

## **Case study**

### **Epidemiology of Coronavirus disease (COVID-19) in Assiut province in Egypt**

#### **Abstract**

##### **Background: -**

Mortality, severity, and recovery of COVID-19 are the main concern all over the world and are still not fully understood, particularly in the Middle East area.

##### **Objective:**

To analyze the prevalence and the characteristics of COVID-19 in Assiut province in Egypt.

##### **Patients and methods:**

This is a retrospective study that includes RT-qPCR- confirmed COVID-19 cases during the period from March 7th 2020 to September 17th 2020 in Assiut province.

##### **Results:**

A total of 1201 cases are confirmed out of 2750 suspected cases. The breakdown of the cases is as follows; 84% fully recovered, 14.6% died and 1.4% are still in quarantine at the time of writing this article. Severe cases occur in old ages with no deaths below 21 years of age. Male and female deaths are 59.4% and 40% respectively. The associated co-morbidities are mainly chronic obstructive pulmonary disease, diabetes mellites, heart failure, ischemic heart disease, and obesity.

##### **Conclusion:**

The total percentage of infection in Assiut is 0.04%; it is lower than the percentage of the total infection in the country (0.1%). Respiratory failure is the leading cause of death in all patients.

##### **Keywords:**

Covid-19, mortality, severity, Assiut, Egypt, co-morbidity.

## **Introduction:**

In December of 2019, an outbreak of severe pneumonia occurred in Wuhan city, China<sup>1</sup>. A month later, the Chinese scientists isolated a new strain of corona virus (SARS-COV-2), from those patients. The following month, the WHO named the disease caused by the novel coronavirus as COVID-19<sup>2</sup>. Shortly after, the viral infection has increased exponentially in more than 196 countries over the world. On the 11<sup>th</sup> of March 2020, the WHO announced COVID-19 as a pandemic infectious disease<sup>3</sup>.

All countries enforced quick strict laws and decisions which would help in restricting the further spread of the virus. These measures include proper hand hygiene, social distancing, travel restrictions, curfew, and markets` shutting down. Moreover, public education on the importance of hand washing and proper respiratory etiquette, as most important tools to combat the virus, were made by the media.

On the 14<sup>th</sup> of February of 2020, the 1<sup>st</sup> case of COVID-19 was announced in Egypt. On the 6<sup>th</sup> of March of 2020, the Egyptian Health Ministry and WHO confirmed 12 positive cases of COVID-19 on the board of a Nile River cruise ship. According to the Egyptian Health Ministry tracking, the reported positive cases in Egypt during the period between the 7<sup>th</sup> of March and the 17<sup>th</sup> of September 2020 are 10,1500 cases (0.1% of the total population of 100 million), total deaths 5,696 cases (5.6% of positive cases), and 86,549 confirmed cases have fully recovered (85.3% of positive cases).

Assiut province which is located at the middle of Upper Egypt on the River Nile, includes 11 cities, with total area 13,720 km<sup>2</sup>, and total population of 4.7 million, 74% of which live in rural areas. The male to female ratio is about 1:1.1 Both agriculture and services which depend mainly on part-time workers, represent together more than 80% of the economy in Assiut.

The Egyptian Health Ministry with its all branches nationwide became prepared quickly and readily after the first Chinese reported cases. The Assiut directorate of health affairs allocated 14 fully equipped hospitals as well as some public buildings to COVID-19 patients.

**Patients and methods:**

This retrospective cohort study includes all reported COVID-19 cases during the period from the 7<sup>th</sup> of March to the 17<sup>th</sup> September 2020 (end of the 1<sup>st</sup> wave) in Assiut province. For every suspected case, a full history including age, gender, rural or urban, co-morbidities, risk factors and a thorough clinical examination, are performed. Moreover, the following investigations are carried out for every case; complete blood count, C-reactive protein, serum ferritin and D.Dimer .In addition, a confirmatory chest CT and RT-qPCR are conducted for all suspected patients. RT-qPCR assays are performed using a diagnostic kit supplied by Sansure Biotech Inc. (Hunan province. China, catalogue No. S3102E), using a 7500 real-time fluorescence quantitative RT-PCR system (Applied Biosystem, Foster City, CA, USA).

## Results:

The total suspected cases during the study period are 2750 cases. All cases including positive, recovered and deaths are recorded (Figure1). 1201 (0.03% of Assiut total population) are confirmed by RT-qPCR. 84% of those are fully recovered, while 14.6% of them died. The remainder 1.4% of cases are still in quarantine at the time of writing the article.

The total percentage of infection in Assiut is 0.04%, it is lower than the percentage of the total infection in the country which is 0.1%. Not surprisingly, the highest rate of death was in age group of 61-70yrs, while the highest rate of infection was in age group of 51-60 yrs.

Most cases fully recovered in less than three weeks (Figure 2). A 92-year-old patient recovered in 26 days, while a 6-month s baby recovered in 15 days. There are no reported deaths below 21 years old. In all age groups, 59.4% of deaths and 52.8% of recovered cases are males. However, in the 21-30 years age group, the female deaths are 4 times more than males (Figure3).

The most common clinical manifestations are fever (95%), muscle ache (90%) loss of smell (78%), dyspnea (67%), loss of taste (65%), cough (61%), chills (60%) sore throat (51%), and fatigue (45%). Other manifestations include diarrhea (40%), chest pain (20%), headache (16%), runny nose (15%), conjunctivitis (15%) and renal failure (6%). Half of the confirmed cases are quarantined at home. From July to September, only 10% of the cases are quarantined in the hospitals.

Emergency cases are commonly presented with cyanosis, confusion, chest pain, and trouble breathing. Respiratory failure is the leading cause of death. The associated comorbidities are none (65%), chronic obstructive pulmonary disease (41%) diabetes melitus(23%), hyper tension (19%),obesity(8%), ischemic heart disease and heart failure(1.2%).

Regarding investigations, 60% of cases have both lymphopenia and leucopenia while lymphopenia alone is found in 17% of cases. The remaining cases shows a normal complete blood count. Surprisingly, 97% of cases have a significant increase in serum ferritin which is also associated with the severity of the disease. Similarly, D.Dimer is significantly increased in the majority of the cases and the increment is higher in the severe cases. CT results reveals the presence of bilateral peripheral GGO and high frequency of crazy-paving appearance which is more frequent in severe cases as well.

## Discussion:

The present study is a retrospective study, carried out in Assiut province in Egypt between 7<sup>th</sup> March and 17<sup>th</sup> September 2020. Out of 2750 suspected cases examined, 1200 cases are confirmed by investigations. The majority of the cases (84%) are fully recovered, whereas the 14.6% of the total positive cases died, the remainder 16 cases (1.4%) are still quarantined.

The present study reveals that severe COVID-19 mainly affects older ages. These findings agree with Mahase <sup>4</sup> and Yang et al<sup>5</sup>. The explanation of this may be due to the decline of immunity in older age, at both the cellular and humoral levels. The current study also reports that male infections are higher than those in females, except for the age group 11 to 30 years, where females shows higher rates of infections and deaths. This may be related to the early marriage for women in Assiut which can have multiple negative health effects.

The current study shows that COVID-19 patients present with a diverse range of clinical manifestations occurring with different frequencies. These rates are similar to those reported by Guan et al<sup>6</sup>. However, the gastrointestinal symptoms reported in our study are less common than Guan et al<sup>6</sup> but in agreement with Chan et al<sup>7</sup>. A possible explanation for this may be the attenuation of SARS-COV-2 virulence by the digestive enzymes.

Chronic obstructive pulmonary disease, diabetes mellitus, hypertension, obesity and ischemic heart disease are the most common co-morbidities associated with COVID-19 in the present study. These findings are in accordance with Emami et al<sup>8</sup> and Marhl et al<sup>9</sup>, who explains the cardiovascular and endocrine disorders by the associated dysregulation of the angiotensin-converting enzyme, liver dysfunction and inflammation. Eight percent of our patients shows obesity (BMI > 30) which is known to be a pro-inflammatory condition <sup>10</sup>.

Respiratory failure is the leading cause of death in all patients, which confirms that the lungs are the most important target organs of SARS-COV2. This also explains the high frequency of chronic obstructive pulmonary disease (41%) as a co-morbidity in our patients<sup>11</sup>. This is validated by the CT findings which are comparable to those reported by others<sup>12</sup>.

The current study reports the presence of lymphopenia and leucopenia in more than 60% of cases, while lymphopenia per se is found in 17%. Likewise, Li and Fan <sup>13</sup> reports similar findings and correlate this with raised cytokines mainly IL-2, IL-6, IL-10 and interferon. We report a significant increase in serum ferritin levels in 97% of patients. Senjo et al explains the increase in serum ferritin levels in viral infection by the release of iron into the reticuloendothelial system and increase of ferritin synthesis and releasing with decrease in the ability of ferritin transport to spleen and liver<sup>14</sup>. Similarly, D-Dimer is significantly increased in 96% of our cases. This increment is higher in severe cases, which explains the higher frequency of emboli in such patients. Likewise, Zhou et al<sup>15</sup> and Danzi et al<sup>12</sup> reports hyper coagulability in the form of pulmonary emboli and microscopic thrombin. C-Reactive protein is raised in 91% of cases. This is in agreement with Petrilli<sup>17</sup> who reports that C-reactive protein is a useful marker in inflammation where it plays an important role in the defense mechanism against pathogens and inflammation.

## **Conclusions**

The present study reveals that:

- 1- Severe COVID-19 disease occurs mainly in older ages.
- 2- Male infections and deaths are higher than in females in all age groups with the exception of the 11-30 years group.
- 3- Chronic obstructive pulmonary disease, diabetes mellitus, and cardiovascular disorders are the main co-morbidities.

## **Study limitations**

The study does not compare between urban and rural infections.

## **Disclosure**

The authors report no conflicts of interest in this work.

UNDER PEER REVIEW

## References

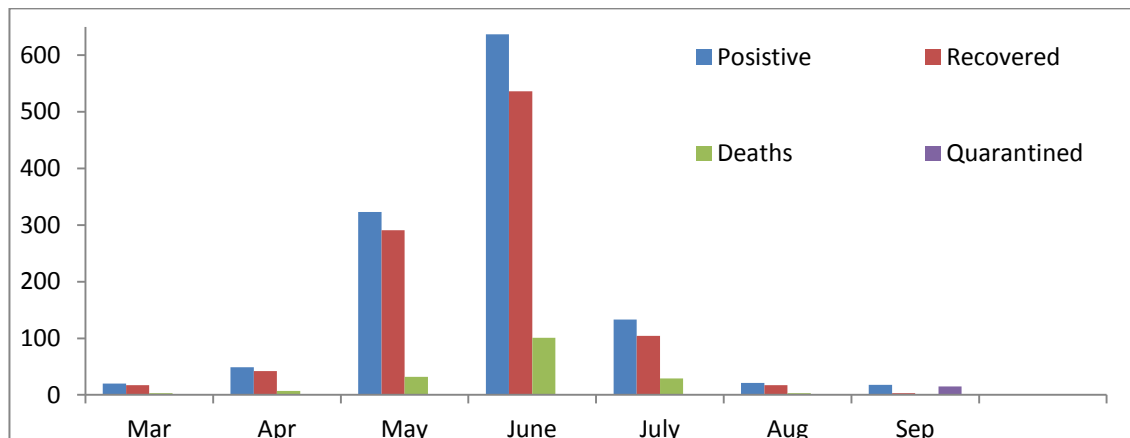
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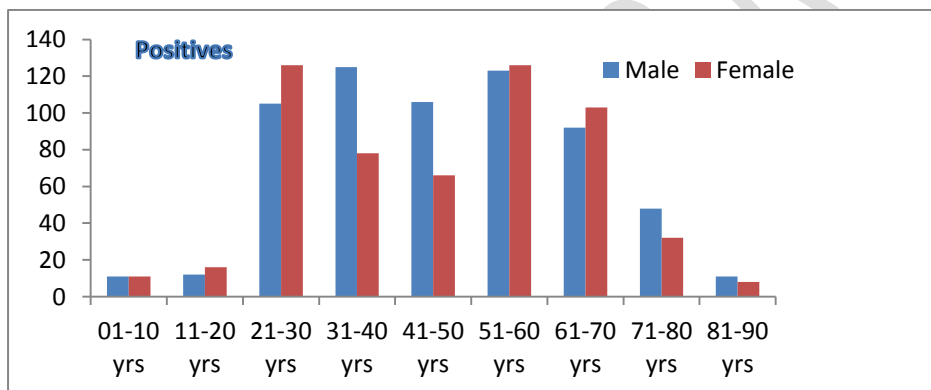


## Figures:

**Figure1.** All reported confirmed COVID-19 cases in Assiut Province from the 7<sup>th</sup> of March to the 19<sup>th</sup> of September, 2020 and their follow up status.



**Figure2:** All male and female positive cases.



**Figure3:** All male and female deaths.

