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SYSTEMIC REVIEW

Comparison of High Resolution Computed Tomography Features in Covid-19 and Other Viral Pneumonia- A Systematic Review

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ABSTRACT

Aim: To compare the high resolution computed tomography features in Covid and other viral pneumonia presented in recent literature.
Methodology: For this study, total 25 studies were included which follow the Preferred Reporting Items guideline for conducting this systematic review analysis (PRISMA). Electronic articles of Covid from January 2020 to April 2020 were searched on PUB Med, online Willey library, and Science Direct site by using keywords related to CT imaging and Corona virus. For pneumonia related studies articles from year 2010 to year 2017 were included for better comparison.
Results: After pooling data, it was observed that bilateral involvement was found in 76.8% of studies, 68.4% GGO, and 62.2% ratio was occupied by peripheral distribution in different studies. Total 48.7% of studies were concerned about the ground glass opacity (GGO) consolidation, 33.2% observed consolidation, 27.7% look for crazy paving pattern, and 25% of studies observed mixed central and peripheral distribution.
Conclusion: Study concludes that the chest CT finding results of selected studies for Covid and pneumonia cases were overlapping. Only high prevalence related to upper and lower lobe involvement and peripheral distribution was relatively high in Covid studies.
Keywords: Computed tomography, pneumonia viral disease, Sars Covid-19

INTRODUCTION

Coronavirus emerged from the city of Wuhan in the last months of 2019. Pathological findings revealed that it is a single-stranded RNA virus which mutates rapidly with 2.2 basic reproductive number[1]. Recent studies examine that 6 species of coronavirus can form human disease[2]. Generally, the four species including 229E, OC43, NL63, and HKU[1] are common which induce common cold symptoms[2]. The rest two species MERS-COV and SARS-COV are caused by the animals and can engage persons in fatal illness[3]. The high prevalence of coronavirus in different regions of the world depicts that it could be occasionally effected the human species due to its cross-species infection features[3,4].

In CT imaging of the patients, pulmonary opacities were also observed[5]. After the analysis of Bronchoalveolar lavage fluid under the electronic microscope, it came to know that a crown like virus emerging from viral spike peplomers[6]. This virus was observed for the first time so newly came virus labeled as 2019 novel coronavirus. Generally, a wide perception is that it could be transmitted from respiratory droplets and close contact but recent studies depict that it may be caused by the digestive tract[7]. The majority of the patients had mild symptoms but in many countries old patients with poor immune systems and comorbidities were severely affected by this deadly virus[8].

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Only early detection and control of its transmission in form of isolation of infected persons can be helpful to stop this deadly virus[9]. Unfortunately, a large number of suspected cases need more time for laboratory examination which causes a wide spread of this disease. A low number of examination kits and a high rate of suspected patients in some regions becomes another issue that causes the wide spread of this virus because of no quarantine administration of the suspected person[10].

CT imaging plays a massive role in the examination of infected cases of novel coronavirus-19. It is considered as the imaging modality which screens out the changes in effected patients and depicts the effectiveness of treatment with time[9]. CT features of affected patients might help create a distinction between novel coronavirus and other viruses which cause pneumonia among patients.

The objective of this study was to compare the high resolution computed tomography features in Covid and other viral pneumonia presented in recent literature.

METHODOLOGY

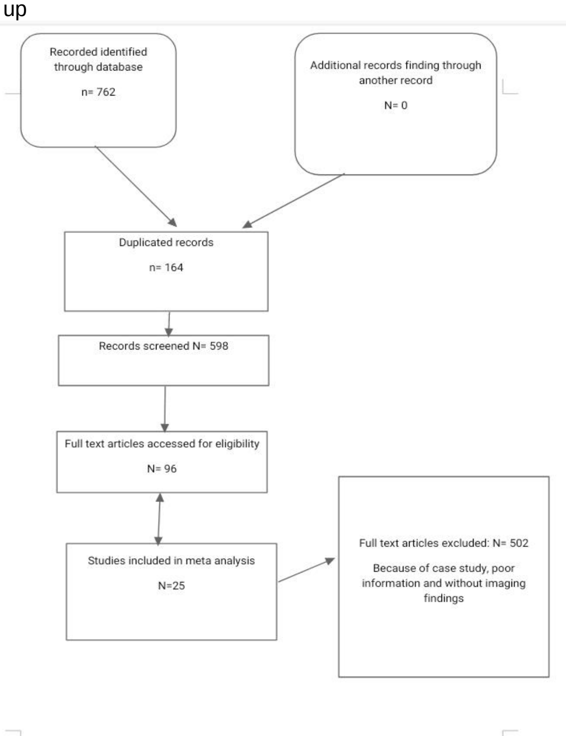
For this study, Preferred Reporting Items guideline for conducting this systematic review analysis (PRISMA) was followed[16]. Electronic articles from January 2020 to April 2020 were searched on PUB Med, online Willey library, and Science Direct site. For pneumonia related studies we include articles from year 2010 to year 2017 for better comparison. We use keywords like Diagnostic Imaging" OR "Diagnostic X-Ray" OR "Diagnostic X-Ray Radiology" OR

"Medical Imaging" OR "X-Ray Computed Tomography" OR "CT" OR "X-Ray Computer Assisted Tomography" OR "CT X-Ray" OR "X-Ray CT Scan" OR "X-Ray Computerized Tomography" AND "COVID-19" OR "2019-nCoV" OR "to" OR "coronavirus" OR "SARS-CoV-2" OR "Wuhan coronavirus" OR "Novel coronavirus" OR "2019 novel coronavirus" OR "coronavirus disease 2019 virus" OR "COVID-19 virus" OR "2019-nCoV infection" OR "coronavirus disease-19, AdV, H1N1, RSV, and PIV to search relevant articles. We make assure that all the data have information such as GGO consolidation, lobes and lesion location along with other features of CT imaging. With the help of keywords, we analyze the title, abstract aims, and objectives to extract the relevant data.

Inclusion criteria: Articles and case studies with complete demographic information and medical symptoms of patients confirmed after RT-PCR were included for this research. To minimize the probability of hetrogenity we only include AdV, H1N1, RSV, and PIV type of viruses in this study.

Exclusion Criteria: Articles which were written in other than English language were not included for this research. On the behalf of keywords seven hundred sixty-two articles were found. Information in the form of posters, case studies without CT imaging, letters to editors, and articles with copied information were excluded from this study.

Fig 1: Inclusion Criteria of selected studies according to PRISMA follow up



The evaluation of selected data was further done into two phases first we select the data based on abstract and title. Secondly, the inner text of articles was examined and included if they were eligible to fill the inclusion criteria of our study. At the initial stage of collecting data, seven hundred and sixty-two articles were found with selected keywords. In the first screening, 164 duplicate articles were excluded and on further screening of the rest of 598 articles, we omitted 502 articles with poor information on CT imaging. Later on, remaining 96 articles were further gone through the screening process. At the last stage, 25 articles (16 Covid related and 9 Non covid) that fulfilled the inclusion criteria and had adequate data on required topic were included.

Demographic information of patients like mean age and rang, the sample size were kept in tabular form. The CT findings regarding parenchymal features, distribution, bronchovascular changes, pleural involvement, and extrapleural findings of all selected researches were observed.

RESULTS

At first sight, the initial symptoms of selected studies were noted. During analysis the main symptoms of Covid infected patients were fever and dry cough, decrease in the count of white blood cells and lymphocyte count, and increase the frequency of C-reactive protein among the affected patients. Covid patients were categorized under four major categories; Asymptomatic, Mild (those who had cough and vomit), Moderate (those who had fever, cough, Headache, and diarrhea) and Severe (patients with Dyspnea, fever, myalgia and vital organ failure).

A large amount of literature was found on ground glass opacity (GGO) (27.3-80%)[9,10,15,17,18,19,20,21,22,23,24], consolidation (0-55%)[6,10,15,19,20,21,22,24], and their combined density frequency (29-61%)[6,10,15,19,20,24]. The frequency of nodular opacity[6,20,23] was 0-10% and 10-75% of crazy paving patterns[6,15,19,20,21,23] were observed with huge diversity in results. Unilateral involvement, central distribution, and normal imaging were less common among the studies (0-25%, 0-20%, and 0-23% respectively)[6,10,19,21,22] as compared to bilateral involvement and peripheral distribution (59-100% and 26-100% respectively)[6,10,12,15,19,20,21,22,23,24].

After pooling data of Covid, bilateral involvement was found in 76.8% of studies, 68.4% ground glass opacity (GGO), and 62.2% ratio was occupied by peripheral distribution in different studies. Total 48.7% of studies were concerned about the GGO consolidation, 33.2% observed consolidation, 27.7% looked for crazy paving pattern, and 25% of studies observed mixed central and peripheral distribution. Only 15.2% of studies observed unilateral involvement and 9.2% of studies were concerned with the nodular opacity feature whereas a very little amount of literature was found on lymphadenopathy (2.4%). On the other hand after applying heterogeneity formula we observed a high probability of heterogeneity among none covid studies but less heterogeneity among the Covid studies. Covid study's results vary from other studies.

In non-covid patients, a high ratio of mixed GGO consolidation was observed. Our results depict that (46%) results of non-Covid studies observed high mixed GGO Consolidations whereas in covid studies total 48% were observed regarding CT abnormalities. Through selected studies, it was observed that the ratio of pleural effusion is rare in Covid (3%) cases but common in other viral pneumonia (25%). Comparing the ratio of bilateral disease and lower lobe involvement we found intensity in Covid cases as compared to other viral diseases (81%; 88%, 69%; 61%). In Covid cases, a high frequency of peripheral distribution and upper and lower lobe involvement was observed as compared to pneumonia.

Table 1: Characteristics of Covid-19 Studies

Author	Nationality	Total suspected cases	Mean age	Gender		Patient's under category of Clinical Symptoms			
				Female	Male	Severe	Moderate	Mild	Asymptomatic
Song et al9	China	44/51	49	26	25	Yes	Yes	Yes	No
Zhu et al10	China	46/116	40	65	51	Yes	Yes	Yes	No
Sun et al11	China	8/8	6.7	2	6	Yes	Yes	Yes	No
Zheng et al12	China	16/24	3	11	14	Yes	Yes	Yes	No
Wan et al13	China	135/135	47	63	72	Yes	Yes	Yes	No
Zhao et al14	China	93/101	44.5	45	56	Yes	Yes	Yes	No
Wei et al15	China	14/14	36	10	4	Yes	Yes	Yes	No
Zhang et al16	China	120/120	45.1	77	43	Yes	Yes	Yes	No
Wu et al17	China	76/80	44	38	42	Yes	Yes	Yes	No
Zhang et al18	China	28/28	65	11	17	Yes	Yes	Yes	No
Xia et al19	China	16/20	-	7	13	Yes	Yes	Yes	No
Zhang et al20	China	4/5	39.6	4	1	Yes	Yes	Yes	No
Xu et al21	China	69/90	50	51	39	No	Yes	Yes	Yes
Yoon et al22	Korea	8/9	54	5	4	No	No	No	No
Xu et al23	China	41/150	46.6	21	29	Yes	Yes	Yes	No
Yang et al24	China	132/149	45.1	68	81	Yes	Yes	Yes	No

Table 2 (a): Assesment of Covid studies through CT imaging

Author	Ground-glass opacities(GGOs)	Consolidation	Airbronchogram	Crazy paving pattern	Adjacent pleural thickening
Song et al	Yes	Yes	Yes	No	No
Zhu et al	Yes	Yes	No	Yes	No
Sun et al	Yes	Yes	No	Yes	No
Zheng at al	No	Yes	No	Yes	No
Wan et al	Yes	Yes	No	No	No
Zheo et al	Yes	Yes	no	no	no
Wei et al	Yes	Yes	No	Yes	No
Zhang et al	Yes	yes	yes	yes	No
Wu et al	Yes	yes	No	Yes	Yes
Zhang et al	Yes	yes	yes	NO	No
Xia et al	Yes	yes	No	No	No
Zhang et al	Yes	Yes	No	No	No
Xu et al	Yes	Yes	Yes	Yes	Yes
Yoon et al	Yes	Yes	Yes	Yes	No
Xu et al	Yes	Yes	Yes	No	No
Yang et al	Yes	Yes	Yes	Yes	No

Table 2 (b): Assessment of Covid studies through CT imaging

Author	Pleural effusion	Pericardial effusion	Lymphadenopathy	Interlobular septal thickening	Others
Song et al	Yes	Yes	yes	yes	Yes
Zhu et al	yes	no	no	no	yes
Sun et al	Yes	no	no	no	no
Zheng et el	no	no	no	no	No
Wan et al	Yes	No	no	no	No
Zheo et al	no	no	no	no	yes
Wei et al	No	No	No	No	No
Zhang et al	yes	no	yes	no	yes
Wu et al	Yes	No	no	yes	yes
Zhang et al	no	no	no	Yes	yes
Xia et al	No	No	no	no	no
Zhang et al	No	No	No	No	No
Xu et al	Yes	Yes	Yes	Yes	Yes
Yoon et al	No	No	No	No	No
Xu at al	Yes	No	No	Yes	No
Yang et al	yes	no	yes	no	yes

Table 3: Assessment of Covid studies through Lesion and Lobe location

Author	Lung Lobe location					Lesion Distribution		
	Left lower lobe	Left upper Lobe	Right lower lobe	Right Middle lobe	Right upper lobe	Centre	Peripheral	Bilateral
Song et al	Yes	yes	yes	yes	yes	yes	yes	yes
Zhu et al	no	no	no	no	no	no	no	yes
Sun et al	no	no	no	no	no	no	no	yes
Zheng et al	yes	yes	yes	yes	No	yes	yes	yes
Wan et al	No	no	no	no	no	no	no	no
Zheo et al	yes	yes	yes	yes	yes	yes	yes	yes
Wei et al	no	no	no	yes	no	no	no	no
Zhang et al	yes	yes	yes	yes	yes	yes	yes	yes
Wu et al	yes	yes	yes	yes	yes	yes	yes	yes
Zhang et al	yes	yes	no	yes	yes	yes	yes	yes

Xia et al	yes	yes	yes	yes	yes	yes	yes	yes
Zhang et al	yes	yes	no	yes	yes	yes	yes	yes
Xu et al	yes	yes	yes	yes	yes	yes	yes	yes
Yoon et al	yes	yes	yes	yes	no	yes	yes	yes
Xu et al	yes	yes	yes	yes	yes	yes	yes	yes
Yang et al	No	No	yes	yes	no	no	no	no

Table 4: Pool data and level of heterogeneity among Covid Studies

Variables	**Heterogeneity**		**Pooled estimates%**	**p value**
	Cochran Q test (%)	**I2 Statistics (%)**		
Female prevelance	64.1	45.4	46 (43, 50)	0.003
Male prevelance	64.1	45.4	54 (57, 50)	0.002
Age prevelance	42.3	21.9	76 (67, 83)	0.129
Chest CTsensitivity	480.1	92.7	89 (96, 80)	0.000
Clinical Symptoms prevelance	7.5	0	91 (96, 85)	1
RT- PCR sensitivity	1322.2	97	98 (100, 90)	0.000
Lesion Distribution	27.6	0	72 (80, 62)	0.541
CT morphological abnormalities prevelance	59.9	44.9	48 (55, 41)	0.003
Lobe location prevelance	61.8	54.7	92 (84, 97)	0.000

Table 5: Characteristics of non Covid studies

Author	**Year**	**Nationality**	**Pathogen**	**Total participants**	**Mean age**
Yoon et a25l	2017	South Korea	AdV	152	21
Park et al26	2016	South Korea	AdV	104	20.1
Valente et al27	2011	Italy	H1N1	50	40.9
Qi et al28	2014	China	H1N1	16	27
Tanaka et al29	2011	Japan	H1N1	10	61.3
Shiley et al30	2010	USA	H1N1, AdV,RSV,PIV	18	55
Son et al31	2011	Korea	H1N1	20	46.5
Song et al32	2011	Korea	H1N1	30	36.6
Sohn et al33	2013	Korea	H1N1	41	46

Table 6: Pool data of non Covid Studies

Features	**Pooled prevalence 95% CI**
CT pattern	
GGO and consolidation absence	0.05 (0.03–0.07)
Predominantly GGO	0.25 (0.17–0.32)
Mixed GGO and consolidation	0.46 (0.35–0.58)
Consolidation	0.17 (0.11–0.23)
Nodules	0.30 (0.19–0.40)
Pleural effusion	0.25 (0.18–0.32
Upper lobe	0.18 (0.10–0.27)
Lower lobe	0.61 (0.44–0.78)
Middle lobe	0.24 (0.11–0.38)
Peripheral	0.34 (0.18–0.49
Bilateral	0.69 (0.54–0.84)
Axial distribution	0.50 (0.35–0.65)

Fig 2: Forrest plot of pooled estimated values of Covid studies

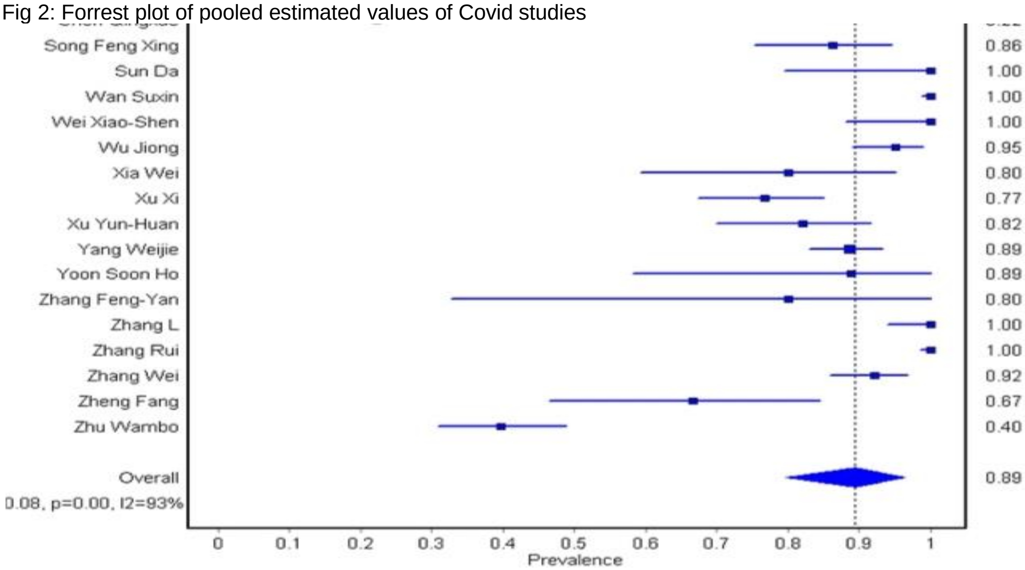
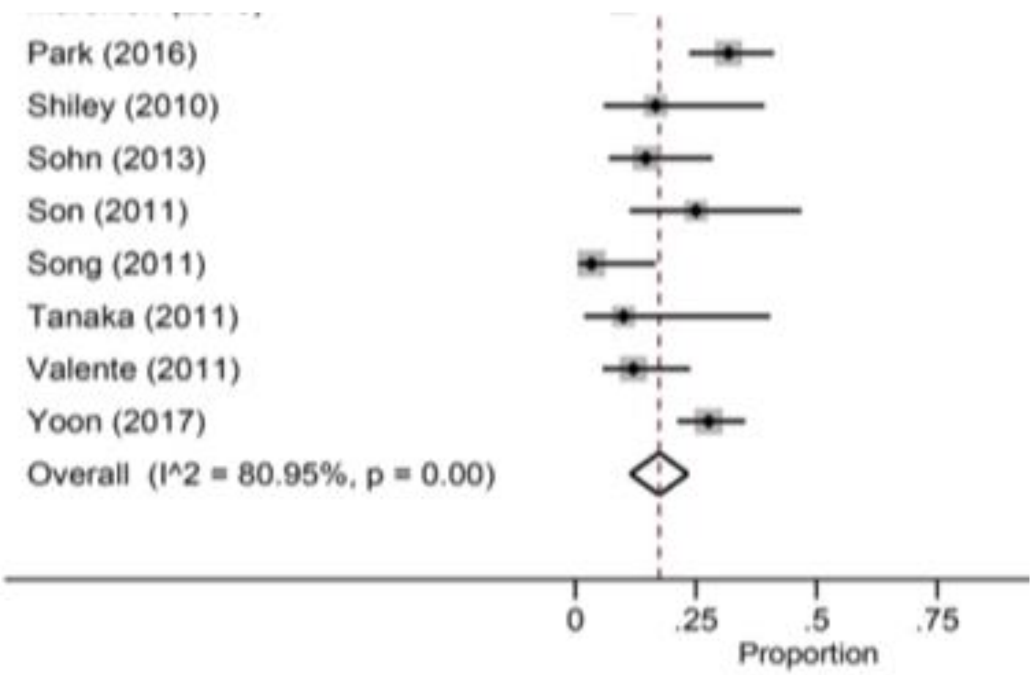


Fig 3: Forest plot for pooled estimated values of Non covid Studies



DISCUSSION

In the majority of selected studies, bilateral involvement was observed in CT imaging along with the peripheral involvement, mixed GGO and consolidation, consolidation, crazy paving pattern. It was further observed that selected articles were more concerned with mixed central and peripheral distribution, unilateral involvement, nodular opacities, pleural effusion, central distribution, and lymphadenopathy of the symptomatic patients. In the majority of the studies, CT imaging reports of the patients revealed that GGO was a hazy grey area that was caused by partial air displacement. All the studies observed that the mechanism of GGO without bronchovascular obscuration happened after the alveoli partial filling of interstitial thickening[18]. In one study autopsy reports revealed the formation of pulmonary edema and hyaline membrane formation inside the affected patients[19]. Another study reported that the formation of the hyaline membrane can be a pathological description of GGO[20]. The density of lesion in all studies had variations which may be due to interval between the CT scan and onset of symptoms.

The occurrence of lesions can be observed within 2 weeks after the occurrence of the symptoms and gradually increase in GGO after two weeks[15]. The study of Xia et al[18] noted the progression of GGO within 1-3 weeks of COVID symptoms along with consolidation. Consolidation exhibit more density than the GGO because they reflect alveolar air that is occupied with fluids, cells and tissues which results in bronchovascular obscuration[18]. In Covid ptients, studies observed secretion of cellular fibromyxoid in alveoli that eventually results in lesion consolidation among patients[10].

Halo is another feature observed among the studies. It is a mass or consolidative nodule around the peripheral ground-glass opacity (GGO)[16]. It is considered one of the major reasons for pneumonia and is highly associated with viral infections[12]. After the pooling of collected data, we observed that halo signs are less common among adult patients and widely occurred in pediatrics[22,23,24].

Majority of the studies had consensus that interstitial lymphocyte infiltration may decrease the interlobular and intralobular septal thickening. After rapid occurrence of Covid symptoms among patients researchers observed an increase in reticular opacity[21]. In a study by Wie et al study15, this high reticular opacity frequency affects 33% of patients while Song et al[9] observed a comparitively large amount of continuity among 67% of his study patients. Association of reticular opacity and GGO formed crazy paving patterns in the patient's lungs[13]. This happens due to alveolar edema and interstitial inflammation that arises after lung injury[11]. In many studies it was observed that 27% of studies reported the prevalence of crazy paving patterns with variation in the frequency of patterns due to a long time interval between CT imaging and symptoms onset.

Lymphadenopathy is another feature of lungs CT which occupies great importance for critically ill patients of Covid 19 because it may increase the risk of superinfection if combine with pleural effusion and numerous lung nodules[13]. In selected studies, we did not observe any information regarding lymphadenopathy. In Covid infection, pleural effusion is considered as an indicator for the poor condition of patients. In one study of Shi et al little frequency of pleural effusion was 5%. Usually, it is less observable of the pleural thickening. Wie Liu et al[15] autopsy report observed pleural thickness in CT imaging. So the total ratio of these two features was slightly less (3.5%).

CONCLUSION

Study concludes that the results of chest CT findings for Covid and other pneumonia were overlapping. Only high prevalence related to upper and lower lobe involvement and peripheral distribution was found in Covid studies.

Limitations: Some researchers performed CT after 2 weeks of symptoms and some performed before 2 weeks. So there must be a specific time interval to perform CT imaging to prevent the variations among results.

Conflict of interest: There was no conflict of interest.

REFERENCES

1. Li Q, Guan X, Wu P, Wang X, Zhou L, Tong Y et al. Early transmission dynamics in Wuhan, China, of novel coronavirus-infected pneumonia. N Engl J Med. 2020; 382:1199–1207
2. Su S, Wong G, Shi W, Liu J, Lai ACK, Zhou J et al. Epidemiology, genetic recombination, and pathogenesis of coronaviruses. Trends Microbiol. 2016; 24:490–502
3. Cui J, Li F, Shi ZL. Origin and evolution of pathogenic coronaviruses. Nat Rev Microbiol. 2019; 17:181–192
4. Wong G, Liu W, Liu Y, Zhou B, Bi Y, Gao GF. MERS, SARS, and Ebola: the role of super-spreaders in infectious disease. Cell Host Microbe. 2015; 18:398–401
5. Novel Coronavirus–China. World Health Organization. Published January 12, 2020.
6. Chung M, Bernheim A. CT imaging features of 2019 novel coronavirus (2019-nCoV). Radiology. 2020; 295:202–207
7. Riou J, Althaus CL. Pattern of early human-to-human transmission of Wuhan 2019 novel coronavirus (2019-nCoV), December 2019 to January 2020. Euro Surveill. 2020: 25.
8. Hui DS, E IA, Madani TA, Ntoumi F, Kock R, Dar O, et al. The continuing 2019-nCoV epidemic threat of novel coronaviruses to global health - the latest 2019 novel coronavirus outbreak in Wuhan, China. Int J Infect Dis. 2020; 91:264-266.
9. Song,F.;Shi,N.; Shan,F.; Zhang,Z.; Shen,J.; Lu,H.; Ling,Y.; Jiang,Y.; Shi, Y. Emerging2019novelcoronavirus (2019-nCoV) pneumonia. Radiology 2020, 295, 210–217.
10. Zhu,W.; Xie, K.; Lu, H.; Xu, L.; Zhou, S.; Fang, S. Initial clinical features of suspected coronavirus disease 2019 in two emergency departments outside of Hubei, China. J. Med. Virol. 2020.
11. Sun, D.; Li, H.; Lu, X.X.; Xiao, H.; Ren, J.; Zhang, F.R.; Liu, Z.S. Clinical features of severe pediatric patients with coronavirus disease 2019 in Wuhan: A single center's observational study. World J. Pediatr. 2020, 1–9.
12. Zheng, F.; Liao, C.; Fan, Q.H.; Chen, H.B.; Zhao, X.G.; Xie, Z.G.; Li, X.L.; Chen, C.X.; Lu, X.X.; Liu, Z.S.; et al. Clinical characteristics of children with coronavirus disease 2019 in Hubei, China. Curr. Med. Sci. 2020, 40, 1–6.
13. Wan,S.; Xiang, Y.; Fang, W.; Zheng, Y.; Li, B.; Hu, Y.; Lang, C.; Huang, D.; Sun, Q.; Xiong, Y.; et al. Clinical features and treatment of COVID-19 patients in northeast Chongqing. Med. Virol. 2020, 92, 797.
14. 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. Roeentgenol. 2020, 214, 1072–1077.
15. Wei,X.S.; Wang, X.R.; Zhang, J.C.; Yang, W.B.; Ma, W.L.; Yang, B.H.; Jiang, N.C.; Gao, Z.C.; Shi, H.Z.; Zhou, Q. Acluster of health care workers with COVID-19 pneumonia caused by SARS-CoV-2. J. Microbiol. Immunol. Infect. 2020.
16. Zhang,R.;Ouyang,H.;Fu,L.;Wang,S.;Han,J.; Huang,K.; Jia,M.; Song,Q.; Fu,Z.CTfeaturesofSARS-CoV-2 pneumonia according to clinical presentation: A retrospective analysis of 120 consecutive patients from Wuhancity. Eur. Radiol. 2020, 30, 4417–4426.
17. Wu,J.; Wu, X.; Zeng, W.; Guo, D.; Fang, Z.; Chen, L.; Huang, H.; Li, C. Chest CT findings in patients with coronavirus disease 2019 and its relationship with clinical features. Investig. Radiol. 2020, 55, 257–261.
18. Zhang, L.; Zhu, F.; Xie, L.; Wang, C.; Wang, J.; Chen, R.; Jia, P.; Guan, H.Q.; Peng, L.; Chen, Y.; et al. Clinical characteristics of COVID-19-infected cancer patients: A retrospective case study in three hospitals within Wuhan, China. Ann. Oncol. 2020, 31, 894–901.
19. Xia,W.; Shao, J.; Guo, Y.; Peng, X.; Li, Z.; Hu, D. Clinical and CT features in pediatric patients with COVID-19 infection: Different points from adults. Pediatr. Pulmonol. 2020, 55, 1169–1174.
20. Zhang, F.Y.; Qiao, Y.; Zhang, H. CT imaging of the COVID-19. J. Formos Med. Assoc. 2020, 119, 990–992.
21. Xu,X.; Yu, C.; Qu, J.; Zhang, L.; Jiang, S.; Huang, D.; Chen, B.; Zhang, Z.; Guan, W.; Ling, Z.; et al. Imaging and clinical features of patients with 2019 novel coronavirus SARS-CoV-2. Eur. J. Nucl. Med. Mol. Imaging 2020, 47, 1275–1280.
22. Yoon, S.H.; Lee, K.H.; Kim, J.Y.; Lee, Y.K.; Ko, H.; Kim, K.H.; Park, C.M.; Kim, Y.H. Chest radiographic and CTfindings of the 2019 novel coronavirus disease (COVID-19): Analysis of nine patients treated in Korea. Korean J. Radiol. 2020, 21, 494–500.
23. Xu,Y.H.; Dong,J.H.; An, W.M.; Lv, X.Y.; Yin, X.P.; Zhang, J.Z.; Dong, L.; Ma, X.; Zhang, H.J.; Gao, B.L. Clinical and computed tomographic imaging features of novel coronavirus pneumonia caused by SARS-CoV-2. J. Infect. 2020, 80, 394–400.
24. Yang, W.; Cao, Q.; Qin, L.; Wang, X.; Cheng, Z.; Pan, A.; Dai, J.; Sun, Q.; Zhao, F.; Qu, J.; 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, 80, 388–393.