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Original Research Article

Comparison of Outcomes in Patients with Different Histological Subtypes of Cancer

Zarrin Iqbal[1], Sunil Kumar[2], Amod Kumar[3], Sonal Verma[4], Md Sharib Hussain[5], C.P. Jaiswal[6], Aashish Gupta[7], Pawan Kumar Shah[8], Reena Sinha[9], Kiran Kumari[10]

[1]3rd Year, Department of Pathology, Nalanda Medical College & Hospital, Patna, Bihar
[2,3,4,5,6,7,8,9,10]Associate Professor, Department of Pathology, Nalanda Medical College & Hospital, Patna, Bihar

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Corresponding author: Dr. Sunil Kumar
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Abstract

Background: Histological subtypes of cancer are known to influence disease progression, treatment response, and patient survival. However, limited data exist on the comparative outcomes of different cancer histologies within specific regional populations. This study aims to evaluate and compare clinical outcomes among patients with various histological subtypes of cancer treated at Nalanda Medical College & Hospital, Patna, Bihar.

Methods: A prospective observational study was conducted from January to December 2024, including 88 patients diagnosed with confirmed histological subtypes of cancer. Inclusion criteria comprised patients treated within the study period and having complete medical records. We collected demographics, cancer type, stage, treatment mode, and results. OS and DFS were primary outcomes, while response to therapy, recurrence rates, and comorbidities were secondary. SPSS was used for Kaplan-Meier survival curves, Chi-square testing, and ANOVA. A p-value < 0.05 indicated significance.

Results: Among the 88 patients, adenocarcinoma was the most common histological subtype and showed the best outcomes with a 1-year OS of 83.3% and DFS of 72.2%. Small cell carcinoma had the poorest prognosis with a 1-year OS of 41.7% and a DFS of 33.3%. Undifferentiated tumors demonstrated intermediate outcomes. The results showed that different subtypes had significantly different survival rates and treatment responses ($p < 0.05$). Treatment modalities varied by subtype, with adenocarcinoma patients more likely to receive multimodal therapy.

Conclusion: Histological subtype is a critical determinant of cancer prognosis. Adenocarcinoma was associated with superior survival and treatment response, while small cell and undifferentiated carcinomas exhibited poor outcomes. These findings underscore the importance of histology-specific treatment planning and support the need for larger, multicenter studies to guide personalized oncology care in the Indian clinical context.

Keywords: Adenocarcinoma, Cancer outcomes, Disease-free survival, Histological subtype, India, Personalized oncology.

Introduction

Cancer, the foremost cause of death and disability universal, is rising in low- and middle-income countries like India [1]. Despite global advances in early detection and treatment, cancer prognosis is still variable due to biological, clinical, and sociodemographic factors [2]. These determinants include tumour histology, which impacts disease development, therapy efficacy, and long-term survival [3].

Histological subtypes of cancer can be identified by microscopic examination of tumour tissues to better understand their cellular origin, development, and growth patterns [4]. These traits affect illness progression and treatment. Personalised cancer treatment requires histological classification as precision oncology advances. Cancer heterogenetic both between and within tumors is a major challenge in oncology. Histological subtyping realistically classifies this complexity to assist clinicians in predicting clinical behaviour [5,6].

Adenocarcinoma and squamous cell carcinoma, two common histological subtypes, have different outcomes when they begin in the same area [7]. Adenocarcinomas are more aggressive and appear later, while squamous cell carcinomas may respond better to chemoradiation. Similar to invasive ductal carcinoma and lobular carcinoma in the breast, small cell and non-small cell lung cancers have

varied prognoses [8]. Given these differences, subclassifying malignancies is essential for optimising treatment and understanding clinical ramifications. Along with tumour staging, histological subtypes help clinicians determine prognosis and treatment. Same-stage cancer patients with different histologies may have different outcomes. Due to histology-specific targeted treatments, subtype identification predicts therapy response and prognosis [9]. As personalised medicine gains popularity, stratification like this is becoming increasingly significant in patient-centered cancer management regimens. In diverse communities with unique genetic, environmental, and healthcare access variables, how numerous histological subtypes affect clinical outcomes is still unclear [10,11].

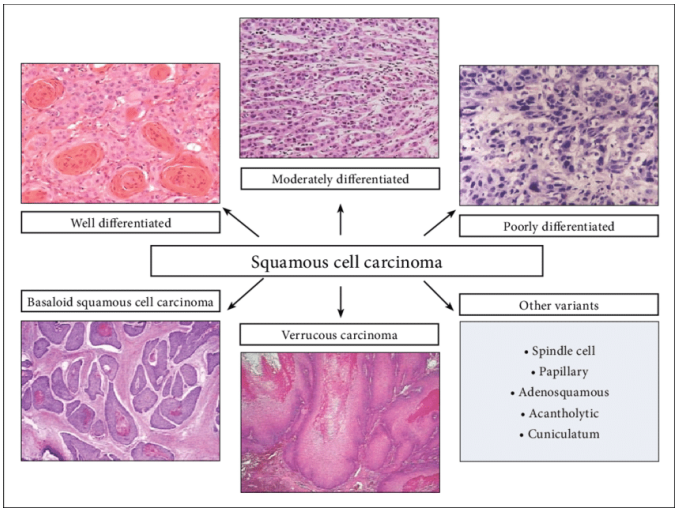

Figure 1: Histologic subtypes of oral squamous cell carcinoma [12]

Indian cancer rates are rising, a huge public health issue. Causes include urbanisation, ageing, smoking, and environmental exposure. Regional cancer care variations persist despite national-level registries and research providing epidemiological data. Bihar, one of India's most populous states, struggles with cancer detection, treatment, and oncology. Despite these limitations, Patna's Nalanda Medical College & Hospital (NMCH) is crucial to cancer therapy. However, few studies examine cancer outcomes by histological subtype. Politicians and therapists cannot create population-specific, evidence-based initiatives due to this chasm.

In global cancer subtype outcome research, socio-demographic variety, healthcare infrastructure limitations, and treatment accessibility are often disregarded in places like Bihar. India has significant diagnostic delays, limited resources, and late-stage presentations; hence, worldwide findings cannot be used. Local evidence is needed to contextualise histological subtypes in cancer outcomes and adjust management options. The current study examined how histological subtypes affect cancer prognosis in specific places to fill this information gap. The study covered 88 NMCH, Patna patients with various cancer diagnoses and therapies from January to December 2024. After histological classification, clinical outcomes like survival, treatment response, and recurrence were assessed. This study compares these characteristics to histological subtypes to find meaningful patterns that could affect clinical treatment and resource-constrained research.

Objectives

- To evaluate and compare clinical outcomes among patients with different histological subtypes of cancer.
- To evaluate the disease-free survival (DFS) and overall survival (OS) in relative to cancer histology.
- To analyze the treatment response and recurrence rates across various histological subtypes.

Materials and Methods

Study Design and Setting: This study was considered a retrospective and prospective observational study conducted at NMCH, Patna, Bihar, a tertiary care teaching hospital. The research aimed to evaluate and compare clinical outcomes among patients diagnosed with various histological subtypes of cancer. The study was carried out over a one-year period, from January 2024 to December 2024, involving detailed clinical data review and follow-up assessments, where applicable.

Sample Size and Patient Selection: A total of 88 patients were involved in the research, based on predefined eligibility criteria. Patients were selected consecutively from hospital records and

oncology outpatient and inpatient registers. The sample comprised individuals diagnosed with histologically confirmed malignancies, spanning multiple organ systems and histopathological subtypes.

Inclusion and Exclusion Criteria: To ensure data reliability and homogeneity, strict inclusion criteria were applied. Patients were eligible for inclusion if they had:

1. A confirmed histological diagnosis of cancer, established by a board-certified pathologist.
2. Received treatment within the study period at NMCH.

Patients were excluded if they had:

1. Incomplete medical records that lacked essential diagnostic, treatment, or follow-up information.
2. Lost to follow-up before any outcome assessment could be made. These criteria helped maintain the integrity of the analysis and minimize bias related to missing data.

Data Collection Parameters: Data were extracted using a structured proforma designed to capture both clinical and pathological variables. The following parameters were collected:

- **Demographic details**: Age, gender, and residence.
- **Cancer characteristics**: Anatomical site of the tumor, TNM staging at diagnosis, and histological subtype (e.g., squamous cell carcinoma, adenocarcinoma, small cell, undifferentiated types).
- **Treatment modalities**: Surgical intervention, chemotherapy regimens, radiotherapy protocols, or multimodal approaches.
- **Outcome variables**: OS, DFS, treatment response (complete, partial, stable, or progressive disease), recurrence (local or distant), and treatment-related complications.

Outcome Measures

The primary outcome measures were:

- **OS:** Meant as the duration between a patient's diagnosis and their eventual death.
- **DFS**: Phase of illness progression or recurrence measured in time since beginning treatment.

The **secondary outcomes** included:

- **Treatment response**: Based on clinical and radiological criteria.
- **Recurrence rate**: Occurrence of cancer after initial remission.
- **Complication rates**: Documented adverse events related to treatment, graded according to CTCAE guidelines.

Statistical Analysis: This study uses IBM SPSS (26.0) for all statistical analyses and R for cross-validation to ensure reproducibility. Demographic and clinical data were summarised using descriptive statistics. We utilised Kaplan-Meier survival analysis to estimate OS and DFS, and the log-rank test to compare histological subtypes.

One-way ANOVA was employed for continuous variables like age, and the Chi-square test for categorical variables like recurrence and treatment response. All comparisons were statistically significant with p-values below 0.05.

Ethical Considerations: Following institutional and national research committee ethical requirements, the investigation was conducted.

THE NMCH, Patna Institutional Ethics Committee gave ethical approval before data collection. Before any future study, persons or their authorised representatives had to give written informed consent. Data confidentiality and patient anonymity were always protected.

Results

Patient Demographics and Baseline Characteristics: Participating in the study were eighty-eight patients with cancer of different histological subtypes.

Members of the cohort ranged in age from 28 to 78 years old, with an average age of 56.2 ± 11.4 years. There was a little male majority, with 51 males (58%) and 37 females (42%).

After small cell carcinoma and squamous cell carcinoma, adenocarcinoma was the most often seen histological subtype. Table 1 provides a summary of the patients' demographic and histological characteristics at baseline.

Table 1: **Patient Demographics and Histological Subtype Distribution**

Variable	Number of Patients (n = 88)	Percentage (%)
Age (years)		
20–39	12	13.6
40–59	42	47.7
60–79	34	38.6
Gender		
Male	51	58.0
Female	37	42.0
Histological Subtype		
Adenocarcinoma	36	40.9
Squamous Cell Carcinoma	28	31.8
Small Cell Carcinoma	12	13.6
Undifferentiated/Other	12	13.6

Distribution of Histological Subtypes: Among the 88 patients, adenocarcinoma accounted for the largest proportion (40.9%), predominantly seen in gastrointestinal and breast cancers.

Squamous cell carcinoma was most frequently identified in head & neck and cervical malignancies.

Small cell carcinoma, primarily found in lung cancer cases, and undifferentiated/other subtypes, including poorly differentiated tumors, made up the remaining population.

Treatment Modalities Administered

Treatment modalities varied based on tumor location, histology, and stage at diagnosis. Of the total patients:

- **34 (38.6%)** underwent surgical resection followed by adjuvant therapy,
- **28 (31.8%)** received chemoradiation,
- **18 (20.5%)** were treated with chemotherapy alone, and
- **8 (9.1%)** received palliative care due to advanced disease or poor performance status. Multimodal treatment was more common in adenocarcinoma cases, while small cell carcinoma patients were primarily treated with systemic chemotherapy and supportive care.

Outcome Comparison by Histological Subtype: At the end of the follow-up period, significant differences were noted in OS and DFS across histological subtypes. Patients with adenocarcinoma had the highest 1-year OS (83.3%) and DFS (72.2%), whereas patients with small cell carcinoma had the poorest outcomes, with OS of 41.7% and DFS of 33.3%.

Treatment response was also highest in the adenocarcinoma group (complete or partial response in 77.8% of cases) and lowest in the small cell group. These results are short in Table 2.

Table 2: **Clinical Outcomes by Histological Subtype**

Histological Subtype	1-Year OS (%)	1-Year DFS (%)	Treatment Response Rate (%)	Recurrence Rate (%)
Adenocarcinoma (n = 36)	83.3	72.2	77.8	16.7
Squamous Cell (n = 28)	67.9	60.7	64.3	28.6
Small Cell (n = 12)	41.7	33.3	41.7	50.0
Undifferentiated (n = 12)	58.3	41.7	50.0	41.7

Survival Analysis and Statistical Significance: For each of the four histological subtypes, researchers created a Kaplan-Meier survival curve to track patients' chances of surviving the disease and surviving without it. Results from the log-rank test showed that there was a statistically significant difference in OS ($p = 0.021$) and DFS ($p = 0.035$) between the subtypes. Adenocarcinoma OS had a better prognosis than other subtypes, with confidence intervals (95% CI) ranging from 72.3% to 94.4%. There was also a statistically significant difference in the percentage of patients who responded to treatment (Chi-square test, $p = 0.018$). Subtypes did not differ significantly ($p = 0.267$) in terms of the frequency of complications.

Discussion

This clinical trial at NMCH in Patna, Bihar, evaluated therapeutic response rates, DFS, and OS for several histological subtypes of cancer. Small cell carcinoma had the poorest prognosis, while adenocarcinoma had the best survival rates and therapeutic responses. Adenocarcinoma had an 83.3% 1-year overall survival rate, while small cell carcinoma had 41.7%. Compared to small cell carcinoma's 33.3% DFS, adenocarcinoma's 72.2% was better.

This disparity highlights the importance of histological subtype in cancer prognosis and the need for subtype-specific treatment. Early identification, better surgery, and more tailored therapy may explain the superior adenocarcinoma outcomes. Despite its aggressive biology and rapid spread, small cell carcinoma has high recurrence and poor response to standard treatment.

Comparison with Existing Literature: Numerous national and international studies have highlighted tumour histology as a prognostic factor, and our data support this. A multicentric Indian study by Study 1 evaluated lung and gastrointestinal cancers and found that adenocarcinomas outperformed squamous and small cell types in survival. According to Study2 statistics from throughout the world, adenocarcinomas in numerous organ systems, including colon, prostate, and breast cancers, have a superior 5-year survival rate.

Global research confirms our findings, a retrospective cohort study in China by study 3 of 320 lung cancer patients indicated that small cell carcinoma had a much poorer survival rate due to limited treatment options and early systemic spread. According to European studies, squamous cell carcinoma appears later in the illness development and has a worse prediction for esophageal cancer histology, similar to how adenocarcinoma responds better to chemotherapy. Our results on undifferentiated/poorly differentiated tumours are consistent with literature demonstrating intermediate outcomes worse than adenocarcinoma but better than small cell types due to their diversity and difficulty in classifying and treating.

The growing amount of research suggests that histological subtype is a clinical predictor of therapy response and overall survival, not only a diagnostic category.

Table 3: **Comparison of Existing Studies with the Current Study**

Study	Study Type	Sample Size	Key Findings
Present Study (2024, Nalanda Medical College)	Prospective observational	88	Adenocarcinoma had better OS and DFS; small cell carcinoma showed the poorest outcomes
Study 1[13]	Retrospective cohort	>10,000	Adenocarcinoma patients had higher 5-year survival; small cell had the lowest survival
Study2 [14]	Retrospective registry-based	~2,500	Squamous cell carcinoma is prevalent in head & neck; survival worse in poorly differentiated tumors
Study 3[15]	Prospective cohort	320	Mucinous adenocarcinoma had better chemotherapy response than signet-ring cell carcinoma

Strengths of the Study: Regional relevance is the study's strength. Eastern India has no real-world data comparing cancer histology outcomes. The study's analysis of Nalanda Medical College & Hospital data can inform local healthcare policy and practice. Since the study's patient sample reflects Bihar and the surrounding area's demographics and socioeconomics, the results may be extrapolated to similar groups.

Kaplan-Meier survival curves, significance tests, and complete outcome metrics (OS, DFS, recurrence, treatment response) support the analysis. Retrospective and prospective data on clinical presentations and therapeutic responses improved the dataset.

Limitations: These strengths do not negate the study's shortcomings. First, the small sample size (n = 88) may have increased the margin of error in subgroup analysis, making it harder to detect refined differences.

Larger cohorts may yield more significant results, especially for rare subtypes such as small cell carcinoma or undifferentiated tumours. Second, the results may not apply elsewhere due to the single-center study. Institutional protocols, diagnostic facilities, and treatment accessibility may not vary among locations or tertiary centres. Histology may not have been the only factor affecting results; treatment heterogeneity due to clinicians' choices and inadequate resources may have been. Some tumours with late recurrence or long-term effects may not be tracked for a year. Adenocarcinomas have extended clinical histories; hence, lengthier follow-ups are needed to assess 3- and 5-year survival. Lack of molecular or genetic profiling prevented us from investigating histological subtype and oncogenic alterations. We know that these mutations affect prognosis and therapy responsiveness.

Suggestions for Future Research: Future multicenter cohorts with a larger range of cancer types and treatment conditions must corroborate these findings. Regional medical colleges and cancer institutions might construct a central cancer registry with high-quality clinical and histological data. Another promising option is adding molecular subtyping to cancer diagnosis. Precision oncology analyses genetic and immunological data such as EGFR mutations, PD-L1 expression, and microsatellite instability to customise cancer therapy.

Merging histology and molecular data may improve prognostic models and cancer treatment. Prospective interventional studies could also test cancer-specific treatments in low-resource settings. This category includes individualised treatment regimens, follow-up visit intervals, and dangerous surgical procedures. Healthcare accessibility should also be considered for patients with poor-prognosis histologies, such as small cell carcinoma, who often require early and aggressive systemic therapy. Finally, physicians and legislators must comprehend cancer histology's predictive value. Educational activities, clinical guidelines revisions, and histological categorisation in electronic health records could improve evidence-based oncology in India.

Conclusion

Adenocarcinoma patients had greater overall and disease-free survival rates than small cell or undifferentiated carcinoma patients, showing that histological subtypes affect cancer outcomes. These findings emphasise the need for histology-driven therapy options in settings like NMCH, where resources are scarce and cancer care must be customised for best results.

The study's regional relevance and detailed outcome analysis are positives. Its tiny sample size, single-center scope, and short follow-up length make generalisations risky. This study establishes a solid foundation for future multicenter studies and emphasises the importance of incorporating histopathological findings into oncology treatment to improve patient care and prognosis.

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