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CLINICAL REVIEW

Alcohol-related head and neck cancer: Summary of the literature

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Abstract

Alcohol drinking is a risk factor for the development of head-and-neck malignancies, including oral, pharyngeal, and laryngeal cancers, and coupled with tobacco use, accounts for 75% of oral cancers. We summarized the literature on alcohol-related head and neck cancer (HNC) and identified gaps that represent areas for future investigation. Research indicates that alcohol consumption has not only been linked to the development of primary HNCs, but also to secondary cancers with continued alcohol intake, cancer recurrences, and other poor health outcomes. Given this evidence, several organizations have called for reduction or avoidance of alcohol, particularly in HNC survivors. Despite these strong recommendations, evidence suggests that HNC survivors continue to use alcohol. There is a need to forge collaborations among clinicians, researchers, and social workers, to address this problem of alcohol consumption in the growing population of HNC survivors.

KEYWORDS

alcohol, head and neck cancer, intervention, mHealth, technology

1 | INTRODUCTION

1.1 | Overview

This manuscript provides an overview of the current state of the literature on alcohol-related head and neck cancer (HNC). The link between alcohol use and HNC and other negative outcomes has been well-documented around the world, although the exact pathways through which alcohol use leads to HNC are less clear. Despite recommendations from several national organizations for HNC survivors to reduce or eliminate alcohol use, evidence suggests that this population continues to use alcohol. In addition, we review the literature on: the multiple self-report tools used to capture alcohol use and abuse within HNC populations and beyond; the dose-response relationship between alcohol and the development of cancer; factors related to alcohol use in HNC survivors; traditional interventions and newer technology-based interventions targeting alcohol use both within and outside of HNC; the alcohol reduction literature outside of HNC; primary prevention of alcohol use from a policy standpoint; and future directions for collaboration and research.

1.2 | Alcohol consumption and HNC around the globe

1.2.1 | United States and worldwide

It is estimated that 3.5% of cancer deaths in the United States and 4.2% of cancer deaths globally are directly attributable to alcohol intake.[1,2] In particular, the International Agency for Research on Cancer (IARC) has indicated that there is a causal relationship between alcohol and the development of many types of HNC and upper aerodigestive tract cancers,

including oral cavity, oropharyngeal, hypopharyngeal, esophageal, and laryngeal cancers.[1,3-6] Evidence suggests that alcohol is responsible for 26.4% of all lip and oral cavity cancers, 30.5% of all other pharyngeal cancers, 21.6% of all laryngeal cancers, and 16.9% of all esophageal cancers.[2] Together with tobacco use, alcohol accounts for approximately 75% of oral cancers.[7] A summary of epidemiological data concludes that, for mouth, pharynx, and larynx cancers, the percent increase in risk per daily drink is 30%, 30%, and 30%, respectively.[8]

1.2.2 | Europe

A population based study in Germany[9] found that, in 2018, the cancer burden in Germany related to high alcohol consumption was approximately 9588 cases, or 2% of all incident cancers. The anatomical location that contributed the most to this estimate was cancer of the oral cavity and pharynx in men, with 3191 cancer cases, and a population-attributable fraction (ie, the proportion of these cancers that could be eliminated by avoiding alcohol) of 34%. Research conducted in Italy has estimated that between 25% and 50% of HNCs are attributable to the use of alcohol.[10]

1.2.3 | East Asia

Research from East Asian countries confirms a strong relationship between alcohol consumption and the development of HNC among Asian individuals. Of interest for Asian populations is research on the genetic polymorphisms including ALDH2 (aldehyde dehydrogenase) and ADH2 (alcohol dehydrogenase 2) which strongly affect the metabolism of alcohol and are especially common in many East Asian nations, putting these populations at particular risk of HNC due to alcohol drinking. A multicenter case control study of 921 East Asian patients with HNC and 806 control subjects indicated that HNC risks were elevated for alcohol consumption, resulting in an odds ratio = 2.29, and the combined attributable risk of tobacco and/or alcohol was 47.2% in this sample.[11] In another study of 811 HNC patients and 940 controls from Taiwan, alcohol was associated with increased risk for HNC, with the highest risk for hypopharyngeal cancer (89.1%) and oropharyngeal (55.7%) cancers. Alcohol explained 47.3% of HNCs in individuals with a genotype combination of slow ADH1B and slow/nonfunctional ALDH2.[12] In a study in Japan, the presence of ADH2 Arg/Arg and ALDH2 Glu/Lys were independently associated with increased risk of HNC, odds ratios of 2.67 and 1.66, respectively. The authors also found significant gene-environment interactions between the polymorphisms and alcohol drinking, ADH2 $P = .035$, ALDH2 $P = .013$.[13] Other evidence from Japan indicates heavy alcohol consumption accounts for 87.4% of HNC deaths.[14] Research from Korea indicates smoking and alcohol use were more strongly related to larynx and hypopharynx cancers than other sites.[15]

1.3 | From alcohol use to HNC: how do we get there?

The pathway from alcohol consumption to the development of cancers is not entirely understood; however, research has demonstrated that alcohol permanently damages the DNA strands in the cell through acetaldehyde, a product of metabolizing alcohol. Other possible mechanisms through which alcohol leads to cancer are through nutritional deficiencies,[16] genetic variations,[17] and, for breast cancer in females, changes in estrogen pathways.[18]

1.4 | Alcohol consumption and other negative outcomes

1.4.1 | Second primary malignancies

Available data show that those who continue to consume alcohol following a primary HNC diagnosis are at increased risk of developing second primary malignancies. Based on data from a multicenter study of 13 population-based cancer registries, involving nearly 100 000 individuals with a primary HNC, about 13% of second primary tumors were alcohol-related cancers.[19] In a multicenter study from the International Head and Neck Cancer Epidemiology Consortium, consisting of over 4000 individuals with HNC, consuming greater than 1 drink per day increased the risk of second primary cancers among those with laryngeal cancer (hazard ratio: 2.11, 95% CI: 1.13-3.94).[20] This relationship was confirmed among individuals with cancer of the upper aerodigestive tract[21]; individuals continuing to consume alcohol postdiagnosis had a 1.3 times greater risk of developing a second primary tumor compared to those who did not use alcohol following initial diagnosis. Furthermore, consumption of more than 14 drinks per week was associated with a 50% increase in risk of developing a second primary tumor.

1.4.2 | Cancer recurrence

Available data suggest that individuals with HNC who continue to drink are not only at risk for developing a second primary tumor but are also at greater risk for cancer recurrence. In a single site, retrospective review study of

482 individuals treated for a primary HNC diagnosis, risk of recurrence was associated with consuming 8-14 alcoholic beverages per week.[22] Further research is needed to elucidate the relationship between quantity of alcohol consumed and recurrence risks in survivors of HNC.

1.4.3 | Physical and psychosocial effects

Negative effects of continued alcohol consumption go beyond the development of second primary cancers and recurrences, however. Evidence suggests that HNC survivors who continue to use alcohol are at an increased risk of needing gastrostomy tube feeding in the future,[23] experiencing osteoradionecrosis of the jaw,[24] poor prognosis[25] as well as social effects such as unemployment[26] and work disability.[27] Indeed, other research[28] has shown that the absence of alcohol use by HNC survivors was significantly associated with better quality of life.[29]

1.5 | Self-report tools to assess alcohol use

We identified multiple self-report tools in the literature used to capture alcohol use and abuse, some of which have been used with HNC samples but all of which could inform future research on alcohol consumption in HNC populations. These include: the Alcohol Use Disorders Identification Test (AUDIT) and the AUDIT-C,[30,31] both of which are alcohol screening tools to identify individuals who are hazardous drinkers or have active alcohol use disorders, the latter (ie, the AUDIT-C) being the shortened version of the former (ie, the AUDIT); the Tobacco, Alcohol, Prescription Medication and other Substance Use tool (TAPS),[32] a brief assessment of problem use of commonly used substances, including alcohol, in the prior 90 days; the Brief DSM-5 Alcohol Use Disorder Diagnostic Assessment[33]; and the Michigan Alcoholism Screening Test (MAST),[34,35] a simple, self-scoring test that an individual can use to determine if he/she has a drinking problem.

Capturing accurate alcohol use data is a challenge, and there is mixed literature on the validity of self-report tools for accurately capturing alcohol use. Several studies indicate that self-report is a valid format for alcohol use data collection, as research has verified it is concordant with objective measures of alcohol use (eg, transdermal alcohol sensors, breath or saliva samples).[36-38] Other research points to variations in validity based on the sample or the questions used. Overall, the literature shows that self-report tools—with adequately designed questions to avoid socially desirable responses—are an appropriate method of measurement in adult HNC populations.

1.6 | Dose-response relationship between alcohol use and HNC

Evidence has indicated a dose-response relationship between alcohol and the development of HNC. In one study, compared to abstainers or light drinkers, those consuming 3-4, 5-7, 8-11 or greater than 12 drinks per day had odds ratios of developing HNC of 2.1, 5.0, 12.2, and 21.1, respectively.[39] The pooled relative risk of developing HNC was 1.21 for those consuming less than 1 drink per day; this figure is in stark contrast to a relative risk of developing HNC of 5.24 for those consuming greater than 4 drinks per day.[40] A meta-analysis[3] of the association between the amount of alcohol drinking and risk of HNC showed that heavy drinkers have a relative risk of 5.13 for developing oral cavity and pharynx cancers, compared to 1.13 for light drinkers and 1.83 for moderate drinkers. In addition, the relative risk for developing larynx cancers is 2.65 for heavy drinkers, 0.87 for light drinkers, and 1.44 for moderate drinkers.

2 | DISCUSSION

2.1 | Recommendations for alcohol consumption

Given this overwhelming evidence that alcohol consumption of varying degrees in HNC survivors is associated with the development of second primary malignancies, recurrences, and poor outcomes, several organizations have provided guidelines recommending that individuals with HNC reduce or avoid alcohol altogether. In 2016, the American Cancer Society published guidelines for HNC survivorship recommending that "primary care physicians counsel HNC survivors to achieve a dietary pattern that is high in fruits, vegetables, and whole grains, and low in saturated fats, sufficient in dietary fiber, and avoids alcohol consumption.[41]" In addition, the World Cancer Research Fund recommends limiting alcohol consumption more generally, and for cancer prevention, not to drink alcohol at all.[42] The American Institute for Cancer Research concurs, recommending abstinence from drinking alcohol to prevent cancer, and for those who do drink, limiting consumption to two standard drinks for men and one for women per day.[43] Finally, the American Society of Clinical Oncology recommends reduced alcohol consumption to prevent cancer.[44]

2.2 | Continued alcohol-use behavior in HNC samples

Despite these strong recommendations, evidence suggests that HNC survivors continue to use alcohol throughout all

stages of the cancer trajectory, including after initial cancer diagnosis/during treatment, into early survivorship, and through long-term survivorship. A literature review on the prevalence and effects of alcohol consumption after oral cancer diagnosis indicates that between 34% and 57% of survivors of upper aerodigestive tract (HNC and esophageal cancers) continue to drink after diagnosis.[45] In a study[46] retrospectively assessing alcohol use before cancer diagnosis, compared to alcohol use immediately following a HNC diagnosis, the prevalence of alcohol use decreased by 16.7% and the proportion of risky drinkers decreased from 46.6% to 24.5%. While this is a considerable decrease, a quarter of the sample with newly diagnosed HNC continues to abuse alcohol. Other longitudinal research[47] suggests that 44.5% (n = 126) of individuals with HNC were still drinking 12 months after diagnosis, with 21.4% (n = 27) of these individuals categorized as problem drinkers (defined as those who scored 3 or more on the Michigan Alcoholism Screening Test). In another study of HNC survivors,[28] about 1/3 of the sample (34%) reported alcohol use at the time of the survey; respondents were, on average, 18.6 months from cancer diagnosis, with 30 individuals (51%) less than 6 months since diagnosis.

During early and long-term survivorship, a substantial proportion of HNC survivors continue to consume alcohol. In a population based study[48] of HNC survivors longer than 6 months posttreatment, there was a mere 13% drinking cessation rate; 62% of the sample considered themselves current drinkers. Of the current drinkers (n = 103), about a quarter of the sample (n = 27, 26%) reported that they currently consumed alcohol at least 4 times per week. A study of HNC survivors 5 years posttreatment reported that 38.9% continued to use alcohol.[49]

2.3 | Factors related to alcohol consumption in HNC

There are several factors associated with increased alcohol use in HNC populations, including male gender, younger age, early-stage disease, fewer years of education, current smoking status and longer time since treatment.[48,50] However, studies also suggest that HNC survivors are often unaware of the relationship between alcohol and HNC, and do not receive adequate information from their providers about the impact of alcohol on the disease course. In one study between 15% and 50% of those surveyed did not recall having received any recommendation regarding alcohol consumption.[46,51] Thus, in addition to the less modifiable demographic factors, there may also be a relationship between being uninformed of alcohol's impact on HNC and the development of HNC.

2.4 | Interventions targeting alcohol consumption in HNC

Existing interventions have attempted to increase knowledge about alcohol as a risk factor for cancer, as well as have aimed to reduce alcohol consumption. One intervention study[51] using an educational pamphlet showed that knowledge of alcohol abuse as a risk factor for cancer increased from 15% to 27% from prereading to postreading.

Few studies have aimed to reduce alcohol use specifically in the HNC population. In one study,[52] researchers developed and tested a tailored smoking, alcohol, and depression nurse-administered intervention consisting of cognitive behavioral therapy and medications, compared to usual care, for individuals with HNC. Alcohol rates improved in both groups, but with no significant differences in percent of problem drinkers at 6-month. In a prospective randomized controlled trial of 105 individuals with HNC[53] focused on tobacco cessation, researchers compared a provider-delivered smoking cessation intervention with a usual-care-advice control condition; results showed that participants experienced reduced smoking but an increase in alcohol use 12 months postintervention.

2.5 | The alcohol-reduction literature outside of HNC

Given the sparse research on alcohol reduction interventions in HNC samples, and the lack of positive results from these interventions, it would behoove us, as oncologists and psycho-oncologists, to borrow and implement alcohol reduction strategies from other populations. There are a myriad of interventions to reduce alcohol use that have not been tested with HNC survivor samples but have demonstrated efficacy in other populations. Personalized Feedback interventions, for example, have been commonly used in alcohol research and involve informing individuals of their risk level, emphasizing the differences between one's risky behavior and the norm, and providing solutions to reduce risky behavior. These interventions have demonstrated efficacy in reducing alcohol use in Iraq veterans[54] and hazardous drinkers,[55] as well as reducing gambling behavior in problem gamblers.[56]

2.6 | Use of technology in alcohol-reduction interventions

Advances in technology have made electronically administered interventions attractive as an alternative to interventions administered in a more traditional manner. Although not yet evaluated in HNC samples, existing literature on

electronically administered interventions indicates their utility and efficacy. A review of the current literature shows that individuals who drink are interested in using text message-based interventions[57] and smartphone-based applications[58] to reduce alcohol use. More specifically, use of an Addiction Comprehensive Health Enhancement Support System, a smartphone app, by those with alcohol dependence was high and sustained over time (94% used it in week one, 80% continued into week 16).[58]

A further review indicates that electronic-based interventions are effective to reduce alcohol use in populations other than HNC. For example, Muench et al[59] found that daily automated texts can help problem drinkers reduce drinking frequency and quantity significantly more than weekly self-tracking messages. A meta-analytic review[60] of 28 electronic intervention trials for alcohol misuse and alcohol use disorders shows a small reduction in consumption (approximately 1 drink per week) in adults and college students at 6 months. More recently, a two-arm randomized controlled trial[61] comparing an intervention group receiving a 6-week text message intervention and a control group that was referred to treatment as usual at the local student health care center showed that, at 3 month follow up, total weekly alcohol consumption decreased in both groups, but no significant between-group difference was seen, potentially due to lack of power and the need to refine the intervention.

In tandem, the FDA approved what it says is the first mobile app to help treat some substance use disorders. The reSET app is a form of cognitive behavioral therapy that gives individuals strategies to help them remain abstinent from using drugs and alcohol and keep up with their outpatient therapy programs. In a multisite 12-week clinical trial of 399 patients who received either standard treatment (control group) or standard treatment plus reSET (intervention group), a greater proportion of the intervention group, compared to the control group, exhibited abstinence, 40.3% vs 17.6%, respectively.[62]

2.7 | Primary prevention of alcohol use outside of HNC

Some efforts have been devoted to primary prevention of alcohol-related HNC through preventing the use of alcohol through restrictive policy measures.[63] These efforts include: policies to tax alcohol,[63] limits on alcohol sales,[63] raising the minimum legal drinking age, more prominent warning labels about the harms of alcohol use, and decreasing accessibility and availability to alcohol.[64] Overall, primary prevention policies that incorporate multiple components, such as educational and environmental changes, have demonstrated greater success in reducing alcohol than educational programs alone.[64]

2.8 | Conclusions and future directions for HNC populations

Our summary of the literature indicates that there is a strong need to forge collaboration among head and neck oncologists, behavioral scientists and alcohol researchers to address alcohol consumption in the growing HNC survivor population. As Mayne[65] suggests, as more people begin to survive first cancers, there is an increased need for science-based recommendations to improve survivorship. Outstanding questions remain, however, which need to be urgently addressed. First, it is unknown if there is a "safe" amount of alcohol consumption. Second, we do not know how to best counsel individuals with cancer about alcohol and many oncologists do not routinely discuss alcohol use with patients. Helping clinicians to initiate a conversation with patients may be an ideal place to start these alcohol reduction efforts. Third, interventions must be developed for HNC survivors at highest risk, as well as those in the moderate and heavy drinking level categories. Aggressive alcohol reduction education and interventions, including physicians, HNC patients and survivors, and their caregivers, need to be incorporated into HNC survivorship plans[49] and should take advantage of promising technological approaches. Finally, reward systems for abstaining from alcohol among cancer survivors need to be explored.

CONFLICT OF INTEREST

The authors declare no potential conflict of interest.

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