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LITERATURE REVIEW:

Pediatric Oral Oncology: A Brief Updated Review

Oncología oral pediátrica: una breve revisión actualizada

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ABSTRACT: Pediatric oral oncology represents a complex and challenging field within pediatric dentistry and oncology. This brief review aims to examine current understanding, diagnostic approaches, and treatment modalities for oral and maxillofacial malignancies in the pediatric population. Special emphasis is placed on early detection, multidisciplinary treatment strategies, and management of treatment-related complications. Recent advances in targeted therapies and their impact on survival rates are also discussed.

KEYWORDS: Mouth neoplasms; Children; Epidemiology; Early diagnosis; Disease management; Posttreatment complications.

RESUMEN: La oncología oral pediátrica representa un campo complejo y desafiante dentro de la odontología y la oncología pediátricas. Esta breve revisión tiene como objetivo examinar la comprensión actual, los enfoques diagnósticos y las modalidades de tratamiento para las neoplasias malignas orales y maxilofaciales en la población pediátrica. Se hace especial hincapié en la detección precoz, las estrategias de tratamiento multidisciplinario y el tratamiento de las complicaciones relacionadas con el tratamiento. También se discuten los avances recientes en terapias dirigidas y su impacto en las tasas de supervivencia.

PALABRAS CLAVE: Cáncer oral; Niños; Epidemiología; Diagnóstico temprano; Manejo de la enfermedad; Complicaciones post-tratamiento.

INTRODUCTION

Oral and maxillofacial malignancies in children are rare but represent a significant health concern. Pediatric oral cancer presents unique challenges due to its aggressive nature and potential impact on craniofacial development (1, 2). The condition comprises only 2-3% of all pediatric cancers (3). Cancer has been often associated with various risk factors, requiring specialized management strategies including diagnosis, treatment, and long-term follow-up. Understanding their biological behavior and optimal management strategies is crucial for improving outcomes in this vulnerable population (3-5). This overview synthesizes current research on the epidemiology and management of oral cancer in children aged 0 to 12 years.

EPIDEMIOLOGY AND CLASSIFICATION OF COMMON MALIGNANCIES

Recent epidemiological studies (6, 7) have shown varying geographical distributions and risk factors for pediatric oral cancer. Most commonly encountered pediatric oral malignancies include unspecified lymphomas and rhabdomyosarcomas (3), although Langerhans cell histiocytosis, has also been frequently mentioned (8). About 40% of all pediatric soft tissue sarcomas that affect the mouth, head, and neck are oral rhabdomyosarcomas, mostly the embryonal subtype (9,10). Human Papilloma Virus (HPV)-related oral squamous cell carcinoma (OSCC) is also one of the frequently documented types (11). A recent systematic review by Di Spirito and colleagues found that only 1.37% of pediatric subjects had OSCC, while benign lesions like verruca vulgaris, squamous cell papilloma, and focal epithelial hyperplasia were more common (12).

RISK FACTORS FOR ORAL CANCER IN CHILDREN

The diverse and multifaceted nature of risk factors for oral cavity cancer in children highlights the complexity of identifying and understanding these elements (4,13). While some children develop oral cancer without any known risk factors, this suggests the existence of unidentified influences, possibly genetic or environmental, that are yet to be fully explored (7). Conversely, not all children exposed to known risk factors develop the disease, highlighting that these factors alone do not guarantee cancer development (14). Contributing elements, such as genetic predispositions, exposure to carcinogenic substances, and lifestyle factors, might play varying roles in individual susceptibility (13,14).

As already mentioned, HPV has been reported as playing a significant role in the development of malignant oral lesions in children. According to Di Spirito *et al.*, the most common HPV genotypes detected in these lesions are HPV-13, -6, -11, and -2, among others (12). HPV can be transmitted through various routes, including vertical transmission from mother to child during delivery, mouth-to-mouth contact, and potentially through sexual abuse, which must be ruled out in pediatric cases (11,15). Regular and meticulous clinical examinations are essential for early detection and management of HPV-related oral lesions (12).

DIAGNOSTIC APPROACHES AND CLINICAL PRESENTATION

Early recognition of suspicious lesions remains challenging due to their initial resemblance to benign conditions (16, 17). Common presenting symptoms include persistent swelling and unexplained tooth mobility (18). Recent advan-

ces in diagnostic imaging have improved early detection rates (13, 17, 18).

IMAGING AND OTHER DIAGNOSTIC TOOLS

Modern diagnostic approaches incorporate advanced imaging techniques, with particular emphasis on molecular diagnostic testing (1, 7). The integration of artificial intelligence in imaging analysis has shown promising results in early detection (19).

TREATMENT MODALITIES

The multidisciplinary approach typically involves a coordinated effort between various specialists, with improved outcomes noted in centers utilizing standardized protocols (20, 21). Recent studies have emphasized the importance of early dental intervention (22, 23). Prolonged time-to-treatment intervals in oral cancer are influenced by factors such as patient unawareness, diagnostic delays, and professional factors, leading to poorer survival rates (24).

THERAPEUTIC STRATEGIES

SURGERY

Surgical approaches have evolved significantly with the implementation of computer-aided navigation and advanced reconstructive techniques (25-27). Minimally invasive approaches have demonstrated promising outcomes in selected cases (28).

CHEMOTHERAPY

Protocol-based combination chemotherapy remains essential, with newer targeted agents showing improved efficacy (22, 29). Long-term dental implications require careful consideration (30, 31).

RADIOTHERAPY

Advanced radiation techniques, including intensity-modulated radiation therapy and proton treatments, have revolutionized treatment approaches (22, 32, 33). Recent studies demonstrate reduced long-term complications with modern techniques (32, 33).

INTERPROFESSIONAL CARE

Effective management of oral health in pediatric cancer patients requires a collaborative approach during and after cancer therapy, involving pediatric dentists and oncologists (21, 22). This ensures the mitigation of oral complications during and after cancer treatment and the development of individualized oral care programs (23, 34). Prenatal oral health care, including fluoride supplements and oral examinations, may protect against early childhood caries onset and reduce Streptococcus mutans carriage (35).

OTHER TREATMENT APPROACHES

Molecularly targeted agents have shown promising results in early trials (36). Immunotherapy approaches are emerging as valuable treatment options (37, 38). Improved pain control protocols (39) and enhanced nutrition support strategies (40) have demonstrated a significant impact on quality of life during treatment.

MANAGEMENT OF COMPLICATIONS

ACUTE COMPLICATIONS

Evidence-based protocols for managing acute complications, such as oral mucositis, subsequent infections, and trismus, have improved supportive care (30, 31, 41-43). Children undergoing cancer treatments such as chemotherapy, radiation, and hematopoietic stem cell transplantation

are at increased risk for severe oral mucositis, a condition that can complicate cancer therapy and affect quality of life (44). Factors such as changes in white cell and platelet counts and the use of specific chemotherapeutic agents are also significant risk factors (42). Female sex, mixed ethnicity, metastasis, and abnormal creatinine levels have also been mentioned (45).

The treatment of oral mucositis includes a combination of different care protocols and interventions such as cryotherapy, low-level light therapy, and keratinocyte growth factor have been suggested, although their use comes with varying degrees of recommendation and potential barriers related to cost and implementation (46). Natural compounds, regular tooth brushing, mouthwash, and lip care are essential. Diet interventions may produce a significant impact on treatment tolerance (47). Effective nutrients and beneficial agents include bee honey, olive oil, aloe vera, andiroba, vitamin E, zinc, and salivary enzyme toothpaste, which help reduce the severity and duration of mucositis and minimize pain (48-50).

Non-medical mouthwashes containing chlorhexidine, normal saline, sodium bicarbonate, and benzydamine are recommended as part of basic oral care management, although there is no conclusive evidence for their effectiveness (49). Other recommended therapeutic interventions such as palifermin, photodynamic therapy, and keratinocyte growth factor have shown promising efficacy in children receiving cancer treatment or undergoing stem cell transplantation (44,46).

LONG-TERM SEQUELAE

Childhood cancer survivors, particularly those treated with radiotherapy and chemotherapy (particularly alkylating agent therapy) before the age of 5, are at high risk for dental anomalies such as tooth agenesis, microdontia, and short roots. Both treatment interventions exhibit independent and additive effects (34). Dental anomalies are significantly more common in cancer survivors compared to healthy controls (51). These conditions require long-term monitoring. Studies demonstrate the importance of early intervention in managing craniofacial growth disturbances among these vulnerable groups (52).

FUTURE DIRECTIONS AND RESEARCH PRIORITIES

Ongoing studies focus on novel targeted therapies and biomarker identification (53). The role of artificial intelligence in diagnosis continues to expand (54). As survival rates for childhood cancers improve, dental professionals must be prepared to address the unique needs of long-term cancer survivors, who may present with complex dental issues resulting from their early cancer treatments (23, 51, 55).

CONCLUSION

Oral cancer in children, though rare, presents unique challenges in terms of epidemiology and management. Pediatric oncology continues to evolve with advances in diagnostic techniques, therapeutic approaches, and supportive care. Success in

treatment requires a delicate balance between aggressive disease control and preservation of function and quality of life. Effective management requires a multidisciplinary approach to address both acute and long-term oral health complications associated with cancer treatments. Further research is essential to fill existing gaps and improve outcomes for pediatric patients.

CONFLICTS OF INTEREST

None

ETHICAL CONCERNS

Not applicable

AUTHOR CONTRIBUTIONS STATEMENT

Conceived the study subject and provided critical feedback: S.A.R.
Designed the theoretical framework and took the lead in writing the manuscript. Both authors contributed to the final version of the manuscript: A.G.R.

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