Fully Developed Flow, *Eurasian Journal of Chemical, Medicinal and Petroleum Research*, 1(2), 2022, 58-63
- [52]. Rothan HA, Byrareddy SN. The epidemiology and pathogenesis of coronavirus disease (COVID-19) outbreak. *Journal of autoimmunity*. 2020:102433.
- [53]. S Golalipour, Z Soleimanydarinsoo, N Qaderi, H Ghazipoor, M Salehi, Examination of Dental Problems and Radiological and Cardiac Evaluations in Patients Affected by Covid-19, *Neuro Quantology*, 2022, 20 (8), 1519- 1527
- [54]. S.H Salehi, K As'adi, S.J Mousavi, S Shoar, Evaluation of Amniotic Membrane Effectiveness in Skin Graft Donor Site Dressing in Burn Patients, *Indian J Surg*, 2015 Dec;77(Suppl 2):427-31.
- [55]. S.H Salehi, M.J Fatemih, K A'sadi, S Shoar, A Der Ghazarian, R Samimi, Electrical injury in construction workers: a special focus on injury with electrical power, *Burns*, 2014 Mar;40(2):300-4.
- [56]. Samiei, N. Ghane, HK. Khaled, Y. COVID-19 and Periodontal Disease: The Potential Role of Interleukin-6, *SVOA Dentistry*, 2021, 2(6), 254-257.
- [57]. Serrano, P., et al., Nuclear magnetic resonance structure of the nucleic acid-binding domain of severe acute respiratory syndrome coronavirus nonstructural protein 3. *J Virol*, 2009. 83(24): p. 12998-3008.
- [58]. SP. Smieszek, Przychodzen BP, Polymeropoulos MH. Amantadine disrupts lysosomal gene expression; a hypothesis for COVID19 treatment. *International Journal of Antimicrobial Agents*. 2020:106004.

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- [59]. Spinner CD, Gottlieb RL, Criner GJ, López JRA, Cattelan AM, Viladomiu AS, et al. Effect of remdesivir vs standard care on clinical status at 11 days in patients with moderate COVID-19: a randomized clinical trial. *Jama*. 2020;324(11):1048-57.
- [60]. V. Monteil, Dyczynski M, Lauschke VM, Kwon H, Wirnsberger G, Youhanna S, et al. Human soluble ACE2 improves the effect of remdesivir in SARS-CoV-2 infection. *EMBO molecular medicine*. 2020: e13426.
- [61]. Zbuzant M., An Overview of the Use of Photo Catalysts for Desulfurization, *Eurasian Journal of Chemical, Medicinal and Petroleum Research*, 1(1), 2022, 10-19
- [62]. Zbuzant M., Different Weight Percentages Doubled in the Catalyst, *Eurasian Journal of Chemical, Medicinal and Petroleum Research*, 1(2), 2022, 40-48