Since January 2020 Elsevier has created a COVID-19 resource centre with free information in English and Mandarin on the novel coronavirus COVID-19. The COVID-19 resource centre is hosted on Elsevier Connect, the company's public news and information website.

Chest CT Characteristics are Strongly Predictive of Mortality in Patients with COVID-19 Pneumonia: A Multicentric Cohort Study

Nicolas Malécot, M.D., Jan Chrusciel, M.D., M.Sc., Stéphane Sanchez, M.D., M.P.H., Philippe Sellès, M.D., Christophe Goetz, M.D., Henri-Paul Lévêque, M.D., Elizabeth Parizel, M.D., Jean Pradel, M.D., Mouklès Almhana, M.D., Elodie Bouvier, M.D., Fabian Uyttenhove, M.D., Etienne Bonnefoy, M.D., Guillermo Vazquez, M.D., Omar Adib, M.D., Philippe Calvo, M.D., Colette Antoine, M.D., Veronique Jullien, M.D., Sylvia Cirille, M.D., Antoine Dumas, M.D., Anthony Defasque, M.D., Yassine Ben Ghorbal, M.D., Marwan Elkadri, M.D., Mathieu Schertz, M.D., Madeleine Cavet, M.D.

Rationale and Objectives: The novel coronavirus (COVID-19) has presented a significant and urgent threat to global health and there has been a need to identify prognostic factors in COVID-19 patients. The aim of this study was to determine whether chest computed tomography (CT) characteristics had any prognostic value in patients with COVID-19.

Materials and Methods: A retrospective analysis of COVID-19 patients who underwent a chest CT-scan was performed in four medical centers. The prognostic value of chest CT results was assessed using a multivariable survival analysis with the Cox model. The characteristics included in the model were the degree of lung involvement, ground glass opacities, nodular consolidations, linear consolidations, a peripheral topography, a predominantly inferior lung involvement, pleural effusion, and crazy paving. The model was also adjusted on age, sex, and the center in which the patient was hospitalized. The primary endpoint was 30-day in-hospital mortality. A second model used a composite endpoint of admission to an intensive care unit or 30-day in-hospital mortality.

Results: A total of 515 patients with available follow-up information were included. Advanced age, a degree of pulmonary involvement $\geq$50% (Hazard Ratio 2.25 [95% CI: 1.378-3.671], $p = 0.001$), nodular consolidations and pleural effusions were associated with lower 30-day in-hospital survival rates. An exploratory subgroup analysis showed a 60.6% mortality rate in patients over 75 with $\geq$50% lung involvement on a CT-scan.

Conclusion: Chest CT findings such as the percentage of pulmonary involvement $\geq$50%, pleural effusion and nodular consolidation were strongly associated with 30-day mortality in COVID-19 patients. CT examinations are essential for the assessment of severe COVID-19 patients and their results must be considered when making care management decisions.

Key Words: COVID-19; Chest CT; Mortality; Pneumonia; Teleradiology.

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From the Department of Radiology, Medin +, Batiment N°9 1350 Av. Albert Einstein, Montpellier 34000, France (N.M.); Department of Public Health, Centre Hospitalier de Troyes, Troyes, France (J.C., S.S.); Department of Medical Information, Hôpital Nord Franche-Comté, Belfort, France (P.S.); Department of Medical Information, Centre Hospitalier Régional Metz-Thionville, Metz, France (C.G.); Department of Radiology, Hôpital Nord Franche-Comté, Belfort, France (H.-P.L.); Department of Radiology, Centre Hospitalier Régional Metz-Thionville, Metz, France (E.P.); Department of Radiology, Centre Hospitalier de Troyes, Troyes, France (J.P., M.A.); Clinical Research Unit, Hôpital Nord Franche-Comté, Belfort, France (E.B.); Department of Radiology, Medin +, Lievin, France (F.U.); Department of Radiology, Medin +, Bordeaux, France (E.B.); Department of Radiology, Medin +, Bastia, France (G.V.); Department of Radiology, Medin +, Villeurbane, France (O.A.); Department of Radiology, Medin +, Chateau-Thierry, France (P.C.); Department of Radiology, Medin +, La Grande Motte, France (C.A.); Department of Radiology, Medin +, Punaauia, France (V.J.); Department of Radiology, Medin +, La Trinité, France (S.C.); Department of Radiology, Medin +, Nouméa, France (A.D., Y.B.G.); Department of Radiology, Medin +, Montpellier, France (A.D.); Department of Radiology, Medin +, Lormont, France (M.E.); Department of Radiology, Medin +, Strasbourg, France (M.S.); Department of Radiology, Medin +, Paris, France (M.C.). Received November 2, 2021; revised December 9, 2021; accepted January 13, 2022. **Address correspondence to:** N.M. e-mail: nmalecot@medinplus.com

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Abbreviations: SARS-CoV-2 Severe acute respiratory syndrome coronavirus 2, **COVID-19** Coronavirus Disease 19, **CT** Computed Tomography, **GGO** Ground Glass Opacity, **RT-PCR** Reverse-transcription polymerase chain reaction, **ICU** Intensive care unit, **PE** Pulmonary embolism

BACKGROUND

The novel coronavirus (COVID-19) has presented a significant and urgent threat to global health (1). The fatality rate has been higher than expected, most notably among the elderly and patients with comorbidities with an estimated mortality rate at 0.68% (2). Despite public health responses aimed at containing the disease and delaying its spread, several countries have been confronted with critical care crises, intensive care unit (ICU) availability concerns and high mortality among infected patients.

Outbreaks have led to a large increase in the demand for hospital beds and a shortage of necessary medical equipment. Early identification of patients at risk of progression may facilitate more individually aligned treatment plans and optimize the use of medical resources. To mitigate the burden on the healthcare system while still providing the best possible care for patients, efficient diagnostic tests providing information on the prognosis of the disease are needed and may help medical staff in the triage of patients when allocating limited healthcare resources.

One such diagnostic tool is chest computed tomography (CT). CT can diagnose the disease in asymptomatic, suspected and equivocal cases, to follow-up disease progression and to detect complications (3–5). Previous studies have shown the potential role of chest CT findings in predicting prognosis; however, its use in predicting mortality in patients with COVID-19 has been limited (6–10). The aim of this study was to determine whether variables derived from the chest CT examination were predictive of mortality in COVID-19 patients.

MATERIALS AND METHODS

Study Design

We conducted a retrospective multicentric cohort study. Four healthcare facilities took part in the study: [institution names blinded to ensure the integrity of the peer-review process]. The study took place from March 14, 2020 to April 26, 2020. The interpretation of some radiological examinations performed in those centers were conducted by a teleradiology organization. Patients were included if they had all the following inclusion criteria:

- Age ≥18 years old.
- Reverse-transcription polymerase chain reaction (RT-PCR) confirmed cases of COVID-19, or suspicion of pulmonary embolism (PE) complicating COVID-19, or clinically diagnosed cases of COVID-19 (cough, respiratory distress, fever and CT characteristics consistent with COVID-19).
- Chest CT examination through the Medin+ teleradiology organization in the four participating hospitals between March 14, 2020 and April 26, 2020.

Data Sources

Radiological data were extracted from the CT-scan examination reports. Follow-up data were acquired from the medical and administrative databases of the participating hospitals. The variables that were extracted from the local databases were age, sex, the type of diagnosis (International Classification of Disease, 10th Edition - ICD-10), admission to an ICU within 30 days after the chest CT scan was performed, and 30-day in-hospital mortality.

CT Acquisition Technique

When a pulmonary embolism (PE) was not suspected, CT scans were performed without contrast media injection with the patient in a supine position and during end-inspiration. When PE was suspected, the scans were carried out with contrast media injection and bolus tracking with the patient in supine position and with neutral inspiration. Scanning parameters were as follows: tube voltage: 120–140kV; mAs modulation - 9mAs basis; collimation width 0.5*80-0.6*128; slice thickness 0.5-0.6 mm; interval 0.9 mm; reconstruction 1.0/0.8mm-1.5/1.5mm. According to each medical facility's protocol, patients and technicians wore face masks and personal protective gear and a thorough decontamination was performed after each patient.

CT Analysis and Structured Reporting

Initial reporting was performed by the teleradiology medical crew composed of 12 radiologists. All members of the team were experienced radiologists: the median experience was 21 years (minimum 7, maximum 32). Seven of the radiologists have held fellowship positions at university hospitals during their careers. All radiologists were specifically trained for teleradiology and COVID-19 scoring. There were no junior or trainee members on the radiology team.

The report form for this study included items from the French Thoracic Imaging Society standardized report. This report was distributed to French radiologists to assist them in their assessment of patients with COVID-19 at the initial stage of the epidemic (11). The full standardized report of the French Thoracic Imaging Society is presented in Appendix A. The items used in this study included: the percentage of lung involvement (absent or minimal [<10 %], moderate [10%–25%], widespread [25%–50%], severe [50%–75%] and critical [>75%]), the topography of radiological signs (inferior, central, peripheral, mixed), Ground Glass Opacities (large GGO or nodular GGO), nodular consolidations, linear consolidations, pleural effusion, and crazy paving. The definitions of the radiological signs used in this study were consistent with the definitions given in Fleischner

Society's glossary first published in 1984 and 1996 and updated in 2008 (12).

To evaluate the percentage of lung involvement, the radiologists had access to a deep learning based semiautomatic quantification process available in the Digital Imaging and Communications in Medicine image viewer Myrian by Intrasense.

Outcomes

We assessed two outcomes: the first outcome was 30-day in-hospital mortality. The second outcome was a composite outcome of death or transfer to the ICU before day 30.

Statistical Analysis

Categorical variables were presented with absolute frequencies and percentages. Numeric variables were presented with the mean and standard deviation. Radiological signs were presumed absent if not mentioned in the case report form. The number and percentage of patients who died before day 30 is shown for the groups of patients who presented the main radiological indicators. A univariate survival analysis was conducted using the Cox proportional hazards model. Survival was measured from the date of the CT scan and censored at 30 days. A multivariable analysis was conducted using the Cox model. Variables included in the model were manually selected based on clinical relevance.

The secondary outcome was a composite of hospitalization in ICU and the 30-day survival. This outcome was positive if either component occurred before day 30. The secondary outcome was studied using a Cox model with the same multivariable modeling method as for the primary outcome model. An analysis of the first and secondary outcomes restricted to patients with positive RT-PCR was also carried out.

Statistical analyses were conducted using R version 4.0.2 (www.R-project.org). All inferential analyses were performed by means of a two-tailed test with a level of significance of 5%.

Ethics

The study was declared to the French national register of studies using healthcare data under declaration number MR0210190520. Approval by an institutional review board was not required in accordance with Article L1121-1 (n° 2012-300, March 5, 2012) of the French Public Health Code as it was a retrospective observational study.

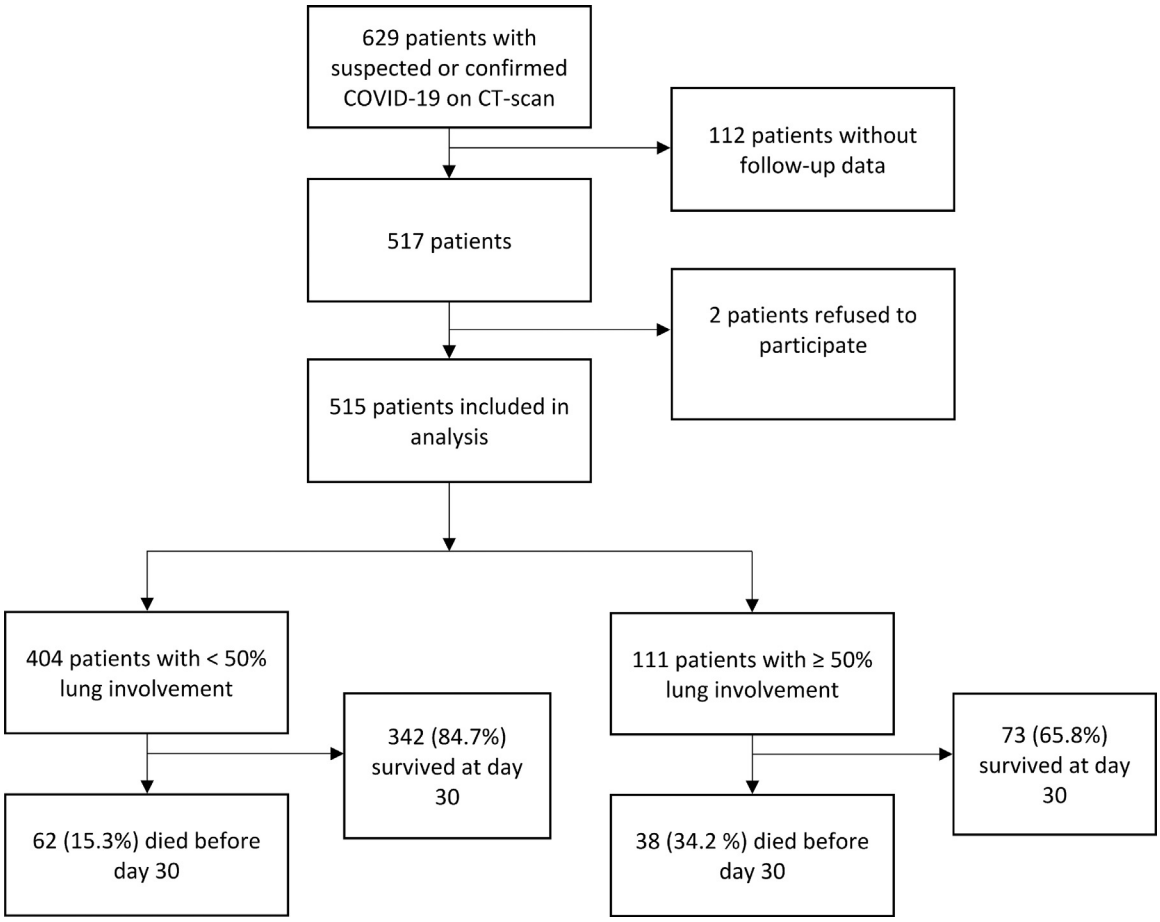

Figure 1. Flow Chart.

Description: Flow chart of the study to determine the prognostic value of chest CT characteristics in patients with COVID-19 pneumonia.

TABLE 1. Characteristics of Hospitalized Patients with COVID-19 with Available Follow-up

Variable	Value
n	515
Age, mean ± SD	68.69 ± 15.75
Age category, n (%)	
18-65	173 (33.6)
65-75	137 (26.6)
75-90	172 (33.4)
≥90	33 (6.4)
Sex: Male, n (%)	314 (61.0)
Lung involvement, n (%)	
Absent or minimal	69 (13.4)
Moderate (10%-25%)	186 (36.1)
Widespread (25%-50%)	149 (28.9)
Severe (50%-75%)	83 (16.1)
Critical > 75%	28 (5.4)
Pleural effusion, n (%)	60 (11.7)
Crazy paving, n (%)	276 (53.6)
Predominantly inferior lung involvement, n (%)	200 (38.8)
Central topography, n (%)	18 (3.5)
Peripheral topography, n (%)	240 (46.6)
Mixed topography, n (%)	276 (53.6)
Nodular consolidations, n (%)	93 (18.1)
Linear consolidations, n (%)	302 (58.6)
Large ground glass opacities, n (%)	459 (89.1)
Nodular ground glass opacities, n (%)	117 (22.7)
30-day in-hospital mortality, n (%)	100 (19.4)
Admitted to intensive care unit within 30 days of CT-scan, n (%)	99 (19.2)
Healthcare facility center, n (%)	
Hôpital Nord Franche Comté (HNFC)	274 (53.2)
Centre Hospitalier de Metz	98 (19.0)
Centre Hospitalier de Thionville	97 (18.8)
Centre Hospitalier de Troyes	46 (8.9)

RESULTS

Overall, 629 consecutive patients had distinct CT-scans in the four healthcare facilities during the study period. In-hospital follow-up information was available for 515 patients (81.8%) (Fig 1 and Table 1). A confirmed diagnosis via RT-PCR for COVID-19 was available for 417 patients (representing 81.0% of included patients; an analysis restricted to PCR-confirmed patients is available in Tables B.1 and B.2, Appendix B).

The percentage of patients that died before day 30 is presented in Table 2. Advanced age, the degree of lung involvement (Hazard Ratio 2.25 [95% CI: 1.378-3.671], $p = 0.001$), nodular consolidations and pleural effusions were associated with lower 30-day in-hospital survival (Fig 2 and Table 3).

A ≥50% degree of lung involvement (Hazard Ratio 4.471 [95% CI: 3.157-6.332]) and crazy paving (Hazard Ratio 1.510 [95% CI: 1.073-2.127]) were associated with increased risk of the secondary outcome of admission to ICU or in-hospital mortality in multivariable analysis (Table 4).

An exploratory analysis showed that a high degree of pulmonary involvement was infrequent in older patients: 16.1% of patients aged 75 and older had ≥50% lung involvement (33/205), compared to 25.2% in younger patients (78/310) as shown in Table 5. However, a high mortality was observed in the few patients aged 75 and older who also had a ≥50% lung involvement (20 deaths in 33 patients; 60.6 % mortality) (Table 5). PEs were not included in the multivariable analysis since only 11 were recorded.

DISCUSSION

The use of CTs may help stratify disease severity and patient prognosis in patients with respiratory symptoms such as dyspnea and desaturation (13). This study was consistent with

TABLE 2. In-hospital 30-day Survival According to the Main Chest Tomography (CT) Scan Findings

	Discharged Alive From Hospital (or Died After Day 30)	In-hospital 30-day Mortality
n	415	100
Percent pulmonary involvement, n (%)		
<50%	342 (84.7)	62 (15.3)
≥50%	73 (65.8)	38 (34.2)
Nodular consolidation, n (%)		
Absent	350 (82.9)	72 (17.1)
Present	65 (68.9)	28 (31.1)
Pleural effusion, n (%)		
Absent	376 (82.6)	79 (17.4)
Present	39 (65.0)	21 (35.0)
Age category, n (%)		
18-64	159 (92.0)	14 (8.0)
65-74	115 (83.9)	22 (16.1)
75-89	120 (69.8)	52 (30.2)
≥90	21 (63.6)	12 (36.4)

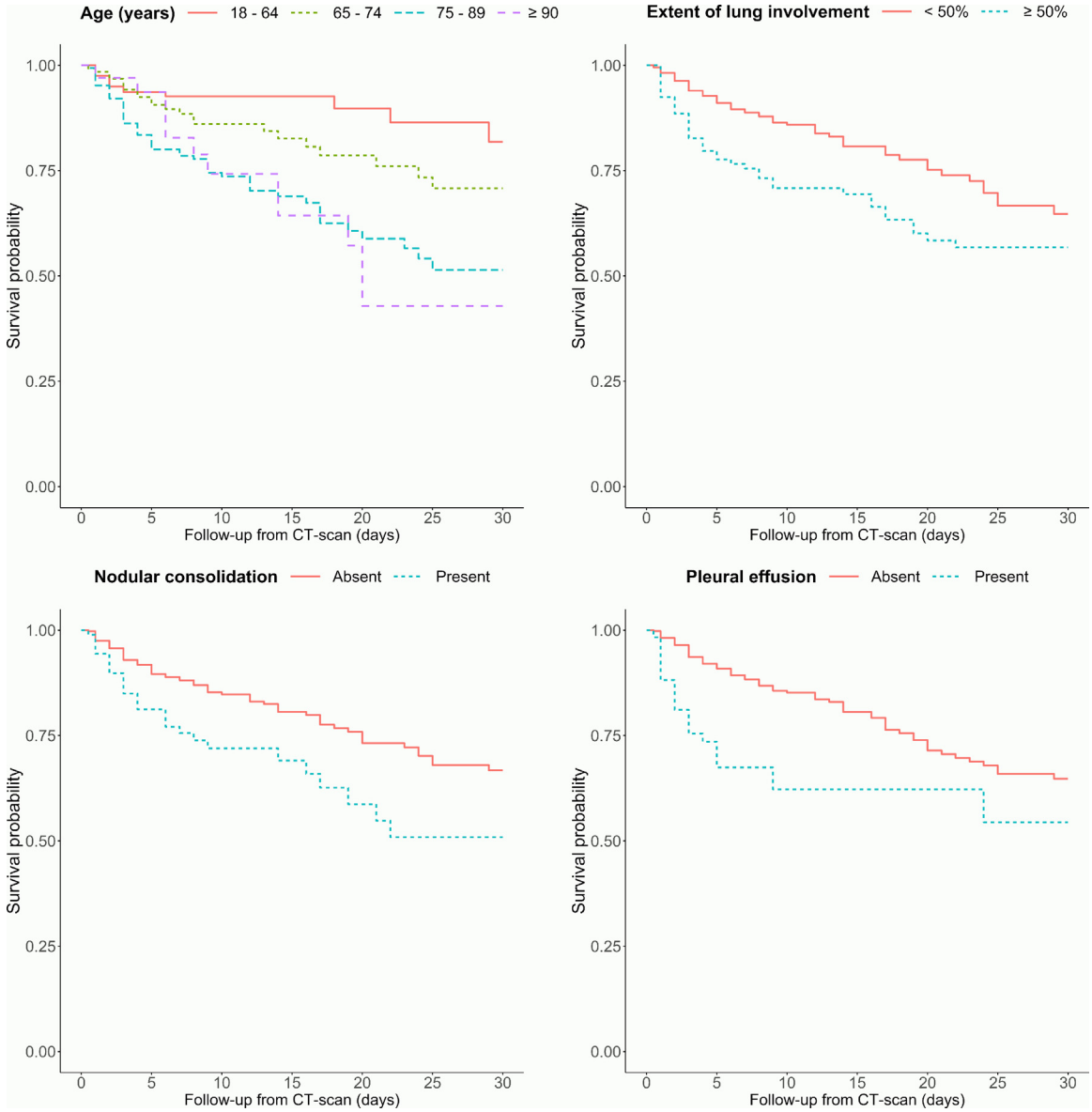

Figure 2. In-hospital 30-day survival according to age, the percentage of lung involvement, the presence of nodular consolidations and the presence of a pleural effusion. (Color version of figure is available online.)

Description: Survival curves for patients hospitalized for COVID-19 pneumonia, according to patient characteristics significantly associated with 30-day in-hospital mortality.

previously published data where age and the percentage of lung involvement showed a strong correlation with in-hospital mortality. In a recent German study (14), deep learning methods were used to estimate the overall extent of lung opacities in patients with COVID-19 pneumonia. Although the precise structure of the observed lesions was not taken into account in the study by Mader et al., the extent of opacities was correlated with several patient outcomes including Intensive Care Unit (ICU) length of stay ($R = 0.81$; $p < 0.001$) (14). Typical findings in COVID-19 include Ground Glass Opacities (GGO) which are often bilateral with a peripheral, posterior and basal distribution (15,16). Adjacent pleura thickening, interlobular septal thickening, and air bronchograms are also common, each occurring in approximately half of cases (16). Crazy paving and consolidation occur later during the course of disease (17,18). Some authors have suggested the existence of pseudo-nodular presentations, which could represent approximately 10% of cases (15,19).

To our knowledge, nodular consolidations and pleural effusion have not been previously reported as mortality risk factors, the latter often being considered an incidental finding. An early review of 121 Chinese cases showed that only one patient (1%) was diagnosed with a pleural effusion (17). In a meta-analysis study by Bao C et al (16), pleural effusion was reported in 5.88% of cases in 2020 and it was shown to be

TABLE 3. Multivariable Analysis of Hospital Mortality within 30 Days of Patients with COVID-19

Characteristic	Univariate Analysis Hazard Ratio (HR) with 95% Confidence Intervals	Univariate Analysis *p*-value	Multivariable Analysis Hazard Ratio (HR) with 95% Confidence Intervals*	Multivariable Analysis *p*-value*
Age (Years)				
<65	**1 (ref)**	**<0.0001**	**1 (ref)**	**<0.0001**
65-74	**1.705 (0.872-3.334)**		**1.931 (0.98-3.802)**	
75-89	**3.403 (1.885-6.144)**		**4.624 (2.485-8.604)**	
≥90	**3.564 (1.647-7.711)**		**3.944 (1.74-8.941)**	
Sex: male (reference: female)	1.126 (0.744-1.704)	0.57	0.999 (0.637-1.569)	0.99
≥50% lung involvement	**1.79 (1.189-2.694)**	**0.01**	**2.25 (1.378-3.671)**	**0.001**
Crazy paving	1.138 (0.765-1.691)	0.52	1.096 (0.706-1.703)	0.68
Predominantly inferior lung involvement	1.036 (0.689-1.556)	0.86	1.345 (0.867-2.088)	0.18
Peripheral topography	0.747 (0.495-1.129)	0.16	0.977 (0.614-1.557)	0.92
Nodular consolidation	**1.913 (1.236-2.961)**	**<0.01**	**2.104 (1.296-3.415)**	**<0.01**
Linear consolidation	0.793 (0.533-1.177)	0.25	0.73 (0.48-1.111)	0.14
Large Ground Glass Opacities	1.121 (0.583-2.155)	0.75	1.545 (0.715-3.337)	0.27
Nodular Ground Glass opacities	1.185 (0.753-1.864)	0.46	1.556 (0.909-2.662)	0.10
Pleural effusion	**2.244 (1.387-3.632)**	**0.001**	**2.279 (1.375-3.778)**	**0.001**

Boldface indicates statistically significant results (p <0.05).

* Analysis adjusted on center.

less frequent in COVID-19 related pneumonia than in non-COVID-19 related pneumonia (20). In our study, pleural effusion may have been due to COVID-19 as a disease itself or to a preexisting/concomitant condition. It may be worth noting that we did not assess whether pleural effusion was unilateral or bilateral. A study by Das KM et al. similarly suggested that pleural effusion might be an adverse risk factor in MERS (21).

This study had several strengths. Firstly, the number of cases included was relatively large for the early outbreak peak period. Secondly, the study was conducted at four different healthcare facilities and in various settings increasing external validity. As inherent to all retrospective studies, this study had some limitations. In the context of the first outbreak peak of the epidemic, many patients did not have access to an RT-PCR at the time of admission. Hence, for some patients,

TABLE 4. Multivariable Analysis of Hospital Mortality or Hospitalization of Patients with COVID-19 in Intensive Care Unit (ICU) within 30 Days

Characteristic	Univariate Analysis Hazard Ratio (HR) with 95% Confidence Intervals	Univariate Analysis *p*-value	Multivariable analysis Hazard Ratio (HR) with 95% Confidence Intervals*	Multivariable Analysis *p*-value*
Age (years)				
<65	1 (ref)	0.08	1 (ref)	0.12
65-74	1.334 (0.906-1.963)		1.322 (0.887-1.970)	
75-89	0.832 (0.567-1.220)		0.828 (0.551-1.244)	
≥90	0.785 (0.417-1.481)		0.833 (0.435-1.594)	
Sex: male (reference: female)	**1.594 (1.153-2.204)**	**<0.01**	1.316 (0.937-1.848)	0.11
≥50% lung involvement	**5.040 (3.727-6.817)**	**<0.0001**	**4.471 (3.157-6.332)**	**<0.0001**
Crazy paving	**1.833 (1.341-2.507)**	**<0.001**	**1.510 (1.073-2.127)**	**0.02**
Predominantly Inferior lung involvement	0.761 (0.554-1.046)	0.09	1.04 (0.738-1.465)	0.82
Peripheral topography	**0.562 (0.409-0.771)**	**<0.001**	0.904 (0.628-1.301)	0.58
Nodular consolidation	**1.699 (1.199-2.407)**	**<0.01**	1.445 (0.981-2.128)	0.06
Linear consolidation	1.263 (0.927-1.720)	0.14	1.263 (0.912-1.750)	0.16
Large Ground Glass Opacities	1.497 (0.866-2.586)	0.15	1.250 (0.673-2.319)	0.48
Nodular Ground Glass Opacities	0.854 (0.591-1.233)	0.40	1.125 (0.748-1.693)	0.57
Pleural effusion	**1.609 (1.073-2.412)**	**0.02**	1.525 (0.997-2.334)	0.052

Boldface indicates statistically significant results (p <0.05).

* Analysis adjusted on center.

TABLE 5. Extent of Pulmonary Involvement in Patients with COVID-19 According to Age

Pulmonary Involvement	<50% Pulmonary Involvement	≥50% Pulmonary Involvement
Age category (years), n (%)		
<75	232 (74.8)	78 (25.2)
≥75	172 (83.9)	33 (16.1)
Mortality rate (n deceased/n total)	<50% pulmonary involvement	≥50% pulmonary involvement
Age category (years), n (%)		
<75	7.8% (18/232)	23.1% (18/78)
≥75	25.6% (44/172)	60.6% (20/33)

inclusion was decided based on the clinical presentation combined with CT scan findings. However, this was the case in only a minority of patients (19.0%). Moreover, the results of the main analysis were consistent with the results of the subgroup analysis restricted to PCR-positive patients. During the outbreak peak, it was considered that due to a high positive predictive value, CT could be considered a good reference for recognizing COVID-19 patients while waiting for RT-PCR confirmation (22-24). Later during the epidemic, deep learning methods trained on CT images also proved interesting for the diagnosis of COVID-19 (25), a meta-analysis reporting a pooled sensitivity of 0.908 and specificity of 0.916 (26), which was significantly higher than the specificity of 37% (95% CI: 26%-50%) reported in previous studies (27). Patients included in the study were all assessed in a hospital imaging facility, although some of them were outpatients. Consequently, there was a recruitment bias because most of them came through the emergency ward. Not all of them were hospitalized afterwards, which is why follow-up was not available for all patients. Despite these limitations, this study demonstrates the need for future prospective investigations to better define the prognostic value of chest CT, especially the presence of pleural effusion and consolidation. Pleural effusion is typically a negative sign in COVID-19. However, its presence should be emphasized in reports as it was predictive of a worse prognosis in our study.

Remarkably, a high mortality rate was observed in patients aged 75 and older who also had a ≥50% lung involvement. It should be noted, however that this specific result was part of a post-hoc exploratory analysis. Age was not associated with the secondary outcome of hospitalization in ICU or mortality. This could be because patients aged over 90 are seldom admitted to the ICU.

CONCLUSION

Chest CT scan examination is recommended in the initial prognostic assessment in severe cases of COVID-19 patients and its results must be considered when making care management decisions. This multicentric teleradiology setting study showed that age, percentage of lung involvement ≥50%, pleural effusion and nodular consolidation were independent predictors of in-hospital 30-day mortality. To our knowledge, pleural effusion and nodular consolidation have not been previously described as mortality risk factors in COVID-19. These findings may contribute to a better identification of patients with a high risk of mortality and facilitate more individually aligned treatment plans optimizing medical resource use.

AUTHOR CONTRIBUTIONS

Conceptualization: NM, MC. Data acquisition: NM, MC, PS, CG, HPL, EP, JP, MAM, EB, FU, EB, GV, OA, PC, CA, VJ, SC, AD, AD, YBG, ME, MS. Statistical analysis: JC. Initial manuscript: NM, MS, MC. Revision for critical intellectual content: MS, NM, MC, SS, JC. All authors approved the final manuscript.

COMPETING INTERESTS

MC was a board member at Medin+ at the time of writing. All other authors do not have anything to disclose.

ETHICS APPROVAL AND CONSENT TO PARTICIPATE

The study was declared to the French national register of studies using healthcare data under declaration number MR0210190520. Approval by an institutional review board was not required in accordance with Article L1121-1 (n° 2012-300, March 5, 2012) of the French Public Health Code as the study was retrospective and observational.

CONSENT FOR PUBLICATION

Not applicable

AVAILABILITY OF DATA AND MATERIAL

Data and material can be obtained upon request to the first author at the following email nmalecot@medinplus.com

FUNDING

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APPENDIX A

English translation of the March 2020 French Thoracic Society standardized report for suspected SARS Cov2 infection

CHEST CT

INDICATION:

Evaluation of suspected SARS Cov2 infection (Covid19)

EXAMINATION TECHNIQUE:

Helicoidal millimetric acquisition [**without injection**] centered on the thorax

PDL: (mGy.cm)

Biocleaning of the scanner with the appropriate surface agent after the examination, according to the recommendations of the hygiene department.

RESULTS:

Abnormal findings evoking COVID-19:

Ground Glass Opacities

Appearance: Large areas / Nodular

Consolidation

Appearance: Linear / Nodular

Crazy paving (reticulations within Ground Glass)

Topography of lesions:

Subpleural / Mixed / Central

Predominantly inferior localization: yes/no

Extent of abnormal findings

Extent: absent /minimal (<10%)/moderate (10-25%)/ widespread (25-50%)/ severe (>50%) / critical >75%

Negative signs:

Absence of centrolobular micronodulation.

Absence of consolidation localized in pulmonary segments.

Absence of endobronchial secretions.

Additional observations:

Absence of underlying lung parenchyma abnormalities.

No unusual features in tracheobronchial tree.

Absence of suspect pulmonary mass or nodule.

Absence of mediastinal or hilar lymphadenopathy.

Absence of pleural or pericardial effusion.

Absence of apparent abnormal findings in abdominal sections.

Absence of bone lesions.

CONCLUSION:

CT examination results typical of/ consistent with/ not evocative of COVID-19

Extent: minimal/ moderate/ widespread/ severe /critical

Absence of parenchymal abnormal findings, which does not exclude COVID-19 within the first three days after the appearance of symptoms.

Original version of the March 2020 French Thoracic Society standardized report for suspected SARS Cov2 infection

APPENDIX B

Tables B.1 and B.2

TABLE B.1. Multivariable Analysis of Hospital Mortality within 30 Days (Analysis Restricted to PCR-Confirmed Cases)

Characteristics	Univariate Analysis Hazard Ratio (HR) with 95% Confidence Intervals	Univariate Analysis *p*-value	Multivariable Analysis Hazard Ratio (HR) with 95% Confidence Intervals*	Multivariable Analysis *p*-value*
Age (years)				
<65	**1 (Ref)**	**<0.001**	**1 (Ref)**	**<0.001**
65-74	**1.663 (0.813-3.405)**		**1.940 (0.936-4.018)**	
75-89	**3.498 (1.852-6.607)**		**5.601 (2.824-11.109)**	
≥90	**3.784 (1.669-8.582)**		**5.061 (2.091-12.248)**	
Sex: male (reference: female)	1.061 (0.681-1.655)	0.79	1.013 (0.630-1.630)	0.96
≥50% lung involvement	**1.759 (1.147-2.698)**	**0.01**	**2.576 (1.539-4.310)**	**<0.001**
Crazy paving	1.162 (0.761-1.776)	0.48	1.185 (0.736-1.910)	0.49
Predominantly inferior lung involvement	1.110 (0.724-1.701)	0.63	1.312 (0.831-2.071)	0.24
Peripheral topography	0.762 (0.493-1.177)	0.22	0.922 (0.565-1.505)	0.74
Nodular consolidations	**1.779 (1.113-2.842)**	**0.02**	**1.941 (1.168-3.225)**	**0.01**
Linear consolidations	0.712 (0.469-1.083)	0.11	0.615 (0.394-0.960)	0.03
Large Ground Glass Opacities	1.112 (0.558-2.215)	0.76	1.285 (0.551-2.995)	0.56
Nodular Ground Glass Opacities	1.170 (0.722-1.894)	0.52	1.627 (0.885-2.989)	0.12
Pleural effusion	**1.938 (1.095-3.430)**	**0.02**	**2.255 (1.238-4.108)**	**0.008**

* Analysis adjusted on center.

TABLE B.2. Multivariable Analysis of Hospital Mortality or Hospitalization in Resuscitation Unit within 30 Days (Analysis Restricted to PCR-Confirmed Cases)

Characteristic	Univariate Analysis Hazard Ratio (HR) with 95% Confidence Intervals	Univariate Analysis *p*-value	Multivariable Analysis Hazard Ratio (HR) with 95% Confidence Intervals*	Multivariable Analysis *p*-value*
Age (years)				
<65	1 (Ref)	0.08	1 (Ref)	0.09
65-74	1.434 (0.949-2.167)		1.562 (1.016-2.400)	
75-89	0.866 (0.571-1.314)		0.964 (0.618-1.503)	
≥90	0.843 (0.431-1.648)		0.898 (0.449-1.797)	
Sex: male (reference: female)	**1.498 (1.057-2.122)**	**0.02**	1.278 (0.889-1.838)	0.18
≥50% lung involvement	**5.337 (3.871-7.357)**	**<0.001**	**5.233 (3.608-7.590)**	**<0.001**
Crazy paving	**1.820 (1.298-2.550)**	**<0.001**	**1.619 (1.115-2.352)**	**0.01**
Predominantly inferior lung involvement	0.773 (0.553-1.08)	0.13	1.014 (0.712-1.444)	0.94
Peripheral topography	**0.537 (0.384-0.752)**	**<0.001**	0.877 (0.596-1.291)	0.51
Nodular consolidation	**1.620 (1.114-2.356)**	**0.01**	1.502 (0.993-2.273)	0.054
Linear consolidations	1.284 (0.923-1.788)	0.14	1.233 (0.869-1.749)	0.24
Large Ground Glass Opacities	1.378 (0.78-2.434)	0.27	0.829 (0.424-1.618)	0.58
Nodular Ground Glass Opacities	0.842 (0.568-1.250)	0.40	1.031 (0.643-1.651)	0.90
Pleural effusion	1.566 (0.968-2.534)	0.07	**1.784 (1.076-2.957)**	**0.02**

* Analysis adjusted on center.