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Oral Health Problems of Children with Cancer After Chemotherapy: A Literature Review

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ABSTRACT

Pediatric cancer patients are particularly vulnerable to oral health complications, primarily due to the adverse effects of chemotherapy. This treatment significantly influences both oral health and nutritional status, especially in children diagnosed with acute lymphoblastic leukemia (ALL). Chemotherapy can trigger a range of oral issues, including mucositis, dry mouth (xerostomia), and oral infections, which in turn can hinder proper nutritional intake and compromise overall health. This paper aims to investigate the impact of chemotherapy on oral health and nutrition in pediatric cancer patients, focusing on those with ALL. Through a literature review, the study examines the prevalence and types of oral complications and their effects on well-being. Relevant literature published between 2014 and 2024 was sourced from databases such as EBSCO, ScienceDirect, SpringerLink, ProQuest, and Scopus. Using the PICO (Population, Intervention, Comparison, and Outcomes) framework, articles were selected and critically appraised by two independent reviewers. A descriptive method was employed to analyze the data. Out of 2,465 initially identified articles, eight were selected for in-depth analysis. The findings show that pediatric cancer patients face both immediate and long-term oral health issues, including dental abnormalities and jaw development problems. These complications can cause pain, eating difficulties, and social stigma, negatively affecting the child's quality of life. The study emphasizes the need for early oral health intervention, better training for healthcare providers, and the development of standardized oral care protocols. Future research should aim to assess the effectiveness of targeted oral health interventions in improving nutrition and overall quality of life in pediatric oncology patients.

Keywords: chemotherapy; children with cancer; oral health problems

Introduction

Chemotherapy is the primary treatment for children with cancer [1]. It can cause abnormalities in tooth development, including root deformities and delayed tooth eruption [2]. Additionally, chemotherapy may lead to oral complications such as mucositis, dry mouth, infections, and other oral health disorders that require ongoing care [3], [4].

The prevalence of oral complications in children includes dental caries (67.8%) and gingivitis (55.6%). [5]. Severe oral mucositis often occurs with increasing chemotherapy doses [6].

Additionally, other complications may include candidiasis (29.5%) and xerostomia, particularly in children with acute lymphoblastic leukemia (ALL) [5], [7].

Children diagnosed at a younger age (≤ 3 years) are at a higher risk of developing severe dental disorders, as their developing dentofacial structures are more susceptible to the effects of treatment [8]. Limited access to dental care and lower socioeconomic status may further exacerbate dental health problems in children with cancer [9]. Hematopoietic stem cell transplantation has been

shown to significantly increase the incidence of dental anomalies in children [8].

Oral complications of chemotherapy, such as mucositis and changes in taste perception, can lead to decreased food intake and an increased risk of malnutrition. [10], [11]. Persistent oral health issues may result in long-term nutritional deficiencies, affecting growth and development in children. [11].

There has been no research to date that comprehensively summarizes the oral health problems experienced by children with cancer. Previous studies have addressed oral health problems in children with cancer individually, focusing on specific complications such as mucositis, dental caries, or infections. However, there is no comprehensive research that integrates and summarizes all these issues in a holistic manner. By summarizing the various oral health problems faced by children with cancer, healthcare providers, parents, and the children themselves can become better informed and more prepared for the potential side effects that may arise during and after chemotherapy. This comprehensive understanding can support early intervention, improve quality of care, and enhance the overall well-being of pediatric cancer patients. This study aims to summarize the oral health problems caused by chemotherapy in children with cancer, highlighting both short- and long-term impacts based on the latest evidence.

Methods

The research method used is a literature review. Articles were obtained from Scopus, ProQuest, SpringerLink, and ScienceDirect, published between 2014 and 2024, using the keywords 'oral' AND 'dental' AND 'pediatric cancer' AND 'problem.' Articles that meet the inclusion criteria are those written in English and available in full text.

Results and Discussion

Oral and dental health problems faced by children with cancer, caused by the therapy they receive, are divided into two categories: short-term and long-term problems. Various dental and oral issues can arise in both the short and long term. Short-term problems include oral mucositis, dental caries, gingivitis, xerostomia, candidiasis, and infections. Chemotherapy for children with cancer is a long-term treatment that involves drug dosages adjusted to the child's condition. The long-term impact of this therapy on oral and dental health

includes dental anomalies, xerostomia, gingivitis and periodontal disease, oral mucositis, infections, oligomicrodontia, congenital tooth absence, microdontia, root agenesis, and short-rooted teeth.

Oral Mucositis: This is the most common complication, affecting approximately 47% of pediatric patients. It manifests as painful inflammation and ulceration of the oral mucosa, often leading to difficulty eating and swallowing [5], [12]. Oral mucositis and opportunistic infections, such as candidiasis, frequently occur during and after treatment, affecting up to 41.6% of patients [5]. Oral mucositis is a painful and prevalent complication in pediatric cancer patients undergoing chemotherapy, significantly impacting their quality of life and treatment compliance. The incidence in this population can be as high as 91.5% [13]. Effective management strategies are essential, as oral mucositis can lead to severe consequences, including increased susceptibility to infections and prolonged hospitalization [13], [14]. Approximately 65% of children undergoing cancer treatment experience oral mucositis [14]. This condition can significantly affect nutrition, speech, and overall well-being, potentially disrupting treatment [14], [15]. Factors such as changes in white blood cell and platelet counts, as well as certain chemotherapy regimens, have been associated with an increased risk of oral mucositis. The type of cancer also influences the timing and severity of the condition, with hematologic malignancies typically causing an earlier onset compared to solid tumors [16].

Candidiasis: Oral candidiasis affects approximately 29.5% of pediatric cancer patients, often due to an altered immune response [5]. Conditions such as oral candidiasis and herpes are also common, with candidiasis affecting 1.8% of patients [5], [12]. Candidiasis is a significant concern for pediatric cancer patients undergoing chemotherapy and hematopoietic stem cell transplantation (HSCT). Chemotherapy-induced immune suppression and weakened epithelial barriers increase susceptibility to Candida infections [13]. Studies have shown a higher incidence of Candida species in cancer patients receiving chemotherapy compared to healthy controls [14]. Oral candidiasis is a common infection in pediatric cancer patients undergoing chemotherapy, with a higher incidence than in healthy individuals. *Candida albicans* is the most common species, followed by *C. parapsilosis*, *C. tropicalis*, and *C. krusei*. Candida biofilms pose challenges in diagnosis and treatment due to increased resistance. The high prevalence of oral

candidiasis in pediatric cancer patients highlights the need for targeted prevention and management strategies to effectively address this infection [17].

Dental Caries: The incidence of dental caries is very high among pediatric oncology patients, with studies reporting rates of approximately 67.8% [5]. This is exacerbated by changes in the oral microbiota and salivary function during treatment [7]. Chemotherapy-related dental caries and gingivitis present an increased risk [18]. Furthermore, the incidence of caries and gingivitis during chemotherapy is notably high, with rates of 67.8% and 55.6%, respectively [5]. Long-term exposure to chemotherapeutic agents is strongly correlated with an increased prevalence of dental caries and anomalies in children [19]. These complications can arise during treatment and persist long after its completion, necessitating specialized dental care for this patient population. To reduce oral complications and prevent dental infections during immunosuppression, children with cancer should receive dental care from a pediatric dentist before, during, and after cancer treatment. An individualized oral care program can help manage both acute and long-term oral complications associated with cancer therapy. Interprofessional collaboration between pediatric dentists and oncologists is essential to achieving optimal dental care outcomes for pediatric cancer patients and survivors [20]. Children with dental caries are more likely to have a lower quality of life (67.0%) compared to those with a higher quality of life (33.0%) [21].

Gingivitis: A significant number of patients (55.6%) had gingivitis, which can lead to further complications if left untreated [5]. This condition, observed in 23.9% of patients, involves inflammation of the gums, often causing pain and bleeding [6]. Severe gingivitis has been reported at a higher rate among survivors, with an odds ratio of 2.04 [9]. Childhood cancer patients undergoing chemotherapy are at a higher risk of developing oral complications. Studies have shown a high prevalence of gingivitis (91.84%) and caries (81.63%) in children with acute lymphoblastic leukemia (ALL) receiving chemotherapy [22]. A systematic review reported overall incidence rates of 67.8% for caries, 55.6% for gingivitis, and 41.6% for mucositis in childhood cancer patients during chemotherapy [5].

Xerostomia: Dry mouth, or xerostomia, is a common problem that causes discomfort and increases the risk of caries [7]. It affects approximately 12% of patients and results from

reduced saliva production, which can lead to a higher risk of dental caries and oral infections [5], [12]. Xerostomia is significantly more prevalent among childhood cancer survivors, affecting them about 7.72 times more often than their healthy peers [9]. Another study reported a hyposalivation prevalence of 32% and a xerostomia prevalence of 9.4% in childhood cancer survivors, with female gender and higher radiation doses to the salivary glands identified as risk factors [14]. Saliva testing in pediatric oncology patients has shown lower pH levels and increased acidity compared to healthy controls, further predisposing them to caries [15].

Dental Anomalies: Survivors frequently experience conditions such as microdontia, hypodontia, and enamel hypoplasia, with odds ratios indicating a significantly higher prevalence compared to non-cancer controls [9]. Childhood cancer patients treated with chemotherapy before the age of seven are at high risk for developing dental anomalies [23]. Common dental anomalies include microdontia, hypodontia, root malformations, and enamel defects [19], [24]. The prevalence of these anomalies varies by tooth type, with premolars and second molars being more affected than other teeth [24]. Patients treated before the age of five show higher rates of microdontia and hypodontia compared to those treated between ages five and seven. Additionally, the combination of chemotherapy and radiotherapy increases the risk of root malformations [23]. Long-term exposure to chemotherapeutic agents is positively correlated with the prevalence of dental anomalies and caries [19]. These anomalies can persist into adulthood, requiring regular dental follow-up and, in some cases, complex treatment [25]. Maintaining long-term oral care is essential for patients who have undergone chemotherapy, even after their cancer treatment has been completed [24].

Oligomicrodontia: A condition characterized by a reduced size and number of teeth [26]. Microdontia refers to teeth that are smaller than normal, particularly the premolars [24]. Childhood cancer treatment, especially chemotherapy, can cause various dental abnormalities in survivors, including oligomicrodontia, microdontia, hypodontia, root deformities, and enamel defects [14], [18], [19]. Certain chemotherapeutic agents, such as vincristine, cyclophosphamide, and doxorubicin, are associated with a higher incidence of dental abnormalities. Early complications during treatment, such as mucositis and vomiting, can also contribute to tooth decay [19]. Ensure proper dental care and assess the long-term effects on oral health,

tooth development, and occlusion, the involvement of a dentist is essential for childhood cancer survivors [18].

Congenital Absence: A condition characterized by missing teeth, particularly the first and second molars [24]. Chemotherapy during childhood can lead to various dental abnormalities, including the absence of cuspids, microdontia, and short-rooted teeth, primarily affecting the premolars and second molars [15]. These dental abnormalities are associated with specific chemotherapeutic agents, such as vincristine, cyclophosphamide, and doxorubicin, as well as early complications like mucositis and vomiting [18]. These findings highlight the importance of long-term oral care for pediatric chemotherapy patients.

Root Agenesis and Short-Rooted Teeth: A condition characterized by incomplete root formation [24]. Childhood cancer treatments, particularly chemotherapy and radiation, can lead to significant dental anomalies, including tooth agenesis, microdontia, and short-rooted teeth, primarily affecting the second premolars and molars [25]. The incidence of dental complications is significantly higher in childhood cancer survivors compared to healthy controls, with 62.29% of survivors exhibiting abnormalities compared to 13.24% of controls [27]. These dental problems can persist long after treatment, necessitating regular dental follow-ups and, in some cases, complex interventions [25]. Understanding these risks is essential for implementing preventive and mitigating measures to improve the quality of life of post-treatment patients.

Conclusions

Children with cancer are at risk of developing oral mucositis, xerostomia, and infections. In the long term, they are also susceptible to dental anomalies and jaw development disorders. Additionally, complications such as pain, difficulty eating, and social stigma can arise, affecting the child's quality of life. Monitoring dental health from the start of chemotherapy is essential to promptly address potential complications with appropriate care and treatment.

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