

Aim of the study: To assess the impact of the COVID-19 pandemic on the diagnosis and treatment of patients at a tertiary hospital in Poland.

Material and methods: This was a retrospective review of head and neck cancer patients who presented to the multidisciplinary tumour board (MTB) during the 12-month period from March 2020 to February 2021 and compared to patients who presented to the MTB during the prior, pre-pandemic 12-month period from February 2019 to March 2020: Patient demographic and clinical variables were compared: sex, age at diagnosis, distance from hospital, date of first visit, radiological diagnosis, pathology specimen, MTB meeting, and initiation of primary and adjuvant treatment

Results: The number of patients who presented to the MTB increased by 22% (278 to 340) from the pre-pandemic to the pandemic period. The mean time from MTB presentation to treatment initiation increased significantly from 17.1 to 21.7 days. The mean time from first visit to treatment start increased from 44.7 to 54.4 days. The proportion of patients with early-stage oropharyngeal cancer who underwent primary surgery rose from 47.3% to 86.6%. The percentage of patients who received palliative radiotherapy increased from 20.5% to 32.9%. The proportion of patients who received best supportive care rose from 1.8% to 6.2%.

Conclusions: One of the most notable findings of this study was the increased time from first visit to treatment initiation, which could negatively impact patient outcomes. The differences in the treatment received in these two periods should be further evaluated to determine their influence on survival.

Key words: COVID-19, head neck, pandemic, oncology, impact.

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The impact of the COVID-19 pandemic on the management of head and neck cancer patients at a tertiary care institution in Poland

Mateusz Szewczyk¹, Jakub Pazdrowski¹, Paweł Golusiński²,
Paweł Pazdrowski³, Barbara Więckowska⁴, Wojciech Golusiński¹

¹Department of Head and Neck Surgery, Poznan University of Medical Sciences, Poznan, Poland

²Department of Otolaryngology and Maxillofacial Surgery, University of Zielona Gora, Poland

³Head and Neck Surgery Student Group, Department of Head and Neck Surgery, Poznan University of Medical Sciences, Poznan, Poland

⁴Department of Computer Science and Statistics, Poznan University of Medical Sciences, Poznan, Poland

Introduction

In December 2019, the first patient was diagnosed with severe acute respiratory syndrome coronavirus disease (SARS-Cov-2), eventually leading to a global pandemic. The clinical manifestations of coronavirus disease 2019 (COVID-19) can vary widely, ranging from mild respiratory symptoms to severe viral pneumonia, which may be followed by respiratory failure and death [1]. Shortly after the emergence of the virus, treating patients with COVID-19 became a key priority and severe restrictions were put in place, thus limiting health care resources, even in hospitals that do not treat these patients. Unsurprisingly, these restrictions also affected the care of cancer patients in terms of access to diagnosis and treatment [2].

In this context, the aim of the study was to assess the impact of COVID-19 on the diagnosis and treatment of patients at the Greater Poland Cancer Center (GPCC), a comprehensive cancer care centre. We compared the characteristics of patients diagnosed with head and neck cancer during the 12-month, pre-pandemic period prior to implementation of pandemic-related restrictions in Poland in March 2020 to patients diagnosed and treated during the pandemic period (March 2020 to February 2021). More specifically, we sought to determine whether there were any differences between the two periods in terms of demographic and clinical variables, and the impact of the pandemic on the diagnosis and treatment of these patients.

Material and methods

This was a retrospective review of all head and neck cancer patients who presented to the multidisciplinary tumour board (MTB) during the 12-month period from March 1, 2020 to February 28, 2021. This patient group was compared to patients who presented to the MTB during the prior, pre-pandemic 12-month period (February 1, 2019 to February 28, 2020).

Patients who had received any prior head and neck treatment at the GPCC were excluded from the analysis due to the risk of bias as these patients would have had greater access than newly diagnosed patients to the outpatient department. Patients with thyroid cancer were also excluded from the study to avoid influencing the study results given that the preoperative assessment and post-operative treatment of these patients are performed at other treatment centres (not at the GPCC).

Multidisciplinary tumour board meetings were held weekly during the pandemic via teleconference, but otherwise the decision-making process remained the same as during the pre-pandemic period. Patient demographic and clinical variables evaluated included sex, age at diagnosis, distance from the GPCC, and dates of the following: first visit, radiological diagnosis, pathology specimen, MTB meeting, and initiation of primary and adjuvant treatment, and centre where radiological and histopathologic diagnostics were performed (GPCC or other). Tumour characteristics, including primary site, TNM status (T – size of the tumour and any spread of cancer into nearby tissue, N – spread of cancer to nearby lymph nodes, M – metastasis) – 8th edition, and nodal status were recorded. Primary treatment was categorised as radical-intent (surgery, radiotherapy, and/or induction chemotherapy) or palliative treatment (radiotherapy and/or best supportive care).

Due to the retrospective nature of the study, the approval of the Research Ethics Board at the local University of Medical Sciences was not considered necessary.

Statistical analysis

The comparative analysis of the quantitative data was performed with Student's t-test for independent groups (unpaired t-test) or the *U* Mann-Whitney test if the normality assumption was not met. The Kolmogorov-Smirnov test was used to evaluate the normality of the distribution. Dichotomous variables were compared with the χ^2 test when Cochran's condition was met or Fisher's exact test when it was not met. To compare multiple proportions within one hypothesis, the test for one proportion was used.

Results

A total of 278 patients were discussed at MTB meetings in the pre-pandemic period versus 340 patients during the pandemic, an increase of 22%. No difference was found between the percentage of male patients, mean patient age, or place of residence (Wielkopolska province or elsewhere) (Table 1).

Similarly, no differences were observed in the percentage of patients receiving radiological diagnosis at the GPCC (49% vs. 50%). However, the proportion of patients whose histopathologic evaluation of the biopsied tumour

was performed at the centre increased from 48.6% in the pre-COVID period to 57.4% ($p = 0.029$) (Table 1).

The mean time from first visit to the MTB meeting differed slightly (but not significantly) from the pre-pandemic to the pandemic period (27.9 vs. 33.5 days, respectively). The mean time from presentation at the MTB to treatment initiation increased significantly from 17.1 to 21.7 days ($p = 0.006$). Similarly, the mean time from first visit to treatment start also increased significantly (44.7 vs. 54.4 days, $p = 0.004$) (Table 1).

The percentage of oral cancer patients decreased significantly from 45.3% to 32.1% ($p = 0.01$) while the proportion of nasopharyngeal cancer patients rose from 0.4% to 3.2% ($p = 0.01$). There were no significant differences between the two time periods in the overall percentage of locally advanced (stage T3-T4) cases (54% vs. 53%), nor by tumour location (i.e., oral cancer, nasopharyngeal cancer).

No differences were observed in the percentage of patients with nodal involvement (N+ disease), which increased slightly (not significantly) from 51.5% to 55.6%. However, the proportion of patients with nasopharyngeal cancer and N+ disease was significantly higher in the COVID-19 period (0.7% vs. 5.3%, $p = 0.038$). The percentage of patients with advanced disease (stage T3-T4) at diagnosis was comparable (67.5% vs. 72.6%, respectively) (Table 2).

No significant differences were detected in the percentage of patients undergoing surgery (71% vs. 75.4%), nor were any differences observed for this same variable by cancer site: in patients with early-stage laryngeal cancer, 80.5% underwent surgery in the pre-pandemic period vs. 74% during the pandemic. By contrast, for patients diagnosed with early-stage oropharyngeal cancer, the percentage of patients who underwent primary surgery increased significantly from 47.3% to 86.6% ($p = 0.001$) (Table 3).

The percentage of patients who received palliative radiotherapy increased significantly, from 20.5% to 32.9% ($p = 0.001$). In addition, the proportion of patients who received best supportive care also increased significantly, from 1.8% to 6.2% ($p = 0.007$).

The meantime from surgery to the start of adjuvant radiotherapy remained essentially unchanged (57.5 vs. 56.3 days) (Table 3). Regarding primary and adjuvant radiotherapy, prolonged overall treatment time (OTT) was observed, due

Table 1. Patient demographic characteristics and time frames for disease diagnosis and treatment

	Pre-pandemic, n (%) N = 278	COVID-19 period, n (%) N = 340	p-value
Sex, males	206 (74.1)	263 (77.4)	0.347
Mean age at diagnosis (years)	63.6	64.1	0.460
Place of residence, Wielkopolska province	226 (81.3)	287 (84.4)	0.305
Radiological diagnosis at the GPCC	136 (48.9)	170 (50)	0.790
Tumor biopsy at the GPCC	135 (48.6)	195 (57.4)	0.029
Mean time from first visit to MTB (days)	27.9	33.5	0.105
Mean time from MTB to treatment start (days)	17.1	21.7	0.006
Mean time from first visit to treatment initiation (days)	44.7	54.4	0.004
Mean waiting time from surgery to adjuvant radiotherapy (days)	57.5	56.3	0.693

GPCC – Greater Poland Cancer Centre, MTB – multidisciplinary tumour board

Table 2. Tumour location and disease stage

	Pre-pandemic period, n (%) N = 278	COVID-19 period, n (%) N = 340	p-value
Larynx/hypopharynx	89 (32)	113 (33.2)	0.845
Oral cavity	126 (45.3)	109 (32.1)	0.010
Oropharynx	39 (14)	64 (18.8)	0.174
Salivary glands	8 (2.9)	12 (3.5)	0.829
CUP	7 (2.5)	18 (5.3)	0.128
Nasal cavity/sinuses	8 (2.9)	13 (3.8)	0.683
Nasopharynx	1 (0.4)	11 (3.2)	0.017
Locally advanced disease (T1–T2)	150 (54)	181 (53.2)	0.858
Regional disease (N+)	143 (51.4)	189 (55.6)	0.303
Advanced stage (III/IV)	187 (67.5)	247 (72.6)	0.165

CUP – carcinoma of unknown primary

Table 3. Treatment type characteristics

	Pre-pandemic period, n (%) N = 278	COVID-19 period, n (%) N = 340	p-value
Primary surgical treatment	157 (71)	172 (75.4)	0.337
Primary surgical treatment in early stage (T1–T2) laryngeal cancer	29 (80.5)	40 (74)	0.613
Primary surgical treatment in early stage (T1–T2) oropharyngeal cancer	9 (47.3)	26 (86.6)	0.001
Palliative radiotherapy	57 (20.5)	112 (32.9)	0.001
Ineligible for treatment (best supportive care only)	5 (1.8)	21 (6.2)	0.007

to COVID-related gaps in radiation therapy. Mean interruption time was 20 days. In all cases radiotherapy and chemotherapy were adapted after the gap, including additional fractions of radiotherapy. To shorten the OTT in order to decrease the probability of treatment interruption, hypofractionated schedules of irradiation were used, where clinically justified. On the other hand, the COVID pandemic has not affected the decision-making process in induction chemotherapy application (5 patients in pre-COVID and 7 patients in COVID period).

Discussion

Our study is the first to show the impact of the COVID-19 pandemic on head and neck patients over the course of a full 12-month time period. The mean time from MTB presentation to treatment initiation increased from 17.1 to 21.7 days ($p = 0.006$), as did the mean time from first visit to treatment start (from 44.7 to 54.4 days, $p = 0.004$). This significant increase in the time from diagnosis to treatment could have negative implications for survival outcomes, although we did not find any significant differences between the time periods in terms of disease staging.

Impact of general restrictions on medical care

The COVID-19 pandemic has influenced every area of medicine. One of the major impacts has been restricted access to medical care [3]. In Poland, similar to other countries, patients' access to general practitioners during the pandemic was limited and most consultations were

conducted through telemedicine, which has a higher risk of an incorrect diagnosis [4]. Many hospitals around the world have been transformed into COVID-19 treating institutions, which means that patients are less likely to be accurately diagnosed and treated in a timely manner when the disease is still in early stages [5]. Nevertheless, cancer centres in many countries have remained open, with adequate local restrictions, while other hospitals were responsible for treating only patients with COVID-19 [6]. In fact, this approach allowed cancer centres in those countries to treat more patients during the pandemic than in the prior year [5, 7]. We observed similar results, as evidenced by the 22% increase in the number of patients who presented to the MTB. In Poland, as in other countries, many hospitals were transformed into COVID-treating institutions, but this did not affect many cancer centres, including ours. Outpatient visits decreased by 50% from March to June 2020 and by 25% thereafter. Even so, most patients were able to schedule a consultation and receive a treatment proposal. By contrast, some high volume cancer centres experienced a substantial reduction in patients in the most acute phase of the pandemic, with one centre (MD Anderson) in the United States of America reporting a 25% decrease over a 6-week period [8].

In the context of limited access to medical care due to pandemic-related restrictions, the distance from the patient's home to the hospital could be an important factor. To evaluate the impact of distance, we divided our patients into two groups: those living in the same province (Wielkopolska) as the hospital and those residing outside

of this province. That analysis showed that the percentage of patients from the relatively large Wielkopolska province (30 000 km²) remained essentially unchanged from the pre-pandemic period (81% vs. 84%, respectively). To our knowledge, the only other study to examine this issue was performed by Kiong *et al.* at the MD Anderson Cancer Center, who did not find any significant differences either [8].

In terms of access to cancer diagnosis and treatment, we found that radiologic tests performed at our centre were similar in the two groups (49% vs. 50%), although a significantly higher proportion of patients (57% vs. 48.6%) required a biopsy during the COVID-19 period. This finding may be related to the need for qualified staff and appropriate equipment to perform laryngeal and hypopharyngeal tumour biopsies. These procedures are usually done under general anaesthesia, thus limiting the role of outside centres. We were unable to identify any other studies that have evaluated this variable to compare results.

Demographic data and tumour location

Most of the studies that have compared patients treated in the pre-pandemic and pandemic periods have not found any significant demographic differences in sex or age, similar to our results [7, 9, 10]. However, we did find a significantly higher proportion of patients diagnosed with oral cancer in the pre-COVID period (45.3% vs. 32.1%, Table 2), but the reason for this difference is difficult to determine. Kiong *et al.* found no significant differences in the main head and neck cancer locations at their centre between the two periods; nor did they find any other studies reporting such differences [8]. In contrast, Thomson and colleagues found a substantial increase in the percentage of patients diagnosed with oral cancer (from 23% to 44.4%), but they did not explain the potential reasons for this difference [7]. Interestingly, we observed a significant increase in the number of nasopharyngeal cancer patients (from 1 to 11), perhaps because most of the symptoms and side effects of COVID-19 affect the nasal cavity and paranasal sinuses, which could have led to early detection of nasopharyngeal cancer during the diagnostic process for COVID-19. Nonetheless, these results need further research.

Diagnostic and treatment time frames

Early diagnosis is a crucial variable in the odds of treatment success in cancer patients, with numerous studies showing that diagnostic delays negatively impact survival outcomes. Rygalski *et al.* retrospectively evaluated 37 730 patients with head and neck cancer included in the National Cancer Database (NCD), finding that the cut-off point for time to surgery that had the greatest impact on survival was 67 days [11]. In another study, Murphy *et al.* evaluated data from 51655 patients included in the NCD who received curative-intent treatment for oral, oropharyngeal, or hypopharyngeal cancer, finding that time from diagnosis to treatment > 60 days was consistently associated with a higher risk of death [12]. In our study, we found a small but non-significant increase in time from first visit to the MTB meeting (27.9 vs. 33.5 days), in line with the data reported by Kiong *et al.* [8]. We also observed a significant increase in

time (from 17.1 to 21.7 days) from presentation to the MTB to treatment initiation, a finding that is consistent with the data described by Tevetoglu *et al.* [10]. Similarly, the time from the first visit to treatment initiation also increased significantly in our study (44.7 vs. 54.4 days), a finding that contrasts with Tevetoglu *et al.*, who found no significant changes (Kiong *et al.* did not evaluate this variable).

Our data show that the percentage of radiological diagnoses performed at the GPCC was similar in both periods. By contrast, a significantly greater percentage of patients underwent biopsy in the COVID period (57.4% vs. 48.6% in the pre-pandemic period). These data show that although restrictions in non-cancer centres at least partially affected outpatient diagnostic tests, they had no significant impact on the time interval to the MTB meeting. However, waiting times for inpatient treatment differed between the periods, and the restrictions in place at our centre and other centres could have affected the time from MTB to treatment [13, 14]. Another factor that may have influenced the time to treatment initiation is patient-related concerns about entering the hospital during the pandemic [15].

Type of treatment

Several groups developed recommendations on the management of patients with head and neck cancer during the pandemic, including general recommendations as well as specific surgical and non-surgical recommendations [16–20]. Treatment of head and neck cancer has been restricted around the world due to capacity limitations and to the increased risk of infection for both staff and patients. In our centre, the intensive care unit (ICU) had only limited restrictions; therefore the decision-making process for surgical treatment was not influenced by any ICU-related restrictions. With regard to non-surgical treatment, we observed some delays during the 12-month COVID-19 study period related to inpatient coronavirus infections during the course of radiotherapy, which perhaps explains why there was no significant difference between the two periods in the proportion of patients eligible for radical surgery (71% vs. 75.4%). Kiong and colleagues did not observe any difference in surgical vs. non-surgical treatment, although fewer patients were considered eligible for primary surgery than in our study (47.3% vs. 73.2%).

We also assessed the type of treatment in two specific anatomic locations (larynx and oropharynx), which were selected because oncological outcomes for these two sites are similar regardless of the treatment type in patients with early-stage disease [21–25]. We found no significant difference between the pre-COVID and COVID periods in terms of the proportion of laryngeal cancer patients treated surgically (80% vs. 74%, respectively), but we did find a significant difference in early-stage oropharyngeal cancer (47% vs. 86%), perhaps due to the use of minimally invasive surgery (mainly robotic surgery) in these patients, where the risk of tracheostomy is low and the hospital stay is much shorter than in radical radiotherapy.

Our data show that a significantly higher proportion of patients received palliative radiotherapy during the pandemic period (20.5% vs. 32.9%) and palliative care alone was indicated in a higher percentage of patients (1.8% vs. 6.2%). Both

findings are likely directly related to the pandemic. Although disease severity (TNM staging) did not differ between the two periods, the limited access to basic medical care (with the consequent delays in diagnosis and treatment) resulted in an increase in the number of patients ineligible for radical treatment due to comorbidities and cancer-related malnutrition. Of the 21 patients in the COVID-19 period referred to best supportive care, six were offered palliative radiotherapy but declined due to pandemic-related fear. Given the importance of palliative care to ensure adequate pain management and nutritional and respiratory support, we believe that a symptom-based approach to these patients should be taken during the pandemic. In this regard, Singh and colleagues published recommendations on the management of palliative patients during the pandemic, emphasizing the need for better access to drugs, greater use of teleconsultation, and wider community support [26].

Strengths and limitations of the study

The main study limitation is the retrospective design. Another limitation is that we did not examine symptom duration prior to the first visit, mainly due to missing data. Although there were some restrictions in outpatient visits and delays in the start of radiotherapy, none of the units had to be closed for more than 2–3 days and none of the doctors had to be transferred to other hospitals to treat COVID-19 patients. A final limitation is that we did not assess or compare patient outcomes. By contrast, an important strength of this study is that it is, to our knowledge, the first to examine the effect of the pandemic on patients with head and neck cancer during an extended time period (12 months) including several waves of the pandemic.

Conclusions

The COVID-19 pandemic has had a major impact on the medical care of patients with head and neck cancer in terms of outpatient diagnosis and inpatient treatment. The results of this study suggest that, in the context of pandemic-related restrictions imposed in non-oncological hospitals, specialized cancer centres must be prepared to consult, diagnose, and treat greater numbers of patients. The increased time from first visit to treatment initiation observed in this study (and others) suggests that greater efforts need to be made to avoid diagnostic delays. Differences in the treatment recommendations between the two time periods should be evaluated in future studies to determine how this affects survival curves. Finally, it would be valuable to determine whether the significant increase in the number of patients with nasopharyngeal cancer is virus-related.

The authors declare no conflict of interest.

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Address for correspondence

Mateusz Piotr Szewczyk, PhD
Department of Head and Neck Surgery
Poznan University of Medical Sciences
Poznań, Poland
e-mail: mateuszszezczyk@yahoo.pl

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