COVID-19 voor de radioloog

Samenvatting imaging-literatuur en voorbeelden

14032020 Dr. L.J.M. Kroft

Inhoud

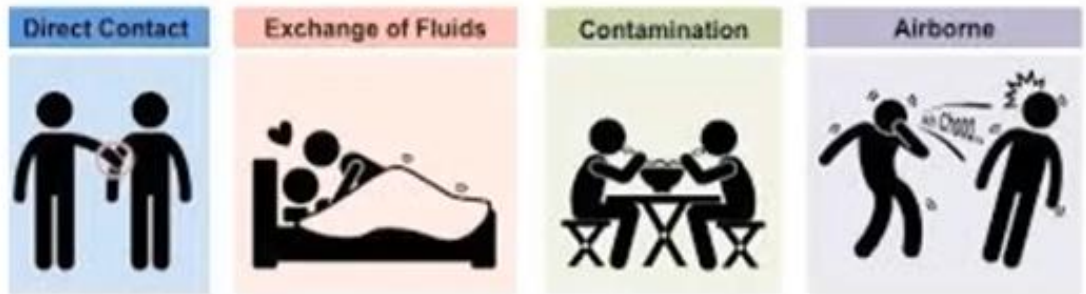
ERS webinar series
Coronavirus outbreak

Perspectives of the management of COVID-19 infection in China

Prof. Dr. Nanshan ZHONG
Academician of Chinese Academy of Engineering
Director, National Clinical Research Center for Respiratory Disease
Professor of Respiratory Medicine , Guangzhou Medical University

ERS

Direct contact transmission

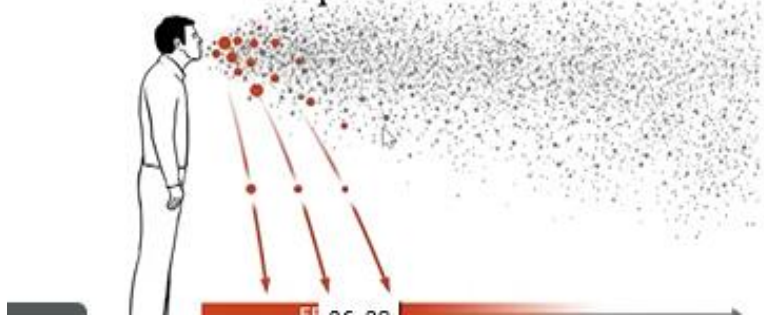


Infected people with cough who wear masks are also transmissiv

Asymptomatic transmission

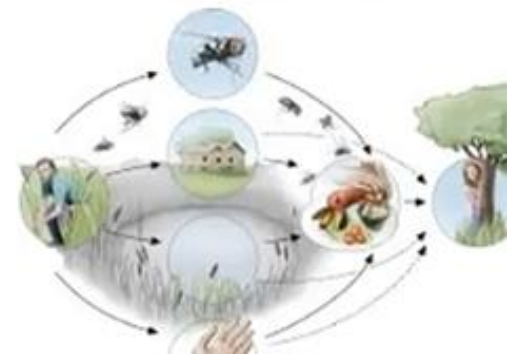
.....

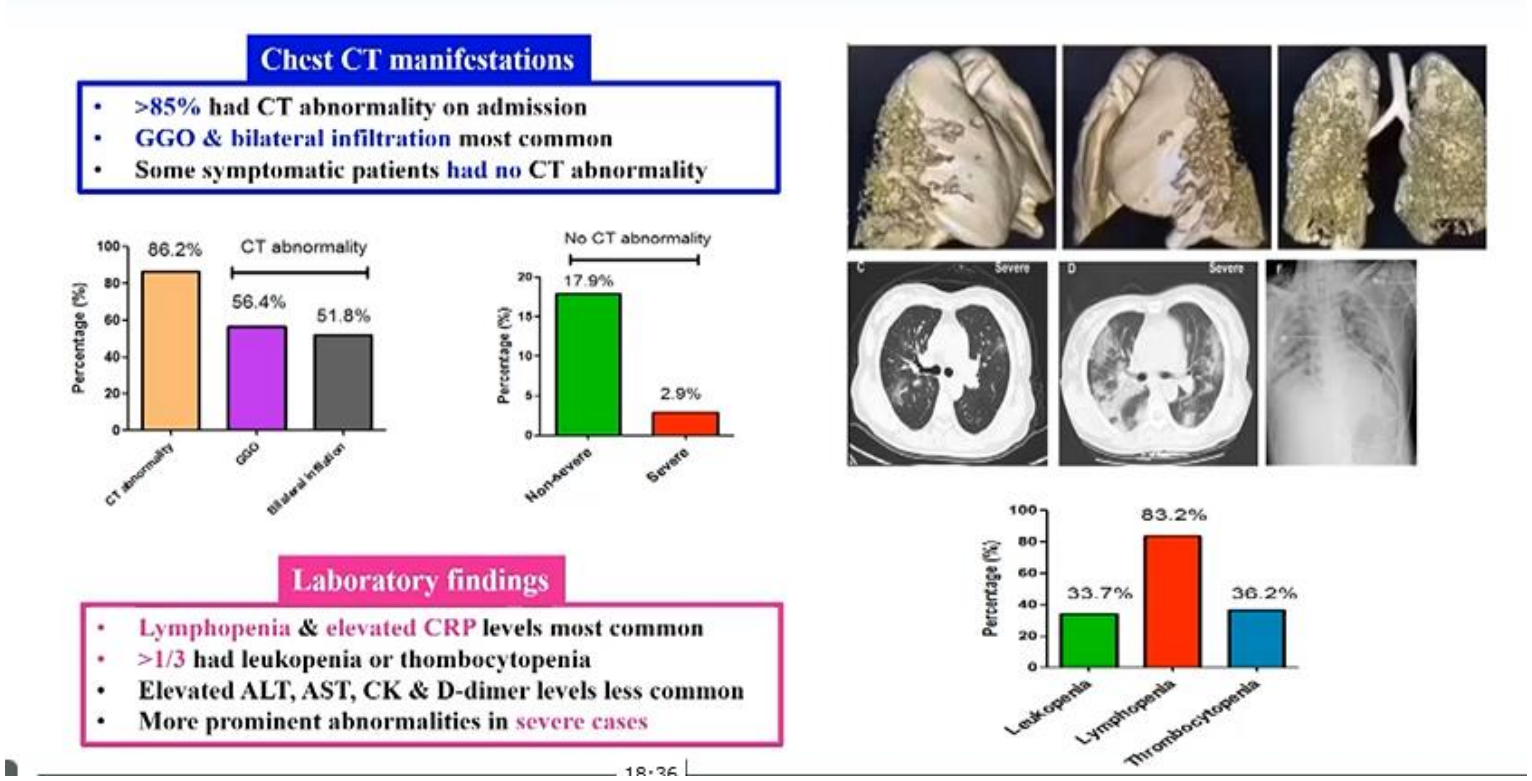
Droplet transmission



Mother-to-child transmission?

Stool transmission?





CT meestal afwijkend (>85%)

1099 patients with laboratory-confirmed Covid-19 from 552 hospitals in 30 provinces, China.

- Median age 47 years; 41.9% female.
- 67 patients with complications (6.1%), including:
  - 5.0% ICU
  - 2.3% invasive mechanical ventilation
  - 1.4% died

Guan WJ et al N Engl J Med 2020

COVID-19

PCR versus CT

Detectie van COVID-19: CT is sensitiever (88%) dan PCR (59%)

PCR COVID-19 positief → CT sens 97%.
PCR COVID-19 negatief → CT sens 75%.

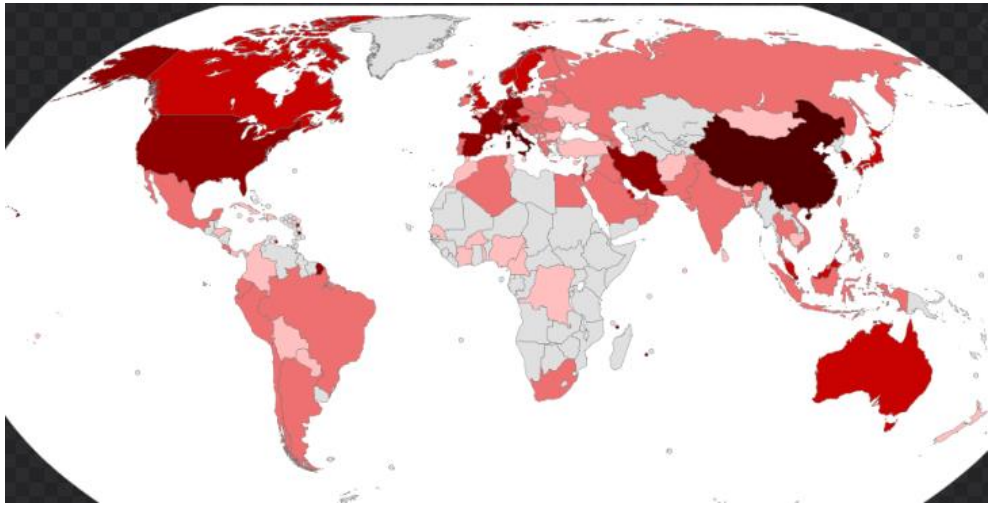
PCR positief → normale CT bij 21/601= 3-4%

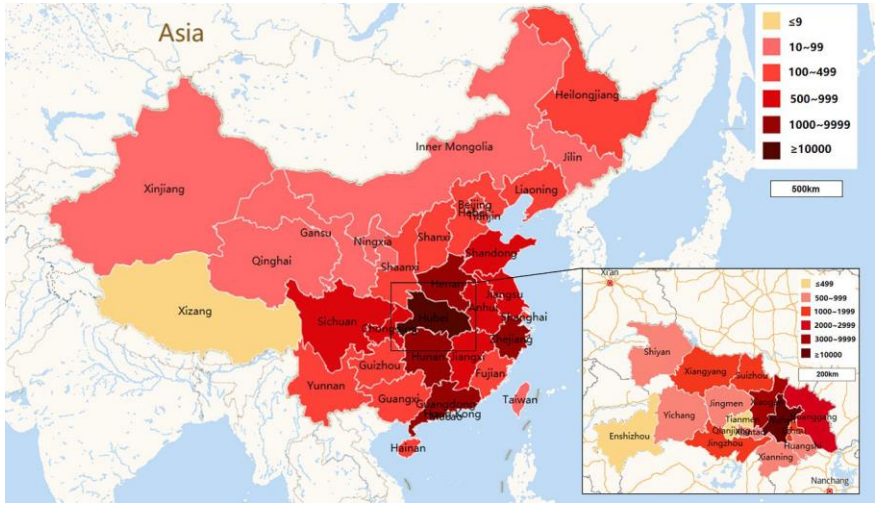
Ai and Yang, et al, Radiology in press, 1014 cases study

Normale CT bij PCR bewezen COVID-19

- Ongeveer 10% negatieve CT bij presentatie
- Afhankelijk van symptomen-duur
- 0-2 dagen → meer dan de helft kan normale CT hebben (Bernheim et al)
- Soms later alsnog CT pneumonie
- Pneumonie op CT bij asymptomatische patient kan ook voorkomen (Shi H et al, Lancet 2020)

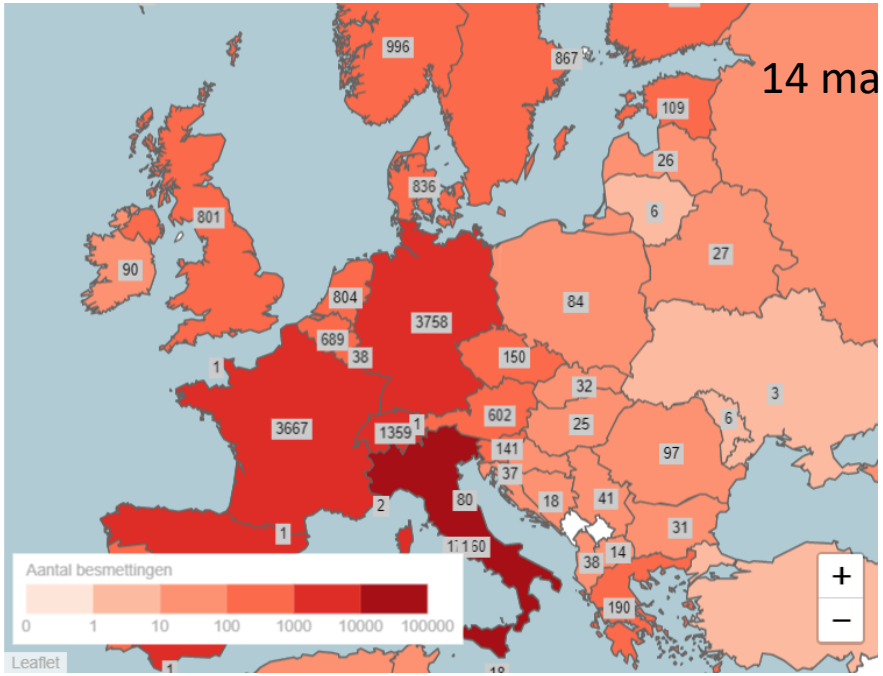
De meeste patienten hebben bij presentatie afwijkingen op de CT thorax



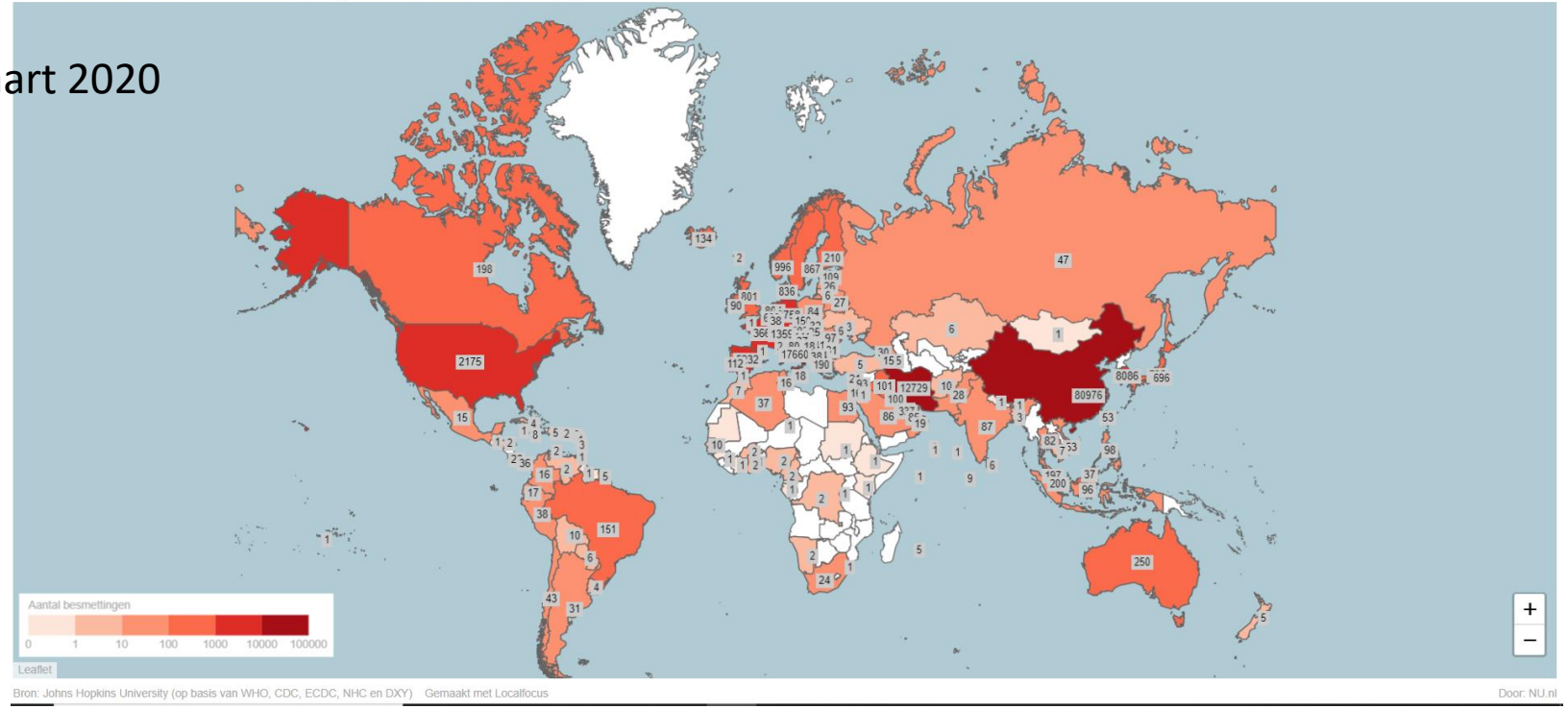


Zu et al, Radiology, in press

Wiki



14 maart 2020



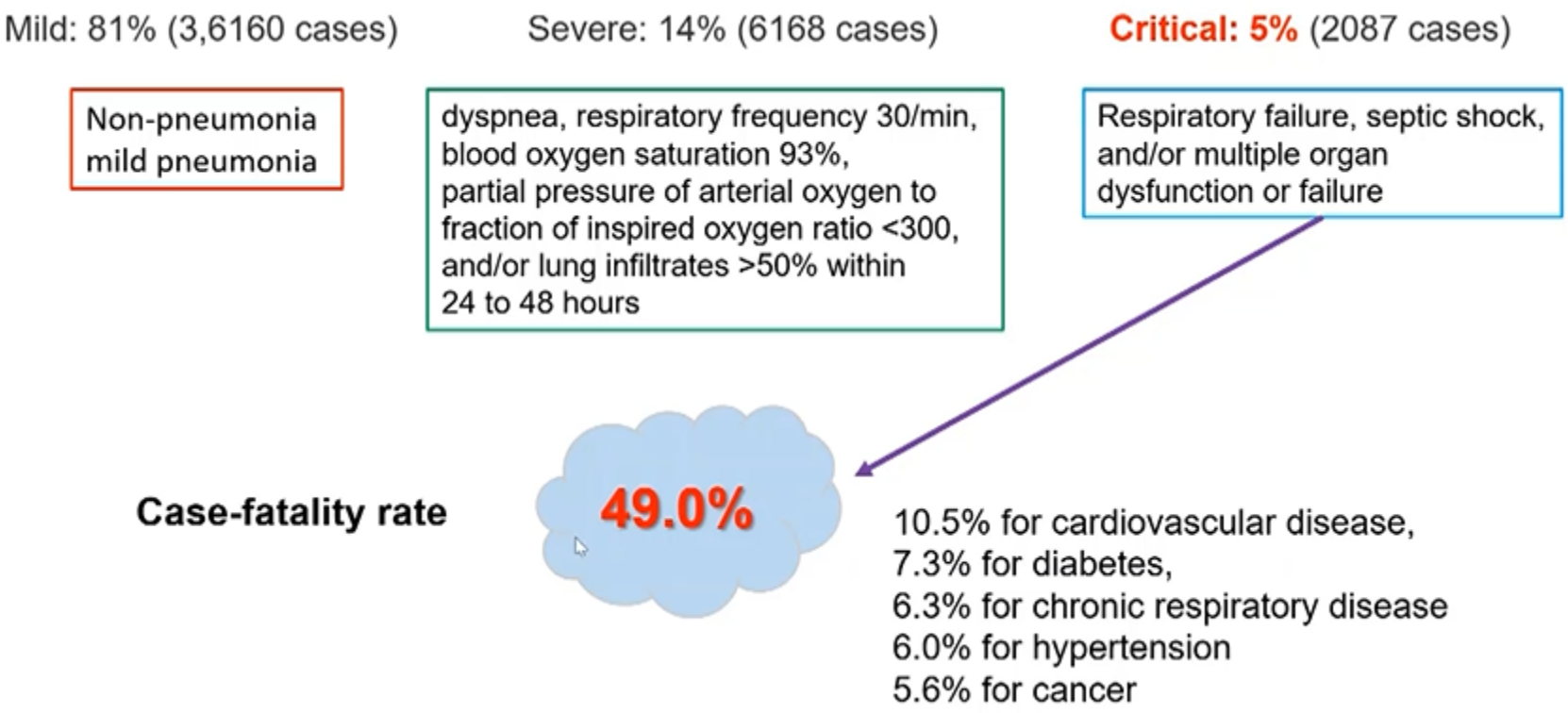
Symptomen COVID-19

1. **Koorts** (86% binnen een week)
2. Hoesten (70% binnen een week)
3. Kortademig (43% binnen een week) Shi H et al, Lancet 2020

Nr 1 en minimaal een van de anderen: suspect.

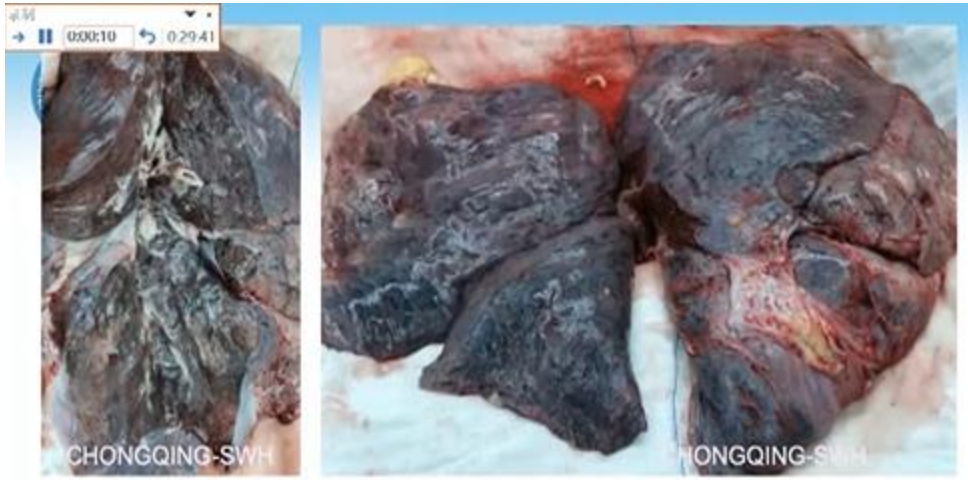
En: na reizen verdacht land of <14 dagn contact SARS-CoV-2.

Spectrum of disease (N = 4,4415)



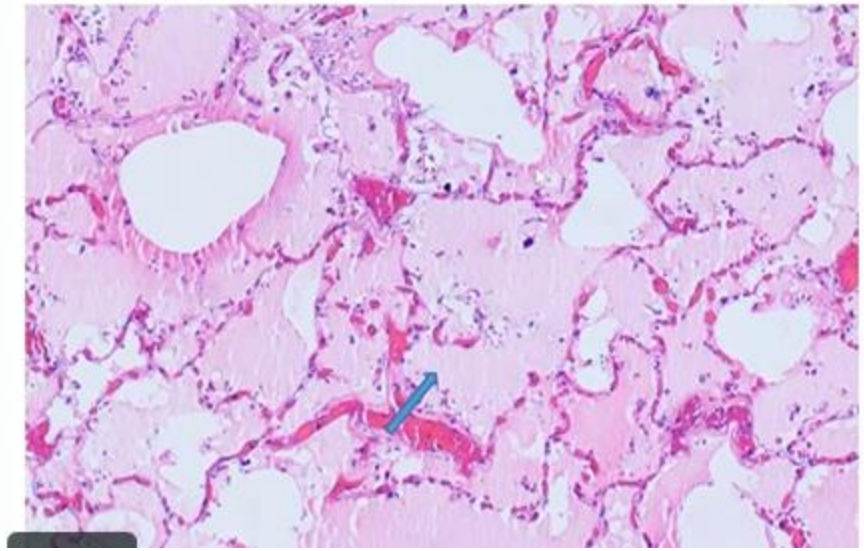
COVID-19 → ongeveer 2,5% dood

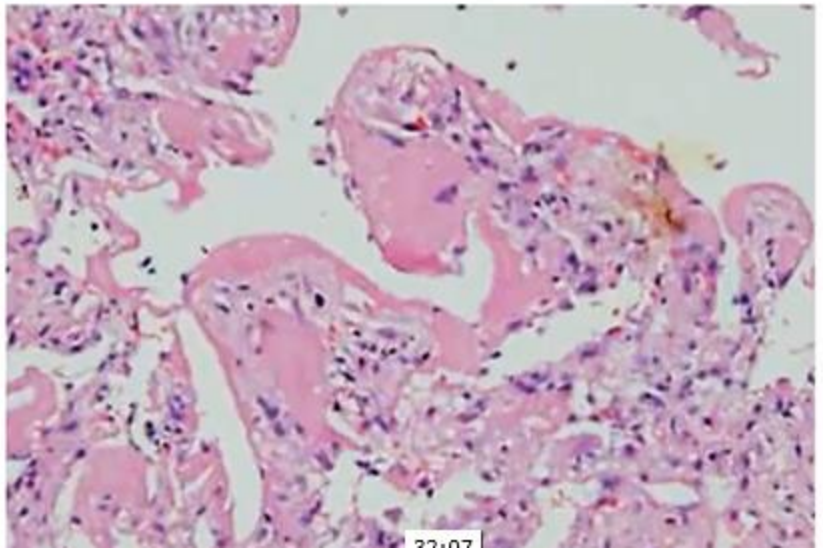
Wu ZY JAMA 24 feb 2020 online



Consolidation with different extent, dark red, tenacious

Large fluid in the alveoli, micro vascular thrombosis, hyaline membrane formation





Uit podcast Prof. Zhong

COVID-19 CT imaging findings (101 patienten):

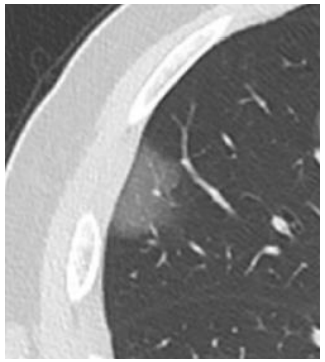
Kenmerken:
- GGO 86%
- Mixed GGO en consolidatie 64%
- Vasculaire vergroting in aangedane regio 71%
- Tractie bronchiectasieen 53%

Verspreiding:
- Perifere distributie 87%
- Bilateraal 82%
- Ondervelden predominant 55%
- Multifocaal 55%

Emergency patients:
- Older (64% >50 years of age)
- More architectural distortion, traction bronchiectasis, LN enlargement and pleural effusion

Zhao et al, AJR 2020 (101 case studies)

4 stages on CT (after onset of symptoms):
Stage 1. Early stage (0-4 days): GGO (75%) or normal CT
Stage 2. Progressive stage (5-8 days): increased crazy paving (53%)
Stage 3. Peak stage (10-13 days): consolidation (91%)
Stage 4. Absorbtion stage (≥14 days): gradual resolution (75%) without crazy paving



Early: small GGO

CT-STADIA COVID-19

In patients recovered from COVID-19 pneumonia on CT:

A. Initial: small subpleural GGO, increasing with crazy-paving pattern and consolidation.

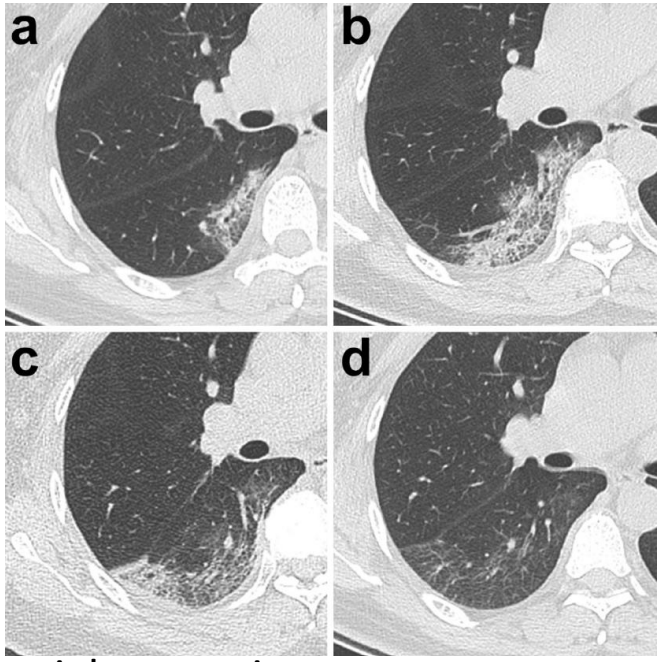
B. < 2 weeks after disease onset: Increased consolidation.

C. > 2 weeks: lesions gradually absorbed leaving extensive GGO and subpleural parenchymal bands.

Day 3 after onset small GGO with consolidation

Day 7 enlarged GGO and consolidation, increased crazy paving

F47



Day 11 partial resorption
New subpl consolidation

Day 20 gradual absorption,
GGO left but **no crazy paving**

Pan et al, time course COVID-19, Radiology in press (21 pts study)

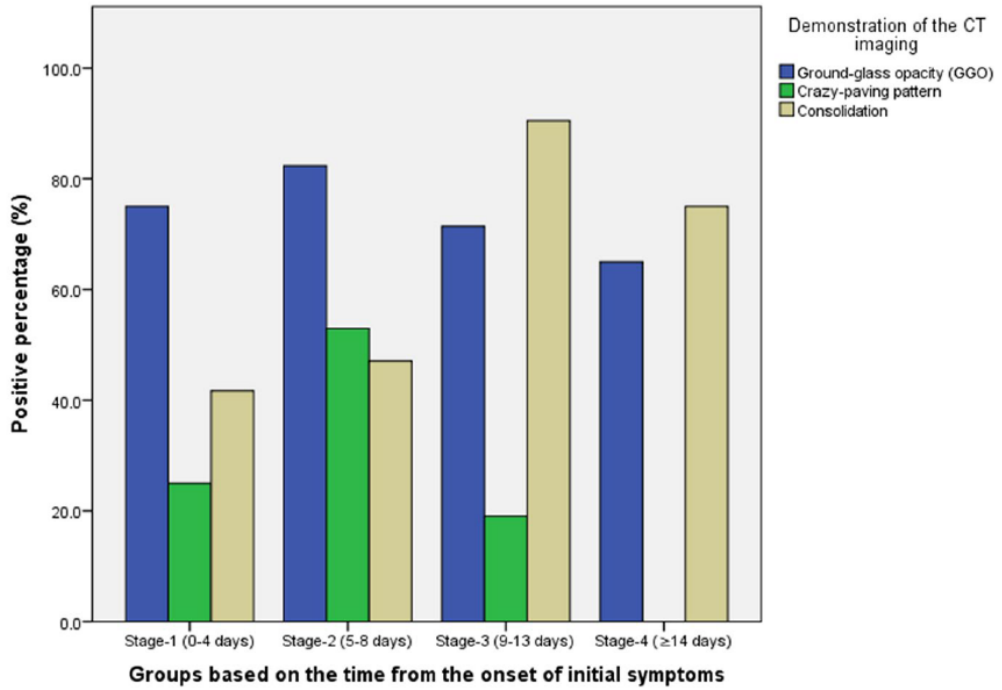


Figure 4. Changes in the proportions of patients with GGO, crazy praving pattern and consolidation as a function of stage (stage definitions from figure 3).

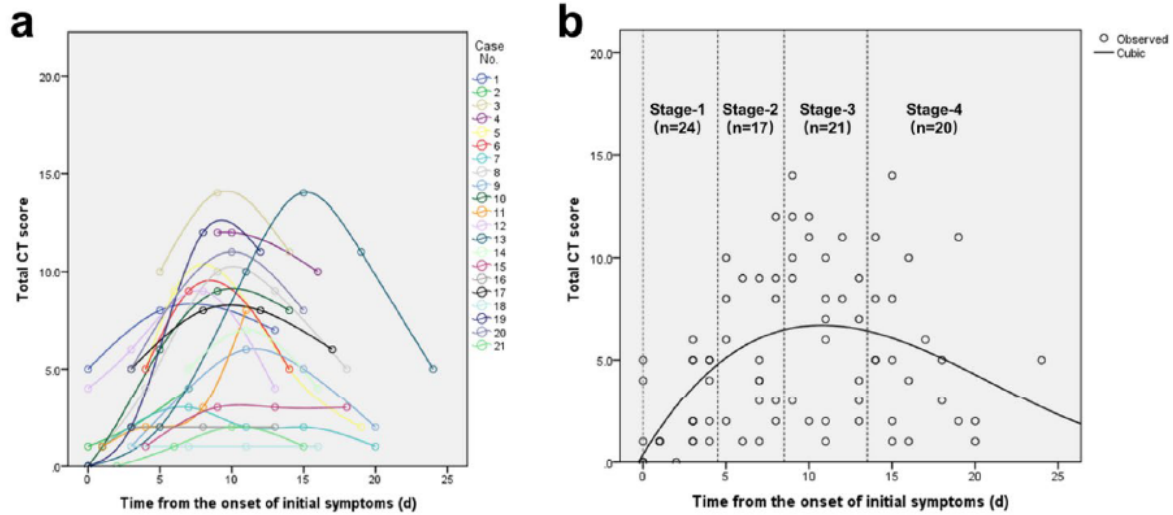


Figure 3. Change in lung involvement on chest CT from time of onset of initial symptoms (in days). (**a**) The dynamic changes in total CT score for each patient; (**b**) Peak total CT lung involvement occurred at day 10 (curve fitting equation: $y=0.001*x^3-0.083*x^2+1.329x+0.373$, in which x = time from the onset of the initial symptoms, y = total CT score of the pulmonary involvement; $R^2=0.25$, $p<0.001$). Quartiles of patients between 0 and 26 days are shown as stages 1 to 4.

Vroeg: mn GGO, consolidatie, en crazy paving
Laat: wel GGO en consolidatie, geen crazy paving

Bijna alle patienten “alle stadia” maar peak op verschillende tijd na aanvang symptomen

Pan et al, time course COVID-19, Radiology in press (21 pts study)

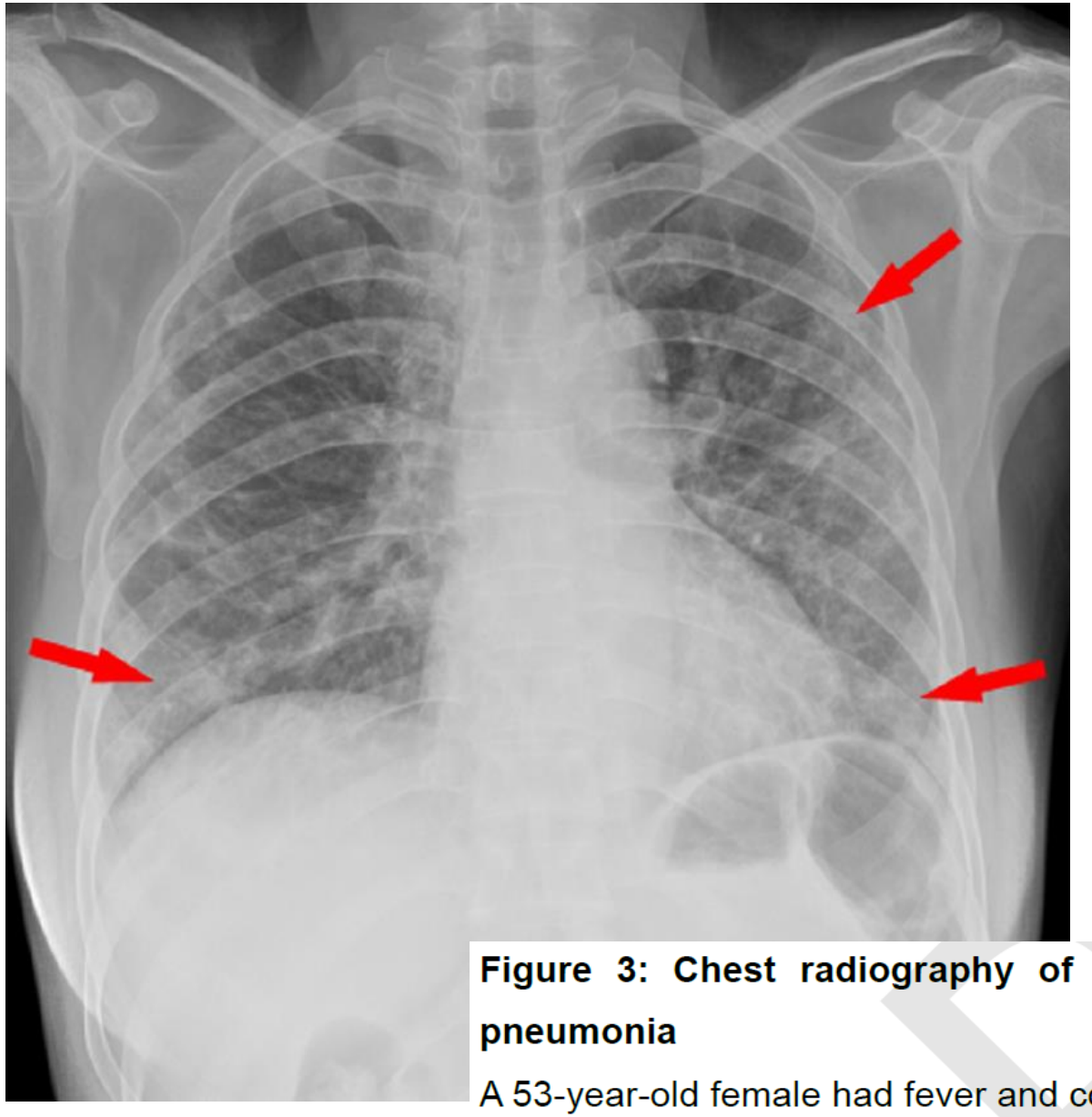
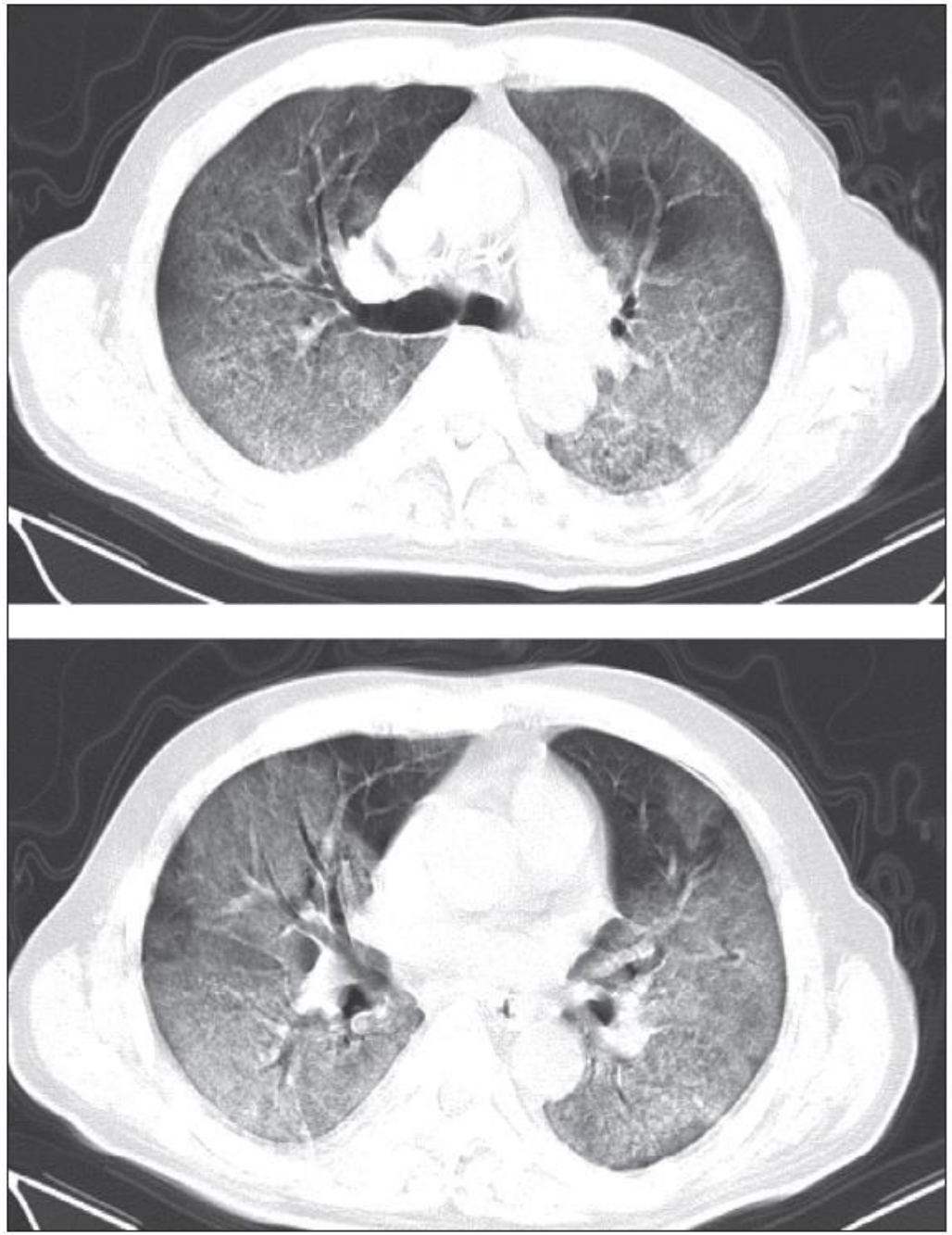


Figure 3: Chest radiography of confirmed Coronavirus Disease 2019 (COVID-19) pneumonia

A 53-year-old female had fever and cough for 5 days. Multifocal patchy opacities can be seen in both lungs (arrows).

Zu et al, Radiology, in press



Ernstig beeld

M60
8 dagen symptomen
bilateraal uitgebreid GGO
met luchtbronchogrammen

Patient overleed 4 dagen later

Shi H et al. The Lancet Feb 24 2020 online. 81 pts with COVID-19

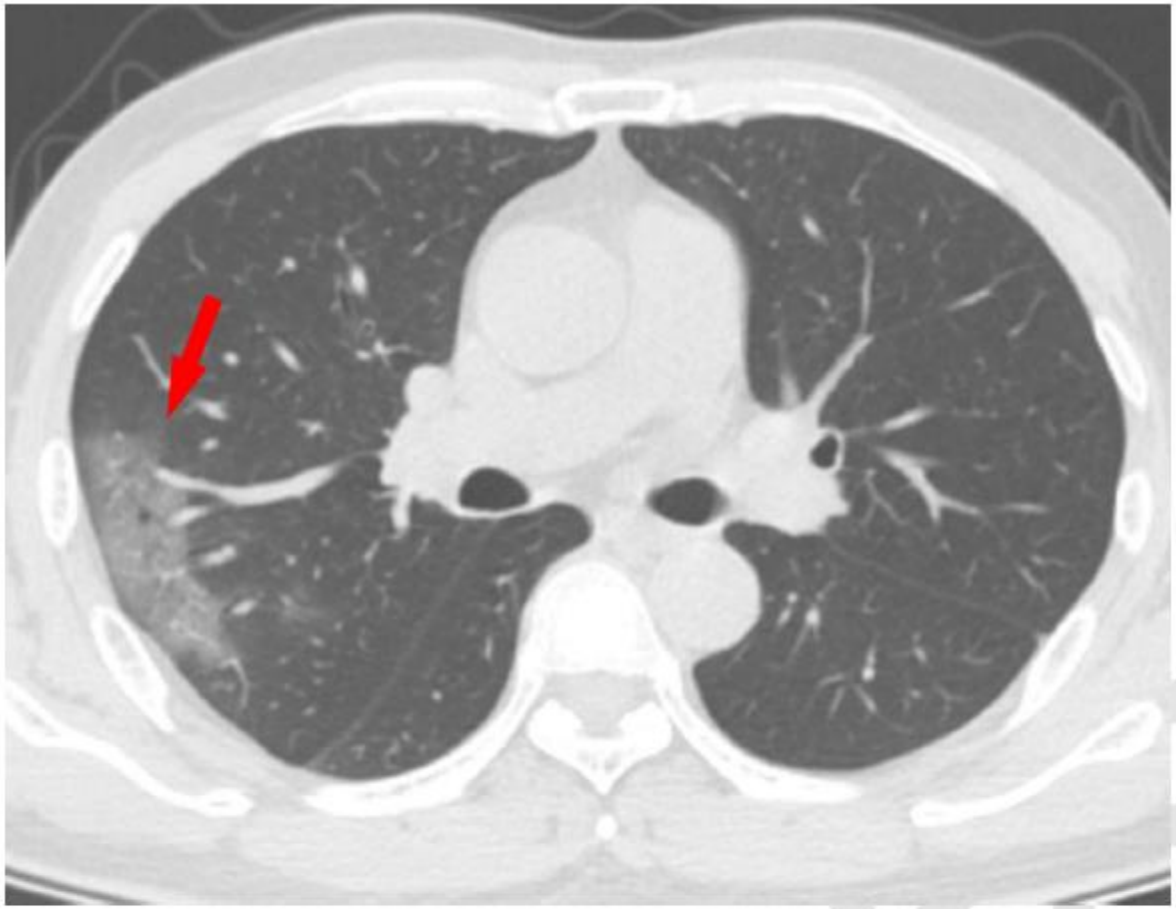


Figure 5: CT findings of confirmed Coronavirus Disease 2019 (COVID-19) pneumonia

Patchy GGO pattern. A 58-old-year man with close contact history presenting without fever. Axial unenhanced chest CT showed patchy pure GGO (arrow).

Zu et al, Radiology, in press

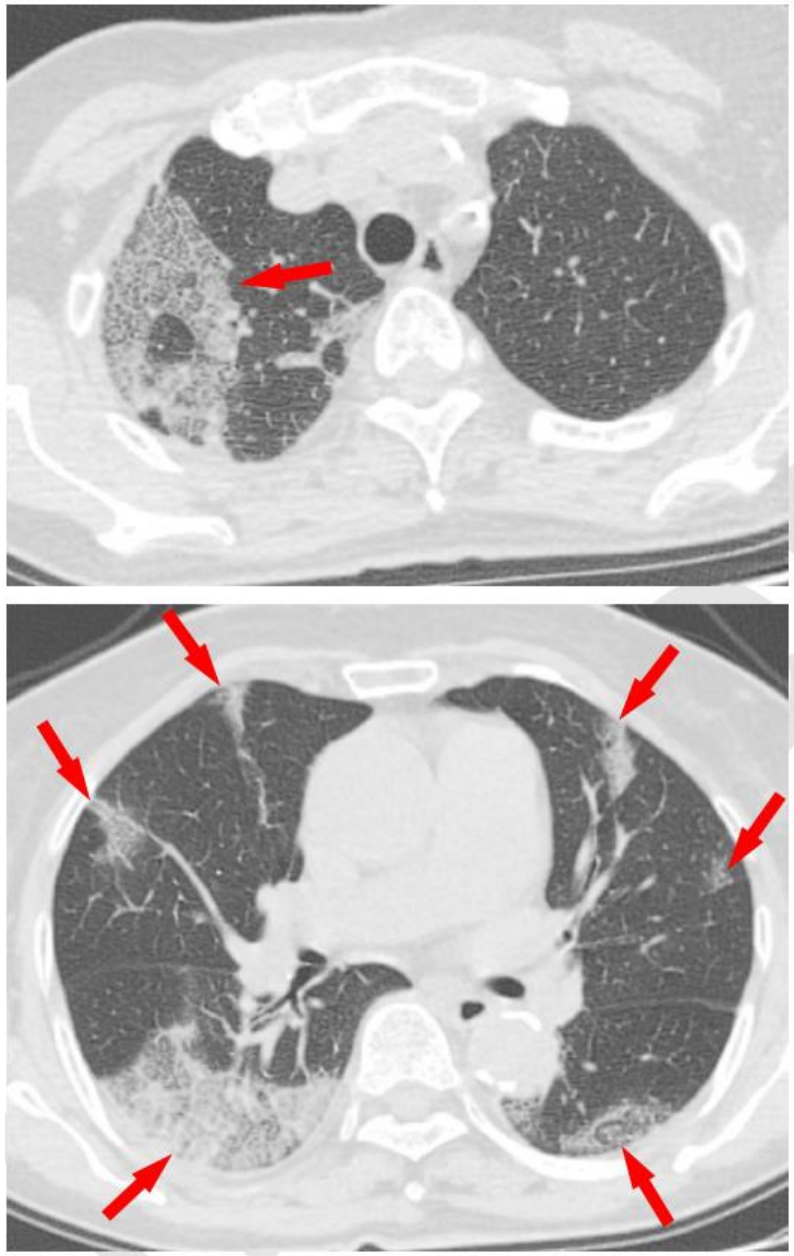


Figure 6: CT findings of confirmed Coronavirus Disease 2019 (COVID-19) pneumonia

Crazy paving pattern. A 69-old-year woman presenting with fever, cough, and muscle soreness with Wuhan exposure history. a, Axial unenhanced chest CT acquired on January 26, 2020 showed patchy GGO with typical crazy paving pattern (arrow). b, Axial unenhanced chest CT acquired on January 31, 2020 showed multiple subpleural distributed GGOs (arrows).

Zu et al, Radiology, in press

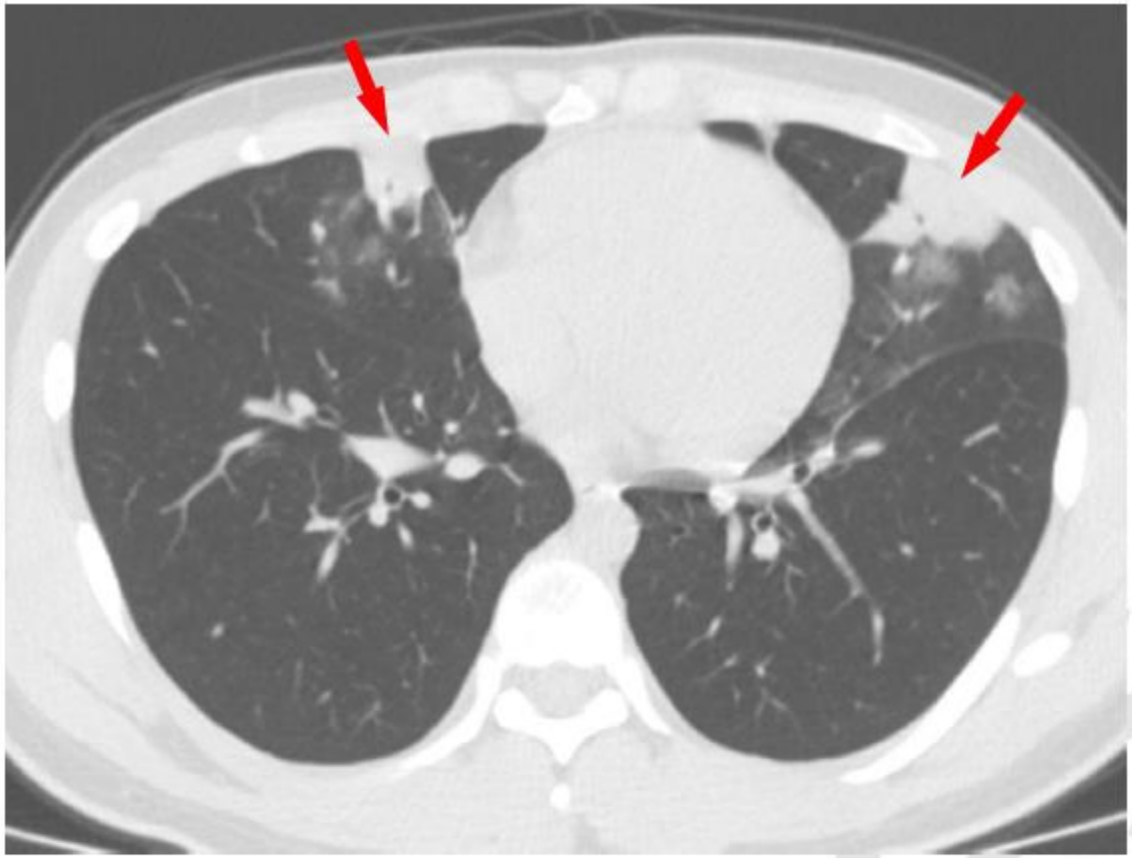
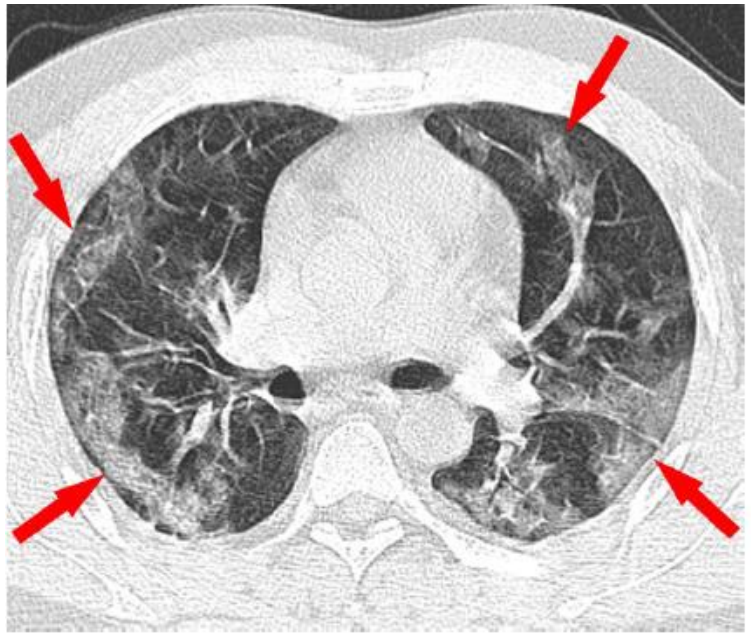
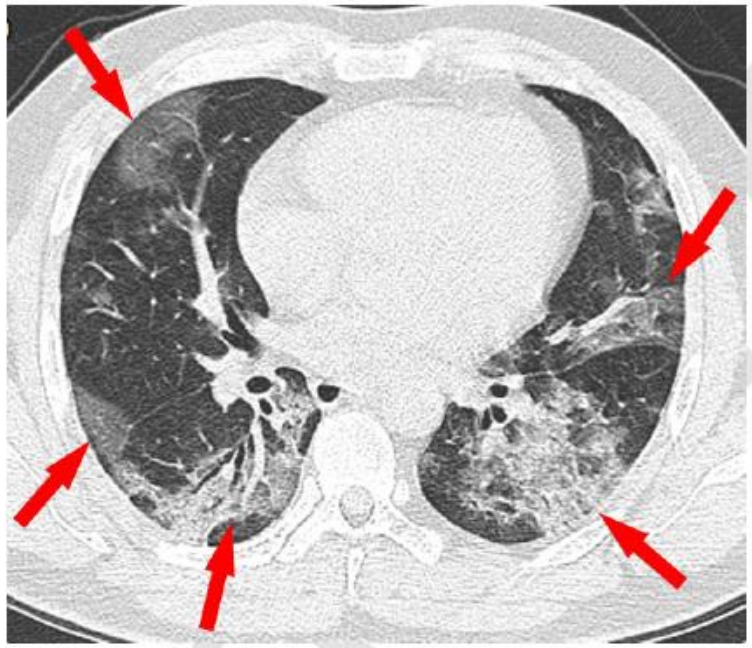


Figure 7: CT findings of confirmed Coronavirus Disease 2019 (COVID-19) pneumonia

Consolidation pattern. A 17-year-old male presented with fever (38.1ºC, 100.58℉), cough for three days, and Wuhan exposure history. Axial unenhanced chest CT acquired on January 27, 2020 showed multiple pure consolidation lesions (arrows) in the middle lobe of right lung and upper lobe of left lung.

Zu et al, Radiology, in press





Bij presentatie geen koorts

Subpleuraal diffuse GGO

Figure 8: CT findings of severe type confirmed Coronavirus Disease 2019 (COVID-19) pneumonia

A 43-year-old man presented with no fever and Wuhan exposure history. Axial unenhanced chest CT was acquired on the same day as reverse-transcription–polymerase-chain-reaction. a-b. Two thin slice axial unenhanced chest CT images showed diffusely subpleural distributed ground-glass opacities (arrows). Images provided by courtesy of Dr. Wei Chen, Department of Radiology, The Second Affiliated Hospital and Yuying Children's Hospital of Wenzhou Medical University, Zhejiang, China.

Zu et al, Radiology, in press

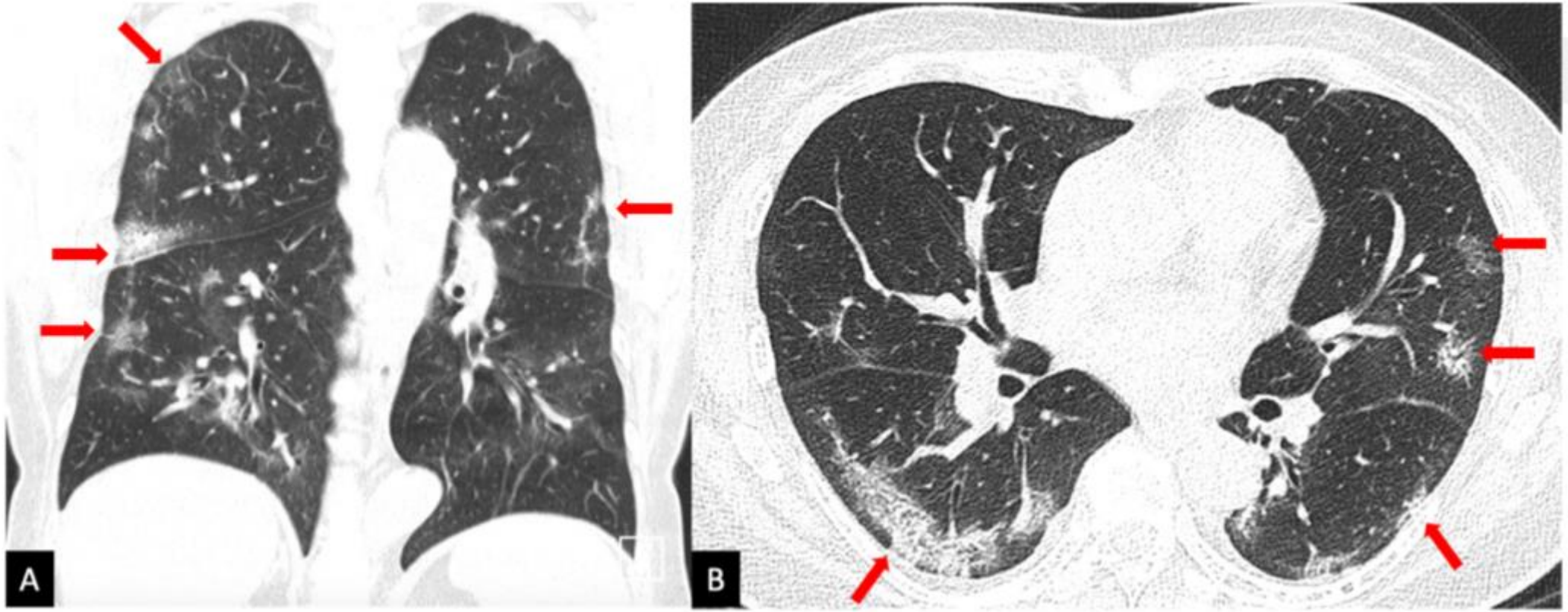


Figure 1. A 65-year-old female patient who had travelled to Wuhan, China, subsequently developing fever and cough 5 days after arrival. She subsequently returned to Shenzhen, China, and had this chest CT 7 days after symptom onset. Coronal and axial CT images (A & B) showing a mixture of ground glass and consolidation in the periphery of the lungs (red arrows), with absence of pleural effusions, which was the typical appearance of patients with confirmed COVID-19 infection.

Ng et al, Radiology Cardiothoracic Imaging Vol2 No1 Feb 13 2020 online

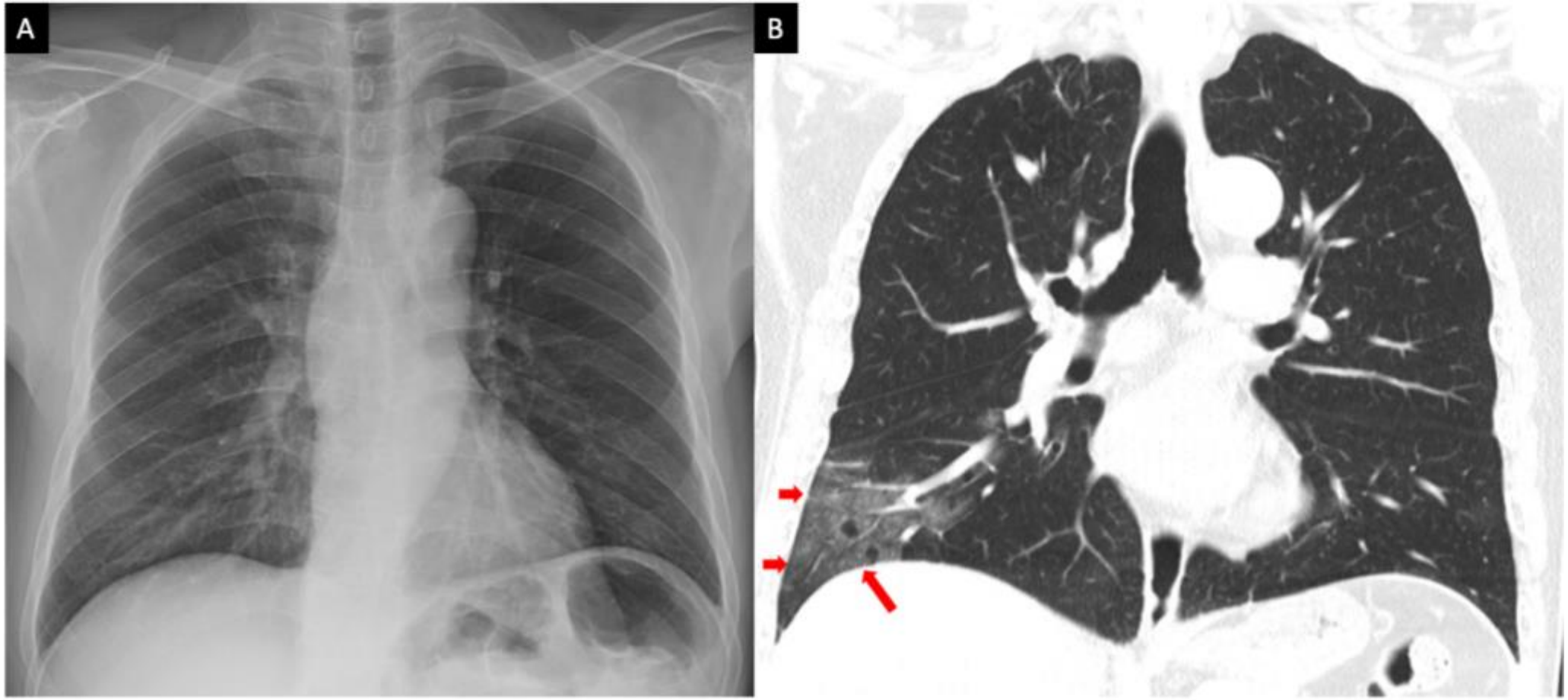


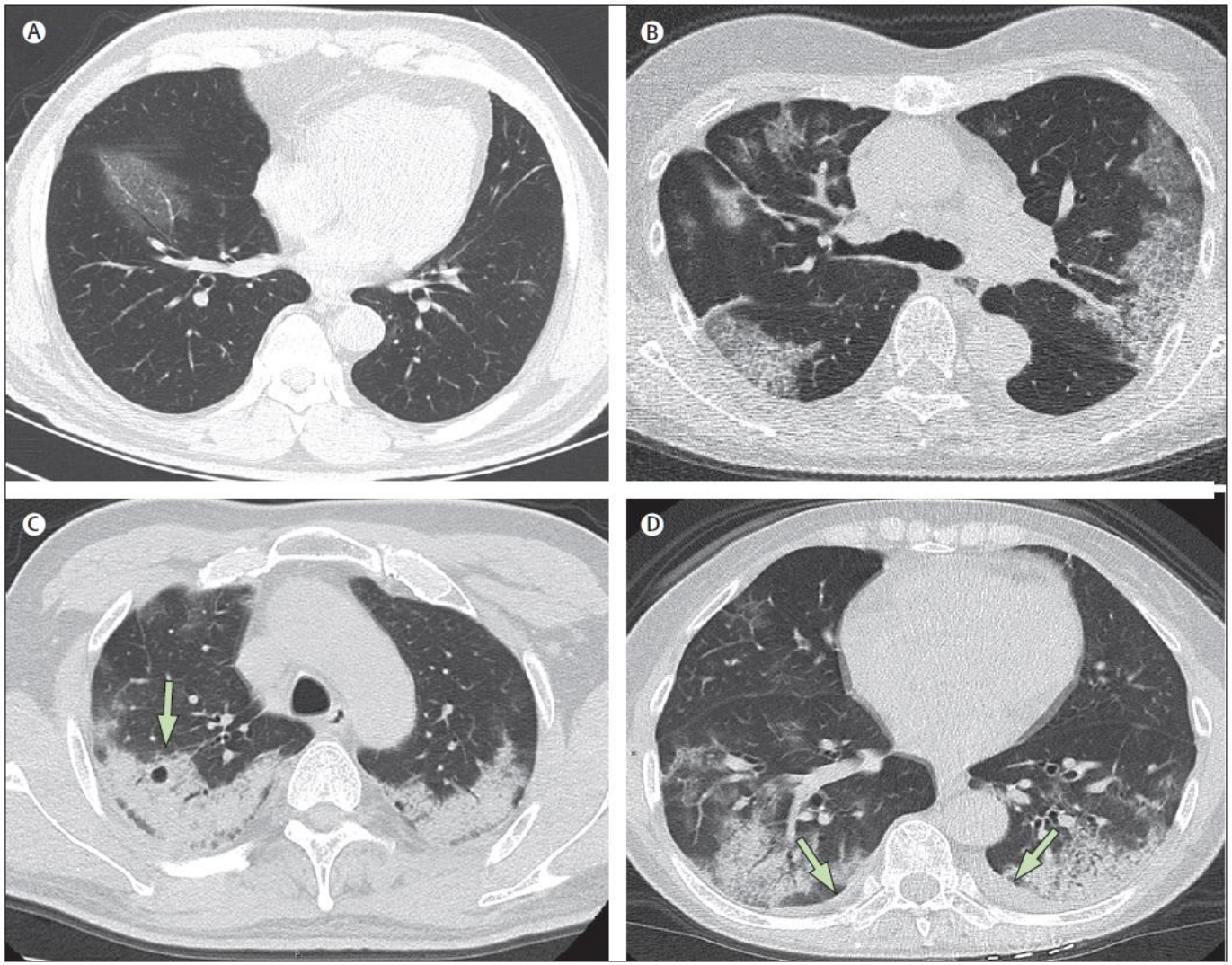
Figure 2. Comparison of chest radiograph (image A) and CT thorax coronal image (image B). The ground glass opacities in the right lower lobe periphery on the CT (red arrows) are not visible on the chest radiograph, which was taken 1 hour apart from the first study.

Ng et al, Radiology Cardiothoracic Imaging Vol2 No1 Feb 13 2020 online

Beloop in de tijd

Within 1-3 weeks: Focal unilateral GGO → Diffuse bilateral GGO → GGO+ Consolidations

M56
3 dgn symptomen
GGO met interlobaire septumverdikking RLL



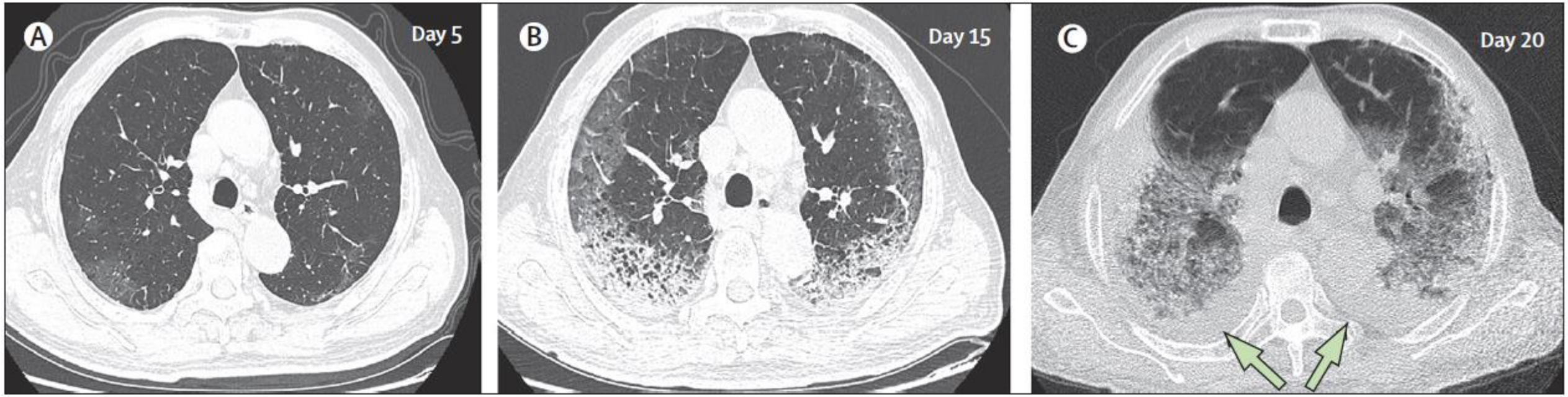
F74
10 dgn symptomen
bilateraal perifere GGO, crazy paving

F61
20 dgn symptomen
bilat perifeer consolidaties cysteuze verandering

F63
17 dagen symptomen
bilat perifeer GGO en consolidaties met luchtbronchogrammen gering pleuravocht

Shi H et al. The Lancet Feb 24 2020 online. 81 pts with COVID-19

Beloop in de tijd



M77
5 dagen symptomatisch
bilateraal subpleuraal GGO

dag 15: Bilateraal subpleuraal GGO en posterieur consolidaties

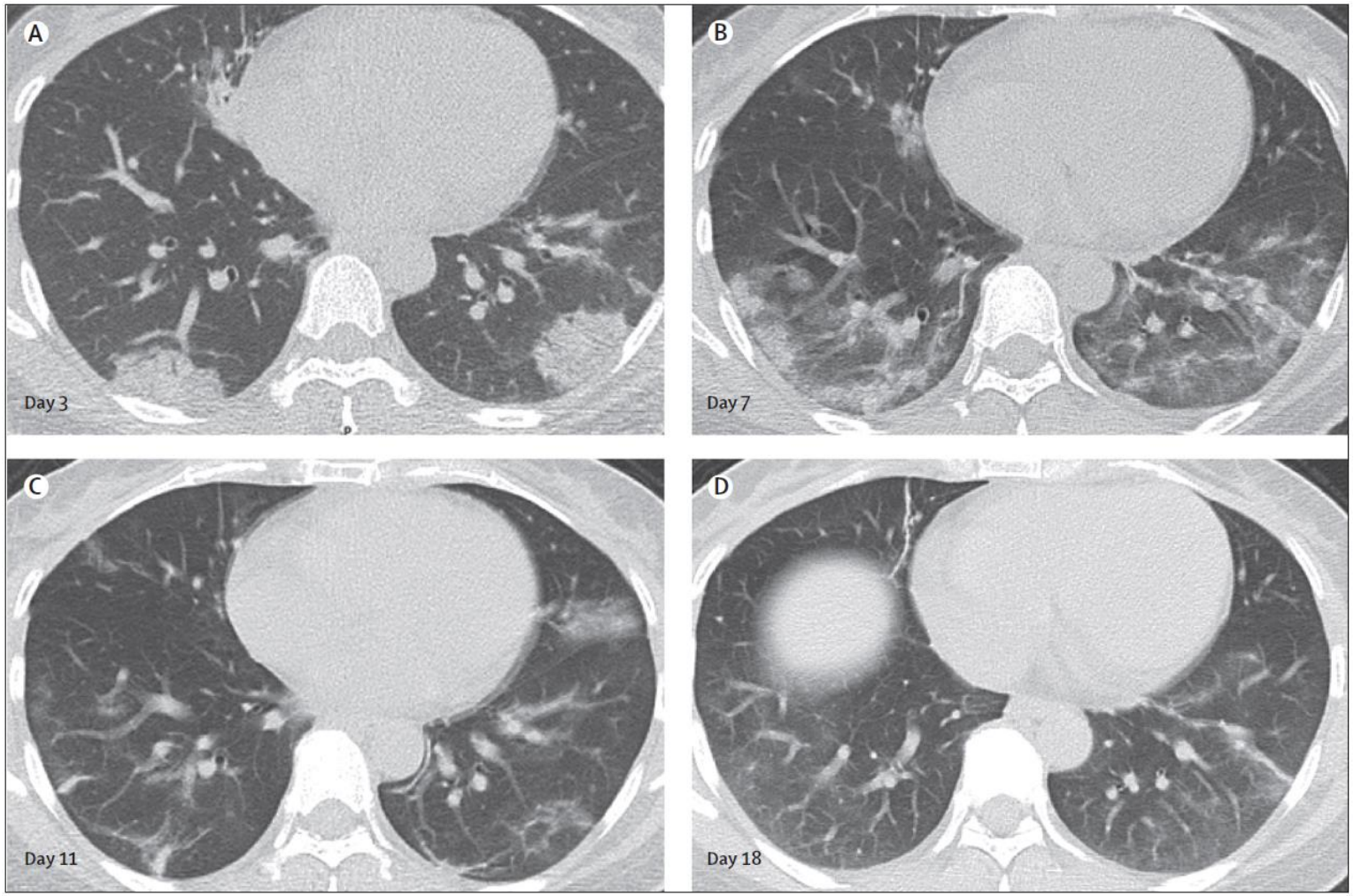
dag 20: toenemende densiteit consolidaties en expansie, bilat pleuravocht

Patient overleed 10 dagen later

Shi H et al. The Lancet Feb 24 2020 online. 81 pts with COVID-19

Beloop in de tijd

F42
3 dgn symptomen
bilat subpleurale
consolidaties



Dag 7
Toename: uitbreiding heterogene densiteit

Bronchovasc. bundel verdikking

Dag 11: Resorptie: resterend GGO en irregulaire lineaire consolidaties

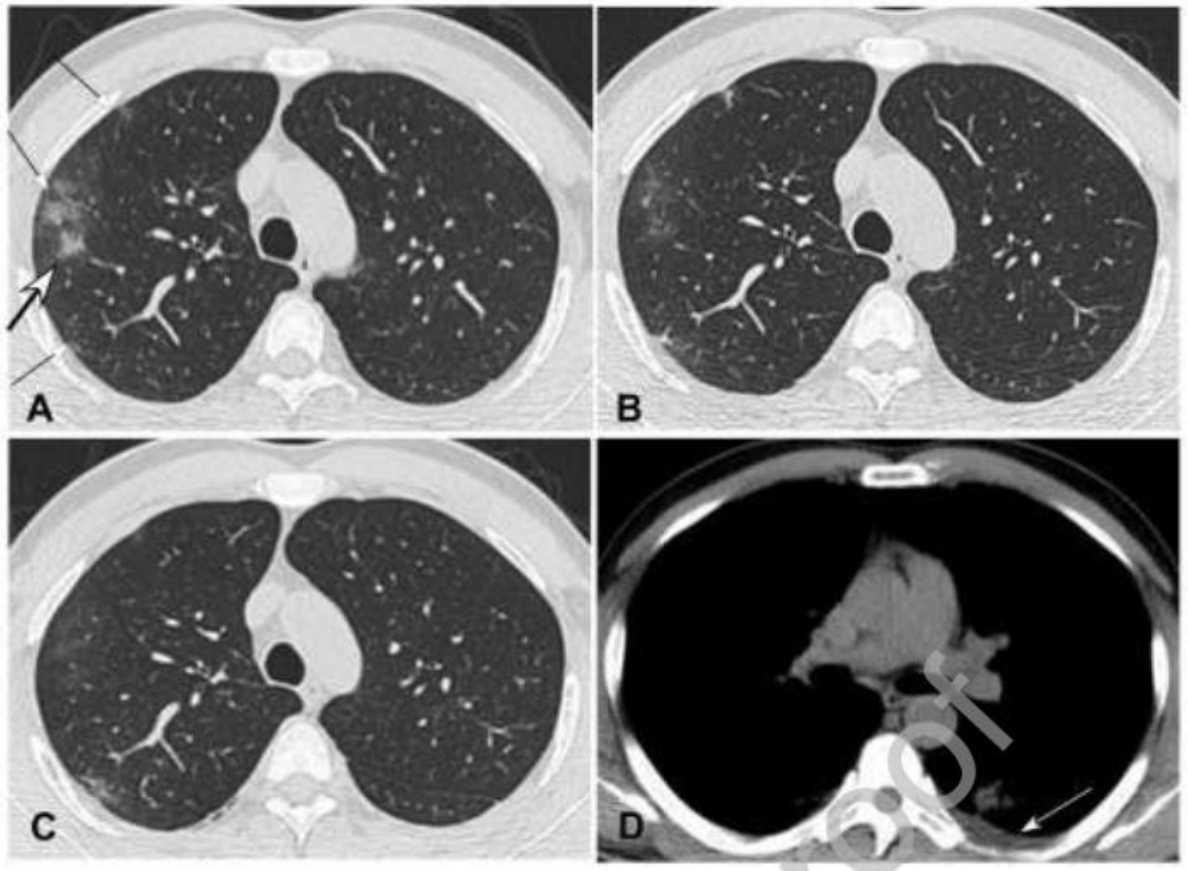
Dag 18:
Verdere resorptie: Restafwijkingen

Patient ging 2 dagen later met ontslag

Shi H et al. The Lancet Feb 24 2020 online. 81 pts with COVID-19

Beloop in de tijd

6 dagen koorts
en 2 dagen hoesten



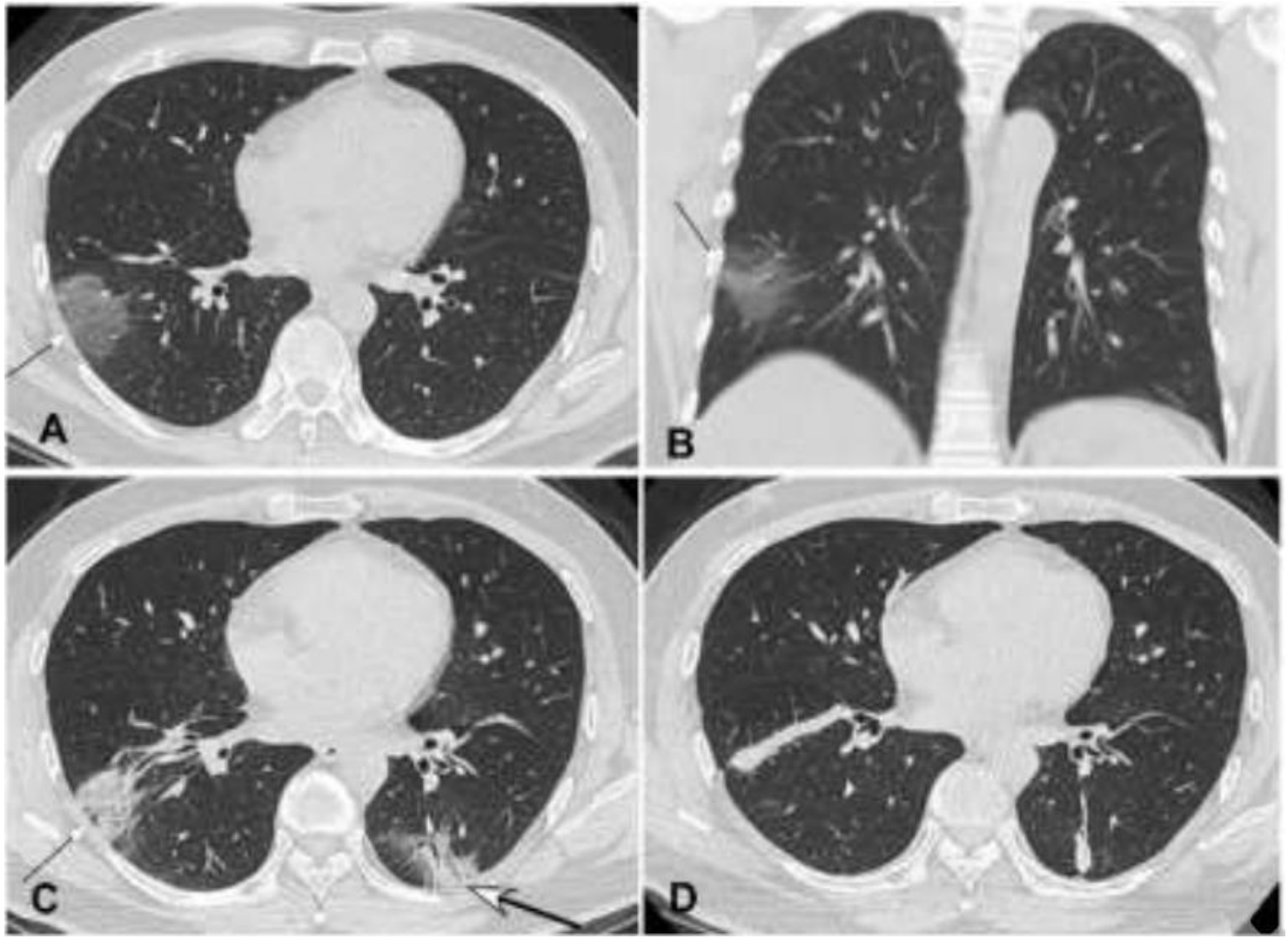
+7dagen

+10 dagen

Spoor plv

Fig.2. Common novel coronavirus pneumonia in a 37-year-old man with fever for six days and cough for two days before admission. A. Axial plane of computed tomography scan in the lung window showed multiple irregular pieces (arrows) of ground glass opacity under the pleura with consolidation (bigger arrow) and thickened interlobular sept in the right upper lobe. B. Seven days after treatment, the extent of the lesions decreased with fibrosis formation. C. Ten days after treatment, the extent of disease further shrank with decreased density. D. Axial plane in the mediastinal window revealed a small amount of pleural effusion (arrow).

Xu et al, J of Infection 2020 pre-proof



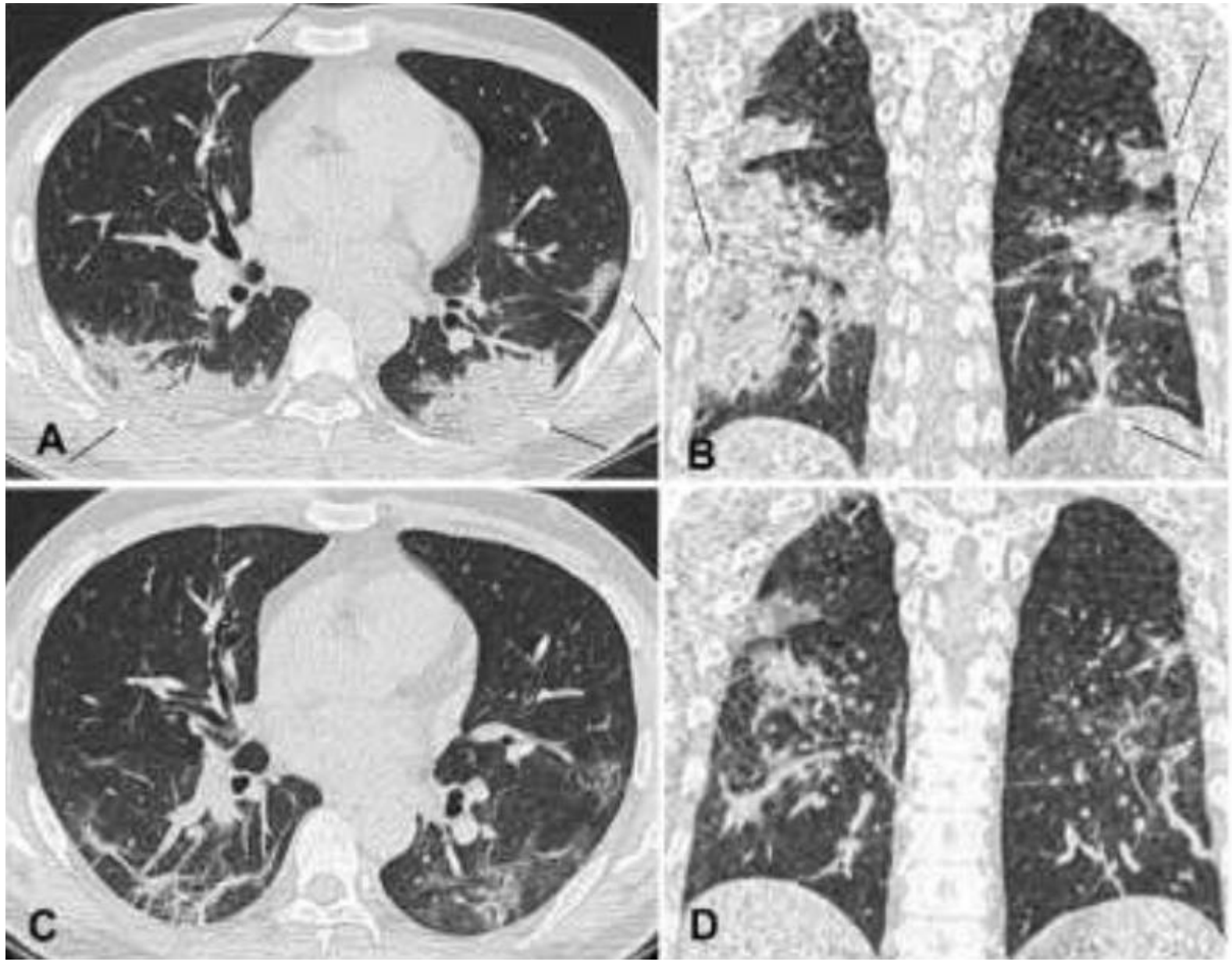
M47
5 dagen koorts
GGO
(presentatie dag 1)

Dag 5: Toename consolidatie en uitbreiding, luchtbronchogr.

Dag 16: Resorptie, bandvormige consolidaties

Fig.3. Common novel coronavirus pneumonia in a 46-year-old man with intermittent fever for five days before admission. A&B. Computed tomography pulmonary scan in the axial (A) and coronal (B) plane demonstrated a piece of ground glass opacity (arrow) under the pleura in the right lower lobe. C. Four days after treatment, the extent of lesion (small arrow) was decreased but with increased density, and a new lesion (bigger arrow) appeared in the left lower lobe with air bronchogram inside. D. Eleven days later, the extent of disease in both lungs shrank further and became consolidated with thickened interlobular septa.

Xu et al, J of Infection 2020 pre-proof



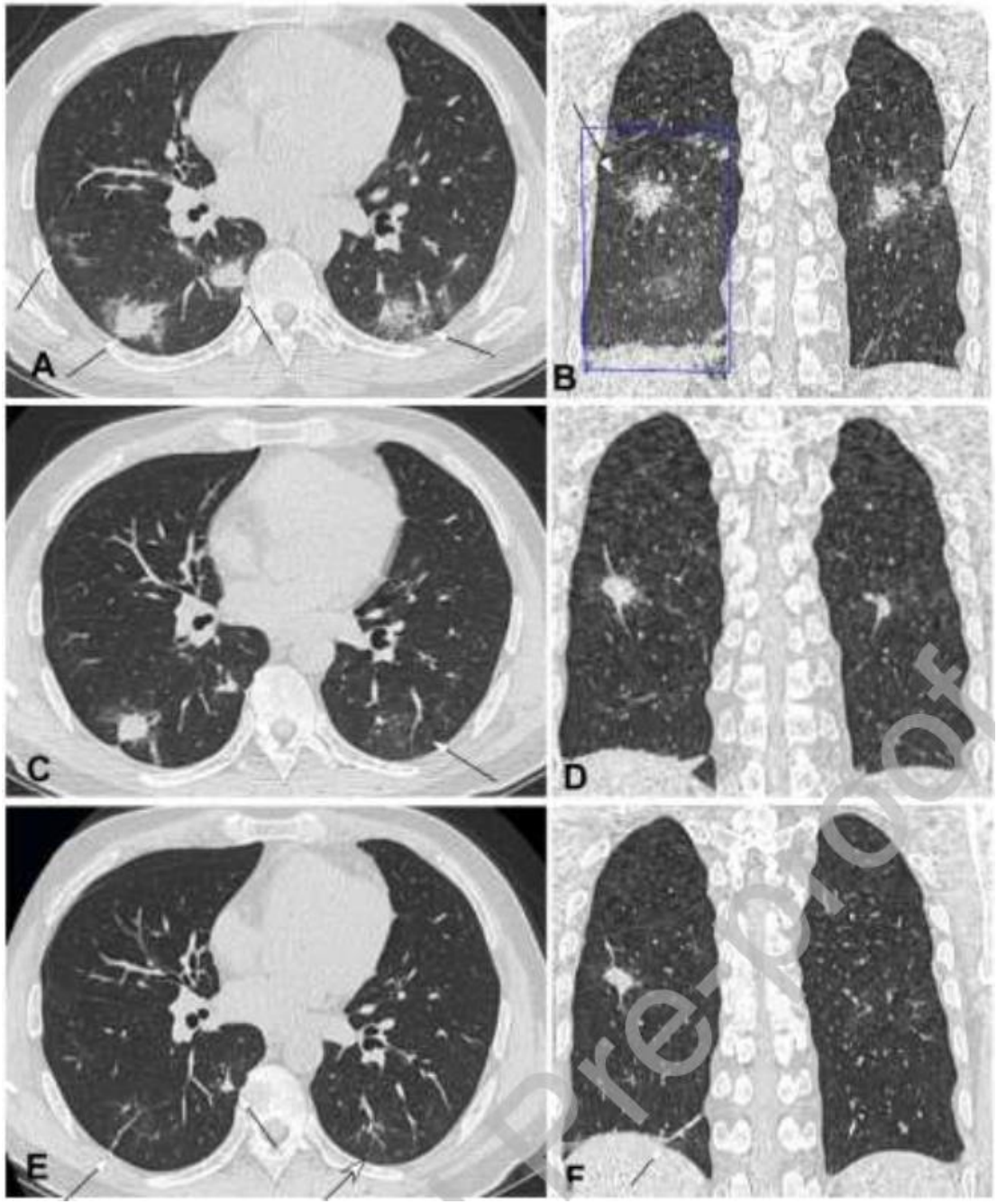
M34
Koorts en 10 dgn hoesten
GGO, consolidatie,
Bilateraal, subpleuraal
Luchtbronchogram

Ernstig beeld

+ 4 dagen
Afname consolidatie
Fibrosevorming

Fig.4. Severe novel coronavirus pneumonia in a 34-year-old man with fever and cough for ten days before admission. A&B. Computed tomography axial (A) and coronal (B) plane revealed multiple lesions of ground glass opacity, consolidation and fibrosis with symmetrical distribution in bilateral lungs, with the lesion extending towards the pulmonary hilum. Air bronchogram was observed within the lesion. C&D. Four days after treatment, the extent of lesion shrank with decreased density and formation of fibrosis.

Xu et al, J of Infection 2020 pre-proof



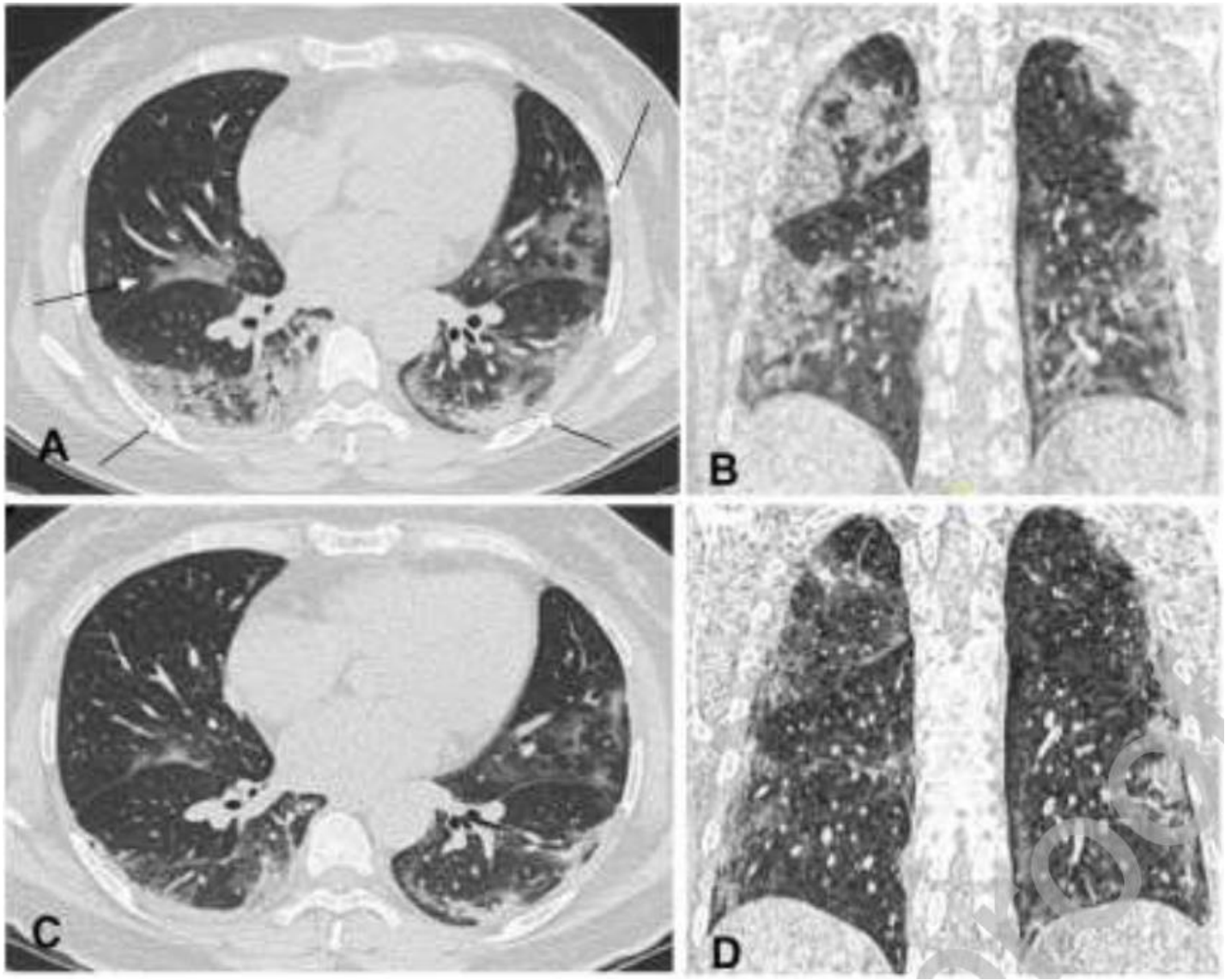
M48
7 dagen koorts
GGO en consolidaties

+7dagen

+10 dagen

Fig.5. Severe novel coronavirus pneumonia in a 48-year-old man with fever for seven days before admission. A&B. Computed tomography axial (A) and coronal (B) plane revealed multiple lesions (arrows) of ground glass opacity accompanied with consolidation under or near the pleura in bilateral lower lobes, with air bronchogram and thickened interlobular septa. A large piece of ground glass opacity (square box) could also be seen in the right lower lobe (B). C&D. Seven days after treatment, the right lesion was significantly reduced with formation of fibrotic stripes, and the left lesion was also absorbed with decreased density like ground glass opacity (arrow in C). E&F. Ten days after treatment, bilateral lesions were mostly absorbed with only some nodules and stripes of fibrosis left (arrows).

Xu et al, J of Infection 2020 pre-proof



F50
5 dagen koorts, duizelig, moe
GGO en consolidaties
Luchtbronchogram en interlobulaire septaverdikking

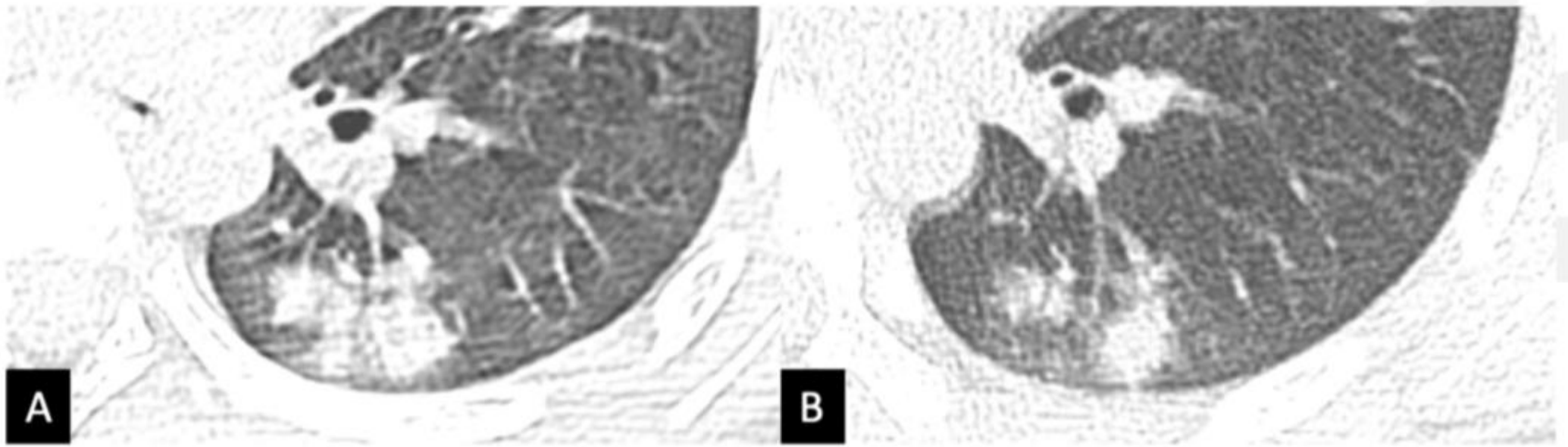
Critically severe pneumonia

+5dagen
Afname consolidaties
Fibrotische banden

Fig.6. Critically severe novel coronavirus pneumonia (NCP) in a 50-year-old woman with fever, cough, dizziness and fatigue for five days before admission. A&B. Computed tomography axial (A) and coronal (B) plane revealed multiple lesions of ground glass opacity accompanied with consolidation. The lesions extended towards the pulmonary hilum and had air bronchogram and thickened interlobular septa. C&D. Five days after treatment, the extent of disease shrank with decreased density but stripes of fibrosis.

Xu et al, J of Infection 2020 pre-proof

Figure 3. A 10-year-old asymptomatic child with confirmed COVID-19 infection, who had travelled to Wuhan, China with his family. Image A shows the initial CT scan at time of presentation, with consolidation in the left lower lobe apical segment. Image B shows mild improvement in the lung consolidation 4 days later.



Ng et al, Radiology Cardiothoracic Imaging Vol2 No1 Feb 13 2020 online

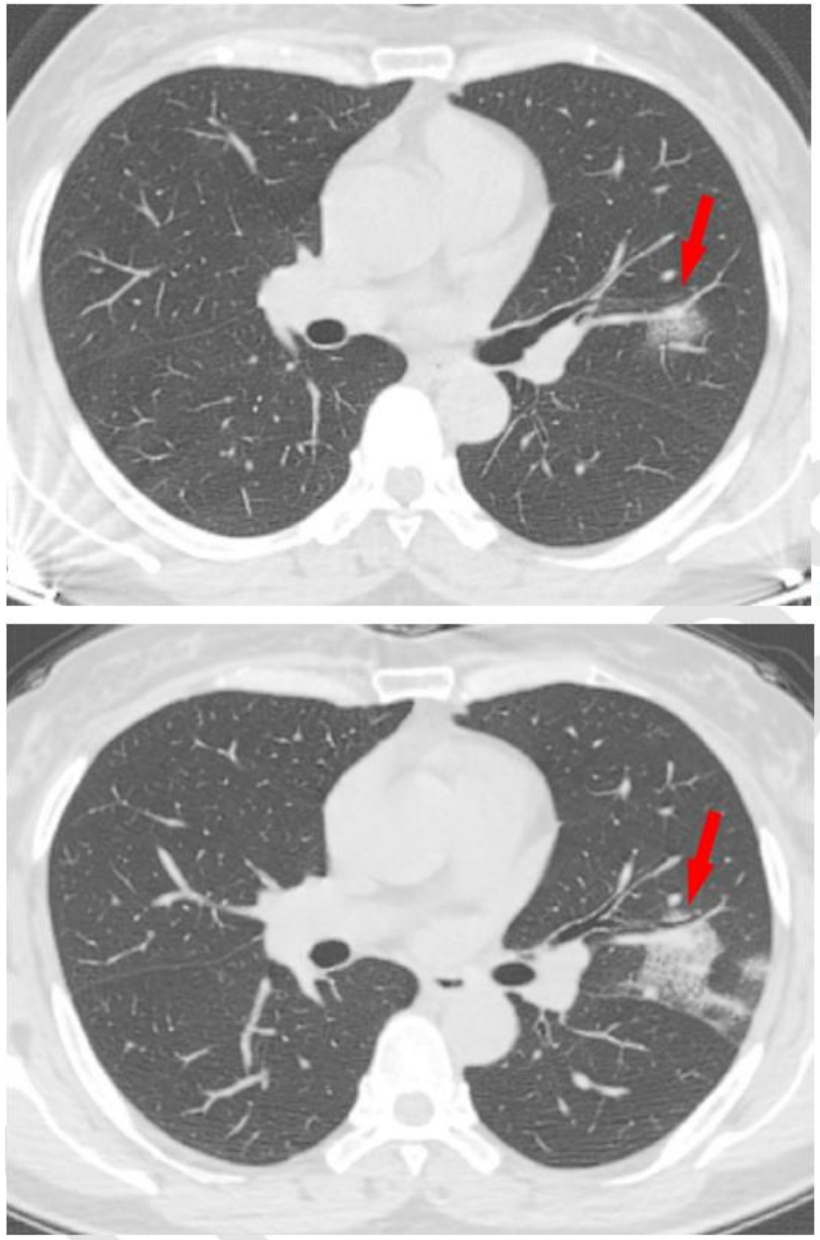


Figure 4: CT findings of confirmed Coronavirus Disease 2019 (COVID-19) pneumonia

Solitary rounded ground-glass opacity (GGO) pattern. A 51-year-old woman presenting without fever had close contact with patients with lab-confirmed COVID-19. a, Baseline axial unenhanced chest CT acquired 6 days before the first positive RT-PCR test showed a rounded GGO in the left lung upper lobe (arrow). b. Follow-up chest CT 4 days later showed the size increase of the lesion (arrow).

Zu et al, Radiology, in press

Beloop in de tijd

GGO + consolidation

CT bij presentatie

GGO

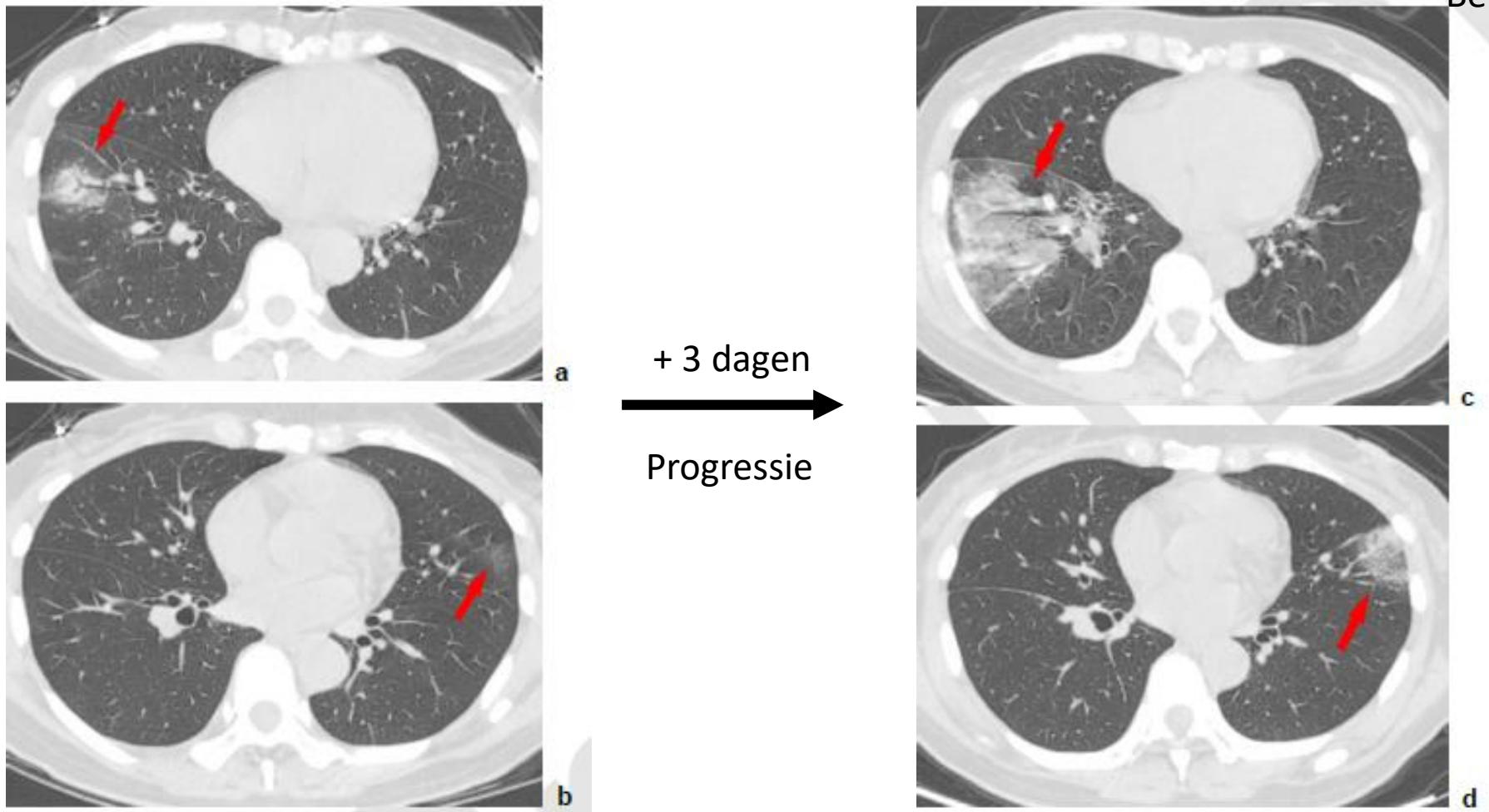


Figure 9: CT findings of confirmed Coronavirus Disease 2019 (COVID-19) pneumonia showing disease progression

A 48-year-old woman presented with high fever (39.1 ℃, 102.38℉) and Wuhan exposure history. a-b, On January 23, 2020, baseline axial unenhanced chest CT showed ground-glass opacity (GGO) with consolidation in lower lobe of right lung with typical air bronchogram (Panel a, arrow) and one pure GGO (Panel b, arrow) in the upper lobe of left lung. c-d, Three days later, follow-up axial unenhanced chest CT showed the disease progression, appearing as increased extent and consolidation (arrows) compared with baseline chest CT.

Zu et al, Radiology, in press

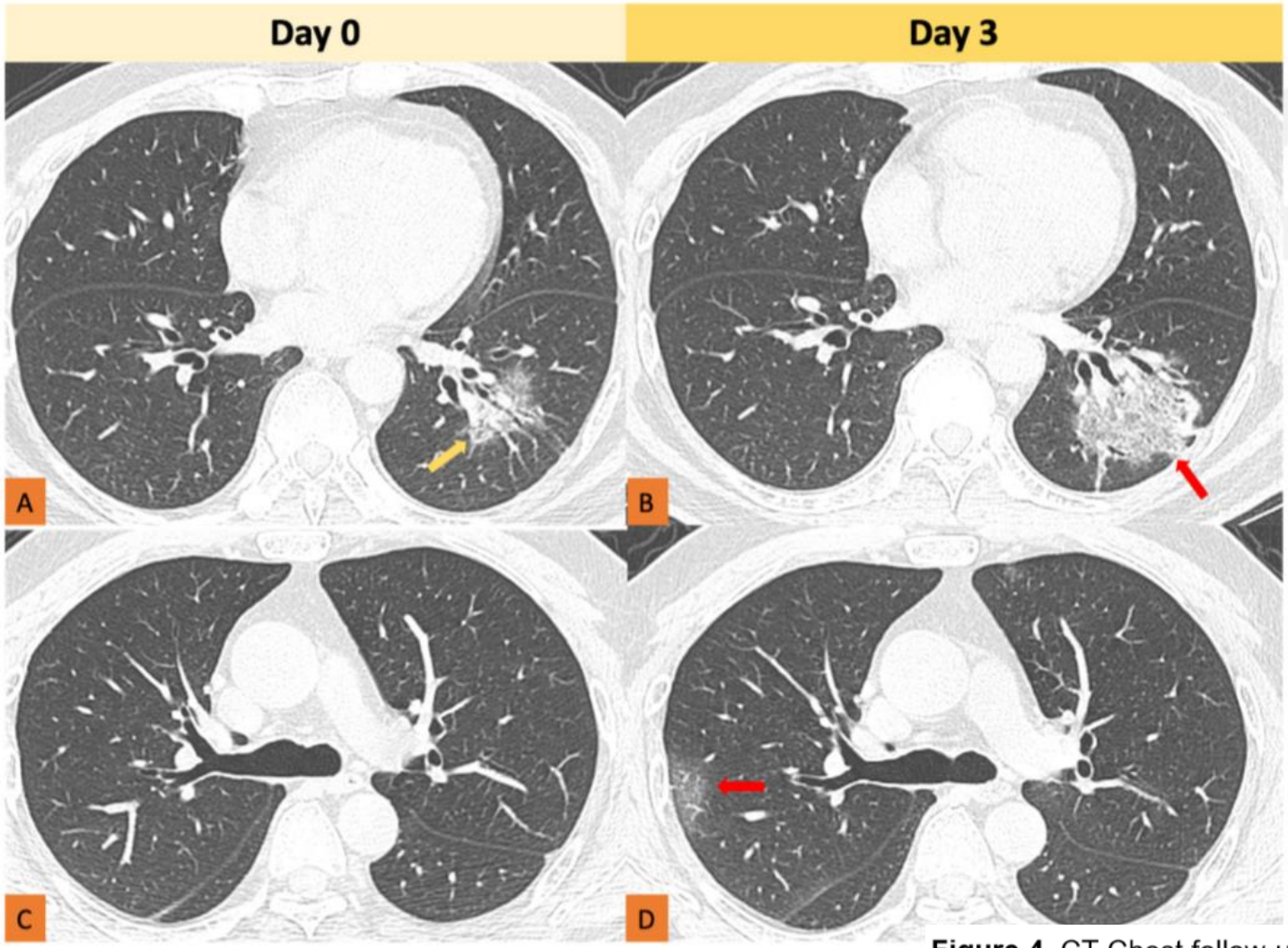


Figure 4. CT Chest follow-up in a patient who had no previous travel to Wuhan, China, but had contact with a patient with confirmed COVID-19 infection. Axial slices from day 0 of presentation to the hospital shows ground-glass opacities in the left lower lobe (image A, arrow), but not in the right upper lobe (image C). Subsequently, 3 days later, the follow-up CT showed increase in the ground glass changes with some peripheral consolidation (reversed halo, image B, arrow) and new ground-glass opacities in the right upper lobe periphery (image D, arrow).

Ng et al, Radiology Cardiothoracic Imaging Vol2 No1 Feb 13 2020 online

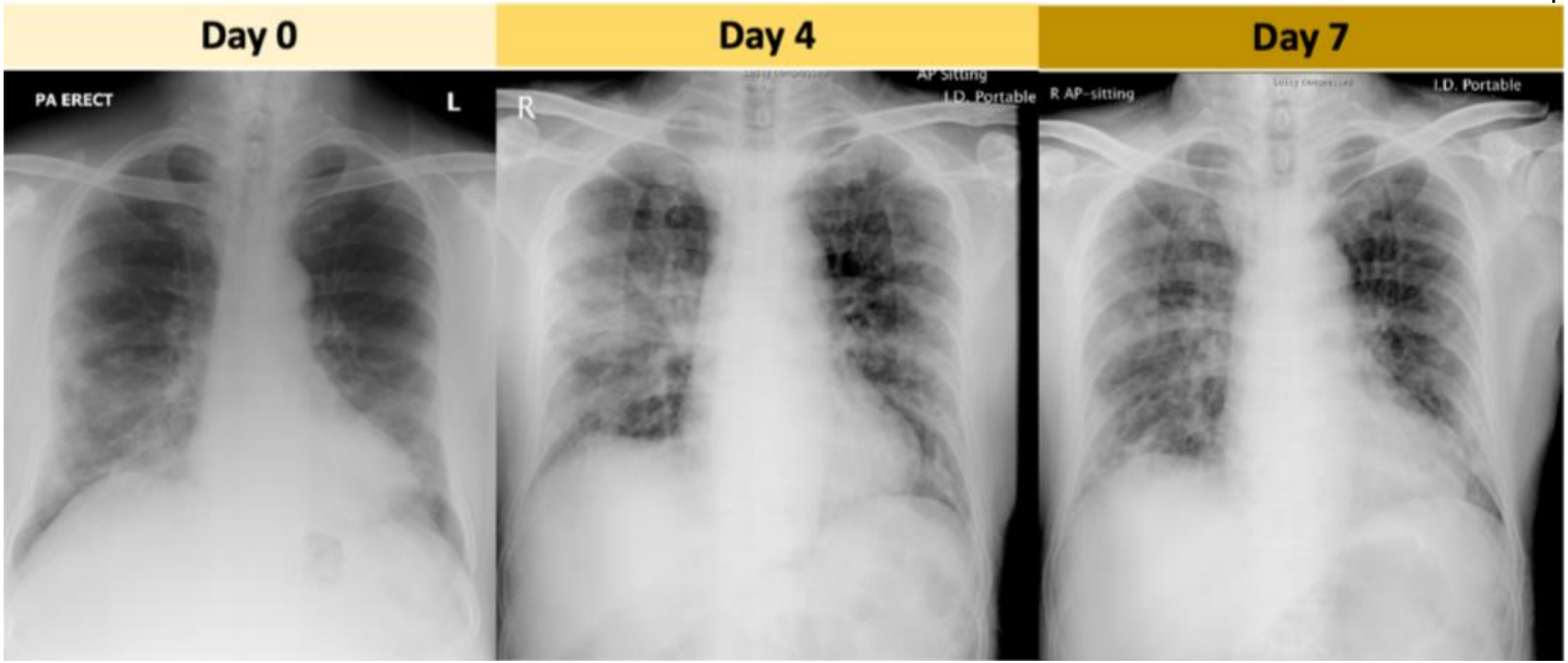
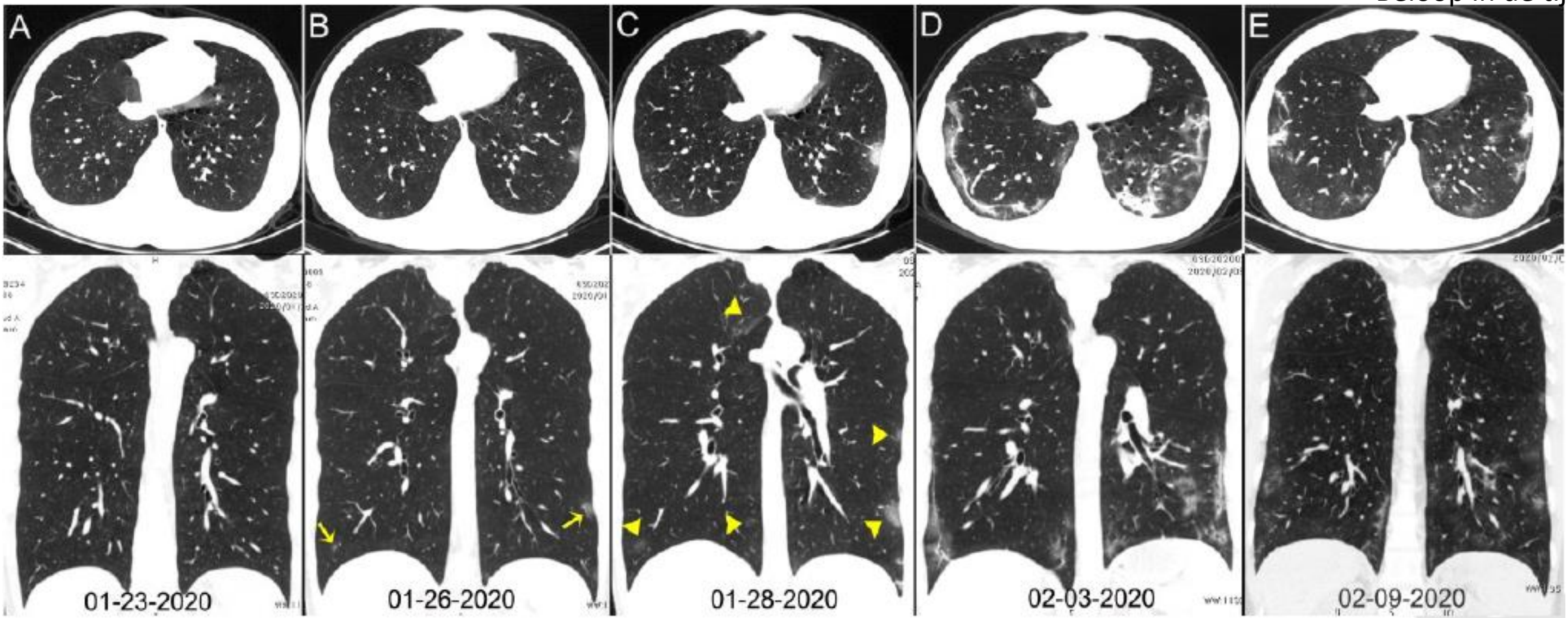


Figure 5. Chest radiographs of an elderly male patient from Wuhan, China, who travelled to Hong Kong, China. These are 3 chest radiographs selected out of the daily chest radiographs acquired in this patient. The consolidation in the right lower zone on day 0 persist into day 4 with new consolidative changes in the right midzone periphery and perihilar region. This midzone change improves on the day 7 film.

Ng et al, Radiology Cardiothoracic Imaging Vol2 No1 Feb 13 2020 online

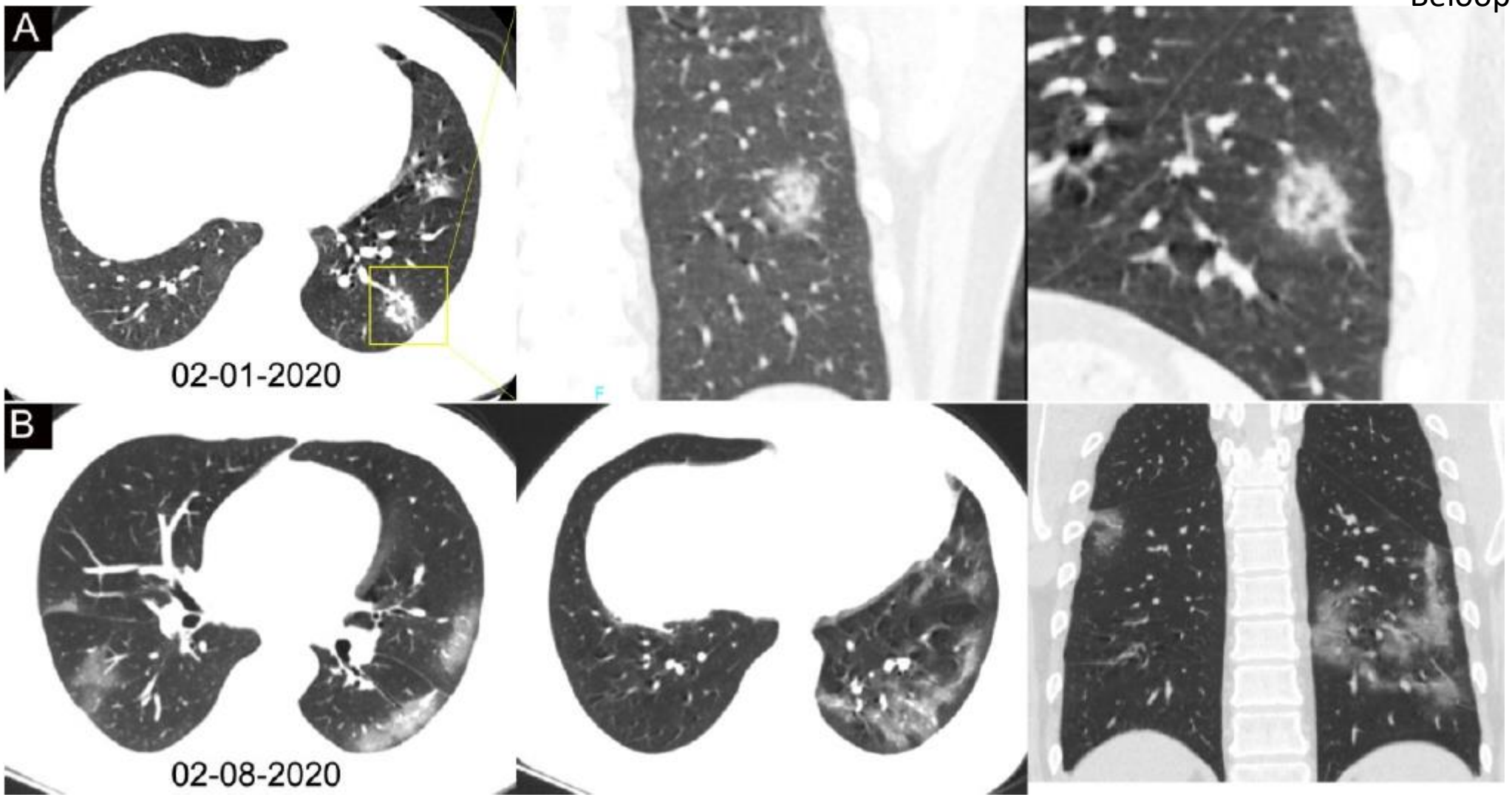
Beloop in de tijd



M29, 6 dagen koorts.
A: presentative op dag 6. Normale CT. B: minimal GGO. C: increased GGO. D: Progression met mixed GGO en bandvormige consolidaties subpleuraal. E: partiele absorptie van GGO en consolidaties.

Ai and Yang, et al, Radiology in press, 1014 cases study

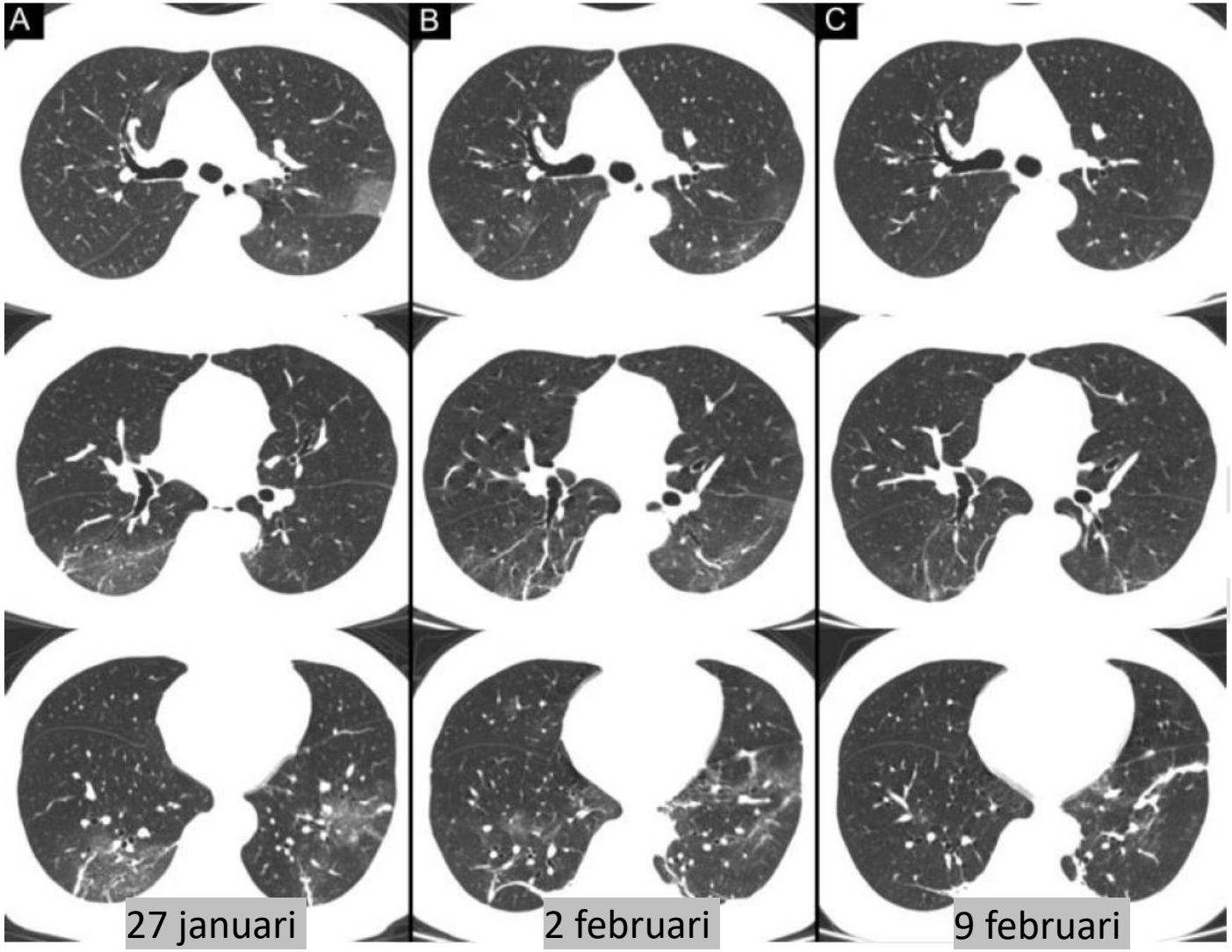
Beloop in de tijd



Man 39, 4 dagen koorts, A: nodule met reversed halo in LLL in vroege fase (atypische presentatie).
B: 1 week later progressieve consolidatie. Nodule was geresorbeerd.

Ai and Yang, et al, Radiology in press, 1014 cases study

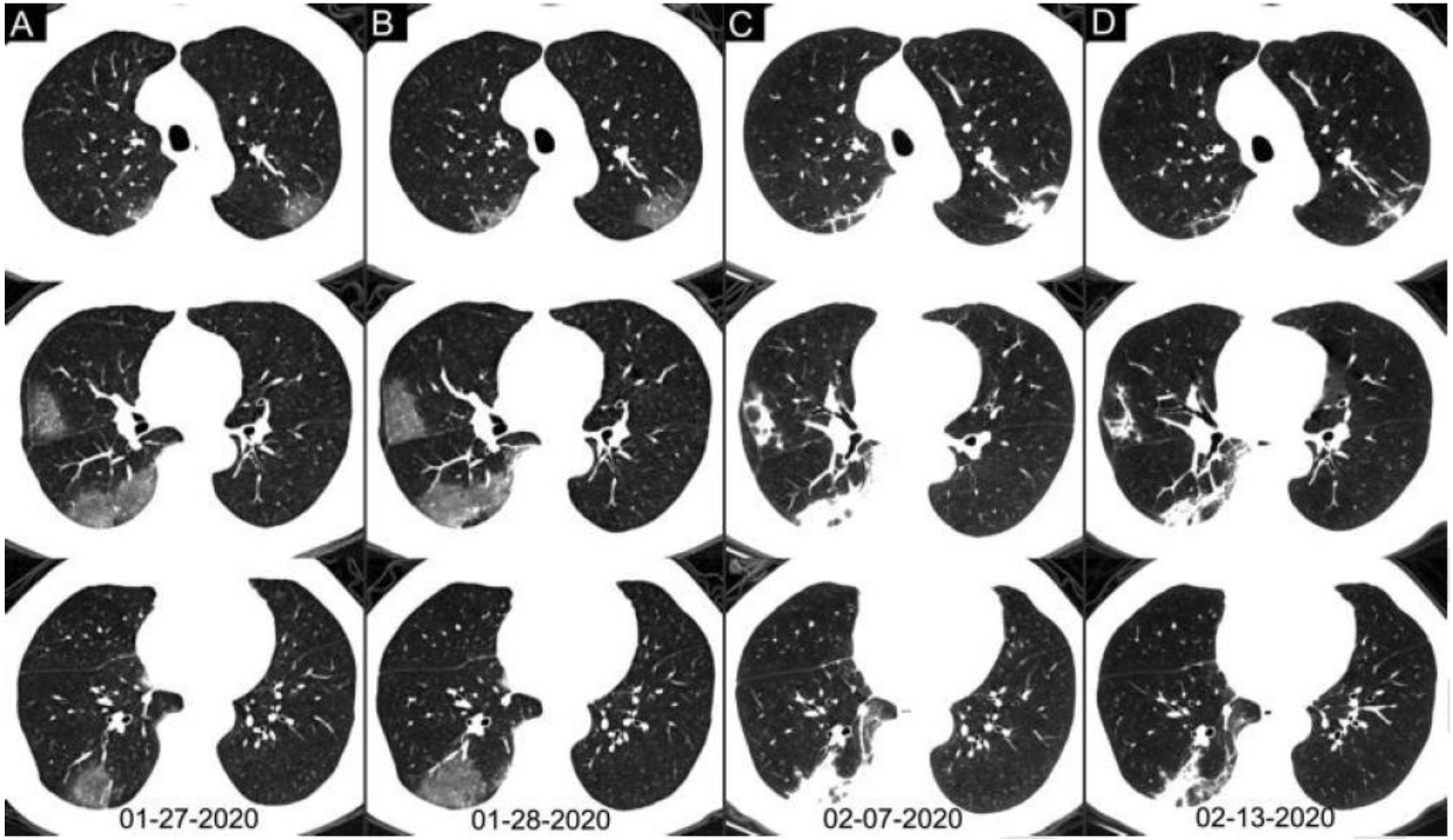
Beloop in de tijd



Graduele absorptie van de GGO en bandvormige consolidaties

Ai and Yang, et al, Radiology in press, 1014 cases study

Figure 4: Chest CT images of a 46-year-old woman with fever for 4 days. The result of RT-PCR assay for the SARS-CoV-2 using a swab sample was positive on February 4, 2020 and was negative on February 12. Three chest CT scans obtained from January 27 (column A), February 2 (column C) and February 09, 2020 (column C) show the gradual absorption of bilateral ground-glass opacities and linear consolidation.



“typisch beeld” maar negatieve PCR

Figure 5: Chest CT images of a 62-year-old man with fever for 2 weeks, and dyspnea for 1 day. Negative results of RT-PCR assay for the SARS-CoV-2 using a swab samples were obtained on February 3 and 11, 2020, respectively. (column A) Chest CT with multiple axial images shows multiple ground-glass opacities in the bilateral lungs. (column B) Chest CT with multiple axial images shows enlarged multiple ground-glass opacities. (column C) Chest CT with multiple axial images shows the progression of the disease from ground-glass opacities to multifocal organizing consolidation. (D column) chest CT with multiple axial images shows partial absorption of the organizing consolidation.

Ai and Yang, et al, Radiology in press, 1014 cases study

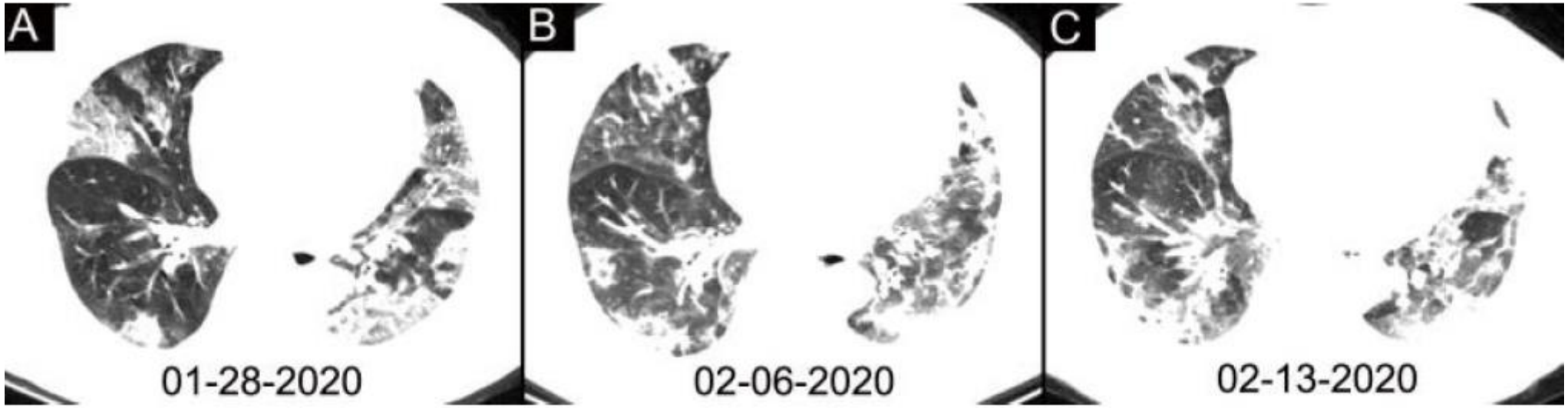
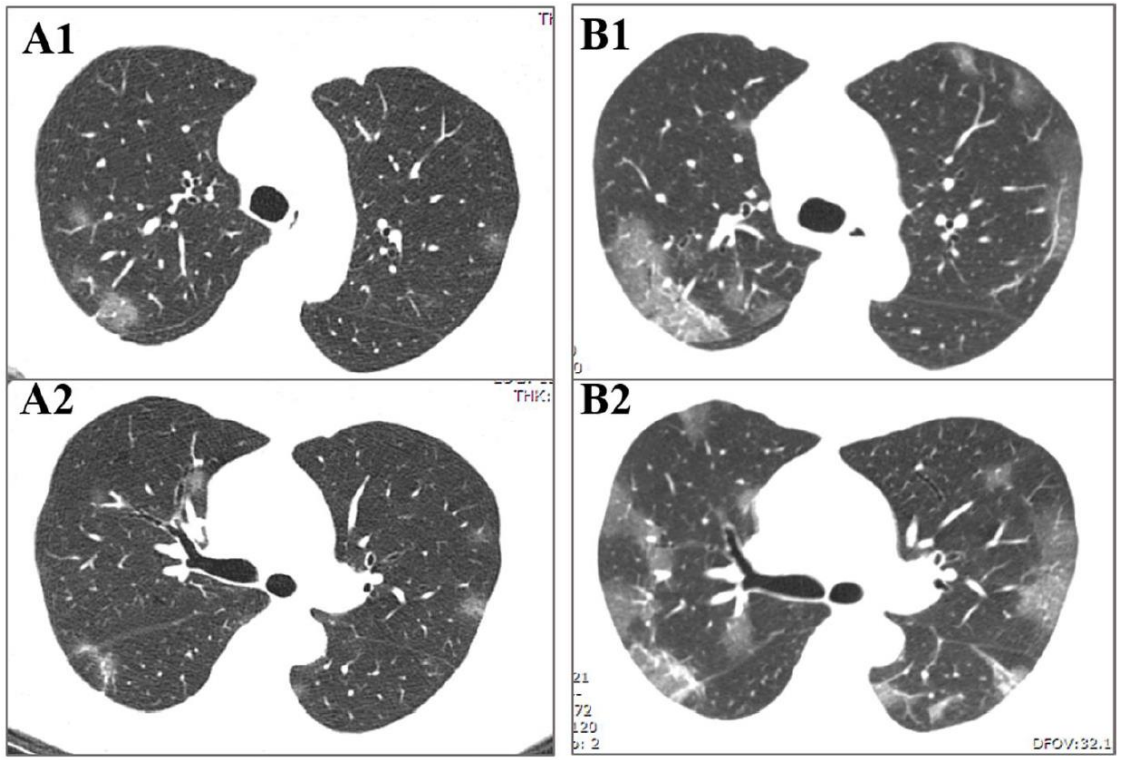


Figure 6: Chest CT images of a 63-year-old woman with fever for 11 days. Negative results of RT-PCR assay for the SARS-CoV-2 using a swab samples were obtained on February 2 and 11, 2020, respectively. (A-C) Chest CT scans show typical mixed ground-glass opacities and multifocal consolidation shadows in bilateral lungs without evidence of resolution without resolution over 16 days.

"typisch beeld" maar negatieve PCR

Ai and Yang, et al, Radiology in press, 1014 cases study

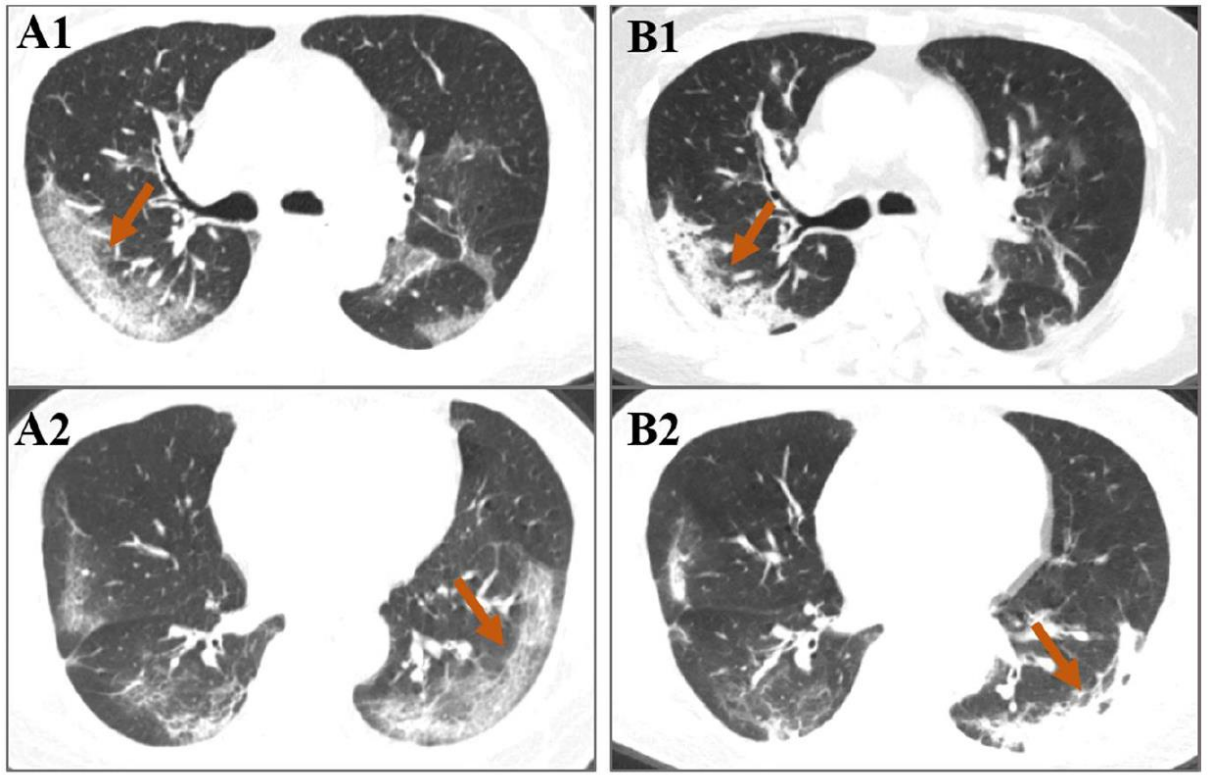


Initial CT (2020.1.21)

F57, dag 4 na klachten, bilateral GGO

Follow-up CT (2020.1.24)

3 dagen later toename.



Initial CT (2020.1.28)

F56, dag 9 na klachten. GGO en It verdikking en banden

Follow-up CT (2020.2.3)

6 dagen later enige afname uitbreiding, met toename densiteit

- Progressie op CT: 83%
- Bij FU: toenemende consolidatie, interstitiele verdikking, fibreuze banden en lucht bronchogrammen

Xiong et al Invest Radiol in press

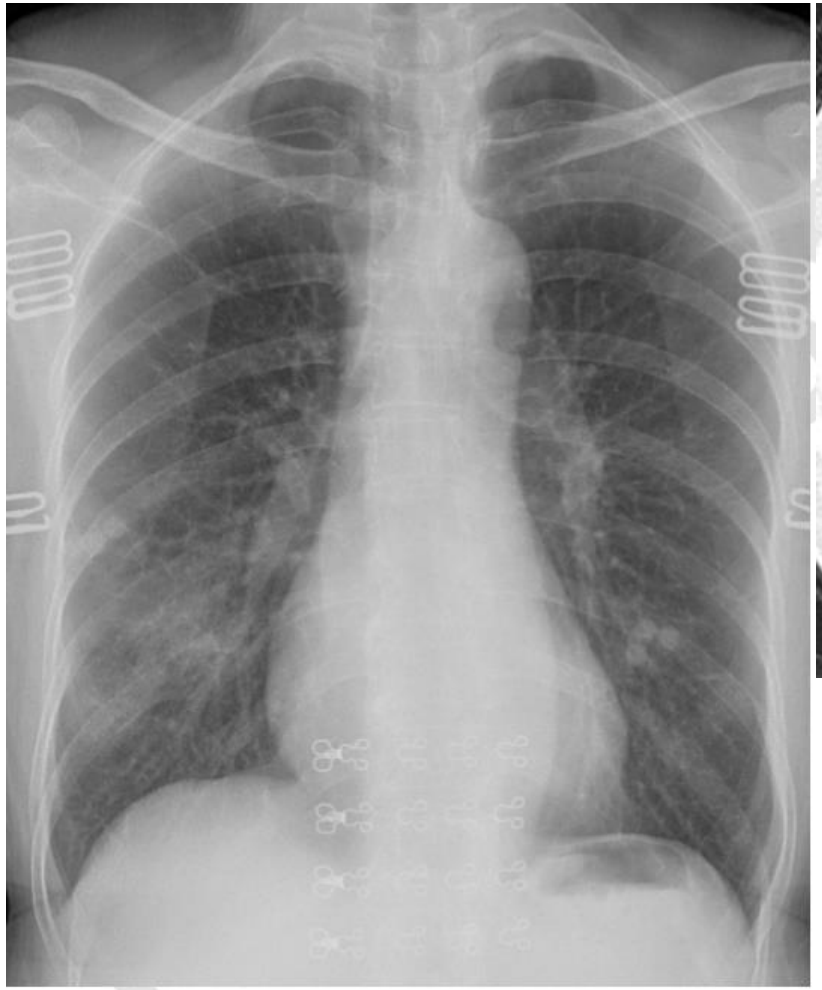
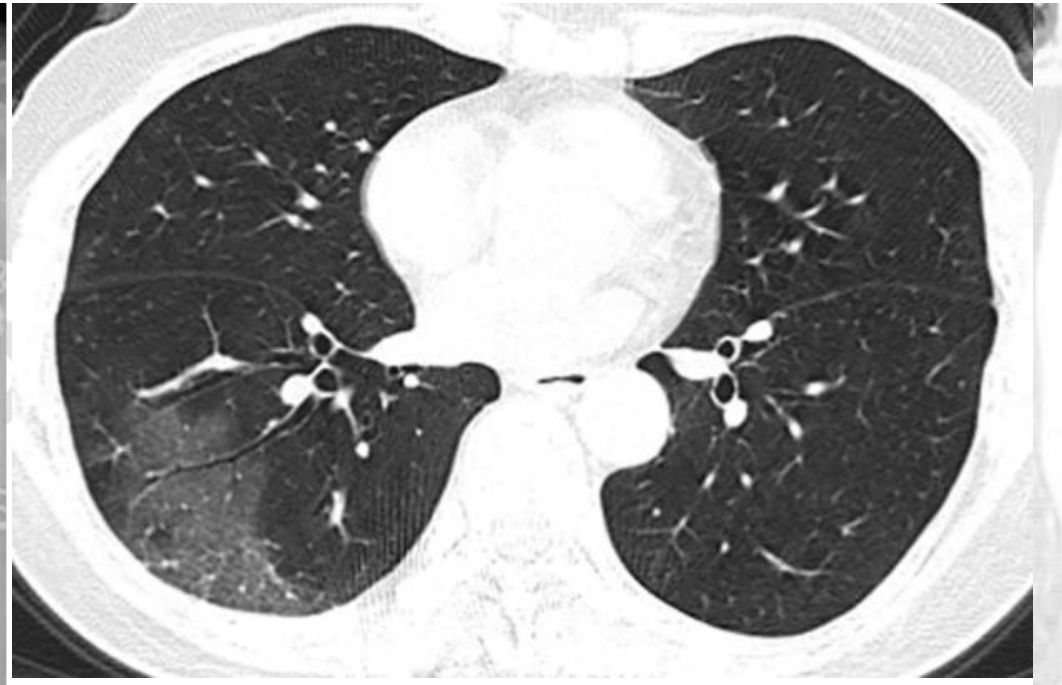


Fig 1a. Chest radiograph in a patient with COVID-19 infection demonstrates right infrahilar airspace opacities.



F59 koorts en KR.
(5 dgn na symptomen)
patchy GGO RLL

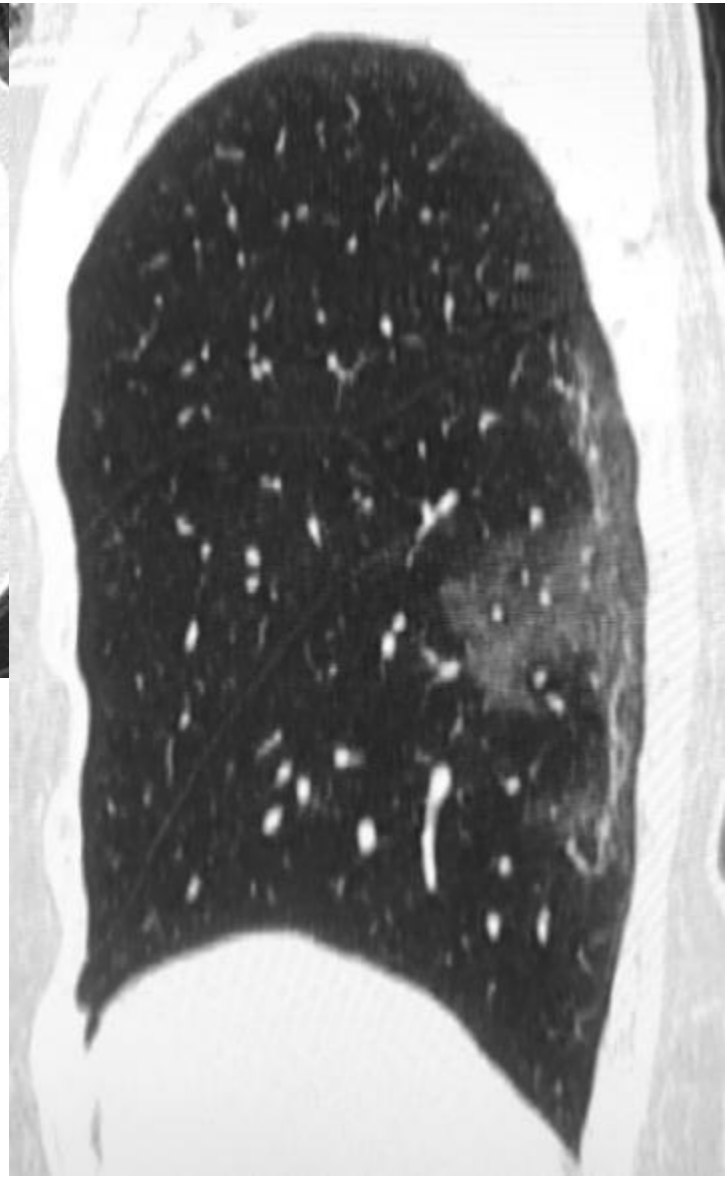
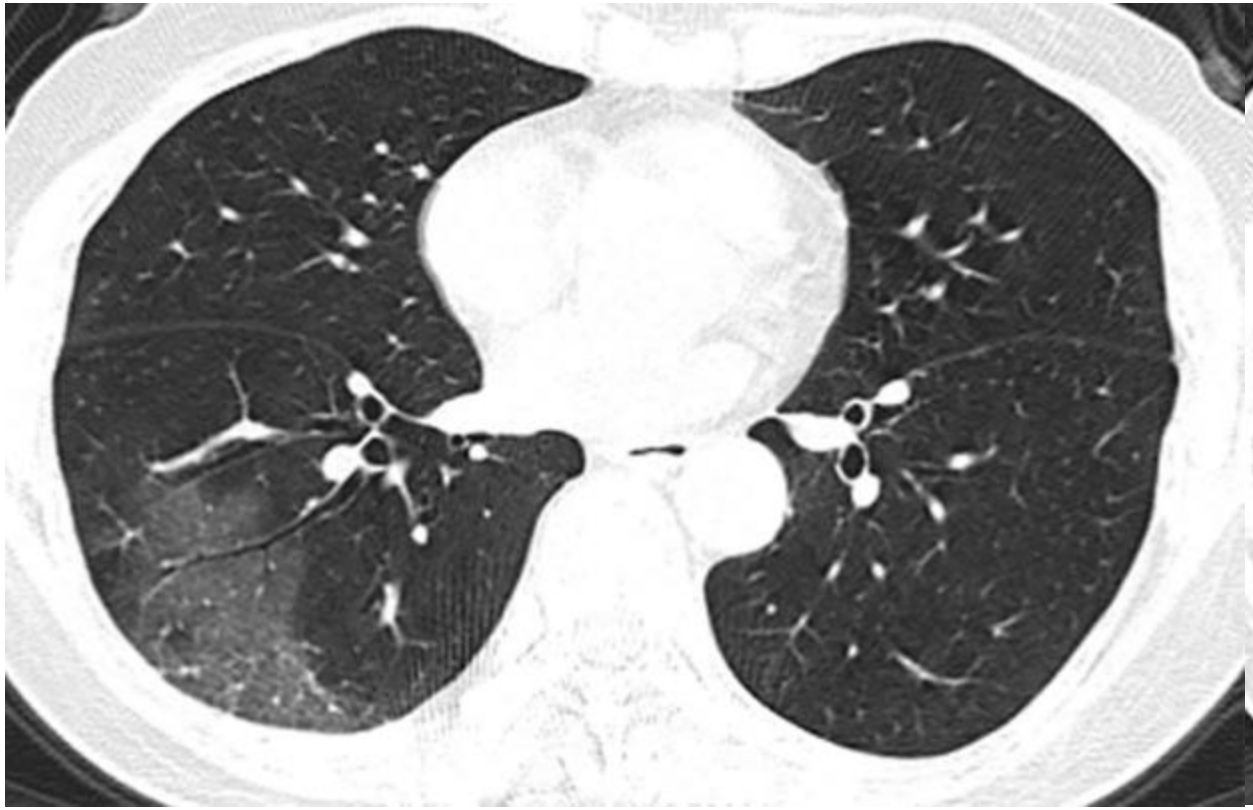


Fig 1b, c. Axial (1b) and sagittal (1c) chest CT images demonstrate peripheral right lower lobe ground-glass opacities.

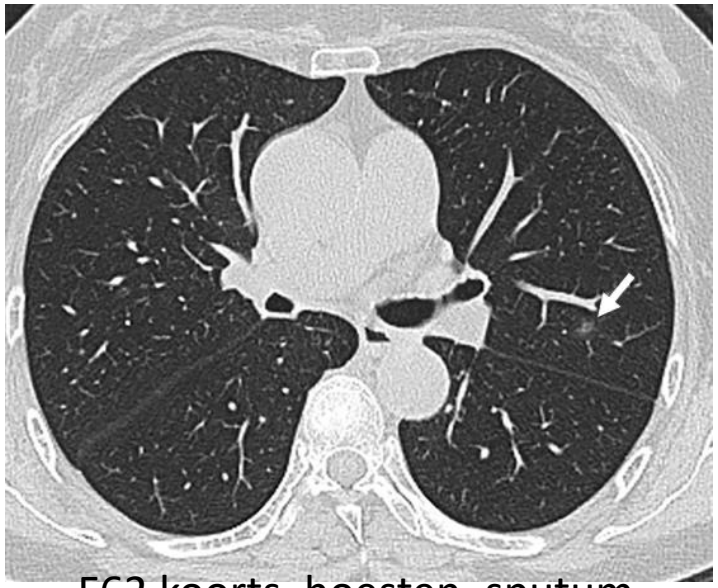
Kong et al, Radiology Cardiothoracic Imaging, in press

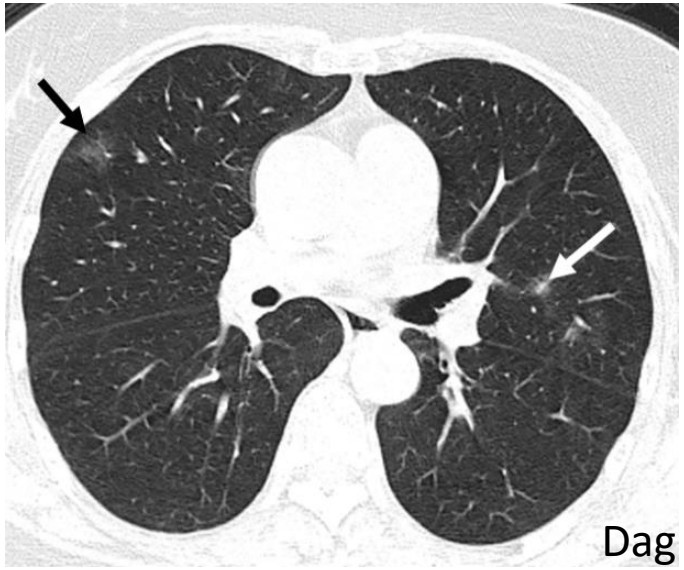


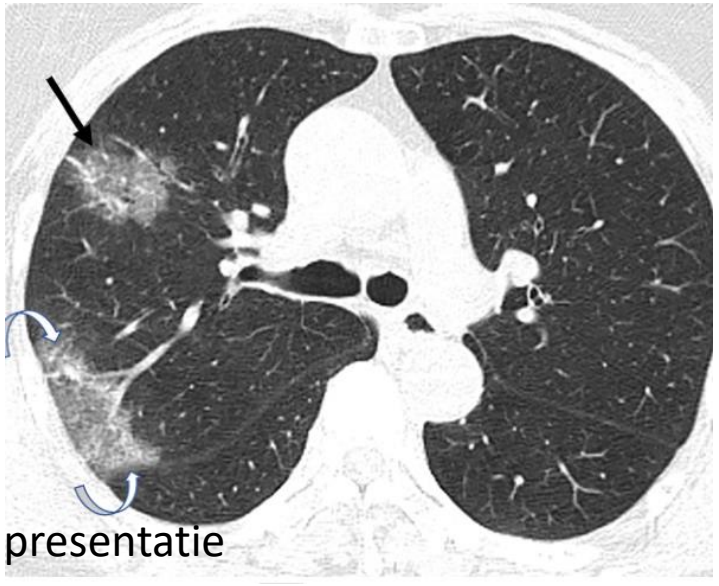
F59 patchy GGO RLL

2 days later, improvement of GGO, with more subpleural curvilinear lines

Kong et al, Radiology Cardiothoracic Imaging, in press



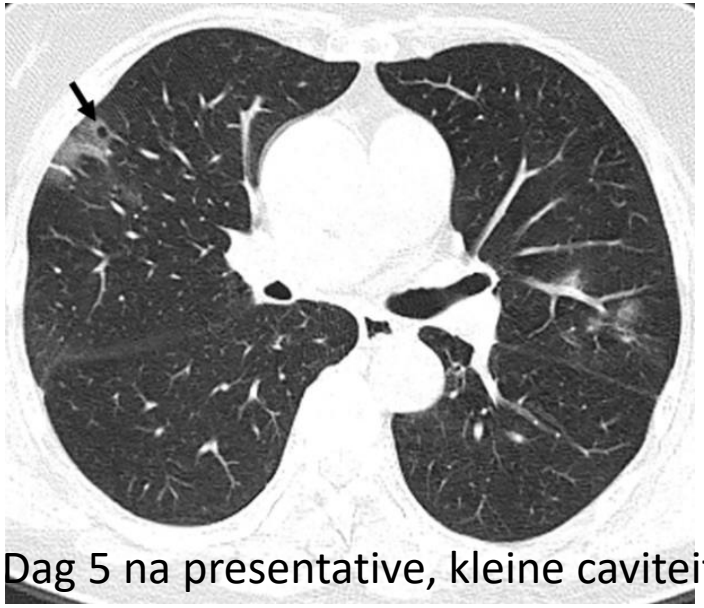


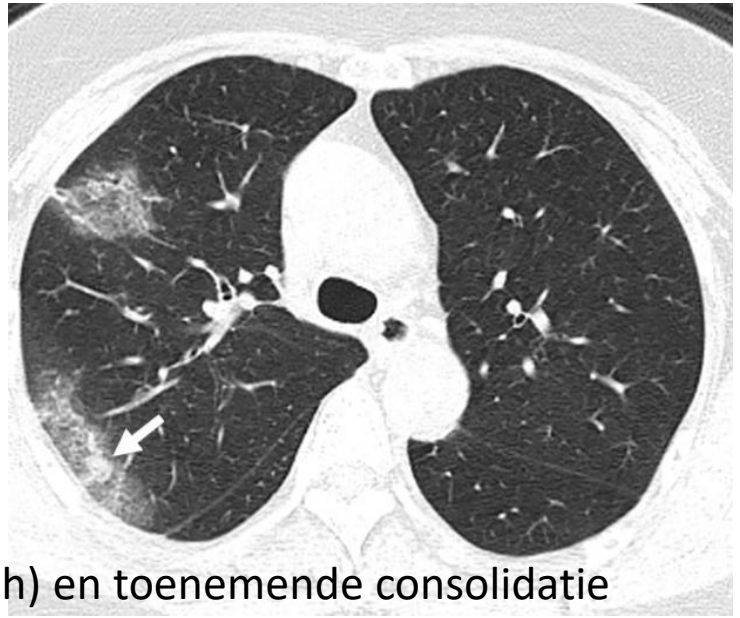


Dag 3 na presentatie

F62 koorts, hoesten, sputum
Presentatie CT 7 dagen na contact

Beloop in de tijd





Dag 5 na presentative, kleine caviteit (niet typisch) en toenemende consolidatie

Kong et al, Radiology Cardiothoracic Imaging, in press

Organiserende veranderingen met toegenomen densiteit bij FU.

F45, koorts, hoesten, POB.
Uitgebreid GGO bilat. bovenkwabben.

Kong et al, Radiology Cardiothoracic Imaging, in press

Ernst: CT imaging score sterk gerelateerd aan ziekte ernst (Wang H. Lancet 2020, 165 patients).
Hoe ernstiger het longbeeld, hoe zieker de patient

Semi-quantitatief aangeven van de long consolidaties obv aangedane oppervlakte:

Visueel (of met CAD) inschatten van het percentage longbetrokkenheid
meest praktisch en meest eenvoudig te communiceren

Of ingewikkelder om een " Longscore" te krijgen volgens Chang et al, Radiology 2005:
Each of the 5 lung lobes visually scored:
0, no involvement
1, <5% involvement
2, 5%-25% involvement
3, 26%-49% involvement
4, 50%-75% involvement
5, >75% involvement.
The total CT score is the sum of the individual lobar scores and ranged from 0 (no involvement) to 25 (maximum involvement).
Het percentage longbetrokkenheid is dan in te schatten door het **getal x 4** te vermenigvuldigen.

Longscore werd gebruikt bij Pan et al Radiology in press, en bij Zhao et al AJR 2020.

Ingeschatte ernst visueel

Ongeveer <5% long aangedaan

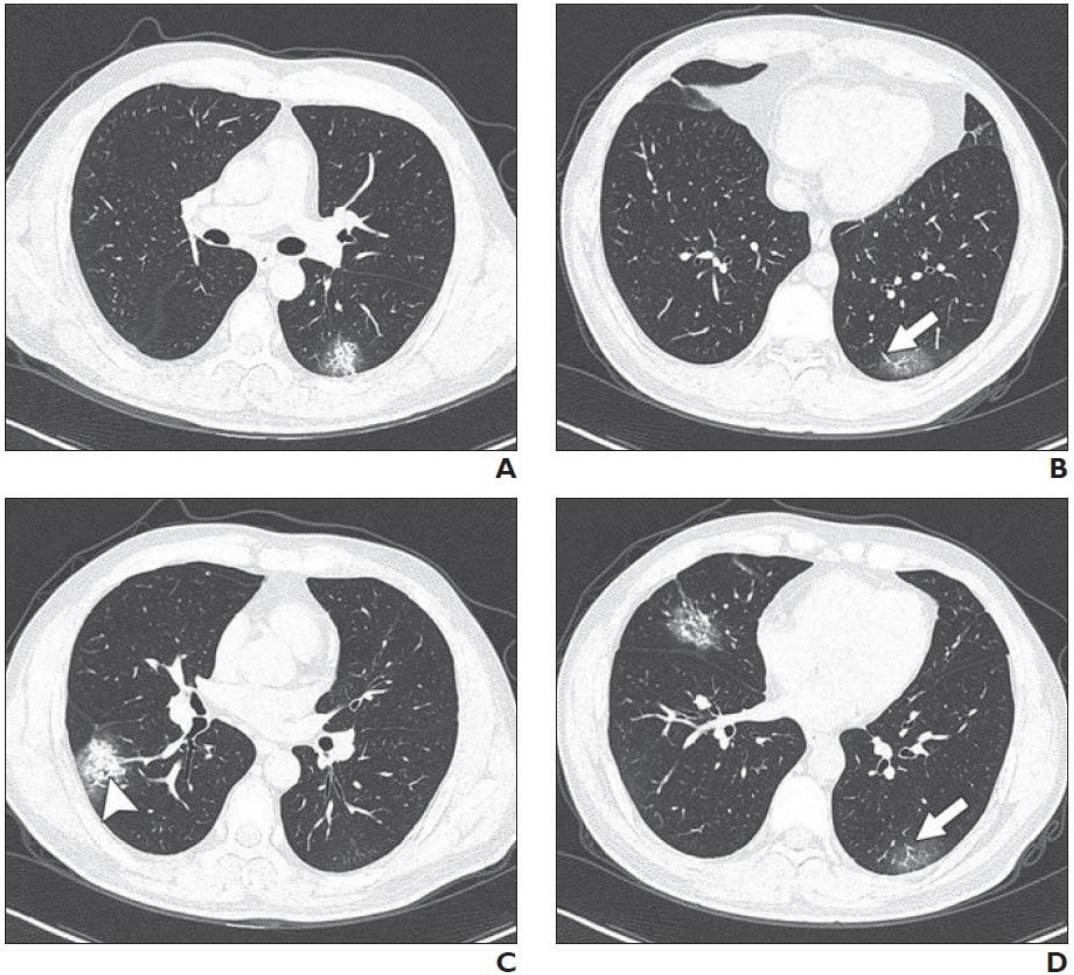


Fig. 1—37-year-old man with confirmed coronavirus disease (COVID-19), common type. Patient had short-term exposure history to Wuhan and onset symptoms of fever (38°C) and cough. CT was performed on day of admission.
A–D, CT images show bilateral multifocal ground-glass opacities (GGO) and mixed GGO and consolidation lesions. Traction bronchiectasis (*arrowhead*, **C**) and vascular enlargement (*arrow*, **B** and **D**) are also present. CT involvement score is 5.

Ongeveer 70% long aangedaan

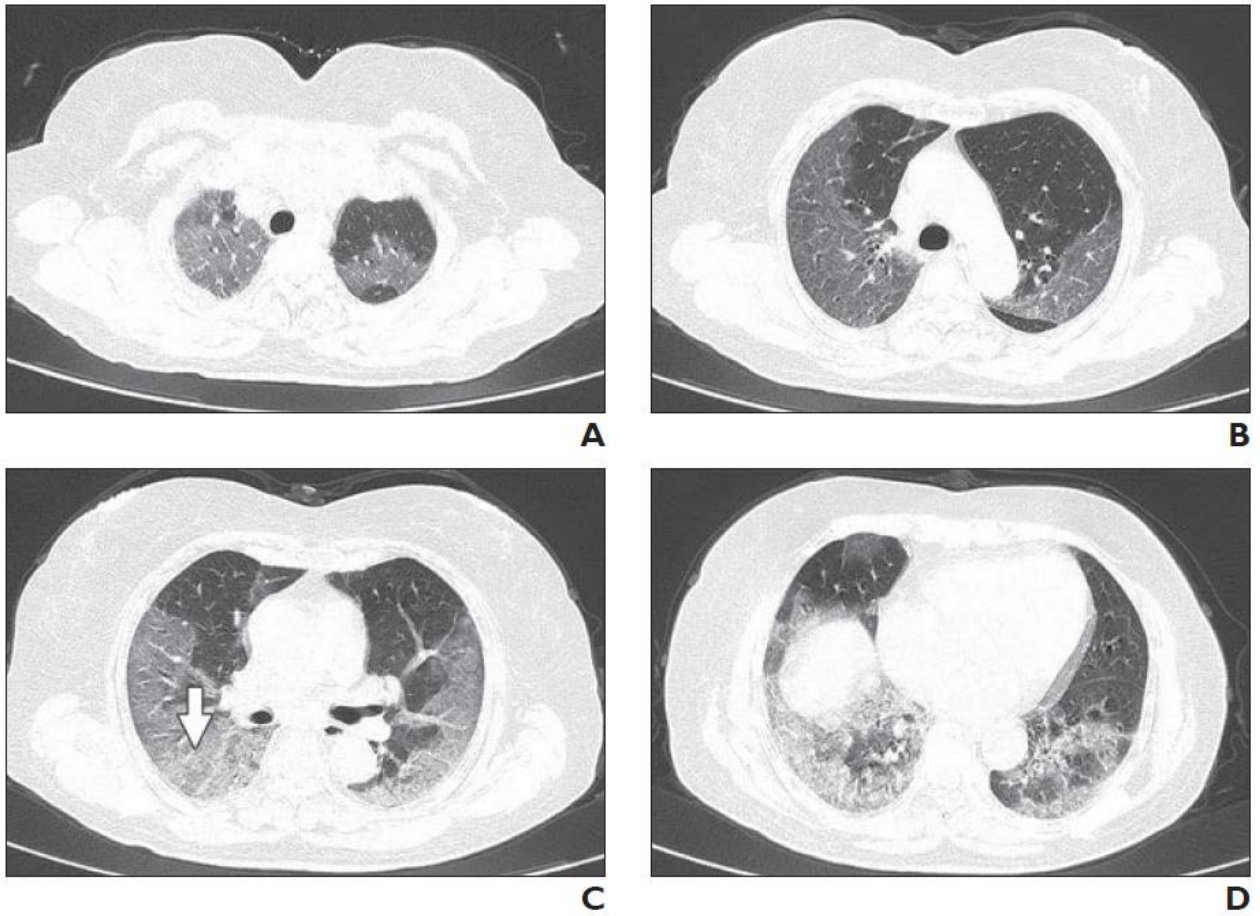
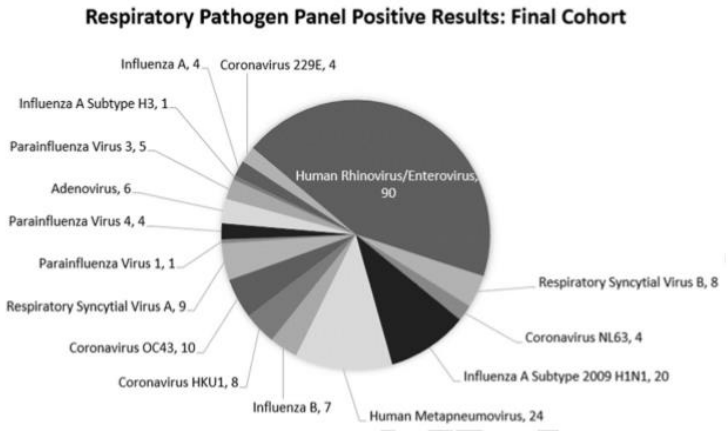


Fig. 2—63-year-old woman with confirmed coronavirus disease (COVID-19), severe type. Patient had long-term exposure history to Wuhan and onset symptoms of fever and cough. CT was performed 1 day after admission.
A–D, CT images show bilateral diffuse ground-glass opacities and reticulation (*arrow*, **C**). CT involvement score is 18.

Zhao et al, AJR 2020

Onderscheid COVID-19 van andere virussen: Moeilijk



COVID-19 Differentiaal diagnose: andere atypische pneumonie, m.n.

- Influenza A,B
- RSV

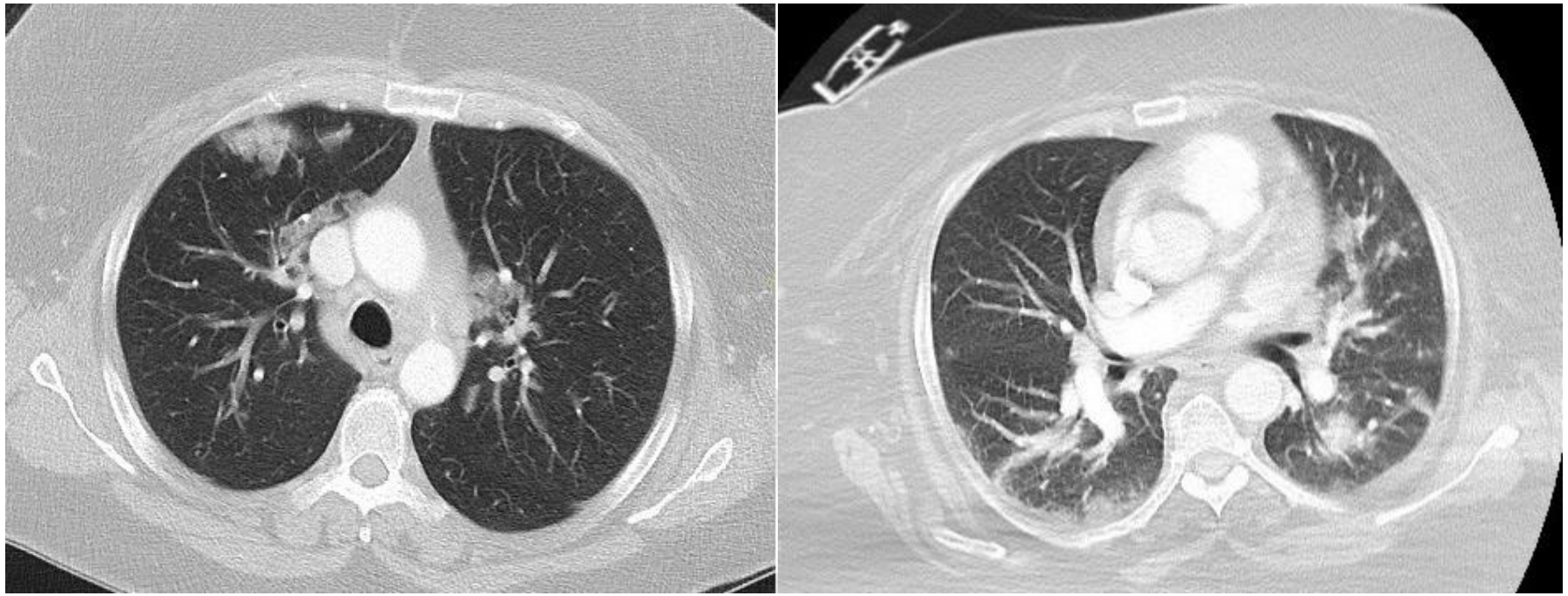
CT	COVID-19	Non-COVID
Perifere distributie	80%	57%
GGO	91%	68%
Vasculaire verdikking	58%	22%

- Veel overlap diagnostische criteria → geen zeker onderscheid
- Bij radiologen test wel specifiek maar weinig sensitief
- Sterke studie bias, uitkomst positiever dan in praktijk haalbaar is

Bai et al Radiology in press

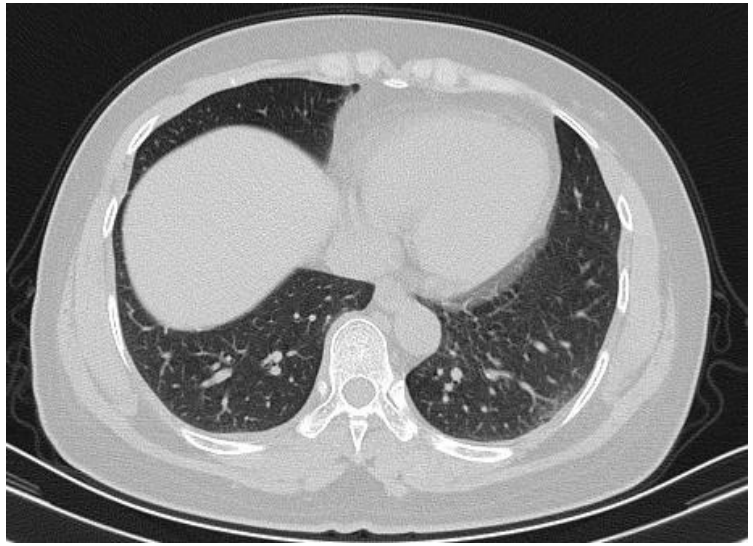
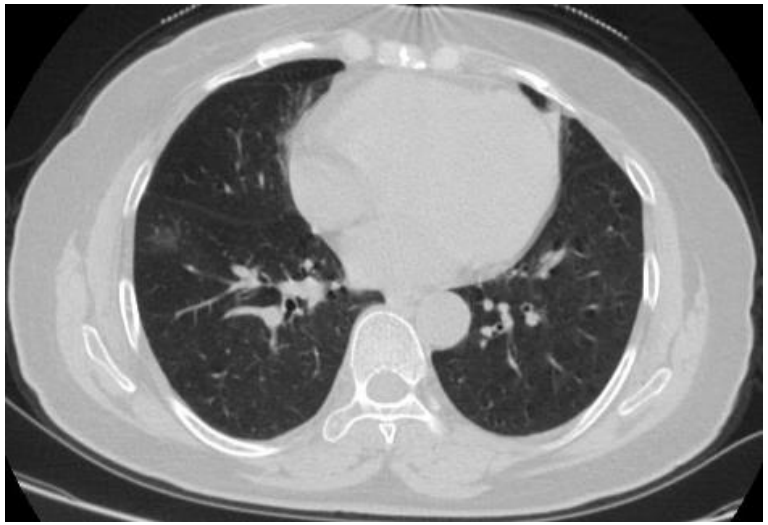
	Entire Cohort (n = 424)	COVID-19 (n = 219)	Non-COVID-19 (n = 205)	p-value
Number of involved segments	7.5 ± 5.3	7.6 ± 5.5	7.4 ± 5.1	0.027
Location				
Unilateral	93 (22)	41 (19)	52 (25)	0.098
Bilateral	308 (73)	165 (75)	143 (70)	0.197
Distribution				
Central	15 (4)	3 (1)	12 (6)	0.013
Peripheral	293 (69)	176 (80)	117 (57)	<0.001
Central + Peripheral	103 (24)	31 (14)	72 (35)	<0.001
Lesion Involvement				
Single Lesion	31 (7)	15 (7)	16 (8)	0.706
Multiple Lesions	279 (66)	134 (61)	145 (71)	0.038
Diffuse	98 (23)	59 (27)	39 (19)	0.053
Main Features				
Ground Glass Opacity	340 (80)	200 (91)	140 (68)	<0.001
Consolidation	303 (72)	150 (69)	153 (75)	0.162
Linear Opacity	229 (54)	111 (51)	118 (58)	0.156
Mixed type	260 (61)	141 (64)	119 (58)	0.181
Interstitial Change				
Septal Thickening	147 (35)	77 (35)	70 (34)	0.827
Fine Reticular Opacity	168 (40)	123 (56)	45 (22)	<0.001
Other Features				
Nodule	131 (31)	70 (32)	61 (30)	0.623
Vascular Thickening	175 (4)	129 (59)	46 (22)	<0.001
Bronchial Wall Thickening	49 (12)	19 (9)	30 (15)	0.055
Air Bronchogram	77 (18)	30 (14)	47 (23)	0.014
Crazy-paving pattern	22 (5)	11 (5)	11 (5)	0.874
Halo Sign	98 (23)	56 (26)	42 (21)	0.215
Reverse Halo Sign	12 (3)	11 (5)	1 (1)	0.005
Pleural Thickening	100 (24)	32 (15)	68 (33)	<0.001
Pleural Effusion	89 (21)	9 (4)	80 (39)	<0.001
Lymphadenopathy	27 (6)	6 (3)	21 (10)	0.002
Total Lesion to Lung Ratio	16.2 ± 17.7	12.9 ± 15.5	19.7 ± 19.2	<0.001
Ground Glass Opacity to Lung Ratio	13.0 ± 14.8	10.5 ± 12.7	15.7 ± 16.3	<0.001
Consolidation to Lung Ratio	3.1 ± 4.0	2.4 ± 4.0	3.9 ± 3.9	<0.001

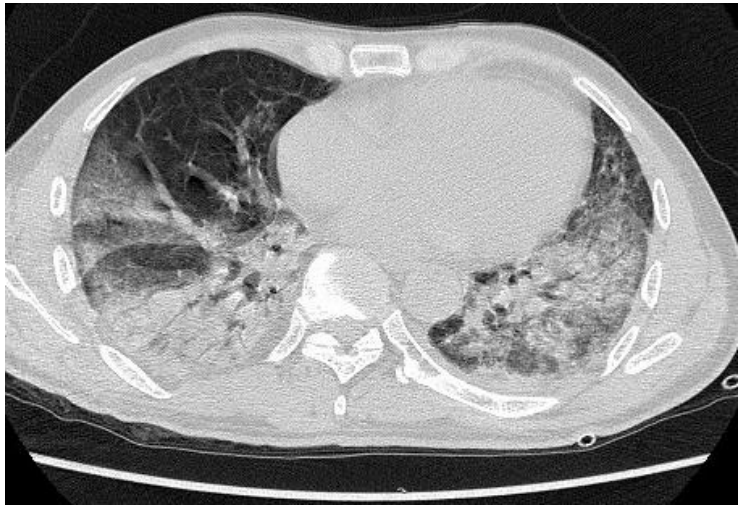
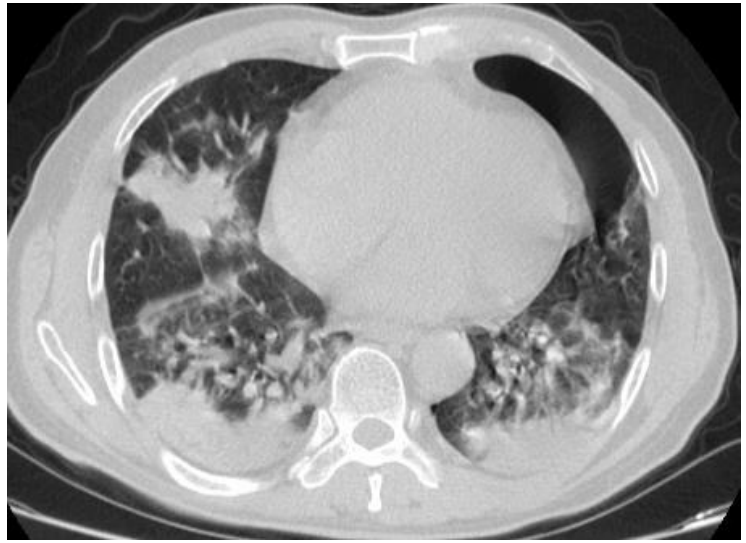
Table 5. CT features comparing COVID-19 and viral pneumonia
Data are number of cases with percentages in parenthesis, or mean ± standard deviation



Geen COVID-19
Maar atypische pneumonie anderszins
(werd meestal niet herkend door radioloog)

Bai et al Radiology in press

Wel COVID-19 (allemaal)
Maar niet als zodanig afgegeven door radioloog

Bai et al Radiology in press

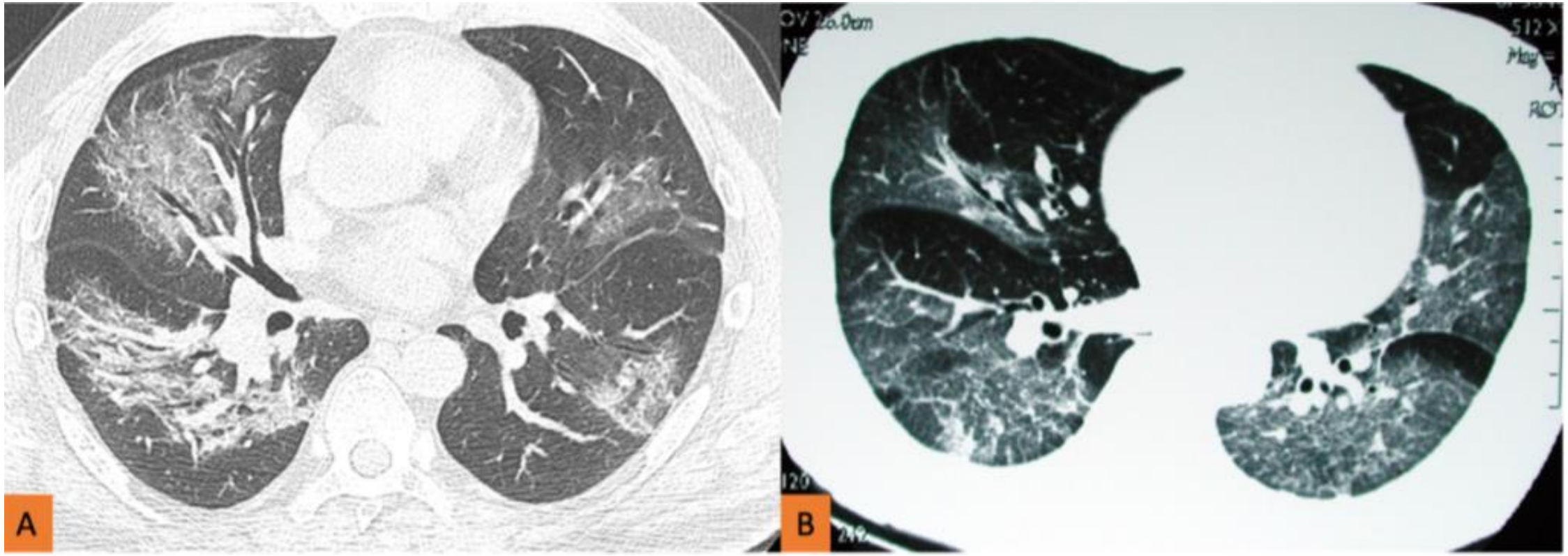


Figure 6. Axial CT images showing a case of COVID-19 (image A) and a case of severe acute respiratory syndrome (SARS) from 2003 (image B). Both cases demonstrate similar predominantly ground-glass opacities affecting both lungs.

Ng et al, Radiology Cardiothoracic Imaging Vol2 No1 Feb 13 2020 online