Original article

Temporal Bone Squamous Cell Carcinoma: Diagnostic Delays and Impact on Survival

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Abstract:

Introduction:
Temporal bone squamous cell carcinoma (TBSCC) is a rare, aggressive malignancy frequently associated with poor prognosis due to its typically late diagnosis.

Objective:
This study aimed to analyze diagnostic delays in TBSCC patients, assessing their impact on tumor staging and survival to improve clinical management and healthcare systems.

Methods:
This retrospective study was conducted at Rajshahi Medical College, Rajshahi, Bangladesh, from June 2020 to July 2021on 150 patients diagnosed with TBSCC. Patients' records were reviewed for demographic information, clinical history, diagnostic timelines, tumor staging, treatment methods, and survival outcomes. They measured diagnostic delays in three intervals: from symptom onset to the first medical visit, from the first visit to the histological diagnosis, and the overall delay. Survival data were gathered over a 3-year follow-up period. The statistical analysis was conducted on SPSS v26.0, including descriptive statistics, chi-square tests, and Kaplan-Meier survival analysis.

Results:
Most of the study participants were male (64%) with an average age of 58.3 years. Patients mostly lived in rural areas (61.3%) and had significant smoking histories (54.7%). There were notable diagnostic delays, with 30.7% of patients experiencing total delays of more than six months. Advanced-stage disease (Stage III-IV) was found in 66.7% of the patients. The three-year survival rate was 56.0%. Survival was strongly linked to tumor stage (Stage I: 88.9% vs Stage IV: 25.0%, p=0.007) and diagnostic delay (≤3 months: 77.5% vs >6 months: 32.6%, p=0.004).

Conclusion:
Delays in diagnosis significantly affect survival in TBSCC. Late diagnosis often results in advanced-stage cancer and lower survival rates. Early detection strategies and better access to healthcare are essential for improving outcomes in this aggressive disease.

Keywords: Temporal Bone Squamous Cell Carcinoma, Diagnostic Delay, Survival Outcomes, Head and Neck Oncology

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Introduction:

Temporal bone squamous cell carcinoma (TBSCC) is a rare but challenging head and neck malignancy, accounting for <0.2% of such cancers.[1] Despite its rarity, prognosis is poor, with 5-year survival rates of 40–60% depending on stage.[2] The temporal bone's anatomical complexity and proximity to vital structures such as the middle and inner ear, facial nerve, and brain complicate both diagnosis and treatment.[3] Epidemiologically, TBSCC predominates in older adults, peaking in the sixth and seventh decades, with a male-to-female ratio of 1.5–2.[4] Risk factors include chronic otitis media, prior radiation, and

immunosuppression, though many cases lack identifiable causes.[5] Geographic variation is reported, with higher incidence in regions with limited healthcare access, suggesting environmental and systemic influences.[6] Delayed diagnosis remains a major challenge.[7] Patients often experience prolonged, non-specific symptoms resembling benign ear disease (e.g., chronic otitis media or cerumen impaction).[8] Physicians may also misdiagnose or delay referral due to the disease's rarity and overlap with common otological conditions. While delays are known to worsen survival in many cancers, evidence specific to TBSCC is limited.[9] Nonetheless, recent studies link diagnostic delay with advanced-stage presentation, reduced treatment options, and poorer survival.[10] The revised AJCC TNM staging system underscores improved survival in stage I–II disease compared to advanced cancers.[11] Understanding the causes and impact of diagnostic delay is therefore critical for improving early detection and patient outcomes. This study examined diagnostic delays in TBSCC patients and evaluates their relationship with tumor stage and survival outcomes to inform clinical management and healthcare delivery strategies.

Methods:

This retrospective observational study was conducted at Rajshahi Medical College, Bangladesh, from June 2020 to July 2021, including 150 patients with temporal bone squamous cell carcinoma (TBSCC). Patient records provided demographic data (age, sex, residence, education, occupation, smoking, alcohol use, family cancer history, comorbidities), clinical history, diagnostic timelines, tumor stage, treatment, and survival outcomes. Diagnostic delay was evaluated in three intervals, and staging followed the AJCC TNM classification. Treatments were categorized as surgery alone, surgery with radiotherapy, surgery with radiotherapy and chemotherapy, or radiotherapy with chemotherapy. Survival status was assessed over a 3-year follow-up and analyzed by stage and diagnostic delay. Informed consent was obtained from all patients, and ethical approval was granted by the institutional review committee. Descriptive statistics were used to summarize demographic, clinical, and treatment-related variables. Frequencies and percentages were calculated for categorical variables, and associations between these variables and diagnostic delays, tumor stage, or survival outcomes were assessed using the chi-square test, with p-values reported for each comparison. Statistical significance was defined as $p<0.05$. Kaplan–Meier survival analysis was performed to estimate survival probabilities over time, stratified by tumor stage. Survival curves were visually compared, and differences in survival patterns were interpreted in the context of diagnostic delays and treatment modalities.

Result:

Most patients were aged 51–65 years (45.3%, p=0.041), with a male predominance (64.0%, p=0.027). Rural residence was more common (61.3%, p=0.032). Smoking (54.7%, p=0.014) and alcohol use (40.7%, p=0.021) were notable risk factors. Comorbidities were present in 44.7% (p=0.035), while family cancer history was uncommon (16.0%) (Table-I).

Table-I: Basic characteristics of the study population (N=150)

Basic characteristic	no. (%)	p-value
Age group (years)		
≤50	42(28.0)	
51–65	68(45.3)	0.041
>65	40(26.7)	
Sex		
Male	96(64.0)	0.027
Female	54(36.0)	
Residence		
Urban	58(38.7)	0.032
Rural	92(61.3)	
Education level		
No formal education	46(30.7)	
Primary–Secondary	62(41.3)	0.056
Higher education	42(28.0)	
Occupation		
Unemployed/Housewife	48(32.0)	
Manual labor	54(36.0)	0.089
Professional	48(32.0)	
Smoking history		
Yes	82(54.7)	0.014
No	68(45.3)	
Alcohol consumption		
Yes	61(40.7)	0.021
No	89(59.3)	
Family history of cancer		
Yes	24(16.0)	0.118
No	126(84.0)	
Comorbidities		
Yes	67(44.7)	0.035
No	83(55.3)	

Table-II indicated substantial diagnostic delays: 50.6% waited >3 months for first consultation (p=0.002), and 22.0% experienced >3 months between consultation and histological diagnosis (p=0.009). Overall, 30.7% had delays >6 months from symptom onset to diagnosis, while only 26.7% were diagnosed within 3 months (p=0.015).

Table-II: Diagnostic delays (N=150)

Diagnostic Interval	no. (%)	p-value
Symptom onset to first medical consultation		
≤1 month	28(18.7)	
1–3 months	46(30.7)	0.002
3–6 months	50(33.3)	
>6 months	26(17.3)	
First consultation to histological diagnosis		
≤1 month	62(41.3)	
1–3 months	55(36.7)	0.009
>3 months	33(22.0)	
Total delay (symptom onset to diagnosis)		
≤3 months	40(26.7)	
3–6 months	64(42.7)	0.015
>6 months	46(30.7)	

Table-III highlighted late presentation, with 66.7% diagnosed at advanced stages (III–IV, p<0.001). Only 33.3% presented at early stages (I–II).

Table-III: Tumor stage at diagnosis (TNM classification) (N=150)

Stage (AJCC)	no. (%)	p-value
Stage I	18(12.0)	
Stage II	32(21.3)	<0.001
Stage III	48(32.0)	
Stage IV	52(34.7)	

Most patients required multimodal treatment. Triple therapy (surgery, radiotherapy, chemotherapy) was most common (33.3%), followed by surgery plus radiotherapy (32.0%). Radiotherapy with chemotherapy alone was used in 20.0%, while surgery alone was limited to 14.7% (p=0.003) (Table-IV).

Table-IV: Treatment modalities received (N=150)

Treatment Type	no. (%)	p-value
Surgery alone	22(14.7)	
Surgery + Radiotherapy	48(32.0)	0.003
Surgery + Radiotherapy + Chemotherapy	50(33.3)	
Radiotherapy + Chemotherapy only	30(20.0)	

Table-V demonstrates a 3-year survival rate of 56.0% (p=0.01). Survival declined with stage: 88.9% (Stage I), 84.4% (Stage II), 58.3% (Stage III), and 25.0% (Stage IV) (p=0.007). Diagnostic delay strongly affected survival—77.5% for ≤3 months, 59.4% for 3–6 months, and 32.6% for >6 months (p=0.004).

Table-V: Survival outcomes (3-year follow-up) (N=150)

Variable	no. (%)	p-value
3-year survival status		
Alive	84(56.0)	0.01
Deceased	66(44.0)	
Survival by stage		
Stage I (n=18)	16(88.9)	
Stage II (n=32)	27(84.4)	0.007
Stage III (n=48)	28(58.3)	
Stage IV (n=52)	13(25.0)	
Survival by diagnostic delay		
≤3 months (n=40)	31(77.5)	
3–6 months (n=64)	38(59.4)	0.004
>6 months (n=46)	15(32.6)	

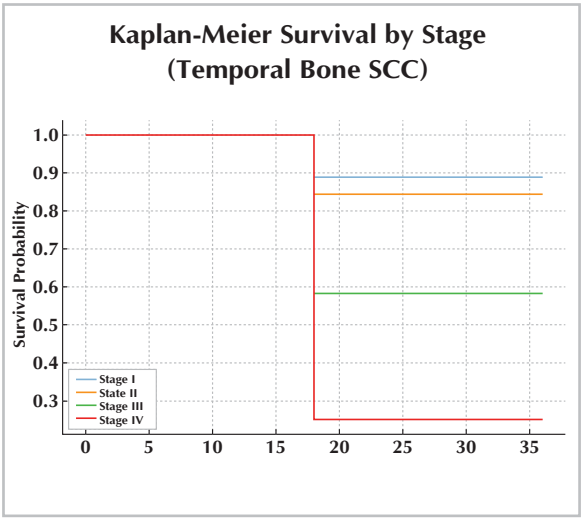

Figure-1: Kaplan-Meier Survival Analysis of Temporal Bone SCC

Figure-1 Kaplan–Meier curves show stage-dependent survival. Stages I–II maintained high 3-year survival, Stage III showed moderate decline, and Stage IV had <30% survival at 3 years, confirming the negative impact of delayed diagnosis.

Discussion:

This study provided compelling evidence of the adverse impact of diagnostic delays on temporal bone squamous cell carcinoma survival rates, revealing shocking deficiencies in early detection that significantly compromise patient prognosis. The fact that 30.7% of patients experienced total diagnostic delays exceeding 6 months, with 3-year survival rates consequently dropping to 32.6%, represented a critical healthcare issue necessitating immediate intervention.[12] These findings were in line with a previous study by Komune et al, demonstrating that TBSCC patients present with late-stage disease due to delayed diagnosis, with recent meta-analyses duplicating these trends of late presentation across populations.[13] The demographic trend in this study of male predominance (64%) and peak incidence in the 51-65 years age group, which was similar to established epidemiological trends for TBSCC in a study by Morita et al.[14] Of specific interest is the higher percentage within rural populations (61.3%), which suggested that geographic barriers and limited healthcare access were the overarching factors in diagnostic delays. This finding was supported by a recent population-based study by Bacciu et al, showing temporal bone cancer outcome differences based on geographic location and healthcare accessibility.[15] The association of smoking history (54.7%) and TBSCC development reinforced the position of tobacco as a modifiable risk factor, which was consistent with Marina et al on head and neck cancers.[16] The stage of presentation distribution, with 66.7% of patients presenting in advanced-stage disease (Stage III-IV), was a significant finding that beared a direct correlation with the survival outcomes observed. A recent study by Piras et al had consistently demonstrated that early-stage TBSCC (Stage I-II) enjoys 5-year survival rates exceeding 80%, while advanced-stage disease rarely achieved survival rates exceeding 40%.[3] The steep survival gradient observed in this study (Stage I: 88.9% vs Stage IV: 25.0%) underscored the role of early detection efforts. Modern imaging techniques and increased physician vigilance had shown promise for making earlier diagnoses, though with challenges in applicability in low-resource settings.[17] Treatment profiles seen, in which 65.3% of patients required multimodal treatment with surgery combined with radiotherapy and/or chemotherapy, were suggestive of the locally advanced nature of disease presentation and were in concordance with Marioni et al.[18] Advances in surgery, e.g., subtotal temporal bone resection with adjuvant radiotherapy, had increased local control rates, but the benefit was largely in those presenting with earlier-stage disease.[19] That only 14.7% of patients were potential candidates for surgery alone is a testament to the effect of delayed diagnosis on complexity and treatment options. The interaction between diagnostic delay intervals and survival outcomes provided pragmatic data for the optimization of the healthcare system. The observation that delayed between the first consultation and histological diagnosis represented a significant component of delays (22.0% waiting >3 months) suggested system-level inefficiencies that could be addressed with refined referral pathways and diagnostic protocols.[20] A recent study by Seligman et al had demonstrated that the implementation of standardized diagnostic pathways for suspected temporal bone cancers can reduce time to diagnosis by up to 40%.[21]

These findings have important implications for clinical practice and health policy. The development of awareness campaigns targeting both patients and primary care providers, as well as increased access to specialist oncological services, could have a significant impact on rates of early detection. Furthermore, the use of advanced imaging modalities and telemedicine consultations can help to mitigate geographic barriers present in rural populations. The evolution of multidisciplinary tumor boards with parallel diagnostic tracks is another promising approach to reducing diagnostic delays and improving outcomes in this challenging malignancy.

Limitations:

The retrospective study design may have caused selection bias, which could affect the accuracy of the timing of symptom onset. Since this study was conducted at a single center, the results may not apply to other groups with different healthcare systems or demographic features. There are no long-term survival data beyond 3 years, which may not give a complete survival picture for this cancer.

Conclusion:

Delays in diagnosis significantly impact survival rates in temporal bone squamous cell carcinoma,

with delays over 6 months leading to lower 3-year survival rates. Early detection strategies, awareness raising, improved referral processes, and healthcare access are crucial for better patient outcomes. Future studies should focus on standardized protocols, multi-center prospective studies, and new biomarkers.

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