

Neurological Symptoms of Corona Virus Disease

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Abstract—Corona virus disease is an infectious disease induced by a family of viruses that can cause common cold and severe acute respiratory syndrome (SARS).

This research work was designed to shed light on the different presentation forms, especially the unusual ones of the disease as an attempt to make early diagnosis for better and efficient treatment and prevention of the disease.

A sample of 203 subjects who have had corona disease were questioned about the symptoms they were complaining of during the illness. Correlation coefficient study was conducted to declare the relationship between the different symptoms especially the unusual ones and the disease, among the symptoms themselves, certain symptoms with the age group, as well as the gender.

The results showed positive correlation between many of the usual symptoms and the disease for instance, fever, headache, cough, dyspnea, malaise, muscle and joint pain, dizziness, loss of smell and appetite, running nose, sore throat, nausea, vomiting, and diarrhea. No significant correlation could be detected with the unusual symptoms like, elevated blood pressure, conjunctival congestion, amnesia, and decreased concentration, skin rash, loss of consciousness, intestinal colic and gastric pain.

According to the available results no specific symptom could be attributed to a given age group or gender with the exception of the neurological symptoms in the form of amnesia, loss of consciousness, and decreased concentration. These findings were found to be firmly correlated with the severity of fever. The authors postulate that these symptoms can be attributed to the temporary reduction in the number of neurotransmitters molecules of the brain. Further work is needed to provide evidence in support of this postulation.

In conclusion, for early diagnosis and therefore to achieve efficient treatment of corona disease, unusual presentation must be kept in mind. Fever must be dealt with seriously and effectively to prevent or minimize the development of neurological symptoms. Using all means of audio, video, and social media to spread the information about the disease will have a crucial role in slowing the spread of the disease especially the new strains.

Index Terms— corona disease, neural symptoms, Amnesia, Loss of concentration, Dizziness, and loss of consciousness.

I. INTRODUCTION

Coronavirus disease actually affects the upper respiratory tract, but it can spread to the lower parts of the respiratory system to involve the lungs. The disease might be symptomless or usually induces mild to moderate symptoms in the form of fever, headache, joint and muscle pain, loss of taste and/or smell, dyspnea, shortness of breath as well as other symptoms. Sometimes the symptoms might be severe especially in elderly patients with underlined chronic diseases for instance, chronic respiratory disease, cardiovascular diseases, diabetes mellitus etc. (1,2,3)

It is well known that the Corona Virus attacks mainly the respiratory system. Meanwhile, it has been established that coronavirus infection can extend beyond the respiratory system to involve the nervous system (4,5). Therefore, producing neurological symptoms of the disease varying from headache, dizziness, decreased concentration, to loss of consciousness, ischemia, stroke, and impaired memory (6,7,8).

The pathophysiology of how the virus gets access to the central nervous system is via the bloodstream invading the endothelial lining cells of the blood vessels. (9,10) It was reported that the virus can enter the peripheral nervous system and via retrograde axonal transport route it gets access to the central nervous system. (11,12,13) The virus could be internalized in nerve synapses through endocytosis, transported retrogradely, and spread trans-synaptically to other brain regions (14).

In a retrospective study performed on COVID-19 patients from Wuhan, China, neurological symptoms were observed in 36.4% of the patients and 45.5% of patients with severe infections (13). Observed symptoms of central nervous system (CNS) infection included dizziness, headache, impaired consciousness, acute

cerebrovascular disease, and ataxia ⁽¹⁵⁾. Moreover, a large-scale study of COVID-19 patients from the United Kingdom revealed neurological disorders were frequent among the 153 “unique” cases of COVID-19 identified by physicians. Of the 125 patients with clinical data, a cerebrovascular event, defined as ischemic stroke, intracerebral hemorrhage, or central nervous system vasculitis, was observed in 62% of patients. An altered mental status, defined as unspecified encephalopathy, encephalitis, or psychiatric diagnosis, was observed in 31% of patients ⁽¹⁶⁾.

II. AIM OF THE WORK:

The primary goal of this work is to highlight the unusual neurological symptoms of the disease.

Patients and Methods:

A retrospective clinicoepidemiological study was conducted on a randomized sample of 180 patients in Kurdistan region in northern Iraq of both genders and different age groups affected with corona virus disease. The signs and symptoms of the disease were recorded by the patients themselves through a questioner designed to put the age, gender, symptoms, and the severity of symptoms.

Statistical analysis:

The data collected were processed and analyzed statistically using spss program version 23, three methods were used for estimating the correlation between the disease and each symptom as well as between the symptoms themselves. The distribution of symptoms according to age group and gender were also estimated.

Results:

In sequence of the frequency of symptoms, the most common symptom observed in this study was fever 75.9%, next is cough 43.9%, malaise 38.9%, headache 38.4, loss of smell 36.5%, dyspnea 34%, loss of taste 32%, muscle pain 21.7%, vomiting 13.3%, tiredness 11.8%, diarrhea 9.6%, chest pain 8.7%. Neurological symptoms in the form of amnesia 20.9%, loss of concentration 19.4%, dizziness 13.3%, loss of consciousness 4.9% were observed. Mild symptoms for instance, throat pain 4.9%, gastric pain 1.5%, abdominal colic 1.5%, cold sensation 1.5%, running nose 0.5% and skin rash 0.5% were also recorded.

The symptoms vary from mild, moderate to severe. Severe symptoms specifically were observed with fever, headache, muscle and joint pain, amnesia, and loss of concentration.

Crosstabulation was done for each symptom in relation to age and sex. No specific age group was found to be more affected by any of the neurological symptoms in the form of dizziness, amnesia, and loss of concentration. Regarding sex variation, no significant difference was found between females and males in relation to dizziness. Whereas, amnesia and loss of concentration were found to affect males more than females.

III. RESULTS

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The symptoms vary from mild, moderate to severe. Severe symptoms specifically were observed with fever, headache, muscle and joint pain, amnesia, and loss of concentration. Crosstabulation was done for each symptom in relation to age and sex. No specific age group was found to be more affected by any of the neurological symptoms in the form of dizziness, amnesia, and loss of concentration. Regarding sex variation, significant differences were found between females and males in relation to dizziness and amnesia, males have higher incidence than females ($P < 0.001$) ($P < 0.01$) respectively. Whereas, loss of concentration was found to affect males and females almost equally.

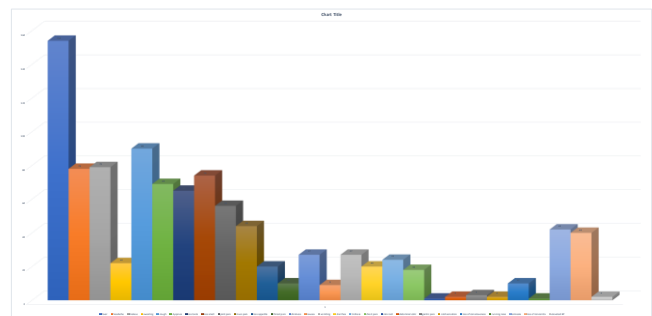


Figure 1: Frequency histogram chart of the different symptoms of corona virus disease.

TABLE 1: THE DISTRIBUTION OF DIZZINESS AMONG PATIENTS IN BOTH MALES AND FEMALES.

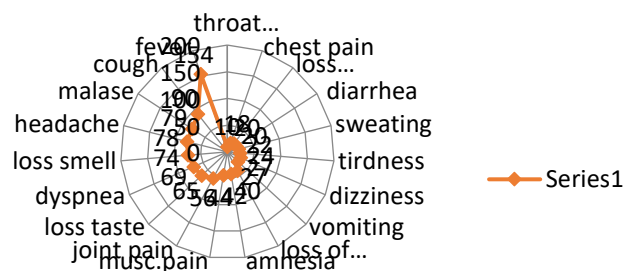
* dizziness * age and gender Crosstabulation				
Count				
	Dizziness		P-value	Total
	Not	Low		
Male	74	24	P< 0.001	98
Female	67	15	P< 0.01	82
Total	141	39	P< 0.001	180

TABLE 2: SEX INCIDENCE OF LOSS OF CONCENTRATION SYMPTOM AMONG PATIENTS OF BOTH GENDERS.

Loss of Concentration age and gender Crosstabulation				
Count				
Gender	loss concentration	Low	P-value	Total
	Not			
Male	70	28	P< 0.001	98
Female	66	16	P< 0.001	82
Total	136	44	P< 0.001	180

TABLE 3: AMNESIA AMONG MALE AND FEMALE PATIENTS.

Amnesia age and gender Crosstabulation				
Count				
Gender	Amnesia		P-value	Total
	Not	Low		
Male	77	21	P < 0.001	98
Female	64	18	P < 0.001	82
Total	141	39	P < 0.001	180



It is well known that corona virus is a disease affecting the respiratory system and called as “Mediterranean Respiratory Distress Syndrome” (MRDS)(17). According to the author’s recent concept, corona virus can extend beyond the respiratory system into many systems of the body including most importantly the nervous system (18). Respiratory symptoms in the form of cough, dyspnea as well as other symptoms of corona disease affecting the gastrointestinal tract, vomiting, diarrhea, gastric pain, abdominal pain can be treated and cured without any disability left behind. What attracts the mind of the authors in this work are the neurological symptoms that varies from mild to severe in many patients. Fever was the main symptom in (75.9%) of the patients who experience moderately elevated body temperature to a temperature of 40oC or above sometimes. Elevated body temperature can be attributed to the normal bodily response to pyrogens and toxins released by the infectious agent. Sex variation regarding high temperature was shown to be nonsignificant (8 females against 6 males). 38.4% of the patients exhibit moderate to severe headache which can be attributed to the involvement of the meninges especially the dura mater, when the virus get access to the brain through the cribriform plate from the upper part of the nose. Because corona disease shares in common some symptoms with influenza virus, therefore, it is not uncommon for the patients to experience loss of smell and taste which was observed in 36.5% and 32% respectively. Fever and increased body metabolism with deprived nutrients lead to exhaustion of the energy sources in the body that in turn can cause malaise, tiredness and muscle pain, this was found in 38.9% and 21.7% respectively. 13.3% of the patients claim that they experience dizziness during the course of the disease, from the neurological point of view dizziness can be caused by brain ischemia and this may happen as a result of brain swelling that accompanies corona virus disease which compresses on the blood vessels of the brain inducing ischemia and dizziness (18). When the swelling is prominent, it might impair neuronal conduction as well, especially in the narrow areas of the brain (brain stem) so that interrupting the excitatory signals arising from the primary excitatory area in the brain stem from passing to the cerebral cortex, leading to the development of diminished or loss of consciousness. This symptom was observed in (4.9%) of the patients. Diminished neuronal conduction among the different brain areas especially so with the frontal lobe of the brain makes patients of corona virus unable to maintain a long span of concentration that was noticed in 19.4% of the patients.

The key finding of this study is that, loss of memory observed in 20.9% of patients caused by corona disease which affects both short-term and/or long-term memories. Amnesia can be attributed to impaired neuronal conduction among the brain cells, that make it difficult to retrieve an old information from the memory store house or to store new one especially when the hippocampus is affected (19). Among the available explanations of how the virus gets entry into the brain according to the authors view, is that the virus invades the endothelial cell lining of the blood vessels and passes through the blood stream into the brain synapses and then taken into the nerve cells by endocytosis, both conditions can interrupt neuronal transmission and impair nerve function. These findings firmly establish the connection between loss of memory and corona disease and leave very little doubt about the causal link

between corona virus disease and loss of memory. This disability might be short lived or life-long depending on the severity of the disease.

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