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The Lethal Spanish Influenza Pandemic in Poland

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The Spanish influenza pandemic in the years 1918–1920 was the largest and most tragic pandemic of infectious disease in human history. Deciphering the structure of the virus (including the determination of complete genome sequence) of this pandemic and the phylogenetic analysis and explanation of its virulence became possible thanks to molecular genetic analysis of the virus isolated from the fixed and frozen lung tissue of influenza victims who died in 1918 and were buried frozen in Alaska and Spitsbergen. Epidemiological data from the course of this pandemic in Poland have not been previously published.

For analysis, we used source materials such as clinical studies and case reports of doctors fighting against the pandemic and registries of influenza cases in units of the Polish Army and military hospitals.

Clinically, the pandemic of 1918 was characterized by the same symptoms and course as influenza in other years. Pathologically, the disease was similar to the other pandemic, in that the destruction was mostly limited to the respiratory tract.

The “Spanish” influenza pandemic of 1918–1920 took place in Poland in 3 epidemic waves. The peaks of morbidity and mortality occurred in the capital, Warsaw, in December 1918 and in December 1919 to January 1920. It is estimated that throughout the pandemic period of 1918–1920 in Poland, 200 000 to 300 000 people died.

MeSH Keywords:

Epidemiological Monitoring • Influenza Pandemic, 1918–1919 • Poland • Public Health

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Pandemic Influenza in Poland 1918–1920

The influenza pandemic in the years 1918–1920 was the largest and most tragic pandemic of infectious disease in the history of mankind [1–5]. Its clinical, epidemiological, and (almost 80 years later) virological molecular analysis [6,7] confirm its uniqueness and continues to fascinate. Epidemiological studies, although on a different scale and with different accuracy, have been essential for the assessment of the dynamics of its spread, severity, and complications. In Poland, which was particularly affected by the struggles of World War I, reviving its independence after 123 years of partitions and entangled in the defense of all of its borders, data on the size and effects of the 1918–1920 influenza pandemic were considered as residual, “which is understandable because of the partitions and war and forming the structure of the Polish state” [2,8]. A source search was carried out, including archival queries that discovered data, allowing us to accurately trace the 1918–1920 pandemic of Spanish influenza in Poland, as well as its complications and sequels. Particularly informative are the records of the Epidemiological Commission of the newly-formed League of Nations and its co-organizer, Polish delegate Dr. Ludwik Rajchman (1881–1965), who was later a co-founder of UNICEF [9] and who in 1919 published on the ongoing “Spanish” influenza pandemic [10]. The cornerstone of multidirectional influenza research was the isolation of influenza virus in humans in 1933 by 3 English researchers – C. Andrews, W. Smith, and P. Landlaw – in London. Currently, there is the WHO Collaborating Center (WHO CC) for Reference and Research on Influenza at the Francis Crick Institute in London, UK. The influenza virus undergoes constant antigenic changes. This results from the structure of the virus. As a consequence, new strains emerge that cause seasonal outbreaks. They arise as a result of minor changes called antigenic drift, and large antigenic changes called antigenic shift, and a consequence of that is a pandemic. The first influenza pandemic of the 20th century was the Spanish flu of 1918–19 caused by subtype A(H1N1) of the virus, which was characterized by unusual virulence and consequently extremely high mortality.

Material and Methods

For this analysis, all available source materials were used. These are:

1. Official materials of Polish authorities. According to the first census of 30/09/1921, the Polish population was 27.2 million. The Act of 25 July 1919 on the fight against infectious diseases and other diseases that occur commonly (Journal of Laws of the Republic of Poland of 1919 No. 67, item 402) introduced the obligation of notification and registration of morbidity and mortality for 21 infectious diseases (without, however, influenza). On its basis, on 19 February 1920 the

Minister of Public Health issued a regulation “obliging doctors to report cases of influenza, combined with pneumonia and pleurisy”.

2. Analysis of deaths from influenza in 1918–1920 published in French in the newly created Epidemiological Chronicle, developed by epidemiologist and pediatrician, and later a prominent Polish pediatrician, Professor Władysław Szenajch (1879–1964) [11]. This analysis was based largely on “Weekly Newsletters” of the Statistics Department of the Municipality of Warsaw.
3. Clinical studies and case reports of doctors fighting the pandemic [10,12–16], summarized in the monograph on pandemic influenza in Poland in 1918–1920 by Professor S. Bronowski [17]. In addition, these pandemics were extensively discussed, from the perspective of almost 30 years, by a leading Polish internist, Professor. Anastazy Landau (1876–1957) in an important textbook on infectious diseases [18]. Bronowski, Zielinski, and Landau gave fragmentary epidemiological data that were used.
4. The registry of influenza cases in units of the Polish Army and military hospitals was used [19], together with data on infectious diseases in hundreds of thousands of soldiers fighting at the front against Soviet Russia in the years 1918–1921 (the Polish-Bolshevik War).

Course of Pandemic in Poland

As in most countries of the world, the “Spanish” influenza in Poland occurred in 3 epidemic waves. The first cases of “Spanish” influenza appeared in June–July 1918 in Lviv, and in mid-September 1918 in Krakow, 2 great cities of southern Poland, during the disintegration of Poland due to the Austro-Hungarian Partition. In July 1918, influenza also appeared in the capital, Warsaw, located in the center of the country, and in October in the center of the coal mining area, Sosnowiec (south-west Poland); both cities belonged to the former Russian Partition, and in 1918 they were under German occupation. During this period (the end of World War I), these lands and cities were acquired by the Polish Army, and were inhabited by Poles and the soldiers of the former occupying armies (Germany, Austria-Hungary, and Russia). On 11 November 1918, there was an announcement of independence, and Marshal Józef Piłsudski became the head of state. From the beginning, there were struggles for the defense of the borders of the reviving country [20].

In the capital, Warsaw (in 1914 it had 884 500 inhabitants and in 1920 about 900 000), influenza appeared in July 1918 and was very mild. Over the 7 weeks from the beginning of July until the second half of August 1918, there were only 5 deaths. Severe cases appeared only after mid-September 1918. The 37th week of 1918 was the first week in which at least 10 deaths occurred. “This epidemic intensified very gradually,

Figure 1. Warsaw: Deaths from influenza in 1918, 1919, and 1920.

and only after 13 weeks duration achieved the highest severity” [11], and during the 50th week, in December 1918, there were 92 deaths (Figure 1). Then, the epidemic subsided, and ended at the end of May 1919. In the 22nd week of 1919, for the first time, a fatal case was not reported. “In the second half of 1919 there were only occasional and isolated serious cases”. Another recurrence (a wave) of the epidemic appeared at the end of 1919 and rapidly grew. At the 52nd week (21–27 December 1919), for the first time there were 7 deaths, in the next week (28 December 1919 to 3 January 1920) 79 people died, and the week after that (4–10 January 1920), the number of deaths was 158 (Figure 1). “After the intensity of the epidemic, it began to fall rapidly and at the 9th week of 1920 there were only 9 deaths. As we can see, outstanding differences occur between the epidemic of 1918–1919 and the intensity of 1919–1920. There was a gradual several-week development and slow decline, then a 2-week rapid development and rapid decline” [11]. The author also cites the following:

- The interval between the largest intensification of epidemics 1918/1919 and 1919/1920 was 55 weeks.
- The gap between the nearly complete end of the epidemics 1918/1919 and the beginning of the epidemic 1919/1920 was 30 weeks.
- Between the end of one of the epidemics and the highest intensity of the other, 33 weeks passed.
- From July 1918 to 21 February 1920, 1198 people died from influenza in Warsaw.

The data from Warsaw quoted above concern, unfortunately, only the number of deaths, and the number of cases/incidences is not known. Nevertheless, from the numerous descriptions of the course of the pandemic in 1918–1919 in Warsaw, we know that the next waves of the pandemic were accompanied by more severe clinical course, and thus higher fatality. Figure 1 shows that the 2 “peaks” of mortality resulted not only from an increase in the number of cases, but also from increased fatality. In this period, epidemic *Encephalitis lethargica* also appeared in Poland and throughout Europe. An epidemiologist who described it in Warsaw associated it with incidence of influenza [21,22]. She wrote that in 1920, 164 cases of the disease were recorded (including 31 in Warsaw) and that there was a significant underestimation of the number of patients because “every neurologist had 30–60 such patients.” The

course of the pandemic and its different “waves” in Warsaw remains consistent with the description of the pandemic in different parts of Poland, as summarized by Bronowski and Landau. The latter wrote that, initially, in the summer of 1918, cases of influenza proceeded smoothly, without complications, but in the autumn pulmonary complications began to appear, and their frequency visibly grew (“a lot of pulmonary complications”). Landau wrote that in the 1918–1920 pandemic in Poland, 96% of deaths were due to pneumonia (and complications associated with it), and so showed the course of the pandemic waves in our country; “The first wave: the course of this wave was a little malicious, the peak of its severity fell in June–July 1918. Already in the autumn of that year, a more malicious second wave of the pandemic broke, with patients much more prone to complications and with significantly higher fatality...” [18]. “The third intensification of the pandemic was in the spring of 1919, lasting for the next few years, and then, after a period of retreat, in the autumn and winter of this year still a number of smaller outbreaks were observed in 1920, which Möllers distinguished in 2 waves – January and December – and the latter had a particular tendency to formation of pulmonary and intestinal complications” [18]. In 1918, during the first wave of the pandemic, Landau reported “isolated cases of acute thyroiditis after influenza only in girls up to 20 years old” [18].

Data from other Polish regions are fragmented, beyond a clear emphasis on the spread of the disease across the country, starting from the June 1918. The number of cases in Poland during the pandemic is unknown, and is probably impossible to reproduce today. Based on the course of the pandemic in Warsaw, assuming the whole country had a fatality rate similar to that in the capital, considering that 30–50% of the population became ill in Europe, and that for every recorded case there may have been 2 unrecorded ones [18], the total number of deaths from influenza and its early complications can be estimated at between 200 000 and 300 000 in Poland. Implemented preventive measures were not very effective [17], and the pandemic caused widespread fear.

Among the testimonies of those living through the epidemic, family members of one of the co-authors of this publication reported that people died in terrible agony, there were difficulties with burials, and people provided food hung on long sticks to the ill, keeping a considerable distance [2].

Discussion

In 1918, the world population was 1.8 billion people. “Yet the 1918 influenza virus killed a likely 50 million and possibly as many as 100 million people” [3]. Dr. Jeffery Taubenberger et al., from the Department of Molecular Pathology, Armed Forces

Institute of Pathology, Rockville, Maryland, USA, began to study the molecular pathology of the “Spanish” influenza virus”, then continued with John Oxford of Queen Mary University of London. Taubenberger has extracted several samples of the 1918 “Spanish” influenza virus obtained from lung tissues preserved after autopsy from bodies buried in Arctic permafrost. He successfully sequenced its genomes and, based on their rates of mutations, believes that the virus “jumped” to humans from birds in the winter of 1917–1918, 6 to 9 months prior to the lethal wave of the pandemic [6,7]. These groundbreaking studies have revealed the molecular genetics of the pandemic “Spanish” influenza virus, and explained its unusual pathogenicity. One of the characteristics of the pandemic of 1918 was its unusual virulence, reflected in the extreme severity of the disease and the prevalence of pneumonia complications. Pandemic viruses generally exhibit greater virulence in pandemics than among strains. Clinically, the pandemic of 1918 was characterized by the same symptoms and course as influenza of other years. Pathologically, the disease was similar to the other pandemic, in that the destruction was mostly limited to the respiratory tract. A much higher percentage of infected people developed severe pulmonary complications, such as flu-like pneumonia with acute massive hemorrhage to the alveoli, flu-like pneumonia with acute severe pulmonary edema, bronchial pneumonia, and flu-like pneumonia with focal bronchiolitis and inflammation of alveoli, which was confirmed by autopsy studies made of post-mortem tissue carried out by J. Taubenberger and presented during a meeting in Madrid in 2003. Based on his extensive experience with the 1918–1920 epidemic, Landau [18] tried to explain the severity of “Spanish” influenza and its high fatality rate, especially among the young and previously healthy: “In 1918–1919, most of the victims were young people between 15 and 30 years old, as all the statistics emphasized...”. He supposed that “Exploding and spreading initially in the war-torn areas, the disease primarily encountered young men, and as the pathogen was passed from person to person, it adapted humorally and developed a special affinity to the tissues of the young and healthy” [18]. The virus’s special affinity for lung tissue has been demonstrated over 60 years later [6].

Due to poverty and suffering from Soviet aggression and border wars, a significant part of Poland’s infrastructure had been destroyed and there was no efficient system for supervision of the pandemic.

As early as 1920, material [15] showing the picture and course of X-ray images of lungs of patients was published, emphasizing the diagnosis of pneumonia, which as we know from the course of the world pandemic, repeatedly became the direct cause of death [3,4,18]. Observations of Landau (e.g., about

thyroiditis or metrorrhagia) were the most precise among all the contemporary literature. The regulations promulgated by the Minister of Public Health on 19 February 1920 required reporting and registration of all cases of influenza, combined with “pneumonia or pleurisy,” and the resulting data should be considered as very accurate, both from an epidemiological and clinical point of view, and was pioneering in Europe.

Only 30 years later, the WHO in 1947 proposed the International Program for the Epidemiology and Virology during the IV International Congress of Microbiology in Copenhagen, establishing the Global Influenza Surveillance and Response System (GISRS) in 6 international WHO reference centers. In addition, the WHO is working with 143 National Influenza Centers (NIC). This surveillance aims to monitor circulating viruses, the emergence of new subtypes of the influenza virus type A as well as the appropriate selection of the influenza virus strains, to produce the influenza vaccine for a given epidemic season. Poland began its cooperation with the GISRS in 1957. The structured supervision confirmed the presence of viruses with possible pandemic potential of subtypes such as A/H5N1/, A/H7N7/, A/H9N2/, A/H7N9/, and A/H1N1/pdm09. The Department of Influenza Virus Research, the National Influenza Center in NIPH-NIH, works closely with WHO-GISRS and ECDC and performs tasks such as sending into the weekly system both the virological data for the influenza strains and the epidemiological data [23,24]. In April 1999, the WHO developed the Influenza Pandemic Preparedness Plan with the explicit command to draw up national plans. In Poland, such a plan was developed and is periodically updated [2]. In addition to GISRS, there is the European Influenza Surveillance Network (EISN), which aims to provide data to public health experts in the Member States to take appropriate actions.

Conclusions

1. A “Spanish” influenza pandemic of 1918–1920 took place in Poland in 3 epidemic waves, in which the intensity of the number of cases was also accompanied by a sharp short-term rise in the number of deaths.
2. The peaks of morbidity and mortality in the capital, Warsaw, were in December 1918 and from December 1919 to January 1920, and there were 1189 deaths reported from July 1918 to 21 February 1920.
3. It is estimated that throughout the pandemic period of 1918–1920 in Poland, between 200 000 and 300 000 people died.

Conflict of Interest

None.

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