REVIEW ARTICLE

Analysis of respiratory complications occasioned by the coronavirus (COVID-19): a systematic review

Análise de complicações respiratórias ocasionadas pelo coronavirus (COVID-19): uma revisão sistemática

Guilherme Pertinni de Morais Gouveia[1], Samira Veras Cunha[2], Rosangela Lago da Silva[2]

1. Physiotherapist, PhD in Medical-Surgical Sciences at the Federal University of Ceará (UFC), professor at the Federal University of Delta of Parnaíba - UFDPar. Coordinator of the Research Group in Evaluative and Therapeutic Physiotherapy - GPFAT - Parnaíba - Piauí - Brazil. 2. Physiotherapy undergraduate at the Federal University of Delta of Parnaíba - UFDPar. Member of the Research Group in Evaluative and Therapeutic Physiotherapy - GPFAT — Parnaíba - Piauí - Brazil.

Abstract

Aim: To describe and analyze the main disorders in the respiratory system, in individuals with confirmed cases of COVID - 19 reported in the scientific literature. **Methods**: Systematic literature review, based on the flowchart of the "Preferred Reporting Items for Systematic Reviews and Meta-Analyzes" (PRISMA), including primary quantitative experimental or quasi-experimental studies, freely accessible articles, available in Portuguese, English, Spanish and published from 2019 to 2020, using the PICOS strategy. 8,543 articles during March and April 2020, through the Lilacs, Scielo, Pubmed, MedLine, PeDro, Cochrane, Science direct and Google academic databases and of these, the Start tool (State-of-the-Art through Systematic Review) managed 94 studies. **Results**: Studies showed that most individuals had admission with signs and symptoms of fever, dry cough, difficulty breathing, expectoration, nausea, vomiting, diarrhea and rare myalgia. reaching from children to the elderly and had some previous comorbidities. **Conclusion:** This review identified the emphatic onset of the disease since symptoms and respiratory complications appear between 3 and 14 days.

Keywords: COVID-19; Coronavirus. Respiratory System. Symptoms; SARS-CoV, Pneumonia.

Resumo

Objetivo: Descrever e analisar as principais doenças do aparelho respiratório, em indivíduos com casos confirmados de COVID - 19 relatados na literatura científica. **Métodos**: Revisão sistemática da literatura, com base no fluxograma dos "Itens de Relatório Preferenciais para Revisões Sistemáticas e Meta-análises" (PRISMA), incluindo estudos quantitativos primários experimentais ou quase experimentais, artigos de livre acesso, disponíveis em português, inglês, espanhol e publicado de 2019 a 2020, utilizando a estratégia PICOS. 8.543 artigos durante os meses de março e abril de 2020, por meio das bases de dados Lilacs, Scielo, Pubmed, MedLine, PeDro, Cochrane, Science direct e Google Acadêmico e, destas, a ferramenta Start (State-of-the-Art through Systematic Review) geriu 94 estudos. **Resultados**: Estudos demonstraram que a maioria dos indivíduos apresentou internação com sinais e sintomas de febre, tosse seca, dificuldade respiratória, expectoração, náuseas, vômitos, diarreia e rara mialgia. atingindo desde crianças até idosos e com algumas comorbidades prévias. **Conclusão**: Esta revisão identificou o início enfático da doença, uma vez que os sintomas e complicações respiratórias aparecem entre 3 e 14 dias.

Palavras-chave: COVID-19; Coronavírus. Sistema respiratório. Sintomas; SARS-CoV; Pneumonia.

INTRODUÇÃO

In December 2019, a Municipal Health and Sanitation Commission in Wuhan, Hubei province - China, reported a series of pneumonia cases of unknown etiology. On January 7, 2020, the Chinese authorities identified a new type of virus in the family Coronaviridae, called SARS-CoV-2, as the cause of problem[1]. On January 30, the World Health Organization (WHO) recorded an epidemic and an international emergency. However, on March 19, 234,073 cases worldwide were confirmed in 176 countries[2]. On March 20, 904 infected with the disease were identified in Brazil in 24 states of the country[3].

Coronavirus is an enveloped RNA virus, widely disseminated among humans, other mammals and birds, causing respiratory, enteric, liver and neurological diseases[4], and hematological diseases. Given the high prevalence and wide distribution of the coronavirus, the great genetic diversity and the frequent recombination of its genomes and the increased activities of the human-animal interface, it is likely that new coronavirus in humans will periodically appear because of frequent infections between species[5].

We know six species of coronavirus to cause human disease. Four of these viruses (229E, OC43, NL63 and HKU1) are prevalent and cause common cold symptoms in immunocompetent individuals [6]. The two other coronaviruses (SARS-CoV and MERS-CoV) are responsible for severe acute respiratory syndrome

Correspondence: Polyanna Helena Coelho Bordoni. Rua Nícias Continentino 1291, Gameleira, Belo Horizonte – Minas Gerais. E-mail: polyannabordoni@gmail.com

Conflict of interest: Não há conflito de interesse por parte de qualquer um dos autores.
Received: 23 Nov 2020; Revised: 15 Dez 2020; Accepted em: 23 Dez 2020

and Middle Eastern respiratory syndrome, respectively. Both are of zoonotic origin, being associated with diseases that are sometimes fatal 7. The SARS outbreak began in southern China and was recognized as a global threat to public health in March 2003, resulting in 774 deaths of 8,098 infected individuals from November 2002 to July 2003. MERS was first reported in 2012 in Saudi Arabia and resulted in 858 deaths among 2,494 infected individuals[4].

The new coronavirus 2019 (COVID-19) is the seventh described as a cause of disease in humans. Phylogenetic analysis classified it as a genus betacoronavirus, which includes human coronavirus, bats and other wild animals. This new coronavirus shares 79.5% of its genetic sequence with SARS-CoV and has 96.2% homology with a bat coronavirus[8].

For the experiences, since 2003, with the other coronavirus (H1N1, SARS-CoV and MERS-CoV) and for the characteristics of the new cases of coronavirus pneumonia, these pulmonary impairments, signs and symptoms common to previous outbreaks such as fever, fatigue, dyspnea, headache, drought, upper respiratory tract infection, decreased number of lymphocytes and white blood cells (although the most recent levels are sometimes normal) and pneumonia[9]. In severe cases, it can progress rapidly to Acute Respiratory Discomfort Syndrome (ARDS), acute respiratory failure, septic shock, difficult to correct metabolic acidosis, coagulopathy and other serious complications[10,11].

Based on the premise that one system most affected by COVID-19 is the respiratory system, being able to lead the individual to a serious state or even to death, it is necessary to survey which pulmonary complications originate from COVID-19 and how they behave. Such information can clarify and help professionals to associate such complications with a diagnosis of the disease, contributing to its prevention and facilitating possible decision-making.

Therefore, this systematic review aims to describe and analyze the main disorders in the respiratory system, in individuals with confirmed cases of COVID - 19 reported in the scientific literature.

METHOD

Study design

This study is a Systematic Review (SR) of the literature, based on the flowchart of the "Preferred Reporting Items for Systematic Reviews and Meta-Analyzes" (PRISMA), including primary quantitative experimental or quasi-experimental studies. We register this review in PROSPERO (ID: 183828).

Inclusion criteria

Open access articles, available in Portuguese, English, Spanish and Chinese, published from 2019 to 2020, because of the increase in research concerning the COVID-19 pandemic. 8,543 articles were searched during the months of March and April 2020, using the Lilacs, Scielo, Pubmed, MedLine, PeDro, Cochrane, Science direct and Google academic databases.

Study protocol

Search strategy

The PICOS strategy (P - population; I - intervention; C - comparison; O - outcomes and S - study) guided the elaboration of the guiding question of SR and served as a basis for the development of search strategies using the Science Descriptors of Health (DECS), with the Boolean operators OR and AND, as shown in Chart 1. We did not address element C of the PICO strategy, as it is not a comparative study. Thus, the delimited research question was: "what pulmonary complications come from COVID-19?" In it, the first element of the strategy (P) comprises the individual with COVID-19; the second (I), the interventions in COVID-19; and the fourth element (O) the commitments in COVID-19; as (S) we considered Cohort studies from 2019 for inclusion. We performed the searches using the descriptors: COVID19, Coronavirus, respiratory system, pulmonary complications in all databases according to the strategies of each site.

Selection of articles

Initially, we analyzed the titles, followed by the reading of the abstracts to identify those that we would test in full, independently, by four researchers. Then the StArt tool (State-of-the Art through Systematic Review) was used to help carry out the review from the planning process to the organization of the collected studies. We extracted the final necessary data using an instrument containing identification data (authors and year), study design, type of population, types of symptoms and respiratory complications of COVID-19.

Analysis of results

We classified all studies included in this review based on their results/complications and presented them descriptively.

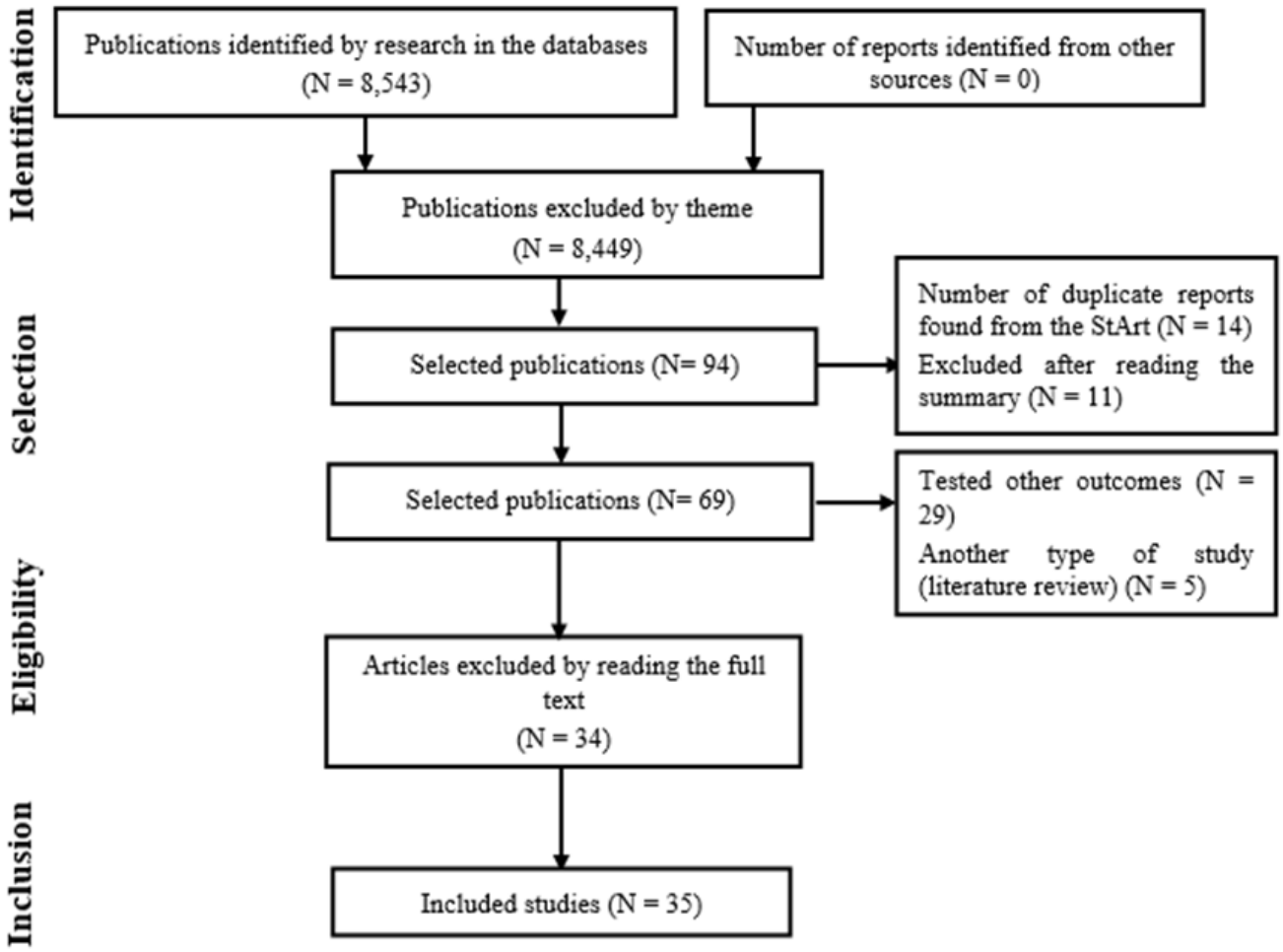
RESULTS

From 8.543 articles found through the descriptors "COVID-19, Coronavirus, Respiratory System, Symptoms, SARS-CoV, pneumonia", in the Lilacs, Scielo, Pubmed, MedLine, PeDro, Cochrane, Science and Google databases, 8.449 were excluded academic databases by the theme and by reading the abstract not directed to the aim proposed in this research.

Based on the search strategies and the selections presented in the methods section, we managed 94 studies using the StArt tool, which showed 14 studies as duplicates, since the research was processed on several platforms. After reading the abstract, we excluded 11 articles for not meeting eligibility criteria. Of

the 69 remaining articles, we removed 34 after reading the full text, as 29 of them dealt with different outcomes, which did not add to this theme. The other 5 articles were systematic reviews, not being of interest for the formulation of this study. Therefore, 35 articles remained. Figure 1 shows the selection process for these studies.

Figure 1. Flowchart of the study selection process, Brazil, 2020. Source: GOUVEIA et al., 2020.



General characteristics and quality of studies

Chart 2 presents the main characteristics, results and quality of studies that included respiratory impairment in patients with COVID-19 (n = 35). The articles included in this research are original in three countries: Brazil (n = 1), China (n = 33) and Italy (n = 1). The characteristics of the samples were different: the number of patients tested ranged from 1 to 1,099, and the age range from 10 months to 90 years, regardless of gender. In some studies used in the research, it monitored patients in the hospital during hospitalization.

The quality of the included studies was assessed using the adapted version of the Cochrane bias risk assessment tool for non-randomized studies of interventions (ACROBAT-NRSI). The adapted version of ACROBAT-NRSI has the following bias domains that were included in the risk of bias assessment: bias because of confusion, bias in the selection of study participants, bias in measuring interventions, bias because of deviations from intended interventions, bias because of missing data, bias in the measurement result and bias in the selection of reported results and are classified as low risk of bias (the study is comparable to a well-run randomized study regarding this domain); moderate risk of bias (the study is valid for a non-randomized study regarding this domain, but cannot be comparable to a well-executed randomized study); serious risk of bias (the study has some important problems in this area); critical risk of bias (the study is very problematic in this area to provide any evidence on the effects of the intervention); and no information to base a judgment on the risk of bias for this domain.

Figure 2. Characteristics of studies on COVID-19-related impairments, with an emphasis on the respiratory system in the investigated outcomes, Piauí, Brazil, 2019-2020. Source: GOUVEIA et al., 2020.

Reference and location	Design / Number of patients	Methodological strategy	Comorbidities / symptomatology
(Ji et al. 2020) China Boa qualidade (1)	49 Hispanic patients with COVID-19. Mean age 43.6 ± 17.1 years. Of which 31 were men. They divided patients into two groups - stable group (34 patients): composed of patients with mild or moderate symptoms. Severe and progressive group (15 patients): comprising patients whose symptoms progressed in severity, requiring intubation.	Factors analyzed: difficulty breathing ≥ 30 breaths / min), SpO2 at rest ≤ 93%. PaO2 / FiO2 ratio ≤39.9 kPa. Need for positive airway pressure or continuous positive airway pressure. Worsening of pulmonary CT findings with development of infiltrates. Disorientation or confusion. SBP <90mmHg requiring fluid resuscitation. Uremia with blood urea nitrogen level ≥20 mg / dL.	16 (32.7%) had at least one comorbidity (hypertension, diabetes, cardiovascular disease, liver disease, asthma and chronic lung diseases). 4 (8.2%) had pneumonia, without fever. 5 (10.2%) had pneumonia accompanied by fever. 4 (8.2%) without symptoms. 9 (18.4%) had fever without pneumonia. 31 (63.3%) had fever followed by pneumonia. Fever (79.6%), dry cough (34.7%) and sputum (22.4%).
(Poggiali et al. 2020) China Boa qualidade (2)	Five children from 10 months to 6 years (average of 3.4 years) were included, who tested positive for the polymerase chain reaction test with reverse transcriptase for COVID-19	All had at least one CT scan after admission.	3 initially had light ground-glass opacities. During antiviral treatment, appearances normalized.
(Hu et al. 2020) China Boa qualidade (1)	24 hospitalized patients were included. 5 cases were younger than 15 years old. 8 cases were male. 2 cases had a smoking history. 2 were diagnosed with diabetes and hypertension.	Epidemiological investigations were carried out among all close contacts of patients with COVID-19 (or suspected patients) in Nanjing, Jiangsu province, China, from January 28 to February 9, 2020, both in the clinic and in the community. Asymptomatic carriers were laboratory confirmed positive for the COVID-19 virus, testing the samples' nucleic acid. They tested CT exams.	5 (20.8%) developed fever, cough, fatigue, etc. 12 (50.0%) cases had a frosted glass appearance and 5 (20.8%) had stripes on the lungs. The 7 (29.2%) had no symptoms. Asymptomatic patients were younger (mean age: 14.0 years; P = 0.012) than symptomatic ones. 0 deaths or cases of pneumonia
(Guan et al. 2020b) China Boa qualidade (1)	They obtained data on symptoms and clinical results from 1099 patients hospitalized with COVID-19 in Wuhan, China. The average age of the patients was 47 years; 0.9% of patients were under 15 years of age. 41.9% were female.	Medical records were analyzed, and we compiled data for hospitalized and outpatients with laboratory confirmed Covid-19, as reported to the National Health Commission between December 11, 2019 and January 29, 2020. The data cutoff point for the study was January 31, 2020.	43.8% had hospitalization with fever, evolving to 88.7% during hospitalization. The second most common symptom was cough (67.8%); nausea or vomiting (5.0%) and diarrhea (3.8%) were uncommon. 23.7% had at least one coexisting disease (hypertension or chronic obstructive pulmonary disease). Ground-glass opacity (56.4%) and irregular bilateral shading (51.8%). Diagnosis of pneumonia (91.1%), followed by ARDS (3.4%) and shock (1.1%).
(Han et al. 2020) China Boa qualidade (1)	They included 108 patients (38 men, 70 women; age range, 21-90 years).	They performed CT scans on all patients. With the supine position, making a sigh after inhalation. The scanning interval was from the bilateral apex to the base.	94 patients had fever (87%), dry cough in 65 (60%) and fatigue in 42 (39%). The 108 patients had normal or reduced white blood cell count. 70 (65%) patients had involvement of two or more lobes, with 97% of the lesions in the peripheral region of the lung. When a single lobe was affected, involvement of the right lower lobe was more frequent (79%). 86% had ground-glass opacities. 41% advanced to consolidation. 86 (80%) patients had vascular thickening. 43 (40%) had signs of air bronchogram. In 52 patients (48%) the halo sign was visualized.

Reference and location	Design / Number of patients	Methodological strategy	Comorbidities / symptomatology
(Li and Xia 2020) China Boa qualidade (2)	51 patients diagnosed with COVID-19 infection confirmed by the nucleic acid test (23 women and 28 men; age range 26 to 83 years) and two patients with adenovirus (one woman and one man; 58 years and 66 years old) were included respectively).	The clinical information, tomographic images and corresponding image reports of these 53 patients were reviewed. CT images included 99 chest examinations (performed on patients from February 9), including initial and follow-up studies. They compared the image reports from the initial CT study with the results of laboratory tests, and we identified CT patterns suggestive of viral infection.	51 of the 53 (96.2%) had viral pneumonia. among the 51 include, 49 patients with confirmed SARS-CoV-2 infection and 2 patients with adenovirus. All five lobes were affected in 38 (74.5%), both lower lobes in eight (15.7%), the right lower lobe in three (5.9%), the left upper lobe and the right lower lobe. in one (2.0%) and the lower left lobe, upper lobe and right middle lobe in one patient (2.0%). The lesions were predominantly peripheral and subpleural in 49 (96.1%), and there were fewer injuries along the bronchovascular bundles. Signs of ground-glass opacity and consolidation in 49 (96.1%). Vascular increase in 42 (82.4%). Air bronchogram in 35 (68.6%).
(Zhao et al. 2020) China Boa qualidade (2)	They analyzed cases of 101 patients. 21 to 50 years old. Of which, 87 of them were in the non-emergency group (48 men and 39 women). And 14 were in the emergency group	Data were collected on 101 cases of COVID-19 pneumonia retrospectively at four institutions in Huwan, China. Basic clinical characteristics and detailed imaging (CT) resources were assessed and compared between two groups based on clinical status: non-emergency (mild or common disease) and emergency (serious or fatal disease).	78.2% had fever. Followed by cough, myalgia, sore throat, dyspnoea, diarrhea, nausea and vomiting. Ground glass opacity in 87 (86.1%). Consolidation occurred in 65 (64.4%), vascular lesion increase in 72 (71.3%) and traction bronchiectasis in 53 (52.5%) patients. The lesions present on CT images were more likely to have peripheral distribution 88 (87.1%), bilateral involvement 83 (82.2%), less pulmonary predominance 55 (54.5%) and multifocal 55 (54.5%)
(Kui et al. 2020) China Boa qualidade (2)	137 patients (61 men, 76 women, aged 20 to 83 years, median 57 years).	The clinical data of 137 patients infected with COVID-19, admitted to the respiratory departments of the respiratory departments of nine hospitals in Hubei province, from December 30, 2019 to January 24, 2020 were collected retrospectively, including general status, clinical manifestations, results of laboratory tests, imaging characteristics and treatment regimens.	Initial symptoms included fever (112/137, 81.8%), cough (66/137, 48.2%) and fatigue (44/137, 32.1%), with other less typical symptoms, including heart palpitations, diarrhea and headache. 80% of patients had normal or decreased leukocyte counts and 72.3% (99/137) had lymphocytopenia. Lesions present in multiple pulmonary lobes, some of which were dense; the opacity of frosted glass coexisted with consolidation shadows or string-shaped shadows.
(Chen et al. 2020) China Boa qualidade (2)	99 patients admitted to the hospital from January 1 to 20, 2020 at Jinyintan Hospital in Wuhan, China. Most patients were male, with a mean age of 55.5 years.	Epidemiological, demographic, clinical, laboratory, managerial and they analyzed results data from the medical records of 99 hospitalized patients. They monitored clinical results until January 25, 2020.	fever 82 (83%); cough 81 (82%); shortness of breath 31 (31%); muscle pain 11 (11%); confusion 9 (9%); headache 8 (8%); sore throat 5 (5%); rhinorrhea 4 (4%); chest pain 2 (2%); diarrhea 2 (2%); nausea 1 (1%); acute kidney injury 3 (3%); acute respiratory injury 8 (8%); septic shock 4 (4%); pneumonia associated with mechanical ventilation 1 (1%); unilateral pneumonia 25 (25%); bilateral pneumonia 74 (75%). Acute respiratory distress syndrome 17 (17%).
(Chan et al. 2020) China Qualidade razoável (3)	6 patients from the same family, with varying ages (10 to 66 years). 3 male and 3 female.	They reported the epidemiological, clinical, laboratory, radiological and microbiological findings of five patients in a family group who experienced unexplained pneumonia after returning to Shenzhen, Guangdong province, China.	The 6 had pulmonary infiltration. 4 had chronic comorbidities and 5 had fever. The 3 oldest patients (aged> 60 years) had a dry cough and generalized weakness. One of the younger patients had a productive cough. 2 had diarrhea, sore throat, nasal congestion and rhinorrhea. 1 had chest pains. The 6 patients had ground-glass multifocal opacities.
(Chung et al. 2020) China Boa qualidade (2)	Chest CT analysis of 21 symptomatic patients from China, from January 18, 2020 to January 27, 2020. 13 men and 8 women. Average age of 51 years. Age range from 29 to 77 years.	They obtained all images with the patient supine during the final inspiration, without intravenous contrast material. All patients were positive for 2019-nCov in laboratory tests of respiratory secretions got through bronchoalveolar lavage, endotracheal aspiration, nasopharyngeal or oropharyngeal swab.	3 (14%) had a normal chest CT scan. Of the 18 patients with ground-glass opacity, consolidation or both, 12 had only ground-glass opacity (without consolidation); no patient presented consolidation without ground-glass opacification. 18 (86%) had a disease that affected at least one lobe. 1 (5%) had an affected lobe, 2 (10%) had two affected wolves, 3 (14%) had three affected wolves, 4 (19%) had four affected wolves and 8 (38%) had the disease that affected all five Wolves.

Reference and location	Design / Number of patients	Methodological strategy	Comorbidities / symptomatology
(Lu et al. 2020) China Boa qualidade (2)	91 patients (49 men and 42 women, aged 18 to 87 years) confirmed with COVID-19 infection, between January 21, 2020 and February 10, 2020.	A retrospective investigation using CT in 91 patients, in the initial stage of the disease.	Fever (75.8%) and dry cough (65.9%). 996 lesions were found in all patients. (95.9%) bilateral lesions, (60.9%) distributed peripherally and (51.9%) distributed along the bronchial and vascular bundles. Ground-glass opacities (68.1%). Vascular thickening in (38.5%). Air bronchogram sign in (46.2%). Nodule with a halo sign in 15 patients.
(Hou et al. 2020) China Boa qualidade (1)	The study was carried out with 1427 hospitalized surgical patients was selected at Renmin Hospital at Wuhan University in Wuhan, China, from January 13 to February 12, 2020. They followed data up until February 18, 2020. Mean age was 59 years old.	They analyzed epidemiology, clinical records, CT scans and laboratory results. They compared the results of the epidemiological and clinical characteristics of surgical patients diagnosed with COVID-19 pneumonia from the first hospitalization to discharge or on February 29, 2020. Next, they screened surgical patients diagnosed with COVID-19 pneumonia	14 (0.88%) were surgical patients diagnosed with COVID-19 pneumonia. The majority of surgical patients with COVID-19, 10 (71.4%) suffered pulmonary infection before surgery. Common symptoms were fever 12 (85.7%) and cough 12 (85.7%) in the diagnosis of COVID-19 pneumonia. Chest CT (85.7%) showed dense bilateral shadows or ground-glass opacity.
(Chang et al. 2020) China Qualidade razoável (3)	13 patients with 2019-nCoV-confirmed infection admitted to hospitals in Beijing. From January 16, 2020 to January 29, 2020, with the final follow-up of this report on February 4, 2020. The average age of patients was 34 years (25th to 75th percentile, 34 to 48 years); 2 patients were children (aged 2 and 15) and 10 (77%) were male.	They got data from 3 hospitals in Beijing. They admitted and placed the patients with possible COVID-19 in quarantine, and collected swab samples in the throat and sent it to the Chinese Centers for Disease Control and prevention for diagnosis, using a quantitative polymerase chain reaction assay. They underwent chest radiography or computed tomography.	12 patients reported fever (mean 1.6 days) before hospitalization. Symptoms included cough (46.3%), upper airway congestion (61.5%), myalgia (23.1%) and headache (23.1%). The youngest patient (2 years old) had intermittent fever for 1 week and persistent cough for 13 days before diagnosis 2019-nCoV. The levels of inflammatory markers, such as C-reactive protein, were high and the number of lymphocytes marginally high. 4 patients underwent chest X-ray and 9 CT. 1 patient had scattered opacities in the lower left lung. In 6 patients, ground-glass opacity was observed in the right lung or in both lungs.
(Wei et al. 2020) China Qualidade razoável (3)	A 40-year-old patient with COVID-19 pneumonia.	Analysis of a CT scan of a patient with COVID-19 pneumonia.	The patient developed fever for 3 days, in addition to chest tightness and fatigue for 2 days. There was an increase in the levels of hematocrit (0.456) and glucose (7.3 mmol / L). The initial chest X-ray, performed three days after the onset of fever, was normal in both lungs. Presence of ground-glass opacities in the subpleural area of the right lower lobe and the left lung was normal. There was an evolution towards consolidations with thickening in the entire lobe.
(Xu et al. 2020) China Qualidade razoável (3)	One patient, male, 50 years old. Admitted to a clinic on January 21, 2020.	Means of biopsy investigated the pathological characteristics of a patient who died of severe infection with coronavírus.	Presence of fever, chills, cough, fatigue and shortness of breath. The chest X-ray showed multiple irregular shadows in both lungs. The patient suffered severe shortness of breath and hypoxemia. The oxygen saturation values decreased to 60%, evolving to sudden cardiac arrest. Patient died. Reported biopsies: moderate microvesicular steatosis and mild lobular and portal activity. Rapid progression of pneumonia.
(Kong and Agarwal 2020) China Boa qualidade (2)	3 female patients hospitalized in China with confirmation for COVID-19. Patient 1: 59 years Patient 2: 62 years Patient 3: 45 years	Analyzed image exams (x-ray and CT).	Patient 1 admitted to the hospital with fever and chills. Presence of ground-glass opacities in the right lower lobe and in the right infrahilar airspace. Patient 2 had paroxysmal cough, productive sputum and fever. Presence of small nodular opacity in solitary ground glass in the upper left lobe. Developing in 3 days for nodal and peripheral multifocal opacities in ground glass involving both upper lobes. 5 days later a sign of increasing consolidation was found. Patient 3 presented fever, cough and chest pain. Presence of ground-glass peripheral opacities prevalent in bilateral upper lobes. Inverted halo sign on the upper left lobe.

Reference and location	Design / Number of patients	Methodological strategy	Comorbidities / symptomatology
(Ng et al. 2020) China Boa qualidade (1)	21 cases of COVID-19 confirmed and hospitalized in Shenzhen and Hong Kong, China.	Analyzed image exams. All patients had at least one chest CT scan, while four patients also had follow-up CT scans. Five patients underwent a chest x-ray, three of whom had a follow-up x-ray daily.	2 patients had a normal chest CT scan. The predominant feature was ground-glass opacification (n = 18, 86%). Followed by consolidation (n = 13, 62%). 8 patients had a predominance of the lower zone, 8 had an equal distribution between the upper and lower zones and 3 had predominant changes in the upper zone. There were no subpleural savers, pleural effusions, pericardial effusion, cavitation, mediastinal and hilar lymph node enlargement in any of the patients. They observed ground-glass opacities and consolidation in the lower left lobe (n = 17, 81%), lower right lobe and upper left lobe (both n = 16, 76%), while the right middle lobe had the least involvement (n = 10, 48%).
(Song et al. 2020) China Boa qualidade (1)	Fifty-one patients (25 men and 26 women; age range 16 to 76 years) with nCoV infection 2019.	They reviewed clinical and laboratory data and tomographic images of 51 patients with pneumonia. They confirmed all patients as having positive results using the RT- nucleic acid test. Real-time PCR for 2019-nCoV by the Center for Disease Control, Shanghai, China.	The most common symptoms were fever (49 of 51, 96%) and cough (24 of 51, 47%). Other symptoms included myalgia or fatigue (16 of 51, 31%), mild headache and dizziness (eight of 51, 16%) and diarrhea (five of 51, 10%). There were 44 of 51 (86%) patients with 1284 of 1324 (97%) injuries involving both lungs and 32 of 51 (63%) patients with 1194 of 1324 (90%) injuries involving four to five lobes. There were 46 out of 51 (90%) patients with 703 out of 1324 (53%) lesions distributed in the lower lobes, 41 out of 51 (80%) patients with 1179 out of 1324 (89%) lesions distributed in the back of the lung and 44 out of 51 (86%) patients with 1198 out of 1324 (91%) lesions distributed in the pulmonary periphery. Pure GGO, GGO with reticular and / or interlobular septal thickening and GGO with consolidation were the main findings (1152 out of 1324, 87%). There were 395 of 1324 (30%) pure GGOs in 39 of 51 (77%) patients, 519 of 1324 (39%) GGO lesions with reticular and / or interlobular septal thickening in 38 (75%). Eleven of the 51 (22%) patients had comorbidities, including diabetes, hypertension, chronic liver disease, chronic obstructive pulmonary disease and heart disease. Three of the 51 (7%) patients with confirmed pneumonia with 2019-nCoV were current cigarette smokers.
(Fang et al. 2020) China Boa qualidade (2)	They included 51 patients (29 men and 22 women) with a median age of 45 (interquartile range, 39 to 55) years, assessed from January 19, 2020 to February 4, 2020	All patients had throat swab samples (45 patients) or sputum samples (6 patients), followed by one or more RT-PCR and chest CT tests (Shanghai ZJ, Bio-Tech Co., Ltd, Shanghai, China).	50/51 (98%) patients had evidence of abnormal CT compatible with viral pneumonia at baseline, while one patient had normal CT. Of the 50 patients with abnormal CT, 36 (72%) had typical CT manifestations (for example, subpleural peripheral opacities in ground glass, usually in the lower lobes, and 14 (28%) had atypical CT manifestations).
(Cheng et al. 2020) China Qualidade razoável (3)	1 patient, 55 years old, a woman, hospitalized on January 20, 2020.	After admission to the hospital, the patient was immediately referred to the quarantine ward and underwent an examination.	With a history of sore throat, dry cough, fatigue and low-grade subjective problems. Fever since January 11, 2020. Chest X-ray revealed bilateral perihilar infiltration and ill-defined irregular opacities. Radiographic findings and a subsequent CT scan of the chest showed pneumonia and tenacious sequelae of COVID-19.

Reference and location	Design / Number of patients	Methodological strategy	Comorbidities / symptomatology
(Pan et al. 2020a) China Boa qualidade (2)	They tested 21 patients (6 men and 15 women, aged between 25 and 63 years) with confirmed COVID-19 pneumonia, presenting between January 12, 2020 and February 6, 2020.	These patients underwent a total of 82 pulmonary CT scans with an average interval of 4 ± 1 days (range: 1-8 days). Chest CT scans were performed using a single inspiratory phase on two commercial multi-detector CT scanners (Philips Ingenuity Core 128, Philips Medical Systems, Best, Netherlands; SOMATOM Definition AS, Siemens Healthineers, Germany).	The most prevalent symptoms were fever (86%) and cough (57%). The distribution of the lesions and the main tomographic findings were compared in the four stages of recovery. Subpleural injuries were more common than central lung injuries. Most patients had bilateral pulmonary involvement during the disease. In Stage 1, ground-glass opacity was found in 18/24 (75%) of patients with partial paving pattern 6/24 (25%) of patients and consolidation 10/24 (42%) of patients. In stage 2, the ground glass opacity 14/17 (82%) of the patients extended to more pulmonary lobes with a more 9/17 paving pattern (53%) and consolidation 8/17 (47%) of the patients. In stage 3, consolidation 19/21 (91%) of patients was the main demonstration with respect to ground-glass opacity 15/21 (71%) of patients and the paving pattern [4/21 (19%) of patients. In stage 4, the consolidation 15/20 (75%) of the patients was partially absorbed without any paving pattern 0/20 (0%) for the patients].
(Bernheim et al. 2020) China Boa qualidade (1)	121 adult patients with a mean age of 45.3 years (age range 18 to 80 years with a standard deviation of 16 years). Interned in four hospitals in four provinces of China, from January 18, 2020 to February 2, 2020, with COVID-19 confirmed.	They underwent chest CT.	Of the 121 patients, 27 (22%) did not have ground-glass opacities and no consolidation on chest CT. Of the 94 GGO patients with consolidation, or both, 41 (34%) had only ground-glass opacities (without consolidation) and two patients (2%) had consolidation in the absence of ground-glass opacities. Eighteen patients (15%) had opacities in one lobe, 14 patients (12%) had two affected wolves, 11 patients (9%) had three affected wolves, 18 patients (15%) had four affected wolves and 33 patients (27%) had injuries in all five wolves. Seventy-three of 121 patients (60%) had bilateral lung disease. Twenty (17%) patients had exclusively unilateral pulmonary involvement, including 13 patients with only right pulmonary involvement and 7 patients who had left only pulmonary involvement. Thoracic lymphadenopathy, pulmonary cavitation and pulmonary nodules were notably absent in all 121 patients, and only 1 patient (1%) had pleural effusion.
(Shi et al. 2020) China Boa qualidade (1)	81 patients admitted to the hospital between December 20, 2019 and January 23, 2020 were included in retrospectively.	Based on the time interval between the onset of symptoms and CT, we designated four groups of patients in our study: group 1 (subclinical cases, in which CT was performed before the onset of symptoms); group 2 (CT performed ≤ 1 week after the onset of symptoms); group 3 (CT> 1 to 2 weeks after the onset of symptoms); and group 4 (CT> 2 weeks to 3 weeks after the onset of symptoms).	The predominant pattern of abnormality observed was bilateral 64 (79%) patients, peripheral 44 (54%), ill-defined 66 (81%) and ground-glass opacification 53 (65%), mainly involving the right lower lobes 225 (27%) of 849 affected segments. In group 1 (n = 15), the predominant pattern was unilateral 9 (60%) and multifocal 8 (53%) ground-glass opacities. The lesions quickly developed to bilateral 19 (90%), predominance of diffuse ground-glass opacity 11 (52%) 17 (81%) in group 2 (n = 21). Subsequently, the prevalence of ground-glass opacities continued to decrease 17 (57%) of 30 patients in group 3 and 5 (33%) of 15 in group 4, and consolidation and mixed patterns became more frequent 12 (40%) in group 3, eight (53%) in group 4.

Reference and location	Design / Number of patients	Methodological strategy	Comorbidities / symptomatology
(Tian et al. 2020) China Qualidade razoável (3)	2 patients who underwent an operation for malignancy and subsequently became infected with COVID-19.	The operation coincided with the infection, which allowed us to get the samples necessary to examine the histopathology of COVID-19 pneumonia.	One patient had a medical history of hypertension for 30 years and type II diabetes. On day 6 of hospitalization, they performed an improved chest CT scan which confirmed an irregular solid nodule in the right middle lobe and bilateral ground-glass opacity. The other patient had a medical history of hypertension 20 years ago, was properly managed. In the retrospective review of the images, they diagnosed the patient as "suspected of atypical viral pneumonia". Fever developed in the patient on the 9th postoperative day (38.2 ° C), with a dry cough, chest tightness and muscle pain. A repeated chest CT scan revealed additional foci of ground-glass opacity in the bilateral upper lobes, consistent with viral pneumonia.
(Bai et al. 2020b) China Qualidade razoável (3)	They admitted a family group of 5 patients to the Fifth People's Hospital in Anyang, Anyang, China and 1 asymptomatic family member.	They performed a detailed analysis of the patients' medical records. All patients underwent chest CT.	The patients developed fever and respiratory symptoms between 23 and 26 January and they admitted to the hospital on the same day. Patient 6 developed a fever and sore throat on January 17 and went to the local clinic for treatment. Two patients developed severe pneumonia; the other infections were moderate. All symptomatic patients had ground-glass multifocal opacities on chest CT, and 1 also had sub-segmental areas of consolidation and fibrosis.
(Moreira et al. 2020) Brazil Qualidade razoável (3)	They admitted a 73-year-old man to the emergency room.	X-ray and chest CT analysis.	With a four-day history of fever, chills, dry cough and fatigue. Chest radiography showed poorly defined pulmonary opacities on the periphery of the left lung. CT revealed predominantly peripheral frosted glass opacities involving all pulmonary lobes, which were more exuberant on the left side of the lung where they also observed small foci of consolidation. He reported systemic arterial hypertension and type 2 diabetes mellitus. On examination, he had a temperature of 37.7 ° C, HR of 85 beats / min, RF of 15 breaths / min, BP of 112/70 mmHg and SpO2 of 94%.
(Huang et al. 2020) China Boa qualidade (2)	They had identified 41 hospitalized patients admitted as having confirmed COVID-19 infection.	They reviewed medical records, nursing records, laboratory findings and chest X-rays in all patients with laboratory-confirmed COVID-19 infection and reported by the local health authority	Common symptoms at the beginning of the disease were fever 40 (98%) from 41 patients, cough 31 (76%) and myalgia or fatigue 18 (44%); less common symptoms were sputum production 11 (28%), headache 3 (8%) in hemoptysis 2 (5%) and diarrhea 1 (3%). Dyspnea developed in 22 (55%). 26 (63%) of the 41 patients had lymphopenia. All 41 patients had pneumonia with abnormal findings on chest CT. Complications included acute respiratory distress syndrome (12 [29%]), acute cardiac injury (five [12%]) and secondary infection (four [10%]). 13 (32%) were admitted to the ICU and six (15%) died. Most infected patients were male (30 [73%]). Less than half had underlying diseases (13 [32%]), including diabetes (eight [20%]), hypertension (six [15%]) and cardiovascular disease (six [15%]).
(Zhang et al. 2020) China Boa qualidade (2)	They carried out a retrospective analysis of 14 laboratory confirmed cases with COVID pneumonia - 19. The mean age of the patients was 41 years (18-87 years) and 7 (50%) were female	From the beginning, we confirmed that cases with COVID-19 pneumonia were a RT-PCR test for pharyngeal swab samples and that they used all oropharynges. As of February 4, 2020, they added stool samples to all cases.	The most common symptoms include fever (92.8%) and cough (71.4%), none of the patients experienced vomiting and diarrhea. All 14 patients had CT at admission, 92.8% manifested as pneumonia. CT images of the chest in one patient (patient 3) did not show healing or healing. Among the remaining 13 patients, they found ground-glass opacity in both lungs.

Reference and location	Design / Number of patients	Methodological strategy	Comorbidities / symptomatology
(Wang et al. 2020) China Boa qualidade (1)	138 hospitalized patients from January 1 to 28, 2020, with a mean age of 56 years (range: 22-92 years) and 75 (54.3%) were men.	They collected and analyzed epidemiological, demographic, clinical, laboratory, radiological and treatment data.	The most common symptoms at the beginning of the disease were fever (136 [98.6%]), fatigue (96 [69.6%]), dry cough (82 [59.4%]), myalgia (48 [34.8%]) and dyspnea (43 [31.2%]). The less common symptoms were headache, dizziness, abdominal pain, diarrhea, nausea and vomiting. Chest CT scan showed irregular bilateral shadows or GGO in the lungs of all patients. Of the 138 patients, 64 (46.4%) had one or more coexisting medical conditions. Hypertension (43 [31.2%]), diabetes (14 [10.1%]), cardiovascular disease (20 [14.5%]) and malignancy (10 [7.2%]) were the most common coexisting conditions. Common complications among the 138 patients included shock (12 [8.7%]), ARDS (27 [19.6%]), arrhythmia (23 [16.7%]) and acute cardiac injury (10 [7.2 %]).
(Wu et al. 2020a) China Boa qualidade (1)	Retrospective cohort study of 201 patients aged 21 to 83 years with COVID-19 pneumonia, who were at Jinyintan Hospital in Wuhan, China. All patients diagnosed with COVID-19 pneumonia.	Epidemiological, demographic, clinical, laboratory, management, treatment and results they also analyzed data were also	The most commonly reported symptoms at the beginning of the disease were fever (n = 188 [93.5%]), cough (n = 163 [81.1%]), productive cough (n = 83 [41.3%]), dyspnea (n = 80 [39.8%]) and fatigue or myalgia (n = 65 [32.3%]). The majority (n = 154 [76.6%]) of the patients had fever with cough; 74 (36.8%) had fever with dyspnea; 66 (32.8%) had fever with fatigue, myalgia or headache; and only 13 (6.5%) had fever alone. 191 (95.0%) patients presented findings of bilateral infiltrates on the radiographic image, while 10 (5.0%) patients had unilateral infiltrates. Sixty-six (32.8%) patients had comorbidities, including hypertension (n = 39 [19.4%]), diabetes (n = 22 [10.9%]), liver disease (n = 7 [3.5%]), nervous system disease (n = 7 [3.5%]), chronic lung disease (n = 5 [2.5%]), chronic kidney disease (n = 2 [1.0%]), diseases of the endocrine system that do not include diabetes (n = 2 [1.0%]) and tumors (n = 1 [0.5%]).
(Zhou et al. 2020a) China Qualidade razoável (3)	A 38-year-old man.	CT analysis.	Fever, cough and headaches. At presentation, his temperature was 38.1 ° C. Chest CT showed bilateral GGO in the lower lobes bilaterally. He developed stress angina with heart palpitations along with wheezing. Chest CT revealed multiple GGO with bilateral parenchymal consolidation and interlobular septal thickening. They also observed spontaneous pneumomediastinum and subcutaneous emphysema were also.
(Qin et al. 2020) China Boa qualidade (1)	Of the 452 patients recruited with COVID-19, they diagnosed 286 as a serious infection. The average age was 58 years and 235 were male.	Demographic and clinical data of all confirmed cases with COVID-19.	The most common symptoms were fever (92.6%), shortness of breath (50.8%), sputum (41.4%), fatigue (46.4%), dry cough (33.3%) and myalgia (21.4%). Of the 452 patients with COVID-19, 201 (44.0%) patients had chronic diseases (ie hypertension, diabetes, chronic obstructive pulmonary disease) in a higher percentage in severe cases (146 [51.0%]) than in mild cases (55 [33.1%]). And these critically ill patients were significantly more likely to have hypertension and cardiovascular disease at the same time.

Reference and location	Design / Number of patients	Methodological strategy	Comorbidities / symptomatology
(Guan et al. 2020b) Italy Qualidade razoável (3)	Twelve patients (9 men and 3 women, mean age 63 ± 13 years).	They analyzed imaging exams in the lung region in patients who presented to our emergency department with COVID-19 pneumonia.	Two patients had emphysema, but with no oxygen therapy. None of the patients had severe breathing difficulties (PaO2 / FiO2 257–376 mmHg). In all patients, we found a diffuse pattern with spared areas. Only three patients had posterior subpleural consolidations. They performed chest CT in all 12 patients and showed a strong correlation with US: bilateral pulmonary involvement with ground-glass opacity; 5 of the 12 patients had a paving pattern. They confirmed organizing pneumonia in four patients and detected with pulmonary US.
(Yang et al. 2020) China Boa qualidade (1)	In this retrospective cohort study, 149 patients with confirmed COVID-19.	They analyzed clinical characteristics and image manifestations of hospitalized patients.	On admission, fever (114/149, 76.5%), cough (87/149, 58.4%) and sputum (48/149, 32.2%) were the most common symptoms, while vomiting (2/149 1.3%) and dyspnea (2/149 1.3%) were rare. 14 (9.4%) patients had decreased oxygen saturation. Upon admission, 33 (24.2%) and 53 (35.6%) patients had leukopenia and lymphopenia, respectively. Platelets were below the normal range in 20 (13.4%) patients. Of the 149 patients, 52 (34.9%) had underlying chronic diseases, including cerebrovascular diseases, digestive diseases, etc. At admission, by median, each patient had 3 (4) pulmonary lobes involved and 6 (10.5) segments involved. 287 (12.1%) segments had ground-glass opacity, 637 (26.8%) segments with mixed opacity and 170 (7.2%) segments with consolidation. The lesions were more in the periphery than in the center of the lung. There were more irregular lesions than oval lesions.

Professionals who implemented the interventions

All studies presented in the results have multi-professional interventions, including the physicians, nurses, radiologists, physiotherapists and psychologists.

Effectiveness and effectiveness of interventions

Most of the studies carried out in China had the participation of patients who had contact with the seafood market, in Wuhan, where scientists still claim to be the initial focus of COVID-19.

Of the 35 studies identified in ten of them, patients had some previous comorbidities, such as diabetes, cardiovascular diseases, liver diseases, asthma and chronic lung diseases 10,12–20. Of these, 27 studies showed that most individuals were admitted to health centers or hospitals, with signs and symptoms of fever, dry cough, difficulty breathing, expectoration, nausea, vomiting, diarrhea and rare myalgia[10,12,21–30,13,31–37,14–20]. The affected population was broad, reaching from children to the elderly, in which young adults were the least affected.

All studies were carried out using imaging tests, including mostly computed tomography and chest radiography, but in one study, they used ultrasound. From the complementary exams, twenty studies counted on patients diagnosed with pneumonia from COVID-19[10,11,25,27,29,30,32–35,38,39,12,40,13–16,19,21,23].

The ground-glass opacity (GGO) sign was the most commonly found in imaging studies, located predominantly on the periphery of the lungs, but acting in a multifocal manner, being mentioned in 29 of 35 studies[4,13,24,26–29,31–35,14,36,38–40,15–18,21–23]. There was a sign of evolution from the GGO for consolidation in 17 studies[4,14,36,38,41–44,15,17,22–24,28,31,34]. Rarely, patients suffered from fibrosis in lung tissue.

They found other findings on a smaller scale, but not negligible. In four studies[10,13,18,25], patients suffered from Acute Respiratory Discomfort Syndrome (ARDS). In two studies, they raised signs of vascular thickening[22,26]. Air bronchogram sign[22,26,38], halo sign 26,31, traction bronchiectasis 23 and pleural effusion[14,42] were also found.

DISCUSSION

This study sought evidence regarding the impact of COVID-19 on the health of individuals, specifically on the respiratory system, from studies that work with chest imaging exams. Recent studies have shown a central role for CT in the early detection and management of COVID-19 pulmonary manifestations, with acute sensitivity, but with still limited specificity[45,46].

The American College of Radiology recommends that they use chest CT in hospitalized patients with symptoms of pneumonia and with specific clinical indications for CT. It is important to highlight that none of them recommend the use of CT for the screening of COVID-19 or as the test of choice for the diagnosis of this disease 47. This is because chest CT can help in the diagnosis of COVID-19, but cannot confirm or exclude it alone. Chest CT has had acute sensitivity (97%), but low specificity (25%), given the overlapping of findings with those of respiratory infections of different etiologies[48].

The tomographic findings commonly observed in cases of COVID-19 are ground-glass pulmonary opacities (GGO) which, in more severe cases, developed to consolidations, with predominantly peripheral distribution, sometimes associated with fine crosslinking (forming the paving pattern), vascular thickening and reversal of the areola signal. Central parenchymal involvement or nodules, cavitation, enlarged lymph nodes or pleural effusion are less common4,49 4,49. Some suggest that the reverse halo sign, described by some authors, shows that organizing pneumonia may be one mechanism of lung injury[31,50].

Professionals should know the various characteristics of the disease and the frequent changes. Imaging manifestations of coronavirus pneumonia are like common viral pneumonia but have imaging features. In a study conducted in January 2020, patients experienced impairment in a single lobe or involvement of multiple wolves. 30.2% of patients had only one lobe involved and 44.4% had involvement of all wolves. The most common manifestations in coronavirus pneumonia are irregular opacities, GGO (85.7%), irregular consolidation (19.0%) and distributed mainly in a subpleural area. They found that, as the disease progressed, the range of GGO samples and consolidation increased. In cases of improvement in the patient's condition, a small fibrous band was noted. When patients got worse, the lungs had diffuse lesions and the density of both lungs increased widely, showing an appearance of "white lung", which seriously affects the patient's lung function. Only a single GGO can be seen in some patients at an early stage, and the interval explodes in the short-term review (3 - 14 days)[51].

Because of the repetitive pattern of these signs and symptoms in several studies, in cases that combine these characteristics, researchers have reported that "the possibility of COVID-19 should be considered among the differential diagnoses"[23]. Implementing a structured report is beneficial, particularly in the current pandemic scenario because of COVID-19, as it improves the understanding of the information and productivity of the professional team, with a potentially positive impact on the conduct towards the patient[52].

Verifying comorbidities is a fundamental item that influences clinical outcomes, as they represent important risk factors for complications and death by COVID-19. For example, COPD, diabetes, hypertension, cancer, coronary heart disease, tuberculosis, cerebrovascular diseases, hepatitis B infections, smokers, chronic kidney diseases and immunodeficiency[13,53,54]. Patients who reported having two or more comorbidities were more common in severe cases than in non-severe cases. These individuals were mostly elderly[55]. Some comorbidities are

present simultaneously in the same individual. For example, diabetes and COPD 56 often coexist with hypertension or coronary heart disease. Patients with comorbidities had a higher severity of the disease compared to those without. In addition, a greater number of comorbidities correlated with greater disease severity. Adequate patient screening should be implemented by carefully consulting the medical history, to identify patients most likely to develop serious adverse results from COVID-19. In addition, these patients deserve greater attention[55]

The results found in this review on pulmonary complications in COVID-19 proved to be diverse and multifocal. A positive point to emphasize is that computed tomography was an evaluative method used in most studies, generating a more effective analysis and comparisons between research. Nevertheless, the results show complications to be better analyzed and studied by health professionals to reduce the risks of pulmonary complications caused by COVID-19 and who knows how to prevent them.

We must consider some limitations of this review, such as data restriction, as it is a novelty in research and including articles available in prevalence in the Chinese language.

This review identified the diversity of pulmonary complications caused by COVID-19, which can affect the organ in a multifocal manner. Based on chest imaging exams, we analyze the emphatic involvement of the disease and its rapid changes within 3 to 14 days. Another considerable survey was seen in the percentage of individuals with more severe conditions of the disease, which was correlated with the amount of comorbidities already diagnosed in these patients.

There is a need for future randomized clinical trials that analyze the impact of these respiratory complications on individuals with COVID-19, for greater reliability in the scientific field and study on sequelae in the pulmonary region that may affect such patients.

CONCLUSION

This review identified the diversity of pulmonary complications caused by COVID-19, which can affect the organ in a multifocal manner. Based on chest imaging exams, the emphatic involvement of the disease and its rapid changes are analyzed within 3 to 14 days. Another considerable survey was seen in the percentage of individuals with aggravated illnesses, a fact correlated with the number of comorbidities already diagnosed in these patients. After a study, there is a need for future randomized clinical trials that analyze the impact of these respiratory complications on individuals with COVID-19, for greater reliability in the scientific field and a study on sequelae in the pulmonary region.

REFERENCES

1. Montero Feijoo A, Maseda E, Adalia Bartolomé R, Aguilar G, González de Castro R, Gómez-Herreras JI, et al. Practical recommendations for the perioperative management of the patient with suspection or serious infection by coronavirus SARS-CoV. Rev. Esp. Anestesiol. Reanim. 2020 May; 67(5):253. doi: 10.1016/j.redar.2020.03.003.

2. World Health Organization. Novel Coronavirus (COVID-19) Situation dashboard [Internet]. Geneve: WHO; 2020 [cited 2020 Mar 21] ;Available from: https://covid19.who.int/.

3. Ministério da Saúde [BR]. Ministério da Saúde declara transmissão comunitária nacional. [Internet]. Brasília: Ministério da Saúde; 2020 [cited 2020 Mar 21]. Available from: https://www.saude.gov.br/noticias/agencia-saude/46568-ministerio-da-saude-declara-transmissao-comunitaria-nacional.

4. Chung M, Bernheim A, Mei X, Zhang N, Huang M, Zeng X, et al. CT imaging features of 2019 novel coronavirus (2019-NCoV). Radiology. 2020 Apr; 295(1): 202-207. doi: 10.1148/radiol.2020200230.

5. Zhu N, Zhang D, Wang W, Li X, Yang B, Song J, et al. A novel coronavirus from patients with pneumonia in China, 2020. N. Engl. J. Med. 2020 Feb; 382: 727-733. doi: 10.1056/NEJMoa2001017.

6. Su S, Wong G, Shi W, Liu J, Lai ACK, Zhou J, et al. Epidemiology, Genetic Recombination, and Pathogenesis of Coronaviruses. Trends Microbiol. 2016 Jun; 24(6): 490-502. doi: 10.1016/j.tim.2016.03.003.

7. Cui J, Li F, Shi ZL. Origin and evolution of pathogenic coronaviruses. Nat. Rev. Microbiol. 2019 Mar; 17(3): 181-192. doi: 10.1038/s41579-018-0118-9.

8. Perlman S. Another decade, another coronavirus. N. Engl. J. Med. 2020 Feb; 382(8): 760-762. doi: 10.1056/NEJMe2001126.

9. Zhou P, Yang X Lou, Wang XG, Hu B, Zhang L, Zhang W, et al. A pneumonia outbreak associated with a new coronavirus of probable bat origin. Nature. 2020 Feb; 579: 270-273.

10. Huang C, Wang Y, Li X, Ren L, Zhao J, Hu Y, et al. Clinical features of patients infected with 2019 novel coronavirus in Wuhan, China. Lancet. 2020 Feb; 395(10223): 497-506. doi: 10.1016/S0140-6736(20)30183-5.

11. Matte DL, Andrade FMD, Martins JA, Martinez BP, Karsten M. O fisioterapeuta e sua relação com o novo betacoronavirus 2019 (2019-nCoV). São Paulo: Assobrafir; 2020. Jan. Available from: https://assobrafir.com.br/wpcontent/uploads/2020/01/ASSOBRAFIR_BETACORONAVIRUS-2019_v.4.pdf.

12. Ji D, Zhang D, Chen Z, Xu Z, Zhao P, Zhang M, et al. Clinical Characteristics Predicting Progression of COVID-19. SSRN Electron. J. 2020 Fev. doi: 10.2139/ssrn.3539674.

13. Guan WJ, Ni ZY, Hu Y, Liang WH, Ou CQ, He JX, et al. Clinical Characteristics of Coronavirus Disease 2019 in China. N. Engl. J. Med. 2020 Feb. doi: 10.1056/NEJMoa2002032.

14. Chan JFW, Yuan S, Kok KH, To KKW, Chu H, Yang J, et al. A familial cluster of pneumonia associated with the 2019 novel coronavirus indicating person-to-person transmission: a study of a family cluster. Lancet. 2020 Jan; doi: https://doi.org/10.1016/S0140-6736(20)30154-9.

15. Song F, Shi N, Shan F, Zhang Z, Shen J, Lu H, et al. Emerging 2019 novel coronavirus (2019-NCoV) pneumonia. Radiology. 2020; 295(1). doi: https://doi.org/10.1148/radiol.2020200274.

16. Tian S, Hu W, Niu L, Liu H, Xu H, Xiao SY. Pulmonary Pathology of Early-Phase 2019 Novel Coronavirus (COVID-19) Pneumonia in Two Patients With Lung Cancer. J. Thorac. Oncol. 2020 May; 15(5): 700-704. doi: 10.1016/j.jtho.2020.02.010.

17. Moreira BL, D'Almeida Brotto MP, Marchiori E. Chest radiography and computed tomography findings from a brazilian patient with covid-19

pneumonia. Rev. Soc. Bras. Med. Trop. 2020 Apr; 53: e20200134.

18. Wang D, Hu B, Hu C, Zhu F, Liu X, Zhang J, et al. Clinical Characteristics of 138 Hospitalized Patients with 2019 Novel Coronavirus-Infected Pneumonia in Wuhan, China. JAMA. 2020 Mar; 323(11): 1061-1069. doi: 10.1001/jama.2020.1585.

19. Wu C, Chen X, Cai Y, Xia J, Zhou X, Xu S, et al. Risk Factors Associated with Acute Respiratory Distress Syndrome and Death in Patients with Coronavirus Disease 2019 Pneumonia in Wuhan, China. JAMA Intern. Med. 2020 Jul; 180(7): 934-943. doi: 10.1001/jamainternmed.2020.0994.

20. Qin C, Zhou L, Hu Z, Zhang S, Yang S, Tao Y, et al. Dysregulation of immune response in patients with COVID-19 in Wuhan, China. Clin. Infect. Dis. 2020 Jul; 71(15): 762-768. doi: 10.1093/cid/ciaa248.

21. Hu Z, Song C, Xu C, Jin G, Chen Y, Xu X, et al. Clinical characteristics of 24 asymptomatic infections with COVID-19 screened among close contacts in Nanjing, China. Sci. China Life Sci. 2020; May; 63(5): 706-711. doi: 10.1007/s11427-020-1661-4.

22. Han R, Huang L, Jiang H, Dong J, Peng H, Zhang D. Early Clinical and CT Manifestations of Coronavirus Disease 2019 (COVID-19) Pneumonia. AJR Am J Roentgenol. 2020 Aug; 215(2): 338-343. doi: 10.2214/AJR.20.22961.

23. Zhao W, Zhong Z, Xie X, Yu Q, Liu J. Relation between chest CT findings and clinical conditions of coronavirus disease (covid-19) pneumonia: A multicenter study. Am. J. Roentgenol. 2020 May; 214(5): 1072-1077. doi: 10.2214/AJR.20.22976.

24. Kui L, Fang YY, Deng Y, Liu W, Wang MF, Ma JP, et al. Clinical characteristics of novel coronavirus cases in tertiary hospitals in Hubei Province. Chin. Med. J. (Engl). 2020 May; 133(9): 1025-1031. doi: 10.1097/CM9.0000000000000744.

25. Chen N, Zhou M, Dong X, Qu J, Gong F, Han Y, et al. Epidemiological and clinical characteristics of 99 cases of 2019 novel coronavirus pneumonia in Wuhan, China: a descriptive study. Lancet. 2020 Feb; 395(10223): 507-513. doi: 10.1016/S0140-6736(20)30211-7.

26. Lu C, Yang W, Hu Y, Hui J, Zhou G, Shu J, et al. Coronavirus Disease 2019 (COVID-19) Pneumonia: Early Stage Chest CT Imaging Features and Clinical Relevance. SSRN Electron. J. 2020 Jan. doi: 10.2139/ssrn.3543606.

27. Hou J, Wan X, Shen Q, Leng Y, Xia Z, Zhao B, et al. Epidemiologic and Clinical Characteristics of Surgical Patients Infected with COVID-19 in Wuhan. Lancet Infect Diseases. 2020. Preprint.

28. Chang D, Lin M, Wei L, Xie L, Zhu G, Cruz CS Dela, et al. Epidemiologic and Clinical Characteristics of Novel Coronavirus Infections Involving 13 Patients Outside Wuhan, China. JAMA. 2020 Mar; 323(11): 1092-1093. doi: 10.1001/jama.2020.1623.

29. Wei J, Xu H, Xiong J, Shen Q, Fan B, Ye C, et al. 2019 novel coronavirus (Covid-19) pneumonia: Serial computed tomography findings. Korean J. Radiol. 2020 Apr; 21(4): 501-504. doi: 10.3348/kjr.2020.0112.

30. Xu Z, Shi L, Wang Y, Zhang J, Huang L, Zhang C, et al. Pathological findings of COVID-19 associated with acute respiratory distress syndrome. Lancet Respir. Med. 2020 Apr; 8(4): 420-422. doi: 10.1016/S2213-2600(20)30076-X.

31. Kong W, Agarwal PP. Chest Imaging Appearance of COVID-19 Infection. Radiol. Cardiothorac. Imaging. 2020 Feb; 2(1): e200028. doi: 10.1148/ryct.2020200028.

32. Cheng SC, Chang YC, Fan Chiang YL, Chien YC, Cheng M, Yang CH, et al. First case of Coronavirus Disease 2019 (COVID-19) pneumonia in Taiwan. J. Formos. Med. Assoc. 2020 Mar; 119(3): 747-751. doi: 10.1016/j.jfma.2020.02.007.

33. Pan F, Ye T, Sun P, Gui S, Liang B, Li L, et al. Time Course of Lung Changes On Chest CT During Recovery From 2019 Novel Coronavirus (COVID-19). Radiology. 2020 Jun; 295(3): 715-721. doi: 10.1148/radiol.2020200370.

34. Bai Y, Yao L, Wei T, Tian F, Jin DY, Chen L, et al. Presumed Asymptomatic Carrier Transmission of COVID-19. JAMA. 2020 Apr; 323(14): 1406-1407. doi: 10.1001/jama.2020.2565.

35. Zhang JC, Wang S Bin, Xue YD. Fecal specimen diagnosis 2019 novel coronavirus–infected pneumonia. J. Med. Virol. 2020 Mar. doi: 10.1002/jmv.25742.

36. Zhou C, Gao C, Xie Y, Xu M. COVID-19 with spontaneous pneumomediastinum. Lancet Infect. Dis. 2020 Apr; 20(4): 510. doi: 10.1016/S1473-3099(20)30156-0.

37. Chu Y, Li T, Fang Q, Wang X. Clinical features of critically ill patients with confirmed COVID-19. J. Infect. 2020 Jul; 81(1): 147-178. doi: 10.1016/j.jinf.2020.03.023.

38. Li Y, Xia L. Coronavirus Disease 2019 (COVID-19): Role of Chest CT in Diagnosis and Management. AJR. Am. J. Roentgenol. 2020 Jun; 214(6): 1280-1286. doi: 10.2214/AJR.20.22954.

39. Fang Y, Zhang H, Xie J, Lin M, Ying L, Pang P, et al. Sensitivity of Chest CT for COVID-19: Comparison to RT-PCR. Radiology. 2020 Aug; 296(2): E115-E117. doi: 10.1148/radiol.2020200432.

40. Poggiali E, Dacrema A, Bastoni D, Tinelli V, Demichele E, Mateo Ramos P, et al. Can Lung US Help Critical Care Clinicians in the Early Diagnosis of Novel Coronavirus (COVID-19) Pneumonia? Radiology. 2020 Jun; 295(3): E6. doi: 10.1148/radiol.2020200847.

41. Ng M-Y, Lee EY, Yang J, Yang F, Li X, Wang H, et al. Imaging Profile of the COVID-19 Infection: Radiologic Findings and Literature Review. Radiol. Cardiothorac Imaging. 2020 Feb; 2(1): e200034. doi: 10.1148/ryct.2020200034.

42. Bernheim A, Mei X, Huang M, Yang Y, Fayad ZA, Zhang N, et al. Chest CT Findings in Coronavirus Disease-19 (COVID-19): Relationship to Duration of Infection. Radiology. 2020 Jun; 295(3): 200463. doi: 10.1148/radiol.2020200463.

43. Shi H, Han X, Jiang N, Cao Y, Alwalid O, Gu J, et al. Radiological findings from 81 patients with COVID-19 pneumonia in Wuhan, China: a descriptive study. Lancet Infect. Dis. 2020 Apr; 20(4): 425-434. doi: https://doi.org/10.1016/S1473-3099(20)30086-4.

44. Yang W, Cao Q, Qin L, Wang X, Cheng Z, Pan A, et al. Clinical characteristics and imaging manifestations of the 2019 novel coronavirus disease (COVID-19):A multi-center study in Wenzhou city, Zhejiang, China. J. Infect. 2020 April; 80(4): 388-393. doi: 10.1016/j.jinf.2020.02.016.

45. Zu ZY, Jiang M Di, Xu PP, Chen W, Ni QQ, Lu GM, et al. Coronavirus Disease 2019 (COVID-19): A Perspective from China. Radiology. 2020 Aug; 296(2): E15-E25. doi: 10.1148/radiol.2020200490.

46. Kanne JP, Little BP, Chung JH, Elicker BM, Ketai LH. Essentials for Radiologists on COVID-19: An Update-Radiology Scientific Expert Panel. Radiology. 2020 Aug; E113-E114. doi: 10.1148/radiol.2020200527.

47. American College of Radiology. ACR recommendations for the use of chest radiography and computed tomography (CT) for suspected COVID-19 infection [Internet]. Washington; 2020 [cited 2020 Mar 11]; Available from: https://www.acr.org/Advocacy-and-Economics/ACR-Position-Statements/Recommendations-for-Chest-Radiography-and-CT-for-Suspected-COVID19-Infection.

48. Ai T, Yang Z, Hou H, Zhan C, Chen C, Lv W, et al. Correlation of Chest CT and RT-PCR Testing in Coronavirus Disease 2019 (COVID-19) in China: A Report of 1014 Cases. Radiology. 2020 Feb. doi: 10.1148/radiol.2020200642.

49. Bai HX, Hsieh B, Xiong Z, Halsey K, Choi JW, Tran TML, et al. Performance of radiologists in differentiating COVID-19 from viral pneumonia on chest CT. Radiology. 2020 Aug; 296(2): E46-E54. doi: 10.1148/radiol.2020200823.

50. Wu Y, Xie Y, Wang X. Longitudinal CT Findings in COVID-19 Pneumonia: Case Presenting Organizing Pneumonia Pattern. Radiol. Cardiothorac Imaging. 2020 Feb; 2(1): e200031. doi: 10.1148/ryct.2020200031.

51. Pan Y, Guan H, Zhou S, Wang Y, Li Q, Zhu T, et al. Initial CT findings and temporal changes in patients with the novel coronavirus pneumonia (2019-nCoV): a study of 63 patients in Wuhan, China. Eur. Radiol. 2020 Jun; 30(6): 3306-3309. doi: 10.1007/s00330-020-06731-x.

52. Shoji H, Fonseca EKUN, Teles GB da S, Passos RBD, Yanata E, Silva MMA, et al. Structured thoracic computed tomography report for COVID-19 pandemic. Einstein (Sao Paulo). 2020; 18: eED5720. doi: https://doi.org/10.31744/einstein_journal/2020ed5720.

53. Salem Szklo A. Associação entre Fumar e Progressão para Complicações Respiratórias Graves em Pacientes com Covid-19. Rev. Bras. Cancerol. 2020 Abr-Jun; 6(2): 1-4. doi: https://doi.org/10.32635/2176-9745.RBC.2020v66n2.974.

54. Maciel ELN, Gonçalves E Júnior, Dalcolmo MMP. Tuberculose e coronavírus: o que sabemos? Epidemiol. e Serv. Saúde. 2020; 29(2): e2020128. doi: http://dx.doi.org/10.5123/s1679-49742020000200010.

55. Guan WJ, Liang WH, Zhao Y, Liang HR, Chen ZS, Li YM, et al. Comorbidity and its impact on 1590 patients with Covid-19 in China: A Nationwide Analysis. Eur. Respir. J. 2020 May; 55(5): 2000547. doi: 10.1183/13993003.00547-2020.

56. Murphy TE, McAvay GJ, Allore HG, Stamm JA, Simonelli PF. Contributions of COPD, asthma, and ten comorbid conditions to health care utilization and patient-centered outcomes among US adults with obstructive airway disease. Int. J. Chron Obstruct Pulmon Dis. 2017; 12: 2515-2522. doi: 10.2147/COPD.S139948.

Como citar este artigo/How to cite this article:

Gouveia GPM, Cunha SV, Silva RL Analysis of respiratory complications occasioned by the coronavirus (COVID-19): a systematic review. J Health Biol Sci. 2021; 9(1):1-15.