Since January 2020 Elsevier has created a COVID-19 resource centre with free information in English and Mandarin on the novel coronavirus COVID-19. The COVID-19 resource centre is hosted on Elsevier Connect, the company's public news and information website.

American Journal of Emergency Medicine 46 (2021) 520–524

Contents lists available at ScienceDirect

American Journal of Emergency Medicine

journal homepage: www.elsevier.com/locate/ajem

Association between COVID-19 diagnosis and presenting chief complaint from New York City triage data

Christopher T. Clifford [a,*], Trevor R. Pour [a], Robert Freeman [b], David L. Reich [d], Benjamin S. Glicksberg [c], Matthew A. Levin [d], Eyal Klang [b]

[a] Department of Emergency Medicine, Icahn School of Medicine at Mount Sinai, New York, USA
[b] Institute for Healthcare Delivery Science, Department of Population Health Science and Policy, Icahn School of Medicine at Mount Sinai, New York, USA
[c] The Hasso Plattner Institute of Digital Health at Mount Sinai, Department of Genetics and Genomic Sciences, Icahn School of Medicine at Mount Sinai, New York, USA
[d] Department of Anesthesiology, Perioperative and Pain Medicine, Icahn School of Medicine at Mount Sinai, New York, USA

ARTICLE INFO

Article history:
Received 1 August 2020
Received in revised form 1 November 2020
Accepted 2 November 2020

ABSTRACT

Background and aim: New York City (NYC) is an epicenter of the COVID-19 pandemic in the United States. Proper triage of patients with possible COVID-19 via chief complaint is critical but not fully optimized. This study aimed to investigate the association between presentation by chief complaints and COVID-19 status.
Methods: We retrospectively analyzed adult emergency department (ED) patient visits from five different NYC hospital campuses from March 1, 2020 to May 13, 2020 of patients who underwent nasopharyngeal COVID-19 RT-PCR testing. The positive and negative COVID-19 cohorts were then assessed for different chief complaints obtained from structured triage data. Sub-analysis was performed for patients older than 65 and within chief complaints with high mortality.
Results: Of 11,992 ED patient visits who received COVID-19 testing, 6524/11992 (54.4%) were COVID-19 positive. 73.5% of fever, 67.7% of shortness of breath, and 65% of cough had COVID-19, but others included 57.5% of weakness/fall/altered mental status, 55.5% of glycemic control, and 51.4% of gastrointestinal symptoms. In patients over 65, 76.7% of diarrhea, 73.7% of fatigue, and 69.3% of weakness had COVID-19. 45.5% of dehydration, 40.5% of altered mental status, 27% of fall, and 24.6% of hyperglycemia patients experienced mortality.
Conclusion: A novel high risk COVID-19 patient population was identified from chief complaint data, which is different from current suggested CDC guidelines, and may help triage systems to better isolate COVID-19 patients. Older patients with COVID-19 infection presented with more atypical complaints warranting special consideration. COVID-19 was associated with higher mortality in a unique group of complaints also warranting special consideration.

1. Introduction

New York City recorded its first case of COVID-19 on March 1, 2020 and quickly became a national epicenter for the disease [1]. As of May 13, 2020, New York state not only had more cases than any other state in the US but also had more cases than any other nation [1].

Presentation and symptomatology of COVID-19 disease has been researched extensively in the Chinese population as shown in the WHO-China joint report that analyzed 55,924 Chinese COVID-19 cases [2]. Yet, the same level of analysis has not been published for the US population.

Emergency Departments (EDs) in the US use a triage system that centers on the Emergency Severity Index (ESI) to risk stratify patients, a large component of which relies on the chief complaint. Most EDs have been relying on the recommended CDC screening tools to help triage COVID-19 patients which is also largely based on the chief complaint. These guidelines highlight the common complaints to be: fever (83–99%), cough (59–82%), fatigue (44–70%), anorexia (40–84%), shortness of breath (31–40%), sputum production (28–33%), and myalgias (11–35%) [3]. However, much of this data was obtained from early infection cases in Chinese populations. Early evidence from the US shows that chief complaints can vary widely for patients presenting to the ED with COVID-19. Two large scale studies from the New York metropolitan area showed fever on presentation in only 32.1% and 25.5%, respectively [4,5].

* Corresponding author at: 1468 Madison Ave, New York, NY 10029, USA.
E-mail addresses: Christopher.clifford@mountsinai.org (C.T. Clifford), Trevor.pour@mountsinai.org (T.R. Pour), Robert.freeman@mountsinai.org (R. Freeman), David.reich@mountsinai.org (D.L. Reich), Benjamin.glicksberg@mssm.edu (B.S. Glicksberg), Matthew.levin@mssm.org (M.A. Levin), Eyal.klang@mountsinai.org (E. Klang).

https://doi.org/10.1016/j.ajem.2020.11.006
0735-6757/

Knowing the common ED chief complaints for COVID-19 patients in the US population has the potential to improve resource utilization and through-put operations while reducing infection risk for patients and staff. This study aimed to investigate the association between different triage chief complaints and COVID-19 status by retroactively looking at a large set of COVID-19 RT-PCR testing done in the ED.

2. Methods

2.1. Study outline

This was an observational multicenter retrospective study conducted at Mount Sinai Helath System in New York City. We retrieved adult ED visits (structured data) of patients who underwent nasopharyngeal swab RT-PCR testing from March 1, 2020 to May 13, 2020. The data were further analyzed as it relates to the patients age, sex, race, comorbidities, and outcomes of admission (intubation and mortality).

2.2. Study setting

The institutional review board (IRB) approved the use of patient data for this study and waived the requirement for informed consent. The study was conducted at the Mount Sinai Health System in New York City. Data were retrieved from five hospital campuses (Mount Sinai Hospital, Mount Sinai Brooklyn, Mount Sinai Queens, Mount Sinai Morningside and Mount Sinai West). We retrieved data for all patients who presented to the EDs and were tested in the ED for COVID-19 using nasopharyngeal swab real time polymerase chain reaction (RT-PCR) test. The study time frame was between March 1, 2020 and May 13, 2020.

Table 1
Demographics, comorbidity profile, and outcomes of COVID-19 positive and negative patients.

	COVID-19 positive (n = 6524, 54.4%)	COVID-19 negative (n = 5468, 45.6%)	P value
Demographics:			
Age, median (IQR), y	62.0 (49.0–74.0)	54.0 (35.0–69.0)	<0.001
Male, N. (%)	3619 (55.5)	2651 (48.5)	<0.001
African American, N. (%)	1697 (26.0)	1583 (29.0)	<0.001
Caucasians, N. (%)	1525 (23.4)	1625 (29.7)	<0.001
Comorbidities:			
HTN, N. (%)	3594 (55.1)	2332 (42.6)	<0.001
CAD, N. (%)	1048 (16.1)	747 (13.7)	<0.001
DM, N. (%)	2402 (36.8)	1295 (23.7)	<0.001
CHF, N. (%)	662 (10.1)	598 (10.9)	0.169
CKD, N. (%)	921 (14.1)	577 (10.6)	<0.001
COPD, N. (%)	453 (6.9)	484 (8.9)	<0.001
Asthma, N. (%)	27 (0.4)	72 (1.3)	<0.001
Obesity, N. (%)	1772 (27.2)	1101 (20.1)	<0.001
Cancer, N. (%)	722 (11.1)	708 (12.9)	0.002
Smoking, N. (%)	1307 (20.0)	1567 (28.7)	<0.001
BMI, median (IQR)	27.4 (23.9–32.5)	25.9 (22.2–30.7)	<0.001
Outcomes:			
Admitted, N. (%)	4229 (64.8)	2544 (46.5)	<0.001
Mortality, N. (%)	1273 (19.5)	206 (3.8)	<0.001
Intubation and MV, N. (%)	1021 (15.6)	226 (4.1)	<0.001
Mortality / Intubation and MV, N. (%)	1594 (24.4)	350 (6.4)	<0.001

IQR = Interquartile range.
N. = number of patients.
% = percentage of patients.
Abbreviations: HTN = Hypertension; CAD = Coronary artery disease; DM = Diabetes mellitus; CHF = Congestive heart failure; CKD = Chronic kidney disease; COPD = Chronic obstructive pulmonary disease; BMI = Body mass index; MV = mechanical ventilation.

Structured patient data was retrieved from our electronic health record system, specifically Epic (Epic Systems Corporation, Verona, WI), and included demographics, known comorbidities from ICD codes, and intubation/mortality outcomes. Obesity was defined as body mass index (BMI) over 30 kg/m^2. Smoking was defined as a record of either past or present smoking [6].

All chief complaints are recorded by the triage nurse as structured data from a list of complaints. Patients can have more than one recorded chief complaint.

2.3. Statistical analysis

The analysis was performed with Python (ver. 3.6.5). A p-value of <0.05 was considered statistically significant. Categorical variables were compared using Chi square test. Continuous variables were compared using Student's t-test.

3. Results

Overall, during the study period, 50,115 ED visits were recorded. Of those, 11,992 visits (23.9%) were of patients who underwent RT-PCR testing. These visits corresponded to 11,477 patients, with 515 repeat ED visits. 54.4% of the RT-PCR tests were COVID-19 positive and 45.6% were COVID-19 negative. We present the demographics, comorbidity profile, and outcomes of the COVID-19 positive and negative patients who presented to the ED in Table 1.

Table 2 shows the percentages of positive COVID-19 test compared to different categories of complaints, prevalence of complaint, and age. 73.5% of fever (95% CI: 71.8% - 75.2%), 67.7% (95% CI: 66.1% - 69.3%) of shortness of breath, and 65% (95% CI: 63.1% - 66.9%) of cough were COVID-19 positive. Other notable complaints were 57.5% (95% CI: 55.2% - 59.8%) of weakness/fall/altered mental status, 52.2% (95% CI: 49.6% - 54.8%) of other viral symptoms, and 51.4% (95% CI, 47.6% - 55.2%) of gastrointestinal symptoms were COVID-19 positive. A more detailed breakdown of which chief complaints fell into each category can be seen in the appendix area (Appendix A, Table 5).

Table 3 shows a sub analysis of the most common chief complaints (cut off N of 15) in patients older than 65. Again, respiratory, fever, and viral symptom chief complaints showed strong correlation with COVID-19 positivity. However, certain unique chief complaints were strongly correlated with COVID-19 positivity. These included altered

Table 2
Categories of chief complaints.

Grouping	# of patients with chief complaint (%)	Covid-19 positive (%)	Mean age
Fever	2649/16867 (15.7%)	1947/2649 (73.5%)	57.5
Shortness of breath	3094/16867 (18.3%)	2095/3094 (67.7%)	64.2
Cough	2444/16867 (14.5%)	1588/2444 (65.0%)	56.3
Weakness/Fall/AMS	1843/16867 (10.9%)	1059/1843 (57.5%)	72.2
Endocrine	128/16867 (0.8%)	71/128 (55.5%)	63.1
Other viral symptoms	1434/16867 (8.5%)	748/1434 (52.2%)	50.6
GI	654/16867 (3.9%)	336/654 (51.4%)	59.2
GU	44/16867 (0.3%)	21/44 (47.7%)	64.3
CNS[1]	152/16867 (0.9%)	47/152 (30.9%)	60.4
Chest pain	570/16867 (3.4%)	176/570 (30.9%)	55.8
Abdominal pain	588/16867 (3.5%)	179/588 (30.4%)	56.2
Orthopedic	325/16867 (1.9%)	93/325 (28.6%)	60.4
Psychiatric/Substance abuse	235/16867 (1.4%)	26/235 (11.1%)	48

Abbreviations: AMS = alerted mental status; GI = gastrointestinal; GU = genitourinary; CNS = central nervous system.
[1] CNS is comprised of neurological deficit and CVA, stroke-like symptoms, and seizures.

Table 3
Chief complaints of elderly patients.

Chief complaint (# of patients)	Mean age	% COVID-19 positive	% Mortality	% Mortality or Intubation/MV
CARDIAC ARREST (28)	81.5	35.7%	100.0%	100.0%
LEG SWELLING (30)	81.0	16.7%	0.0%	0.0%
RESPIRATORY DISTRESS (156)	80.3	79.5%	76.6%	85.5%
FALL (207)	79.9	46.9%	32.0%	34.0%
ALTERED MENTAL STATUS (386)	79.6	64.5%	49.8%	52.6%
TACHYCARDIA (18)	79.0	55.6%	50.0%	60.0%
ABDOMINAL PAIN (172)	78.7	34.3%	10.2%	11.9%
LETHARGY (18)	78.5	61.1%	27.3%	27.3%
HIP PAIN (19)	78.4	36.8%	0.0%	14.3%
HYPOTENSION (45)	78.4	53.3%	33.3%	33.3%
DIARRHEA (103)	77.8	76.7%	21.5%	22.8%
WEAKNESS (387)	77.7	69.3%	34.3%	35.8%
ABNORMAL RESULTS (56)	77.5	41.1%	30.4%	30.4%
FATIGUE (95)	77.3	73.7%	30.0%	30.0%
LEG PAIN (27)	77.2	18.5%	60.0%	60.0%
HYPERGLYCEMIA (45)	77.1	62.2%	35.7%	39.3%
SHORTNESS OF BREATH (1324)	76.6	72.8%	42.8%	46.1%
DIZZINESS (81)	76.5	55.6%	17.8%	20.0%
POSSIBLE PNEUMONIA (29)	76.3	93.1%	33.3%	37.0%
SYNCOPE (82)	76.1	53.7%	18.2%	18.2%
CHILLS (31)	76.0	64.5%	20.0%	20.0%
VOMITING (78)	75.9	41.0%	18.8%	25.0%
BACK PAIN (33)	75.8	36.4%	16.7%	25.0%
FEVER (860)	75.4	84.8%	30.5%	34.2%
NEUROLOGICAL DEFICIT AND CVA (36)	75.2	30.6%	45.5%	63.6%
PAIN (18)	75.0	27.8%	0.0%	0.0%
RECTAL BLEEDING (20)	74.9	35.0%	14.3%	14.3%
COUGH (660)	74.8	80.8%	25.5%	28.9%
CHEST PAIN (179)	74.6	35.8%	15.6%	15.6%
SORE THROAT (21)	73.5	61.9%	23.1%	23.1%
GENERALIZED BODY ACHES (43)	73.1	76.7%	24.2%	27.3%
NAUSEA (36)	73.1	55.6%	15.0%	20.0%
SEIZURES (33)	73.0	36.4%	41.7%	41.7%
PALPITATIONS (19)	72.7	15.8%	33.3%	33.3%
URI (29)	72.5	69.0%	10.0%	15.0%
FLU SYMPTOMS (38)	72.4	79.0%	23.3%	26.7%
HEADACHE (30)	71.9	76.7%	13.0%	17.4%
ASTHMA (19)	69.2	52.6%	50.0%	50.0%

Table 4
Chief complaints associated with highest percentage of death or intubation/mechanical ventilation.

Chief Complaint (# of patients)	Mean age	% COVID-19 positive	% Mortality	% Mortality or Intubation/MV
Cardiac arrest (36)	72.1	47.2%	82.4%	94.1%
Respiratory distress (209)	73.1	76.1%	67.9%	81.1%
Dehydration (17)	81.4	64.7%	45.5%	54.5%
Hematemesis (15)	64.5	13.3%	50.0%	50.0%
Altered mental status (497)	75	60.6%	40.5%	48.5%
Neurological deficit and CVA (61)	61.8	34.4%	23.8%	42.9%
Hip pain (23)	76.6	34.8%	12.5%	37.5%
Hypotension (68)	66.6	60.3%	34.1%	34.1%
Shortness of breath (2885)	63.6	67.1%	27.2%	33.7%
Hypoglycemia (21)	67.3	71.4%	26.7%	33.3%
Medical device issue (21)	71.1	42.9%	22.2%	33.3%
Hyperglycemia (107)	62.3	53.3%	24.6%	33.3%
Tachycardia (28)	63.4	57.1%	25.0%	31.2%
Fall (245)	77.2	45.3%	27.0%	30.6%
Seizures (81)	58.3	28.4%	17.4%	30.4%
Hemoptysis (15)	52.2	66.7%	20.0%	30.0%

mental status at 64.5% (95% CI: 59.7% - 69.3%), diarrhea at 76.7% (95% CI: 68.5% - 84.9%), weakness at 69.3% (95% CI: 64.7% - 73.9%), fatigue at 73.7% (95% CI: 64.8% - 82.6%), hyperglycemia at 62.2% (95% CI: 48.0% - 76.4%).

Table 4 shows the chief complaints (cut off N of 15) with the highest percentage of mortality and/or intubation/mechanical ventilation (MV) for the entire cohort. Cardiac arrest and respiratory distress were associated with the highest percentage of mortality and/or intubation/MV by a significant margin at 94.1% (95% CI: 86.4% - 100.0%) and 81.1% (95% CI: 75.8% - 86.4%). Other complaints with associated high mortality and/or intubation/MV with high COVID-19 positivity included: dehydration with 54.5% (95% CI: 30.8% - 78.2%) mortality or intubation/MV, and altered mental status with 48.5% (95% CI: 44.1% - 52.9%) mortality or intubation/MV.

14/16 of the complaints had over 30% COVID positivity, hematemesis and seizure being the exceptions. Mean age in this high mortality group trended toward an older demographic with mean age being over 60 years old in 14/16 complaints, seizures at 58.3 and hemoptysis at 52.2 being the exceptions.

4. Discussion

Triaging patients with possible COVID-19 via chief complaint is not yet fully optimized and mainly relies on the suggested CDC screening guidelines [3]. In this study, we analyzed triage complaints in a large cohort of patients tested for COVID-19 in a NYC health system. We have shown that COVID-19 patients presented with a spectrum of complaints, with particular variety in the elderly population.

Overall, 6524 / 11,992 (54.4%) tested patients were COVID-19 positive. Published prevalence of positive community testing in March of 2020 in New York was roughly 33% [7]. This discrepancy is likely from COVID-19 patients seeking care at hospitals and therefore concentrating the prevalence.

Certain groups of complaints had higher and lower correlations with a COVID-19 positive status. Fever, shortness of breath, cough, and viral symptoms were very likely to be COVID-19 positive which is consistent with prior evidence [4,8,9], [10,11].

Yet, a separate grouping of high risk COVID-19 patients presented itself in the data such as: weakness/fall/AMS, endocrine, gastrointestinal symptoms, and genitourinary symptoms.

The weakness/fall/AMS category having a high percentage of COVID-19 positive patients is fairly novel. One recent case series described four elderly patients presenting with AMS [12] and one early study from China showed confusion in 9% of patients [8]. Some anecdotal evidence of US doctors warning the public of elderly patients having symptoms of confusion and AMS has been published [13]. Whether this change in cognition is a problem from global disease (e.g. hypoxia), change in social situation (e.g. poor nutrition intake), or a potential neuroinvasive property of the virus is yet to be determined.

The endocrine grouping (hypoglycemia and hyperglycemia) being associated with COVID-19 has some supporting evidence. One early Chinese study (Jan 2020) showed 52% hyperglycemia and 1% hypoglycemia on admission [8]. Hyperglycemia at admission has been shown to be a bad prognostic factor in COVID-19 and has been postulated that it is marker for increased inflammatory mediators [14]. One study even showed hyperglycemia on day −1 to be the best predictor of radiographic imaging of SARS-CoV2 regardless of past medical history of diabetes [15]. No definitive link between hypoglycemia and COVID-19 has been published and further research is needed.

GI symptoms have been debated in past papers. Some early Chinese papers (Jan 2020) showed <5% GI symptoms on presentation for COVID infection [8,16] while other papers showed ⅓ to ½ GI symptoms on presentation [17,18]. Our GI complaint category showed 51.4% COVID-19 positivity which was higher compared to prior papers. This difference in prevalence needs to be further studied but could be from early data

being underpowered as well as early testing being too focused on a respiratory virus and therefore not explicitly assessing GI complaints.

The genitourinary category has very little evidence and is fairly novel. Dysuria has been shown to be a presenting complaint for COVID-19 in case studies but seems to be atypical [19]. Having a relatively low patient population that presented with GU symptoms (44/16867) is a potential limitation in our data.

Less frequent COVID-19 positivity was shown in complaints related to central nervous system, chest pain, abdominal pain, orthopedics, and psychiatric/substance abuse. Some CNS complaints such as large-vessel stroke in the young, have been shown to have association with COVID-19 but seems to be a relatively rare complication [20]. Chest pain, abdominal pain, orthopedic complaints, and psychiatric/substance abuse have not shown to have a particular relationship with COVID-19.

These results described in Table 2 have significant real-world implications. Since the CDC triage guidelines highlight shortness of breath, cough, and fever as the top symptoms to screen for, many EDs have created respiratory pods as their high risk COVID-19 areas [3]. It may be worth considering the creation of an intermediate risk pod for patients that present with other moderate-high risk categories that are not respiratory related. The low risk categories could then be separated in their own pod as well to prevent them from catching the virus from other patients. Waiting for patients to develop classic COVID-19 symptoms such as cough and fever could also possibly delay treatment and increase spread of infection if the patient is sent home, especially to a communal living situation. One important caveat with this recommendation is that our data was collected during a time of high COVID-19 prevalence in our community, so these practices may only be extrapolated if similar prevalence is present.

Chief complaints with a higher percentage of COVID-19 positive patients in the older demographic included common complaints such as fever, shortness of breath and viral symptoms, but also included certain unique complaints such as alerted mental status, diarrhea, weakness, fatigue, and hyperglycemia. Currently there are no studies on presenting complaints of elderly patients with COVID-19. It is important for physicians in the ED to test elderly patients for COVID-19 if they present with atypical chief complaints as described above in order to reduce spread of the disease amongst a vulnerable population and increase quality of care.

In our cohort, some complaints with high mortality and/or intubation/mechanical ventilation (MV) and high COVID-19 positivity were expected such as cardiac arrest and respiratory distress. However, the data also highlighted a group of unique complaints that had high mortality and/or intubations/MV and high COVID-19 positivity. Such examples include dehydration, altered mental status, hypotension, hypoglycemia, hyperglycemia, tachycardia, and fall. Morbidity and mortality based on chief complaint is a difficult topic to study and has limited evidence [21]. However, physicians and triage systems should pay special attention to these high mortality presentations and prioritize their care in order to effectively care for mass amounts of patients that present during a pandemic.

There were many complaints not included in the results section since they had small N values (Appendix B, Table 6). It is possible that these complaints are too underpowered to make any significant conclusions from. However, a large data set such as this may be the only way to capture outliers with small N values and could yield ideas for future studies.

Research on COVID-19 is still early and rapidly evolving. Many communities around the US have not had enough cases to adequately conduct high powered research. With the US seeing a consistent rise in cases in almost every state, it is clear that the COVID-19 pandemic will be a problem for the immediate future [22]. Thus, research from the New York area about COVID-19 is highly valuable so other affected communities may learn how to better their response efforts. The chief complaint is pivotal for triaging ED patients, especially in the era of COVID, and thus should be further optimized.

5. Limitations

Approximately 13.4% of our total visits were complaints of "unspecified" or "other". The chief complaint is put in the computer by the initial triage nurse at the front of the ED. When the chief complaint is unable to be determined (e.g. non-verbal patient, chief complaint not otherwise found in our systems selections, too many complaints, etc) then the patient is given an "unspecified" or "other" label so that they can continue to move along the process and see a physician. A certain level of unspecified and other categories is therefore inevitable in any triage data. This reflects the real-life scenario of a stressed triage system in a time of a pandemic.

There was likely a testing bias for patients that were sick enough to be admitted to the hospital as our health system was initially discouraged by the New York State Department of Health from testing patient with mild to moderate symptoms. There is also the fact that our COVID-19 test likely has a false negative rate, which at this time is largely unknown.

Lastly, ED visits in the US dropped during the peak of the New York COVID-19 outbreak by 42% according to the CDC. This likely skewed our data away from certain complaints toward respiratory chief complaints. Therefore, our data may not be able to be extrapolated to communities that are not experiencing similar parameters.

6. Conclusion

A novel high risk COVID-19 patient population was identified from chief complaint data which warrants a potential change in triage systems to better isolate COVID-19 patients from non-COVID-19 patients. Older patients with COVID-19 infection presented with more atypical complaints which warrants physicians taking special precautions in this population. COVID-19 was associated with higher mortality in a unique group of complaints which warrants physicians giving special consideration to these presentations.

Acknowledgments

N/A.

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

Author contributions

Concept and design: CC, TP, RF, DR, BG, ML, EK.
Acquisition of data: EK.
Analysis and interpretation: CC, TP, EK.
Drafting the manuscript: CC.
Critical revision: CC, TP, RF, DR, BG, ML, EK.
Statistical expertise: EK.
Acquisition of funding: N/A.

Declaration of Competing Interest

None.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.ajem.2020.11.006.

References

[1] New York State Department of Health. NYSDOH COVID-19 Tracker. https://covid19tracker.health.ny.gov/views/NYS-COVID19-Tracker/NYSDOHCOVID-19Tracker-Map?%3Aembed=yes&%3Atoolbar=no&%3Atabs=n; 2020. Accessed July 27, 2020.

[2] World Health Organization. Report of the WHO-China Joint Mission on Coronavirus Disease 2019 (COVID-19). Feb 28, https://www.who.int/docs/default-source/coronaviruse/who-china-joint-mission-on-covid-19-final-report.pdf; 2020.
[3] Centers for Disease Control and Prevention. Clinical Care Guidance. https://www.cdc.gov/coronavirus/2019-ncov/hcp/clinical-guidance-management-patients.html; 2020. Accessed July 27, 2020.
[4] Richardson S, Hirsch JS, Narasimhan M, Crawford JM, McGinn T, Davidson KW, et al. Presenting characteristics, comorbidities, and outcomes among 5700 patients hospitalized with COVID-19 in the New York City area. JAMA. 2020;323(20):2052–9.
[5] Goyal P, Choi JJ, Pinheiro LC, Schenck EJ, Chen R, Jabri A, et al. Clinical characteristics of Covid-19 in New York City. N Engl J Med. 2020;382:2372–4.
[6] Klang E, Kassim G, Soffer S, Freeman R, Levin M, Reich D. Morbid obesity as an independent risk factor for COVID-19 mortality in hospitalized patients younger than 50. Obesity. 2020;28(9):1595–9.
[7] Rosenberg ES, Dufort EM, Blog DS, Hall EW, Hoefer D, Backenson BP, et al. COVID-19 testing, epidemic features, hospital outcomes, and household prevalence, New York State-March 2020. Clin Infect Dis. 2020;71(8):1953–9. https://doi.org/10.1093/cid/ciaa549.
[8] Chen N, Zhou M, Dong X, Qu J, Gong F, Han Y, et al. Epidemiological and clinical characteristics of 99 cases of 2019 novel coronavirus pneumonia in Wuhan, China: a descriptive study. Lancet. 2020;395(10223):507–13.
[9] Suleyman G, Fadel RA, Malette KM, Hammond C, Abdulla H, Entz A, et al. Clinical characteristics and morbidity associated with coronavirus disease 2019 in a series of patients in metropolitan Detroit. JAMA Netw Open. 2020;3(6):e2012270.
[10] Argenziano MG, Bruce SL, Slater CL, Tiao JR, Baldwin MR, Barr RG, et al. Characterization and clinical course of 1000 patients with coronavirus disease 2019 in New York: retrospective case series. BMJ. 2020;369:m1996.
[11] Zhu W, Xie K, Lu H, Xu L, Zhou S, Fang S. Initial clinical features of suspected coronavirus disease 2019 in two emergency departments outside of Hubei. China J Med Virol. 2020;92(9):1525–32.
[12] Ward CF, Figiel GS, McDonald WM. Altered mental status as a novel initial clinical presentation for COVID-19 infection in the elderly. Am J Geriatr Psychiatry. 2020;28(8):808–11.
[13] Graham J. Seniors with COVID-19 show unusual symptoms. Doctors Say Kaiser Health News; 2020.
[14] Ceriello A. Hyperglycemia and the worse prognosis of COVID-19. Why a fast blood glucose control should be mandatory Diabetes. Res Clin Pract. 2020;163:108186.
[15] Iacobellis G, Penaherrera CA, Bermudez LE, Bernal Mizrachi E. Admission hyperglycemia and radiological findings of SARS-CoV2 in patients with and without diabetes. Diabetes Res Clin Pract. 2020;164:108185.
[16] Huang C, Wang Y, Li X, Ren L, Zhao J, Hu Y, et al. Clinical features of patients infected with 2019 novel coronavirus in Wuhan, China. Lancet. 2020;395(10223):497–506.
[17] Zhang Y, Zhang X, Liu L, Wang H, Zhao Q. Suggestions for infection prevention and control in digestive endoscopy during current 2019-nCoV pneumonia outbreak in Wuhan, Hubei province, China. Endoscopy. 2020;52(4):312–4.
[18] Cholankeril G, Podboy A, Aivaliotis VI, Tarlow B, Pham EA, Spencer S, et al. High prevalence of concurrent gastrointestinal manifestations in patients with SARS-CoV-2: early experience from California. Gastroenterology. 2020;159(2):775–7.
[19] Zhang Q, Douglas A, Abideen ZU, Khanal S, Tzarnas S. Novel coronavirus (2019-nCoV) in disguise. Cureus. 2020;12(4):e7521.
[20] Oxley TJ, Mocco J, Majidi S, Kellner CP, Shoirah H, Singh IP, et al. Large-vessel stroke as a presenting feature of Covid-19 in the young. N Engl J Med. 2020;382(20):e60.
[21] Forberg JL, Barfod C. Emergency Department presenting complaints associated with high mortality and the need for intensive care. Scand J Trauma, Resuscitation Emerg Med. 2012;20(S2) P16.
[22] John Hopkins University. COVID-19 United States Cases by County. https://coronavirus.jhu.edu/us-map; 2020. Accessed July 27, 2020.