Case Report

COVID-19 and Pulmonary Tuberculosis Coinfection in a Moroccan Patient with Pulmonary Embolism: A Case Report and Literature Review

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Emerging cases of coinfection of coronavirus disease 2019 (COVID-19) and tuberculosis (TB), although rare, have attracted the attention of health systems around the world and have arisen many concerns about the diagnosis, treatment, and prognosis of this coinfection especially in high TB burden countries. Here, we report a rare case and, to the best of our knowledge, the first reported case in Morocco of simultaneous diagnosis of an active pulmonary TB infection and a COVID-19 pneumonia. We present a case of a sixty-seven-year-old male patient who was admitted to our COVID-19 emergency department with a diagnosis of COVID-19 pneumonia, confirmed by nasopharyngeal swab’s polymerase chain reaction (PCR) for detection of SARS-CoV-2. The atypical radiological findings suggested a TB coinfection which was later confirmed by sputum cultures and Xpert MTB/Rif assay. The patient also presented some complications including thrombosis of the left leg, pulmonary embolism and inaugural ketosis. Treatment was administered as per local protocols: broad spectrum antibiotics, corticosteroids, fixed dose-combination of antituberculosis treatment along with hydration and insulin therapy for ketosis treatment and anticoagulation. The patient was discharged after twenty-three days of hospitalization. Due to the currently limited data, further studies are necessary to establish any possible correlation between COVID-19 infection and the progression of a latent and/or the severity of an active TB infection.

1. Introduction

The coronavirus disease 2019 (COVID-19) caused by the novel severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) is still spreading across the world since its start on December 2019 in Wuhan city, China, and then declared a pandemic by the WHO on March 2020 [1]. The clinical features are dominated by respiratory and flu-like symptoms such as fever, cough, and fatigue. Meanwhile, tuberculosis is still a global burden affecting millions of people every year with the highest mortality rate of any infectious disease [2]. The concurrence of these two pandemics has arisen many concerns in terms of clinical management, differential diagnosis, treatment, and prognosis, especially in high TB burden countries [3]. There is a scarcity in the current literature concerning cases of coinfection of COVID-19 and TB. Here, we report a rare case of simultaneous diagnosis of an active pulmonary TB infection and COVID-19 pneumonia with thrombotic complications.

2. Case Presentation

On December 30th, 2020, a sixty-seven-year-old Caucasian male, with no medical or surgical history, presented to our emergency COVID-19 department with persistent dyspnea at rest, along with chest pain, and a persistent cough initially dry becoming productive fifteen days before admission, showing no improvement on clavulanic acid-amoxicillin taken by the patient on self-medication, in a context of fever and night sweats, and deterioration of general status including a weight loss of 10 kg, fatigue, and anorexia. However, the patient had not shown any signs of otorhinopharyngeal viral infection (no anosmia, no taste alteration, no sore throat, and no rhinitis) and had not reported any known close contact with a COVID-19 exception.
that his son had been treated for pulmonary TB infection a year earlier.

Upon his admission, physical examination revealed a conscient bedridden patient, febrile at 38°C, tachypneic at 30 cpn, saturation levels at 86% on ambient air, tachycardic at 100 bpm, and normotensive with bilateral rhonchi, a swollen painful left leg with positive Homans’ sign and vesicular eruption on his abdomen. On another note, his admission’s capillary blood glucose was as high as 4 g/l and his urine strip revealed 2 positives for ketones and 2 positives for glucose, thus revealing an inaugural diabetic ketosis. His EKG and cardiac enzymes were normal.

His laboratory findings showed an elevated white blood cells count (10240/ml) (normal: 7000–10000/ml) with high neutrophilic count, a microcytic hypochromic anemia at 10.7 (normal: 13–18 mg/dl), lymphocytopenia at 710 (normal: 1500–4000/mL), an elevated C-reactive protein at 208 (normal:<5 mg/l), normal procalcitonin level 0.26 (normal <5), elevated lactate dehydrogenase at 371 (normal: 135–225 U/L), elevated ferritin at 764 ng/ml (normal: 30–400 ng/ml), blood sugar at 2.29 g/l, and bicarbonates at 22.75 (normal: 22–30). His renal and liver full workup was normal. HIV and other viral serologies also came back negative. His chest computed tomography (CT) scan showed foci of pulmonary consolidation with diffused ground-glass opacities and multiple bilateral nodules and micronodules all in favor of a CO-RADS 5 with signs of active tuberculosis (Figure 1).

His nasopharyngeal swab for COVID-19 reverse transcriptase-polymerase chain reaction (RT-PCR) came back positive, thus confirming a COVID-19 infection. Also, his sputum for MTB PCR was positive with no rifampicin resistance detected revealing a concomitant infection with Mycobacterium tuberculosis. A venous doppler ultrasound of his left leg revealed a total thrombosis of the superficial femoral, popliteal, and sural veins.

The patient was admitted to one of our COVID-19 isolation units and was put under oxygenotherapy via a high flow nasal cannula at 6 liters/min. He was started on broad spectrum antibiotics (2 g of ceftriaxone) for 10 days, corticosteroids (methyprednisolone) 80 mg for 5 days, 40 mg of prednisolone orally, a fixed dose-combination of antituberculosis treatment (isoniazid + rifampicin + pyrazinamide + ethambutol), and anticoagulation with low-molecular weight heparin enoxaparin at 0.6 IU*2 per day and was prescribed support stockings. Intravenous hydration was started as per ketosis correction protocol with correction of hydroelectrolytic disorders and intravenous and then subcutaneous insulin therapy with the following regimen: basal insulin in the evening with boluses of rapid insulin.

![Figure 1: CT scan images showing foci of pulmonary condensation and cavitations of the right upper lobe with diffused ground-glass opacities and multiple bilateral foci of nodules and micronodules suggesting CO-RADS 5 with signs of active tuberculosis.](image-url)
three times a day, depending on the patient’s capillary blood sugar.

The evolution was favorable with apyrexia on the second day of treatment, the oxygenotherapy was discontinued progressively over 10 days, the patient's COVID-19 PCR came back negative on day 15th of his admission, and his chest CT scan showed endoluminal defects of the segmental arteries of the left pulmonary base, focal cystic dilatation of the upper right lobe with focal parenchymatous consolidation, multiples bilateral micronodules, and lymphadenopathy in Barety’s compartment all in favor of a pulmonary embolism with signs of active TB infection (Figure 2).

After a stay of 23 days, the patient was discharged with a prescription of anti-TB therapy, antivitamin K (started on day 15th of admission), and oral corticosteroids (prednisone) for 10 days with progressive degression and a basal bolus insulin regimen.

3. Discussion

Our patient presented a rare case of simultaneously diagnosed coinfection of COVID-19 and active pulmonary TB. This coinfection was described in both genders and in all age groups including a three-month-old Gambian patient, with a slight predominance in males and migrants [4]. These cases were only reported in some countries like Italy [5–9], Singapore [10, 11], India [12–15], China [16–19], Brazil [20, 21], Turkey [22, 23], Saudi Arabia [24–26], and Mexico [27].

In Table 1, we describe clinical features and radiological findings as well as treatment options and outcome in our literature review of reported cases of this coinfection. The most common symptoms of COVID-19 include fever, cough, and dyspnea [56]. These symptoms are also common in TB infection [57] which makes TB diagnosis rather difficult and sometimes even delayed as in some cases. Our patient as well as multiple reported cases have presented unusual symptoms including night sweats, anorexia, weight loss, and hemoptysis (Table 1). These clinical features are typical of tuberculosis [57] and thus are important to look for when a patient presents respiratory complaints especially in high TB burden countries like ours.

In our case, the diagnosis of COVID-19 was confirmed by RT-PCR for SARS-CoV-2 done upon admission, systematically as per national protocols due to the ongoing pandemic. The complementary CT scan showed pulmonary condensation and diffused ground-glass opacities, commonly described in COVID-19 pneumonia [58]. It also revealed bilateral nodules and micronodules which are characteristic of an underlying active TB infection [59]. In the reported cases, other radiological findings suggesting TB
| Study                  | Country      | Number of patients | Median age | Comorbidities                                      | Clinical presentation | Radiological findings | Site of TB                  | COVID treatment                     | TB treatment                      | Mortality |
|------------------------|--------------|--------------------|------------|---------------------------------------------------|-----------------------|-----------------------|-------------------------------|-------------------------------------|------------------------------------|-----------|
| Tadoliniet al. [28]    | Multicenter  | 49                 | 49         | 8 COPD/asthma, 8 diabetes, 6 HIV, 5 kidney disease, 7 liver disease, 10 alcoholism, 20 smoking, 4 drug abuse | 32 fever, 27 cough, 17 dyspnea | 21 bilateral GGO, 23 cavitation, 25 infiltrates | 36 pulmonary, 1 extrapulmonary, 12 both | 22 HCQ, 12 antiviral therapy, 7 AZT, 1 other | NM                   | 6 deaths  |
| Gupta et al. [12]      | India        | 22                 | 44         | 3 diabetes, 4 hypertension, 2 seizure disorder, 1 hypothyroidism | 22 fever, 11 cough, 7 dyspnea, 1 weight loss, 1 headache | 14 bilateral infiltrates typical of COVID, 9 pulmonary fibrosis, 3 cavitations, 6 infiltrates/consolidation, 2 pleural effusion | 17 pulmonary, 4 extrapulmonary; 1 disseminated | NM                   | 21 (RIF, INH, PYR, ETB), 1 MDR therapy | 6 deaths  |
| Stochino et al. [5]    | Italy        | 20                 | 40         | 1 COPD, 4 diabetes, 1 psoriasis, 1 hypertension, 1 sickle cell disease | 12 fever, 9 cough, 3 dyspnea, 3 chest pain, 2 headache, 1 conjunctivitis, 3 asymptomatic 3 fever, 7 cough, 3 dyspnea, 2 headache, 4 anorexia, 1 hemoptysis, 1 skin rash, 4 asymptomatic 3 fever, 3 cough, 1 chest pain | 1 GGO, 3 interstitial syndrome, 8 cavitations, 14 nodules, 1 pleural effusion, 1 calcification, 2 miliary | 16 pulmonary, 1 extrapulmonary; 2 both, 1 disseminated | 20 HCQ                | 14 (RIF, INH, PYR, ETB), 2 MDR therapy, 4 tailored therapy | 1 death   |
| G¨ u et al. [22]       | Turkey       | 16                 | 40.68      | 2 smoking, 2 asthma, 2 cardiac disease, 2 diabetes | 9 GGO, 6 infiltration, 4 cavitations, 1 nodule, 1 pleural effusion | 9 pulmonary, 5 extrapulmonary, 1 both | 10 HCQ, 8 FAV                | 13 (RIF, INH, PYR, ETB), 1 (RIF, INH, PYR, STR), 1 (RIF, INH, STR, ETB) | 1 death   |                      |
| He et al. [16]         | China        | 3                  | 56.3       | 2 smoking                                         | 3 GGO, 1 cavitation      | 3 pulmonary              | 3 LOP/RIT, Arbidol            | 1 (RIF, INH, PYR, ETB)             | 0                    |                      |
| Liu et al. [17]        | China        | 3                  | 40         | 1 MDR-TB, 1 *Aspergillus* infection               | 3 GGO                  | 3 pulmonary              | 1 AZT, 3 Arbidol, 3 MOX, 2 LNZ, 1 (ETB/PYR/AMK/LEV), 1 CS, 1 CFZ, 1 LNZ | 0                    |                      |
| Study             | Country       | Number of patients | Median age | Comorbidities                             | Clinical presentation | Radiological findings | Site of TB | COVID treatment | TB treatment | Mortality |
|-------------------|---------------|--------------------|------------|-------------------------------------------|-----------------------|-----------------------|------------|-----------------|--------------|-----------|
| Yao et al. [18]   | China         | 3                  | 50.3       | 2 smoking, 1 diabetes                     | 3 fever, 3 cough, 3 weight loss, 1 night sweat | 3 GGO, 2 pleural effusion | 3 pulmonary | 2 LOP/RIT, 1 UMP HCL, 2 IFN-α | 2 RIF, INH, PYR, ETB | 1 death   |
| Cao et al. [19]   | China         | 1                  | 47         | Asthma                                    | Unwellness, poor appetite | Cavern calcification | Pulmonary | LOP/RIT         | RIF, INH, PYR, ETB | 0         |
| Tham et al. [10]  | Singapore     | 4                  | 31.75      | NM                                        | 1 GGO, 1 cavitation, 2 pleural effusion, 3 consolidations | 4 pulmonary | NM          | 4 RIF, INH, PYR, ETB | 0         |
| Al Lawat et al.   | Oman          | 2                  | 49         | 1 smoking, 1 diabetes, 1 hypertension     | 1 cavitations, 2 nodules | 2 pulmonary | 2 CTX, CLR, and OSE, 2 HCQ, 1 LOP/RIT | 2 RIF, INH, PYR, ETB | 0         |
| Gadelha Farias et al. [20] | Brazil         | 2                  | 41         | 1 HIV, 1 hepatitis B                      | 2 GGO, 1 cavitation | 2 pulmonary | 2 HCQ, 2 AZT, 2 CTX | 2 RIF, INH, PYR, ETB | 0         |
| Yousaf et al. [30] | Qatar         | 6                  | 35.5       | 1 diabetes mellitus                       | 6 infiltrations, 6 cavitation, 1 pleural effusion | 6 pulmonary | 6 (HCQ, AZT, CTX) | 6 (RIF, INH, PYR, ETB) | NM        |
| Shabrawishi et al. [24] | Saudi Arabia | 7                  | 34.8       | 1 HIV                                     | 1 GGO, 7 consolidation, 3 cavitations, 2 nodules, 1 pleural effusion, 1 pneumothorax | 6 pulmonary, 1 both | 4 (AZT, CTX), 1 HCQ, 1 (RIF, INH, LOP/RIT) | 7 RIF, INH, PYR, ETB | 1 death   |
| Khayat et al. [25] | Saudi Arabia  | 1                  | 40         | None                                      | Consolidation          | Pulmonary | NM          | RIF, INH, PYR, ETB | 0         |
| Study              | Country       | Number of patients | Median age | Comorbidities                                | Clinical presentation                                                                 | Radiological findings | Site of TB | COVID treatment                  | TB treatment | Mortality |
|-------------------|---------------|--------------------|------------|----------------------------------------------|---------------------------------------------------------------------------------------|-----------------------|------------|-----------------------------------|--------------|-----------|
| Baskara et al.    | Indonesia     | 1                  | 42         | Diabetes                                     | Dizziness, headache, cough, abdominal pain, night sweats                              | GGO                   | Pulmonary | AZT, CTX, CTZ, PYR, MTB          |              | 0         |
| Vilbrun et al.    | Haiti         | 1                  | 26         | MDR-TB                                       | Fever, cough, dyspnea, weight loss                                                    | Cavitation            | Pulmonary | NM                               | BDQ, LEV, LNZ, CFZ, PYR | 0         |
| Luciani et al.    | Italy         | 1                  | 32         | BCG vaccination                              | Fever, myalgia                                                                          | Consolidation         | Pulmonary | LOP/RIT, HCQ, LNZ, CLR, TZP       | RIF, INH, PYR, ETB | 0         |
| Musso et al.      | Italy         | 1                  | 45         | Immunosuppression, alcoholism                | Fever, productive cough, fatigue, weight loss, respiratory failure.                    | GGO, cavitation, atelectasis | Pulmonary | HCQ, corticosteroids              | RIF, INH, ETB, PYR, AMK, MOX | Death     |
| Lovino et al.     | Italy         | 1                  | 45         | None                                         | GGO, excavated consolidation                                                            | Pulmonary             | NM        | NM                               |              | 0         |
| Rivas et al.      | Panama        | 2                  | 41         | 2 HIV                                        | 2 infiltrations                                                                        | Pulmonary             | NM        | 2 AZT, 2 HCQ, 1 CTX, 1 LEV, 1 antiviral therapy | 2 RIF, INH, PYR, ETB | 0         |
| Pozdnyakov et al. | Canada        | 1                  | 64         | Diabetes, hypertension, and dyslipidemia     | Dyspnea, respiratory distress syndrome                                                | GGO, interstitial syndrome | Pulmonary | CTX                             | RIF, INH, PYR, ETB | 1 death   |
| Faqih et al.      | Saudi Arabia  | 1                  | 60         | Diabetes, hypertension                       | Anosmia, dysgeusia, cough, dyspnea                                                    | GGO                   | Pulmonary | LOP/RIT, RIB, DEX                | RIF, INH, PYR, ETB | 0         |
| Starshinova et al.| Russia        | 1                  | 59         | Heart disease, COPD, emphysema, tuberculosis | Fever, rhinitis, cough, shortness of breath                                            | GGO, infiltration, pneunothorax, emphysema                                         | Pulmonary | CTX, LEV, AZT                    | RIF, INH, PYR, ETB | 0         |
| Orozco et al.     | Mexico        | 1                  | 51         | Diabetes                                     | Anosmia, dysgeusia, cough, dyspnea                                                    | GGO cavitation        | Pulmonary | Oxygenotherapy                   | RIF, INH, PYR, ETB | 0         |
| Study                  | Country | Number of patients | Median age | Comorbidities                          | Clinical presentation | Radiological findings          | Site of TB       | COVID treatment                     | TB treatment | Mortality |
|-----------------------|---------|--------------------|------------|----------------------------------------|-----------------------|-------------------------------|----------------|-------------------------------------|--------------|-----------|
| Marwah et al. [13]    | India   | 1                  | 34         | MDR tuberculosis, chronic hepatitis B | Productive cough, dyspnea, weight loss, fever, respiratory failure Fever productive cough, chest pain, dyspnea, anorexia, weight loss, hemoptysis   | Cavitation nodules       | Pulmonary       | Corticosteroids, oxygenotherapy     | RIF, INH, ETB, PYR, BDQ | 0         |
| Patil and Gondhani [14]| India   | 1                  | 75         | Ex-smoker                             | GGO, cavitation infiltrates | Pulmonary      | Remdesivir, corticosteroids, anticoagulation | RIF, INH, ETB, PYR | 0         |
| Yadav and Rawal [15]  | India   | 1                  | 43         | None                                  | Bilateral consolidation | Pulmonary      | NM                           | RIF, INH, ETB, PYR | 0         |
| Yadav et al. [36]     | India   | 1                  | 26         | None                                  | Consolidation          | Pulmonary      | NM                           | INH, ETB, PYR, kanamycin, MOX, CFZ, ethionamide | 0         |
| Jacob et al. [37]     | India   | 1                  | 20         | Multiple sclerosis                    | Opacity                | Pulmonary      | Corticosteroids, oxygenotherapy, antibiotics | RIF, INH, ETB, PYR | 0         |
| Ata et al. [38]       | India   | 1                  | 28         | Glioma                                | GGO nodules            | Pulmonary with CNS involvement | HCQ, AZT | RIF, INH, PYR, ETB, pyridoxine     | 0         |
| Goel Sharma et al. [39]| India   | 1                  | 53         | Diabetes chronic kidney disease      | GGO, consolidation, fibrosis | Pulmonary      | Ampicillin, AZT, HCQ           | RIF, INH, PYR, ETB | 0         |
| Study                  | Country          | Number of patients | Median age | Comorbidities                                      | Clinical presentation                                      | Radiological findings                                      | Site of TB | COVID treatment                          | TB treatment | Mortality |
|------------------------|------------------|--------------------|------------|---------------------------------------------------|-----------------------------------------------------------|-----------------------------------------------------------|------------|------------------------------------------|--------------|-----------|
| Singh et al. [40]      | India            | 1                  | 76         | Hypertension                                      | Fever, respiratory distress, cough, anorexia, weight loss | GGO Consolidation, pleural effusion                       | Pulmonary  | AZT, HCQ, corticosteroids               | RIF, INH, PYR, ETB | 0         |
| Sahara and Yokota [41] | Japan            | 1                  | 59         | None                                              | GGO, tree-in-bud pattern                                   | Pulmonary                                               | NM         | RIF, INH, ETB, PYR                     | 0            |           |
| Ortiz-Martínez et al. [42] | Colombia     | 1                  | 34         | HIV drug use, anxiety disorder                    | Fever, dyspnea, headache, cachexia, respiratory distress  | GGO, miliary, pleural effusion                           | Pulmonary   | SAM, DOX, corticosteroids, oxygenotherapy | NM Death     |           |
| Aissaoui et al. [43]   | French Guiana    | 1                  | 30         | NM                                                | Consolidation, tree-in-bud pattern                         | Pulmonary                                               | CTX, DOX   | RIF, INH, ETB, PYR                     | 0            |           |
| Bouaré et al. [44]     | Morocco          | 1                  | 32         | HIV                                               | Fever cough, headache, myalgia                            | Miliary                                                 | Pulmonary   | HCQ, AZT                               | RIF, INH, ETB, PYR | 0         |
| Cutler et al. [45]     | USA              | 1                  | 61         | Parkinson                                         | Fever, cough, hemoptysis                                  | Pleural effusion, atelectasis                           | Pulmonary   | HCQ, oxygenotherapy, AMX, HCQ, AZT, DOX, FAV, TCZ, meropenem | RIF, INH, ETB, PYR | 0         |
| Freij et al. [46]      | USA              | 1                  | 5          | Group A streptococcal pharyngitis                 | Fever, headache                                           | Clear                                                   | Extrapulmonary | AZT, corticosteroids, remdesivir     | None Death   |           |
| Butt et al. [47]       | UK               | 1                  | 42         | None                                              | Dyspnea fever, dry cough, fatigue                         | GGO, Pleural effusion, Consolidation                    | Pulmonary   | DEX, remdesivir                        | RIF, INH, ETB, PYR | 0         |
| Çınar et al. [23]      | Turkey           | 1                  | 55         | Myelodysplastic disease, kidney disease, *Klebsiella pneumoniae* infection | Fever, cough, dyspnea                                     | GGO                                                     | Disseminated | Plasma therapy, FAY, TCZ, meropenem | RIF, INH, PYR, ETB | 0         |
| Study                  | Country       | Number of patients | Median age | Comorbidities                              | Clinical presentation                                                                 | Radiological findings | Site of TB | COVID treatment | TB treatment | Mortality |
|------------------------|---------------|--------------------|------------|--------------------------------------------|---------------------------------------------------------------------------------------|-----------------------|------------|----------------|--------------|-----------|
| Tolossa et al. [48]    | Ethiopia      | 1                  | 55         | HIV                                       | Fever, productive cough, headache, chest pain, dyspnea, night sweats, weight loss, anorexia, fatigue, hemoptysis | Patchy opacities       | Pulmonary  | Cefepime, corticosteroids | RIF, INH, PYR, ETB | 0         |
| Bongomin et al. [49]   | Uganda        | 1                  | 37         | HIV, cryptococcal meningitis              | Fever, productive cough, dyspnea, night sweats, weight loss, anosmia, headache, myalgia, episodes of loss of consciousness. Fever, chest pain, productive cough, dyspnea. | GGO, miliary          | Disseminated | TZP, corticosteroids, oxygenation | None Death |           |
| Wong et al. [11]       | Singapore     | 1                  | 47         | None                                      | Fever, chest pain, productive cough, dyspnea.                                          | Opacities cardiomegaly | Extrapulmonary (pericardiac) | Remdesivir, oxygenotherapy | RIF, INH, PYR, ETB | 0         |
| Kozinska and Augustynowicz-Kopeć [50] | Poland        | 2                  | 67.5       | 1 smoking, 1 HIV, 1 atrial fibrillation, 1 renal insufficiency, 2 treated pulmonary TB, treated urogenital TB | 1 (cough, fever, dyspnea, sore throat), 1 no data | 1 (atelectasis pleural effusion), 1 no data | 1 pulmonary, 1 disseminated | No data | 1 (RIF, INH, PYR, ETB), 1 no data | 1 death |
| Gerstein et al. [51]   | USA           | 1                  | 49         | Alcoholism cirrhosis                      | Fever, dry cough, orthopnea, abdominal pain                                              | Pleural effusion, opacities                  | Disseminated | HCQ, plasma infusion | RIF, INH, ETB, LEV | 0         |
| Mulale et al. [52]     | Botswana      | 1                  | 3 months   | None                                      | Infiltrates, opacities, consolidations                                                    | Disseminated | Ampicillin, gentamicin, oxygenotherapy | RIF, INH, PYR, ETB | Death |
| Study                          | Country       | Number of patients | Median age | Comorbidities                                                                 | Clinical presentation                                                                 | Radiological findings | Site of TB | COVID treatment                                                                 | TB treatment          | Mortality |
|-------------------------------|---------------|--------------------|------------|--------------------------------------------------------------------------------|--------------------------------------------------------------------------------------|-----------------------|------------|---------------------------------------------------------------------------------|-----------------------|-----------|
| Essajee et al. [53]           | South Africa  | 1                  | 2 y 7 months | Cerebral venous thrombosis, Bladder cancer, BCG intravesical instillation, diabetes, COPD, abdominal aortic aneurysm | Lethargy, hemiplegia, respiratory distress, Fever, cough, dysuria, dyspnea, respiratory distress | Miliary, Disseminated | Corticosteroids, oxygenotherapy, antibiotics | RIF, INH, PYR, ethionamide, corticosteroids | 0         |
| Brandi et al. [9]             | Italy         | 1                  | 78          | Bladder cancer, BCG intravesical instillation, diabetes, COPD, abdominal aortic aneurysm | GGO, miliary                                                                      | Disseminated          | NM         | RIF, INH, ETB                                                                    | Death                 |           |
| Osejo-Betancourt et al. [54]  | Colombia      | 1                  | 71          | Smoking                                                                                           | Bilateral alveolar opacities, cavitation, consolidation, nodules                   | Pulmonary             | NM         | DEX, SAM, oxygenotherapy                                                          | RIF, INH, PYR, ETB | 0         |
| Pinheiro et al. [21]          | Brazil        | 1                  | 68          | Diabetes, hypertension, chronic liver disease                                                   | Fever dyspnea, cough, Anosmia, dysgeusia, nocturnal diaphoresis, cough, respiratory distress, 2 fever, 2 cough, 2 weight loss, 1 respiratory distress, 1 sore throat. | GGO, opacities, consolidations | Pulmonary             | NM         | NM                                               | NM                   | NM        |
| Orozco et al. [27]            | Mexico        | 1                  | 51          | Diabetes                                                                                           | GGO, cavitation, nodules                                                          | Pulmonary             | Oxygenotherapy                     | RIF, INH, PYR, ETB | 0         |
| Gbenga et al. [55]            | Nigeria       | 2                  | 31.5        | None                                                                                              | 1 reticulonodular infiltrates, 1 opacity, 1 respiratory distress, 1 sore throat. | Pulmonary             | 2 AZT, 2 LOP/RIT, 2 (Vit C, zinc sulfate, prednisone) | 2 RIF, 2 INH, 2 PYR, 2 ETB | 0         |
infection included infiltrates, consolidation, cavitation, pleural effusion, miliary, and calcification (Table 1). These previous aspects are atypical of COVID-19 and their presence signs a TB coinfection [59] in need of further confirmatory tests.

The TB diagnosis in our case was first brought up by the atypical CT scan findings and was later confirmed by GeneXpert MTB/RIF assay and sputum cultures coming back positive for drug susceptible M.tb (Mycobacterium tuberculosis) like most of the reported cases (Table 1). However, drug resistance was reported in some cases (Table 1).

In our case, we noted lymphocytopenia, neutrophilia, increased inflammatory markers (CRP and ferritinemia), and LDH which was described in COVID-19 infection and linked to severe disease and higher mortality [60]. On the same note, an elevated D-dimers level was also related to worse prognosis and to high probability of coagulopathy [60]; although not measured in our case, they would have been elevated since our patient had already presented thrombotic complications.

Although thrombotic complications are frequent in COVID-19 infection, their exact incidence has not yet been determined. However, it is noted that their rate is higher in critically ill COVID-19 patients admitted to ICU wards in comparison to non-ICU patients [61]. Their pathogenesis could mainly be related to local factors including inflammation and immunothrombosis induced by the viral infection and/or to the usual thrombotic factors such as prolonged bed rest, age, and certain comorbidities [61, 62]. Our patient has presented PE complicating DVT, but studies show that PE could occur independently from DVT which supports the hypothesis of in situ thrombosis mechanism [61, 62]. Fortunately, our patient has made an uneven recovery, but these complications and specifically PE are considered independent factors of morbidity and mortality in COVID-19 patients [63], highlighting the importance of the close monitoring and the development of prophylactic anticoagulation protocols especially for critically ill patients.

There is still no consensus considering the treatment of COVID-19 and tuberculosis coinfection. Our patient received the classic quadruple antituberculosis regimen (isoniazid + rifampicin + pyrazinamide + ethambutol) along with broad spectrum antibiotics for the COVID-19 pneumonia as per the national protocol in Morocco. In the cohort of Tadolini et al., while the antitubercular treatment was the same for drug susceptible M.tb, the reported treatment for COVID-19 was of different combinations of hydroxychloroquine, azithromycin, and lopinavir/ritonavir. 17 patients received a monotherapy, 9 a combination of two drugs, and 2 received 3 or more drugs [28]. Antiretroviral therapy and hydroxychloroquine are empirically used for COVID-19 treatment; however, they were shown to have interaction with antitubercular drugs, especially rifampicin, isoniazid, and second-line treatments [64]. Since these drug interactions have not been fully elucidated, their use in our case was avoided.

The use of corticosteroids in COVID-19 is recommended in certain cases to modulate the inflammatory process as in our national COVID-19 protocol. Many cases in literature suggest the possibility of TB reactivation under these immunosuppressive treatments [65], but due to limited data, no conclusion can be drawn about this subject. Recommendations are to administer corticosteroids in a low dose and for a short period of time when it is indicated to avoid inducing immunosuppression and risk opportunistic infections such as TB [66].

In the study by Tadolini et al., 9 patients had both diseases diagnosed within the same week including 4 on the same day, and 14 had COVID-19 first [28]. However, the authors failed to show the role of COVID-19 in the progression of TB due to the study limitations. The relationship between COVID-19 and the onset of TB infection is still debatable, but it seems to be bidirectional. Since both infections depend on cellular immunity, temporary immunosuppression caused by SARS-CoV-2 increases susceptibility for new TB infections or reactivation of latent TB infections and vice versa [34].

In the same cohort, the mortality rate was as high as 6/49 (12.3%) and was reported in aging patient with 1 or plus comorbidities [28]. The risk factors for this coinfection are comparable to those of TB without COVID-19 including age, COPD, HIV, smoking, diabetes, hypertension, and renal failure. Our patient checked two of these factors, those of age and diabetes, and fortunately presented a moderate pneumonia that did not require intensive care with a favorable evolution.

In conclusion, the possible overlap of symptoms of COVID-19 and TB must alert clinicians to think of TB coinfection when confronted with atypical clinical or radiological presentations, especially in migrants and high TB burden countries. Larger studies are needed to fully to explore and establish clear treatment and prevention protocols for this coinfection.

Written informed consent was obtained from the patient for using images and other relevant data for publication in this study.

4. Conclusion

In the mist of the ongoing pandemic, as all resources are being allocated to the fight against COVID-19, the emerging cases of COVID-19 and TB coinfection is ought to remind us of an every important fight, that against TB. Therefore, we strongly recommend testing for both diseases when faced with respiratory symptoms especially in high TB burden countries like ours or at least before atypical clinical or radiological presentations. The available data about these cases is limited still, and further studies are necessary to better comprehend the effects of COVID-19 on TB and vice versa.

Abbreviations

NM: Not mentioned
MDR: Multidrug resistant
COPD: Chronic obstructive pulmonary disease
GGO: Ground-glass opacities
**Data Availability**

The data supporting this case report are from previously reported studies and datasets, which have been cited. The patient’s personal data are available from the corresponding author upon request and cannot be disclosed publicly due to the patient privacy policy of our institution.

**Conflicts of Interest**

The authors declare that they have no conflicts of interest.

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