



The Evaluation of BMI as a Risk Factor for Lateral Tongue Squamous Cell Carcinoma

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Background

- Lateral tongue squamous cell carcinoma (LTSCC) has previously been associated with chronic tobacco, alcohol use, and chronic inflammation.
- Repetitive trauma to the tongue by teeth and poorly fitting dentures in the field of the tongue movement may increase inflammation and risk of cancer formation.
- Previous studies have demonstrated an association between obesity and increased tongue volumes in animals and humans, with fat deposition increasing myofiber diameter and overall volume (Brennick et al., 2009, Saito et al., 2010, Nashi et al., 2007, Shigeta et al., 2011)
- This fat may alter resting position of the tongue, as patients with tongue indentations along lateral surfaces had significantly larger tongue width than those without (Yanagisawa et al., 2007)
- Currently, there is limited evidence regarding if elevated BMI acts as a contributor to trauma of the tongue, and its role in tongue cancer formation.
- In our retrospective study, we assessed a population with LTSCC to identify if elevated BMI was associated with elevated risk of chronic tongue trauma.

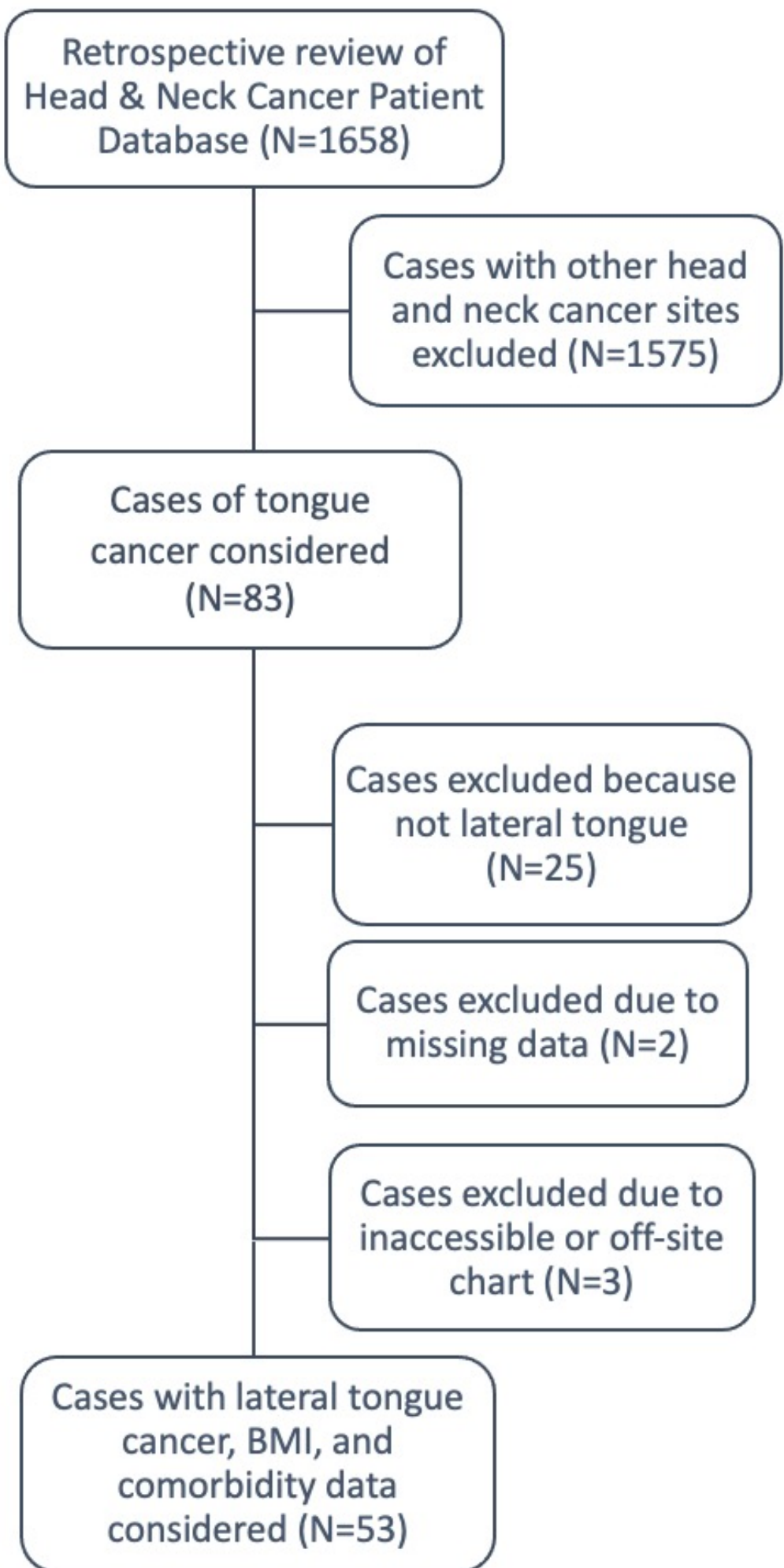


Figure 1: Flow chart of case inclusion.

Methods

- This was a single-centre, retrospective cohort study completed via chart review of patients receiving care for LTSCC at the North East Cancer Centre in Sudbury, ON between January 2012 and March 2020.
- This study retrospectively evaluated 1658 head and neck cancer cases, of which included 53 patient cases with LTSCC were included and treated with primary surgery +/- radiation therapy post-surgery for curative intent (Figure 1).

Table 1a: Characteristics of 53 cases of lateral tongue cancer, overall, and by the presence or absence of chronic trauma on exam.

	Chronic Trauma (n=40)**	Absence of Chronic Trauma (n=13)	Total (N=53)
Gender (%n)			
Male	26 (65)	7 (53)	33 (62)
Female	14 (35)	6 (46)	20 (38)
Age Range (%n), y			
<41	1 (3)	2 (15)	3 (6)
41-50	3 (8)	0 (0)	3 (6)
51-60	12 (30)	3 (23)	15 (28)
61-70	12 (30)	2 (15)	14 (26)
71-80	8 (20)	1 (8)	9 (17)
>80	4 (10)	5 (38)	9 (17)
Comorbidities (% n)			
OSA	5 (13)	1 (8)	6 (11)
HTN	13 (33)	5 (38)	18 (34)
DM	5 (13)	5 (38)	10 (19)

Table 1b: Characteristics of 53 cases of lateral tongue cancer, overall, and by the presence or absence of chronic trauma on exam.

	Chronic Trauma (n=40)**	Absence of Chronic Trauma (n=13)	Total (N=53)	OR	CI 95%
BMI, (%n), kg/m²					
<24.9	10 (25)	5 (38)	15 (28)	1.0 (reference)	
>25.0	30 (75)	8 (62)	38 (72)	1.875	0.96-3.67
Smoking History					
Ever (% n), pack-year	27 (68)	9 (69)	36 (68)		
<26	12 (30)	5 (38)	17 (32)		
26-50	12 (30)	3 (23)	15 (28)		
>50	3 (8)	1 (8)	4 (8)		
Never (% n)	13 (33)	4 (31)	17 (32)		
Alcohol Use (% n)					
Within Canada's Low Risk Drinking Guidelines*	33 (83)	11 (85)	44 (83)		
Above Canada's Low Risk Drinking Guidelines*	7 (18)	0 (0)	7 (13)		
No Data	0 (0)	2 (15)	2 (4)		
Cancer Site (% n)					
No Tooth at Site	3 (8)	6 (46)	9 (17)	1.0 (reference)	
Tooth Present at Site	37 (93)	7 (54)	44 (83)	10.57	2.13-52.58

*Defined as >10 alcoholic beverages per week for females, and >15 alcoholic beverage per week for males²⁶

** Includes one patient with Lichen Sclerosis on biopsy, for this study, considered a patient with chronic trauma to tongue as is the inflammatory process.

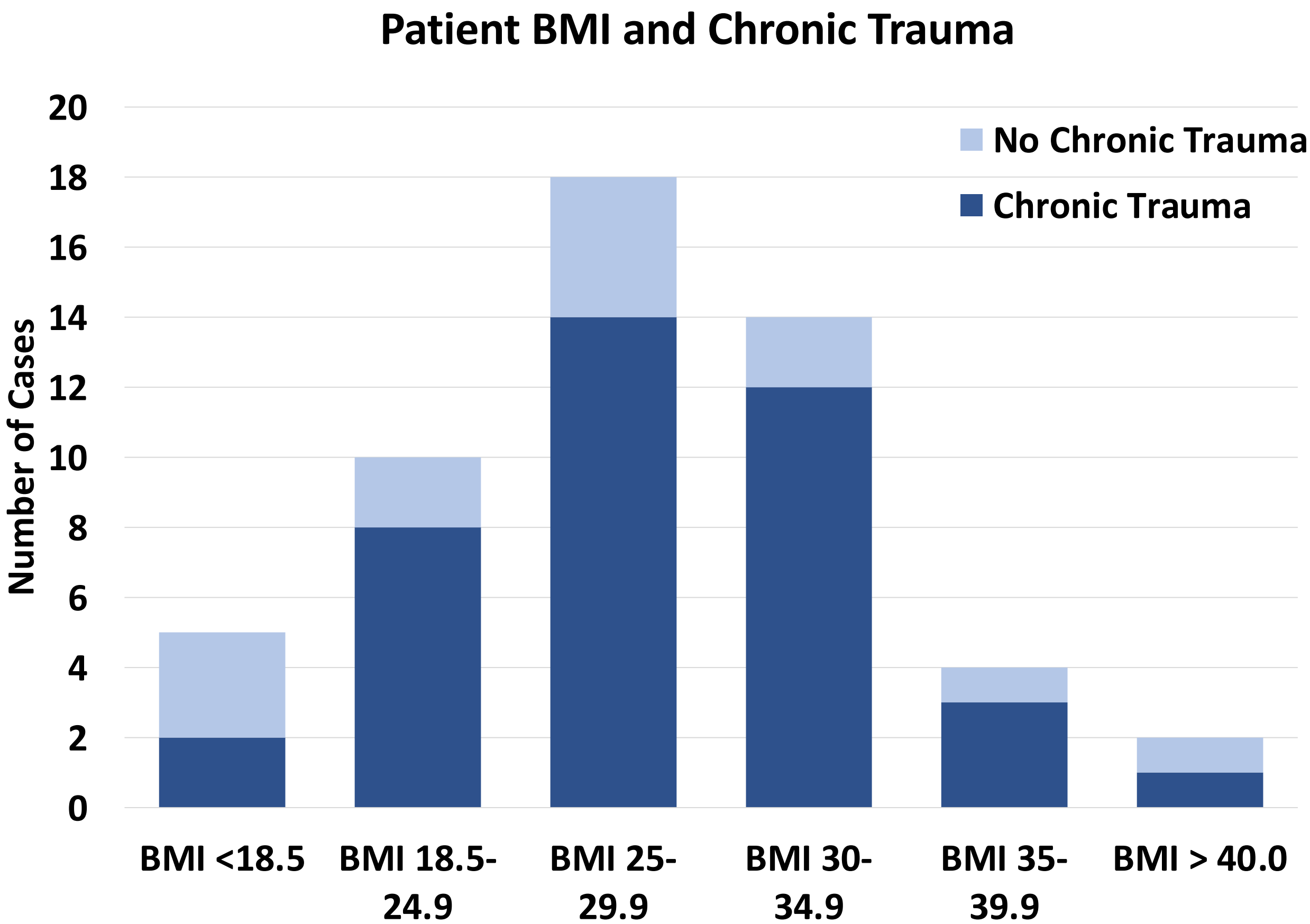


Figure 2: Combined histogram of patient BMI and prevalence of chronic trauma.

Results & Discussion

- In our study, the majority of participants were identified as having elevated BMI, with 71.7% having BMI >25 kg/m2 (M = 28.2 kg/m2, SD = 6.4, Min = 16.4, Max = 44.8) (Figure 2).
- Previous studies have found that the tongue contains a higher percentage of adiposity compared to other musculature, with total tongue volume correlating with elevated BMI.³ When compared to BMI and age-matched controls, patients with OSA also have increased fat deposition specifically in the tongue increasing its volume, indicating that tongue adiposity may alter the resting position, movement patterns, and overall function of the tongue (Li et al., 2012, Kim et al., 2014).
- In this study, we identified an elevated risk in obese individuals of having chronic trauma to the tongue, with a odds ratio of 1.88 (95% CI 0.96-3.67) between chronic trauma and elevated BMI (Table 1).
- This may be attributed to adiposity and volume of the tongue increasing intraoral trauma via nearby structures including teeth, dentures, and implants, as previous studies have indicated that elevated BMI increases tongue volume and indentation on the lateral surfaces (Nashi et al., 2007).
- Our study indicated an odds ratio of 10.57 (95% CI 2.13-52.58) of patients having a tooth present at the cancer site and chronic trauma identified on exam.
- As functional factors that increase contact time and frequency of contact of tissues with mechanical causes of inflammation, such as defective teeth, have been indicated to increase trauma, we speculate that lingual fat deposition may alter resting position, and in combination with parafunctional movements, may place tissues at risk for chronic trauma against nearby teeth (Table 1).

Table 2: Statistical comparison of mean BMI for subgroups, by presence or absence of chronic trauma

	Mean BMI, kg/m² (SD)		p value
	Chronic Trauma (n=40)	Absence of Chronic Trauma (n=13)	
Total Sample (N=53)	28.57 (5.82)	26.91 (8.00)	0.25
Smoking History			
Ever (n=36)	28.35 (5.84)	29.54 (7.69)	0.68
Never (n=17)	29.02 (5.99)	20.98 (5.53)	0.055
Alcohol Use			
Within Canada's Low Risk Drinking Guidelines* (n=44)	29.19 (5.51)	26.60 (8.72)	0.37
Above Canada's Low Risk Drinking Guidelines* (n=7)	25.63 (6.78)	0 (0)	N/A
Low Risk Substance Use Subgroup (n=15)**	28.66 (6.11)	18.73 (3.96)	0.018
Cancer Site			
No Tooth at Site (n=9)	24.37 (6.91)	25.38 (8.26)	0.85
Tooth Present at Site (n=44)	28.91 (5.70)	28.21 (8.18)	0.84

- Trauma may act as a promoter, by stimulating cellular proliferation and increasing the potential for DNA mutation, as well as creating sites of increased carcinogen absorption including alcohol and tobacco (Pérez et al., 2005, Kuper et al., 2001).
- In a subgroup analysis of cases with low-risk substance exposure, mean BMI was significantly elevated in those with identified chronic trauma (M= 28.66, SD=6.11) as compared to those without (M=18.73, SD = 3.96), p=0.018.
- This may indicate that elevated BMI could act as an independent risk factor in precipitating lateral tongue chronic trauma, and in turn, tongue cancer, in the absence of previously documented risk factors, and should be further investigated in larger subgroup analyses.