RESEARCH LETTER

The impact of the COVID-19 pandemic on surgical treatment of lung cancer

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Introduction The outbreak of COVID-19 in 2020 led to the introduction of numerous administrative decisions aimed to slow down the pandemic.¹⁻³ Some of those decisions resulted in restrictions on the access to health care for patients with diseases other than COVID-19.⁴ The aim of the present study was to analyze the impact of the COVID-19 pandemic on surgical treatment of lung cancer in Poland.

Patients and methods The Bioethics Committee of Poznan University of Medical Sciences waived the requirement for ethics approval for this non-interventional study.

Data on all patients who underwent surgery for lung cancer from January 1, 2019 to December 31, 2020 were retrieved from the Polish National Lung Cancer Registry (PNLCR). Data on new cases of COVID-19 were retrieved from the official website of the Republic of Poland.

The primary study end point was the number of complete resections for primary lung cancer per specified time period. Secondary end points were pathological stage, duration of hospital stay, and outcome at discharge.

A questionnaire regarding restrictions in terms of lung cancer diagnosis and treatment was sent by mail to the directors of all thoracic surgery departments in Poland (Supplementary material, *Questionnaire S1*).

Statistical analysis Data were presented as absolute numbers and percentages or median and interquartile range (IQR), as appropriate. Categorical data were analyzed using the χ^2 or Fisher–Freeman–Halton test or as the difference between 2 proportions. The normality of distribution was tested using the Shapiro–Wilk test.

Comparisons between 2 groups were performed using the Mann–Whitney test. All results were considered significant at a P value of less than 0.05. Statistical analyses were performed using Statistica 13.0 (StatSoft, Tulsa, Oklahoma, Unites States).

Results The study included 7302 patients (3181 women [43.6%] and 4121 men [56.4%]) at a mean (SD) age of 66.5 (8.1) years.

The analysis of data from the PNLCR revealed that 4066 and 3236 resections for lung cancer were performed in 2019 in 2020, respectively, showing a reduction of 20.5% in the number of procedures in 2020 compared with 2019 (P < 0.001).

The number of operations decreased most significantly during the period of the greatest severity of the COVID-19 pandemic (FIGURE 1), with reductions of 21% (P < 0.001), 32% (P < 0.001), and 32% (P < 0.001) in the second, third, and fourth quarters of 2020, respectively, compared with the same quarters in 2019 (Supplementary material, *Figure S1*).

The largest decrease in the number of resections was observed in August, October, and November of 2020, wherein the number was 35% lower than in 2019 (Supplementary material, *Figure S2*).

In 2020, the number of procedures decreased in all thoracic surgery departments in Poland. The decrease in the number of procedures in 2020 ranged from 7% to 36% for individual departments (Supplementary material, *Figure S3*).

The rate of patients with more advanced pathological stage (stage III or IV) was higher in 2020 than in 2019 (20% vs 18.1%, P = 0.04). There was an increase in the rate of patients undergoing

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FIGURE 1 Month-to-month comparison of the number of resections for lung cancer in 2019 and 2020 in relation to new COVID-19 cases

preoperative endobronchial ultrasound staging procedures (15% vs 13%; P = 0.006) and video-assisted thoracoscopic surgery in 2020 compared with 2019 (46% vs 41%; P < 0.001). In-hospital mortality did not differ between 2019 and 2020 (1.1% and 1.0%; P = 0.85). The median (IQR) durations of total and postoperative hospital stays were significantly shorter in 2020 compared with 2019 (8 [6–12] vs 9 [7–12.5] days; P < 0.001 and 6 [4–8] vs 6 [5–8] days; P < 0.001, respectively) (Supplementary material, *Table S1*).

Among all 29 thoracic surgery departments in Poland, 11 departments, which treated 61% of patients, responded to the questionnaire. The following reasons were recognized by all questionnaire participants as main causes of the diminished number of lung cancer surgeries: conversion of pulmonology departments in the region into departments designated to treat patients with COVID-19, lower number of referrals from pulmonologists, and significant difficulties in getting an appointment with primary care physicians. Between 30% and 75% of the pulmonology departments in each region were closed for a period of 4 to 12 months.

Temporary closures of thoracic surgery departments or operating theaters, division of surgical teams, or other sanitary measures implemented to limit the spread of SARS-CoV-2 in thoracic surgery wards were not indicated as the cause of the decrease in the number of procedures.

Discussion Our study results clearly indicate that the COVID-19 pandemic and its impact on the health care system had an adverse effect on the treatment of patients with lung cancer and led to a marked reduction in lung cancer referrals, a 20% reduction in the number of resections with curative intent, and a higher pathological TNM stage in operated patients. The higher percentage of patients who underwent surgery for more advanced lung cancer is a concern

as this might have been due to delayed diagnosis. We predict the escalation of this unfavorable trend at the end of 2021 and in the beginning of 2022, because the pandemic is unlikely to end in the coming months.

There was no decline in the quality of surgical treatment for lung cancer, with sustained increases in the number of patients undergoing invasive mediastinal staging with endobronchial ultrasound and minimally invasive surgery. There was no change in in-hospital mortality, which remained at a low level of 1%. The durations of total and postoperative hospital stays were also shorter in 2020 compared with 2019. This phenomenon might be related to the policy of minimizing the risk of acquiring SARS--CoV-2 infection during hospitalization, which was largely in line with the acceleration of implementation of the Enhanced Recovery After Surgery protocols.⁵

Responses to the questionnaire revealed that, contrary to the study by Hilzenrat et al,⁶ temporary closure of thoracic surgery units, temporary division of surgical teams to minimize the risk of suspending activities due to SARS-CoV-2 infection, and changes in the functioning of operating rooms did not have a significant impact on the surgical capacity of any of the thoracic surgery departments throughout 2020. This additionally emphasizes difficult access to general practitioners, closure of pulmonology departments, and a lower number of lung cancer referrals as the main reasons for the decrease in the number of lung cancer operations.⁷ This indicates that the increase in the number of hospital beds for patients treated for COVID-19 should result from opening of new temporary hospitals rather than from conversion of pulmonary departments into units designated to the treatment of patients with COVID-19, as this could have serious consequences for individuals diagnosed with and treated for pulmonary diseases.

Numerous recommendations published in the early days of the pandemic suggested stereotactic body radiation therapy, induction chemotherapy, or delaying surgery in early-stage, operable lung cancer in the event of worsening pandemic conditions.^{8,9} In contrast, Mayne et al¹⁰ found that delayed surgery was associated with worse survival in patients with stage IA2-IB adenocarcinoma and stage IB squamous cell carcinoma. As revealed in our study, no center in Poland had to change the qualification criteria for surgical treatment of lung cancer during the pandemic. Our opinion, which is in line with other publications, is that if sanitary measures are in place and patients are tested for SARS-CoV-2 on admission, there is no need to change the qualification criteria and surgery should not be postponed.¹¹ Despite the undisputable differences in the organization of health care systems across countries, the issues appear to be common and negative consequences of the pandemic for patients with lung cancer may persist in the future.¹² Utmost effort is necessary to minimize the negative impact of the COVID-19 pandemic on the treatment of patients with lung cancer.

Strengths and limitations The most important strength of the study was collection of data on approximately 95% of all resections performed each year due to the obligatory inclusion of data regarding surgical treatment of lung cancer into PNLCR in Poland.

The main limitation was the lack of possibility to objectively assess all factors that might have contributed to the decrease in the number of lung cancer resections. Certainly, data on the number of computed tomography scans, bronchoscopic procedures, and the number of people evaluated in lung cancer screening programs, would be very valuable.

Another limitation was related to the fact that transformation of pulmonary units into departments designated to the treatment of patients with COVID-19 was a local strategy adopted in Poland and might not be observed in other countries. However, the COVID-19 pandemic has led to significant disruptions in health care systems and is likely to have affected the quality of diagnosis and treatment of cancer patients, including those with lung cancer, worldwide.

Conclusions The COVID-19 pandemic was associated with a significant reduction in the number of patients undergoing surgery for lung cancer in Poland, which resulted mainly from difficult access to general practitioners and pulmonary departments. Higher clinical stage of cancer in operated patients may increase the risk of worse long-term outcomes in subsequent years.

SUPPLEMENTARY MATERIAL

Supplementary material is available at www.mp.pl/paim.

ARTICLE INFORMATION

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CONFLICT OF INTEREST None declared.

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