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Comparison of Clinical, Laboratory, and Radiological Characteristics Between COVID-19, Influenza, and Adenovirus Pneumonia: A Narrative Review

COVID-19, İnfluenza ve Adenovirüs Pnömonilerinin Klinik, Laboratuvar ve Radyolojik Özelliklerinin Karşılaştırılması: Derleme

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Abstract

The Coronavirus disease-2019 (COVID-2019) pandemic is a major global healthcare problem nowadays, and because of the high numbers of infected patients, it is vitally important to distinguish this from other types of viral pneumonia caused by influenza or adenovirus, which may have similar signs and symptoms. We conducted a narrative literature review and performed a PubMed and Scopus search for studies published up to November 18, 2020, using the following medical subject headings terms: ["comparison," "comparisons" AND "severe acute respiratory syndrome coronavirus 2," "ncov," "2019 ncov," "covid 19," "sars cov 2," "coronavirus," "cov" AND ("influenzas," "influenza," "influenzae," "human influenza" OR "adenoviridae," "adenovirus," "adenoviridae infections")]. This narrative review aims to compare pneumonia caused by severe acute respiratory syndrome coronavirus-2, influenza, and adenovirus in terms of clinical, laboratory, and radiological characteristics. In conclusion, although these viral pneumonia clinics share the similar patterns of symptoms and laboratory findings; we believe that there have some distrinctions especially in radiological findings.
Keywords: COVID-19, SARS-CoV-2, influenza, adenovirus, pneumonia, comparison

Öz

Günümüzde Koronavirüs hastalığı-2019 (COVID-19) pandemisi yüksek sayıda enfekte hasta nedeniyle tüm dünyayı etkileyen büyük bir halk sağlığı problemi olup, benzer semptom ve bulgulara sahip diğer viral pnömoniye sebep olan influenza veya adenovirüs gibi etkenlerden ayrımının yapılması hayati önem arz etmektedir. Bu literatür derlemesinde PubMed ve Scopus veritabanlarındaki 18 Kasım 2020 tarihine kadar yayınlanmış olan tüm çalışmalar belirtilen anahtar kelimeler ve arama yöntemi ile ["comparison", "comparisons" AND "severe acute respiratory syndrome coronavirus 2", "ncov", "2019 ncov", "covid 19", "sars cov 2", "coronavirus", "cov" AND ("influenzas", "influenza", "influenzae", "human influenza" OR "adenoviridae", "adenovirus", "adenoviridae infections")] gerçekleştirilmiştir. Bu derlemede, şiddetli akut solunum yolu sendromu koronavirüs-2, influenza ve adenovirüs ile gelişen pnömonileri klinik, laboratuvar ve radyolojik özellikleri doğrultusunda karşılaştırma hedeflenmiştir. Sonuç olarak, belirtilen viral pnömoni kliniklerinin benzer semptom ve laboratuvar bulguları olmasına rağmen özellikle radyolojik bulgular açısından farklılıklar içerdiğini düşünmekteyiz.
Anahtar Kelimeler: COVID-19, SARS-CoV-2, influenza, adenovirus, pnömoni, karşılaştırma

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Introduction

The Coronavirus disease-2019 (COVID-19) pandemic is a global public health problem that affects millions of people worldwide. Globally, as of November 11, 2020, there have been 51,251,715 confirmed cases of COVID-19, including 1,270,930 deaths, as reported by the World Health Organization[1]. In the past years, there have been four pandemics that were caused by novel influenza viruses, but this is the first pandemic that is caused by a new coronavirus.

Coronavirus disease-2019 symptoms include fever, cough, shortness of breath, myalgia, and diarrhea, which can also be seen in either influenza or adenovirus diseases[2-4]. However, some differences may be helpful for the differential diagnosis, and it is important for clinicians and epidemiologists to differentiate severe acute respiratory syndrome coronavirus-2 (SARS-CoV-2) from other respiratory viruses, such as influenza and adenovirus, which cause pneumonia.

This narrative review aims to compare pneumonia caused by SARS-CoV-2, influenza, and adenovirus in terms of clinical, laboratory, and radiological characteristics.

Materials and Methods

We conducted a literature review by applying the methodology described below.

Information Sources

An electronic PubMed and Scopus search was performed.

Search

We conducted a PubMed and Scopus search for studies published up to November 18, 2020. The following search medical subject headings (MeSH) terms were used: "comparison," "comparisons" AND "severe acute respiratory syndrome coronavirus 2," "ncov," "2019 ncov," "covid 19," "sars cov 2," "coronavirus," "cov" AND ("influenzas," "influenza," "influenzae," "human influenza" OR "adenoviridae," "adenovirus," "adenoviridae infections"). We also examined the references of the included articles to find additional studies. The inclusion and exclusion criteria were as follows:

Inclusion criteria:

- Only human studies that were written in English.
- Only studies with a diagnosis of pneumonia.
- Only studies that compared pneumonia caused by SARS-CoV-2 and influenza or adenovirus in terms of clinical, laboratory, and radiological characteristics.

Exclusion criteria:

- Presence of other co-infections with bacterial or fungal pathogens.

Study Selection

We collected data using a study-specific form, which included a list of clinical questions under the population, intervention, comparison, and outcome framework (Table 1).

The studies were initially selected by the author (UO), who performed title and abstract screening. We then obtained the full text of each potentially eligible study.

Synthesis of Results

Analysis of all outcomes was performed, including the authors, country, study design, the total number of patients, and the comparison of COVID-19 and influenza and adenovirus pneumonia in terms of clinical, laboratory, and radiological characteristics. The results were also sorted according to the number of patients. The reference lists of all relevant studies were also checked.

As this study was a narrative literature review, no ethical committee permission or informed consent from the patients was needed.

Results

A total of 128 articles from PubMed and Scopus databases were selected using the MeSH terms. After removing duplicated studies, we included 13 studies in this narrative review (Table 2).

Overall, 201,798 patients were investigated from the 13 relevant studies, which included 2 systematic reviews/meta-analyses and 11 retrospective studies[5-17].

The main clinical presentations including fever, dyspnea, cough, sore throat, fatigue, myalgia, and diarrhea were investigated. Leukocyte, neutrophil, lymphocyte, and platelet counts, as well as C-reactive protein (CRP) and procalcitonin levels, were investigated as main laboratory parameters. Thorax computed tomography (CT) and chest X-ray results were evaluated as radiological parameters, and the main findings were grouped as ground-glass opacity (GGO), consolidation, bilateral involvement, interstitial changes, pleural effusion, and peripheral distribution.

Table 1. Population, intervention, comparison, and outcome framework

Population	Intervention	Comparison	Outcome
Patients with COVID-19	Assessment of clinical features, laboratory, and radiological tests	Influenza and adenovirus pneumonia	Similarities and differences of COVID-19, influenza and adenovirus pneumonia

COVID-19: Coronavirus disease-2019

Table 2. Main characteristics and administrative strategy of the studies included

Study	Country	Methodology of the study	Number of patients	Comparison	Results
Pormohammad et al.[5]	-	Systematic review and meta-analysis	198,248	COVID-19 and influenza types A and B	

	COVID-19, % (p value)	Influenza A, % (p value)	Influenza B, % (p value)
Fever	76 **(<0.001)**	87.5 **(<0.001)**	89.5 **(<0.001)**
Dyspnea	15 **(<0.001)**	45.5 **(<0.001)**	33 **(<0.001)**
Cough	54 **(<0.001)**	83.5 **(<0.001)**	79 **(<0.001)**
Runny nose	14 **(<0.001)**	70 **(<0.001)**	74 **(<0.001)**
Rhinorrhea	9.3 **(0.001)**	44.5 **(<0.001)**	49 **(<0.001)**
Sore throat	11.5 **(<0.001)**	49 **(<0.001)**	38 **(<0.001)**
Diarrhea	8.5 **(<0.001)**	12 **(<0.001)**	9 **(<0.001)**
Myalgia	20 **(<0.001)**	32 **(<0.001)**	22.5 **(<0.001)**
Elevated CRP	81 **(<0.001)**	62 **(<0.001)**	43 **(<0.001)**
Lymphopenia	62.5 **(<0.001)**	49 **(<0.001)**	–
Bilaterality	76.8 **(<0.001)**	37.5 **(<0.001)**	16.5 **(<0.001)**
GGO	71 **(<0.001)**	47 **(<0.001)**	6.5 **(<0.001)**
Consolidation	75.5 **(<0.001)**	27 **(<0.001)**	27.5 **(0.09)**

Jiang al.[6]	China	Retrospective observational	54	COVID-19 and adenovirus pneumonia

	COVID-19 (%)	Adenovirus (%)	p value
Fever	77.8	100	**0.03**
Dyspnea	11.1	50	**0.002**
Expectoration	13.9	77.8	**<0.001**
Leukocytosis	3	32	**0.002**
Elevated CRP (>10 mg/L)	36.1	100	**<0.001**
Elevated procalcitonin (>0.5 ng/mL)	2.8	77.8	**<0.001**
PaO_2/FiO_2 (<300 mmHg)	8.3	83.3	**<0.001**
Infiltration on imaging	29	68	**0.003**
GGO	88.9	22.2	**<0.001**
Peripheral distribution	91.7	0	**<0.001**
Consolidation	2.8	77.8	**<0.001**

Altmayer et al.[7]	Brazil	Systematic review and meta-analysis	1911	COVID-19 and other viral pneumonia (H1N1, Adenovirus, RSV, Parainfluenza virus) CT findings

	COVID-19, pooled prevalence (95% CI)*	Non-COVID, pooled prevalence (95% CI)*
GGO	0.92 (0.89-0.96)	0.80 (0.74-0.85)
Consolidation	0.47 (0.32-0.63)	0.69 (0.61-0.77)
Bilaterality	0.81 (0.77-0.85)	0.69 (0.54-0.84)
Pleural effusion	0.03 (0.01-0.04)	0.25 (0.19-0.35)
Interstitial changes	0.27 (0.11-0.43)	0.27 (0.19-0.35)

Qu et al.[8]	China	Retrospective cohort	366	COVID-19 and influenza pneumonia

	COVID-19 (%)	Influenza (%)	p value
Fever	78	89	**<0.05**
Leukocytosis	10.9	40.8	**<0.01**
Lymphopenia	24.3	32.5	>0.05
Elevated CRP	47.9	57.5	>0.05
Elevated procalcitonin	26.8	75	**<0.01**
Cluster cases	65	10	**<0.01**

Table 2. Continued

Study	Country	Methodology of the study	Number of patients	Comparison	Results			
Song et al.[9]	USA	Retrospective cohort	345	COVID-19 and influenza A/B		**COVID-19 (%)**	**Influenza A and B (%)**	**p value**
					Fever	76	55	**0.005**
					Cough	48	31	0.05
					Headache	11	3	**0.01**
					Diarrhea or vomiting	26	12	**0.01**
					Body ache or myalgia	22	7	**0.001**
					Chest pain	6	9	**0.01**
Chen et al.[10]	China	Retrospective observational	300	COVID-19 and influenza		**COVID-19**	**Influenza**	**p value**
					Leucocytes ($\times10^9$ L^{-1})	4.92±1.75	6.33±2.35	**0.000**
					Platelets ($\times10^9$ L^{-1})	187.79±63.93	205.12±69.96	**0.026**
					Neutrophil count ($\times10^9$ L^{-1})	2.93%	4.26%	**0.000**
					Monocyte count ($\times10^9$ L^{-1})	0.36%	0.55%	**0.000**
Tang et al.[11]	China	Retrospective case-control	148	COVID-19 and H1N1		**COVID-19 (%)**	**H1N1 (%)**	**p value**
					Fever	98.6	92	0.116
					Dyspnea	71.2	74.7	0.712
					Cough	79.5	89.3	0.115
					Gastrointestinal symptoms	37	6.7	**<0.001**
					Fatigue	63	18.7	**<0.001**
					Myalgia	34.2	14.7	**0.007**
					CRP (mg/dl)	87.2	11.7	**<0.001**
					Procalcitonin (ng/ml)	0.1	1.0	**<0.001**
					GGO	94.5	45.3	**<0.001**
					Consolidation	28.8	45.3	**0.004**
Zayet et al.[12]	France	Retrospective observational	124	COVID-19 and influenza A/B		**COVID-19 (%)**	**H1N1 (%)**	**p value**
					Fever (>38 °C)	75.7	92.6	**0.042**
					Sputum	28.6	51.9	**0.010**
					Dyspnea	34.3	59.3	**0.007**
					Anosmia	52.9	16.7	**<0.001**
					Diarrhea	40	20.4	**0.021**
					Sore throat	20	44.4	0.052
					Headache	72.9	57.4	0.086
					Conjunctival hyperemia	4.3	29.6	**<0.001**
					Rhonchi	1.4	16.7	**0.002**

Table 2. Continued

Study	Country	Methodology of the study	Number of patients	Comparison	Results			
Li et al.[13]	China	Retrospective	116	COVID-19 and influenza		**COVID-19**	**Influenza**	**p value**
					Fever	54.4%	84.7%	**<0.001**
					Dyspnea	3.5%	8.5%	**<0.001**
					Cough	70.2%	98.3%	**<0.001**
					Gastrointestinal symptoms	14.1%	35.6%	**0.007**
					Leukocytes ($\times 10^9$ L^{-1})	7.87±2.87	9.89±4.84	**0.027**
					Lymphocytes ($\times 10^9$ L^{-1})	4.58±2.06	3.56±2.01	**0.006**
					CRP (mg/dL)	3.7±6.85	15.1±32.2	**0.001**
					Procalcitonin (ng/mL)	0.09±0.09	0.68±1.82	**<0.001**
					GGO	42.1%	15%	**0.032**
					Consolidation	5.2%	25%	**0.025**
Yin et al.[14]	China	Retrospective	60	COVID-19 and influenza A (H1N1)		**COVID-19 (%)**	**H1N1 (%)**	**p value**
					Fever	80	70	0.552
					Dyspnea	73.3	50	0.796
					Cough	73.3	96.6	**0.026**
					Expectoration	43.3	80	**0.007**
					Rhinorrhea	0	16.6	0.052
					Sore throat	0	16.6	0.052
					Diarrhea	16.6	0	0.052
					Neutrophil ($\times 10^9$ L^{-1})	3.57	4.75	**0.037**
					CRP (mg/L)	36.1	41.7	0.446
					Procalcitonin (ng/ml)	0.04	0.11	**0.002**
					GGO	90	73.3	0.181
					Consolidation	96.6	86.6	0.353
					Linear opacification	90	50	**0.002**
					Pleural thickening	90	63,3	**0.03**
Lin et al.[15]	China	Cross-sectional retrospective	57	COVID-19 and CAP caused by influenza		**COVID-19 (%)****	**Influenza (%)**	**p value**
					Fever	80	86	0.539
					Dyspnea	9	59	**<0.001**
					Expectoration	28	91	**<0.001**
					Leukocytosis	3	32	**0.002**
					Elevated CRP (>10 mg/l)	48	86	**–**
					Elevated procalcitonin (>0.1 ng/ml)	15	73	**<0.001**
					PaO_2/FiO_2 (<200 mmHg)	4	22	**0.022**
					Infiltration on imaging	29	68	**0.003**
					GGO with reticular pattern	63	0	**<0.001**
					Interlobular septal thickening	71	27	**0.001**

Table 2. Continued

Study	Country	Methodology of the study	Number of patients	Comparison	Results			
Vanhems et al.[16]	France	Retrospective	40	COVID-19 and influenza pneumonia		**COVID-19 (%)**	**Influenza (%)**	**p value**
					Fever	44.4	64.5	0.99
					Cough	22.2	100	**<0.001**
					Rhinopharyngitis or runny nose	11.1	23.1	0.99
Lee et al.[17]	Korea	Retrospective	29	COVID-19 and influenza pneumonia		**COVID-19 (%)**	**Influenza (%)**	**p value**
					Fever	100	89	0.310
					Dyspnea	100	89	0.310
					Cough	50	89	0.096
					Myalgia	45	56	0.700
					Diarrhea	10	11	1.0
					Sputum	30	67	0.106
					Leukocytes ($\times 10^9$ L^{-1})	7.47	2.68	**0.027**
					Bilateral infiltrate	100	89	0.310

*P values could not be listed because of pooled prevalence (95% CI) data.

**Most patients with COVID-19 had familial clustering (63%), which is unlikely from the influenza group.

COVID-19: Coronavirus disease-2019, GGO: Ground-glass opacity, CRP: C-reactive protein, CI: Confidence interval, H1N1: Swine influenza A, CAP: Community-acquired pneumonia

Table 3. Summary of main clinical features, as well as laboratory and radiological findings

Clinical features, laboratory and radiological tests	COVID-19 pneumonia*[5], n (%)	Influenza pneumonia*[5], n (%)	Adenovirus pneumonia**[6], n (%)
Fever	15,537 (76)	69,600 (87.7)	18 (100)
Cough	15,162 (54)	60,613 (92.5)	18 (94.4)
Dyspnea	7761 (15)	35,052 (45.1)	18 (50)
Headache	9311 (10.5)	40,223 (26.6)	18 (38.9)
Myalgia	5077 (20)	45,415 (30.6)	18 (61.1)
Diarrhea	11,421 (8.5)	31,302 (11.6)	18 (44.4)
Rhinorrhea	879 (9.3)	31,356 (44.8)	18 (5.6)
Runny nose	1758 (14)	16,432 (70.8)	-
Lymphopenia	10,185 (62.5)	8820 (49)	18 (88.9)
Elevated CRP level (>10 mg/L)	1054 (81)	5524 (60.9)	18 (100)
Thrombocytopenia (<100×10^9 L^{-1})	1811 (28.5)	1091 (9.7)	11 (61.1)
Ground-glass opacity	46,270 (71)	8825 (27)	18 (22.2)
Consolidation	1378 (75.5)	602 (41.8)	18 (77.8)

*According to the systematic-review and meta-analysis data with the highest number of patients with COVID-19 and influenza[5].

**According to the comparative data between COVID-19 and adenovirus pneumonia[6].

n: total number of participated patients, COVID-19: Coronavirus disease-2019, CRP: C-reactive protein

The main clinical features, as well as laboratory and radiological test findings, are summarized according to the systematic review and meta-analysis data of the highest number of patients with COVID-19 *versus* influenza pneumonia and COVID-19 *versus* adenovirus pneumonia (Table 3)[5,6].

In patients with COVID-19, fever was observed in 44.4-100%, dyspnea in 3.5-100%, cough in 22.2-79.5%, myalgia in 20-45%, diarrhea in 8.5-40%, and headache in 11-72.9%. In patients with influenza, fever was reported in 55-92.6% of patients, dyspnea in 8.5-89%, cough in 31-100%, myalgia in 7-56%, diarrhea in 0-20.4%, and headache in 3-57.4%.

In relevant studies, elevated CRP and procalcitonin levels were noted, respectively, in 36.1-81% and 2.8-26.8% patients with COVID-19 and 43-86% and 73-75% in patients with influenza.

Radiological findings of patients with COVID-19 revealed consolidation in 2.8-96.6%, GGO in 42.1-94.5%, and bilateral lung involvement in 76.8-100%, whereas in patients with influenza, consolidation was observed in 25-77.8%, GGO in 0-73.3%, and bilateral lung involvement in 16.5-89%.

In patients with adenovirus pneumonia, radiological findings revealed consolidation in 77.8%, GGO in 22.2%, and peripheral lung involvement in 0%. In addition, elevated CRP and procalcitonin levels were observed in 100% and 77.8% of patients, respectively. The main clinical findings were fever (100%), expectoration (77.8%), and dyspnea (50%).

Discussion

The COVID-19 pandemic has a huge impact on our daily life, and because of the high numbers of infected patients, it is vitally important to distinguish this from the other types of viral pneumonia caused by influenza or adenovirus, which may have similar signs and symptoms. Our review provides helpful information for clinicians and epidemiologists to differentiate COVID-19 from other respiratory viruses, such as influenza and adenovirus, which cause pneumonia.

Borges do Nascimento et al.[18] reported that fever was extremely common among patients admitted to hospital in COVID-19 [pooled prevalence: 84%; 95% confidence interval (CI): 80-87], and the prevalence of cough appeared to increase from ~35% to above 50%. They further revealed that among the patients admitted to the hospital, there was a wide variation in the prevalence of dyspnea (1-81%), and the association of dyspnea with disease severity in hospitalized patients was shown. Additionally, the most common radiological findings were GGO, septal thickening, and consolidation, and the pooled prevalence of any CT finding was 89% (95% CI: 83-93) among all studies on patients with COVID-19[18]. Jutzeler et al.[19] also revealed that the most frequent clinical signs and symptoms were fever (6955 of 8859 patients, 78.5%), cough (4778 of 8885 patients, 53.8%), and fatigue (1996 of 7980 patients, 25.0%), and approximately 90% of patients with COVID-19 had abnormal CT findings. The most common patterns of CT abnormalities indicated pneumonia (unilateral or bilateral, 83.6%), including air bronchogram (264 of 523 patients, 50.5%) and GGO with (153 of 323 patients, 47.4%) and without consolidation (2446 of 5.591 patients, 43.8%)[19]. Soraya and Ulhaq[20] also investigated seven studies in a meta-analysis and found significantly lower leukocyte ($p<0.00001$), neutrophil ($p=0.01$), and platelet ($p=0.0005$) counts in COVID-19 pneumonia than in non-COVID-19 pneumonia. Another meta-analysis of patients with COVID-19 revealed that the most common symptoms were fever 87% (95% CI: 73-93, $p<0.001$) and cough 68% (95% CI: 55.5-74, $p<0.001$), and also noted elevated CRP level in 79% (95% CI: 65-91, $p<0.001$) and lymphopenia in 57.5% (95% CI: 42-79, $p<0.001$) of patients. Similar to other studies, the most common radiographic findings were bilateral lung involvement in 81% (95% CI: 62.5-87, $p<0.001$), consolidation in 73.5% (95% CI: 50.5-91, $p<0.001$), and GGO in 73.5% (95% CI: 40-90, $p<0.001$) of patients[21]. In our review, variations in the prevalences of symptoms in patients with COVID-19 were noted as fever was observed in 44.4-100%, dyspnea in 3.5-100%, and cough in 22.2-79.5%. Moreover, consolidation was noted in 2.8-96.6%, GGO in 42.1-94.5%, and bilateral lung involvement in 76.8-100% of patients with COVID-19. Presentation with different stages and severities of the disease together with the high heterogeneity of the patients may be the key point of these variations in the results.

Ebell et al.[22] systematically analyzed patients with influenza with rigors. The study noted that admission within three days of the onset of illness together with fever and sweating was best at ruling in influenza, and cough, nasal congestion, and fever were the most common symptoms. Önal et al.[23] studied 103 patients with a diagnosis of acute respiratory infection and found viral pathogens in 76 patients [influenza A (n=23), influenza B (n=14), and adenovirus (n=3)] with symptoms of fever (73.8%), cough (72.8%), sore throat (45.6%), sputum (38.8%), dyspnea (36.9%), runny nose (27.8%), and headache (20.4%). Pormohammad et al.[5] revealed that sore throat and rhinorrhea were less common in patients with COVID-19 (11.5% and 9.3%, respectively) than in those with influenza types A and B (49-38% and 44.5-49%, respectively). They also revealed that most patients with COVID-19 had abnormal chest radiology (84%) than those with influenza types A (57%) and B (33%), with more frequent GGO and consolidation cases[5]. Based on these findings, they concluded that SARS-CoV-2 targets the lower respiratory system and unlikely cause influenza infections[5]. Lin et al.[15] also analyzed 57 patients [COVID-19 (n=35) and community-acquired pneumonia (CAP) by influenza (n=22)] with high fever (≥39.0 °C; 11% vs. 45%), dyspnea (9% vs. 59%), leukocytosis (3% vs. 32%), elevated CRP levels (>10 mg/L, 48% vs. 86%), elevated procalcitonin levels (>0.1 ng/mL, 15% vs. 73%), PaO_2/FiO_2 <200 mmHg (4% vs. 22%), and infiltration on imaging (29% vs. 68%). They found that patients with COVID-19 were less hospitalized than patients with CAP caused by the influenza virus and that GGO with reticular pattern (63% vs. 0%; $p<0.001$) and interlobular septal thickening (71% vs. 27%; $p=0.001$) was more frequently seen in the chest CT findings of the patients with COVID-19.

Gu et al.[24] reviewed the adenovirus disease in 228 patients and found that the adenovirus type B species was more isolated in patients with pneumonia (45 of 228 cases, 19.7%). Jiang

et al.[6] retrospectively analyzed 54 patients [COVID-19 (n=36) and adenovirus pneumonia (n=18)] and found that the median body temperature of the adenovirus pneumonia cohort was significantly higher (p<0.001), and 77.8% of patients with adenovirus pneumonia had a productive cough than patients with COVID-19 (13.9%; p<0.001). They also revealed that constitutional symptoms including headache (16.7% vs. 38.9%, p=0.072), myalgia (8.3% vs. 61.1%, p<0.001), diarrhea (8.3% vs. 44.4%, p=0.002), and sore throat (8.3% vs. 27.8%, p=0.058), and laboratory abnormalities such as thrombocytopenia (2.8% vs. 61.1%, p<0.001), lymphocytopenia (61.1% vs. 88.9%, p=0.035), elevated CRP (36.1% vs. 100%, p<0.001), and elevated procalcitonin (2.8% vs. 77.8%, p<0.001) were less common in patients with COVID-19[6]. Finally, on radiological CT findings, peripherally distributed GGO and patchy shadowing were recorded significantly in patients with COVID-19 (91.7% vs. 0%; p<0.001 and 88.9% vs. 22.2%; p<0.001), whereas consolidation and pleural effusion were present more frequently in patients with adenovirus pneumonia (77.8% vs. 2.8%; p<0.001 and 72.2% vs. 2.8%; p<0.001)[6].

In our review, clinical symptoms such as fever, cough, dyspnea, headache, diarrhea, and myalgia, and laboratory findings including elevated acute phase reactants, leukocytosis, and lymphopenia had different percentages that favor both COVID-19 and influenza/adenovirus pneumonia. However, rhinorrhea or runny nose was less frequently seen in COVID-19 than in influenza pneumonia. The main radiological finding in patients with COVID-19 that distinguishes from influenza/adenovirus pneumonia was GGO with peripheral and/or bilateral involvement.

The main limitation of our study is that statistical analysis could not be performed because of the heterogeneity of the results. Also, the results could not be compared in different age groups because of the differences in inclusion criteria in each study. To compare the similarities or differences of these viral pneumonia clinics, more systematic reviews or meta-analyses should be performed.

Conclusion

Although this study was a narrative review of the literature, we described comparatively the clinical, laboratory, and radiological findings of COVID-19 *versus* influenza and adenovirus pneumonia. In clinical symptoms, we found that rhinorrhea or runny nose was less frequently seen in patients with COVID-19 than with influenza pneumonia. In conclusion, although these viral pneumonia clinics share similar patterns of symptoms and laboratory findings, we believe that there are some distinctions, especially in radiological findings. Main radiological findings are predominant pattern of GGO with bilateral and/or peripheral distribution in patients with COVID-19 and consolidation pattern in adenovirus or influenza pneumonia patients. Because of the heterogeneity of the studies' populations and lack of disease severity data at presentation, we are unable to conclude a distinct clinical symptom or laboratory result to distinguish COVID-19 from adenovirus or influenza pneumonia.

Ethics

Peer-review: Externally and internally peer-reviewed.

Authorship Contributions

Concept: U.Ö., H.A., Design: U.Ö., H.A., Data Collection or Processing: U.Ö., A.U., H.A., Analysis or Interpretation: U.Ö., A.U., H.A., Literature Search: U.Ö., Writing: U.Ö., H.A.

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