Oral infections - a retrospective study of patients treated in the Oral and Maxillofacial Surgery clinic of the Emergency County Clinical Hospital in Sibiu

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Abstract

Background and aims. The present study was carried out in the Department of Oral and Maxillo-Facial Surgery of the Sibiu County Emergency Clinical Hospital and aimed to evaluate the oral health status of patients who refer to this medical unit, identifying the presence and frequency of dental infections among these patients. The study also aimed to identify and characterize the comorbidities present in patients with these oral conditions. Finally, the study aims to highlight the degree of concern regarding the oral health status of patients and provide relevant information for dental health services and for the development of appropriate prevention and intervention strategies.

Methods. The study was conducted retrospectively and descriptively, using the hospital's electronic medical records. The total sample consisted of 1246 people, the inclusion criteria were: (a) patients admitted to the OMF Surgery Department; (b) outpatients who required hospitalization; (c) patients hospitalized under continuous hospitalization regime; (d) patients over 16 years of age; (e) patients diagnosed with infectious pathologies.

After data registration, information on sex, background, distribution of diagnoses, associated pathologies of the patients and the existence of combined pathologies of the patients included in the study were taken into account. The duration of hospitalization of patients, the need and duration of antibiotic therapy, the frequency of use of combinations of antibiotics, and the number of antibiotics used in correlation with the duration of hospitalization were also analyzed.

The data are presented as frequency and percentages. The combination of the most frequent associated pathologies was analyzed using an algorithm based on association rules and chord diagram was used for their visual representation. Statistical analyses were performed using IBM SPSS® (Statistical Package for the Social Science) version 20 and R software.

Results. The total sample consisted of a total of 1246 people. From the preliminary analysis, the majority of people in the sample, 68.5%, did not suffer from infectious conditions, while 31.5% were affected. Most of the patients came from the urban environment (61.73%) and were male (54.34%). Frequent comorbidities included cardiac pathologies (11.99%) and diabetes (4.08%).

These data indicate the poor state of oral health among patients who call on the OMF Surgery services. It is not an isolated case, but it reflects a pattern observed globally. Based on the results of the study, the hypothesis is validated that there is a poor state of oral health among the population, manifested by the increased incidence of dental infections. International studies confirm that dental infections are often complicated by the presence of comorbidities.

Conclusion. The study concludes that patients hospitalized in the department of Oral and Maxillofacial Surgery face a poor oral health state, characterized by a

high prevalence of dental infections. The presence of comorbidities and seasonal factors contribute to the aggravation of these infections. These results emphasize the need for preventive and educational interventions to improve the oral health of the population in this region, as well as the development of personalized treatment strategies.

Keywords: O.M.F. infections, comorbidity, retrospective study, hospitalized morbidity, antibiotics

Background and aims

Oral and maxillofacial surgery, a dental specialty focused on diagnosing and treating conditions affecting the mouth and facial area, has progressed significantly over time. Advancements have replaced antiquated methods like tooth extraction with more sophisticated techniques. Andre Fouchard is credited as a founding figure in dental surgery, while pioneers such as Lister championed aseptic practices, Wells introduced anesthesia, and Bell pioneered orthognathic surgery. Gillie and Champy contributed to fracture treatment, collectively establishing the scientific groundwork for modern oral and maxillofacial surgical procedures. Their contributions are integral to the evolution of this field [1].

The scope of oral and maxillofacial surgery varies based on individuals' qualifications and expertise. There's a notable contrast between the cases suitable for an undergraduate trained in Oral Surgery versus a postgraduate trained in Oral and Maxillofacial Surgery, particularly for cases requiring a multidisciplinary approach. Oral and maxillofacial surgery encompasses the treatment of several conditions, including (a) extractions and associated care, (b) management of jaw-related cysts and tumors, (c) maxillary sinus issues, (d) trauma to the mouth and facial area, (e) temporomandibular joint disorders, (f) salivary gland diseases, (g) dentofacial deformities, (h) orofacial infections, (i) pre-prosthetic procedures like implantology, (j) precancerous lesions, oral cancer diagnosis and treatment, (k) orofacial pain management, (l) jaw bone reconstruction through grafting and (m) facial nerve issues [1].

Maxillofacial infections, often stemming from dental origins, can penetrate deep tissues in the head and neck, posing risks to vital structures [2]. Despite decreased incidence thanks to antibiotics and improved oral hygiene, these infections still pose significant morbidity and mortality risks [3]. Oral and maxillofacial surgeons must often make rapid decisions in such cases. Most infections arise from teeth, dental sockets, and their supportive tissues, affecting the jaws, face, and surrounding deep tissues [2]. The severity of infection ranges from localized, manageable cases to complex ones necessitating hospital-based, multidisciplinary intervention [3].

As stated before, most infections originate in the teeth, dental sockets and their supporting structures, affecting the jaws, face and deep tissues of the head and neck [4]. Because of this, the extent of the infectious process can vary from well-localized forms, which require a simple approach, to extremely complex infections, which require multidisciplinary interventions in a hospital setting. Defining objective criteria for admitting cases of odontogenic infection is essential to improve patient management and reduce the risk of deep infections [2].

Various studies have identified potential risk factors for oro-maxillo-facial infections, examining the need for specialist treatment [5,6], complication rates [7] and the impact of treatment duration on the severity of infection. These factors include age [8,9], diabetes [10,11], number of spaces involved, and site of infection [10].

Antibiotics are frequently used in dentistry, accounting for approximately 10% of all antibiotic prescriptions [12]. In 2005, amoxicillin-clavulanate was the most commonly prescribed antibiotic by dentists. The prescription of antibiotics in dentistry is based on empirical criteria, influenced by epidemiological, clinical and bacteriological factors [12]. The use of broad-spectrum antibiotics for short periods of time is preferred, and the range of antibiotics used is quite limited [12]. These drugs are recommended for the treatment of odontogenic and non-odontogenic infections, for prophylaxis against focal infections and for preventing the spread of infection to neighboring tissues and organs [12].

The purpose of this study is to evaluate the oral health status of the population that addresses the Department of Oral and Maxillofacial Surgery in Sibiu and to identify the presence and frequency of dental infections among these populations. It also aims to identify and characterize the comorbidities present in patients suffering from these oral conditions. Thus, the study aims to highlight the degree of severity of the patients' oral health status based on the incidence of infectious pathologies among them, as well as to provide relevant information regarding oral health services and for the development of strategies for prevention and adequate intervention in this situation.

We formulated a series of hypotheses to be tested in the study and to clarify the state of oral health and the

associated risk factors among patients who address the Department of Oral and Maxillofacial Surgery in Sibiu with various infectious pathologies. Therefore, we formulated the following hypotheses:

• There is a poor state of oral health among the population, manifested by the increased incidence of dental infections.

• The presence of comorbidities such as diabetes and cardiovascular diseases increases the risk of severe dental infections.

• Seasonal factors influence the prevalence of dental infections.

Methods

The present study was carried out in the Department of Oral-Maxillo-Facial Surgery of the Sibiu County Emergency Clinical Hospital. Document research, retrospective and descriptive, was performed using electronic medical records from the Clinical Hospital's IT System. The total sample consisted of a total of 1246 people. This study was approved by the Scientific Research Ethics Committee of the "Lucian Blaga" University of Sibiu, number 10/2024.

The inclusion criteria were: (a) patients admitted to the OMF Surgery Department; (b) outpatients who required hospitalization; (c) patients hospitalized under continuous hospitalization regime; (d) patients over 16 years of age; (e) patients diagnosed with infectious pathologies.

Exclusion criteria were: (a) outpatients who did not require hospitalization; (b) patients hospitalized under day hospitalization regime; (c) patients under the age of 16; (d) patients diagnosed with non-infectious pathologies within the scope of O.M.F. Surgery.

After recording the data, information about sex, environment of origin, distribution of diagnoses, associated pathologies of the patients and the existence of combined pathologies of the patients included in the study were taken into account.

The data are presented as frequency and percentages. The combination of the most frequent associated pathologies was analyzed using an algorithm based on association rules and chord diagram was used for their visual representation. Statistical analyses were performed using IBM SPSS® (Statistical Package for the Social Science) version 20 and R software.

Results

First of all, a statistical analysis was performed regarding the distribution of infectious pathology in the studied sample. The total sample consisted of a total of 1246 people. From the preliminary analysis, the majority of people in the sample, 68.5%, did not suffer from infectious conditions, while 31.5% were affected.

We can draw some essential conclusions regarding the prevalence of various infectious pathologies in the studied sample. First, primary and secondary fascial space infections have a very high prevalence, affecting 95.41% of patients. This is the most common pathology among those listed. Diffuse suppurations are rare, affecting only 1.28% of patients. Several pathologies, including specific infections, necrotizing fasciitis, and acute and chronic lymphadenitis, have a very low prevalence, each affecting approximately 0.51% of patients. Pathologies such as acute gingivitis, acute periodontal disease, superinfected sebaceous cysts or suprainfected wounds were each identified in only 0.26% of patients.

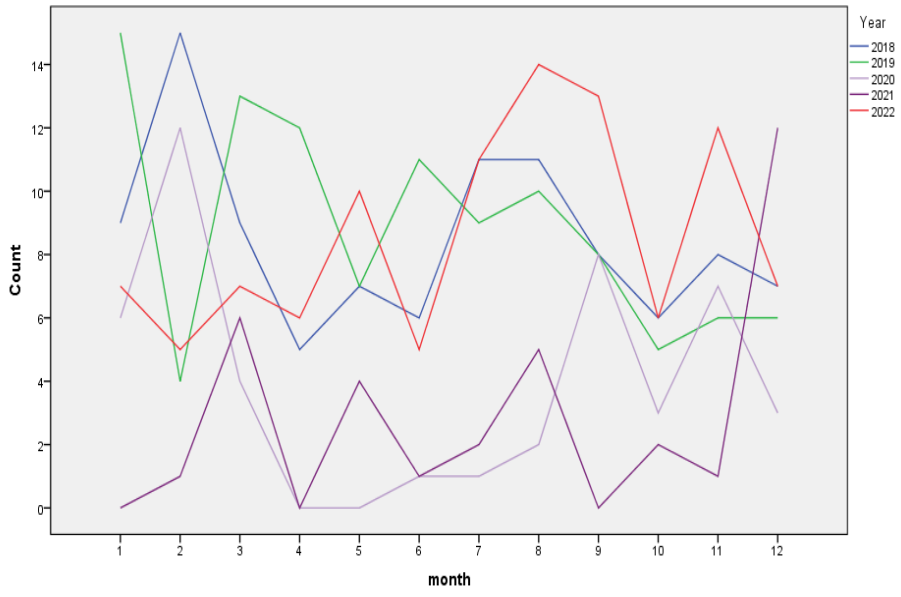

Figure 1. Statistical analysis of the monthly distribution (frequency) of infectious pathology cases.

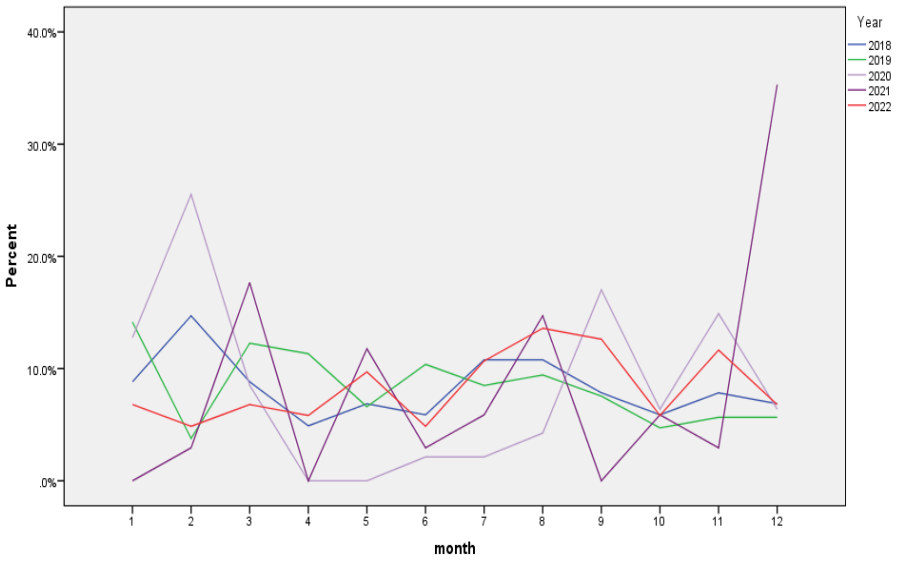

Figure 2. Distribution of the cases of infectious pathology (percentages) during the period 2018-2022.

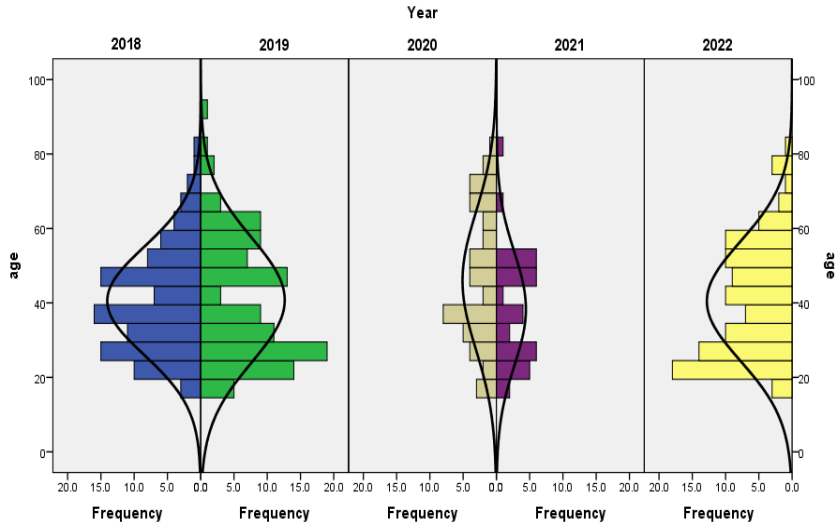

Figure 3. Statistical analysis of the distribution of patients' age and year.

Next, a detailed distribution of the frequency of dental infectious pathology cases during a year, divided by month, was made. Figure 1 shows, for each month, the frequency, percentage, valid percentage and cumulative percentage. These data are essential for understanding seasonal variations in the incidence of infectious pathology.

The distribution of patients by month is relatively balanced, without extreme variations. The months with the most patients are August (10.7%) and March (9.9%), while April has the lowest percentage of patients (5.9%).

Figure 3 provides a detailed distribution of the frequency of infectious pathology cases over several years, covering the period 2018-2022. For each year, the frequency, percentage, valid percentage, and cumulative percentage are shown. These data are essential to understand temporal trends in the incidence of infectious pathology.

The number of patients varied over the years, with a peak in 2019 (27.0%) and 2022 (26.3%). The significant decrease in 2020 and 2021 can be attributed to the impact of the COVID-19 pandemic on hospital admissions and access to medical services. The mean age of patients was M=41.04 (SD=16.121), with fluctuations during the COVID-19 period (2020: M=45.94 (SD=18.40), 2021: M=38.38 (SD=15.31).

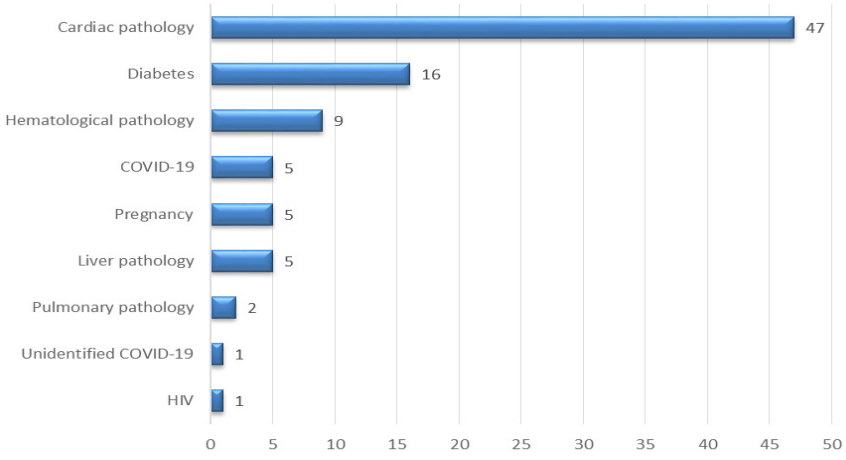

Figure 4. Statistical analysis of the distribution of common associated pathologies.

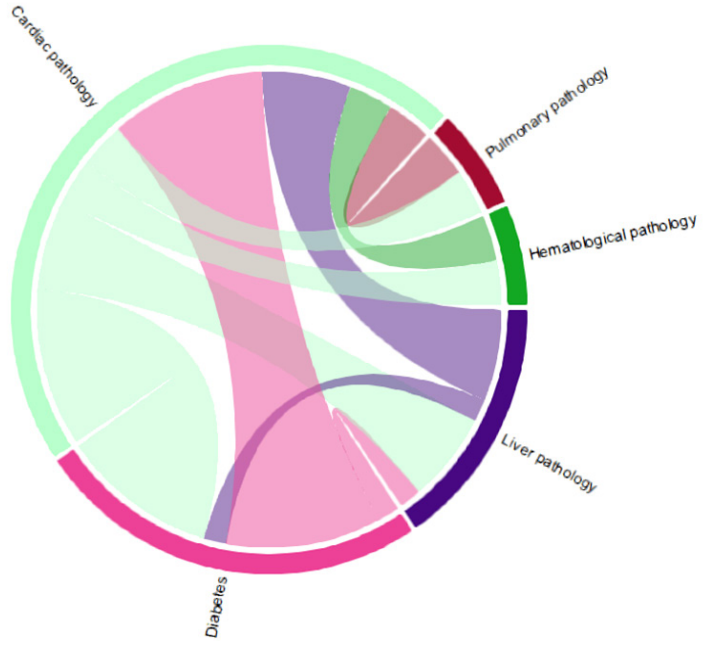

Figure 5. Statistical analysis of the coexistence of various pathologies.

The proportion of male patients (54.34%) is higher than that of female patients (45.66%). Cases from the urban environment 61.73%, while those from the rural environment are 38.27%. This difference may reflect greater access to medical services and more frequent reporting in the urban environment or differences in lifestyle and pathogen exposure.

Figure 4 provides a detailed distribution of the associated pathologies of the patients included in the study, highlighting the presence or absence of various medical conditions. Each pathological category is presented with the absolute number of cases and the corresponding percentage of the total sample.

The most common associated pathologies are cardiac diseases (11.99%) and diabetes (4.08%). Other associated pathologies were identified in very low percentages,which suggests a low prevalence of these conditions among patients with dental infectious pathology.

The prevalence of identified (1.28%) and unidentified (0.26%) COVID-19 reflects the incidence of this disease in the sample and the need for ongoing prevention and treatment measures.

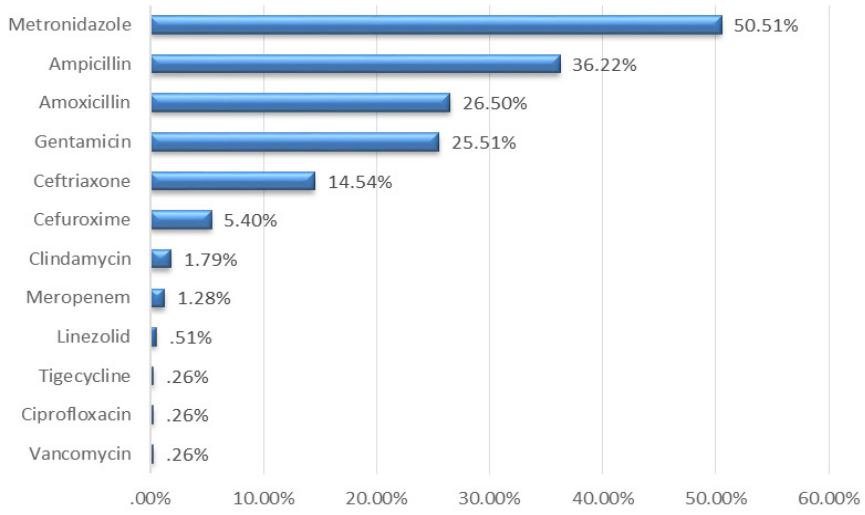

Figure 6. Statistical analysis of the types of antibiotics administered.

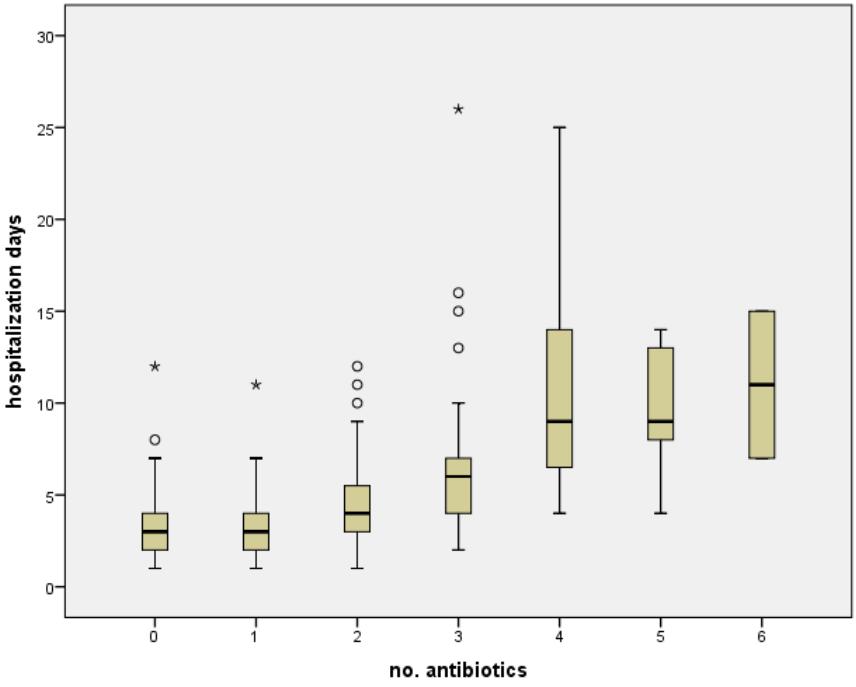

Figure 7. Statistical analysis of the number of antibiotics used for each patient in correlation with the duration of hospitalization.

Finally, the coexistence of various pathologies is presented, including liver pathology, diabetes, cardiac pathology, pulmonary pathology, hematological pathology, pregnancy, HIV, COVID-19, and unidentified COVID-19.

According to figure 5, the most common combinations are between cardiac pathologies and diabetes (7 cases), folowed by combinations of cardiac and liver pathologies (4 cases), cardiac and pulmonar pathologies (2 cases), cardiac and hematological pathologies (2 cases). Other associated pathologies were identified in very low percentages (hepatic and diabet - 1 case). These combinations indicate that patients with dental infections often have other medical conditions that can complicate their treatment and management.

From the data identified in our study, the duration

of hospitalization varies between 1 and 26 days, with a mean of 4.58 days (SD = 3.25). The distribution of the length of hospitalization is presented as follows: 1 day: 12 cases (3.1%); 2 days: 83 cases (21.2%); 3 days: 73 cases (18.6%); 4 days: 76 cases (19.4%); 5 days: 55 cases (14.0%); 6 days: 28 cases (7.1%); 7 days: 24 cases (6.1%); 8 days: 11 cases (2.8%); 9 days: 7 cases (1.8%) and 10 days: 4 cases (1.0%).

The rest of the durations (11-26 days) have very low frequencies, each representing less than 1% of all cases.

The distribution of hospitalization duration shows a high concentration of cases in the range of 2-5 days (73.2% of cases). This indicates that most patients require short-term hospitalization, with a significant decrease in frequency for longer periods.

Regarding the use of antibiotics, the analysis in figure 6 shows the following distribution: Metronidazole: 198 cases (50.51%); Ampicillin: 142 cases (36.22%); Amoxicillin: 104 cases (26.50%); Gentamicin: 100 cases (25.51%) and Ceftriaxone: 57 cases (14.54%).

Other antibiotics were used to a much lesser extent, with frequencies below 5%.

We note that Metronidazole is the most used antibiotic, being prescribed in more than half of the cases. Ampicillin, Amoxicilin and Gentamicin are also commonly used, but to a considerably lesser extent than Metronidazole. This may suggest a prevalence of infections treatable with these specific antibiotics or preferences in treatment protocols.

The analysis of the number of antibiotics used shows the following: 0 antibiotics: 74 cases (18.9%); 1 antibiotic: 102 cases (26.0%); 2 antibiotics: 132 cases (33.7%) and 3 antibiotics: 58 cases (14.8%).

Most patients (59.7%) received one or two antibiotics, which suggests a trend towards less complex treatments. However, a significant percentage of patients (18.9%) did not receive antibiotics at all, indicating other therapeutic strategies.

Data suggest that the average length of hospital stay is relatively short, with most patients requiring between 2 and 5 days of hospital stay. The predominant use of Metronidazole and several other antibiotics reflects the likelihood of a prevalence of infections treatable with these drugs. Most patients were treated with one or two antibiotics, indicating relatively simple and well-defined treatments.

Figure 7 demonstrates the following: 0 antibiotics: The median is around 5 days. The IQR is relatively small, suggesting little variability in hospital days. 1 antibiotic: Median is similar to 0 antibiotics, but with slightly greater variability. 2 antibiotics: Median remains roughly constant, but IQR increases, indicating greater variability. 3 antibiotics: Median increases slightly. The IQR shows greater variability and outliers are present more often. 4 antibiotics: Median and IQR are significantly higher, indicating an increase in hospital days. Variability is greater with a wide distribution of data. 5 antibiotics: The median is around 10 days, indicating a significant increase in hospital days. Variability is also high. 6 antibiotics: Median is lower than at 5 antibiotics, but IQR remains high. The variability is significant.

There is a general tendency to increase the days of hospitalization with the increase in the number of antibiotics administered. The variability of hospital days also increases with the number of antibiotics. The existence of more severe cases that required more days of hospitalization than the average is noted.

These observations might suggest that the administration of a greater number of antibiotics is associated with longer hospital stays, but also with greater variability in length of hospital stay.

This analysis may provide valuable insights for optimizing treatment protocols and managing hospital resources, given trends in hospital length of stay and antibiotic use.

Discussion

Our study highlighted the prevalence and characteristics of infectious dental pathology in patients admitted to the Oro-Maxillo-Facial Surgery department of the Sibiu County Emergency Clinical Hospital. Detailed analysis of these data allowed a deeper understanding of the distribution of dental infections, socio-demographic factors and associated comorbidities. To contextualize the results, we will correlate them with the findings of other relevant studies in the specialized literature.

According to our data, 31.5% of patients were also diagnosed with various infectious conditions. These figures are consistent with other studies that have reported variable prevalence rates of dental infections in the field of oral-maxillofacial surgery. For example, a 10-year retrospective study showed that odontogenic infections were common and posed a significant risk to patients, similar to our data [13].

Odontogenic infections are responsible for 50-89% of oral and maxillofacial infections reported in various parts of the world. Yuvaraj [14], in his study of 2140 patients over two years', found that the mandibular third molars are the most frequently involved, penicillin being the most frequently used drug, and the pterygomandibular space being the most frequently affected [14]. Ekta et al., in a five-year retrospective study, concluded that maxillofacial space infections require prompt intervention, aggressive treatment, and hospitalization when necessary [15]. Huang et al. [16] reported that 50% of 185 cases of deep throat infections in Taiwan were of odontogenic origin. Zhang et al. [17] found that 56.1% of 212 cases of oral and maxillofacial infections in China were odontogenic. Bross Soriano et al. [18] reported an

89% proportion of odontogenic infections in 121 cases of Ludwig's angina pectoris from Mexico. Also, an increase in odontogenic infections in deep neck abscesses over the years was noted by Parhiscar and Har-El in the USA [19].

These data suggest that the poor state of oral health among patients who call on the OMF Surgery services is not an isolated case, but reflects a pattern observed globally. Based on the results of the study, the hypothesis is validated that there is a poor state of oral health among the population, manifested by the increased incidence of dental infections.

The monthly distribution of patients shows a relatively constant variation, with a peak in August and March. This seasonal pattern is also observed in other studies that suggest that seasonal variations in dental infections may be influenced by factors such as changes in temperature and humidity, which affect the behavior of pathogenic bacteria [13]. At the same time, a study carried out in Taiwan showed a similar seasonal variability, influenced by climatic factors [20]. The monthly distribution of dental infection cases shows peaks in the summer and spring months (August and March), suggesting an influence of seasonal factors on the prevalence of dental infections, confirming the third hypothesis of our research.

The annual distribution of patients reflects a significant decrease in 2020 and 2021, most likely due to the COVID-19 pandemic. An article by Meinen et al. highlighted the impact of the pandemic on access to medical services, including oral and maxillofacial surgery, thus confirming our observations [21].

The higher proportion of male patients (54.34%) and predominance of urban patients (61.73%) aligns with the findings of other studies suggesting that men are more prone to dental infections due to poor oral hygiene and exposure higher risk factors [13,21]. Epidemiological studies point out that better access to medical services in urban areas may explain the higher proportion of urban patients.

Diabetes (4.08%) and cardiac pathologies (11.99%) are among the most common comorbidities associated with dental infections, according to our data. These comorbidities may complicate the management of dental infections, which is consistent with the existing literature. For example, one study found that patients with diabetes are at greater risk of developing severe infections due to compromised immune systems and poor blood sugar control [13]. For example, one study found that diabetic patients are at greater risk of developing severe infections due to compromised immune systems and poor glycemic control [22].

According to Ramachandran et al., the prevalence of diabetes among urban population in India was estimated to be 12.1% [23]. However, the percentage of diabetic patients is lower than that reported by Huang et al. [16] (88.9%) and by Parhiscar and Har-El (50%) [19]. Immunological studies have revealed various deficiencies in the immune mechanisms of hosts with diabetes. Their polymorphonuclear leukocytes show problems in migration, phagocytosis, intracellular destruction and chemotaxis [24]. In addition to the general weakness of the immune system, several non-immunological variables contribute to an increased risk of infections. Vascular abnormalities such as microangiopathy and macroangiopathy favor infections by compromising local circulation, leading to a delayed response to infections [25].

These findings confirm our hypothesis, indicating that the presence of comorbidities increases the risk and severity of dental infections.

International studies confirm that dental infections are often complicated by the presence of comorbidities. For example, a study in Germany showed that oral-maxillofacial infections are common in patients with chronic diseases, including diabetes and heart disease, similar to our findings [20].

Analyzing the average duration of hospitalization from the identified data, which is 4.58 days, we can correlate these results with other relevant studies.

For example, a study by Ullah et al. in Australia determined that the mean length of hospital stay for dental infections was 2.7 days (SD = 1.6). Most patients required short-term hospitalization [26], these results being consistent with the results of our study.

Furthermore, the study by Desa et al. found that the mean length of hospital stay for complicated dental infections, including deep abscesses, was 7 days, which is slightly higher than the mean observed in our results but similar for complicated cases [27]. At the same time, the study reported a mean length of hospital stay of 8.19 days for severe deep cervical space infections [27], indicating a longer length of stay for complicated cases, but still comparable to the overall average in the reviewed studies. The study also reported a mean length of hospital stay of 5 days for dental infections requiring surgery [27], confirming that the mean length observed in our data is in line with other international studies on dental infections.

For example, studies from different countries show a large variability in the length of hospital stay in patients with dental infections. In the United States, the average length of hospital stay ranged from 3 to 8.3 days [28-31]. In Iran, patients had a mean length of hospital stay of 6.8 days [32], while in Finland, it was 14.8 days [5]. In China, the average length of hospital stay was 12 days [8, 33]. These data suggest that the length of hospital stay for dental infections differs considerably between regions. However, the number of studies analyzing this duration in different countries is limited, making a detailed comparison difficult.

Regarding the use of antibiotics for patients with

dental infections, the study by Ullah et al. notes that Metronidazole and Ampicillin were frequently used for the treatment of dental infections [26], similar to our data, where Metronidazole is used in 50.51% of cases.

In our case, amoxicillin was used in 26.50% of cases. This is consistent with other studies showing that amoxicillin is one of the most prescribed antibiotics in dentistry due to its effectiveness and broad spectrum of action [34]. The study by Abraham et al. in 2020 showed that Amoxicillin is used in 43.7% of cases of severe infections. Furthermore, the study confirmed that Metronidazole is the first-line antibiotics for many common dental infections [34], reflecting the preferences observed in our study data.

In the study by Desa et al. it is shown that approximately 30-40% of patients receive two antibiotics simultaneously to treat dental infections [27], which correlates with the percentage of 33.7% observed in our data.

Among the limitations of the study can be counted a small number of patients whose data were centralized only during 5 years and the fact that data from only one medical center were analyzed, namely the Oral and Maxillofacial Surgery Clinic Facial at the Emergency County Clinical Hospital in Sibiu. Our study emphasizes the importance of early identification and management of dental infections at the population level and their appropriate treatment in Oral and Maxillofacial Surgery departments. Correlation with other studies reveals a consistent pattern in the prevalence and risk factors associated with these infections. Multidisciplinary approaches and tailored treatment strategies are essential to improve the clinical outcomes of these patients. Future studies should continue to explore these correlations to develop more effective and preventive interventions.

Conclusion

The results of our study indicate that a good part of the patients who turn to the Oral and Maxillofacial Surgery service face a poor oral health state, characterized by a high prevalence of dental infections, influenced by seasonal, socio-demographic factors and pandemics, and complicated by the presence of comorbidities. There is a clear need for preventive interventions and oral health education, as well as tailored treatment strategies to improve the quality of treatments provided.

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