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Original Article

Sarcomatoid carcinoma of the head and neck mucosal region: a clinico-demographical, histopathological, and immunohistochemical investigation with treatment data: a six-year experience from a state cancer institute of gujarat

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Keywords:

Head and Neck;
Immunohistochemistry;
Sarcomatoid carcinoma;

ABSTRACT

Background: Sarcomatoid carcinoma is a rare and aggressive variant of squamous cell carcinoma, accounting for 3% of all squamous cell carcinomas in the head and neck region, characterized by dysplastic surface squamous epithelium and an invasive spindle cell component.

Materials and Methods: The study was conducted over six-years (2017-2022) at the Gujarat Cancer and Research Institute, and a total of 117 cases of sarcomatoid carcinoma in the head and neck region were included, comprising resected specimens, biopsies, and cases reviewed from external institutions.

Results: The median age at presentation was 49 years, with predominance in males (male: female 3.5:1). The most common sites were the buccal mucosa (44.4%), tongue (20.5%), and larynx (10.2%), typically presenting as proliferative or ulceroproliferative lesions with a polypoidal appearance. Immunohistochemistry, performed in 86 cases, revealed immunoreactivity to epithelial markers (EMA, p40, p63, CK5/6, AE1/AE3) in the majority of cases. In the resected specimen, over half of the patients (53.3%) presented with early T-stage disease (T1: 15.6%, T2: 37.8%), and 60% had no lymph node involvement (N0). Various treatment modalities were employed, including primary surgical resection (20.8%), neoadjuvant chemotherapy followed by surgery, and palliative care. The two-year survival rate was 43.8%, with recurrence observed in seven patients and one case of distant metastasis to the lung during the follow-up period.

Conclusion: Sarcomatoid carcinoma of the head and neck is a rare but aggressive variant of squamous cell carcinoma that requires careful histopathological and immunohistochemical evaluation for accurate diagnosis due to its resemblance to other spindle cell tumors. Early-stage detection and timely intervention are crucial for improving patient outcomes. Despite diverse treatment approaches, the prognosis remains guarded, underscoring the need for heightened clinical awareness and further research to optimize management strategies.

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INTRODUCTION

Sarcomatoid carcinoma (SaC) is a rare and aggressive variant of squamous cell carcinoma (SqC), histologically characterized by dysplastic surface squamous epithelium and/or invasive conventional SqC, accompanied by an atypical spindle cell component and/or pleomorphic epithelioid cells.[1] These tumors pose considerable diagnostic challenges due to their histological and immunohistochemical overlap with other spindle cell neoplasms. Accurate diagnosis is essential, as it significantly influences clinical management and patient outcomes.[2-4]

Although SaC is a subtype of SqC, it exhibits distinct pathological and clinical behavior. It has been described in the literature under various terms, including carcinosarcoma, pseudosarcoma, spindle cell carcinoma, and SqC with pseudosarcomatous transformation.[3] SaC predominantly arises in the head and neck region, most frequently affecting the larynx. It is believed to result from epithelial-mesenchymal transition (EMT), contributing to its biphasic histological appearance, comprising both malignant squamous epithelial components and a neoplastic spindle cell population. Clinically, SaC often presents as a rapidly enlarging polypoidal or bulky mass, and it is associated with a worse prognosis compared to conventional SqC at similar clinical stages.[5-8]

SaC can affect a wide age range but most commonly occurs in the seventh decade of life, with a strong male predilection.[9] While tobacco and alcohol remain well-established risk factors for head and neck cancers, the role of human papillomavirus (HPV) has gained prominence in recent years, particularly in oropharyngeal squamous cell carcinoma.[10] Lesions are often exophytic or polypoidal, though endophytic or nodular forms may also be encountered. Histologically, SaC displays a biphasic architecture with dysplastic or invasive squamous epithelium and a spindle cell component representing a neoplastic epithelial-derived population with mesenchymal-like features. This morphologic overlap with true sarcomas complicates diagnosis.[9,11]

In the head and neck region, SaC typically presents as fleshy polypoidal masses, with the larynx being the most frequently affected site, followed by the oral cavity and hypopharynx.[3,12,13] It can also occur in other upper aerodigestive tract sites such as the paranasal sinuses and oropharynx. Patients often present with a short history and an aggressive disease course.[14,15]

The SaC is notably aggressive, with higher rates of local recurrence (52%-73%) and distant metastasis (up to 33%), contributing to a higher overall mortality compared to conventional SqC, with reported 5-year survival rates as low as 16%. Initially misdiagnosed in a significant number of cases due to diagnostic challenges, SaC accounts for approximately 1% to 4% of SqC cases.[16,17]

This retrospective study aims to evaluate the demographical, clinicopathological, histomorphological, and immunohistochemical characteristics of sarcomatoid carcinoma in head and neck mucosal sites, along with their treatment modalities and follow-up outcomes.

MATERIALS AND METHODS

Data Source: This retrospective analysis was conducted at the Department of OncoPathology, Gujarat Cancer and Research Institute (GCRI), a state cancer center in Gujarat, India. The study encompasses all cases with a histopathological diagnosis of sarcomatoid squamous carcinomas of the head and neck region treated in the Department of Head and Neck Surgical Oncology from January 1, 2017, to December 31, 2022, with a follow-up study up to July 2024. The anatomical sites involved included buccal mucosa, maxilla, tongue, pharynx, lip, palate, and larynx. This tertiary referral center manages a substantial burden of head and neck cancers within the region.

Inclusion Criteria and Exclusion Criteria: Patients were included in the study if they had a microscopically confirmed primary diagnosis of head and neck sarcomatoid carcinoma (SaC) as per World health organization classification of head and neck tumors - 5th edition, while those exhibiting sarcomatoid transformation from previously diagnosed squamous cell carcinoma were excluded. The primary sites considered were confined to the head and neck region, specifically the oral cavity, pharynx and larynx.

Study Variables: Baseline variables assessed included age, sex, history of addiction, HPV status (by p16 IHC),American Joint Committee on Cancer (AJCC) stage (T stage, N stage), and treatments such as radiation therapy (RT), postoperative radiotherapy (PORT), chemotherapy, and surgery. The N stage was categorized into NX, N0, and N1–3 (N1, N2, and N3). The primary endpoint was Disease-Free Survival (DFS), defined as the duration from treatment initiation to the first recurrence or death.

Case Selection and Diagnosis: Of the 155 spindle cell tumor cases reported between 2017 and 2022, 117 cases with a confirmed primary diagnosis of sarcomatoid squamous carcinoma were included in the study. The remaining 38 cases were excluded as they were relapsed cases of sarcomatoid carcinoma originating from an initial diagnosis of squamous cell carcinoma. The evaluation comprised 45 resected specimens and 73 biopsies, with an additional 35 cases reviewed externally. Immunohistochemistry (IHC) was performed on 86 cases using standard markers to confirm the diagnosis and exclude differential diagnoses. Cases lacking squamous features underwent IHC to differentiate them from other tumors.

Immunohistochemistry (IHC): IHC was conducted on representative paraffin blocks using the Ventana Benchmark XT autoimmunostainer. The panel included markers such as epithelial membrane antigen, cytokeratin (AE1/AE3), p40, p63, vimentin, cytokeratin 5/6 (CK5/6), SMA, desmin, S100 protein, HMB45, and melan A. Appropriate epithelial marker (cytokeratin, p40 etc) and mesenchymal marker (vimentin) positivity, along with morphological features, confirmed the diagnosis of sarcomatoid carcinoma. For HPV status, diffuse and block positivity of p16 IHC was done.

Survival analysis and Statistical methods data, treatment histories, and follow-up information were retrieved from the institutional centralized database. Follow-up data ranging from one to twenty-four months were available (mean duration of 13.5 ± 9.8 months), and Disease-free survival

(DFS) was calculated as the interval from treatment initiation or initial diagnosis to the first recurrence or death. Survival curves were generated using the Kaplan–Meier method, and statistical analyses were conducted by an institutional biostatistician employing descriptive methods.

RESULTS

This study included a total of 117 cases of sarcomatoid carcinoma. The age at presentation ranged from 21 to 80 years, with the maximum number of patients in the fourth to sixth decades, and a median age of 49 years (mean 48.5 ± 12.7). (fig.1)

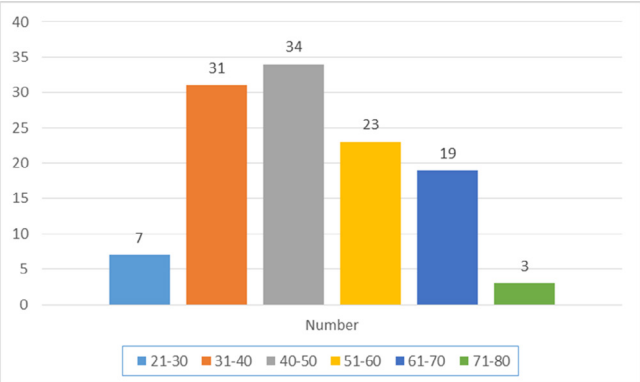

Figure 1: Bar graph showing age range of patients

There were 91 male patients and 26 female patients (male: female ratio was 3.5:1)

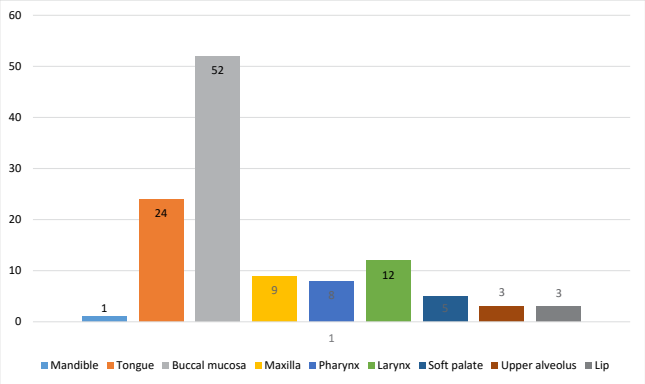

Figure 2: *Bar graph showing case distribution by site of involvement*

The subsite distribution in the oral cavity showed that the most common site involved was buccal mucosa and gingivobuccal sulcus (52/117, 44.4%) followed by tongue (24/117, 20.5%), maxilla (9/117, 7.6%), pharynx (8/117, 6.8%), soft palate (5/117, 4.3%), larynx (12/117,10.2%), lip (3/117, 2.5%), upper alveolus (3/117,2.5%) and mandible (1/117,0.9%). (fig.2)

Predisposing Factors: A history of the presence of a predisposing risk factor was available in 37 patients (37/117, 31.6%), of which 30 patients had a history of chewing tobacco, and 7 patients had a history of smoking (bidi and cigarette). One patient had a prior history of radiation exposure, and one patient in pharyngeal carcinoma had diffuse and block positive p16, which most likely represents HPV infectivity.

Clinical Presentation: The most common presentation was proliferative or ulceroproliferative lesions in the buccal mucosa and also in other sites like the tongue, maxilla, pharynx, or larynx. Patients had symptoms of lump, ulcer, palpable neck swelling, throat pain, dysphagia, bleeding or hoarseness of voice for duration depending on the site of the lesion for duration of minimum of 1 month to 3 years.

Gross: The size of the tumor ranged from 1 to 12 cm in size and growth was described as proliferative or ulceroproliferative tumor with a polypoidal configuration. (fig.3)

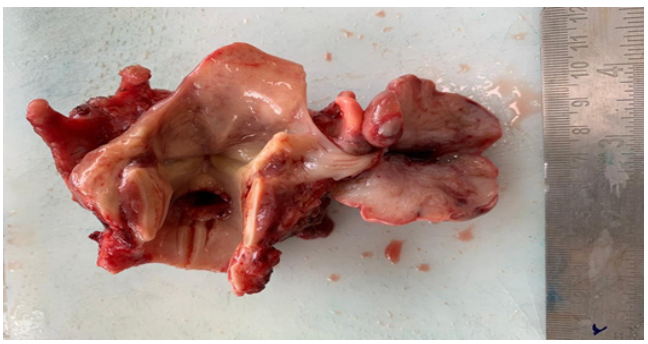

Figure 3: *Gross image showing smooth polypoidal growth in right pyriform fossa (arrow).*

Microscopy: The majority of tumors- 95/117 (81.2%) had a polypoid configuration on biopsy. The tumor was seen to invade the underlying bone in 13/45 cases (28.9%) where surgical excision was done.

The sarcomatoid component of the tumor was arranged in various patterns mimicking mesenchymal malignancies both by light microscopy as well as on IHC. Tumor cells were seen arranged in fascicles in inflammation and granulation tissue. (fig.4)

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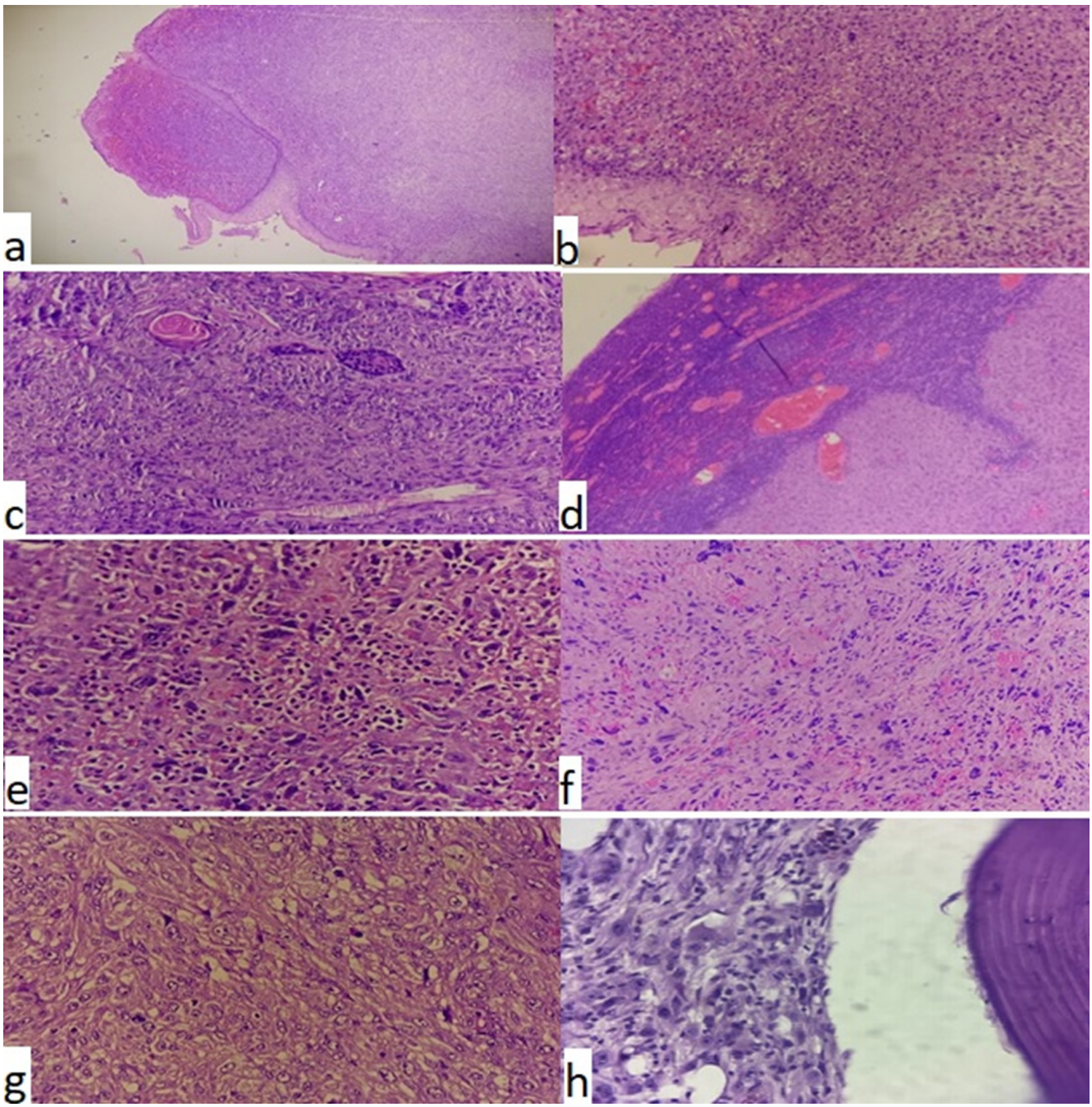

Figure 4: *Photomicrograph showing a) Ulcerated polypoidal lesion (40X); b) Polypoidal lesion with squamous epithelium merging into underlying spindle component (200X); c) Frank squamous differentiation seen in-between spindle cell component (200X); d) Lymph node metastasis in a known case of sarcomatoid carcinoma (100x); e) Spindle shaped tumor cells with pleomorphism (100x); f) Bizarre spindle shaped cells in a background of myxoid matrix (40x); g) Pleomorphic cells with increased mitosis (400x); h) Pleomorphic cells within bone (400x). [H&E]*

In 31 cases, squamous differentiation was present on morphology. Mitotic count of more than 10/10 high-power fields was noted in 90/117 (93.2%) cases.

Immunohistochemistry was performed in 86/117 (73.5%) of the cases. The remaining 31 cases had the presence of an epithelial component and hence, IHC was not considered essential for diagnosis. At least one of the epithelial markers (EMA, p40, p63, CK5/6, AE1/AE3) was positive. The percentage and intensity of staining in tumor cells that were positive for epithelial markers varied widely; in some cases, the cells showed diffuse and intense positivity, and in some cases, the staining was weak and focal. Vimentin expression was seen in 81/86 (94%). (fig.5) Of the eight cases of sarcomatoid carcinoma of pharyngeal origin, only one exhibited diffuse block positivity for p16.

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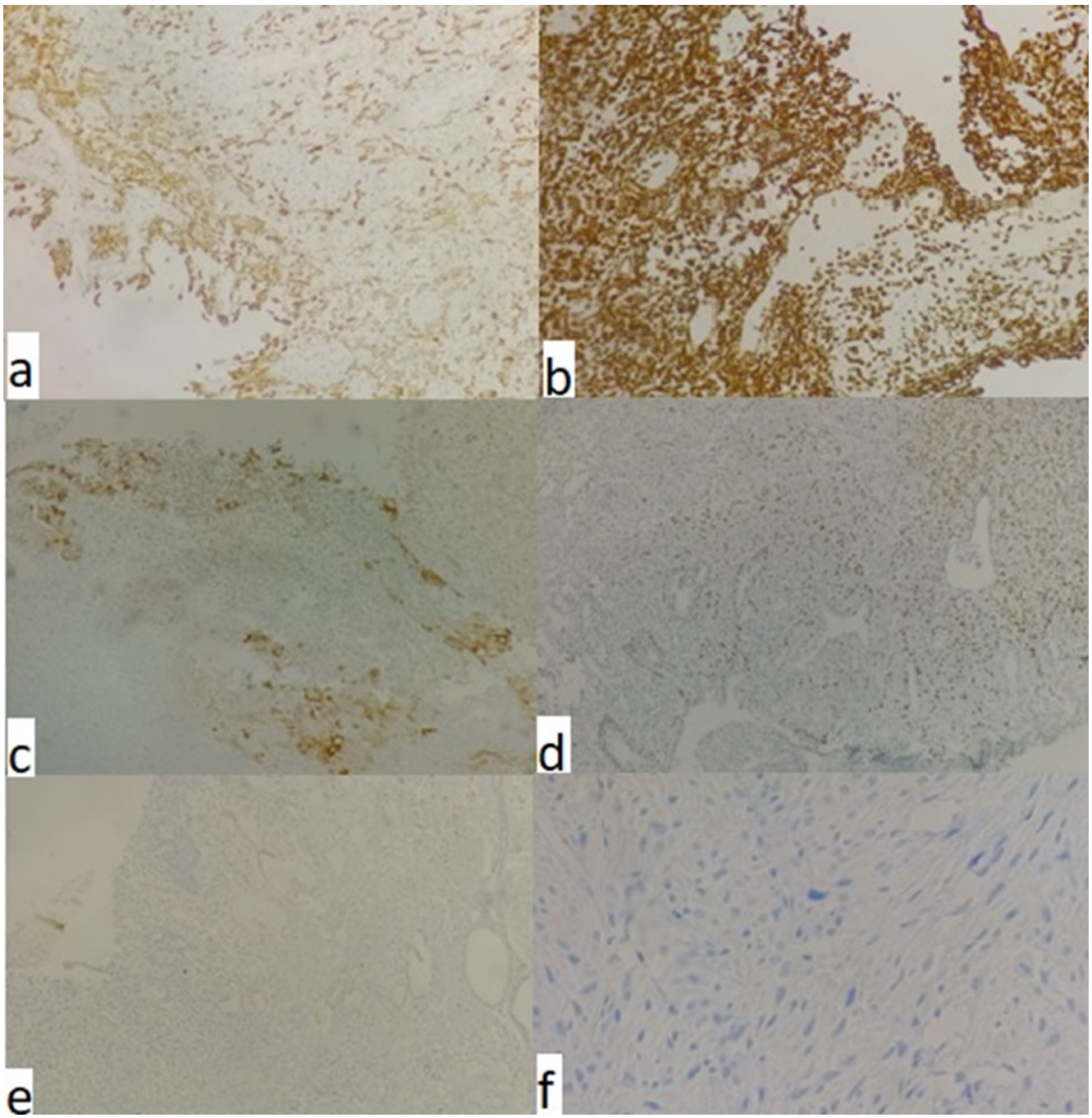

Figure 5: : *Immunohistochemistry: a)Tumor cells show cytokeratin (AE1/AE3) positivity (200X); b) Vimentin shows strong positivity (200X); c) Focal EMA positivity (100X); d)Tumor cells show scattered nuclear P63 positivity (100X); e) Tumor cells immunonegative for S100 (100x) and f) Desmin (400x).*

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Table 1: Summary of Pathological staging and Tumor Pathology of resected specimen and Treatment Modality

Initial T classification (N=45)		Number (%)		
T1		7 (15.6)		
T2		17 (37.8)		
T3		8 (17.8)		
T4		13 (28.9)		
Initial N classification (N=45)		Number (%)		
NX		3 (6.7)		
N0		30 (60)		
N1		3 (6.7)		
N2		4 (8.9)		
N3		5 (11.1)		
Pathological features		Number (%)		
ENE (42)		5 (12)		
LVI (45)		2 (4/4)		
PNI (45)		10 (22.2)		
Treatment modalities		Number (%)		
Treatment Intent (117)	Curative	77 (65.6)		
	Palliative	40 (34.4)		
Curative treatment (77)	Surgery	16 (20.8)	N0-11	T1-2
			N1-1	T2-4
			N2-1	T3-3
			N3-1	T4-7
	Surgery with non-surgical (radiation/ chemoradiotherapy)	29 (37.7)	N0-19	T1-5
			N1-2	T2-13
			N2-3	T3-5
			N3-4	T4-6
	Non-surgical (radiation/ chemoradiotherapy)	32 (41.5)		

In surgical resection specimen, approximately half of the patients-24/45(53.3%) presented with early T-stage disease [7/45 (15.6%) - T1, 17/45(37.8%) - T2], while the remaining patients presented with late-stage disease [8/45(17.8%) - T3, 13/45(28.9%)- T4]. Over half-[30/45cases (60%)] exhibited no lymph node metastasis (N0), whereas 3 (6.7%), 4 (8.9%) and 5 (11.1%) presented with N1, N2 and N3 diseases respectively (as per American Joint Committee on Cancer (AJCC) 8th edition staging criteria). Extra-nodal lymph node extension (ENE) was observed in 5 cases out of 42 modified neck dissection specimens (12%). Lymphovascular invasion (LVI) was present in 2/45 patients (4.4%), and perineural invasion (PNI) was noted in 10/45 patients (22.2%). For treatment, 16/77 (20.8%) patients underwent primary surgical resection, 32/77 (41.5%) received primary non-surgical therapy, and 29/77 (37.7%) underwent multimodality therapy due to high-risk pathological features (such as LVSI, PNI, ENE, or positive surgical margins). Palliative care was provided to 40 patients due to the advanced stage at presentation (Table 1).

Although no significant differences in survival were observed in relation to tumor stage, neck lymph node stage, lymphovascular invasion, or treatment modality (all $p > 0.05$) in patients treated with curative intent, however, Kaplan-Meier survival analysis indicated that shorter survival was associated with female patients, tumors in the upper alveolus or maxilla, presence of perineural invasion, higher nodal stage and for nonsurgical treatment (Table 2 and fig.6).

During the follow-up period, with a mean duration of 13.5 ± 9.8 months (range 1 - 24 months), 51/117 patients (43.6%) remained alive, comprising 41 males and 10 females. Among these, 7/51 patients (13.72%) experienced local recurrence, and one patient developed distant metastasis to the lung five months post-treatment initiation.

Table 2: Follow up: Survival – Kaplenmeier [Time interval 1-24 months]

Survival		Total	Death	Alive [n (%)]	p-value
Over all		117	66	51 (43.6)	-
Gender	Male	91	50	41 (45.1)	0.502
	Female	26	16	10 (38.5)	
Smoking/Addiction	Yes	37	19	18 (48.6)	0.397
	No	79	47	32 (40.5)	
Site	Mandible	1	0	1 (100)	0.537
	Tongue	24	14	10 (41.7)	
	Buccal mucosa	52	31	21 (40.4)	
	Maxilla	9	7	2 (22.2)	
	Pharynx	8	3	5 (62.5)	
	Larynx	12	5	7 (58.3)	
	Soft palate	5	3	2 (40)	
	Upper alveolus	3	2	1 (33.3)	
	Lip	3	1	2 (66.67)	
LVI	Yes	2	2	0	0.155
	No	43	28	15 (34.9)	
	Na	72	36	36 (50)	
PNI	Yes	10	7	3 (30)	0.2
	No	35	23	12 (34.4)	
T-stage	Stage - 1	7	5	2 (28.6)	0.368
	Stage - 2	17	12	5 (29.4)	
	Stage - 3	8	5	3 (37.5)	
	Stage - 4	13	9	4 (30.8)	
N-stage	Nx	3	1	2 (66.7)	0.277
	N0	30	21	9 (30)	
	N1	3	2	1 (33.3)	
	N2	4	3	1 (25)	
	N3	5	4	1 (20)	
Treatment	CT	13	9	4 (30.7)	0.513
	RadiotRTherapy	9	4	5 (55.6)	
	CT + RT	10	7	3 (30)	
	Sx	16	8	8 (50)	
	Sx + CT + RT	29	19	10 (34.5)	

LVI: Lymphovascular invasion; PNI: Perineural invasion; CT: Chemotherapy; RT: Radiotherapy; Sx: Surgery

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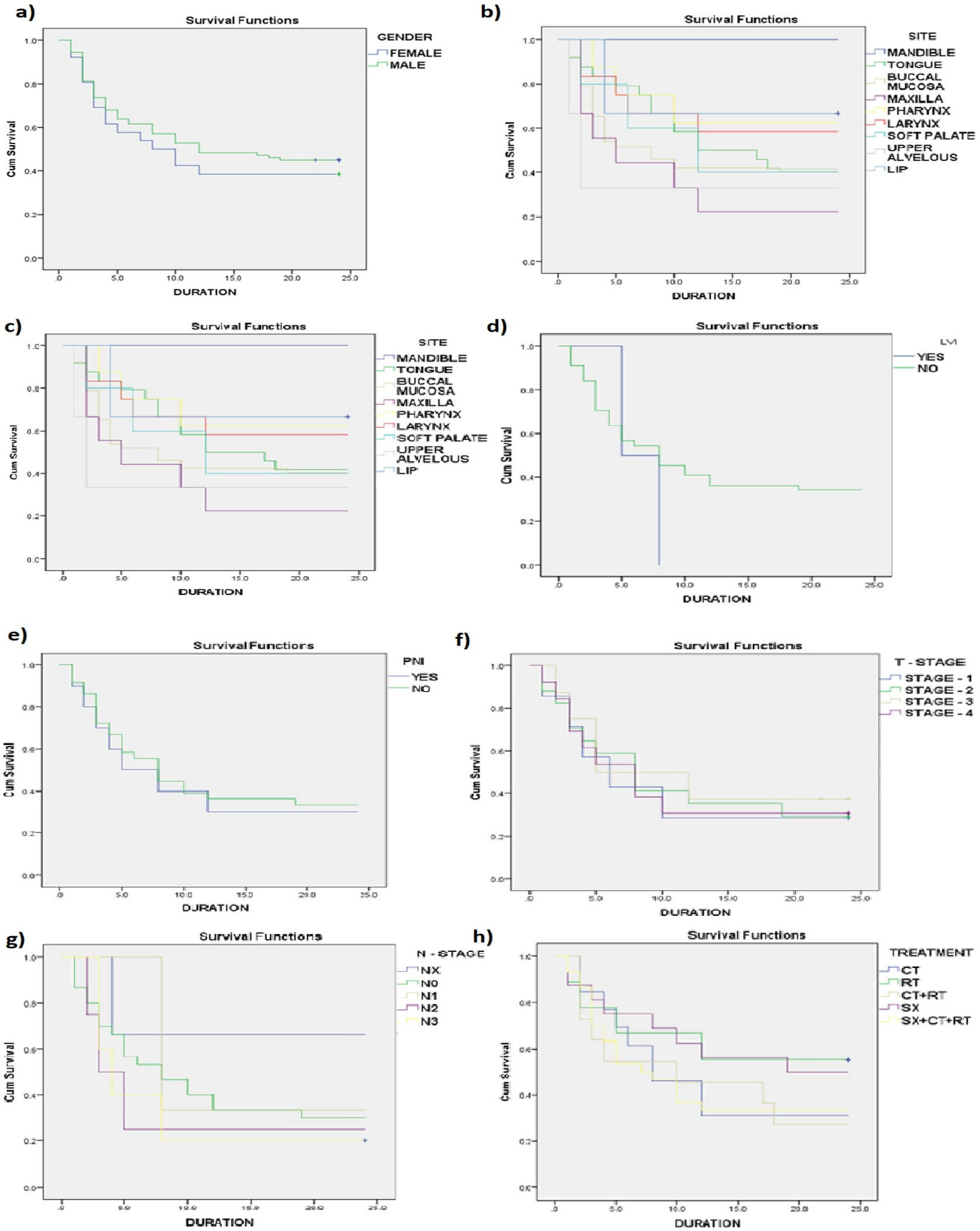

Figure 6: *Kaplan -Meier survival function graph showing relation to a) Gender; b) Smoking; c) Site; d) LVI; e) PNI; f) T-stage; g) N-Stage; h) Treatment*

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DISCUSSION

Sarcomatoid carcinoma (SaC) is a rare subtype of squamous cell carcinoma characterized by a dysplastic surface squamous lining along with an invasive spindle cell component.[1] Various terminologies have been proposed for its histogenesis. Krompecher introduced the term "sarcomatoid carcinoma" to describe a tumor of epithelial origin that undergoes "dedifferentiation" to a spindle cell form.[9,18] According to the WHO 5th edition, spindle cell squamous cell carcinoma is the preferred term, while spindle cell carcinoma and sarcomatoid carcinoma are also accepted terminologies.[19]

Sarcomatoid carcinoma comprises less than 1% of all tumors of the oral cavity, with age distribution ranging from the second to ninth decade and a male predilection.[3,18,20] In a study by Vishwanathan et al., the most common site for sarcomatoid carcinoma was the oral cavity (63.1%), followed by the larynx (17.5%).[20]

In our study of 117 cases, the majority occurred in the buccal mucosa [52/117 (44.4%)], followed by the tongue [24/117 (20.5%)] and larynx [12/117 (10.2%)], with a mean age at occurrence of 48.5 ± 12.7 years (range 21-78 years). This finding is consistent with other reports in the literature, which suggest maximum occurrence between the fifth and seventh decades of life, with a male predominance.[3,20-22] The male-to-female ratio in our study was 3.5:1.

Tobacco use (both chewed and smoked forms) and excessive alcohol intake are among the strongest carcinogenic agents for the development of squamous carcinoma, including sarcomatoid carcinoma.[3,20-22] This can be attributed to the habit of chewing tobacco, which is more common in our region compared to other forms of tobacco use, like smoking.[21] A history of substance abuse in the form of chewing tobacco or smoking was present in 37/117(31.6%) of cases. One patient had a history of radiation exposure due to cervical cancer, which could be an etiological agent for developing sarcomatoid carcinoma. Human papillomavirus (HPV) is a well-established risk factor for oropharyngeal squamous cell carcinoma; however, its association with sarcomatoid carcinomas of non-oropharyngeal head and neck sites is limited or absent.[10,23] In our study, only one case of pharyngeal primary showed p16 block positivity.

These variants commonly present as polypoidal fleshy tumors with rapid onset and fast progression.[4]Sarcomatoid carcinomas tend to have a more aggressive clinical course and higher mortality rates compared to other variants of squamous cell carcinoma at a similar stage.[24,25] In our study, the majority of lesions (81.2%) presented as polypoidal, fleshy, and ulcerated masses, with 46.7% of patients presenting in stage T3/T4.

It has been hypothesized that epithelial cells undergo progressive phenotypic changes, acquiring mesenchymal differentiation to a spindle shape, with loss of cellular polarity, production of mesenchymal matrix components, and gaining vimentin while losing keratin expression. This is supported by light microscopic, immunohistochemical, and ultrastructural studies.[4,20,26] Of the 117 cases, 86 underwent immunohistochemical analysis. Although no aberrant metaplastic elements were observed in any of our cases, we did see the expression of vimentin, SMA, desmin, and S100 protein, which is well reported in the literature.[4] While diffuse and strong positivity for vimentin was seen in 81/86 cases (94%), SMA, desmin, and S100 protein were weak, faint, and patchy, helping rule out leiomyosarcoma (which shows strong SMA/ desmin positivity) or melanoma, and malignant peripheral nerve sheath tumor (both of which show strong S100 positivity).[20]

In 31 cases, squamous differentiation was present morphologically. In the remaining 86 cases (73.5%), immunohistochemistry was performed to detect epithelial components (AE1/AE3, EMA, P40, CK5/6) and mesenchymal components (vimentin, SMA, desmin, S100). Negative or patchy faint positivity for other markers helped diagnose and exclude other differentials or mimickers of SaC. Thus, although immunopositivity can help, a negative result does not rule out the diagnosis of sarcomatoid carcinoma.[20]

Overall, lymph node metastasis is typically uncommon in sarcomatoid carcinoma of the head and neck; however, the incidence of cervical nodal metastasis reported varies widely, between 7.5% and 26%.[4,27,28] Gamez et al. reported that positive neck disease represented only 5% of cases of sarcomatoid carcinoma of the larynx.[29] In the current study, of the 117 patients, nodal status was available in 45 cases, and 12/45(26.7%) had cervical lymph node metastasis, while 5/45(11.1%) cases had extranodal extension.

The most appropriate treatment plan depends on the tumor's site. For the sarcomatoid variant of SqC occurring in the oral cavity, surgery followed by adjuvant therapy based on histopathological findings is the mainstay of treatment.[30] Concurrent chemo-radiation can be considered for advanced laryngeal and hypopharyngeal sarcomatoid variants of SqC.[4] However, it was later shown that using radiation therapy alone in T1-T2 glottic sarcomatoid SqC can produce acceptable locoregional control rates.[31] Even with aggressive treatment regimens, the recurrence rates and prognosis are dismal for this subset of tumors, as well as the overall survival and disease-specific survival, which are much lower than conventional SqC.[32]

Of the 117 patients, 77 received active curative treatment: 16/77 (20.8%) underwent primary surgery, 32/77 (41.5%) received non-surgical therapy, and 29/77 (37.7%) received neoadjuvant or adjuvant multimodality therapy. The remaining 40/117 (34.1%) patients received only palliative care due to advanced stage at diagnosis.

Patients who received different treatment regimens may not

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be directly comparable due to differences in baseline disease stage, comorbidities or overall health status. The variability in the duration of symptoms before diagnoses or over six-years period during treatment may influence staging and survival independent of treatment or tumor characteristics.

The prognosis for patients with SaC of the head and neck is typically dismal. Berthelet et al. described a median survival time of 32 months.[14] In our observation, the overall two-year survival rate was 43.8%. We found that female patients, upper alveolar carcinoma, perineural invasion, N2/N3 stage, and treatment based only on chemotherapy had the worst survival rates, although these were not statistically significant. The effectiveness of radiotherapy and chemotherapy for increasing local-regional and distant control in SqC of the head and neck is widely accepted, but there is little evidence in the literature on the role of such adjuvant treatments for SaC.[13]

This study included only primary cases of sarcomatoid carcinoma. Recurrent squamous cell carcinomas exhibiting spindle cell transformation, which may have different biological behavior, were not included. Moreover, survival analysis was based on a relatively small retrospective cohort of 117 cases, which may limit the generalizability of our findings. The absence of multivariate analysis further restricts the ability to draw robust conclusions regarding prognostic factors.

CONCLUSIONS

Sarcomatoid carcinoma (SaC) is a rare but aggressive variant of squamous cell carcinoma with distinct clinicopathological features. This study, based on primary cases, highlights a predominance in middle-aged males, frequent buccal mucosa involvement, and a strong association with tobacco use. The relatively high rate of cervical nodal metastasis and significant number of patients requiring palliative care underscore the aggressive nature and late presentation of SaC in our setting. The novelty of this study lies in its large cohort of exclusively primary SaC cases with detailed immunohistochemical analysis and treatment outcomes from a South Asian population, contributing meaningful data to the limited existing literature.

REFERENCE

1. Neville BW, Damn DD, Allen CM, Bouquot JE. Oral and Maxillofacial Pathology. 2nd ed. Philadelphia, WB Saunders; 2002.541-93.
2. Anderson CE, Al-Nafussi A. Spindle cell lesions of the head and neck: an overview and diagnostic approach. Diagn Histopathol. 2009;15(5):264-72.DOI:Crossref
3. Thompson LD. Squamous cell carcinoma variants of the head and neck. Curr Diagn Pathol. 2003;9(6):384-96.DOI:Crossref
4. Thompson LD, Wieneke JA, Miettinen M, Heffner DK. Spindle cell (sarcomatoid) carcinomas of the larynx: a clinicopathologic study of 187 cases. Am J Surg Pathol. 2002 ;26(2):153-70.DOI:Crossref
5. Kim JH, Moon WS, Kang MJ, Park MJ, Lee DG. Sarcomatoid carcinoma of the colon: a case report. *J Korean Med Sci*. 2001;16(5):657.DOI:Crossref
6. Batsakis JG, Suarez P. Sarcomatoid carcinomas of the upper aerodigestive tracts. Adv Anat Pathol. 2000;7(5):282-93.DOI:Crossref
7. Batsakis JG, Rice DH, Howard DR. The pathology of head and neck tumors: spindle cell lesions (sarcomatoid carcinomas, nodular fasciitis, and fibrosarcoma) of the aerodigestive tracts, Part 14. Head & neck surgery. 1982;4(6):499-513.DOI:Crossref
8. Tulunay Ö, Küçük B, Yorulmaz İ, Tulunay EÖ, Sanatípour M, Ayva Ş. Sarcomatoid carcinoma of the larynx: immunohistochemical analysis in two cases. *Otolaryngol Head Neck Surg*. 2006;134(6):1057-9. DOI:Crossref
9. Kwon GY, Choi YJ, Song MS, Yun KI. Sarcomatoid carcinoma of the mandible: report of a case. J Korean Assoc Oral Maxillofac Surg.2010;36(3):228-30.DOI:Crossref
10. Sabatini ME, Chiocca S. Human papillomavirus as a driver of head and neck cancers. Br. J. Cancer. 2020 Feb 4;122(3):306-14.DOI: Crossref
11. Mahajan A, Mohanty S, Ghosh S, Urs AB, Khurana N, Gupta S. Sarcomatoid carcinoma of the oral cavity: a diagnostic dilemma. Case Rep Dent. 2017;2017(1):7495695.DOI:Crossref
12. Takata T, Ito H, Ogawa I, Miyauchi M, Ijuhin N, Nikai H. Spindle cell squamous carcinoma of the oral region: an immunohistochemical and ultrastructural study on the histogenesis and differential diagnosis with a clinicopathological analysis of six cases. Virchows Archiv A. 1991;419(3):177-82.DOI:Crossref
13. Dai L, Fang Q, Li P, Liu F, Zhang X. Oncologic outcomes of patients with sarcomatoid carcinoma of the hypopharynx. Front. Oncol. 2019;9:950.DOI:Crossref
14. Berthelet E, Shenouda G, Black MJ, Picariello M, Rochon L. Sarcomatoid carcinoma of the head and neck. Am. J. Surg. 1994;168(5):455-8. DOI:Crossref
15. Chakraborthy A, Thiagarajan S, Bal M, Chaukar D. Clinical presentation and pattern of care for sarcomatoid variant of squamous cell carcinoma of the head-and-neck region: A retrospective study. *Cancer Res Stat* Treat. 2021;4(3):466-71.DOI: Crossref
16. Mingo KM, Derakhshan A, Abdullah N, et al. Characteristics and Outcomes in Head and Neck Sarcomatoid Squamous Cell Carcinoma: The Cleveland Clinic Experience. Ann Otol Rhinol Laryngol. 2021;130(7):818-24. DOI: Crossref
17. Chang NJ, Kao DS, Lee LY, et al. Sarcomatoid carcinoma in head and neck: a review of 30 years of experience--clinical outcomes and reconstructive results. Ann Plast Surg. 2013;71 Suppl 1:S1-S7.DOI: Crossref
18. Prakash N, Kumar MH, Sharada P, Pradeep GL. Spindle cell carcinoma of the oral cavity: a case report of a rare entity and review of literature. World Journal of Dentistry. 2011;1(1):55-8. DOI: Crossref
19. World Health Organization, International Agency for Research on Cancer. Spindle cell squamous cell carcinoma. In: WHO Classification of Tumours Editorial Board. WHO classification of head and neck tumours. 5th ed. Lyon (France): International Agency for Research on Cancer; 2023. Available from:Website
20. Viswanathan S, Rahman K, Pallavi S, et al. Sarcomatoid (spindle cell) carcinoma of the head and neck mucosal region: a clinicopathologic review of 103 cases from a tertiary referral cancer centre. Head Neck Pathol. 2010;4(4):265-75. DOI: Crossref
21. Mohanti BK, Nachiappan P, Pandey RM, Sharma A, Bahadur S, Thakar A. Analysis of 2167 head and neck cancer patients' management, treatment compliance and outcomes from a regional cancer centre, Delhi, India. J Laryngol Otol. 2007;121(1):49-56. DOI: Crossref
22. Walvekar RR, Chaukar DA, Deshpande MS, et al. Verrucous carcinoma of the oral cavity: a clinical and pathological study of 101

cases. Oral Oncol. 2009;45(1):47–51. DOI: Crossref

23. Shaker N, Mansoori P, Fattah YH, et al. P16 and HPV status in head and neck sarcomas and sarcomatoid carcinomas. Ann DiagnPathol. 2024;71:152307. DOI: Crossref
24. Vazquez A, Khan MN, Blake DM, Patel TD, Baredes S, Eloy JA. Sinonasal squamous cell carcinoma and the prognostic implications of its histologic variants: a population-based study. Int Forum Allergy Rhinol. 2015;5(1):85-91. DOI: Crossref
25. Benninger MS, Kraus D, Sebek B, Tucker HM, Lavertu P. Head and neck spindle cell carcinoma: an evaluation of current management. Cleve Clin J Med. 1992;59(5):479-82. Available from: Website
26. Guarino M. Epithelial-to-mesenchymal change of differentiation. From embryogenetic mechanism to pathological patterns. HistolHistopathol. 1995;10(1):171-84. PMID: 7756736.
27. Goellner JR, Devine KD, Weiland LH. Pseudosarcoma of the larynx. Am J Clin Pathol. 1973;59(3):312-26. DOI: Crossref
28. Lambert PR, Ward PH, Berci G. Pseudosarcoma of the larynx: a comprehensive analysis. Arch Otolaryngol. 1980;106(11):700-8.DOI: Crossref
29. Gamez ME, Jeans E, Hinni ML, et al. Outcomes and patterns of failure of sarcomatoid carcinoma of the larynx: The Mayo Clinic experience. Laryngoscope. 2018;128(2):373-7. DOI: Crossref
30. Ellis GL, Corio RL. Spindle cell carcinoma of the oral cavity. A clinicopathologic assessment of fifty-nine cases. Oral Surg Oral Med Oral Pathol. 1980;50(6):523-33. DOI: Crossref
31. Ballo MT, Garden AS, El-Naggar AK, et al. Radiation therapy for early stage (T1-T2) sarcomatoid carcinoma of true vocal cords: outcomes and patterns of failure. Laryngoscope. 1998;108(5):760-3. DOI: Crossref
32. Bice TC, Tran V, Merkley MA, et al. Disease-Specific Survival with Spindle Cell Carcinoma of the Head and Neck. Otolaryngol Head Neck Surg. 2015;153(6):973-80. DOI: Crossref