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Determined the Frequency of Neurosurgeries Canceled Due to the Asymptomatic COVID-19 in the Patients

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Abstract

Background: The COVID-19 pandemic has caused severe complications, deaths, and damage to societies, and the disease course is unpredictable and ranges from asymptomatic infections to multi-organ failure and death.

Objectives: The present study determined the frequency of neurosurgeries canceled owing to the asymptomatic COVID-19 in the patients.

Methods: The present study was descriptive-analytical and was conducted on all neurosurgeries in Kashani hospital, Isfahan, Iran in 2021. Moreover, 116 (52.5%) out of 2100 neurosurgeries were canceled, among which 41 cases (35.4%) were related to asymptomatic COVID-19. The necessary data were extracted from the information in the patients' medical files and were included in the data collection forms. The data were analyzed in SPSS 22 after collection.

Results: Among 41 people, whose neurosurgery was canceled, 7 had asymptomatic COVID-19 with few or mild symptoms, and 34 were asymptomatic. The patients of the two groups with asymptomatic and symptomatic COVID-19 were significantly different in age, albumin level, C-reactive protein, and serum creatinine ($P<0.05$) as the mean age, albumin, and C-reactive protein levels were lower, and serum creatinine was higher in the group of patients with asymptomatic COVID-19.

Conclusion: The prevention of asymptomatic severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) infections played a crucial role in the unhindered transmission of this virus and was the turning point in controlling the pandemic.

Keywords: Neurosurgery Department, Asymptomatic COVID-19, COVID-19 Pandemic

1. Background

The outbreak of severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), the cause of COVID-19, has become a global pandemic.[1] This disease is transmitted by droplets containing the virus released from the upper airways and airborne particles that can float in the environment for a long time depending on the airflow.[2] Infection with SARS-CoV-2 appears to spread more quickly than other diseases, including seasonal influenza. It causes various clinical manifestations ranging from asymptomatic infection to acute respiratory distress syndrome (ARDS) and even death.[3]

The transmission of the virus by asymptomatic infected people has been reported since the early stages of the outbreak. In this respect, the frequency and infectivity of asymptomatic people have been the main reasons for COVID-19 transformation into a pandemic.[4]

There are two classes of asymptomatic cases of SARS-CoV-2 infection.[5] The first is the cases with low or mild symptoms during the incubation period observed with the onset of symptoms during the quarantine and on chest radiography. The second includes patients with no symptoms but positive antibody or viral nucleic acid test.[6]

Uncertainty about the significance of asymptomatic infections is reinforced by the vagueness with which the term "asymptomatic" is used.[7] The World Health Organization (WHO) defines an asymptomatic case as a laboratory-confirmed infected person without overt symptoms. It remains to be established how thoroughly such a person needs to be examined clinically. Moreover, the distinction between asymptomatic and presymptomatic individuals is often neglected in COVID-19 case definitions.[8]

The stages of asymptomatic COVID-19 can be distinguished only retrospectively and after the occurrence or absence of clinical symptoms. Recent evidence suggests that higher serum/plasma lactate dehydrogenase levels may indicate asymptomatic infections at early stages, thereby facilitating early differentiation.[9] Even diagnostic imaging could not distinguish between the two stages of infection. The explanation is that 30% of asymptomatic people had ground-glass opacity, and 27% had diffuse consolidations.[10]

The percentage of asymptomatic SARS-CoV-2 infections is 30% to 40%. However, a systematic study reported it from 1.4% to 78.3%, indicating an unprecedented challenge to inhibiting the pandemic.[11] In this regard, understanding the asymptomatic patients' immune responses may help develop immunomodulatory treatments to improve the progression of symptoms in COVID-19 patients.[12,13]

2. Objectives

Failure to detect asymptomatic patients in the surgery field (including neurosurgery) can infect medical personnel and cause adverse effects such as post-operation infection. Hence, the present study aimed to determine the frequency of cancellation of secondary neurosurgery due to asymptomatic COVID-19 infection.

3. Methods

The present descriptive-cross-sectional study was conducted in 2021. All neurosurgeries in Kashani hospital Isfahan, Iran from March 20, 2021, to March 21, 2022, were examined according to Figure 1.

Non-COVID-19 causes referred to the lack of NPO, lack of medical ultrasound, lack of empty beds in the ICU, and lack of patient consent to undergo surgery.

Of 2100 neurosurgeries, 116 were canceled, of which 41 (35.4%) were related to asymptomatic COVID-19. Figure 2 presents the status of patients with COVID-19 in this hospital.

After receiving an ethical code and the necessary permissions, the researcher referred to the Kashani hospital and detected the canceled neurosurgeries due to the patients' asymptomatic COVID-19 infection. Therefore, patients with lung positive polymerase chain reaction (PCR) tests and CT scans before neurosurgery were included in the study. Overall, 41 patients diagnosed with asymptomatic COVID-19 were examined by the census method. The study's inclusion criteria consisted of patients who were candidates for neurosurgery and visited Kashani hospital whose surgeries were canceled due to the diagnosis of asymptomatic COVID-19. Al-Zahra hospital, which is a COVID-19 center, was excluded from the study since all its patients diagnosed with COVID-19 underwent surgery. The necessary data were extracted and included in the data collection instrument using the information in each individual's medical file.

In the present study, patients with asymptomatic COVID-19 (n = 41) were divided into two groups, asymptomatic and low symptomatic, and then some demographic and clinical factors were compared between the patients and those with symptomatic COVID-19. In this study, patients with symptomatic COVID-19 were selected using simple random sampling, and the sample

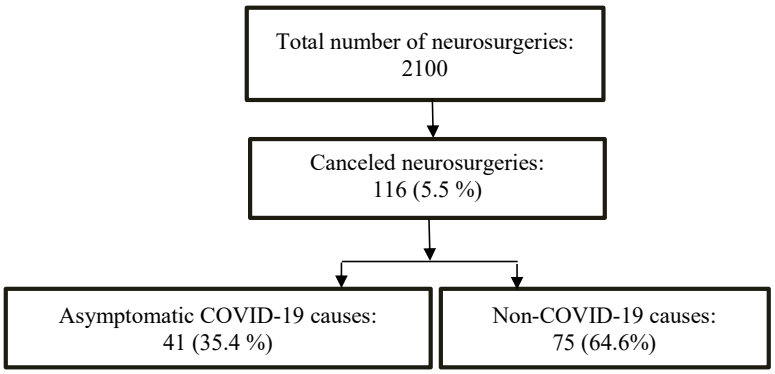

Figure 1. The Neurosurgery Status.

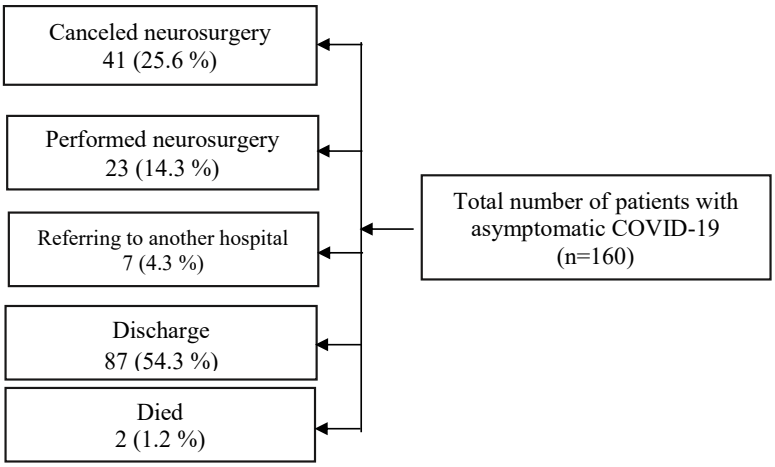

Figure 2. Presents the Status of Patients With COVID-19 in This Hospital.

size was equal to 350 according to DeMorgan's table.

Data were examined after collecting using SPSS version 22 at a significance level of lower than 0.05; and quantitative data were described by mean and standard deviation, and qualitative data were described by distribution (percentage).

4. Results

Table 1 shows the general characteristics of the patients. mean age of with a mean age of 43.88 ± 18.15 years, 23 (56.1%) were male and 18 (43.9%) were female. Seventeen patients (41.5%) had comorbidities. None of the participants had an infected family member. The most common diagnosis was disc herniation (29.3%), followed by cerebral tumor (26.8%) and vertebral fracture (17.1%). The most common planned surgical procedure was vertebral fusion (53.7%), followed by craniotomy (26.8). The most frequent type/site of lesions was lumbar disc herniation (31.7%), followed by cerebral mass (26.8%) and lumbar vertebra fracture (14.6%). More than three fourth of the patients (78%) were discharged with good general condition and no deaths occurred.

The results of Table 2 indicated that the two groups of asymptomatic and symptomatic COVID-19 patients were significantly different in terms of age, albumin level, C-reactive protein level, and serum creatinine variables ($P < 0.05$). Therefore, the mean age, albumin, and C-reactive protein levels were lower, and serum creatinine was higher in the group of patients with asymptomatic COVID-19.

5. Discussion

Serious damage and challenges have affected more than 200 countries and regions worldwide since the outbreak of COVID-19 in the late December 2019; however, there is growing evidence that many patients with COVID-19 are asymptomatic or have only mild symptoms; however, they can transmit the virus to others, and will be a key agent in the spread of COVID-19. There are problems in screening asymptomatic infections making national prevention and control of this pandemic more difficult.

Sah et al[14] conducted one systematic review, analyzed more than 350 studies and estimated that 42.8% of cases were asymptomatic. Being asymptomatic was significantly less among the elderly than among children (19.7% vs. 46.7%). People with underlying diseases were also asymptomatic compared to those who had no underlying diseases. The patients' age with asymptomatic COVID-19 was significantly lower in the present study; however, the two studies had no significant relationship in terms of underlying diseases.

Nikolai et al[15] reported that younger age was strongly associated with asymptomatic and mild infections, being consistent with the results of the present study. It was also estimated that asymptomatic infections ranged from 18% to 81%. He et al[16] conducted a systematic review, examined 50 to 155 patients from 41 studies, and reported that asymptomatic infection was observed in 15.6% of patients. The total asymptomatic infection was 27.7% in 1152 children with COVID-19 in 11 studies, being much higher than that in patients in the other age groups. Abnormal CT features were common in asymptomatic infection, being inconsistent with the results of the present study. A total of 15 patients (41.7%) had bilateral involvement and 14 (38.9%) had unilateral involvement in the CT results. A decrease in the number of white blood cells, an increase in lactate dehydrogenase, and an increase in C-reactive protein were also recorded. In the present study, the C-reactive protein was significantly lower in the group of asymptomatic COVID-19 patients.

Alene et al,[17] in one systematic review, examined 6071 cases of COVID-19 in 28 studies. The rate of asymptomatic infections in the studies ranged from 1.4% to 78.3%. Syangtan et al[18] reviewed 16 studies, including 2788 patients with SARS-CoV-2. In addition, 48.2% of the cases were asymptomatic, 55.5% were women, and 49.6% were children.

Xu et al[19] indicated that 15 (4.4%) out of 342 patients infected with SARS-CoV-2 had no symptoms during the disease course. The mean duration of infection until diagnosis was 7 days. During hospitalization, only 1 patient (6.7%) had lymphopenia. Li et al[20] reported that 42% of people with COVID-19 were asymptomatic in China. Al-Qahtani et al[21] found that 92 out of 188 patients (48.9%) were asymptomatic in Bahrain. Martinelli et al[22] conducted one study in Italy, indicating that 19.9% of COVID-19 patients were asymptomatic. Asymptomatic COVID-19 decreased with age, underlying diseases, and in men, and the results of the two studies were consistent in terms of age.

Yu et al[23] reported that asymptomatic COVID-19 might occur at any age from 9 to 96 years. The patients also had lower levels of alanine aminotransferase and C-reactive protein. Some asymptomatic vectors exhibited mild or moderate symptoms during hospitalization. Age and underlying diseases, particularly hypertension, were among the predictors of the occurrence of symptoms in asymptomatic primary vectors during admission, and the results of the two studies were consistent with each other in terms of age. Gao et al[24] reported that cardiovascular diseases accounted for 25% of patients' underlying diseases. Blood factors were within the normal range in most patients. CT images showed no signs of COVID-19 infection. In one systematic review, Ma et al[25] reported that the total number of asymptomatic infections was 0.25% among the test population.

Li et al[20] indicated that 42% of people with COVID-19 were asymptomatic in China. Chen et al[26] also reported the total rate of asymptomatic infections as 23.6% in one systematic review. Compared to symptomatic patients, asymptomatic patients had a higher number of mature neutrophils and a lower number of CD169 + expressing monocytes in peripheral blood. Systemic levels of pro-inflammatory cytokines were also lower in asymptomatic patients. Furthermore, asymptomatic patients had higher

Table 1. Characteristics of Asymptomatic COVID-19 Patients

Variables	Asymptomatic (n = 7) Low or Mild Symptoms	Asymptomatic (n = 34) Onset of Symptoms	All Patients (n = 41)
Age (years), mean ± SD	45.43 ± 25.94	43.56 ± 16.62	43.88 ± 18.15
Gender, n (%)			
Male	3 (42.9)	20 (58.8)	23 (56.1)
Female	4 (57.1)	14 (41.2)	18 (43.9)
Coexisting disorder, n (%)	5 (71.4)	12 (35.3)	17 (41.5)
CT findings for COVID-19, n (%)	3 (42.9)	2 (5.9)	5 (12.2)
Positive COVID-19 PCR, n (%)	6 (85.7)	32 (94.1)	38 (92.7)
Blood cells, mean ± SD			
WBC count (/μL)	11528.57 ± 5367.09	7564.71 ± 3314.33	8241.46 ± 3957.71
Platelet count (/μL)	262428.57 ± 79550.23	214088.24 ± 52120.70	222341.46 ± 59409.85
Neutrophil (%)	75.66 ± 11.76	64.88 ± 12.59	66.72 ± 12.97
Lymphocyte (%)	16.84 ± 10.81	26.34 ± 11.46	24.72 ± 11.79
Vital signs, mean ± SD			
Temperature (°C)	37.04 ± 0.45	36.90 ± 0.41	36.92 ± 0.41
RR (/min)	17.71 ± 2.87	18.65 ± 1.91	18.49 ± 2.09
PR (/min)	85.29 ± 9.60	79.74 ± 4.83	80.68 ± 6.13
O_2Sat No. (%)	93.86 ± 2.73	94.41 ± 16.37	92.66 ± 14.92
SBP (mm Hg)	119.57 ± 22.90	120.59 ± 14.24	120.42 ± 15.69
DBP (mm Hg)	69.29 ± 10.97	77.85 ± 11.52	76.39 ± 11.75
Diagnosis, No. (%)			
Disc herniation	0 (0.0)	12 (35.3)	12 (29.3)
Vertebral fracture	2 (28.6)	5 (14.7)	7 (17.1)
Cerebral hemorrhage	0 (0.0)	4 (11.8)	4 (9.8)
Cerebral tumor	5 (71.4)	6 (17.6)	11 (26.8)
Lordosis	0 (0.0)	1 (2.9)	1 (2.4)
Spinal stenosis	0 (0.0)	5 (14.7)	5 (12.2)
Cervical mass	0 (0.0)	1 (2.9)	1 (2.4)
Type/site of the lesions, No. (%)			
Cervical disc herniation	0 (0.0)	2 (5.9)	2 (4.9)
Lumbar disc herniation	0 (0.0)	13 (38.2)	13 (31.7)
Cervical vertebra fracture	1 (14.3)	2 (5.9)	3 (7.3)
Lumbar vertebra fracture	1 (14.3)	5 (14.7)	6 (14.6)
Cervical vertebra mass	0 (0.0)	1 (2.9)	1 (2.4)
Hemorrhage, midline shift, edema	0 (0.0)	2 (5.9)	2 (4.9)
Cerebral mass	5 (71.4)	6 (17.6)	11 (26.8)
Skull defect	0 (0.0)	2 (5.9)	2 (4.9)
Cervical lordosis	0 (0.0)	1 (2.9)	1 (2.4)
Planned surgical procedure, No. (%)			
Vertebral fusion	1 (14.3)	21 (61.8)	22 (53.7)
Kyphoplasty	1 (14.3)	2 (5.9)	3 (7.3)
Craniotomy	4 (57.1)	7 (20.6)	11 (26.8)
Shunt placement	1 (14.3)	1 (2.9)	2 (4.9)
Cranioplasty	0 (0.0)	2 (5.9)	2 (4.9)
Spinal surgery	0 (0.0)	1 (2.9)	1 (2.4)
Hospital length of stay (days), mean ± SD	9.86 ± 18.21	2.59 ± 2.45	3.83 ± 7.89
Final status, No. (%)			
Transferred to another center	0 (0.0)	8 (23.5)	8 (19.5)
Good general condition	6 (85.7)	26 (76.5)	32 (78.0)
Non-responsive	1 (14.3)	0 (0.0)	1 (2.4)
Death	0 (0.0)	0 (0.0)	0 (0.0)

Abbreviations: N, number; SD, standard deviation; COVID-19, Coronavirus disease 2019; CT, computed tomography, PCR, polymerase chain reaction; WBC, white blood cell; RR, respiratory rate; PR, pulse rate; O_2Sat, oxygen saturation; SBP, systolic blood pressure; DBP, diastolic blood pressure.

Table 2. Demographics and Baseline Characteristics of the Asymptomatic/ Symptomatic Patients With COVID-19

Variables	Asymptomatic Patients (n = 41)	Symptomatic Patients (n = 350)	*P* Value
Age, median (IQR) (range)	43.88 ± 18.15	52.47 ± 21.34	0.003
Gender, No. (%)			
Male	23 (56.1)	147 (42)	0.163
Female	18 (43.9)	203 (58)	
Coexisting disorder, No. (%)	17 (41.5)	43 (12.3)	
Respiratory disease	2 (11.7)	5 (11.6)	0.158
Coronary heart disease	0 (0)	9 (20.9)	0.111
Diabetes	6 (35.3)	26 (60.5)	0.362
Hypertension	7 (41.2)	31 (72)	0.058
Cerebrovascular disease	0 (0)	3 (6.9)	0.625
Chronic hepatopathy	1 (5.8)	4 (9.3)	0.147
Chronic renal disease	1 (5.8)	2 (4.6)	0.098
Cancer	3 (17.6)	4 (9.3)	0.102
Clinical outcome			
Discharged	41 (100)	21 (6)	0.068
Died	0 (0)	344 (94)	
Blood routine test			
Leukocytes ($\times 10^9$ per L; normal range 3.50–9.50)	5.80 (4.40-7.10)	5.90 (4.40-7.10)	0.145
Neutrophils ($\times 10^9$ per L; normal range 1.80–6.30)	3.31 (2.14-5.10)	3.64 (2.27-4.94)	0.321
Lymphocytes ($\times 10^9$ per L; normal range 1.10–3.20)	1.53 (1.04-2.00)	1.51 (1.12-2.36)	0.546
Monocyte ($\times 10^9$ per L; normal range 0.10–0.60)	0.37 (0.28-0.61)	0.42 (0.31-0.55)	0.147
Platelets ($\times 10^9$per L; normal range 125.00–350.00)	216.00 (164.00-227.00)	225 (172.00-254.00)	0.238
Neutrophil percentage (%; normal range 40.00–75.00)	58.00 (51.5-62.8)	53.00 (48.5-61.6)	0.257
lymphocytes percentage (%; normal range 20.00–50.00)	28.65 (24.87-34.56)	30.07 (23.71-35.12)	0.257
Monocytes percentage (%; normal range 3.00–10.00)	6.05 (4.30-6.98)	6.11 (5.27-7.14)	0.658
Blood biochemistry			
Albumin (g/L; normal range 35.00–52.00)	37.20 (31.64-42.69)	38.50 (30.25-43.69)	0.001
Total bilirubin (μmol/L; normal range 0.00–21.00)	9.14 (6.31-14.29)	9.22 (6.41-13.69)	0.086
Blood urea nitrogen (mmol/L; normal range 3.10–8.80)	4.52 (3.51-5.48)	4.82 (3.50-5.21)	0.365
Serum creatinine (μmol/L; normal range 49.00–90.00)	68.12 (60.23-70.45)	52.63 (53.14-62.11)	0.012
D-dimer (mg/L; normal range 0.00–0.55)	0.23 (0.10-0.52)	0.36 (0.23-0.68)	0.358
C-reactive protein (mg/L; normal range 0.00–10.00)	1.09 (0.42-4.32	0.72 (0.28-2.41)	0.0001

systemic levels of growth factors that are associated with cellular repair. According to data, asymptomatic patients had fewer pro-inflammatory and more protective immune responses against SARS-CoV-2, indicating disease tolerance, which could not be compared with the results of the present study due to the research limitations.

5.1. Study Limitation

The limitations of this study included the expensiveness and the failure to conduct some tests for the patients, especially proinflammatory and growth factors. Since patients with asymptomatic COVID-19 in the present study were only patients undergoing neurosurgery, the results could not be compared with the ratios obtained in other studies. More tests on this issue are expected to provide more information about the real number of asymptomatic infections in the general population. Various guidelines have been reported

Research Highlights

What Is Already Known?

Asymptomatic COVID-19 can have potential effects on routine neurosurgery.

What Does This Study Add?

This study reports that asymptomatic COVID-19 outbreaks have resulted in the cancellation of a small number of neurosurgery procedures. Patients with asymptomatic covid-19 were different from patients with symptomatic COVID-19 in terms of age, albumin level, C-reactive protein and serum creatinine.

for the management of asymptomatic cases in China and other countries. Therefore, early detection and isolation of asymptomatic patients require joint efforts of the health and treatment system with society and policymakers.

6. Conclusion

The findings of the present study provided broader insight into asymptomatic COVID-19 infections in different groups of people, and thus it is important to detect the patients to develop public health policies that aim to achieve early diagnosis and to control the pandemic more accurately.

Authors' Contributions

MM contributed as the main author with the concept of planning the study. MM, MS and SN contributed in study design, patient selection and follow ups. SN performed the statistical analysis and interpreted the data. MS and SJ helped write the manuscript and MM mentored the edition of the final version. All authors read and approved the final manuscript

Conflict of Interest Disclosures

All the authors have no conflicts of interest.

Ethics Approval

The current study was approved by the Isfahan University of Medical Sciences Ethics Committee with the code of IR.MUI.MED.REC.1400.800.

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