Infection control: Dental extractions in ICU patients and their relation to the exams

Controle de infecção: extrações dentárias em UTI e sua relação com o resultado de exames

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ABSTRACT

Through dental extraction, dentists are able to eliminate infectious foci that can lead to systemic problems in patients during their admission to the Intensive Care Unit (ICU). Therefore, the objective of this study was to analyze the influence of dental extraction on laboratory exams of ICU patients, identify the profile of patients undergoing dental extraction in the ICU, and assess the safety of performing this procedure in critically ill patients. A retrospective analysis of medical records was conducted for patients admitted to the ICUs of two public hospitals, both before and after the dental extraction procedure. The following tests were examined: daily laboratory glucose levels and daily leukocyte counts for a period of ten days. The profile of patients requiring dental extractions in the ICU, in order, includes those admitted for respiratory diseases, sepsis, heart disease, and kidney problems. There were no statistically significant differences in blood glucose and leukocyte values after the dental extractions. Therefore, this study suggests that when dental extractions are properly indicated, they are a safe procedure as they do not cause significant worsening in leukocyte counts or glycemia, and they do not increase mortality in ICU patients.

Keywords: Dentist; Intensive Care Unit; Dental Extraction; Infection Control;
RESUMO

Por meio da extração dentária, o cirurgião-dentista pode eliminar focos infecciosos que podem levar a problemas sistêmicos nos pacientes durante sua permanência na Unidade de Terapia Intensiva (UTI). O objetivo deste estudo foi analisar a influência de exodontias nos exames laboratoriais de pacientes internados em UTI, identificar o perfil desses pacientes e avaliar a segurança da realização desse procedimento em pacientes críticos. Foi realizada análise retrospectiva de prontuários de pacientes de dois hospitais públicos, antes e após extração dentária. Foram examinados os seguintes exames: glicemia laboratorial diária e contagem diária de leucócitos por um período de dez dias. O perfil dos pacientes que necessitam de extrações dentárias na UTI, pela ordem, inclui aqueles internados por doenças respiratórias, sepse, doenças cardíacas e problemas renais. Não houve diferenças estatisticamente significativas nos valores de glicemia e leucócitos após extrações dentárias. Portanto, este estudo sugere que as extrações dentárias, são um procedimento seguro, pois não causam piora significativa na contagem de leucócitos ou nos níveis de glicemia e não aumentam a mortalidade em pacientes internados em UTI.

Palavras-chave: Cirurgião-Dentista; Unidade de Terapia Intensiva; Extração Dentária; Controle de Infecção;

INTRODUCCION

The practice of dental care in a hospital environment is not recent and has been utilized for patients requiring complex medical attention and nursing care. The Doctor of Dental Surgery (DDS) plays a crucial role in performing pre and postoperative surgical and prophylactic procedures within hospitals, as well as preparing patients for chemotherapy, radiotherapy and transplants (KWAK et al., 2020).

Patients admitted to Intensive Care Units (ICUs) often lack oral health care assistance, which directly influences oral health problems related to increased morbidity and mortality (BLUM et al., 2017). Poor oral health can lead to clinical issues such as locally disseminated infections, respiratory tract infections, higher costs of ICU admissions, and increased use of medications such as antibiotics, which can result in the development of bacterial resistance and opportunistic infections (SCANNAPIECO, BUSH & PAJU, 2003; AZARPAZHOOH & LEAKE, 2006; MORAIS et al., 2006; GOMES-FILHO, PASSOS & SEIXAS DA CRUZ, 2010; BANSAL et al., 2013).

In the hospital environment, dentistry is necessary to address the most common issues affecting the oral cavity, such as the presence of biofilm, cavities, periodontal disease, oral lesions that precede systemic viral and fungal infections, traumatic injuries, and other oral conditions that pose risks or discomfort to hospitalized patients (GAETTI-JARDIM et al., 2013).
According to Sousa, Pereira & Silva (2014), dentists play an essential role in providing patients with comprehensive care and preventing infections in other organs and systems that could hinder the improvement of the initial clinical condition. They should be trained in interpreting complementary exams, diagnosing and preventing oral changes, and responding to emergency situations.

Although it is not a recent field, there is a lack of literature regarding the analysis of laboratory test results in the ICU following dental surgery. Therefore, the objective of this study is to identify the patient profile that requires dental extractions in ICUs and determine if this procedure has any impact on the patient's systemic condition. This will be achieved through the analysis of blood glucose levels, leukocyte count, and mortality rates. Additionally, the study aims to assess the safety of performing dental extractions in the ICU, providing support for the implementation of surgical procedures in this setting. It is important to address the existing resistance from both the medical team and dentists regarding the performance of dental extractions in the ICU.

MATERIAL AND METHODS

Data collection was initiated only after the approval of the Research Ethics Committee of Fundação de Ensino e Pesquisa em Ciências da Saúde. Search by opinion number: 3,822,373.

A retrospective analysis of the medical records of patients admitted to the ICU of two hospitals of the Health Department of the Federal District in Brazil, where dentists work was performed. The research was carried out at the Hospital Regional de Ceilândia (HRC) and the Hospital Regional de Samambaia (HRSAM). The information was obtained through the Trakcare database (Intersystems – Cambridge – MA - USA). The sample consisted of patients who had at least one tooth extracted during the period of ICU admission from the year in which there was a regular performance of a DDS. The sample made up of HRC patients was collected from January 2012 until December 2018. At HRSAM, data collection was from December 2017 to November 2019.
The following tests were verified: venous glycemia once a day and leukogram once a day. These exams were analyzed for 10 days, starting 72 hours before the procedure and up to 7 days after.

In both hospitals, patients who had dental extraction were identified using professional productivity sheets and the sample size was convenient. In all, twenty-seven patients were analyzed at HRSAM and 46 at HRC.

Before performing extractions, a multidisciplinary discussion took place involving ICU professionals to ensure optimal decision-making regarding the patient's dental treatment plan. The inclusion criteria for the study were as follows: patients over 18 years old who were admitted to the adult ICU, had at least one tooth extracted during their hospitalization, and had obtained authorization from their legal guardian through the Informed Consent Form (ICF).

On the contrary, the exclusion criteria encompassed patients who during the evaluation period: initiated or modified antibiotic treatment, developed infections unrelated to dental issues, received blood transfusions, began or discontinued corticosteroid therapy, and had medical devices inserted or removed, such as a bladder catheter, endotracheal tube, or central venous access.

Laboratory tests of the patients were evaluated prior to each procedure to analyze the minimum parameters necessary for surgical intervention. These minimal parameters varied from patient to patient, highlighting the importance of multidisciplinary discussions in the decision-making process.

The legal guardians were previously informed about the procedure to be performed and the Informed Consent Form (ICF) was signed by all participants.

Initially, descriptive analysis of the data was performed with frequency, percentage, average, standard deviation, median, minimum and maximum values. To analyze the profile of patients who underwent extractions in the ICUs, all patients who underwent dental extractions were considered. For the analysis of leukocyte count and blood glucose, only patients with this data were considered in at least two records (of the three proposed) before the procedure and in at least four records (of the seven proposed) in the postoperative period. Thus, for the analyses of leukocyte count, the sample was 48 patients and for Glycemia it was 19. An exploratory analysis was performed, which
indicated that the data does not meet the assumptions of an analysis of variance (ANOVA), being then analyzed by generalized linear models, considering the design of repeated measures over time. All analyzes were performed using the R program [R Core Team (2019), Vienna, Austria].

RESULTS

Table 1 presents the demographic data of the 73 patients who underwent dental extractions. Among them, 42.5% were female and 57.5% were male. The average age of the patients was 53 years, with a standard deviation of 15.8 years. A total of 337 teeth were extracted, with the main indication for extraction being the presence of a residual root in 82.2% of the cases. Mobility accounted for 8.2% of the extractions, while 6.9% were due to both mobility and residual root.

Out of all the patient evaluated, 71 (97.3%) did not develop ventilator-associated pneumonia during the analysis period, while 2 (2.7%) did develop pneumonia and were subsequently excluded from the final sample. It was observed that 70 (95.9%) of the patients were discharged due to improvement, while only 3 (4.1%) were discharged due to death.

Analyzing Table 2, it is evident that there were multiple reasons for patient hospitalization, and it is possible for a patient to have more than one comorbidity. The highest rate of hospitalization was attributed to Lung Diseases (47.9%), followed by Sepsis (30.1%), Heart Diseases (28.7%), and Kidney Diseases (23.2%).

Table 1. Profile of patients undergoing dental extractions in ICUs

<table>
<thead>
<tr>
<th>Variable</th>
<th>Category</th>
<th>Frequency (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sex</td>
<td>Female</td>
<td>31 (42.5%)</td>
</tr>
<tr>
<td></td>
<td>Male</td>
<td>42 (57.5%)</td>
</tr>
<tr>
<td>Extraction reason</td>
<td>Mobility</td>
<td>6 (8.2%)</td>
</tr>
<tr>
<td></td>
<td>Residual root</td>
<td>60 (82.2%)</td>
</tr>
<tr>
<td></td>
<td>Both</td>
<td>5 (6.9%)</td>
</tr>
<tr>
<td></td>
<td>Uninformed</td>
<td>2 (2.7%)</td>
</tr>
</tbody>
</table>
In a total of 73 patients, 337 teeth were extracted.

The number of patients without sufficient leukocyte and blood glucose data was 25. On the other hand, there were 19 patients with sufficient data for both leukocyte count and blood glucose analysis. Additionally, there were 29 patients with sufficient leukocyte data only. However, there were no patients with sufficient data on blood glucose alone, resulting in a count of 0.
<table>
<thead>
<tr>
<th>Reasons*</th>
<th>Frequency (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>External causes</td>
<td>2 (2,7%)</td>
</tr>
<tr>
<td>Neoplasms</td>
<td>2 (2,7%)</td>
</tr>
<tr>
<td><strong>Others</strong></td>
<td>6(8,2%)</td>
</tr>
</tbody>
</table>

*The same patient could present more than one reason. **Pancreatitis, Tolosa Hunt syndrome, meningitis

Table 3. Results of laboratory tests (leukocyte count and venous blood glucose) of patients undergoing dental extractions in the ICU over time.

<table>
<thead>
<tr>
<th>Time in relation to tooth extraction</th>
<th>Total Leukocytes (x1000)</th>
<th>Glycemia (mg/dL)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean (standard deviation)</td>
<td>Median (minimum-maximum)</td>
</tr>
<tr>
<td>72 hours before</td>
<td>14,6 (6,6)</td>
<td>13,2 (3,6-33,3)</td>
</tr>
<tr>
<td>48 hours before</td>
<td>13,2 (5,9)</td>
<td>12,2 (2,7-31,2)</td>
</tr>
<tr>
<td>24 hours before</td>
<td>13,2 (5,5)</td>
<td>12,4 (2,9-31,7)</td>
</tr>
<tr>
<td>01 day later</td>
<td>12,7 (4,4)</td>
<td>12,3 (3,7-21,4)</td>
</tr>
<tr>
<td>02 days later</td>
<td>13,5 (5,7)</td>
<td>12,4 (3,6-31,8)</td>
</tr>
<tr>
<td>03 days later</td>
<td>12,7 (4,9)</td>
<td>13,0 (2,1-26,6)</td>
</tr>
<tr>
<td>04 days later</td>
<td>14,1 (6,1)</td>
<td>13,5 (5,0-33,4)</td>
</tr>
<tr>
<td>05 days later</td>
<td>13,4 (6,0)</td>
<td>13,0 (2,2-31,0)</td>
</tr>
<tr>
<td>06 days later</td>
<td>13,4 (6,2)</td>
<td>12,0 (0,4-31,1)</td>
</tr>
<tr>
<td>07 days later</td>
<td>13,5 (5,7)</td>
<td>13,1 (4,5-30,0)</td>
</tr>
<tr>
<td>p-value</td>
<td>0,9091</td>
<td>0,3256</td>
</tr>
<tr>
<td>Sample size (n)</td>
<td>48</td>
<td>19</td>
</tr>
</tbody>
</table>
As shown in Graph 1, the average total leukocyte count decreased from 14.6 three days before extraction to 13.5 on the tenth day of follow-up, which was not considered statistically significant. Similarly, there was no significant difference in the mean blood glucose values (Graph 2) before and after the extractions, with levels decreasing from 166 on the first day of follow-up to 141.1 on the last day.
DISCUSSION

Dentists should be part of the multidisciplinary teams that provide care for patients with systemic diseases, given that many of these diseases have significant direct and indirect impacts on oral health. Oral health care should be an integral component of chronic disease management. Proper and timely referral to oral health care by health care providers can improve overall health and well-being of patients (CHÁVES et al., 2018).

The presence of a dentist is crucial for ensuring the overall health of patients hospitalized in the ICUs, as these individuals require meticulous care due to their clinical condition characterized by immunosuppression and complex systemic conditions. This makes them more vulnerable to the development of oral and/or systemic infections, which can further deteriorate their general health (ARAÚJO et al., 2009). Therefore, considering the heightened susceptibility of immunocompromised patients to infections, dental extractions have proven to be beneficial in preventing acute infections in these individuals, even in the ICU patients and in long term.

The reasons for dental extraction in the present study were tooth mobility and the presence of residual roots. None of the patients had an acute dental condition at that time. Therefore, the justification for extraction was to ensure an optimal oral environment and
prevent the occurrence of infections. Luiz et al., 2008 e Osterne et al., (2008) suggest that the treatment and/or removal of factors that can retain plaque and potentially lead to infection, such as residual roots, open caries lesions, restorations, fractured teeth with sharp edges, and intraosseous abscesses of endodontic origin, among others, are recommended for inpatients.

At any point, both during transportation and after hospitalization, these patients may require non-dental surgical interventions or even catheter insertion. Therefore, it is crucial that they already have an appropriate oral environment to prevent infections such as bacterial endocarditis, surgical site infections, or catheter-related infections. Oral bacteria, particularly those originating from periodontal disease, can cause distant hematogenous infections, leading to a systemic metastatic effect, especially in patients with compromised health (GOMES & ESTEVES, 2012). Consequently, performing dental extractions could potentially minimize infections related to the heart, surgical sites, catheters, and even pneumonia.

In one of the observed ICUs in the present study, the overall mortality rate was 45.8%. However, among patients who underwent dental extraction in the two analyzed hospitals, the mortality rate was only 4.1%. The vast majority of patients were discharged due to improvement (95.9%). Generally, there is a high mortality rate in the ICU, which varies according to international articles between 5.4% and 33% (FRIEDRICH, WILSON & CHANT, 2006; LAUPLAND et al., 2006; GERSHENGORN et al., 2017; HON et al., 2017). However, in Brazil, the death rate is higher than the international average, ranging from 36.9% to 50.74%. It is unknown whether this is due to the Brazilian public healthcare system or recording failures (ACUÑA et al., 2007; FAVARIN & CAMPONOGARA, 2012; GUIA et al., 2018).

The fact that the mortality rate among patients who underwent extraction remained below all averages demonstrates that when properly indicated, the procedure is safe for ICU patients. On the other hand, while it is not yet possible to conclude a significant improvement in the exams, we can say that there was no worsening and that the performance of dental extraction did not increase mortality in critically ill patients. Ultimately, we believe that in addition to not worsening the patient’s clinical condition, performing extractions can prevent deterioration by avoiding the progression of chronic processes and infections in other sites. Furthermore, the performance of dental extractions
did not cause serious adverse events in patients, as observed in the study by Bellissimo-Rodrigues et al., (2018) who also performed dental procedures.

The cause of hospitalization for 47.9% of patients was related to respiratory problems. Teeth requiring extractions serve as sites for the accumulation of bacterial plaque, and its removal is essential to reduce the oral microbial load in these patients (ensuring an adequate oral environment). According to Fourrier et al. (1998), patients who developed nosocomial pneumonia after five days in the ICU had their bacterial etiology associated with the composition of dental plaque. Similarly, even in patients without ventilator support, there is a higher accumulation of organic matter in the oral cavity and residual saliva, particularly on the lingual dorsum and in regions of the buccal sac. Furthermore, several studies have suggested a strong association between periodontal disease and nosocomial pneumonia, indicating the need for further investigation into the relationship between these pathologies (ALMEIDA et al., 2006; OLIVEIRA et al., 2007). Therefore, reducing the accumulation of biofilm sites can potentially decrease the risk of developing lung diseases, emphasizing the importance of early intervention.

Once sepsis or septic shock is diagnosed, immediate measures aimed at stabilizing the patient must be taken as a priority within the first few hours, given their importance in improving patient survival. Focus control, including careful oral assessment, is part of the initial measures to be taken in septic patients in the first hours of care (ILAS, 2019). Among these measures, we consider oral care assessment essential. Sepsis is the leading cause of death in Intensive Care Units (ICUs) and ranks among the top causes of death in the United States (BORGUEZAM et al., 2021). In our study, 30.1% of the included patients were admitted with sepsis. This further supports the need for early dental intervention, including dental extractions, to eliminate infectious foci.

One of the objectives of this study was to examine the correlation between the removal of the dental infectious focus and the reduction of leukocytes and improvement in the glycemic rate. In certain cases, the results after 7 days indicated a slight decrease in total leukocyte count and blood glucose levels, although the difference was not statistically significant, suggesting similarity in the data. According to the literature, it would be expected that these values would decrease. However, we believe that the lack of statistical significance can be attributed to the limitations of this study, which are mentioned below, primarily the sample size. Although these changes may not be
considered significant, it is important to note that there was no worsening observed in these same laboratory exams. This finding supports the hypothesis that performing dental extractions in ICU patients is a safe procedure.

Regarding the limitations of this study, it is important to mention the small number of patients in the final sample (19 with blood glucose data and 48 with leukocyte data). There was also insufficient data available for several patients, as we only included those with at least 6 records (2 before and 4 after the procedure) in the final sample. Additionally, blood glucose measurements were taken without ensuring that patients were fasting, which could have affected the reliability of the results. Another significant limitation is that this study was retrospective in nature. Furthermore, the postoperative follow-up period was relatively short (7 days), whereas other studies examining glycemic changes in type 2 diabetic patients have followed up for one month (POZZANI et al., 2012) or three months (KHADER et al., 2010). It is important to note that the patient group in this study was not exclusively composed of diabetic individuals, which may have influenced the results related to blood glucose levels. To better assess the effects of dental extractions on test results and patient safety, future studies should be conducted, preferably using randomized and prospective clinical designs, with a larger sample size.

In order to ensure proper treatment for patients admitted to the ICU, it is essential to have a dentist available in the hospital. This dental professional plays a crucial role in diagnosing oral conditions and collaborating with medical therapy. They are involved in emergency procedures for trauma cases, preventive procedures to prevent worsening of the systemic condition or hospital-acquired infections, as well as curative and restorative procedures to enhance patient comfort and maintain an optimal oral environment, and provavelmente wellness and dignity.

CONCLUSION

The profile of patients requiring dental extractions in the ICU, in order, includes those admitted for respiratory diseases, sepsis, heart disease, and kidney problems. Furthermore, this study suggests that performing dental extractions in ICU patients is a safe procedure, as it did not result in worsening leukocyte levels or glycemia in the
patients who underwent it. Additionally, this procedure does not increase mortality in these patients.

REFERENCES


