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Comparative Analysis of the Prognostic Value of TNM 7 and TNM 8 in a Cohort of Early Oral Tongue Carcinomas

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Abstract

The prognostic validity of the TNM staging system for oral squamous cell carcinoma (OSCC) has been widely debated. The 8th edition of the TNM system introduced depth of invasion (DOI) as a new criterion for determining the T category, leading to reclassification of a considerable percentage of early tumors.

Objective: This study aims to compare the prognostic performance of TNM 7 and TNM 8 in a homogenous cohort of 57 cases of early-stage OSCC of the oral tongue.

Materials and Methods: Medical records were reviewed and all cases were staged independently according to TNM 7 and TNM 8 criteria. Statistical analysis included Kaplan-Meier survival estimates, log-rank tests, Cox regression, and ROC curve evaluation.

Results: In TNM 7, 75.4% were classified as pT1 and 24.6% as pT2. Under TNM 8, 59.6% remained pT1, 31.6% became pT2, and 8.8% were upstaged to pT3. The survival analysis showed that TNM 8 provided clearer stratification of survival outcomes, especially distinguishing pT3 from lower stages with statistical significance ($p < 0.001$). ROC analysis revealed better discriminatory capacity for TNM 8 (AUC = 0.671) than for TNM 7 (AUC = 0.605).

Conclusion: While both systems differentiate survival risk in early OSCC, TNM 8 offers improved prognostic accuracy by incorporating DOI. However, it still demonstrates only moderate performance in risk stratification. These findings support the use of TNM 8 for better prediction of mortality in early oral tongue carcinoma, although further enhancements in staging criteria may still be warranted.

Keywords: oral tongue cancer, squamous cell carcinoma, histologic risk model, Brandwein-Gensler, prognosis, survival, occult metastasis

Introduction

The prognostic value of the TNM system has been a subject of extensive discussion in the scientific literature. There are conflicting reports regarding its predictive accuracy (12, 9, 5, 11). These concerns led to revisions in the latest edition – TNM 8 (2018). In the eighth edition of the TNM classification (4), depth of invasion (DOI) was added as a criterion for determining the T category for oral squamous cell carcinoma, based on research by the ICOR group (11). Following the

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introduction of DOI for primary tumor staging, an increase in tumor stage was observed in 10% to 38% of cases (11, 7, 5, 2). It became evident that some lesions traditionally classified as T1 based on maximum surface size were reclassified into a higher T category after evaluating the depth of invasion. As a result, improvements in the system's ability to differentiate and stratify disease risk were reported (11). One of the weaknesses of TNM 7 was the reported similarity in survival curves between T2, T3, and T4 oral cavity carcinomas (12, 1). In TNM 8, a statistically significant difference in survival was noted between early-stage tumors (T1 and T2) and T3 tumors of the tongue; however, no significant difference was observed between T1 and T2 tumors (1). This has led to criticisms of the TNM system's prognostic value in early oral cavity cancers (10).

Aim

The aim of this study was to evaluate differences in survival outcomes for cases of early-stage squamous cell carcinoma of the tongue using the TNM 7 and TNM 8 classifications.

Material and Methods

Medical documentation of 72 cases of early-stage oral tongue squamous cell carcinoma was reviewed. Among these, 43 (59.7%) were male and 29 (40.3%) were female. Tumor localization was as follows: lateral tongue in 53 cases (73.6%), ventral tongue in 17 cases (23.6%), and dorsum of the tongue in 2 cases (2.8%).

Of the 72 cases defined as early-stage tongue cancer, 57 had complete data required for pathological staging according to TNM 8 criteria. Cases with clinical staging cT3 or cT4, or those who had undergone preoperative radiotherapy or chemoradiotherapy, were excluded.

All included cases were independently staged according to both the 7th and 8th editions of the TNM system, regardless of their original clinical staging.

Statistical analysis (SPSS) was conducted on the 57 early-stage oral tongue SCC cases (T1 and T2). Overall survival was evaluated using Kaplan-Meier analysis, log-rank test, and Cox regression analysis. ROC analysis was also used to calculate the area under the curve (AUC).

Results

According to TNM 7 criteria (based on lesion size), 75.4% (43 cases) were staged as pT1 and 24.6% (14 cases) as pT2. When classified using TNM 8 criteria (considering lesion size and depth of invasion), 59.6% (34 cases) met the criteria for pT1, 31.6% (18 cases) for pT2, and 8.8% (5 cases) were staged as pT3. Statistical analysis was performed for the entire group.

The analysis showed that out of the 57 early SCC cases, 34 maintained the pT1 category in both TNM 7 and TNM 8. In 7 cases originally staged as pT1 under TNM 7, the T category was upgraded to pT2 under TNM 8. In 2 cases, reclassification from pT1 to pT3 was observed. Of the 14 pT2 cases in TNM 7, 11 retained the same stage in TNM 8, while 3 were upgraded to pT3. (Table 1)

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Table 1. Cross-tabulation of pT Category According to TNM 7 and TNM 8

Count					
		pT (TNM 8)			Total
		1	2	3	
pT (TNM 7)	1	34	7	2	43
	2	0	11	3	14
Total		34	18	5	57

Kaplan-Meier analysis for TNM 7 showed significantly higher survival in the pT1 category compared to pT2. The log-rank test indicated that the difference in survival between pT1 and pT2 was statistically significant (p = 0.04). Survival rate in pT1 was 79.1%, compared to 57.1% in pT2. (Table 2.) (Figure 1.)

Table 2. Kaplan–Meier Analysis of Overall Survival According to pT Category Based on TNM 7

pT Category (TNM 7)	Total Cases	Deaths	Survivors (%)	Mean Survival	95% CI	Log-rank
pT1	43	9	34 (79.1%)	73.8 months	63.9-83.7	$\chi2 = 4.27$ p = 0.04
pT2	14	6	8 (57.1%)	48.1 months	28.5-67.6	
Total	57	15	42 (73.7%)	69.0 months	59.6-78.5	

Figure 1. Overall Survival by Kaplan-Meier According to pT Category (TNM 7)

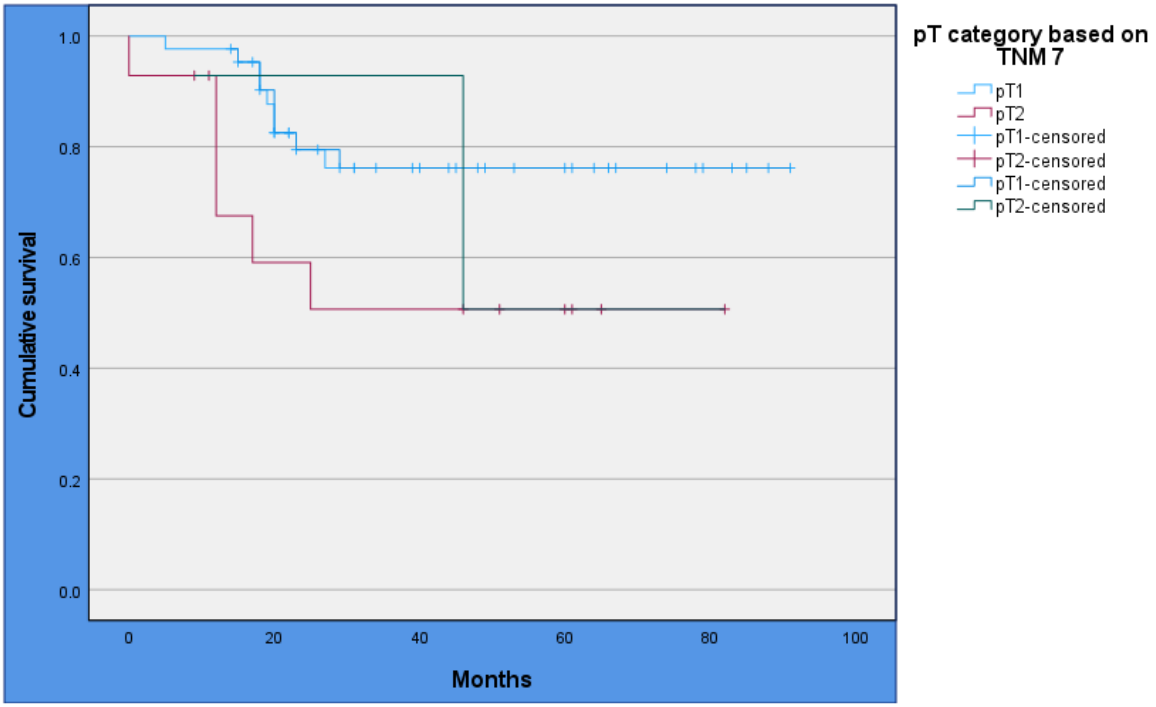

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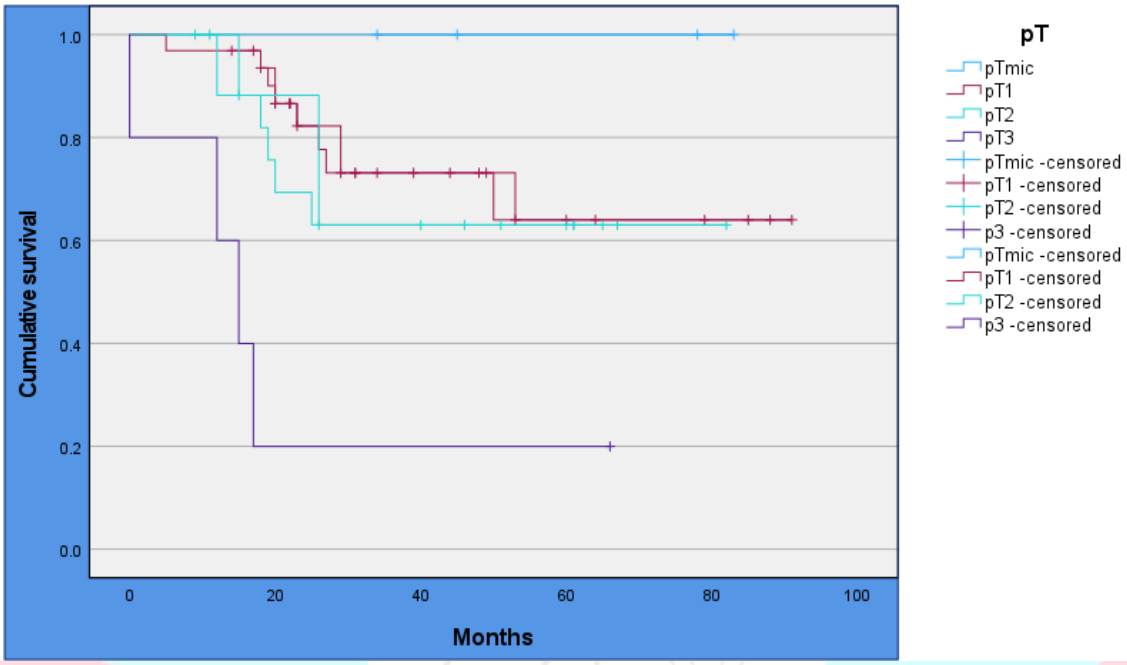
Figure 2. Overall Survival by Kaplan-Meier According to pT Category (TNM 8)



Kaplan-Meier analysis for TNM 8 showed that patients with pT1 tumors had the highest overall survival, followed by those with pT2 and pT3 tumors. Survival was significantly lower in the pT3 category, with log-rank test indicating highly significant differences in survival ($\chi 2 = 17.56$, $p < 0.001$). pT1 had a survival rate of 82.4%, pT2 had 72.2%, and pT3 had only 20%. (Table 3.) (Figure 2.)

Table 3. Kaplan–Meier Analysis of Overall Survival According to pT Category Based on TNM 8

pT Category (TNM 8)	Total Cases	Deaths	Survivors (%)	Mean Survival	95% CI	Log-rank
pT1	34	6	28 (82.4%)	76.2 months	65.5-86.9	$\chi 2 = 17.56$ $p < 0.001$
pT2	18	5	13 (72.2%)	60.9 months	45.7-76.2	
pT3	5	4	1 (20.0%)	22.0 months	2.04-42.0	
Total	57	15	42 (73.7%)	69.0 months	59.6-78.5	

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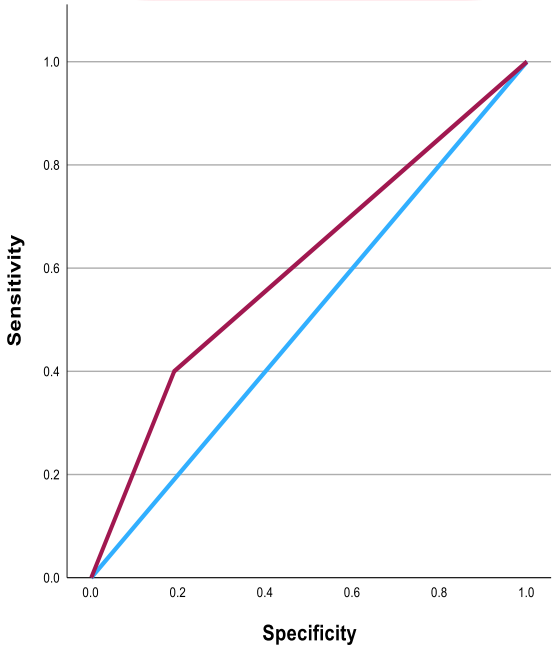
Figure 3. ROC Curve for TNM 7 pT Category



Univariate Cox regression analysis for TNM 7 showed a positive correlation between higher tumor stage and risk of death, with HR = 2.83, which approached statistical significance (95% CI [1.002–7.975], p = 0.05). Univariate analysis for TNM 8 demonstrated a statistically significant difference in survival among the tumor stages (p = 0.02). A significant difference was noted between pT3 and pT1 with HR = 9.986 (95% CI [2.729–36.535], p < 0.001), indicating a nearly 10-fold higher risk of death for pT3 compared to pT1. Although patients with pT2 had higher mortality risk than those with pT1 (HR = 1.816), this was not statistically significant (95% CI [0.554–5.956], p = 0.325). (Table 4.) (Table 5.)

Table 4. Univariate Cox Regression Analysis of pT Category According to TNM 7

	B	SE	Wald	df	Sig.	Exp(B)	95.0% CI
pT category according to TNM 7 (overall model)	1.039	.529	3.859	1	.049	2.827	1.002 - 7.975

Table 5. Univariate Cox Regression Analysis of pT Category According to TNM 8

	B	SE	Wald	df	Sig.	Exp(B)	95.0% CI
pT category according to TNM 8 (overall model)			12.370	2	.002		
pT2 vs. pT1 (TNM 8)	.597	.606	.969	1	.325	1.816	0.55 -5.96
pT3 vs. pT1 (TNM 8)	2.301	.662	12.091	1	<.001	9.986	2.73-36.54

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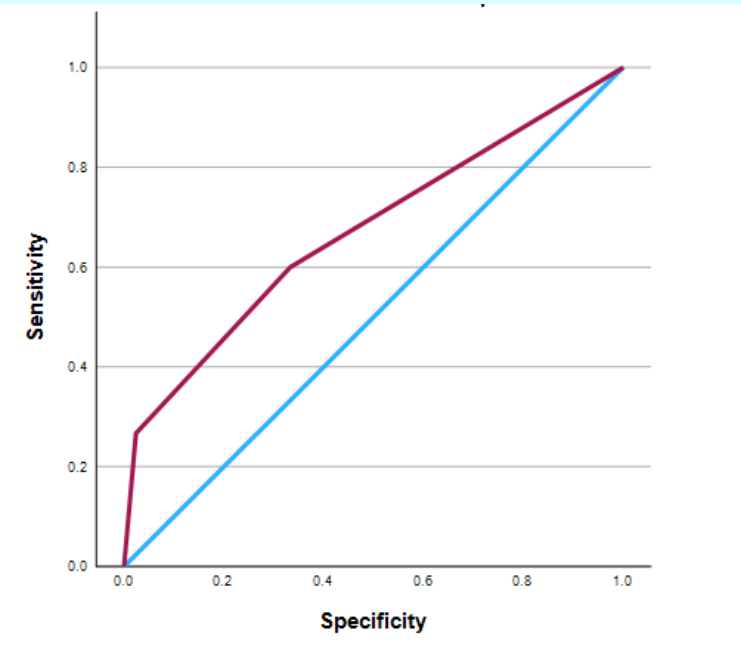
Multivariate analysis comparing TNM 7 and TNM 8 showed that TNM 7 did not reach statistical significance for survival (p = 0.571), while TNM 8 did (p = 0.012). (Table 6.)

Table 6. Multivariate Cox Regression Analysis of TNM 7 and TNM 8

	B	SE	Wald	df	Sig.	Exp(B)	95.0% CI
pT category according to TNM 7	.322	.569	.320	1	.571	1.380	0.322 - 0.569
pT category according to TNM 8	1.018	.405	6.334	1	.012	2.768	1.018 - 0.405

To assess prognostic value, ROC analysis was performed. The AUC for TNM 7 was 0.605, indicating moderate predictive accuracy. (Figure 3.) For TNM 8, the AUC was 0.671, suggesting better discrimination compared to TNM 7. (Figure 4.)

Figure 4. ROC Curve for TNM 8 pT Category



Discussion

The TNM system is the established standard for staging malignant tumors and is crucial for guiding treatment decisions. However, it has been criticized for its limited ability to distinguish risk in early-stage disease (12, 9, 5, 11). Studies report minimal survival differences between T1, T2, and T3 oral cavity tumors (12, 9, 5, 11). A core weakness of the TNM system is its reliance on tumor surface size without accounting for other pathological features (5).

The addition of depth of invasion as a staging criterion in TNM 8 allows reclassification of some T1 or T2 lesions into higher stages. In our study, 21.0% of patients were upstaged under TNM 8. Most upstaging occurred from pT1 to pT2 (7 cases), pT1 to pT3 (2 cases), and pT2 to pT3 (3 cases). No

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downgrading was observed. These results align with literature reporting upstaging in 10% to 38% of cases and no downstaging (13, 11, 8, 5, 2).

Kaplan-Meier analysis for TNM 7 found a statistically significant difference in survival between pT1 and pT2 ($p = 0.039$), though survival curves intersected at points. This limitation is addressed in TNM 8 through the inclusion of DOI, improving discriminatory power (1, 8, 3, 6). After restaging under TNM 8, highly significant differences in survival among categories were found ($p < 0.001$), with lowest survival in pT3.

Cox regression analysis confirmed this, showing nearly 10-fold higher mortality risk in pT3 vs. pT1 ($Exp(B) = 9.986$, $p < 0.001$). Like other studies (1, 8), we found no significant survival difference between pT1 and pT2. In multivariate analysis, TNM 7 did not reach statistical significance ($B = 0.332$, $p = 0.571$), while TNM 8 did ($B = 1.018$, $p = 0.012$). The AUC for TNM 7 was 0.605, compared to 0.671 for TNM 8, indicating better prognostic performance of TNM 8. Despite this improvement, TNM 8's discriminatory ability remains moderate.

Conclusion

The inclusion of DOI as a staging criterion in TNM 8 improves the prognostic value of the system. Our results confirm that TNM 8 offers better discriminatory power than TNM 7 for predicting survival and mortality risk.

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