A Comparison in Work-Up Between the First and Second Covid 19 Infection in the Same Patients in the ED Tawam Hospital, UAE

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Abstract

Aim of study: To identify the significance of routine laboratory investigations conducted in patients infected with COVID-19 for the second time as compared to being infected with COVID-19 for the first time in the UAE.

Methods: 345 patients between the ages of 16 and 65 years who were infected with COVID-19 were included in the study. Patient’s charts were reviewed and all laboratory tests and imaging conducted were reviewed. Furthermore, patients were divided into two groups: one as a first time COVID-19 infection group and the other as a second time COVID-19 infection group.

Results: Fifteen laboratory tests have been conducted. Of these tests, 44.4% (4 tests) (procalcitonin, phosphate, magnesium, amylase, and lipase) that were abnormally elevated in patients in the first infection group were found to be significantly reduced in patients with a second COVID-19 infection. Also, two imaging modalities done which included Chest-X ray and CT thorax without contrast were abnormal in all the patients in the second infection group.

Conclusion and recommendations: We recommend not using the following labs in patients with COVID-19 infection for the second time: procalcitonin, magnesium, lipase, amylase, phosphate. However, we do recommend performing Chest X-ray and CT thorax without contrast in assessing severity of disease in patients with COVID-19 infection for the second time.

Keywords: Covid-19; Infection; Patient; X-ray.

Introduction

After COVID-19 has been considered a global pandemic by WHO in March 2020, several recommendations regarding laboratory investigations that may aid in identifying the severity of the disease have been suggested. These laboratory investigations include complete blood count (CBC), C-reactive protein (CRP), Lactate dehydrogenase (LDH),
ferritin, procalcitonin, D-dimer, creatinine, and urea. According to recent literature, significant elevation of some of these laboratory tests correlated with more severe disease and/or worse prognosis. Furthermore, imaging such as Chest X-ray and CT thorax without contrast also helped identify the severity of the disease.

Objective

The purpose of this study is to identify the significance of routine laboratory investigations that are conducted in patients who are infected with COVID-19 for the second time as compared to their first time being infected in the UAE. This may aid in decreasing the number of investigations carried out, decreasing the length of hospital stay and reduce the number of admissions, therefore, improving cost-effectiveness. This study will also aim to assess the precautionary measures needed with regards to patients who are infected with COVID-19 for the second time as compared to their first time being infected.

Methods

This is a retrospective cohort study that uses patients’ charts from Tawam Hospital’s Cerner system from 1st of January 2021 to 1st of March 2021. Study included 422 patients, out of which only 345 met the inclusion criteria. Hypothesis testing, including chi-square and 2–proportional tests were used to identify differences between lab tests, imaging and diagnosis in the first COVID-19 infection group versus the second COVID-19 infection group.

Inclusion criteria

Patients between the ages of 16 to 65 who had a positive PCR-COVID-19 test have been included. Patients who had a positive PCR test after at least 2 months from the first positive PCR test have been considered to have been infected with COVID-19 for the second time and were included in the study.

Exclusion criteria

Patients whose age was below 16 or above 65 who have tested positive for COVID-19 have been excluded. Patients who had a positive PCR-COVID-19 test less than 2 months from their first positive PCR test were not included in the second infection group.

Laboratory investigations

Different laboratory investigations such as LDH, Ferritin, uric acid, CRP, CBC including lymphopenia, amylase, lipase, liver function tests, creatinine, urea, potassium, magnesium, calcium, and D-dimer have been recorded and a comparison between both groups has been conducted.

Imaging

Chest X-ray and CT Thorax without contrast were also done in several patients to help identify the severity of the disease. After meeting the inclusion criteria, the patients were then divided into two groups. One group representing the first- time infection with COVID-19 and the second group representing the second- time infection with COVID-19.

Results

A total of 422 patients tested positive for COVID-19 at Tawam Hospital between
January 2021 to March 2021. A total of 77 (18.25%) patients were excluded. 50 (9.48%) of those patients were excluded for being below 16 years of age, while 27 (6.4%) were excluded for being above 65 years of age. Therefore, 345 patients who met the inclusion criteria were included in the study. Of those 345 patients, 176 were males (51%) and 169 were females (49%) with a male to female ratio of 1.04. Also, nationals of the UAE represented 166 (48.1%) of patients as compared to non-nationals, which were 179 (51.9%) of patients. Also, the number of patients who were considered to be infected with COVID-19 for the first time were 340 while those who were considered to be infected for the second time were 5 patients.

![Pie Chart of Gender](image1.png)

**Figure 1:** Pie chart showing gender percentage.

![Pie Chart of Nationality](image2.png)

**Figure 2:** Pie chart showing nationality percentage.

Furthermore, the symptomatology and clinical status of patients were also observed with 248 patients being asymptomatic (72.9%), 89 patients being symptomatic and
hemodynamically stable (26.2%) while 3 patients being symptomatic and in critical condition (0.9%), as shown in Figure 3.

Figure 3: Pareto chart showing different symptomatology Percent and count.

Laboratory investigations

Fifteen different lab investigations that were conducted were included in the study. These tests include complete blood count (CBC), including the degree of lymphopenia, ferritin, LDH, procalcitonin, D-dimer, urea, electrolytes (which includes potassium, magnesium, calcium, phosphorus, and others), Liver function tests (LFT), amylase, lipase, uric acid, C-reactive protein (CRP). Table 1. shows a summary of symptomatology and all the results of lab tests and imaging carried out including count, percentages, and p-value for each test. In addition, Figure 4 represents the difference (in percentage) between the results of the second infection group as compared to the first infection group.

Figure 4: Abnormal laboratory test results Percent change between 1st and 2nd covid.
The result of CBC in the first infection group showed that 131 (38.5%) of patients was abnormal while they were normal in 209 patients (61.5%). However, in the second infection group, the result of CBC was abnormal in 4 patients (80%) as while being normal in one patient with a p-value of 0.059, showing no significant difference in CBC results between the first and second infection group. Furthermore, lymphopenia was observed in 162 (47.6%) patients in the first COVID-19 infection group while lymphocyte count was normal in 178 (52.4%) patients in the same group. However, lymphopenia was observed in 4 out of 5 patients in the second COVID-19 infection group while lymphocyte count was normal in 1 patient with a p-value of 0.151. Therefore, no significant difference in lymphopenia was found between the two groups.

Also, in the first infection group, ferritin was found to be abnormal in 123 (47.6%) patients while 217 (52.4%) patients had normal results. However, in the second infection group, all 5 patients had an abnormal ferritin result with p-value of 0.03 representing a great significance of ferritin as a lab test in patient being infected with COVID-19 for the second time. Regarding LDH, in the first infection group, 69 (20.3%) of patients had an abnormal result while 217 (79.7%) of patients had a normal result. However, in the second COVID-19 infection group, there were 3 patients (60%) who had an abnormally elevated LDH while 2 patients (40%) had a normal LDH result. The p-value comparing abnormally elevated LDH in both groups was found to be 0.03 which shows a significant difference.

Levels of D-dimer was also studied in which 42 patients [12.4%] had an abnormally elevated level in the first COVID-19 infection group while 298 patients had a normal level within the same group. However, in the second COVID-19 infection group, 4 patients [80%] had an abnormally elevated D-dimer level while only one had a normal level. Also, p-value was found to be <0.005 signifying a great difference between the two groups. Regarding Urea and electrolytes, results have shown them to be abnormal in only 29 of patients (8.5%) while they were found to be normal in 311 of patients in the first infection group. However, in the second infection group, 4 patients (80%) had an abnormal result with regards to urea and electrolytes while only one patient had a normal result. Hypothesis testing shows a significant difference in laboratory results between First and second Covid infection when it comes to Urea and electrolyte tests with a p-value of <0.005.

In addition, potassium level specifically was found to be abnormal in 23 (6.8%) in the first Covid-19 infection group while the other 317 patients in the same group had a normal level of potassium. In the second COVID-19 infection group, only one patient had an abnormal level of potassium while the other 4 patients had a normal level with a p-value of 0.461 showing that there is no significant difference between the first and second COVID-19 infection groups when it comes to potassium level. Also, only 17 (5%) patients were found to have an abnormal calcium level in the first COVID-19 infection group as compared to 323 patients with normal results within the same group. As for the second infection group, only one patient (20%) has an abnormal calcium level as compared to 4
patients having a normal level within the same group. Therefore, no significant difference between calcium levels between both groups was found.

Regarding magnesium level, only 7 patients (2.1%) in the first infection group were found to have an abnormal level while 333 patients had a normal level within the same group. In the second infection group, none of the five patients had an abnormal level. A comparison was done between both groups regarding magnesium level and a p-value of 0.08 was found. Therefore, no significant difference in magnesium level between the first and second COVID-19 infection groups was found.

Phosphorus level was also observed in patients. In the first infection group, 8 patients (2.4%) had an abnormal phosphorus level, while 330 patients had a normal level within the same group. However, in the second infection group, none of the patients were found to have an abnormal level of phosphorus. A significant difference in phosphorus level between both groups was found.

Regarding Liver Function tests, only 7 patients (2.1%) had an abnormally elevated levels as compared to 333 patients who had normal levels in the first infection group. In the second infection group only 1 patient had an abnormal elevation in LFT while 4 patients had a normal LFT. Therefore, no significant difference was identified between both groups with regards to LFT as the p-value was 0.316.

Looking at levels of amylase and lipase, the first infection group only had 4 (1.2%) patients displaying an abnormally elevated level of both enzymes while 336 patients had a normal result within the same group. In the second infection group, none of the patients had an abnormal amylase and lipase level, indicating a significant difference between results of amylase and lipase levels in first and second COVID-19 infection.

Regarding uric acid level, 38 patients (11.2%) in the first COVID-19 infection group had an abnormally elevated level, while the remaining 302 patient had a normal level. In the second infection, only one patient (20%) had an abnormally elevated level as compared to the 4 other patients who had a normal level. So, no significant difference in uric acid levels were found between both groups.

Furthermore, inflammatory markers such as C-reactive protein and procalcitonin were also observed. Regarding CRP, in the first COVID-19 infection group, 68 patients (20%) were found to have an elevated CRP as compared to 270 patients who had a normal level of CRP. While, in the second COVID-19 infection group, four out five patients (80%) were found to have an elevated level of CRP proving a significant difference in CRP levels between both groups.

Furthermore, results of procalcitonin were also observed in which only 19 patients (5.6%) had an elevated level in the first infection group as compared to 321 patients having a normal level within the same group. On the other hand, all patients in the second infection group had a normal level of procalcitonin with a p-value of <0.005. Therefore, a significant difference can be seen in both groups with regards to procalcitonin.
<table>
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<tr>
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<th>2nd COVID (5)</th>
<th>P-Value</th>
<th>Significant difference?</th>
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<tr>
<td>Type</td>
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<td>Normal</td>
<td>Abnormal</td>
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<td>209</td>
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<td>298</td>
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<td>Urea Electrolyte (7 tests)</td>
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<td>LFT (liver function test)</td>
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<td>Ca</td>
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<td>302</td>
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<td>337</td>
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<td>269</td>
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<tr>
<td>CT thorax without contrast - Abnormal</td>
<td>103</td>
<td>237</td>
<td>30.30%</td>
</tr>
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</table>

**Table 1:** Table of count, percentage and significance for imaging, diagnosis, and laboratory test.
**Imaging**

Regarding imaging, chest x-ray and CT thorax without contrast has been conducted for patients in both, the first and second COVID-19 infection groups. Data has shown that 71 patients (20.9%) had an abnormal chest X-ray in the first COVID-19 infection group while all five patients (100%) in the second COVID-19 infection group had an abnormal chest x-ray with a p-value of <0.005. Therefore, a significant difference in the results of chest x-ray between the first and second COVID-19 infection groups was found emphasizing the importance of performing a chest x-ray in patients who are infected with COVID-19 for a second time.

In addition, CT thorax without contrast was also conducted where 103 patients (43.3%) in the first infection group were found to have an abnormal result. Also, in the second infection group, all five patients had an abnormal CT thorax without contrast. A p-value of 0.001 was found which indicates a significant difference between both groups which in turn emphasizes the importance of performing a CT thorax without contrast in patients who are infected with COVID-19 for the second time.

**Figure 5:** Change in abnormal radiology % between 1st and 2nd covid infection.

**Discussion**

This study included 340 patients who were infected with COVID-19 for the first time. It also included 5 other patients who were infected with COVID-19 for the second time. Fifteen laboratory tests were routinely conducted at our hospital and all fifteen tests were studied. Only 9 (60%) tests were found to be significant in the second COVID-19 infection group as compared to the first COVID-19 infection group due to them being abnormal in several patients. These 9 tests include ferritin, LDH, procalcitonin, D-dimer, urea and electrolytes, amylase/lipase, magnesium, phosphate, uric acid, and CRP.

It has been observed that in 4 out of 9 of these tests (44.4%), the abnormal levels found in patients infected with COVID-19 for the first-
time in each of these tests improved or went back to normal in patients who were infected with COVID-19 for the second time (Figure 4). These 4 tests include procalcitonin, phosphate, magnesium, and amylase/lipase. This observation indicates that performing these 4 tests in patients infected with COVID-19 for the second time is not necessary. However, the remaining 5 out of 9 tests (55.6%) that were found to be initially abnormally elevated in patients infected for the first time, remained to be elevated or further increased in patients infected with COVID-19 for a second time (Figure 5). Therefore, indicating that these 5 tests are necessary in patients infected with COVID-19 for the second time. These 5 tests include ferritin, D-dimer, urea and electrolytes, CRP and LDH.

Figure 6: Test with significant difference decrease between 1st and 2nd covid.

Figure 7: Tests with significant difference increase between 1st and 2nd covid.
Furthermore, patients have been categorized based on severity into three categories: asymptomatic (no symptoms), symptomatic (symptoms but clinically stable), and critical (symptomatic but clinically unstable, high risk). It has been found that 248 patients (72.9%) from the first COVID-19 infection group were asymptomatic while none of the patients in the second COVID-19 infection group were asymptomatic. Regarding the second category, 89 patients (26.2%) in the first infection group were found to be symptomatic but clinically stable while 3 patients (60%) in the second infection group were found to be symptomatic and clinically stable. However, only 3 patients were found to be in critical condition in the first infection group as compared to 2 patients (40%) in the second infection group (Figure 6).

A comparison between both groups with regards to symptomatology and severity was done by looking at the p-value and no significant difference was found. The p-value for symptomatic and critical categories was 0.09 and 0.074, respectively. However, there was a significant difference between people who were found to be asymptomatic in the first COVID-19 infection group and those who were asymptomatic in the second COVID-19 infection with the number of patients being asymptomatic decreasing from 72.9% to 0%. This also emphasizes the importance of conducting tests for patients infected with COVID-19 for the second time based on their symptom severity when they were first infected with COVID-19.

Also, safety measures were examined. These include wearing facemasks and maintaining social distancing. A compliance of 100% was found in all 340 patients in the first infection group and all 5 patients in the second infection group. 330 (95.6%) patients were from Abu Dhabi, while 15 (4.3%) were from outside Abu Dhabi.

**Limitations**

This study also has its limitations. That includes a short period (3 months) in which the study was conducted. Also, the second infection group only included 5 patients which is a very small sample size therefore further studies with a greater sample size is recommended. Also, the study did not include children and elderly. Another limitation was that only patients with a positive PCR from Tawam hospital emergency department were included.

**Conclusion**

To improve cost-effectiveness by reducing the number of unnecessary lab investigations routinely conducted in COVID-19 patients, we do not recommend performing the following lab investigations in patients infected with COVID-19 for the second time: procalcitonin, magnesium, lipase, amylase, and phosphorus. Even though these tested may initially be abnormally elevated in patients infected with COVID-19 for the first time, they were found to be insignificant in assessing the severity of the disease as their levels decrease or return to normal in patients infected with COVID-19 for the second time. However, in our study, five tests were found to be significant in patients infected with COVID-19 for the second time as their levels continued to be abnormally elevated in such patients. These tests include ferritin, D-dimer, urea and electrolytes, CRP and LDH. Furthermore, imagining such as Chest X-ray and CT thorax without contrast was found to be abnormal in all patients infected with COVID-19.
COVID-19 for the second time. Therefore, such imaging is recommended in all patient infected with COVID-19 for the second time.

Recommendations

- To maintain the safety measures already in place by health authorities in Abu Dhabi. That is believed to be the reason for a smaller number of patients being infected for the second time.
- We recommend not using the following lab tests in patients infected with COVID-19 for the second time with symptoms but are clinically stable: procalcitonin, magnesium, lipase, amylase, phosphorus (Table 1). This will improve cost-effectiveness by reducing unnecessary testing and by reducing length of hospital stay.
- We recommend performing Chest X-ray and Ct thorax without contrast for all patients infected with COVID-19 for the second time.

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References