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The Incidence of Head and Neck Cancer in East Sudan

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ABSTRACT

This review aims to provide an updated and detailed overview of the incidence of head and neck cancer in the eastern region of Sudan, focusing on studies conducted between 2018 and 2023. It aims to shed light on changes in incidence rates, emerging risk factors, advancements in diagnostic techniques, treatment modalities, and preventive strategies. Accurate knowledge of the latest trends and developments in head and neck cancer incidence is essential for effective public health planning and intervention. One significant aspect that the review highlights is the limited number of head and neck surgeons in East Sudan. It emphasizes the need for specialized training in staging malignancies using head and neck anatomy, as this information is vital for determining appropriate treatment approaches. With a shortage of trained professionals, it becomes even more critical to enhance the anatomic understanding and staging capabilities in order to improve patient outcomes and optimize treatment plans. The review underscores the urgency of addressing this gap in healthcare infrastructure. By increasing the number of head and neck surgeons in East Sudan and providing them with the necessary training, the region can improve its capacity to accurately stage head and neck cancers, leading to more effective treatment decisions and improved patient care. This review provides a comprehensive resource for understanding the current landscape of head and neck cancer incidence in the eastern region of Sudan. It addresses recent trends, emerging risk factors, and the need for improved anatomic understanding and staging capabilities. The findings can guide policymakers, healthcare providers, and researchers in implementing targeted strategies to reduce the burden of head and neck cancer in East Sudan and improve patient outcomes.

INTRODUCTION

The sixth most prevalent type of cancer worldwide is head and neck squamous cell carcinoma (HNSCC) (Johnson *et al.*, 2020). HNC was the second most prevalent malignancy recorded in men, after cancer of the prostate, and in women, behind cancers of the breast, cervix uteri, eye, and oesophagus, between 2018 and 2023, according to the Nairobi cancer registry (Joko-Fru *et al.*, 2020). Cancer-related morbidity and mortality are prevalent in Sudan East and are rising quickly.

While the number of yearly fatalities in the area from HIV, TB, and malaria is progressively dropping, the number of deaths from cancer is expected to rise by 85% between 2008 and 2030 (Ibrahim *et al.*, 2021). These forecasts are primarily based on predicted population increase and aging and assume static age-specific incidence rates. However, population-based cancer registries show rising cancer incidence, perhaps due to HIV and the westernisation of lifestyles (Msyamboza *et al.*, 2012). Traditional HNSCC risk factors include drinking alcohol, smoking, and using tobacco products for chewing; ethnicity, genetic background, regional origin, and dietary condition are other risk factors. Human papillomavirus (HPV) infection is a newly identified risk factor for HNSCC, defining a new subtype of tumour distinct from HPV-negative tumours (Sabatini & Chiocca, 2020). The International Agency for Research on Cancer has identified HPV as an HNSCC carcinogen (Papillomaviruses, 2011). In the upper

aerodigestive tract, which includes the mouth (oral cavity), lip, paranasal sinuses, nasal cavity, larynx, and pharynx, a variety of primary cancers arise. These are collectively called head and neck cancers (Pai & Westra, 2009). HNC is the sixth most prevalent cancer globally, with around 600,000 new cases each year with unacceptable fatality rates, particularly in underdeveloped nations, approaching 300,000 deaths annually (Jou & Hess, 2017). Head and neck squamous cell carcinoma (HNSCC), a subtype of HNC that develops from the mucosal lining epithelium of the upper aerodigestive tract, accounts for more than 90% of all cases of HNC (Chaturvedi *et al.*, 2013). This means that estimates of the future cancer burden in the area may be greatly exaggerated. In high-income nations, cancer survivorship has increased thanks to earlier cancer detection through screening, more knowledge of the biology and aetiology of tumours, better treatments, and supportive care. The larynx, other pharynx, nasopharynx, oral cavity, and lip sites comprise the sixth most prevalent malignancy (Wright, 2023). Based on the intricate anatomy and physiology of the head and neck area, upper aerodigestive tract malignancies are staged by site and sub-site per the American Joint Commission on Cancer (AJCC) staging manual (Allen *et al.*, 2017). The AJCC has identified the aerodigestive anatomic locations of the larynx, hypopharynx, oral cavity, nasopharynx, and sinonasal. Squamous cell carcinoma is the most prevalent histology across all head and neck sites (Giannis *et al.*, 2021).

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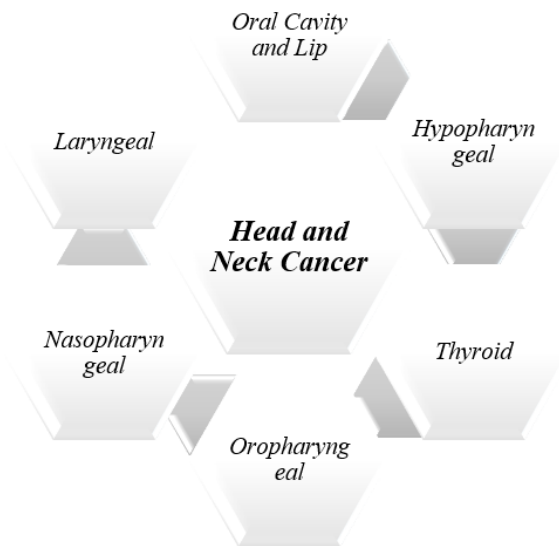


Figure 1: Shows the flow of head and neck cancer in the human body

The head and neck are depicted. The mucosal surface of the lips, the front two-thirds of the tongue, the buccal mucosa, the retromolar trigone, and the hard palate are all parts of the oral cavity. The soft palate, palatine tonsils, and tongue base are all located in the oropharynx, directly behind the oral cavity. The nasal cavity, clivus, soft palate, and sphenoid surround the superiorly situated nasopharynx. The supraglottis, glottis, and subglottis are parts of the larynx. The piriform sinus, postcricoid gap, and posterior pharyngeal wall are the subsites of the hypopharynx, located immediately posterior to the larynx. The paranasal sinuses and nasal cavities are additional head and neck locations.

LITERATURE REVIEW

Particularly in Sudan's east, head and neck cancer is a frequent and alarming problem. An updated and thorough grasp of the incidence, risk factors, diagnostic procedures, treatment modalities, and preventive measures particular to this area is what this literature review tries to deliver. This evaluation addresses significant deficiencies in the healthcare infrastructure while also shedding light on current trends and changes by emphasising investigations carried out between 2018 and 2023. The few head and neck surgeons in East Sudan is a key issue that is mentioned in this review. The essential need for specialised training in staging malignancies utilising head and neck anatomy is highlighted by the dearth of qualified experts. Accurate treatment strategies can be chosen, ultimately improving patient outcomes, by improving anatomical understanding and staging capabilities. To meet the increasing demands of head and neck cancer management, it is critical to address this gap in the healthcare infrastructure. Examining new risk factors is crucial for understanding the state of head and neck cancer in East Sudan. Infection with the human papillomavirus (HPV) and immunosuppression have both been noted as significant risk factors for the development of head

and neck cancer in recent research. These discoveries deepen our comprehension of the local aetiology of the disease and call for specialised preventive measures. Modernizations in diagnostic methods and therapeutic approaches are essential for efficient management. This study emphasises the advancements made in fields including laboratory research, imaging modalities (CT, MRI), and biopsies. Early detection, appropriate staging, and individualised treatment planning have all improved thanks to these developments. East Sudan's healthcare personnel can improve patient care by utilising these diagnostic tools.

Head and neck cancer prevention and early detection are crucial in reducing the burden. East Sudan has implemented public health interventions, tobacco control programs, HPV vaccination, and awareness campaigns to educate the population, promote healthy behaviors, and encourage regular screenings. Evaluating these strategies and addressing region-specific challenges is vital for tailored prevention and management approaches. Understanding regional challenges, such as limited resources, infrastructure, cultural considerations, and socioeconomic disparities, is essential for designing effective strategies. This review can guide future research, prevention programs, and treatment approaches, ultimately leading to improved outcomes and reduced incidence of head and neck cancer in East Sudan.

Immunosuppression

Immunosuppressed people are more likely to acquire mouth cancer. Patients with human immunodeficiency virus (HIV) are prone to Kaposi's sarcoma and lymphomas but not to OSCC. Lip tumours have been linked to immunosuppressed organ transplant patients, and the possible cause was suggested to be greater exposure to solar radiation and other risk factors, including smoking (Ritchie & Singanayagam, 2020). The investigations did not, however, provide evidence linking immunosuppression directly to the emergence of lip cancer (Van Leeuwen *et al.*, 2009).

Risk Factors

Identifying risk factors is crucial for understanding the aetiology of head and neck cancer and developing targeted preventive strategies. This section reviews the recent literature on risk factors associated with head and neck cancer in the East of Sudan (Almarzooqi *et al.*, 2023), including tobacco and alcohol use, betel quid chewing, HPV infection, dietary habits, and genetic predisposition (Mosalleum, 2014). The emphasis is on the evolving understanding of these risk factors and their impact on the local population. The most frequent risk factors for people with head and neck squamous cell carcinoma (HNSCC) historically have been cigarette and alcohol use (Zhou *et al.*, 2020).

About 80% of HNSCC patients were associated with an elevated risk due to cigarette smoking or alcohol consumption, which is common in those with a lengthy

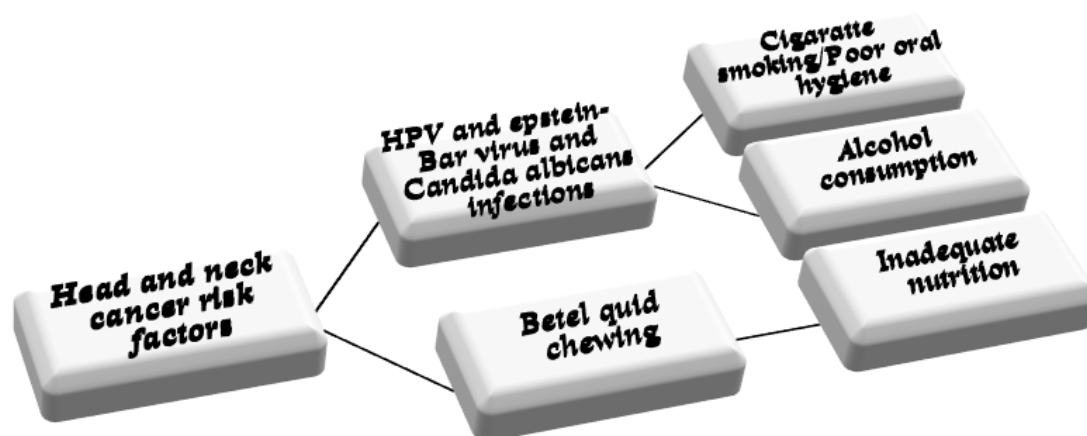


Figure 2: Summary of potential risk factors that cause the generation of HNSCC

history of both behaviours (Cherry *et al.*, 2018). The primary cause of many types of cancer, including HNSCC, has been identified as the carcinogenic influence of tobacco use. All tobacco products, including water pipes and electronic cigarettes, have negative, long-term impacts on health, especially in the head and neck region (Saunders *et al.*, 2022).

Histological Types and Distribution

Head and neck cancers encompass various histological types with distinct characteristics and treatment implications (Chiesa-Estomba *et al.*, 2021). This section provides an updated overview of the histological types and their distribution in the East of Sudan. The focus is on the prevalence of specific subtypes and any changes observed during the review period (Bhattacharjee *et al.*, 2006).

Histological Types

Head and neck cancers refer to a group of cancers that can occur in various regions of the head and neck, including the oral cavity, pharynx, larynx, and others (Doobaree *et al.*, 2009). These cancers are classified based on their histological types, which means the specific cell types and tissue characteristics involved in the cancer formation. Histological types help determine the behaviour of the cancer, its response to treatment, and prognosis (da Cruz Perez *et al.*, 2006).

Distinct Characteristics and Treatment Implications

Each histological type of head and neck cancer has distinct characteristics, such as the cell type involved, the pattern of growth, and the molecular features (Perri *et al.*, 2020). These characteristics can influence the behaviour of the cancer and its response to different treatment modalities, such as surgery, radiation therapy, or chemotherapy. Therefore, understanding the histological types is important for tailoring each patient's most appropriate treatment approach (De Carvalho *et al.*, 2012).

Overview of Histological Types

It provides an updated overview of the histological types in the East of Sudan. This suggests that there may have been

previous studies or data that described the distribution of histological types, and this paragraph aims to present a more recent understanding based on new information or research.

Distinct Characteristics and Treatment Implications

The focus is on the prevalence of specific subtypes within the histological types of head and neck cancers. Subtypes refer to different variations or subcategories within a broader histological type (Gebriel *et al.*, 2022). For example, within the category of squamous cell carcinoma (a common histological type of head and neck cancer), there may be subtypes like basaloid squamous cell carcinoma or papillary squamous cell carcinoma. This paragraph aims to provide information about the prevalence of these specific subtypes in the East of Sudan (Blumberg *et al.*, 2015).

Changes Observed During the Review Period

Any changes observed during the review period will be discussed. This indicates that the researchers or authors of the paragraph have conducted a review or analysis of data from a specific period. They likely compared this data to previous studies or data to identify any shifts or alterations in the prevalence or distribution of histological types or specific subtypes of head and neck cancers in the East of Sudan.

Advances in Diagnosis

Rapid and accurate diagnosis is crucial for optimal head and neck cancer management. This section discusses the recent advancements in diagnostic techniques, including biopsy, imaging modalities (CT, MRI), and laboratory investigations (Grégoire *et al.*, 2015). The focus is on how these advancements have improved early detection, staging, and treatment planning in the East of Sudan.

Rapid and Accurate Diagnosis: A prompt and accurate diagnosis is crucial for optimal managing head and neck cancer. Early detection and accurate diagnosis allow for the timely initiation of appropriate treatment strategies, which can significantly impact patient outcomes (Harris *et al.*, 2010).

Advancements in Diagnostic Techniques

Recent advancements have been made in head and neck cancer diagnostic techniques. These advancements refer to improvements or innovations in the methods used to diagnose and evaluate the disease. The following techniques are specifically mentioned:

Biopsy

Biopsy is a procedure in which a small tissue sample is taken from the affected area and examined under a microscope to determine if cancer is present. Recent advancements in biopsy techniques may include minimally invasive procedures or more precise sampling methods to enhance diagnostic accuracy (Kong & Birkeland, 2021).

Imaging Modalities

The paragraph mentions CT (Computed Tomography) and MRI (Magnetic Resonance Imaging) as imaging modalities to diagnose head and neck cancer. These imaging techniques provide detailed images of the affected areas, allowing healthcare professionals to visualise the tumour's location, size, and extent of spread (Liao *et al.*, 2012). Advancements in CT and MRI technology may include higher-resolution imaging, improved contrast agents, or specialised protocols for specific head and neck cancer types.

Laboratory Investigations

Laboratory investigations encompass tests performed on blood, saliva, or other samples to detect specific markers or abnormalities associated with head and neck cancer. Recent advancements in laboratory investigations may involve the development of new biomarkers or more sensitive and specific testing methods that aid in diagnosing, staging, or monitoring the disease (Peter *et al.*, 2013).

Improved Early Detection, Staging, and Treatment Planning

These advancements in diagnostic techniques have improved early detection, staging, and treatment planning, specifically in the East of Sudan. Early detection refers to identifying the cancer early when it is more likely to be treated successfully. Accurate staging helps determine the extent of the disease and guides treatment decisions. Advanced diagnostic techniques enable healthcare professionals in the East of Sudan to identify head and neck cancer earlier, accurately stage the disease, and develop personalised treatment plans tailored to each patient's condition (Scott *et al.*, 2008).

METHODOLOGY

To indicate the incidence of head and neck cancer in east Sudan in different age groups, several recent studies, review articles, prospective studies, cross-sectional studies, and literature reviews, all published and peer-reviewed, were searched and considered. Data was gathered from different search engines and databases such as; Google Scholar, Scopus, PubMed, Elsevier, Cochrane, Sage, Medline and Web of Science.

Numerous studies were selected from 2018-2023, using the keywords "Head and Neck Carcinomas", "HNSCC", "East of Sudan", "Risk Factors", "Incidence", "Advancements", "Future challenges", "Diagnosis", "Treatment". The full texts of the retrieved articles were made accessible.

This article is a review. Thus not all information on the incidence of head and neck cancer has been provided are contained in this. We have included observational studies and all significant, pertinent big trials to highlight the overall conclusions. Although we tried to incorporate the largest and most pertinent research, it is important to remember that the tiny, hopeful observational studies were likely chosen due to publication bias.

DISCUSSION

Treatment Modalities

Effective management of head and neck cancer requires a multidisciplinary approach. This section reviews the recent advancements in treatment modalities, including surgery, radiation therapy, chemotherapy, targeted therapies, and immunotherapy, in the East of Sudan. The focus is on new treatment options, outcomes, and challenges in resource-limited settings (Syrigos *et al.*, 2009).

Multidisciplinary Approach

Effective management of head and neck cancer requires a multidisciplinary approach. This means that various healthcare professionals from different specialties, such as surgeons, radiation oncologists, medical oncologists, and others, collaborate to develop comprehensive treatment plans and provide optimal patient care.

Recent Advancements in Treatment Modalities: Recent advancements have been made in treatment modalities for head and neck cancer in the East of Sudan. These advancements refer to new or improved methods of treatment that have emerged in recent times (Galbiatti *et al.*, 2013). The following treatment modalities are specifically mentioned:

Surgery

Surgery involves the removal of the tumour and nearby affected tissues. Advancements in surgical techniques may include minimally invasive procedures, improved reconstructive options, or more precise surgical navigation systems, which can help maximise tumour removal while minimising damage to healthy tissues (Mody, 2021).

Radiation Therapy

Radiation therapy uses high-energy radiation to kill cancer cells or shrink tumours. Recent advancements in radiation therapy may include more precise and targeted radiation delivery techniques, such as intensity-modulated radiation therapy (IMRT) or stereotactic radiosurgery (SRS), (Lalla, R. V., Brennan, 2019) which can improve treatment outcomes while minimising side effects.

Chemotherapy

Chemotherapy involves using drugs to kill cancer cells or

prevent their growth. Advancements in chemotherapy may include the development of new drugs or more targeted chemotherapy regimens that specifically target cancer cells while minimising damage to normal cells.

Targeted Therapies

Targeted therapies are drugs that specifically target certain molecular or genetic abnormalities in cancer cells. These therapies aim to disrupt specific pathways or proteins that promote cancer growth (Alsaifi, E., Begg, K., Amelio, I., Raulf, N., Lucarelli, P., Sauter, T., & Tavassoli, M. (2019). Advancements in targeted therapies may include discovering new targets or developing more effective drugs that can inhibit these targets, leading to improved treatment outcomes.

Immunotherapy

Immunotherapy is a treatment that harnesses the body's immune system to fight cancer (Gavrielatou, N., Dumas, S., Economopoulou, 2021). Recent advancements in immunotherapy for head and neck cancer may include immune checkpoint inhibitors, therapeutic vaccines, or adoptive cell therapies, which can enhance the immune response against cancer cells and improve treatment outcomes.

New Treatment Options, Outcomes, and Challenges

The paragraph mentions the focus is on new treatment options, treatment outcomes, and challenges in resource-limited settings (Starzyńska *et al.*, 2022). This indicates that the authors or researchers have examined the introduction of novel treatments, the impact of these treatments on patient outcomes, and the specific challenges faced in implementing these advancements in a resource-limited setting like the East of Sudan. Resource limitations may include factors such as the availability of specialised equipment, financial constraints, or limited access to certain medications (Zaryouh *et al.*, 2022).

Prevention and Screening Strategies

Prevention and early detection play a vital role in reducing the burden of head and neck cancer. This section discusses recent efforts and strategies implemented in the East of Sudan for prevention and screening, including public health interventions, tobacco control programs, HPV vaccination, and public awareness campaigns. The focus is on the impact of these strategies and any barriers to implementation (Hashim *et al.*, 2019).

Prevention and Early Detection

Prevention and early detection are crucial in combating head and neck cancer. Prevention strategies aim to reduce the occurrence of cancer by targeting risk factors, while early detection strategies focus on identifying cancer at an early stage when treatment outcomes are generally more favourable (Johnson, D. E., Burtneiss, 2020).

Recent Efforts and Strategies

In the East of Sudan, recent initiatives and tactics have

been put into practise to detect and prevent head and neck cancer. This shows that deliberate steps or activities have been done to address the disease's impact in the area. They mention the following tactics:

Public Health Interventions

Public health interventions refer to targeted actions implemented at the population level to promote health and prevent diseases. In the context of head and neck cancer, public health interventions may include educational campaigns, community outreach programs, or health promotion initiatives to raise awareness about risk factors, promote healthy behaviours, and encourage regular screenings (Mady, L. J., Kubik, M. W., Baddour, K., Snyderman, C. H., & Rowan, N. R. (2020).

Tobacco Control Programs

Tobacco use is a significant risk factor for head and neck cancer. Tobacco control programs aim to reduce tobacco consumption through various measures such as awareness campaigns, tobacco taxation, smoking cessation programs, and the implementation of smoke-free policies in public places (Mody, M. D., Rocco, 2021). These programs can help decrease the incidence of head and neck cancer by reducing tobacco-related exposures.

HPV Vaccination

The human papillomavirus (HPV) is a known risk factor for certain types of head and neck cancer. HPV vaccination programs target the prevention of HPV infection, primarily through vaccination of adolescents (Turbeville, H. R., Toni, T. A., & Allen, C. (2022). HPV vaccination can significantly reduce the risk of developing HPV-related head and neck cancer. Implementing HPV vaccination programs in the East of Sudan can contribute to prevention efforts.

Public Awareness Campaigns

Public awareness campaigns aim to educate the general population about the signs and symptoms of head and neck cancer, the importance of early detection, and the availability of screening services. These campaigns raise awareness, improve knowledge, and encourage individuals to seek timely medical evaluation, potentially leading to early diagnosis and treatment.

Impact of Strategies and Barriers to Implementation

The paragraph mentions that the focus is on the impact of these strategies and any barriers to implementation. This indicates that the authors or researchers have evaluated the effectiveness of the implemented strategies and assessed the challenges faced in carrying out these initiatives in the East of Sudan. Barriers to implementation could include limited resources, cultural factors, access to healthcare services, or community engagement (Russell, 2015).

Future Directions and Challenges

This section highlights the future directions for research, prevention, and management of head and neck cancer in the East of Sudan. It discusses the challenges specific

to the region and identifies areas that require further investigation and intervention (Mody, M. D., Rocco, 2021). The aim is to provide insights into potential strategies to improve outcomes and reduce the incidence of head and neck cancer.

Challenges Specific to the Region

There are challenges specific to the East of Sudan regarding head and neck cancer. These challenges could include limited resources, infrastructure, access to healthcare services, cultural considerations, or socioeconomic disparities. Understanding and addressing these region-specific challenges are crucial for designing effective strategies to tackle head and neck cancer in the East of Sudan.

Areas Requiring Further Investigation and Intervention

Certain areas require further investigation and intervention. This suggests that there are gaps in knowledge or areas that need more attention to improve the region's prevention and management of head and neck cancer. These areas could include understanding the specific risk factors prevalent in the population, evaluating the effectiveness of current interventions, identifying new treatment options, studying the impact of genetic or molecular factors, or exploring disparities in access to healthcare.

Insights and Potential Strategies

The aim is to provide insights into potential strategies to improve outcomes and reduce the incidence of head and neck cancer. This indicates that the authors or researchers aim to offer valuable information and recommendations to guide future efforts. These insights may include suggestions for targeted prevention programs, improvements in early detection methods, the development of more accessible and affordable treatment options, or recommendations for policy changes to address the challenges faced in the region.

CONCLUSION

The incidence of head and neck cancer in the East of Sudan continues to be a significant public health concern. This review provides an updated understanding of the recent epidemiological trends, risk factors, diagnostic advances, treatment modalities, and preventive strategies specific to the region. By focusing on the recent developments and future directions, this review aims to contribute to the ongoing efforts to address head and neck cancer in the East of Sudan. The review emphasises the importance of a multidisciplinary approach in effectively managing this disease. It underscores the significance of rapid and accurate diagnosis, enhanced by recent advancements in diagnostic techniques such as biopsy, imaging modalities (CT, MRI), and laboratory investigations. These advancements have improved the region's early detection, staging, and treatment planning.

The review also emphasises recent advancements in treatment modalities, including surgery, radiation therapy, chemotherapy, targeted therapies, and immunotherapy. These advancements offer new options for patients in the East of Sudan and have the potential to improve treatment outcomes. Furthermore, prevention and early detection strategies are vital in reducing the burden of head and neck cancer. Efforts such as public health interventions, tobacco control programs, HPV vaccination, and public awareness campaigns have been implemented to address these aspects in the region. Highlights the challenges specific to the East of Sudan, such as limited resources, infrastructure, access to healthcare services, and cultural considerations. These challenges necessitate further research, investigation, and intervention to develop tailored strategies that address the region's unique needs. Identifying future directions for research, prevention, and management is crucial in guiding efforts to improve outcomes and reduce the incidence of head and neck cancer in the East of Sudan.

Novelty of Research

The study focuses on head and neck cancer incidence in the eastern region of Sudan, focusing on the region's unique characteristics and challenges. It provides an updated overview of the landscape from 2018 to 2023, identifying emerging risk factors, highlighting advancements in diagnostic techniques and treatment modalities, and emphasizing the need for specialized training in head and neck anatomy staging malignancies. The review emphasizes the need for improved healthcare infrastructure and addressing the gap in head and neck surgeons in the eastern region.

Contribution to Knowledge

The review provides an updated overview of head and neck cancer incidence in the eastern region of Sudan from 2018 to 2023, highlighting emerging risk factors like immunosuppression and HPV infection. It also discusses advancements in diagnostic techniques and treatment modalities, emphasizing the need for specialized training and healthcare infrastructure to improve early detection, staging, and personalized treatment planning. Addressing the gap in healthcare infrastructure is crucial for enhancing anatomic understanding and staging capabilities, ultimately leading to better patient outcomes.

Fulfillment of Research Gap

The review provides a comprehensive resource on head and neck cancer incidence in the eastern region of Sudan, incorporating recent studies and data. It addresses the need for targeted strategies, diagnostic techniques, and treatment modalities, guiding policymakers, healthcare providers, and researchers in implementing these interventions. The review also highlights challenges, such as limited resources and infrastructure, and offers recommendations for future research and intervention.

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Conflict of Interest

The authors declare no conflict of interest.

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