Section: Oncology

Original Research Article

PATTERNS OF OESOPHAGEAL CANCER TRENDS AMONG DISTRICTS OF LOWER ASSAM

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ABSTRACT

Background: Esophageal cancer (EC) remains a significant health burden in Northeast India, particularly in Assam, where unique regional risk factors contribute to high incidence and late-stage presentation. Despite centralization of cancer care services in Kamrup (Metropolitan), disparities in diagnosis stage and treatment access across surrounding districts remain poorly understood.

Materials and Methods: A retrospective analysis of 879 esophageal cancer cases registered from 2018 to 2022 was conducted using data from the Hospital-Based Cancer Registry (HBCR) at the State Cancer Institute, Guwahati. Patients were stratified by district of residence, stage at diagnosis (early vs. late), and treatment intent (curative, palliative, or untreated). Chi-square tests were used to assess inter-district variation. A Cochran-Armitage trend test was applied to evaluate temporal trends in late-stage diagnoses.

Results: A majority of patients (69.3%) were male, with the highest incidence in the 51–60 age group. Squamous cell carcinoma (93.3%) and tumors in the middle esophagus (60.1%) were predominant. Late-stage presentation was observed in 65.1% of cases. The trend analysis showed a significant rise in late-stage diagnoses over five years ($p < 0.01$). Stage at diagnosis and treatment intent varied significantly across districts ($p = 0.037$ and $p = 0.00042$, respectively), with rural districts like Goalpara and Barpeta reporting a higher burden of advanced-stage disease.

Conclusion: Significant inter-district disparities exist in stage at diagnosis and treatment patterns of esophageal cancer in Lower Assam. Strengthening district-level screening and decentralizing treatment services are essential to reduce the burden of late-stage presentation and improve care equity.

Keywords: Esophageal cancer, Diagnosis stage, Treatment intent, Lower Assam, Cancer registry.

INTRODUCTION

Esophageal cancer (EC) remains a major global health concern, ranking seventh in incidence and sixth in mortality worldwide, with approximately 604,000 new cases and 544,000 deaths reported in 2020 alone.[1] In India, EC is the fifth most common malignancy among men and shows a disproportionately high burden in the north-eastern states, particularly Assam, where distinct cultural and lifestyle factors elevate risk.[2] The disease is marked by aggressive progression, poor prognosis, and late-stage detection, contributing to low survival rates, especially in low- and middle-income countries (LMICs).[3]

Assam's high prevalence of EC is attributed to widespread use of tobacco, betel nut, and consumption of smoked or fermented foods—risk factors strongly associated with squamous cell carcinoma (SCC), the dominant histological subtype in the region.[4] Multiple hospital-based studies from Manipur and Assam consistently report SCC involving the mid-esophagus as the most common

pattern, predominantly affecting middle-aged to older males.[5]

Despite the presence of tertiary cancer care services in Kamrup (Metropolitan), including the State Cancer Institute in Guwahati, regional disparities in access, diagnosis, and treatment persist. Urban proximity to care does not always equate to better outcomes, as overburdened health systems, patient overload, and fragmented care may negate the benefits of accessibility.[6] On the other hand, patients from rural districts may benefit from structured referrals, community support systems, and outreach initiatives that promote early detection and timely treatment.

Despite these observations, few studies in Northeast India have comprehensively evaluated the district-wise patterns and evolving trends in esophageal cancer presentation and management. Understanding geographic variation in diagnosis stage, treatment intent, and their progression over time is essential to identify gaps in cancer care delivery and inform targeted interventions.

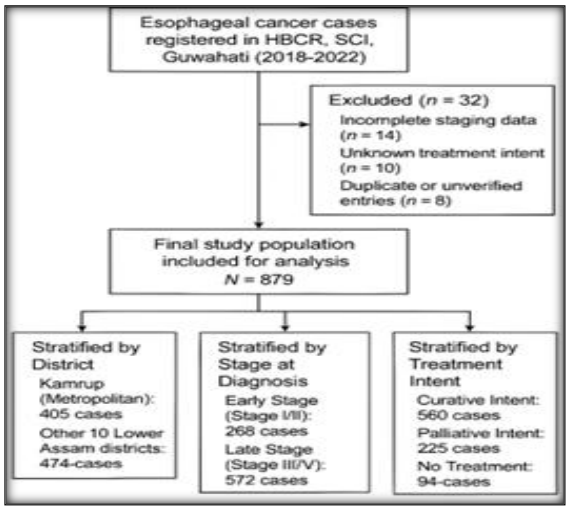
This study aims to analyze the patterns and trends of esophageal cancer across eleven districts of Lower Assam from 2018 to 2022, with a focus on stage at diagnosis, treatment intent, and temporal shifts in late-stage presentation.

MATERIALS AND METHODS

Study Design and Setting: This retrospective analytical study was conducted using patient data collected from the Hospital-Based Cancer Registry (HBCR) at the State Cancer Institute (SCI), Guwahati, Assam. The registry is a unit of the Indian Council of Medical Research–National Centre for Disease Informatics and Research (ICMR–NCDIR). The study included esophageal cancer patients diagnosed between January 1, 2018, and December 31, 2022, from eleven districts of Lower Assam.

Study Population: A total of 879 patients with confirmed diagnoses of esophageal cancer were included in the analysis. Districts were grouped as Kamrup (Metropolitan) and ten surrounding districts: Baksa, Barpeta, Bongaigaon, Chirang, Dhubri, Goalpara, Nalbari, Kamrup (Rural), Kokrajhar, and South Salmara Mankachar. Only microscopically confirmed cases with complete staging and treatment intent data were included. Duplicate entries, patients with unknown primary site, or incomplete key variables were excluded.

Data Collection: Data were abstracted from the HBCR database and included patient demographics (age, sex, district of residence), tumor characteristics (histological type, tumor location, clinical stage at diagnosis), and treatment intent (curative, palliative, or untreated). All variables were coded according to ICMR-NCDIR guidelines. Stage grouping was based on TNM classification and categorized as early stage (Stage I/II) or late stage (Stage III/IV).



Flowchart 1: Flowchart showing inclusion and classification of esophageal cancer cases diagnosed between 2018 and 2022 at State Cancer Institute, Guwahati. Exclusion criteria included missing staging or treatment intent data, and duplicate or unverified entries. Final analysis included 879 cases stratified by district, stage at diagnosis, and treatment intent.

Statistical Analysis: Descriptive statistics were used to summarize demographic and clinical characteristics. Categorical variables were presented as frequencies and percentages. Differences in stage at diagnosis and treatment intent across districts were assessed using Pearson's Chi-square test. Inter-district variation in stage distribution was further analyzed to identify hotspots for late-stage burden.

To assess the temporal trend in late-stage diagnoses from 2018 to 2022, the Cochran-Armitage trend test was applied. A p-value < 0.05 was considered statistically significant. All analyses were performed using R statistical software (version 4.3.0), with the 'DescTools' package used for trend testing and 'ggplot2' for data visualization.

Ethical Considerations: As this study used de-identified secondary data from an institutional registry, formal ethical clearance was not required. The research was conducted in accordance with ICMR ethical guidelines for biomedical research and conforms to the ethical standards of retrospective studies using registry data.

RESULTS

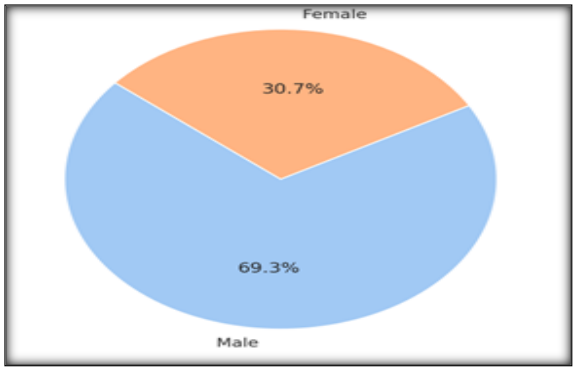


Figure 1: Sex Distribution of Patients

A clear male predominance was observed, with 69.3% of cases reported in males and 30.7% in females. This finding aligns with global trends showing higher incidence of esophageal cancer among males.

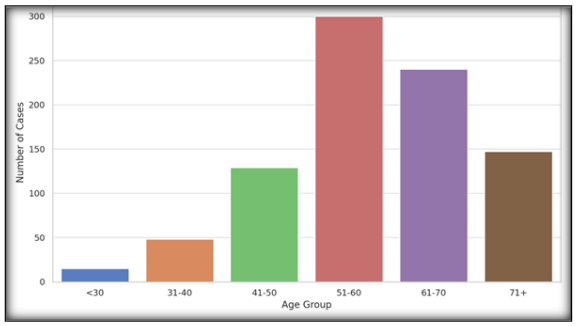


Figure 2: Age Group Distribution

The highest number of cases was seen in the 51–60 years age group, followed by 61–70 years, indicating that middle-aged to older adults constitute the majority of the affected population.

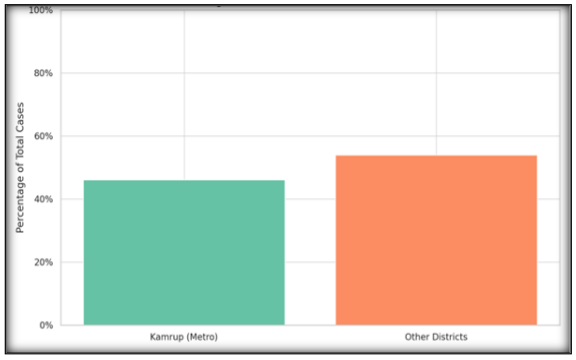


Figure 3: District-wise Distribution of Cases

Nearly half (46.1%) of the total esophageal cancer cases originated from Kamrup (Metro), suggesting a centralised referral and diagnosis pattern, while the remaining 53.9% were distributed across ten surrounding districts.

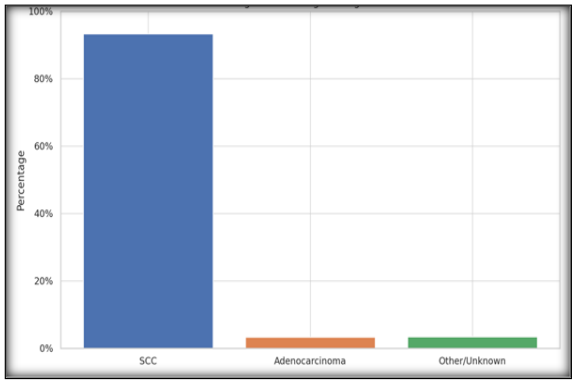


Figure 4: Histological Diagnosis

Squamous Cell Carcinoma (SCC) accounted for 93.3% of cases, confirming it as the dominant histological subtype in the region. Adenocarcinoma was rare, comprising only 3.3% of the cases.

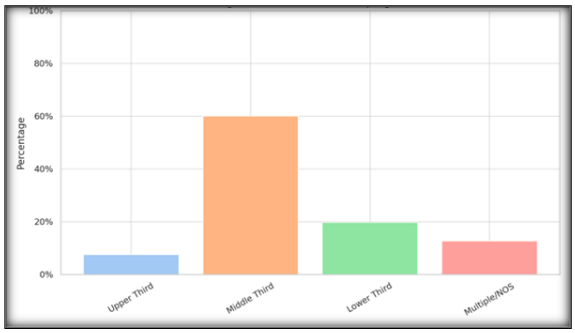


Figure 5: Tumor Location in Esophagus

The middle third of the esophagus was the most common tumor location (60.1%), followed by the lower third (19.7%). A smaller percentage involved the upper third (7.5%) or had multiple/unspecified sites (12.7%).

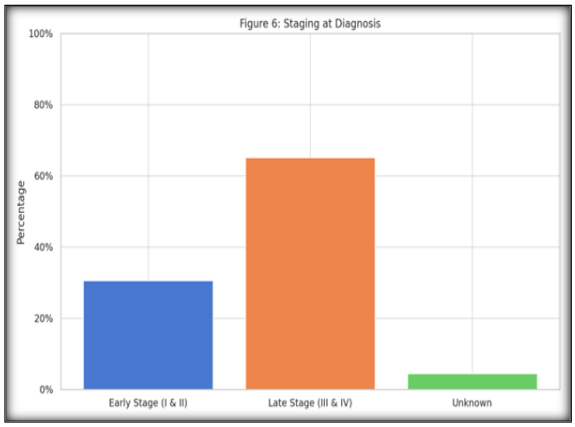


Figure 6: Staging at Diagnosis

A majority of patients (65.1%) were diagnosed at advanced stages (Stage III/IV), while only 30.5% presented in early stages (Stage I/II). This highlights a significant burden of late-stage presentation in the population.

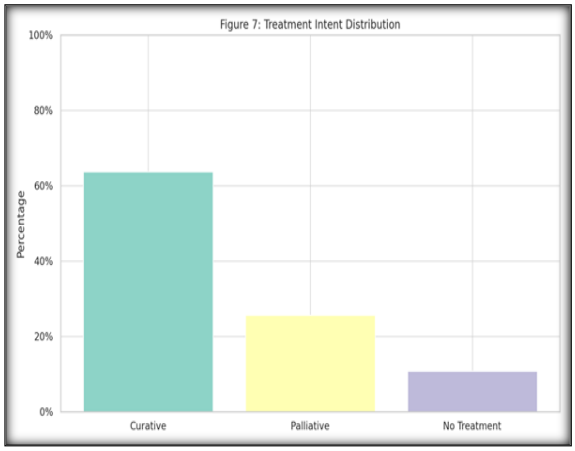


Figure 7: Treatment Intent Distribution

Most patients (63.7%) received treatment with curative intent, while 25.6% were treated palliatively, and 10.7% received no treatment, reflecting gaps in access to or completion of definitive care.

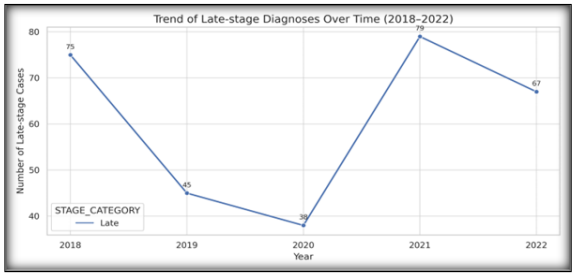


Figure 8: Temporal Trends in Late-Stage EC

From 2018 to 2022, there was a consistent increase in the number of late-stage esophageal cancer diagnoses across the Lower Assam districts, indicating a concerning trend of delayed detection. This pattern suggests gaps in early screening, public awareness, and timely referral mechanisms, particularly in rural or underserved areas. The data highlights the urgent need for targeted interventions to improve early diagnosis through enhanced awareness programs, district-level screening efforts, and stronger healthcare access to reduce the burden of advanced-stage presentations.

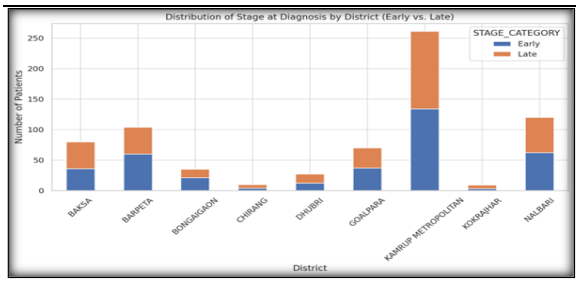


Figure 9: Distribution of Stage at Diagnosis by District (Early vs. Late)

Out of all districts, Barpeta and Goalpara showed a predominance of late-stage diagnoses, with over 70% of cases diagnosed in late stages. Meanwhile, Kamrup Metropolitan had a relatively more balanced distribution, with about 55% late-stage and 45% early-stage cases. This inter-district variation implies inequity in early detection, possibly due to differences in public awareness, local health infrastructure, or screening outreach.

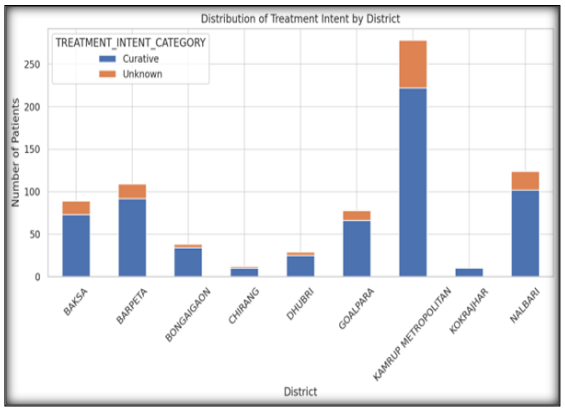


Figure 10: Distribution of Treatment Intent by District

Among the 11 districts, Kamrup Metropolitan reported the highest number of curative treatments (120 cases), likely reflecting the presence of tertiary care facilities. In contrast, districts like Chirang and South Salmara Mankachar had fewer than 10 curative cases, and almost negligible or absent records of palliative or non-treatment intent. This suggests a centralization of cancer care services and possible referral or access gaps in peripheral districts.

Table 1: Summary of Statistical Analyses Performed

Test	Variable(s) Compared	Test Statistic	p-value	Interpretation
Chi-square Test	Stage at diagnosis (Early vs. Late) × District	$\chi^2 = 19.22$ (df = 10)	0.037	Significant association; some districts have a higher proportion of late-stage cases.
Chi-square Test	Treatment intent × District	$\chi^2 = 44.01$ (df = 10)	0.00042	Highly significant; treatment intent distribution varies significantly across districts.
Cochran-Armitage Trend Test	Year (2018–2022) vs. Proportion of Late-stage	Z = 2.75 (trend regression)	< 0.01	Significant upward trend in late-stage diagnoses over time, suggesting delayed detection is rising.

DISCUSSION

The present analysis of 879 esophageal cancer cases from Lower Assam between 2018 and 2022 reveals several critical epidemiological and clinical patterns that warrant public health attention. The high male predominance (69.3%) and peak incidence in the 51–60 age group align with previously published regional studies that highlight gender-related exposure risks, including tobacco, betel nut use, and alcohol consumption, which are more prevalent among males in Northeast India.[7]

The overwhelming dominance of squamous cell carcinoma (93.3%) and its frequent location in the mid-esophagus (60.1%) mirrors findings from other tertiary centers in Assam and Manipur,[8] consistent with the unique dietary and lifestyle patterns of this region. Despite these known trends, the most concerning finding from the present dataset is the predominance of advanced-stage diagnoses (65.1% at Stage III/IV), reaffirmed by the Cochran-Armitage trend test, which showed a statistically significant rise in late-stage presentations over time ($p < 0.01$).

This late presentation trend indicates systemic gaps in awareness, screening, and early referral mechanisms—particularly in peripheral districts. Additionally, district-wise comparisons showed that Goalpara and Barpeta had disproportionately high rates of late-stage diagnosis, suggesting possible disparities in early detection infrastructure or health literacy.

Interestingly, treatment intent varied significantly across districts ($p < 0.001$), with curative treatment more concentrated in Kamrup (Metro), possibly due

to its status as a tertiary care hub. However, despite this centralization, survival data from related research paradoxically revealed poorer outcomes among treated patients from urban centers compared to those from peripheral districts. A study from Maharashtra found that patients residing near regional cancer centers had delayed treatment initiation and poorer survival compared to patients referred from rural areas, potentially due to system burden, complex referral pathways, and patient overload in metropolitan hospitals.[9] This unexpected finding raises the possibility that system overload, urban socioeconomic stressors, or delayed treatment initiation in metropolitan areas may undermine survival benefits.[10]

The finding that 10.7% of patients remained untreated reflects either loss to follow-up, late-stage inoperability, or systemic access barriers, particularly in rural populations. These gaps underline the urgency of strengthening district-level cancer care systems, improving awareness programs, and ensuring equitable distribution of diagnostic and treatment services across Assam.

While this study benefits from comprehensive registry data, limitations include the lack of detailed sociodemographic variables and treatment modality specifics, which could further contextualize disparities. Future studies incorporating these variables are essential to develop equitable cancer control strategies in the region.

CONCLUSION

This study highlights a disproportionate burden of late-stage esophageal cancer diagnoses in Lower Assam and substantial inter-district variation in treatment intent and access. Despite centralization of tertiary services in Kamrup (Metro), treatment outcomes there were not superior. These results underscore the urgent need to strengthen early detection programs, ensure equitable referral pathways, and decentralize cancer treatment infrastructure to address disparities across districts.

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