



African Journal of Biological Sciences



<https://doi.org/10.33472/AFJBS.6.5.2024.2371-2380>

Epidemiological Trends and Statistical Analysis of Upper Aerodigestive Tract Cancer in Western Algeria: A 7-Year Study

Abia Khouani^{1*}, Lamia Boublenza¹, Ilyes Zatla^{1*}, Nafissa Chabni², Riad Ben Hbib², Hafida Hassaine¹

¹ Laboratory of Microbiology applied to the Food industry, Biomedical and the Environment, Faculty of Natural and Life Sciences, Earth and Universe Sciences. Department of Biology. University of Tlemcen, Algeria.

² Department of Epidemiology, Dr Tidjani Damerdji University Hospital, Tlemcen, Algeria.

* **Author for correspondence:** E-mail abia.kouani@univ-tlemcen.dz, ilyes.zatla@univ-tlemcen.dz

Abstract

Uncontrolled cell proliferation characterizes cancer, driven by abnormal gene expression intricately linked to cell cycle dysregulation. Algeria has witnessed a significant escalation in cancer incidence and mortality rates, with 32,802 deaths recorded in 2020. This surge is largely attributed to prevalent risk factors such as tobacco and alcohol consumption, coupled with inadequate intake of fruits and vegetables, all major contributors to upper aerodigestive tract (UADT) cancers. Additionally, viral factors, notably Human Papillomavirus (HPV) and Epstein-Barr Virus (EBV), play significant roles in UADT cancer etiology. This category encompasses tumors affecting the oral cavity, pharynx, and larynx, primarily characterized by epidermoid histological features. This study represents a comprehensive statistical analysis of UADT cancer patients in western Algeria utilizing SPSS software, over the period spanning 2012 to 2019, whereas a total of 1,124 cases of UADT cancer were documented in western Algeria, peaking notably in 2017. The larynx emerged as the most frequently affected site, comprising 60.3% of recorded cases. Males exhibited a higher susceptibility, constituting 75% of the affected population, with the age group ≤ 60 demonstrating the highest representation. This recent epidemiological investigation holds significant implications for clinical practice and preventive healthcare strategies aimed at addressing the burden of UADT cancer.

Keywords: Cancer, Risk Factors, Epidemiology, Public Health, Algeria.

Introduction

Cancers affecting the upper aerodigestive tract (UADT), encompassing anatomical regions such as the lips, oral cavity, pharynx, larynx, salivary glands, and esophagus, constitute a formidable global health challenge. With 1.4 million new cases diagnosed in 2018, UADT cancers rank as the sixth most prevalent malignancies, accounting for 8.1% of all cancer sites [1]. This collective term serves to underscore the intricate interplay of various physiological systems within the upper digestive and respiratory pathways.

The etiology of UADT cancers is multifaceted, reflecting a complex interplay between genetic predisposition and environmental exposures. Lifestyle factors, including alcohol consumption, cigarette smoking, betel nut chewing, and poor oral hygiene, collectively contribute to an elevated risk of developing multiple squamous cell carcinomas (SCC) within the UADT [2]. Moreover, dietary habits characterized by inadequate intake of green vegetables and fruits further exacerbate this risk profile. Notably, the emergence of oncogenic strains of the human papillomavirus (HPV), predominantly HPV-16, has garnered significant attention in recent years, particularly in the context of oropharyngeal tumors. Infection with HPV represents a pivotal risk factor, implicated in the pathogenesis of UADT cancers, albeit to a lesser extent compared to traditional carcinogens [3]. Similarly, the Epstein-Barr virus (EBV), a member of the herpesvirus family, has been implicated in nasopharyngeal carcinoma, further underscoring the diverse viral etiologies underlying UADT malignancies.

Against this backdrop, this work endeavors to furnish a comprehensive overview of the epidemiological landscape of UADT cancers in western Algeria over a span of seven years. By synthesizing existing data and elucidating key trends, this study aims to shed light on the prevalence, distribution, and determinants of UADT cancers within the region. Through a nuanced understanding of these epidemiological patterns, stakeholders can inform evidence-based interventions and policy initiatives aimed at mitigating the burden of UADT cancers in this population.

Materials and Methods

Data collection

Data acquisition for this retrospective study was facilitated through collaboration with the Epidemiology Department of the Western Algeria Hospital Centre. A comprehensive dataset

comprising 1,124 cases of upper aerodigestive tract (UADT) cancer diagnosed between 2012 and 2019 was meticulously curated for analysis.

Inclusion criteria encompassed patients with histopathological confirmed UADT cancer diagnoses within the specified time frame. Exclusion criteria were applied to ensure the integrity and homogeneity of the study cohort, excluding cases with incomplete or inconsistent clinical records.

Data analysis

Statistical analysis was conducted utilizing SPSS (Statistical Package for the Social Sciences) version 23, supplemented by data validation and visualization through Microsoft Excel®. Descriptive statistics were employed to delineate demographic characteristics, tumor distribution, and temporal trends within the study population.

Ethics

Ethical considerations were paramount throughout the research process, with adherence to established guidelines and protocols governing patient confidentiality and data privacy. Institutional review board approval was obtained to ensure compliance with ethical standards and safeguard the rights and welfare of study participants.

Results

Over the 7-year study period, the incidence of upper aerodigestive tract (UADT) cancers exhibited notable variation. Commencing at 8% in 2012, the prevalence experienced a slight decline in 2013, followed by a progressive escalation culminating in a peak of 29% in 2017, subsequently declining sharply until 2019 (Fig. 1).

In this study cohort, the age distribution of UADT cancer patients revealed distinct patterns, with the age group between 60 and 69 exhibiting the highest prevalence at 30.01%, followed closely by individuals over 70 years old, comprising 27.85% of cases. The mean age at diagnosis was 56.51 years. Notably, a noteworthy percentage of 3.01% was observed among patients under 30 years old (Tab. 1).

Nasopharyngeal cancer emerged as the predominant malignancy within the UADT spectrum, constituting 42% (342 cases) of all documented cases. Laryngeal cancer followed closely, accounting for 27% of cases, with esophageal and oropharyngeal cancers representing 9% and 8%, respectively (Fig. 2).

Analysis of the entire study population underscored a clear male predominance, with males comprising 65.8% (740) of UADT cancer cases compared to 34.16% (384) in females, resulting in a sex ratio of 1.9 (Fig. 3).

Morphological analysis revealed a predominant occurrence of squamous cell carcinoma among these cancer cases, comprising 53.46% (601 cases), followed by carcinomas at 37.45% (421 cases). Other histological types, including verrucous carcinoma, spindle cell carcinoma, mucoepidermoid carcinoma, and others, accounted for 5.16% collectively, with adenocarcinomas trailing at 3.91% (Tab.2).

A male predominance was observed across all areas of upper aerodigestive tract cancers, with the nasopharynx showing 57.89% cases in men versus 42.1% in women, the larynx with 81.44% in men versus 18.55% in women, the esophagus with 65.21% in men versus 21.73% in women, and the oropharynx with 86.56% in men versus 13.43% in women. Notably, oral cavity cancer exhibited a deviation from this trend, with the highest percentage occurring in women at 61.01% (69 cases) compared to 38.93% (44 cases) in men ($P < .0001$) (Fig. 4).

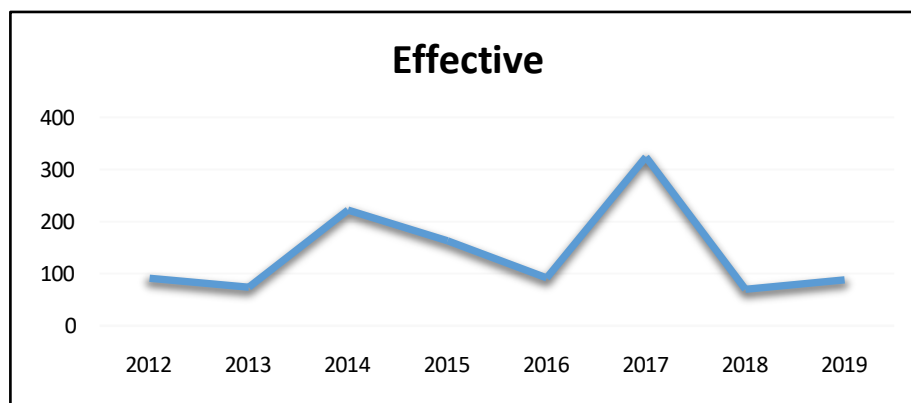


Figure 1. Distribution of UADT cancers between 2012 and 2019

Table 1. Distribution of UADT Cancers by Age Group

AGE GROUP	PERCENTAGE
>30	3.01%
[30-39]	6.20%
[40-49]	10.44%
[50-59]	22.49%
[60-69]	30.01%
≤70	27.85%

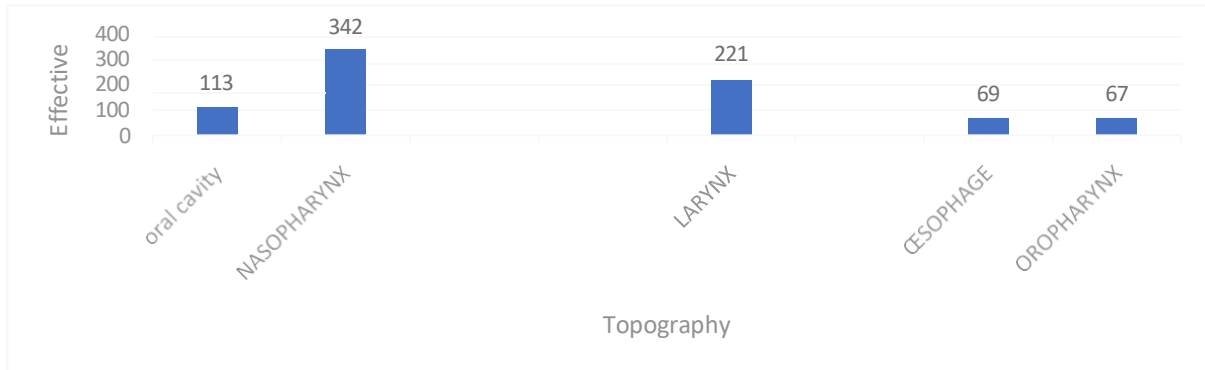


Figure 2. Topography of UADT cancers

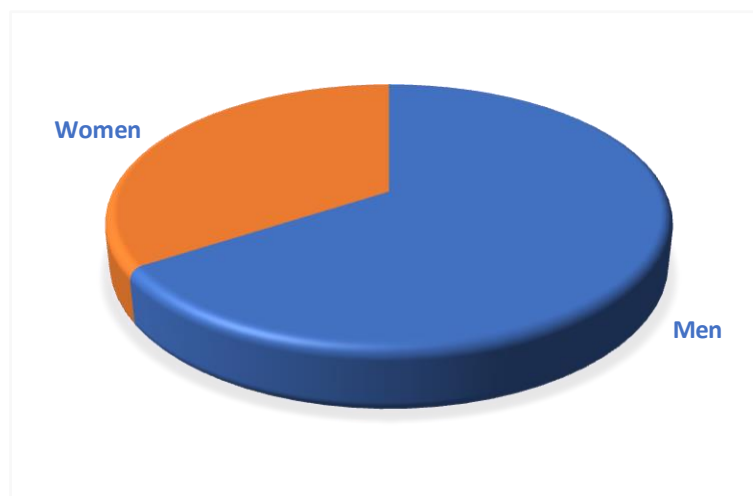


Figure 3. Distribution of UADT Cancers by sex

Table 2. Distribution of upper aerodigestive tract cancers by morphology

Morphology	Effective	Percentage
Squamous cell carcinoma	601	53.46 %
Adenocarcinoma	44	3.91 %
Carcinoma	421	37.45 %
Other	58	5.16 %

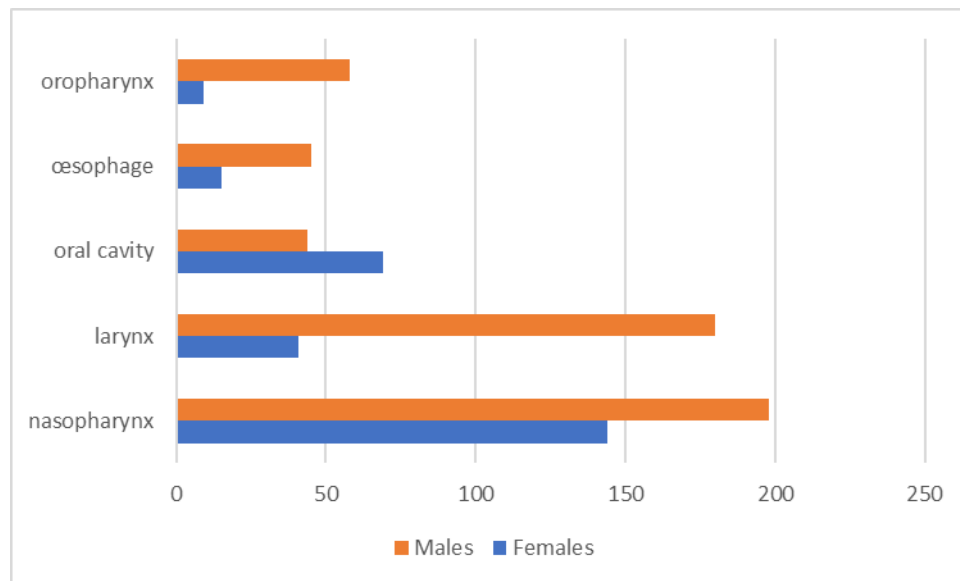


Figure 4. Distribution of UADT cancers by gender and tumor location

Discussion

Cancers of the head and neck (HNC) or upper aerodigestive tract (UADT) constitute a significant public health burden globally, accounting for 10% of all cancers and ranking fifth in terms of incidence, and sixth in terms of cancer mortality [4]. In 2020, Algeria reported 2,671 new cases and 1,558 deaths attributed to UADT cancers [5]. Our study underscores a pronounced male predominance in UADT cancers, with males comprising 65.8% of cases.

These findings align with epidemiological data from Africa, the Maghreb region, and worldwide, where men exhibit a heightened susceptibility to HNC, often experiencing a twofold to fivefold greater risk than women [6]. While precise data on the prevalence of smoking and alcohol consumption among females in our geographical area are lacking, cultural and religious factors likely contribute to a lower prevalence of these risk behaviors among women. Additionally, environmental factors such as poor dental hygiene, dietary habits, and viral infections, particularly human papillomaviruses (HPV), may play significant roles in UADT carcinogenesis, potentially contributing to the observed incidence among women [7]. Our study corroborates previous literature indicating a peak incidence of UADT cancers in the age group between 60 and 69 years, consistent with global trends [7]. Notably, UADT cancers exhibit a male predominance, with a male-to-female ratio of 3.1, peaking at around 50-60 years of age [7].

While chemical risk factors such as smoking and alcohol consumption have been extensively studied, emerging evidence implicates HPV infection in a subset of head and neck squamous cell carcinomas (HNSCC), particularly oropharyngeal SCC (OPSCC). HPV has emerged as a major driver of malignant transformation in 20-30% of OPSCC cases, independent of traditional risk factors [8]. Similarly, the Epstein-Barr virus (EBV) has long been associated with nasopharyngeal carcinoma, potentially explaining the observed incidence among individuals under 30 years of age in our study cohort [8].

Regarding cancer topography, nasopharyngeal cancer emerged as the most prevalent, followed by laryngeal and oral cavity cancers. Notably, nasopharyngeal carcinoma exhibits geographical and racial variations, with a higher incidence observed in regions such as South China, Southeast Asia, and North Africa, particularly Libya and Tunisia [9].

Squamous cell carcinoma (SCC) is a type of epithelial malignancy that commonly emerges on the skin's surface, as well as in the linings of the aerodigestive tract and anogenital region. The incidence rates of these tumors are on the rise, largely due to significant risk factors such as ultraviolet light exposure, smoking, excessive alcohol consumption, and human papillomavirus (HPV) infection. They represent the most prevalent malignancies within upper aerodigestive tract cancers [13]. In our study, squamous cell carcinoma accounted for over half of all other morphological types (53.46%), consistent with findings in existing literature.

Overall, male dominance was observed in UADT (upper aerodigestive tract) cancers, except for oral cavity cancer, which was the most frequent site in 61.06% of women. This result slightly diverges from the literature, possibly attributable to dietary habits, particularly the inadequate consumption of fruits, vegetables, and vitamins among women in the studied geographical area (western Algeria). Nutritional factors such as diet, weight, alcohol intake, and physical activity are recognized influencers on the onset of various cancer types. While scientific evidence is less abundant, their impact on tumor progression is also underscored [14]. Factors like insufficient physical activity or potentially higher rates of HIV infection among some women, given the increased prevalence of HIV in this population, could further contribute to these observations. Our study contributes to the limited body of research focused on UADT cancers in Algeria, particularly in the western region. By analyzing various parameters and cancer subtypes, our findings provide valuable insights into the epidemiological landscape of UADT cancers in this population. This investigation represents a crucial step towards informing targeted interventions and healthcare policies aimed at alleviating the burden of UADT cancers in Algeria.

However, it's important to acknowledge certain limitations in our study. These include the absence of detailed data on lifestyle factors such as smoking and alcohol consumption, as well as the lack of information on HPV and EBV infection status among study participants. Additionally, the retrospective nature of the study may introduce bias and constrain the generalizability of findings. Further prospective studies with larger sample sizes and comprehensive data collection are warranted to validate our findings and elucidate the underlying mechanisms driving UADT carcinogenesis. Despite its limitations, our study sheds light on the epidemiology of UADT cancers in western Algeria, highlighting the need for targeted interventions and healthcare policies to mitigate the burden of these malignancies. Our findings underscore the importance of addressing modifiable risk factors such as smoking, alcohol consumption, and viral infections in the prevention and management of UADT cancers. Moreover, our study provides a foundation for future research aimed at elucidating the complex interplay between genetic, environmental, and lifestyle factors in UADT carcinogenesis.

Conclusion

Cancers of the upper aerodigestive tract (UADT) constitute a significant proportion of malignancies, particularly among men, ranking fourth among the most frequent cancers. Our study in the west of Algeria over a 7-year period reaffirms the male predominance of UADT cancers, with the most affected age group being between 60-69 years, and nasopharyngeal cancer emerging as the most prevalent subtype. Despite these limitations, the increasing incidence of UADT cancers in Algeria, as evidenced by the significant number of new cases and deaths recorded in 2020, underscores the urgent need for improved diagnostic techniques, including molecular identification methods. Addressing these challenges and gaps in knowledge is essential for developing effective strategies for the prevention, diagnosis, and management of UADT cancers in Algeria.

Acknowledgments

The authors extend their gratitude to Mr. Ben Hbib Riad, a valued member of Madame Chabni's team at Tlemcen University Hospital Center, as well as Ms. Kherraf Hayat and Ms. Said Samia, esteemed members of the Pathological Anatomy Laboratory at the Popular Hospital Establishment of Benaouda Benzardjeb in Ain Temouchent. Their invaluable assistance in selecting upper aerodigestive tract data from cancer registries in the western Algerian region is greatly appreciated.

Declarations

Ethical Considerations

This study adheres to the principles outlined in the Declaration of Helsinki and was conducted with approval from the Institutional Review Board of Tlemcen University Hospital Center. All patient data were anonymized and handled with strict confidentiality to protect privacy rights. Informed consent was obtained from all participants included in the study. This research with integrity and transparency, aiming to contribute to the advancement of medical knowledge and public health initiatives.

Availability of data and materials

The data that support the findings of this study are available from the corresponding author upon request.

Competing interests

The authors declare no conflict of interest.

Funding

This research received no external funding.

Authors contributions

All authors contributed equally to the work.

References

1. Jiahao Zhu, Yuxiao Ling, Shuai Mi, Hanzhu Chen, Jiayao Fan, Shaofang Cai, Chunhong Fan, Qing Shen, Yingjun Li, Association between dietary inflammatory index and upper aerodigestive tract cancer risk: A systematic review and dose-response meta-analysis, *Oral Oncology*. 2020; 103.
2. Chen, C.-H., Wang, W.-L., Hsu, M.-H.; Mochly-Rosen, D. Alcohol Consumption, ALDH2 Polymorphism as Risk Factors for Upper Aerodigestive Tract Cancer Progression and Prognosis. *Life*. 2022; 12: 348.
3. Gormley, M., Creaney, G., Schache, A. et al. Reviewing the epidemiology of head and neck cancer: definitions, trends and risk factors. *Br Dent J*. 2022; 233: 780–786.
4. Argiris A, Eng C. Epidemiology, Staging, and Screening of Head and Neck Cancer In Rosen Steven T, Cancer Treatment and Research. Head and Neck Cancer. Kluwer publishers. Edited by Bruce Brocksteinand Gregory Masters.2004 Kluwer Academic Publishers New York, Boston, Dordrecht, London, Moscow. p.16-21.

5. Globocan, 2020.
6. Imard EP, Torre LA, Jemal A. International trends in head and neck cancer incidence rates: differences by country, sex and anatomic site. *Oral Oncol.* 2014; 50(5):387–403
7. Badoual, C. Adimi, J. Martin, B. Morin, R. Baudouin, Les cancers des voies aérodigestives supérieures induits par une infection par Papillomavirus humain : spécificités épidémiologiques, diagnostiques, pronostiques et thérapeutiques, *Bulletin de l'Académie Nationale de Médecine*, Volume 207, Issue 3, 2023, Pages 295-302.
8. Broccolo, F., Ciccarese, G., Rossi, A. et al. Human papillomavirus (HPV) and Epstein-Barr virus (EBV) in keratinizing versus non-keratinizing squamous cell carcinoma of the oropharynx. *Infect Agents Cancer.* 2018; 13: 32.
9. Salehiniya H., Mohammadian M., Mohammadian-Hafshejani A., Mahdavi N. Nasopharyngeal cancer in the world: epidemiology, incidence, mortality and risk factors. *WCRJ.* 2018; 5 (1): e1046.
10. Charef, S., Jrad, B. B., Mahfouth, W., et al. Detection of EBV by PCR in fresh and paraffin embedded samples of cavum tumour. *Archives de L'institut Pasteur de Tunis*, 2006; 83(1-4): 41-47.
11. Bofares KM. Epstein-Barr Virus Infection as Significant Predisposing Factor and Post-Radiotherapy Prognostic Indicator among Libyan Patients with Nasopharyngeal Cancer. *J Biomed Res Environ Sci.* 2022; 3(9): 1020-1026.
12. El Bousaadani, A. et al. Epidemiology and incidence of cancers of the upper aerodigestive tract in the greater Casablanca region in Morocco during 2014. *African Journal of Cancer.* 2015; 7: 202-205.
13. Sanchez-Danes A, Blanpain C. Deciphering the cells of origin of squamous cell carcinomas. *Nat Rev Cancer.* 2018; 18: 549–561.
14. Ancellin R., Cottet V., Dossus L., Fassier P., de Saintignon J.G., Ginhac J., Romieu I., Salas S., Schneider S., Srour B., Touillaud M., Touvier M., Latino-Martel P. Impact des facteurs nutritionnels pendant et après cancer. *Bulletin du Cancer.* 2021; 108:455-464.