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Clinicodemographic, Morphological, Stage and Treatment Patterns of Sarcomas at a Tertiary Cancer Centre in Northeast India: A Five-Year Hospital-Based Cancer Registry Study

Dr. Tarjina Begum[1], Dr. Maruf Hussain Barbhuiya[2*], Progyan Mahanta[3], Dr. Neelakshi Mahanta[4]

[1]Assistant Professor, Department of Medical Oncology, State Cancer Institute, Gauhati Medical College and Hospital, Guwahati, Assam, India;

[2]Scientist B (Medical), Hospital-Based Cancer Registry (HBCR), ICMR- National Institute of NCD Epidemiology (NINE), State Cancer Institute, Gauhati Medical College; Guwahati, Assam, India;

[3]Project Technical Officer (Statistician), Hospital-Based Cancer Registry (HBCR), ICMR- National Institute of NCD Epidemiology (NINE), State Cancer Institute, Gauhati Medical College; Guwahati, Assam, India;

[4]Professor and Head of Department, Department of Medical Oncology; State Cancer Institute , Gauhati Medical College and Hospital, Guwahati, Assam, India

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Corresponding Author:

Dr. Maruf Hussain Barbhuiya
Scientist B (Medical), Hospital-Based Cancer Registry (HBCR), ICMR- National Institute of NCD Epidemiology (NINE), State Cancer Institute, Gauhati Medical College; Guwahati, Assam, India; ORCID iD: 0000-0001-5811-8245

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ABSTRACT

Background: Sarcomas are rare and heterogeneous malignancies, and regional data from Northeast India remain limited. This study analysed the clinicodemographic, morphological, stage and treatment profile of sarcoma cases registered at a tertiary cancer centre in the region.

Methods: This retrospective hospital-based cancer registry study included patients with sarcoma registered between 1 January 2018 and 31 December 2022. Data on age, sex, morphology, stage and treatment were extracted from structured registry records. Descriptive statistics were used to summarise the findings. Age distribution across disease stages was compared using the Kruskal-Wallis test.

Results: A total of 298 eligible sarcoma cases were analysed. Males constituted 57.8% of the cohort and females 42.2%. The highest proportion of cases was observed in the 40-50 year age group, followed by the 50-60 year and 20-30 year groups. Osteosarcoma was the most common morphology, accounting for 19.69% of cases, followed by soft tissue sarcoma, spindle cell sarcoma and Ewing's sarcoma. Stage II was the most frequently recorded stage, followed by Stage III and Stage IV. Age distribution did not differ significantly across disease stages on Kruskal–Wallis testing, with a p value of 0.336. Among treated cases, surgery alone was the most common modality, followed by radiotherapy and chemotherapy.

Conclusion: Sarcomas in this registry cohort showed a broad age distribution, modest male predominance, heterogeneous morphology and a substantial burden of intermediate and advanced-stage disease. The findings provide useful baseline evidence on sarcoma patterns in a regional tertiary-care setting.

Keywords: *Sarcoma; hospital-based cancer registry; Northeast India; osteosarcoma; soft tissue sarcoma.*

INTRODUCTION

Sarcomas are uncommon malignant tumours of mesenchymal origin that include a wide spectrum of soft tissue and bone neoplasms. Although soft tissue sarcomas account for only about 1% of adult malignancies, their clinical significance is disproportionate to their rarity because they comprise more than 100 histological subtypes with distinct biological behaviour, patterns of spread and treatment responses[1]. The classification of these tumours has also evolved considerably with advances in immunohistochemistry, cytogenetics and molecular pathology, improving diagnostic reproducibility but also making registry-based categorisation more complex[2]. Recent global burden estimates suggest that the absolute

number of soft tissue sarcoma cases has increased over recent decades, from approximately 54,631 cases in 1990 to 96,201 cases in 2021, despite relatively stable or slightly declining age-standardised rates[3].

In India, sarcoma-related evidence remains relatively limited compared with common epithelial cancers. Available Indian literature has largely emerged from tertiary referral centres or from subtype-specific registry analyses. Puri and Gulia (2012) highlighted that soft tissue sarcomas in Indian tertiary-care settings commonly affect adults in the third to fifth decades, show male predominance, and require multidisciplinary management at specialised centres[4]. Population-based evidence is even more restricted. One important NCRP-based study on Ewing sarcoma of bone, using data from five Indian population-based cancer registries over three decades, reported that Ewing sarcoma constituted around 15% of all bone malignancies and showed an increasing trend in pooled age-standardised incidence rates[5].

Northeast India occupies a distinct position in the Indian cancer landscape. The region has consistently reported a high cancer burden and a unique cancer profile compared with many other parts of the country[6]. However, published evidence from this region has predominantly focused on common cancers such as oesophageal, gastric, lung, breast, cervical and head-and-neck cancers. Sarcomas, despite their diagnostic and therapeutic complexity, have received limited regional attention, particularly from hospital-based cancer registry datasets in Assam and adjoining Northeast Indian populations.

This gap is important because hospital-based cancer registry data can provide practical insights into patient demographics, morphology, stage at presentation and initial treatment patterns, especially for rare malignancies that are difficult to study through single-department case series. A registry-based sarcoma profile from a tertiary cancer centre in Assam may therefore help describe the regional clinical spectrum and generate baseline evidence for service planning, referral pathways and future outcome studies. The present study aimed to analyse the clinicodemographic characteristics, morphological spectrum, stage distribution and treatment patterns of sarcoma cases registered at a tertiary cancer centre in Northeast India over a five-year period.

MATERIALS AND METHODS

Study design and setting

This was a retrospective hospital-based cancer registry study conducted at the State Cancer Institute, Assam, a tertiary cancer care centre catering to patients from Assam and other parts of Northeast India. The study analysed sarcoma cases registered in the Hospital-Based Cancer Registry during the study period.

Study period

The study included cases registered from 1st January 2018 to 31st December 2022. The hospital registration date was used to determine eligibility.

Study population

All patients with a registry-recorded diagnosis of sarcoma during the study period were considered for inclusion. Sarcomas included malignant mesenchymal tumours arising from bone, articular cartilage, soft tissue, peripheral nerve, retroperitoneum and other relevant anatomical sites.

Inclusion criteria

Patients were included if they were registered in the HBCR between 1st January 2018 and 31st December 2022, had a diagnosis consistent with malignant sarcoma, and had adequate demographic and tumour-related information available for analysis.

Exclusion criteria

Cases registered outside the study period, duplicate entries, benign or borderline mesenchymal tumours, non-sarcoma malignancies such as sarcomatoid carcinoma, haematolymphoid malignancies, and records with insufficient information to confirm sarcoma diagnosis were excluded.

Data collection

Data were extracted from structured HBCR records. The variables collected included age, sex, district of residence, primary tumour site, histological diagnosis, morphology, basis of diagnosis, stage at presentation, treatment received, treatment modality and vital status where available. No direct patient contact was involved.

Tumour classification

Primary site and morphology were reviewed using registry-recorded information. Histological diagnoses with spelling variations were standardised into appropriate morphology groups, such as osteosarcoma, Ewing sarcoma, chondrosarcoma, rhabdomyosarcoma, leiomyosarcoma, dermatofibrosarcoma protuberans and soft tissue sarcoma not otherwise specified. Ambiguous records were not reclassified unless supported by the registry diagnosis.

Stage and treatment classification
Stage at presentation was analysed as recorded in the registry. Unknown, not applicable or inadequately documented stage entries were reported separately. Treatment was classified as surgery, chemotherapy, radiotherapy, combined-modality treatment or no recorded cancer-directed treatment, based on available registry information.

Data cleaning and statistical analysis
The dataset was checked for duplicate records, inconsistent dates, entries outside the study period and spelling variations in morphology and district names. Missing data were not imputed. Continuous variables were summarised using mean, standard deviation, median, interquartile range and range, as appropriate. Categorical variables were presented as frequencies and percentages.

Age distribution across disease stages was compared using the Kruskal-Wallis test, as age was summarised using median and interquartile range. A p value of <0.05 was considered statistically significant. The analysis was primarily descriptive, focusing on clinicodemographic profile, morphology, stage distribution and treatment patterns.

Ethical considerations
The study was conducted after approval from the Institutional Ethics Committee. As this was a retrospective registry-based study, patient identifiers were removed before analysis, and confidentiality was maintained throughout.

RESULTS
Male patients constituted a higher proportion of the cohort, accounting for 57.8% of sarcoma cases, while females accounted for 42.2%. This indicates a modest male predominance among the registered sarcoma cases in the study population. (Figure 1).

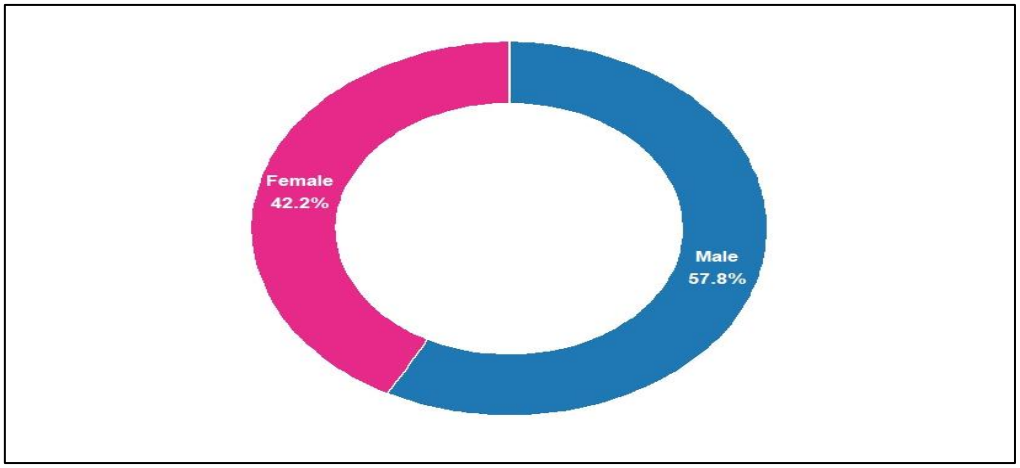

Figure 1. Gender distribution of sarcoma cases

The age distribution showed that sarcoma cases occurred across a wide age range, with the highest proportion observed in the 40-50 years age group at 20.9%**.** This was followed by the 50-60 years age group at 17.5% and the 20-30 years age group at 15.6%. Relatively fewer cases were recorded at the extremes of age, particularly below 10 years and above 80 years, suggesting that the case burden in this cohort was concentrated mainly in young to middle adulthood. (Figure 2)

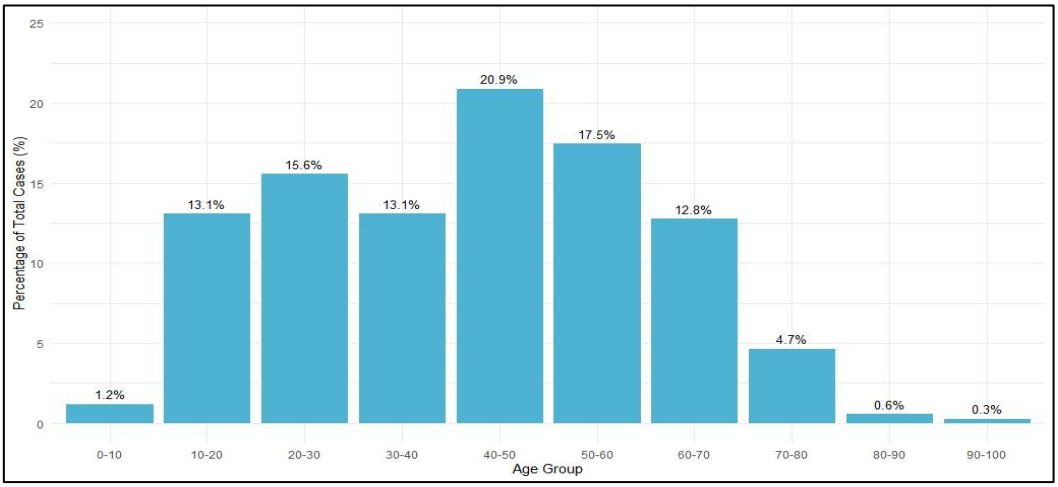

Figure 2. Age distribution of sarcoma cases

On morphology-wise analysis, osteosarcoma was the most common diagnosis, accounting for 19.69% of cases. This was followed by soft tissue sarcoma at 13.44%**,** spindle cell sarcom**a** at 10.31%, and Ewing's sarcoma at 8.12%. Other common histological diagnoses included chondrosarcoma, leiomyosarcoma, synovial sarcoma, pleomorphic cell sarcoma, dermatofibrosarcoma protuberans and liposarcoma. Overall, the distribution reflects the morphological heterogeneity of sarcomas, with both bone and soft tissue subtypes contributing substantially to the registered case burden. (Figure 3)

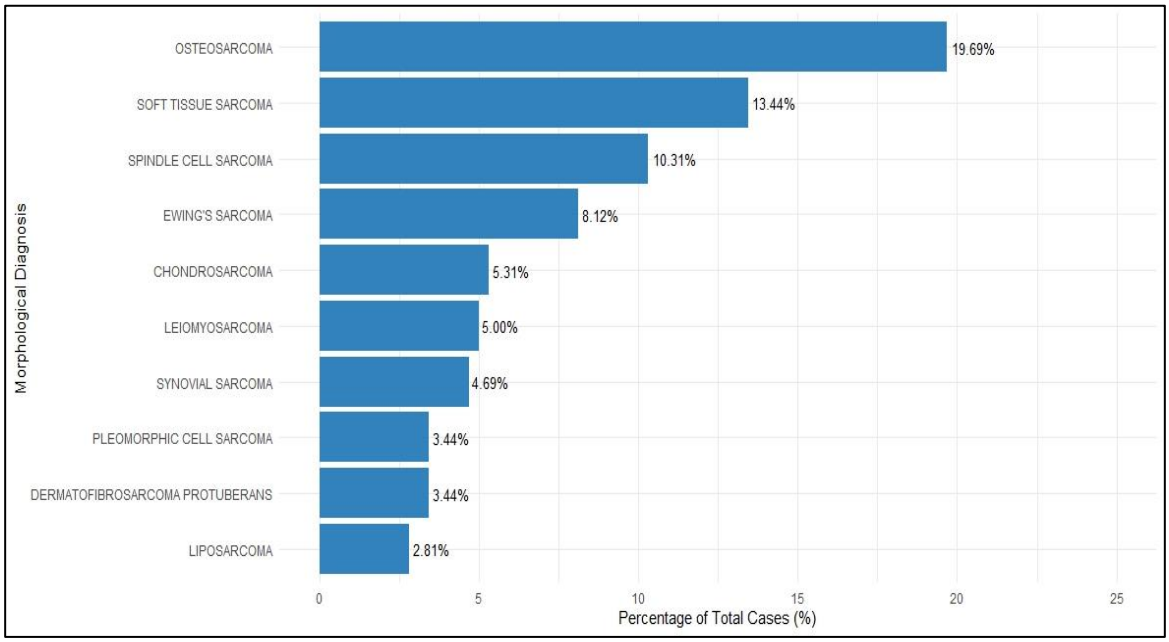

Figure 3. Top 10 sarcoma cases by morphology

The composite stage distribution showed that Stage II was the most frequently recorded stage, comprising 25.5% of cases. This was followed by Stage III at 11.9%**,** Stage IV at 11.0%, and Stage I at 9.1%. Sub-stage categories such as IA, IB, IIA, IIB, IIIA, IIIB, IVA, IVB and IVC were recorded in smaller proportions. The overall pattern suggests that a considerable proportion of patients presented with intermediate or advanced disease at the time of registration. (Figure 4)

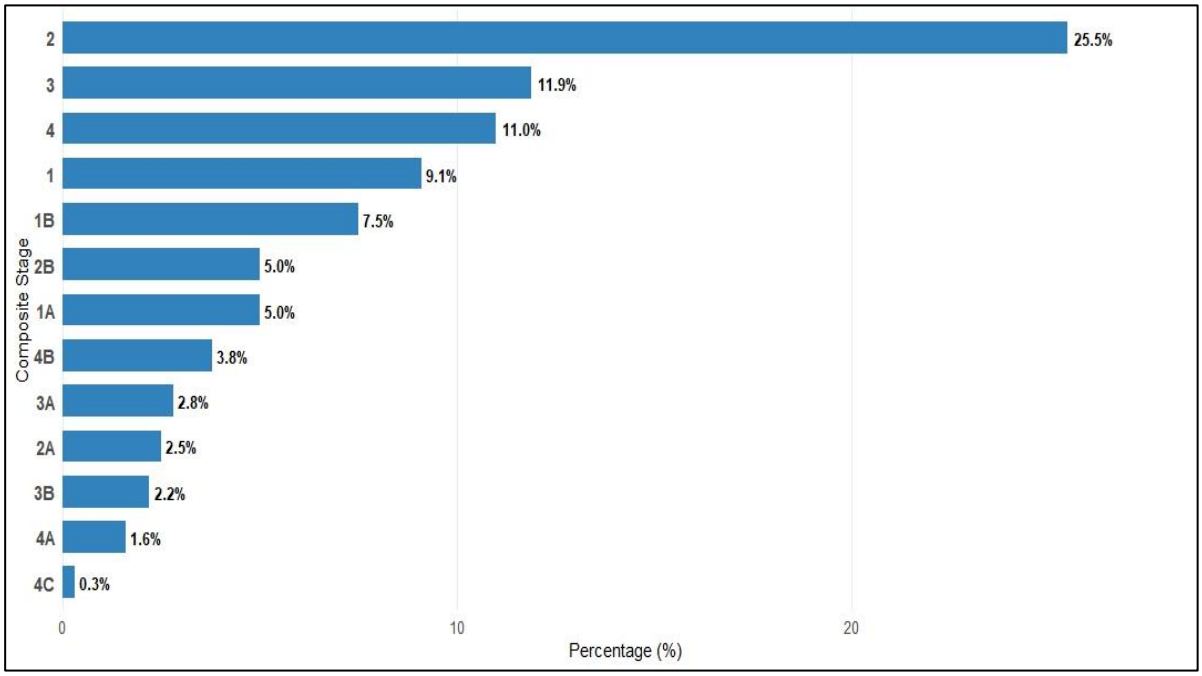

Figure 4. Distribution of cases by composite stage

The median age was similar among patients with Stage I and Stage II disease, with both groups showing a median age of 42 years. Patients with Stage III and Stage IV disease had slightly higher median ages of 48.5 years and 47 years, respectively. However, the interquartile ranges overlapped across all four disease stages, indicating that age distribution was broadly comparable between early and advanced-stage groups. (Table 1)

Stage	N	Median (IQR)	Range (Min-Max)
Stage 1	70	42 (28 - 51)	7 - 80
Stage 2	105	42 (23 - 56)	7 - 83
Stage 3	54	48.5 (30.5 - 59.8)	10 - 80
Stage 4	53	47 (33 - 55)	14 - 92

Table1: Age distribution across disease stages: median, IQR and range

The boxplot of age across disease stages further demonstrated wide age variability within each stage group, without a clear separation between early and advanced disease. Although Stage III and Stage IV showed marginally higher median ages, this difference was not statistically significant. The Kruskal–Wallis test confirmed that age distribution did not differ significantly across the four disease stages, $\chi^2(3) = 3.38$, $p = 0.336$, $n = 282$**.** (Figure 5)

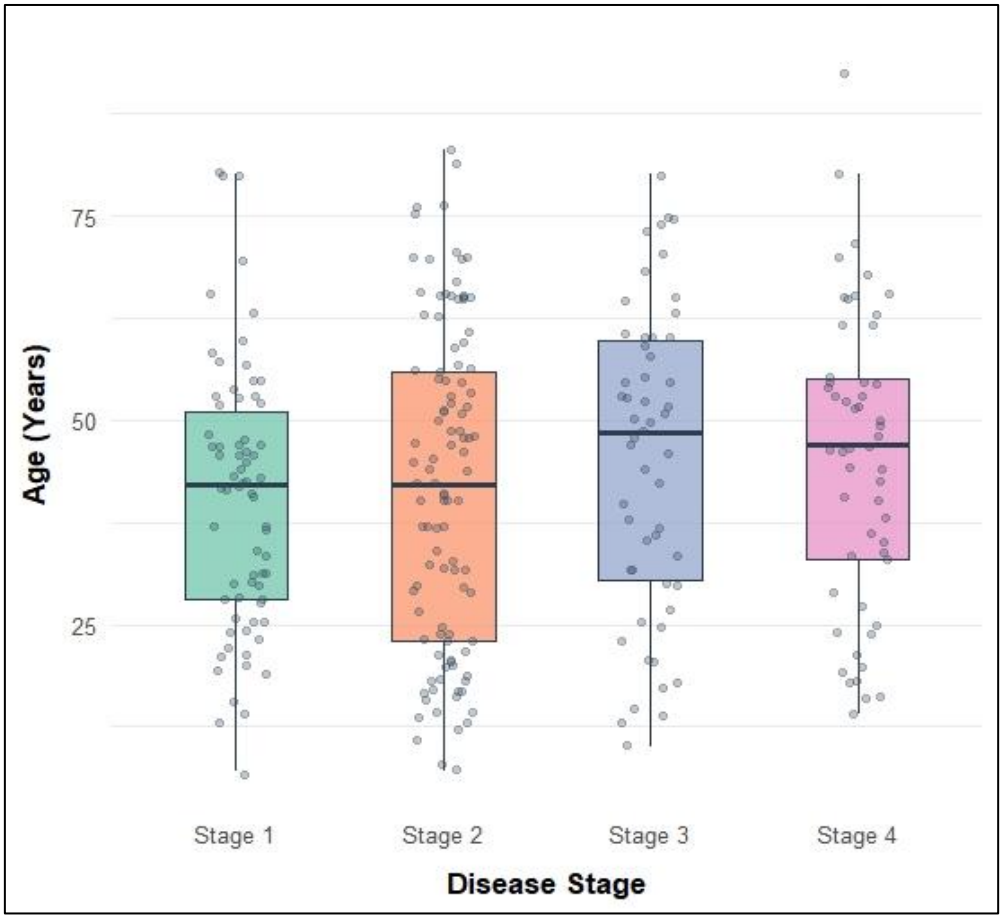

Figure 5. Boxplot showing distribution of age across disease stages

Among treated cases, surgery alone was the most commonly recorded treatment modality, accounting for 37.2% of patients. Radiotherapy alone and chemotherapy alone accounted for 21.8% and 18.6%, respectively. Combined-modality treatment was less frequent, with surgery plus radiotherapy recorded in 9.0%, surgery plus chemotherapy in 8.5%, and radiotherapy plus chemotherapy in 3.2%. Trimodality treatment with surgery, radiotherapy and chemotherapy was recorded in only 1.1% of treated cases, while hormone therapy was rarely used. (Figure 6)

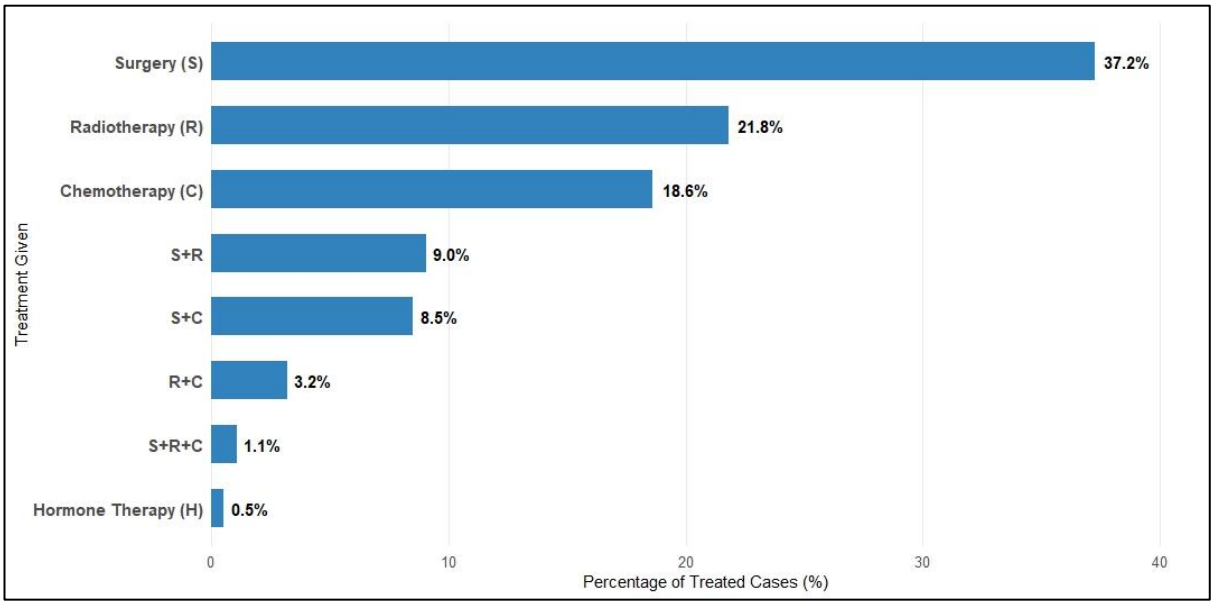

Figure 6. Sarcoma treatment distribution.

DISCUSSION:

The present hospital-based registry study shows that sarcomas registered at this tertiary cancer centre in Northeast India had a modest male predominance and a broad age distribution, with the highest proportion of cases in the 40-50-year age group. This pattern is broadly comparable with Indian tertiary-care series, where sarcoma cohorts have also shown male predominance and presentation largely in young to middle adulthood. Shukla and Deo reported a mean age of 40.6 years in an AIIMS soft tissue sarcoma series, while Garg et al. reported a mean age of 44.6 years with marked male predominance in a surgically treated Indian soft tissue sarcoma cohort [7,9]. A recent Indian tertiary referral centre study also observed that males slightly outnumbered females and that nearly half of patients were below 50 years of age [10]. Thus, the age-sex pattern in the present study appears consistent with available Indian data, although direct comparison is limited because our cohort included both bone and soft tissue sarcomas.

Osteosarcoma was the most frequent morphology in the present study, followed by soft tissue sarcoma, spindle cell sarcoma and Ewing's sarcoma. This differs from soft tissue sarcoma-only Indian series, where synovial sarcoma, undifferentiated pleomorphic sarcoma, liposarcoma and leiomyosarcoma have commonly featured among the leading histologies[9,10]. The difference is expected because the present registry-based cohort included bone sarcomas along with soft tissue sarcomas. In contrast, a histopathological study from southern Assam reported only nine malignant soft tissue tumours among 89 soft tissue tumours, with pleomorphic sarcoma and liposarcoma being the most frequent malignant subtypes [8]. The present study therefore adds a broader regional registry perspective, capturing both skeletal and extraskeletal sarcoma burden rather than only pathology-department soft tissue tumour experience.

The stage distribution showed that Stage II was the most frequently recorded category, followed by Stage III and Stage IV. Although this suggests a substantial burden of intermediate and advanced disease, stage interpretation in sarcoma requires caution because staging varies according to site, grade, tumour size, depth and metastatic status. Current international guidelines emphasise multidisciplinary evaluation and site-specific staging for both soft tissue and bone sarcomas [11,12]. In the present cohort, age did not differ significantly across disease stages, as confirmed by Kruskal–Wallis testing. This absence of a clear age-stage gradient may reflect the biological heterogeneity of sarcomas and the referral-based nature of hospital registry data, rather than a true lack of association between age and disease severity.

Treatment patterns showed surgery as the most frequently recorded modality among treated patients. This is in keeping with established management principles, where complete surgical resection remains central for localised sarcomas, often combined with radiotherapy and/or chemotherapy depending on histology, grade, site and stage [11-13]. However, compared with surgically selected Indian cohorts in which all or most patients underwent resection with frequent adjuvant radiotherapy or chemotherapy, the present study showed a lower proportion of combined-modality treatment [9,10]. This likely reflects the broader HBCR denominator, inclusion of advanced cases, referral after partial treatment elsewhere, patients not receiving treatment at the reporting centre, and incomplete treatment capture.

The study has certain limitations. Being a retrospective hospital-based registry analysis, the findings reflect patients reaching tertiary cancer care and should not be interpreted as population-level incidence. Referral patterns, prior diagnosis or treatment elsewhere, and variable completeness of registry documentation may have influenced the observed morphology, stage and treatment distribution. Some cases were recorded under broad histological categories, and detailed

staging, molecular classification or complete treatment information was not uniformly available. Follow-up data were also limited, restricting meaningful survival analysis. Nevertheless, this study provides a relevant baseline description of the clinicodemographic, morphological, stage and treatment profile of sarcomas from a regional tertiary-care setting where published sarcoma-specific registry data remain limited.

CONCLUSION

This study provides a regionally relevant hospital-based registry profile of sarcomas from a major tertiary cancer centre in Northeast India. The findings help establish a baseline for understanding referred sarcoma burden in the region and underline the need for improved registry completeness, standardised diagnostic classification, and prospective follow-up to support future sarcoma research and service planning.

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