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ORIGINAL RESEARCH ARTICLE

COVID-19: Epidemiological and clinical characteristics in Morocco

Mounia Es-sarhir*, Abdelhalem Mesfioui, Hinde Hami

Laboratory of Biology and Health, Ibn Tofail University, Kenitra 14000, Morocco

*** Corresponding author:** Mounia Es-sarhir, mounia.essaghir@uit.ac.ma

ABSTRACT

Introduction: Since the identification of the novel coronavirus disease associated with severe acute respiratory syndrome in December 2019 in Wuhan, China, it has rapidly disseminated globally, resulting in the onset of a severe respiratory illness known as COVID-19. Notably, the SARS-CoV-2 virus exhibits the capacity to induce multi-organ involvement, including the central and peripheral nervous systems in certain individuals. Consequently, a diverse array of neurological manifestations stemming from SARS-CoV-2 infection has been recognized. This study aims to discern the epidemiological characteristics of COVID-19 and explore its various clinical manifestations within the context of Morocco. **Materials and Methods:** Our retrospective epidemiological study spanned a 5-month period from April to August 2020. Employing a comprehensive data collection methodology, we sought to amass detailed information to comprehensively grasp various facets of the phenomenon under investigation. **Results**: In our investigation, Kenitra Provincial Hospital admitted 658 cases to the COVID-19 isolation unit, with 309 cases testing positive. The average age of hospitalized individuals during this period was 34.75, ranging from 1 to 86 years. Notably, females exhibited a higher susceptibility to COVID-19. Upon analyzing the clinical manifestations observed during COVID-19 infection, neurological manifestations were particularly noteworthy. Specifically, 54.04% of SARS-CoV-2 cases experienced ageusia, 53.39% presented with anosmia, and 43.36% suffered from headaches. These neurological symptoms ageusia, anosmia and headaches emerged as the most prevalent among confirmed COVID-19 patients, suggesting their specificity to this particular disease. **Conclusion:** COVID-19 is capable of inducing severe respiratory complications, and the implicated virus can precipitate multi-organ failure, including neurological manifestations. In accordance with our study and relevant literature, anosmia and ageusia appear to be distinctive symptoms of COVID-19. Intriguingly, women seem to exhibit a greater susceptibility to the loss of smell and taste than men, a phenomenon that warrants further investigation.

Keywords: Anosmia; Ageusia

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1. Introduction

The novel COVID-19 is a highly transmissible infectious disease caused by the coronavirus 2019-nCoV, also recognized as SARS-CoV-2 by the International Committee on Taxonomy of Viruses[1] (ICTV). Its emergence dates back to December 2019 in Wuhan, Hubei province, China, where patients presented severe and unexplained pneumonia[2]. Consequently, on January 30, 2020, the World Health Organization (WHO) declared the outbreak a global public health emergency, later classifying it as a global pandemic[3]. As of June 29, 2020, the worldwide confirmed COVID-19 cases totaled 12,552,765, with 561,617 deaths[3]. In Morocco, by April 25, 2020, there were 3,897 confirmed cases, 159 deaths, and 537 recoveries reported by the Ministry of Health, with 21,546 cases testing negative for COVID-19[4].

In February 2020, the new virus received its official taxonomic name, Coronavirus Type 2, associated with Severe Acute Respiratory Syndrome (SARS), leading to the nomenclature COVID-19 (Coronavirus Disease 2019). This nomenclature stems from genetic similarities with the first SARS-CoV discovered in Guangdong, China, which caused a pandemic in 2002-2003. This marks the third global health threat related to a coronavirus in less than two decades, following SARS-CoV-1 and MERS-CoV in 2012 in the Arabian Peninsula, both affecting the respiratory system and causing often fatal respiratory distress syndromes[5]. The rapid global spread of the new coronavirus poses a significant threat to public health, prompting researchers in China to isolate the pathogen in January 2020, initiating extensive research into its nature, structure, and clinical manifestations.

Symptomatically, COVID-19 was initially characterized by respiratory involvement, encompassing an infectious syndrome with symptoms such as asthenia, fever, cough, and dyspnea that could progress to acute respiratory distress syndrome (ARDS), with distinctive lung abnormalities evident on CT scans[6]. However, it has been reported that COVID-19 patients may manifest neurological symptoms independently of respiratory issues. Despite being relatively understudied or studied in small patient cohorts, these neurological manifestations can be categorized into two groups: those affecting the peripheral nervous system (PNS) and those affecting the central nervous system (CNS).

The coronavirus pandemic, attributed to Severe Acute Respiratory Syndrome (SARS-CoV-2/COVID-19), stands as a global health emergency. The response to this emergency involves the swift reorganization of healthcare services to reinforce COVID-19 infection control measures. This study seeks to delineate the epidemiological characteristics of COVID-19 and its diverse clinical manifestations in Morocco, with the overarching objective of enhancing their recognition in clinical diagnosis. To achieve this, we aimed to characterize the incidence of neurological manifestations among confirmed positive patients hospitalized in the COVID-19 unit.

2. Materials and methods

This retrospective descriptive study focuses on suspected or confirmed cases of COVID-19 admitted to El Idrissi Hospital in Kenitra from April 1, 2020, to August 31, 2020. Initiated shortly after the onset of the pandemic as part of the early screening efforts by the Moroccan Ministry of Public Health, the study encompasses 5 months, capturing the immediate aftermath of the pandemic's emergence. Out of the cases under scrutiny, 309 were confirmed positive; while 349 tested negative. The diagnostic confirmation of COVID-19 relied on the Reverse Transcription Polymerase Chain Reaction (RT-PCR) test for SARS-CoV-2 conducted on nasopharyngeal swabs. This technique, which detects SARS-CoV-2 RNA, was complemented by radiological examinations, notably thoracic computed tomography (CT) scans, owing to their diagnostic efficacy in revealing characteristic COVID-19 lesions[3].

The data collection methodology employed aimed to gather comprehensive information for a nuanced understanding of the phenomenon under investigation. Access to the archive of medical records of patients admitted to the COVID-19 isolation unit facilitated categorization based on study months. Despite the inherent risk of contamination, requisite precautions were implemented. The extracted information from medical records enabled the determination of demographic details, including gender and age, as well as personal and family medical histories, clinical manifestations, neurological symptoms, duration of symptom evolution, results of pulmonary radiology and thoracic CT scans, and laboratory findings (PCR).

Following data collection, a descriptive analysis of all variables was executed, with presentation through summary tables and graphs. Excel spreadsheets were utilized for data tabulation and graph configuration, and SPSS 17.0 software facilitated comprehensive data analysis.

Study limitations

Our research centered on patients admitted to Idrissi Kenitra Hospital, specifically within the COVID-19 isolation unit, encompassing both suspected and confirmed positive cases. However, several challenges were encountered, including incomplete medical records lacking essential information on patient management. The study was further constrained by a limited number of cases, and difficulties accessing the isolation unit due to contamination risks. Additionally, the absence of post-treatment follow-up posed limitations in assessing the long-term outcomes and recovery trajectories of the studied cases.

3. Results

3.1. Epidemiological data

Number of cases Hospitalized at Idrissi Hospital in the COVID-19 isolation unit over the five months of the study

The provincial hospital in Kenitra accommodated a total of 658 cases in the COVID-19 isolation unit, stratified between suspected and confirmed positive cases. Notably, the study period witnessed 309 individuals affected by the virus, with confirmed positive cases comprising 46.96% of this cohort. The distribution of these positive cases unfolded over five months.

In April, the hospital admitted 83 cases, constituting 12.6% of the total, with 19 confirmed positive cases through PCR testing, representing 6.14% of the SARS-CoV-2-infected patients. May exhibited a notable surge in hospital admissions, with 187 cases (28.4% of the total), including 25 confirmed positive cases (8.09%). June continued the upward trend, admitting 183 cases (27.8%), with 118 patients testing seropositive, accounting for 38.18%.Contrastingly, July witnessed a decline in admissions to the isolation unit, with a total of 44 cases, of which 19 were confirmed positive through PCR testing, constituting 6.14% of the total positive cases. August marked resurgence, with the hospital receiving 161 cases, of which 128 were virus-affected, representing 41.42% of the total (**Figure 1**).

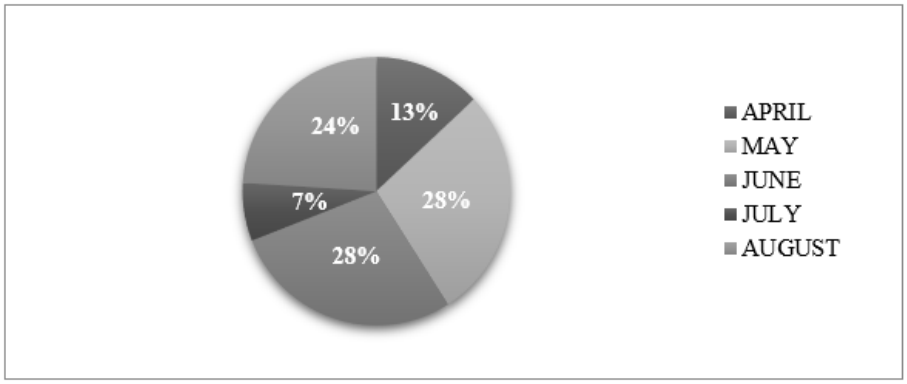

Figure 1. Distribution of the number of hospitalized cases by month.

a. Distribution of cases by age:

Based on the collated dataset, the mean age of patients admitted to the COVID-19 unit at Idrissi Hospital throughout the comprehensive study duration was determined to be 34.75 years, exhibiting a range spanning from 1 to 86 years. The patient demographic was categorized into distinct age brackets: 0–15 years, 15–30 years, 30–45 years, 45–60 years, and beyond 60 years. The resultant findings are delineated as follows:

The age group encompassing 0–15 years comprised 67 cases, constituting 10.18% of the overall cohort. Within the 15–30 years age category, there were 108 patients, representing a share of 16.41%. The 30–45 years age group exhibited the highest count with 280 patients, constituting a substantial 42.55% of the total. Patients falling within the 45–60 years age range numbered 153; accounting for 23.25%. The age group

extending beyond 60 years included 50 patients, making up 7.59% of the overall population. Hence, it can be deduced that the preeminent age stratum among those admitted to the COVID-19 isolation unit is the 30–45 years group, commanding a noteworthy percentage of 42.55% (**Figure 2**).

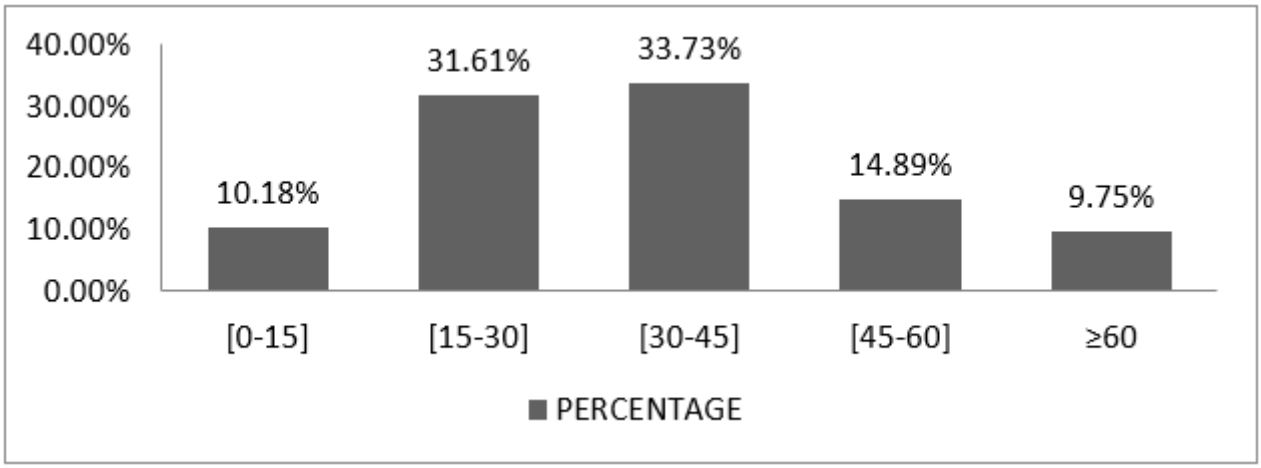

Figure 2. Distribution of Hospitalized cases by age group.

The mean age of individuals afflicted by COVID-19 is determined to be 38.15, underscoring that the age bracket most significantly impacted by the virus resides within the range of 30 to 45 years.

b. Distribution of cases by gender:

Among the cohort of 658 patients, a notable gender distribution was observed, with 380 women constituting 57.8% of the cases, and 278 men representing 42.2%. This underscores a prevailing female preponderance, as reflected in a sex ratio (female/male) in favor of women, calculated at 1.36 (**Figure 3**).

Specifically focusing on COVID-19-positive cases within the 5-month study period involving 309 confirmed patients, women exhibited a higher incidence, accounting for 61.8% (191 cases), whereas men constituted 38.1% (118 cases). Consequently, women emerge as the majority among the confirmed cases, establishing the female gender as the more prominently affected gender (**Figure 4**).

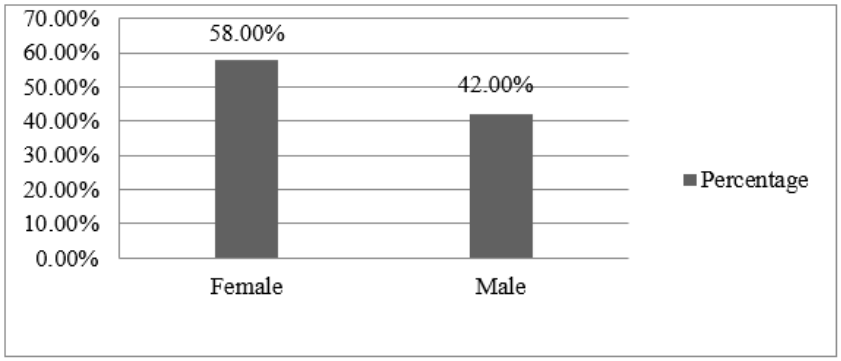

Figure 3. Distribution of Hospitalized cases by gender.

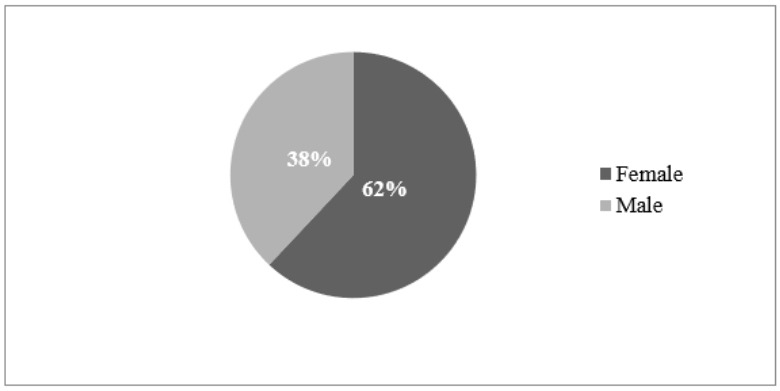

Figure 4. Positive cases by gender.

c. Pregnant cases hospitalized in the COVID-19 unit:

Within the confines of our study conducted in the COVID-19 isolation unit, subsets of 17 individuals were identified as pregnant. Notably, among these individuals, 7 tested positive for COVID-19, representing 2.26% of the aggregate of positive cases hospitalized during the study period.

d. Distribution of cases hospitalized in the COVID-19 intensive care unit (ICU) by month:

Throughout the study duration, 36 cases were admitted to the COVID-19 Intensive Care Unit (ICU). In April, 15 cases constituted 18.07% of the total monthly admissions to the COVID-19 ICU. All these cases, with an average age of 68.8, tested positive through PCR. Among them, 5 had diabetes, 2 were asthmatic, and 2 had hypertension.

In May, only 1 patient, aged 21 and without any associated conditions, was admitted to the ICU, accounting for 0.53% of the total ICU admissions. Moving to June, 5 cases were admitted to the ICU, of which 3 tested positive by PCR, making up 2.73% of the total admissions. These patients, with an average age of 54.4, had no personal medical history.

July saw 7 ICU admissions, comprising 15.9% of the total for that month. All of them tested positive, with an average age of 65. Among these, 4 had diabetes, and 3 had hypertension. In August, 8 cases were hospitalized in the COVID-19 ICU, representing 4.96% of the total admissions, with an average age of 58.8. Three of these patients had diabetes, and 2 had hypertension.

In summary, April recorded the highest number of critical cases, predominantly affecting individuals over 60 years old. The overall average age of those admitted to the COVID-19 ICU during the entire study period was 53.62, with 33 cases, or 91.66% of ICU admissions, testing positive (**Figure 5**).

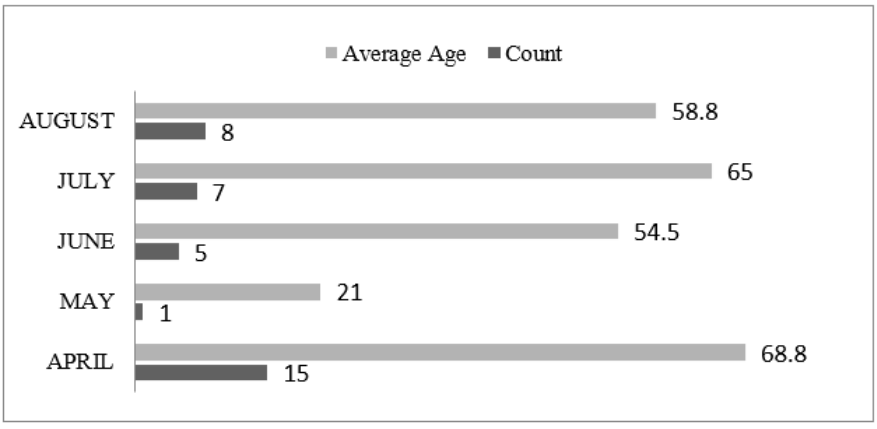

Figure 5. Distribution of Covid-19 ICU Hospitalized cases and their average by study months.

3.2. Clinical results

Personal medical history

Within the cohort of patients hospitalized in the COVID-19 isolation unit, 40 cases were identified with diabetes, constituting 6.1% of the overall hospitalized patient population. Additionally, 38 cases presented with hypertension (HTA), representing 5.7%, while 9 patients were identified as asthmatic, and accounting for 1.4% (**Table 1**).

In the context of patients admitted to the COVID-19 Intensive Care Unit (ICU), it was observed that 58.33% of these individuals had underlying medical conditions.

Table 1. Personal history.

Personal History	Diabetes	Asthma	Hypertension
Hospitalized Cases	40	9	38
Percentage	6.1%	1.4%	5.8%

Within the subset of 309 positive cases, it was determined that 28 patients presented with diabetes, constituting 9.06% of the total number of individuals affected by the virus. Moreover, 6 patients were identified as asthmatic, representing 1.94%, and 21 cases among the positive cases had hypertension (**Figure 6**).

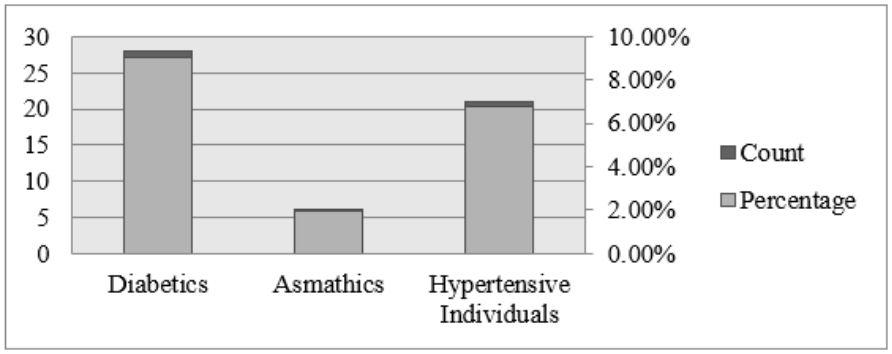

Figure 6. Distribution of positive cases based on personal history.

3.3. Clinical data

Clinical manifestations

In our comprehensive study, an analysis of various clinical forms revealed that among the hospitalized patients, 79 individuals manifested fever, accounting for 12.1% of the total patient cohort. Respiratory symptoms were prevalent, with 118 patients exhibiting a cough (17.9%), and 73 patients experiencing dyspnea (11.1%). Gastrointestinal manifestations were observed in 73 patients, with 11.1% presenting with diarrhea and 4.9% reporting vomiting.

Notably, neurological manifestations during the study period were noteworthy. Headaches and migraines were the most prevalent, with 170 patients reporting headaches (25.8%), 166 patients presenting with anosmia (25.2%), and 167 patients experiencing ageusia (25.4%). Regarding psychological manifestations, 11 cases developed signs of stress and anxiety during their hospitalization, constituting 1.7% of the total hospitalized patients.

In the subset of confirmed positive cases (309 in total), specific clinical manifestations were further delineated. Among these cases, 63 patients had a fever (20.38%), 97 exhibited a cough (31.39%), and 63 reported dyspnea (20.38%). Gastrointestinal symptoms were evident in 57 positive cases, constituting 18.44%.

The neurological manifestations observed during the study period were particularly significant. Ageusia was present in 167 cases, accounting for a substantial percentage of 54.04% of those affected by the SARS-CoV-2 virus. Anosmia was observed in 165 cases (53.39%) and 134 positive cases reported headaches (43.36%). In terms of psychological manifestations, 8 positive cases exhibited psychiatric disturbances, representing 2.58% of the confirmed cases.

From this comprehensive analysis of clinical manifestations, it is evident that neurological symptoms, specifically ageusia, anosmia, and headaches, emerge as the most prevalent among confirmed positive patients. This substantiates our research hypothesis that headaches, anosmia, and ageusia serve as specific indicators of COVID-19 (**Table 2**).

Table 2. Clinical manifestations in confirmed positive patients.

Clinical Symptoms	Fever	Cough	Dyspnea	Diarrhea	Headaches	Anosmia	Ageusia	Psychological disorders
Count	63	97	63	57	134	165	167	8
Percentage	20.38%	31.39%	20.38%	18.44%	43.36%	53.39%	54.04%	2.58%

Among the cohort of pregnant women who tested positive for COVID-19, comprising a total of 7 cases, the predominant symptom observed was headaches. A significant 58.8% of pregnant women affected reported experiencing headaches.

4. Discussion

In our retrospective descriptive study, conducted from April 2020 to August 2020, shortly after the onset of the pandemic, we identified a cohort of 658 patients hospitalized in the COVID-19 isolation unit at Idrissi Hospital in Kenitra, Morocco. Among these patients, 309 were confirmed as positive cases, constituting 47%, while 349 tested negative, making up the remaining 53% of the total. Throughout the study period, 11 deaths were recorded, resulting in a case fatality rate of 3.55%. Notably, the month of April witnessed the highest number of deaths, with 8 fatalities, representing 72.72% of the total deaths. Males exhibited a higher mortality rate, comprising 81.81% of the deceased patients. The average age of the deceased patients was 69.7 years, underscoring the significance of age as a contributing factor.

Globally, as of August 4[3], according to the World Health Organization's daily report, there were 18 million confirmed cases of COVID-19 worldwide. However, the impact of the pandemic exhibited regional disparities, with the African continent, home to 17% of the global population, accounting for only 5% of the total global COVID-19 cases.

Concerning the temporal evolution of the number of hospitalized and confirmed positive cases during our study period: In April, there were 83 hospitalizations, accounting for 12.6% of the total, with 19 confirmed positive cases through PCR testing, representing 6.14% of the overall SARS-CoV-2 infections. May witnessed a notable increase in admissions, with 187 patients hospitalized (28.4% of the total), and 25 patients tested positive (8.09%). June also experienced a rise, with 183 hospitalizations (27.8% of the total), and 118 confirmed positive cases (38.18%). However, in July, there was a significant decrease in admissions, with only 44 cases, and 19 of them tested positive through PCR, constituting 6.14% of the total cases.

Analyzing the monthly trend, May and June recorded the highest number of hospitalizations, constituting 28.4% and 27.8% of the total admitted patients, respectively. Conversely, the prevalence of confirmed positive cases peaked in August, with 128 cases (41.42%), followed by June, with 118 cases (38.18%) of the total infected.

On a national scale, the first case of COVID-19 was reported on 2 March 2020, and the initial death occurred on 11 March 2020. By June 30, there were 12,533 confirmed cases, resulting in a cumulative

incidence of 33.96 per 100,000 inhabitants. The pandemic's progression included 228 deaths (1.82%), 8920 recoveries, and 3385 active cases (27.01%). The highest number of new cases was reported on April 17, with 281 cases, followed by a decreasing trend in subsequent waves. However, on June 19, the situation changed drastically, reaching a new peak of 539 cases.

In April, the cumulative cases were 6.2 times higher than in March, while in June, the multiplier factor decreased to 1.4. It's noteworthy that 76% of the deaths occurred between March 23 and May 11. When assessing the epidemiological situation in comparison to other Arab and European countries during the same period, Morocco exhibited a confirmed case incidence rate of 33.96 per 100,000 inhabitants. Morocco's position in terms of incidence was lower than that of Egypt and Algeria but higher than Tunisia and Jordan. Importantly, the case fatality rate in Morocco was among the lowest in Arab countries, with Algeria reporting the highest rate.

In contrast to three European countries, Morocco had significantly lower incidence rates, with multiplier factors ranging from 10 to 20 times. This indicates a comparatively milder impact of the virus in Morocco compared to some European nations during the specified timeframe.

In the temporal evolution of COVID-19-related deaths in our study, as of 30 June 2020, the total number of deaths reached 8 cases, resulting in a fatality rate of 4.93%. On a national scale, the total number of deaths had reached 228 cases, with a lower fatality rate of 1.82%. The progression of deaths exhibited an initial increase during the early weeks, with 48 deaths recorded during the week of 6 April to 12 April. Subsequently, the number of deaths steadily decreased. It is worth noting that during this same period, some sources reported varying fatality rates ranging from 1–2% among diagnosed cases in China.

4.1. The distribution of cases by age and gender

In our study, the average age of individuals hospitalized in the COVID-19 isolation unit was 34.75 years, reflecting a relatively young demographic, with a range spanning from 1 to 86 years. Notably, the age group between 25 and 40 years accounted for 42.55% of the cases, and for the confirmed positive cases in our series, the average age was 38.15%. This contrasts with studies conducted in Wuhan, which revealed that the majority of COVID-19 patients had average ages of 55.5, 49, and 56 years. Older subjects constituted only a small proportion of the infected population, with the elderly representing only 10.1%, 14.6%, and 15.1% of the patients in those respective studies[7–9].

Regarding the age of older patients in our study, it was observed that they constituted 11.32% of the total cases. Notably, the majority of older patients were identified in April, representing 40% of the older subjects infected by the virus during the study period from April to August 2020. This finding differs from some studies that reported over 53% of confirmed cases occurring in adults aged over 40, specifically in the age group between 40 and 64.

In our study, the average age of total COVID-19-related deaths was determined to be 69.9 years. In contrast, a study conducted in Belgian hospitals found that more than half of the patients who died were over 82 years old[10]. Regarding the dominant gender among hospitalized cases at Idrissi Hospital in our study, women were in the majority, constituting 57.8% of the cases. In confirmed cases, there was also a female predominance, with 61.8% compared to 38.1% for males, resulting in a sex ratio of 1.61 in favor of females.

The variation in gender distribution among COVID-19 patients across different studies highlights the complex nature of the disease and its impact on diverse populations. In the study conducted in Wuhan, it was reported that men were the most affected by the SARS-CoV-2 virus. On the other hand, according to authors in a study carried out in March 2020 at the Georgia Department of Public Health and eight hospitals in Georgia, the gender distribution among hospitalized COVID-19 patients showed that 50.5% were women. These differences emphasize the importance of considering regional and demographic factors that may

contribute to variations in the presentation and impact of the virus. In Morocco until 11 April 2020, the distribution of confirmed COVID-19 cases by gender indicated that men were more affected than women, with a male-to-female sex ratio of 1.13 in favor of males, according to data from the Moroccan Ministry of Health.

In another Belgian study conducted in Belgian hospitals, which collected individual information for 15,160 patients upon admission and for 13,362 patients upon discharge until June 14, it was observed that among all hospitalized COVID-19 patients, slightly more men than women were affected, with men accounting for 53% and women for 47%.

The observed disparities in gender distribution underscore the significance of incorporating regional and demographic variables in the analysis of the impact of COVID-19 on diverse populations. Regarding the prevalence of gender in COVID-19-related fatalities, out of 11 reported deaths, 8 were males, constituting 72.72%, whereas 2 were females, representing 18.18%. These findings imply a propensity for the male gender to experience more severe cases compared to their female counterparts.

In a study utilizing the publicly available dataset from the Chinese Public Health Science Data Center, it was found that among the 37 deceased patients, 70.3% were men, while 29.7% were women. The male-to-female ratio among the deceased patients was 2.4, indicating a notable higher prevalence of men in this cohort.

Furthermore, according to a Belgian study conducted in Brussels, encompassing data from Belgian hospitals until June 14, the mortality proportion was slightly elevated in men compared to women (23% versus 19%). From this observation, it can be inferred that male patients exhibit a higher mortality rate in the context of the studied population (**Figure 7**).

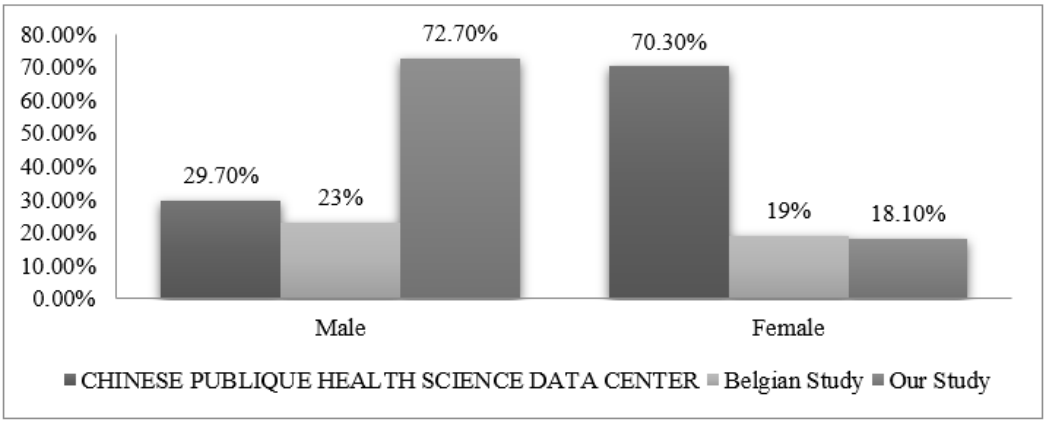

Figure 7. Distribution of the number of deaths by gender according to the authors.

4.2. Clinical manifestations

Clinical symptomatology

In our study, we discerned various clinical manifestations in confirmed COVID-19 patients. Out of the 309 reported positive cases, 63 patients exhibited fever, representing 20.38% of the cases. Concerning respiratory symptoms, 97 of the positive patients presented with a cough, constituting 31.39%, while 63 experienced dyspnea, accounting for 20.38%. Regarding gastrointestinal symptoms, 57 cases were associated with diarrhea, comprising 18.44%, and 24 patients, equivalent to 7.76%, reported vomiting.

Conversely, in a study conducted similarly and rooted in a meta-analysis encompassing 10 studies predominantly focused on Chinese data, hospitalized patients with SARS-CoV-2 infection demonstrated prevalent symptoms. Fever was observed in 89.1% of cases, while cough was reported in 72.2%[8]. Other less frequent clinical manifestations encompassed dyspnea (31.2%) and diarrhea (10.1%)[11]. In accordance with

this study, the predominant complaints associated with SARS-CoV-2 infection were fever (87.9%) and cough (67.7%)[12]. Additionally, a substantial proportion of patients reported some degree of dyspnea, with a prevalence of 39.8% in a cohort of 1099 patients and 18.7% in a group of 201 patients, as documented in the studies conducted by Wu et al. and Guan et al.[6]. Nevertheless, digestive symptoms such as diarrhea (3.7%) and vomiting (5%) were less frequently reported in several cohorts studied by Guan et al.[6], Wu et al.[13], and Young et al.[14] (Ann. Afr. Med., vol. 13, no. 3, June 2020). Particularly noteworthy is the cohort of Song[15].

Concerning neurological manifestations, European studies highlight the prominence of anosmia (loss of smell) and dysgeusia (altered or loss of taste). For example, Salepci and Lechien[16] reported that anosmia was present in 31.83% and 68.10% of cases, while dysgeusia was present in 34.52% and 82% of cases, respectively. In a European multicenter study, Lechien et al. found that 85.6% and 88% of patients experienced olfactory and gustatory dysfunctions related to COVID-19[17] (**Table 3**). Multiple case series from diverse regions, including China, South Korea, Iran, Europe, and the USA, consistently report partial or total loss of smell and/or taste in a significant proportion of SARS-CoV-2 infected patients, ranging from 20% to 90%[18]. Notably, in South Korea, around 30% of SARS-CoV-2 positive patients exhibited anosmia as the primary symptom of COVID-19[19].

A multicenter European study conducted in 12 European hospitals, involving 417 patients (263 women and 154 men), and utilizing a questionnaire to identify olfactory and gustatory disorders in individuals with non-severe SARS-CoV-2 infection (confirmed by PCR testing), revealed that 86% of infected individuals experienced partial or complete olfactory disorders, and 88% experienced partial or complete gustatory disorders. In an online survey of 382 COVID-19 patients, 86.4% reported complete anosmia, and 11.5% experienced a very severe loss of smell[20]. Another study with 31 patients suggested that taste disorders occurred in 81% of COVID-19 cases, with 94% experiencing taste disturbances. The results of our study indicated that 167 patients had ageusia (loss of taste), constituting a significant percentage of 54.04% of the total cases affected by the SARS-CoV-2 virus, and 165 had anosmia, accounting for 53.39% (**Table 3**).

Concerning the temporal progression of cases exhibiting anosmia and ageusia in our series, the data reveals the following trends. In April, 10.52% of cases reported anosmia, and an equivalent percentage reported ageusia. By May, these figures increased to 16%, encompassing both anosmia and ageusia. In June, a notable surge was observed, with 51.69% of cases reporting anosmia and 55.08% reporting ageusia. Subsequently, these percentages further elevated, reaching 84.21% for anosmia and 84.26% for ageusia. By August, 64.06% of confirmed positive cases reported anosmia, and 62.5% reported ageusia **(Figure 8)**.

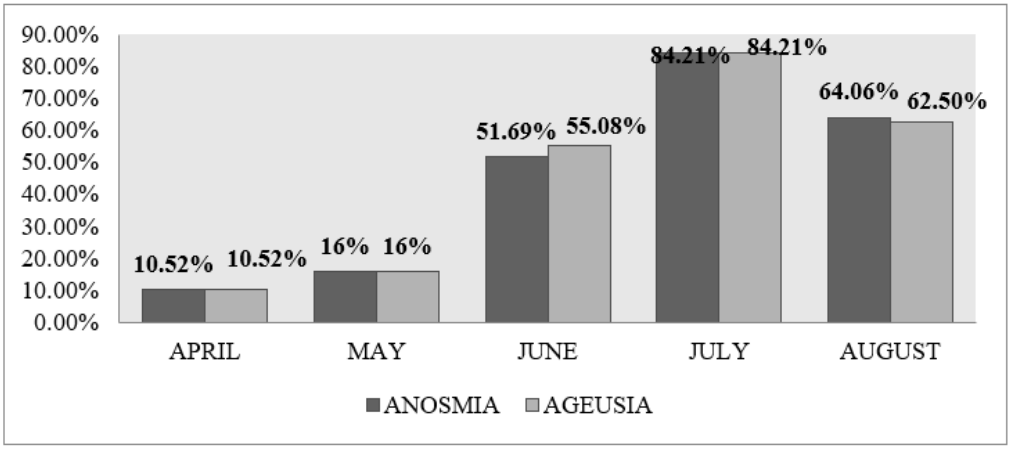

Figure 8. Number of cases of anosmia and ageusia by month in our study.

The findings from our analysis indicate a noticeable prominence of symptoms related to anosmia and ageusia, particularly in the month of June. During this period, these manifestations emerged as highly conspicuous clinical features among confirmed COVID-19 patients.

Table 3. Comparative table of anosmia and ageusia cases according to the authors.

	Number of cases	**Anosmia**	**Ageusia**
Vaira 2020	72	61.11%	48.61%
Lechien 2020	417	68.10%	82.01%
Carol H.Yan 2020	128	58.59%	54.68%
Sartale 2021	180	55.55%	58.88%
Notre étude	309	53.39%	54.04%
Total	1106	59.34%	59.64%

a. Distribution of cases of Anosmia and Ageusia by age and gender

Women seem to be more affected, with a prevalence of 92% compared to 82% in men[16]. These findings align with observations made within the Department of Otolaryngology and Cervicofacial Surgery at CHUV in Lausanne. According to the literature, the abrupt onset of anosmia could serve as an initial symptom of SARS-CoV-2 infection, functioning as an early warning sign. As noted by Lechien et al., this symptom tends to affect younger patients and is frequently associated with a favorable prognosis of the disease[16,20]. In our series of confirmed COVID-19 patients reporting anosmia and ageusia, there was a notable predominance of females, constituting 69.04%, while males accounted for 30.95%. The average age of patients experiencing anosmia and ageusia was 37 years.

Anosmia and ageusia emerge as specific symptoms of COVID-19, as indicated by our study and other research conducted by various authors. The recognition of self-reported olfactory impairment has gained significance as a distinctive feature of COVID-19 and may serve as a valuable predictor of clinical outcomes[21]. In light of these findings, it is recommended that anosmia and/or ageusia be officially acknowledged as specific symptoms of COVID-19 and included in the list of other symptoms recommended by the WHO, as advocated by Lechien et al.[16].

Cranial nerve involvement in COVID-19 constitutes 32% of neurological manifestations[22], primarily characterized by anosmia, often accompanied by dysgeusia in 85% of cases[23]. Anosmia and dysgeusia are regarded as pathognomonic signs of COVID-19, frequently appearing in the early stages of the disease, particularly in pauci-symptomatic patients and mild forms, with a predilection for young females[23]. Across various large series in the literature, the prevalence of anosmia ranges from 34% to 86%[24]. Notably, it often occurs without nasal obstruction, suggesting a pathogenesis distinct from mechanical nasal obstruction. Unlike viral rhinitis, where anosmia typically resolves within three days, anosmia in COVID-19 is attributed not only to viral invasion of the olfactory epithelium[25] but also, and significantly, to the invasion of the olfactory cortex by SARS-CoV-2. This is supported by FLAIR hyper intensities observed in both olfactory bulbs and the rectus gyrus in anosmic patients[26,27].

The spontaneous recovery of anosmia and ageusia appears to be favorable in most cases, although limited information is available for severely affected patients. A multicenter European study, as reported by Lechien et al.[16], indicates that 44% of patients experience a recovery of smell within 15 days. For those who do not regain their sense of smell, olfactory retraining may be beneficial. This involves smelling various odors such as cloves, lemongrass, rose, eucalyptus, coffee, and peppermint. Olfactory training consists of two short daily sessions (15 seconds each) of olfactory stimulation using 4 to 6 different odors for several weeks.

Concerning cases of headaches observed in confirmed COVID-19 patients, it is evident that headaches are a common symptom. Tian et al.[28] reported a 6.5% incidence of headaches in a population of 262 positive patients, while Ding et al.[29] reported a higher percentage of 40% (2 out of 5 patients).

Our study consistently demonstrates that headaches are a prevalent symptom among positive cases, with an overall incidence of 43.36%. Notably, pregnant women exhibited a higher prevalence, constituting 42.85% of this subgroup. Specifically, 3 out of 7 confirmed pregnant women reported experiencing headaches.

Among patients who encountered psychiatric disturbances during hospitalization, our study identified 11 cases, with 8 of them confirmed positive by PCR testing. Numerous surveys consistently highlight significant adverse effects of the COVID-19 pandemic on the mental health of individuals, both within the general population and in clinical settings. These effects are particularly notable in patients who have experienced COVID-19 symptoms. Beyond the infectious episode, at least 20% of these individuals suffer from psychological sequelae, including chronic anxiety disorders, post-traumatic stress disorder, and depressive disorders.

5. Conclusion

COVID-19 has the potential to lead to severe respiratory complications, with its causative agent, SARS-CoV-2, being responsible for the current global pandemic. This viral infection can escalate to organ failure and is associated with the observation of neurological manifestations.

The analysis of epidemiological and clinical characteristics of COVID-19 at El Idrissi Provincial Hospital in Kenitra has deepened our understanding of the profile of patients infected with SARS-CoV-2. It has brought to light deficiencies in prevention, diagnosis, treatment, monitoring, and overall management of this condition. These findings will serve as a guide in implementing necessary solutions to improve the quality of patient care, particularly in anticipation of potential future waves.

Based on the obtained results, it is evident that symptoms of anosmia and ageusia were notably prominent, especially in the month of June, emerging as highly prevalent clinical features among confirmed COVID-19 patients.

Upon conducting a comprehensive examination of clinical manifestations, it becomes clear that neurological symptoms, specifically ageusia, anosmia, and headaches, are the most prevalent among confirmed positive patients. This supports our research hypothesis, confirming that headaches, anosmia, and ageusia can be considered specific indicators of COVID-19.

The reasons behind women’s predisposition to the loss of smell and taste compared to men remain unexplained, thereby paving the way for future studies on this subject.

Author contributions

Conceptualization, ME; methodology, ME; software, ME and HH; validation, ME, AM and HH; formal analysis, ME; investigation, ME; resources, ME; data curation, ME and HH; writing—original draft preparation, ME; writing—review and editing, ME; visualization, ME; supervision, ME; project administration, ME, AM and HH; funding acquisition, ME. All authors have read and agreed to the published version of the manuscript.

Conflict of interest

The authors declare no conflict of interest.

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