Clinical and paraclinical indicators to evaluate the prognosis of COVID-19: Lessons from a case

Indicadores clínicos y paraclínicos para evaluar el pronóstico de COVID-19: lecciones de un caso

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SUMMARY

The coronavirus is a disease that affects the respiratory system, it comes from the SARS-CoV-2 virus that belongs to the Beta coronavirus group and is currently the cause of a high mortality rate worldwide. The diagnosis through images and oropharyngeal and nasopharyngeal tests helps in the recognition of this respiratory condition. We present a clinical case of a 74-year-old patient with diarrhea, dyspnea, and cough, establishing the diagnosis of COVID-19. We found clinical and paraclinical parameters such as advanced age, history of arterial hypertension, dyspnea, low oxygen saturation, increased azoados, increased hepatic enzymes (AST), leukocytosis, lymphopenia, neutrophilia, increased PCR and procalcitonin, plaquetopenia, increased lactic dehydrogenase, increased ferritin, pulmonary infiltrates with a frosted glass appearance evidenced in the X-ray and CT scan of the chest; all these determining factors of unfavorable prognosis according to current scientific evidence. The results of the case analysis are discussed.

Keywords: *SARS-CoV-2, COVID-19, risk factors, predictive factors, mortality, prognosis.*

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RESUMEN

El coronavirus es una enfermedad que afecta al sistema respiratorio, proviene del virus SARS-CoV-2 que pertenece al grupo Betacoronavirus y en la actualidad es la causa de una alta tasa de mortalidad a nivel mundial. El diagnóstico a través de imágenes y pruebas orofaríngeas y nasofaríngeas ayudan en el reconocimiento de esta afección respiratoria. Presentamos un caso clínico de un paciente de 74 años con diarrea, disnea y tos, estableciéndose el diagnóstico de COVID-19. Se encontraron parámetros clínicos y paraclínicos como: edad avanzada, antecedente de hipertensión arterial, disnea, saturación baja de oxígeno, aumento de azoados, aumento de enzimas hepáticas (AST), leucocitosis, linfopenia, neutrofilia, aumento de PCR y procalcitonina, plaquetopenia,

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aumento de deshidrogenasa láctica, aumento de ferritina, infiltrado pulmonar con aspecto de vidrio esmerilado evidenciado en la Rx y TAC de tórax; todos estos factores determinantes de pronóstico desfavorable según la evidencia científica actual. Se discuten los resultados del análisis del caso.

Palabras clave: *SARS-CoV-2, COVID-19, factores de riesgo, factores predictivos, mortalidad, pronóstico.*

INTRODUCTION

The COVID-19 is a disease caused by the virus (SARS-CoV-2) respiratory condition that has an incubation period of 2-14 days, can be transmitted from person to person by respiratory droplets when talking, coughing, and sneezing at a distance of approximately 2 meters, patients with coronavirus have pneumonia in both lungs (1). There is no treatment for this virus; those affected are treated symptomatically.

The disease began in China (Wuhan) with 3 287 infected people. Authorities notified the World Health Organization (WHO) on December 8, 2019; patients were monitored by collecting samples from patients with dyspnea, asthenia, and fever (2). The COVID-19 is recognized as a pandemic by the World Health Organization (WHO) on March 11, 2020, which declared a global health emergency (3).

As of May 12, 4 233 504 confirmed cases have been registered worldwide (53 % of them asymptomatic), of which 1 481 314 have recovered and 289 932 have died (0.68 % of mortality). 193 countries are facing COVID-19, which is causing a decline in the population and economy worldwide. For this reason, the WHO has established social isolation to prevent the spread on a larger scale, enabling the governments of the different countries to take hygienic health measures (4).

China, the country of origin of the virus, presented 82 926 confirmed cases, 78 189 recovered cases, and 4 633 dead, a nation that overcame the virus by staying in isolation for 3 months and using the biosecurity measures proposed by the WHO. The United States is the country with the most positive cases of infection, with 1 399 905 confirmed cases, 234 607 recovered cases and 83 019 deaths.

Despite the high number of infections, the U.S. government has taken drastic measures to avoid the economic crisis by following the proposed health measures (4).

In Ecuador, the first case of coronavirus was presented on February 29, 2020. Since then, the numbers have increased, and there are currently 30 419 confirmed cases, 3 433 recovered cases, and 2 327 deaths. Guayas is the province with the most positive cases, corresponding to 62 % of the cases nationwide.

This pandemic has caused an economic crisis by preventing the development of daily activities, vulnerable areas have been more affected as they depend on daily earnings and cannot cover their basic needs. One of the factors that have also affected is the curfew because traders have a limited time to sell their products (2).

Regarding age as a prognostic factor in COVID-19, Wu et al., in their study entitled: Risk factors associated with acute respiratory distress syndrome and death in patients with coronavirus pneumonia 2019 in Wuhan, China, mention that most patients can develop mild disease and even be asymptomatic, however, advanced age and comorbidities give the worst prognosis (5). The authors studied the signs, symptoms, and factors associated with the development of acute respiratory distress syndrome (ARDS) after hospital admission and the progression to death of patients. The study showed that factors such as advanced age, high fever, comorbidities, neutrophilia, thrombocytopenia, elevated pro-inflammatory factors, and alterations in coagulation factors were significantly associated with the development of ARDS and patient death (5).

Images in patients with COVID-19, such as simple chest radiography in viral cases of pneumonia are very unspecific, similar images being found in other inflammatory or infectious processes. Eighty-five percent of simple chest X-rays show an interstitial pattern, 75 % are bilateral, which was related to the need for admission to intensive care (6).

The tomography shows images of frosted glass with or without pulmonary condensation with air bronchiogram, affecting one or more lobes generally bilaterally (6,7).

High procalcitonin is associated with a 5 times greater risk of developing severe SARS infection, however, it has also been observed that there is a reduced number of patients with VOC-19 with increased calcitonin values; this was demonstrated in a meta-analysis performed by Lippi and Plebani (9), who also recommend measuring serial procalcitonin to predict the disease towards a severe and fatal prognosis (8). Xu et al. (11) conducted a study to demonstrate the usefulness of the prone maneuver in patients with type A influenza.

Regarding the use of the prone maneuver in patients infected with SARS-CoV-2, the maneuver was performed on 6 patients, 4 of whom died (10). Of the total number of patients who needed oxygenation therapy with extracorporeal circulation, 6 (11.5 %) died. This shows that protective ventilation and prone maneuver did not manage to improve the condition of the patients (11).

Clinical Case

Male patient, 74 years old, with a history of arterial hypertension, went to the emergency department due to a 4-day clinical picture of evolution characterized by a non-quantified thermal rise, accompanied by diarrhea; concomitantly he presented persistent dry cough for which he received home treatment with paracetamol, oral rehydration salts, amoxicillin, without giving up symptoms, then he progressed to dyspnea. On arrival at the emergency room, the patient was cyanotic, dyspnoea, restless, with capillary saturation of 36 %, tachypneic (34 breaths per minute), tachycardia (120 beats per minute), decreased vesicular murmur in both pulmonary fields, and auscultation of rales in both pulmonary fields. High-flow oxygen was administered, which improved saturation to 70 %, and blood gases were taken on admission, revealing pH 7.35, PCO_2:19, and PO_2:50.

Laboratory tests

Leukocytes: 12.73; Hemoglobin: 12.5 gr/dL; Hematocrit: 38.4 %; Platelets: 45 000/mm³; Monocytes %: 0.9; Eosinophils %: 0.1; Lymphocytes %: 3.2; Neutrophils %: 95.5; Glucose: 122.10; Sodium: 142.0; Potassium: 3.6; Chlorine: 104; Direct bilirubin : 0. 20; Indirect bilirubin: 0.04; Total bilirubin: 0.24; Test: LDH (lactate dehydrogenase): 1 380; Albumin: 2.19; Urea: 36 mg/dL; Creatinine: 2 mg/dL; AST (SGOT): 71 μ/L; ALT (SGPT): 29U/L; PCR: 336.88, procalcitonin: 2.85 md/dL, ferritin: greater than 2 000 images.

The images obtained from standard chest radiography (Figures 1 and 2) show the following in frontal projection: congestive pulmonary hilum; diffuse alveolar interstitial infiltrates condensed in both pulmonary fields, as well as speckled opacities that occupy almost all of both pulmonary fields, presence of endotracheal tube; the presence of airborne bronchogram.

Figure 1. Standard chest radiography.

Figure 2. Standard chest radiography.

In Simple Chest Computed Tomography (CT) (Figures 3 and 4), a large pattern of lung involvement in frosted glass, broncho-alveolar network thickening is observed.

Figure 3. Simple Chest Computed Tomography (CT).

Figure 4. Simple Chest Computed Tomography (CT).

Evolution

A patient diagnosed with respiratory insufficiency plus severe pneumonia, admitted to Intensive Care Unit, COVID-19 test performed and positive, hemodynamic, and vasoactive support started, controlled assisted mechanical ventilation plus pseudoanalgesia, broad-spectrum antibiotic therapy, treatment with hydroxychloroquine, placed in a prone position, treatment with tocilizumab, enoxaparin, nitazoxanide, acetylcysteine, dexamethasone. However, the patient does not improve clinically or radiologically, he suffers from renal failure and liver failure increased inflammatory parameters (PCR and procalcitonin), as well as increased ferritin and lactic dehydrogenase, lymphopenia, plaquetopenia; after nine days of hospitalization the patient dies.

DISCUSSION

COVID-19 can cause everything from mild symptoms to severe respiratory illness and even death. Most deaths have occurred in people over the age of 65, with comorbidity or chronic pathology. In contrast, children seem to be less susceptible to the disease, although it is not yet known how they contribute to the transmission of the virus.

At present, multiple clinical and paraclinical variables have been found to predict prognosis in patients with COVID-19. Its clinical presentation may be mild, moderate, or even present as acute respiratory distress syndrome (ARDS) and multisystem organ failure (MSF) with fatal outcomes. The identification of prognostic factors, both clinical and paraclinical, allows the risk of patients to be graduated and the severity of the disease to be actively controlled.

Different studies predict the risk of mortality as in the case of our patient: Advanced age, comorbidity (hypertension), dyspnea, low oxygen saturation, leukocytosis, lymphopenia, increased Dimer D and ferritin, increased liver, and kidney enzymes; as the study by Fei Zhou (12) in Wuhan reports as risk factors associated with mortality in hospitalized patients: arterial hypertension 30 %, diabetes 19 %, coronary disease 8 %; advanced age, high SOFA score, D-dimer greater than 1 μg / L.

Likewise, in the study in Wuhan by Ruan et al. (13), they analyzed the clinical predictors of mortality by COVID-19, in 150 patients and found predictors of fatal outcome: age, underlying diseases, secondary infections, and elevated pro-inflammatory indicators in the blood.

There is also a systematic review with the meta-analysis by Jain and Yuan (14) [7 studies, 1813 patients] in which the group of patients admitted to ICU, mean age 62.4 years compared to 46 years for those not admitted. Dyspnea was the only predictive symptom, for ICU admission, COPD was the comorbidity associated with severe disease and risk of ICU admission.

Other studies (15-17) conducted in the city of Wuhan, China on the clinical course and risk factors for mortality in patients hospitalized with COVID-19 show that the main risk factors for poor prognosis include advanced age, comorbidities, lymphopenia, type I respiratory failure, sepsis, cardiac pathology, alkalosis, hypercalcemia, acute renal damage, hypoxic encephalopathy, chronic obstructive pulmonary disease (COPD), cardiovascular disease, increased lactate dehydrogenase (LDH), C-reactive protein (CRP).

It should also be noted that the extent of alveolar infiltration and the frosted glass pattern evident on chest X-ray and tomography is a predictor of aggravated prognosis, as the study by Shi et al. (18) indicates that the most frequent finding found on chest tomography was frosted glass opacity (65 %), in addition to poorly defined margins (81 %); furthermore, it concludes that old age, male gender, underlying comorbidities, and progressive radiographic deterioration on follow-up CT may be risk factors for poor prognosis in patients with VOC pneumonia-19.

We found in the literature the "CALL Scale" to predict outcomes in patients with COVID-19 pneumonia. It covers a list of 4 to 13 points (comorbidity 1-4, age 1-3, lymphocytes 1-3, LDH 1-3), classified into 3 risk levels according to their probability of disease progression. Scores of 4-6 (class A), low risk with a probability of progression less than 10 %; 7-9 points (class B) with an intermediate-risk probability of progression 10 % - 40 %; and 10-13 points (Class C) with a high-risk probability of progression greater than 50 %. In our case it obtained 11 points, i.e., high risk of disease progression, therefore we found it to be of great predictive value on this scale (19).

Current data place the mortality rate at around 2 %. It could be lower if many asymptomatic or very mildly symptomatic cases have not been diagnosed. The mortality rate is lower than that of SARS (10 %) and higher than that of seasonal influenza (SI) (which is below 0.1 %).

CONCLUSIONS

In relation to this disease, it is known that most of the deaths have occurred in people over 65, with comorbidity or chronic pathology. By identifying prognostic factors, both clinical and paraclinical, we can graduate the risk of patients and actively control the severity of the disease. Also, several clinical and paraclinical indicators of prognosis of severity and mortality of COVID-19 have been validated. Its clinical presentation may be mild, moderate, or even present as acute respiratory distress syndrome (ARDS) and multisystem organ failure (MSF) with fatal outcomes.

Conflict of Interest

There are no personal or professional conflicts.

List of abbreviations

ALT (SGPT): Alanine aminotransferase.

AST (SGOT): Aspartate aminotransferase.

COVID-19: Coronavirus disease.

ECMO: Extra Corporeal Membrane Oxygenation.

COPD: Chronic obstructive pulmonary disease.

FOM: Multisystemic Organic Failure.

IE: Seasonal Influenza.

LDH: Lactate Dehydrogenase.

LDL: Low-density lipoproteins (bad cholesterol).

WHO: World Health Organization.

PCO_2: Partial Pressure of Carbon Dioxide in the Arterial Blood.

PCR: Protein C Reactive Test.

PCT: Procalcitonin Test.

pH: Hydrogen Potential.

PO_2: Partial Pressure of Oxygen.

Dimer D test: A protein fragment produced when a blood clot dissolves in the body.

CRS: Complete Blood Count.

NIV: Noninvasive Ventilation.

SARS-CoV-2: Severe Acute Respiratory Syndrome Coronavirus 2.

ARDS: Acute Respiratory Distress Syndrome.

SOFA: Sequential Organ Failure Assessment.

CT Scan of the Chest: Chest CT scan.

ICU: Intensive Care Unit.

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