

# Osteonecrosis of the jaw: surgical treatment results before and during the COVID-19 pandemic in one of the reference hospitals in Poland

A. NOWAK<sup>1,3</sup>, Ł. SŁOWIK<sup>1</sup>, M. SZCZEŚNIAK<sup>1,3,4</sup>, M. OKŁA<sup>1</sup>, K. OSMOLA<sup>1</sup>, M. WYGANOWSKA<sup>2</sup>

<sup>1</sup>Department of Maxillofacial Surgery, Poznan University of Medical Sciences, Poznan, Poland

<sup>2</sup>Department of Dental Surgery, Periodontology and Oral Mucosa Diseases, Poznan University of Medical Sciences, Poznan, Poland

<sup>3</sup>Doctoral School of Poznan, University of Medical Sciences, Poznan, Poland

<sup>4</sup>Department of Diagnostics, University of Medical Sciences, Poznan, Poland

**Abstract. – OBJECTIVE:** The COVID-19 pandemic has had a huge impact not only on everyday life but, above all, on the functioning of medical entities. During its duration, there were problems with access to health care, including maxillofacial surgery departments. The aim of the study is to analyze how the pandemic affected the surgical results of the treatment of osteonecrosis of the jaws at the Clinic of Maxillofacial Surgery in Poznań which delivers services in maxillofacial surgery for almost 4.5 million inhabitants in Poland.

**PATIENTS AND METHODS:** We conducted a retrospective analysis of patients' medical records before and during the pandemic restrictions. The data was obtained by entering the appropriate passwords and ICD-10 diagnoses (e.g., M87) in the hospital's IT system. The obtained information was subjected to statistical analysis.

**RESULTS:** The number of patients before and during the pandemic did not differ significantly. During the COVID-19 pandemic, the waiting time of patients after admission to the hospital for surgery and the total time of hospitalization were shortened. The number of complications was similar in both groups. However, the waiting time for a follow-up visit was longer during restriction time.

**CONCLUSIONS:** The COVID-19 pandemic had an impact on the course of surgical treatment in patients with osteonecrosis of the jaws. The outcomes of the medical procedure remained consistent with the ones observed before the implementation of restrictions. This is likely due to the urgency of the illness. Despite the pandemic, a critical condition called osteonecrosis of the jaw was treated promptly.

*Key Words:*

COVID-19, Necrosis of the jaw, Mronj, Medication-related osteonecrosis of the jaw, Osteoradionecrosis, Maxillofacial surgery, Sequestration, Oral pathology.

## Introduction

The discovery of the new SARS-CoV-2 in December 2019 caused several consequences<sup>1</sup>. The rapid transmission of the virus resulted in a pandemic declared by the World Health Organization (WHO) on March 11, 2020<sup>2</sup>. The method of transmission of the new virus – droplets through coughing, sneezing, as well as through contact of mucous membranes with virus-contaminated material<sup>3</sup> – made it necessary to introduce restrictions in social life as well as in health care.

In Poland, the state of the epidemic and the resulting restrictions on everyday functioning were introduced on March 20, 2020<sup>4</sup>.

The COVID-19 pandemic has impacted maxillofacial surgery departments differently around the world. Various countries have introduced different recommendations based on their financial status<sup>5</sup>.

During the lockdowns, the number of patients admitted to the emergency ward due to injuries decreased<sup>6-8</sup>. However, an increase in patients admitted due to complications of inflammation of the oral cavity was noted<sup>6</sup>. The decrease in the number of patients was related to restrictions on movement, interpersonal contacts (which limited aggressive behaviors, as well as sports practice), and people's fear of being exposed to infection<sup>8</sup>.

The detection of precancerous conditions and early stages of head and neck cancers also decreased, as shown by the Dalanon and Matsuka study<sup>9</sup>. Difficult access to health care resulted in a decrease in newly diagnosed head and neck cancers, which, according to various publications and in relation to the region, amounted to even 25-50%<sup>10,11</sup>.

Tumors diagnosed during the pandemic were larger in size<sup>10</sup> and in a more advanced stage<sup>12</sup>.

These data may indicate the need for more frequent use of radiotherapy as adjuvant therapy in the treatment of head and neck cancers and the need for more frequent use of drugs that can cause Medication-Related Osteonecrosis of The Jaw (MROJN) in the case of metastases. Therefore, it could significantly affect the number of hospitalizations and the scope of procedures of patients affected by osteonecrosis of the jaw.

## Patients and Methods

The records of 72 patients treated at the Maxillofacial Surgery Clinic in Poznań in 2019-2021 due to osteonecrosis of the maxilla or mandible of various etiologies were analyzed. The collected data was divided into two groups: group I included data from March 20, 2019 to March 20, 2020, i.e. the period when there were no epidemic restrictions in Poland, group II included data from March 21, 2020 to March 21, 2021, i.e., the period when the pandemic lasted in Poland. The Poznan Department of maxillofacial surgery provides services for almost 4.5 million inhabitants of Poland (two regions- Wielkopolska and Lubuskie province)<sup>13</sup>. The study was limited to two years due to the ongoing vaccination process, which has reduced the number of COVID-19 cases among patients in older age groups as well as those with chronic diseases<sup>14</sup>. The data was obtained by entering the appropriate passwords and ICD-10 diagnoses (e.g., M87) in the hospital's IT system. Patient data has been anonymized. The study took into account gender, age of patients, intensity of pain on admission, cause of necrosis, time to discharge, selected biochemical and blood count parameters, hematocrit, hemoglobin level, C-reactive protein (CRP) level, white blood cell count, complication during hospitalization, as well as patients' follow-up.

### Statistical Analysis

The data was statistically analyzed using the PQ Stat Software (Poznan, Poland, version 1.8.2). The maxima and minima, mean, standard deviation, median, and mode of selected data were estimated depending on the scale – interval, ordinal, and nominal. The normality of the distribution was checked using the Shapiro-Wilk test. Data meeting the conditions of normal distribution were subjected to parametric Student's *t*-test.

Other data were verified with non-parametric tests: Mann-Whitney and Chi-square. Statistical significance was determined for *p*-values <0.05.

## Results

Group I – before the outbreak of the pandemic – included 33 patients, and group II – after the outbreak of the pandemic – included 39 patients. These data did not differ significantly with respect to the total number of patients hospitalized in the ward ( $p > 0.05$ ,  $\chi^2$ ). The percentage of patients before the pandemic period accounted for 2.3% of all patients, and during the pandemic period accounted for 3.2%.

The number of females and males was similar in both groups. Before the pandemic, 17 female and 16 male patients were hospitalized during restrictions 18 and 21, respectively.

Among the 73 patients, the average age was 66 (SD±9.27), of which it was 64.45 (SD±8.61) before the pandemic, and 67.49 (SD±9.69) during the pandemic. The groups before and after the pandemic were statistically similar, with no significant difference.

The most common cause of necrosis was medication-related osteonecrosis with 55 cases in total, of which 26 concerned patients before the pandemic. Radionecrosis occurred in 17 cases, including 7 patients, before limiting access to health care. There were no statistical differences between the groups according to the type of necrosis.

Complications during hospitalization concerned 5 patients before the COVID-19 period and 5 patients during the restrictions. These values did not differ statistically. There was 1 death during the COVID-19 pandemic, but it was not caused by infection with the SARS-CoV-2 virus.

Most patients underwent procedures under general anesthesia - 60 in total, 33 of them during the pandemic. The number of both general and local anesthesia did not differ significantly.

The need for bone resection concerned 33 patients, 18 of them during the pandemic. These numbers did not differ statistically significantly ( $p > 0.05$ ,  $\chi^2$ ).

The average hospitalization time in group 1 was 8.97 days, and 6.87 days in group 2. Both of these values were statistically significantly different ( $p < 0.05$ ; Mann-Whitney test; due to lack of normal distribution of data).

This could be due to the shorter waiting time for the procedure. During the pandemic, it was

3.46 days, and before it was 5.18. These values differ statistically significantly ( $p < 0.05$ ). The time from surgery to discharge was at a similar level and amounted to 3.78 days before the pandemic and 3.41 during the pandemic, respectively, without significant differences.

Before the pandemic, patients received the date of the first follow-up visit at the outpatient clinic (it did not concern the removal of sutures) after 33.48 days on average, while during the pandemic, these dates were extended to 40.59 days. Statistical significance was found between these data ( $p < 0.05$ ). The longest scheduled visit period was 96 days during the restrictions. This may have been due to the temporary closure of the clinic during the first wave of COVID-19 (Table I).

The follow-up visit to the clinic, which took place about 6 weeks after the procedure, involved 63 patients. 39 of them experienced complications. As complications, we considered dehiscence of the wound, recurrence, and fistula presence. 17 cases occurred before the pandemic, and 22 cases occurred during the pandemic. The data are presented in Table I.

There was a difference in the number of follow-up visits before and during the pandemic: 31 out of 33 patients completed the visits prior to the pandemic, while 32 out of 38 patients completed the visits during the pandemic. However, its statistical significance was not demonstrated.

The level of pain intensity on admission did not differ significantly between groups of patients.

There were no statistically significant differences between the values of biochemical and morphological blood parameters between the groups.

The graph shows the level of pain Numerical

Rating Scale (NRS) with which patients presented to the hospital for surgery. It was more severe in patients admitted during the pandemic, which may indicate a more advanced form of necrosis (Figure 1).

## Discussion

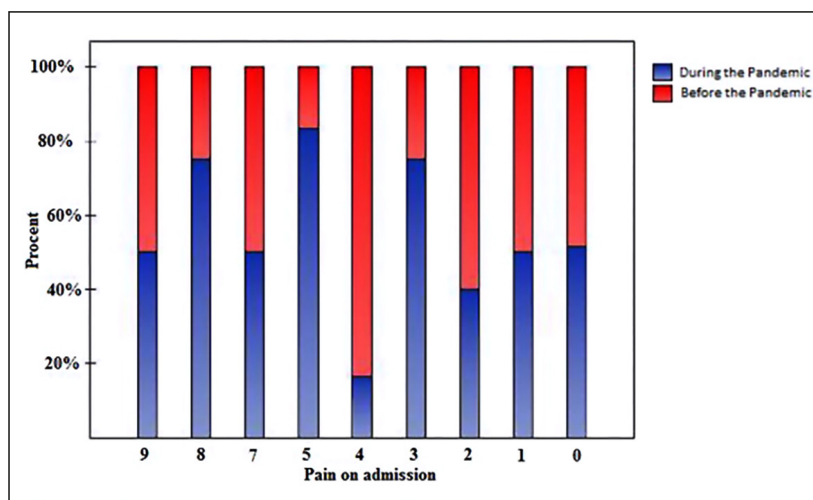
The analysis of the data we cited shows a slight increase in the number of patients affected by osteonecrosis during the pandemic. This increase remains clear in a rare disease, despite not being statistically significant. This is especially evident when comparing the percentages.

This may be due to a partial limitation in the availability of dental care<sup>15,16</sup>. The Polish Dental Association recommended the possible postponement of scheduled visits and check-ups for patients. Pain patients could be admitted, while elective procedures, including extractions, were postponed<sup>17</sup>. The lack of planned procedures and regular follow-up appointments in patients at risk of necrosis was at risk of progression of periodontal infections and periapical changes, which are the main factors in the development of Medication-Related Osteonecrosis of the Jaw (MRONJ) and Osteoradionecrosis (ORN)<sup>18</sup>. Patients' concerns about the possibility of becoming infected with SARS-CoV-2 in the dentist's office have also been reported<sup>15</sup>. This may have resulted in patients developing a symptomatic form of the disease with pain and only then were admitted and directed to our unit. Pain was more severe among patients admitted during COVID-19, as shown in Figure 1. The number of perioperative complica-

**Table I.** Comparison of the analyzed parameters before and during the pandemic.

	Before Pandemic		During Pandemic		<i>p</i>
Number of patients	33		39		> 0.05
Age [years] ± (SD)	64.45 (± 8.61)		67.49 (± 9.69)		> 0.05
Reason	ORN	MRONJ	ORN	MRONJ	> 0.05
	7	26	10	29	
Time of hospitalisation [days]±(SD)	8.97 (± 4.75)		6.87 (± 3.65)		< 0.05*
Time to surgery [days] ± (SD)	5.18 (±3.31)		3.46 (± 2.02)		< 0.05*
Time to discharge [days] ± (SD)	3.78 (±2.48)		3.41 (± 2.22)		> 0.05
Time to follow-up appointment [days] ± (SD)	33.48 (±12.55)		40.59 (± 12.92)		< 0.05*
Resection	15		18		> 0.05
Complication on follow-up	17		22		> 0.05
General anaesthesia	27		33		> 0.05

\*Significant difference. ORN- Osteoradionecrosis; MRONJ- Medication-Related Osteonecrosis of the Jaw; SD-Standard deviation.



**Figure 1.** The level of pain (NRS) on admission.

tions remained at a similar level. The number of procedures requiring general anesthesia was also at a similar level. It can be concluded that despite the limited availability of anesthesiologists during the pandemic, patients requiring urgent interventions were not postponed. However, the number of complications during clinic visits increased, specifically 22 out of 32 (68.75%) patients who attended a follow-up visit at the outpatient clinic; compared to pre-pandemic 17 patients (54.83%). However, the difference was not significant. Before the pandemic, 33 visits were planned, out of which 31 were completed. After the pandemic, 38 visits were planned, out of which 32 were completed (one patient died). This suggests that there may have been some complications that were not reported due to a lack of control. Additionally, the waiting time for a follow-up visit increased.

An interesting conclusion is the shortening of hospitalization time, which may be the result of a shorter waiting time for the procedure. This may be due to a general decrease in the number of patients in the clinic, from 1,415 before the pandemic to 1,217 during the pandemic in the analyzed periods. During the Pandemic, the number of injuries decreased, which reduced the number of procedures requiring anesthesiologic care and shortened the waiting time for a procedure under general anesthesia (this type of anesthesia was the majority in both groups). Most planned procedures were also postponed, which resulted in a change in the functioning of the department.

Due to a similar period of patient stay after the procedure, shorter hospitalization time does not seem to be associated with worse follow-up results during the restrictions.

## Conclusions

The pandemic and restrictions in the functioning of health care have affected the work of many maxillofacial surgery departments.

However, it seems that patients requiring urgent interventions were not deferred. Such are the people affected by osteonecrosis of the jaws, qualified for surgical treatment. This is also confirmed by the fact that more people are supplied with this condition during the period of restrictions. Fewer injuries and elective surgeries lead to shorter hospital stays and lower costs. The treatment results before and after the pandemic did not differ significantly, which shows that in the face of disease entities requiring urgent intervention, our department was able to supply them at the same level as before. The extended waiting time for a follow-up visit may have been due to the prolonged period of restrictions. The study is limited only to short period due to ongoing vaccination process but showing data from the most rigorous restrictions time.

Although the study is limited to one center, it has to be underline that our department deliver care to almost 4.5 million population in Poland<sup>13</sup>. The main limitation of the study is its retrospective character.

Although it seems that the COVID-19 era is coming to an end, it is worth presenting articles and drawing conclusions from this situation.

At the time of submitting the work, we have not found any other publication on this topic. The results can be used for further analysis in order to develop better procedures for dealing with similar situations in the future.

### Conflict of Interest

The authors declare that they have no conflict of interests.

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### Informed Consent

This retrospective cohort study was conducted in agreement with the declaration of Helsinki of 1975, revised in 2013. In order to maintain data anonymity and confidentiality, patient data were collected anonymously, deleting the possibility of identification of subjects, either in this paper or in the database. Therefore, informed consent was not required.

### Ethics Approval

The study was based on hospital data obtained consulting clinical records; ethical approval was not required. The Ethics approval waiver status issued by the Poznan University of Medical Sciences Bioethical Commission is available. The bioethics committee of the Poznań University of Medical Sciences confirms that the study is conducted in accordance with Good Clinical Practice.

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### Authors' Contribution

Aleksy Nowak conception and design of the study, drafting the article. Łukasz Słowik acquisition of data. Marta Szcześniak acquisition of data and statistics. Maciej Okła literature review. Krzysztof Osmola critical revisions. Marzena Wyganowska critical revisions, validation and final approval of the version of the article to be published.

### ORCID

Aleksy Nowak: 0000-0002-0588-8331  
Łukasz Słowik: 0000-0002-4960-6420  
Marta Szcześniak: 0000-0001-8864-8933  
Maciej Okła: 0000-0003-3158-1592  
Krzysztof Osmola: 0000-0002-8862-6758  
Marzena Wyganowska: 0000-0003-2029-2277

### Data Availability

The datasets generated during and analyzed during the current study are available from the corresponding author upon reasonable request.

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