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Research Article

Impact of COVID-19 Pandemic on Hospitalization for Influenza-Related Pneumonia: A Cross-Sectional Study

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Abstract

Introduction: Since the introduction of the first measures designed to tame the COVID-19 pandemic, several speculations have been made about their simultaneous effect on seasonal influenza. Although social distancing policies could be effective in mitigating influenza spread, the ultimate consequences remain unknown.

This study aims to evaluate the effect of the COVID-19 pandemic on influenza related-pneumonia in hospitalized patients.

Methods: We conducted a cross-sectional retrospective analysis to evaluate the rate of influenza-related pneumonia in the current pandemic year (April 2020 to March 2021), compared to the previous five years (April 2015 to March 2020). Analysis was based on the clinical records and ICD-9 diagnosis code of all adult patients admitted for pneumonia at Fondazione Policlinico Universitario A. Gemelli, IRCCS of Rome. The diagnosis of pneumonia caused by influenza and by other common respiratory tract viral infections was assessed.

Results: Overall 15,029 (15.2%) hospitalized for pneumonia were considered. Patients' median age was 76 years [inter quartile range 64-84); males were 8652 (57.6%). Influenza-related pneumonia almost disappeared in 2020-2021 (0.0002%) compared previous five years (1.5%). Conversely, other virus-related pneumonia had a similar incidence in both the evaluated periods.

Discussion: The present analysis suggests that during the COVID-19 pandemic the cases of influenza-related pneumonia were basically absent among our hospitalized patients. Interestingly, other virus-related pneumonia showed a countertrend, and the actual incidence rate was slightly higher than the previous five years. Further investigations are needed to assess the ultimate effect of the COVID-19 pandemic on the total trend of influenza and other respiratory tract infections.

Introduction

Since the introduction of the first measures designed to tame the COVID-19 pandemic, several authors have speculated about the simultaneous effect on seasonal influenza [1]. Both SARS-CoV-2 and influenza are predominantly spread through respiratory droplets during close community contact. Consequently, social distancing policies could be effective in mitigating influenza spread. On the other hand, it has been speculated that influenza season could just fan the flames of the COVID-19 plague.

First reports suggest that COVID-19 measures are quashing both influenza and most respiratory diseases [1]. However, it is still unclear if the drop in influenza diagnosis is due to an effective cases reduction. Worldwide, the seasonal influenza cases in 2020 were lower than the previous year, but not unprecedented low [2].

However, since in most countries the social distancing measures were started in the early spring 2020, the peak of expected effect on influenza should be seen in the current 2020-21 winter. In Italy, severe lockdown measures have been in place since early March 2020 and are still ongoing, and available reports suggest a 2020-21 influenza incidence lower than the previous year (0.12%, vs. 4.6% in2019-20) [3]. No

data are available regarding hospitalized patients and influenza-related pneumonia.

Methods

Study design

We conducted a cross-sectional retrospective analysis to evaluate the rate of influenza-related pneumonia in the current pandemic year (April 2020 to March 2021), compared to the previous five years (April 2015 to March 2020).

Analysis was based on the clinical records and ICD-9 diagnosis code of all adult patients admitted for pneumonia through the Emergency Department (ED) of Fondazione Policlinico Universitario A. Gemelli, IRCCS of Rome.

We selected all patients admitted for pneumonia during the study period, and compared the diagnosis of influenza in the pandemic period compared to the previous five years. To correct our analysis for the number of tests made for viral pneumonia, we assessed the diagnosis of pneumonia due to other common respiratory tract viral infections.

Among the patients admitted for pneumonia, we identified those with flu-related pneumonia diagnosis, as well as those with pneumonia of other etiology, including COVID-19, other Corona viruses, and common respiratory tract infections.

For each patient, the flu-related pneumonia diagnosis was based on the ICD-9 coding at discharge. The diagnosis of flu infection, such as COVID-19 diagnosis, was assessed in our institution by nasopharyngeal swab molecular analysis. Patients with overlapping or uncertain clinical and radiological findings, based on the institutional protocols, had repeated sample analyses to assess the final diagnosis.

Study outcomes

The primary study outcome was the incidence of flu-related pneumonia in the COVID-19 pandemic period compared to the 5 previous years.

As secondary endpoints, we evaluated the overall outcome of these patients, including the length of hospital stay (LOS), the need for mechanical ventilation (VM), and the in-hospital deaths.

Statistical analysis

Continuous variables were reported as median [inter quartile range], and are compared at univariate analysis by Mann-Whitney U test. Categorical variables were reported as absolute number (percentage), and are compared by Chi-square test (with Fisher's test if appropriate).

A two-sided $p \leq 0.05$ was considered significant. Data were analyzed by SPSS v25® (IBM, Armonk NY, USA).

Statement of ethics

The study was conducted in accordance with the Declaration of Helsinki and its later amendments, and was approved by the local Institutional Review Board (IRB #001705520).

Results

Overall 99,088 patients ≥ 18 years were hospitalized (males 53.9%) in the evaluated period. Among these 15,029 (15.2%) had a pneumonia diagnosis and were considered. Patients median age was 76 years [inter quartile range 64-84); males were 8652 (57.6%).

Influenza-related pneumonia almost disappeared in 2020-2021 (0.0002%) compared previous five years (1.5%) (Figure 1). Conversely, other virus-related pneumonia had a similar or higher incidence compared to 2015-2019. (Table 1) shows the comparison between the pandemic period and the previous five years.

Discussion

The present analysis suggests that during the COVID-19 pandemic the cases of influenza-related pneumonia were basically canceled. This finding suggests a very low incidence of flu in the general population during the period. Indeed, most people with flu do not seek medical assistance and do not need hospital admission. Thus, in any given country the overall incidence of flu in the population is mostly speculative, and is often derivate from questionnaires and absences from work in the "flu season". For this reason, we evaluated the "flu pneumonia" cases, which are an objective surrogate of the overall incidence of flu in the general population.

Interestingly, although the overall cases of flu-related pneumonia were scarce in the pandemic period, the other virus-related pneumonia showed a countertrend, and the actual incidence rate was slightly higher than the previous five years. This could either be related to a more accurate viral screening of the hospitalized patients, or to a different effect of pandemic measures on the spreading of these viruses.

It should be pointed out that increased influenza vaccination could not explain these findings, since although increased in 2021, the overall coverage in the Italian population barely reaches 17% [4].

The extensive use of personal protection devices, such as face masks, and increased hand hygiene, could be advocated for this impressive reduction [5]. Similarly, the severe lockdown measures could have indeed played a positive effect.

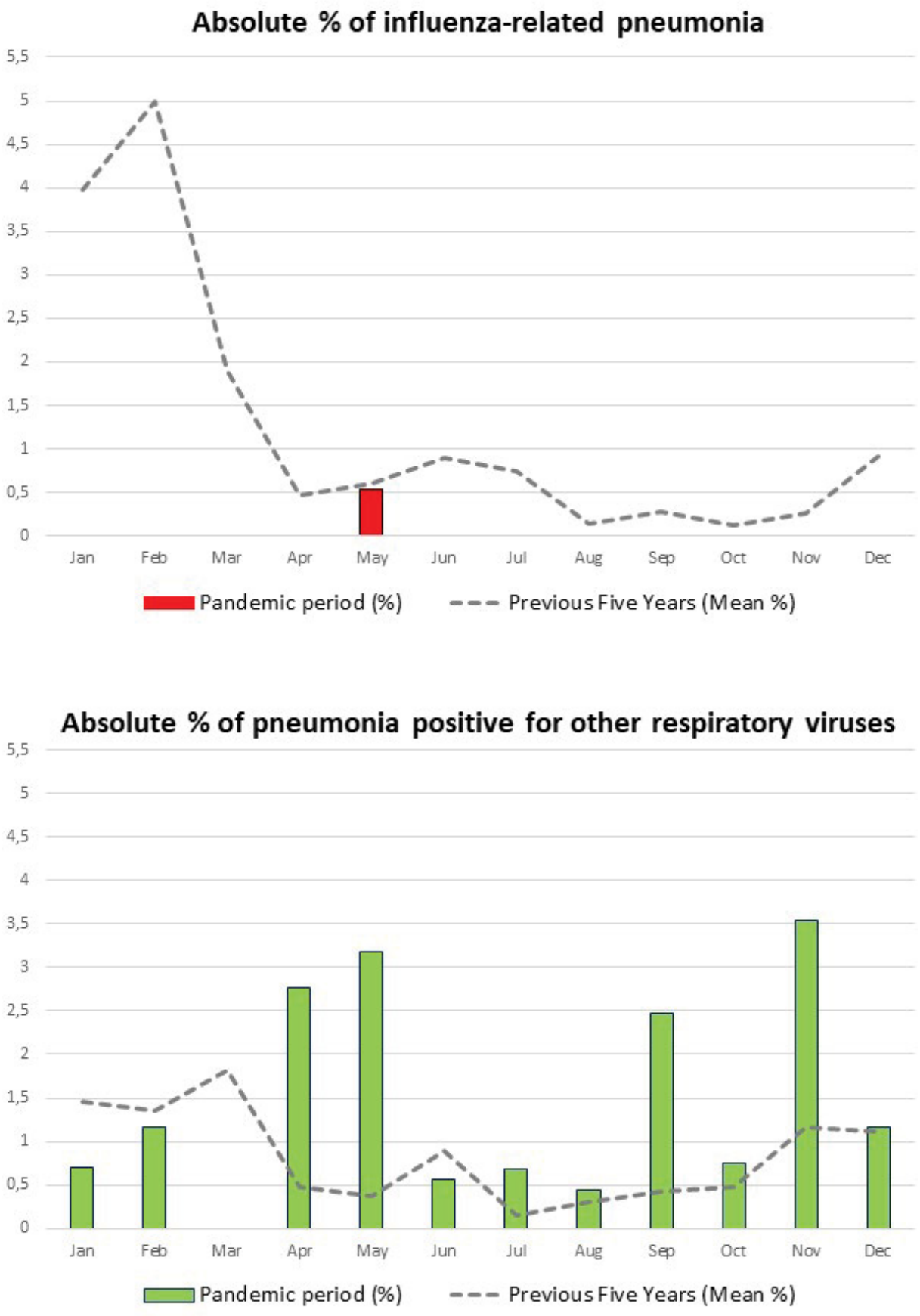

Figure 1: Absolute percentage of patients with pneumonia positive for influenza and other respiratory viruses in the "pandemic" period compared to the mean percentage in the previous five years.

Table 1: Demographic and epidemiological features of patients hospitalized for pneumonia.

	All Cases n 15029	Pandemic period April 2020 – March 2021 n 4411	Previous five years April 2015 - March 2020 n 10618	*p* Value[#]
Sex *(males)*	8652 (57.6%)	2605 (59.1%)	6047 (57.0%)	0.017
Age *(years)*	76 (64-84)	73 (60-83)	77 (67-85)	< 0.001
Influenza related pneumonia	162 (1.1%)	1 (0.0002%)	161 (1.5%)	< 0.001
Other virus pneumonia[*]	165 (1.1%)	65 (1.5%)	100 (0.9%)	0.004
Coronaviruses[§]	3054 (20.3%)	2992 (67.8%)	62 (0.6%)	< 0.001
Mechanical Ventilation	2324 (15.5%)	1468 (33.3%)	856 (8.1%)	< 0.001
Length of hospital stay*(days)*	11.2 (7.1-18.4)	11.7 (7.1-19.3)	11.0 (7.11-8.0)	0.003
Deceased	2452 (16.3%)	891 (20.2%)	1561 (14.7%)	< 0.001

[*]include respiratory syncytial virus, adenovirus, rhinovirus, parainfluenza virus, and metapneumovirus; [§]include Coronaviruses HKU1, NL63, 229E, OC43, and SARS-CoV-2; [#]Data were compared by Mann-Whitney U test (continuous variables) and Chi-square test for categorical variables. Continuous variables are expressed as median (interquartile range); categorical as total number (%).

A further clue could be searched in the worldwide reduction in ED visits in 2020. People fearing COVID-19 infection could have avoided searching for medical attention, even in cases of severe illness. Nonetheless, available data suggest that while most ED visits dropped, influenza-like illness visits showed a considerable increase compared to previous years [6,7].

An additional explanation could be found in the collapse of air travel and international travel. Influenza typically spreads around the world following the movement of people, and the reduction of travelers may certainly have contributed to the reduction in its spread. However, given the unprecedented situation, this can only be speculated.

Finally, it could not be excluded that the direct viral competition between SARS-CoV-2 and common respiratory viruses could have modified the overall respiratory *"viral bioma"* in the Italian population.

Indeed, it was described that other strains of corona viruses could compete for infection with SARS-CoV-2 in children [8]. On the other hand, it has also been found that the epidemiology of metapneumovirus infections did not change during the COVID-19 outbreak [9]. Hence, the ultimate effect of viral competition on the total trend of influenza and other respiratory tract infections has yet to be investigated.

Conflict of Interest Statement

The authors declare no conflict of interest.

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