Section: Pathology

Original Research Article

HISTOPATHOLOGICAL ANALYSIS OF OESOPHAGEAL CARCINOMAS AND THEIR PRECURSORS –A STUDY IN TERTIARY CARE CENTER OF SOUTH INDIA

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ABSTRACT

Background: Oesophageal carcinoma is a major health concern worldwide, with a higher incidence in males and variable anatomical and histological patterns. Understanding the histopathology and distribution of these cancers and their precursors is crucial for early detection and management. **Objectives:** To determine the frequency of oesophageal carcinomas over two years, analyse the age- and sex-wise distribution of different histological variants, and evaluate the anatomical distribution of carcinomas and precursor lesions. **Materials and Methods:** In this retrospective study, 136 specimens, including endoscopic biopsies of the oesophagus and oesophagectomy samples, were retrieved from the archives over a two – year period. Clinical details were obtained from requisition form and case records. Histopathology slides and paraffin blocks were retrieved from the departmental archives. Where necessary, fresh sections were cut and stained with hematoxylin and eosin and special stains. **Result:** Among the 136 patients, 101 (74.26%) were male and 35 (25.74%) were female, with a peak incidence over 60 years in males and 36–40 years in females. Of 130 analysed biopsies, 120 (92%) were carcinoma, 3 (2%) carcinomas in situ, 4 (3%) HSIL, 2 (2%) LSIL, and 1 (1%) Barrett's oesophagus. Tumours were located in the upper third (10 cases, 7.7%), middle third (58, 44.6%), lower third (53, 40.8%), and OG junction (9, 6.9%). Squamous cell carcinoma was most common in the middle third (54 cases), and adenocarcinoma was most common in the lower third and OG junction. Most SCC were moderately differentiated (85.71%), while adenocarcinomas showed equal distribution between well-and moderately differentiated types (46.15% each). **Conclusion:** Oesophageal carcinoma showed male predominance, middle and lower oesophageal involvement, and moderate differentiation. Although less common, precursor lesions are important for early detection.

INTRODUCTION

Oesophageal carcinoma is a serious global health concern. It is the eighth most common cancer worldwide and accounts for approximately 3.8% of all cancers. It is also the sixth leading cause of cancer-related deaths, accounting for nearly 5.4% of cancer mortality.[1-3] The incidence of this cancer is not the same everywhere and shows regional differences. In India, particularly in the southern region, the disease burden is significant. According to the Chennai cancer registry, oesophageal carcinoma is the third most common cancer among males, forming about 6.5–7.5% of all cancers, and the fifth most common among females, forming about 3.5%.[4] There is a clear sex difference in the occurrence of this cancer. Males are affected three to four times more often than females are. The disease is commonly seen in people between 45 and 55 years of age.[1] In most studies, the middle and lower third of the oesophagus are the sites most often involved.[1,2]

From a histological perspective, two main types of cancer are usually found: squamous cell carcinoma and adenocarcinoma. Squamous cell carcinoma is the

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most common type reported, although the number of adenocarcinoma cases has been increasing in recent years, possibly due to lifestyle changes.[1-3,5,6] Each type has different risk factors. Squamous cell carcinoma is strongly associated with smoking, chewing tobacco, very hot drinks and alcohol consumption. Adenocarcinoma is more often associated with gastroesophageal reflux disease, high fat –low dietary fibre foods, obesity, and Barrett's oesophagus.[1,2,5,7] More than 90% of oesophageal cancers belong to either of these two types.[2,8] Rare forms are also reported, such as basaloid squamous carcinoma, verrucous carcinoma, spindle cell carcinoma, adenosquamous carcinoma, adenoid cystic carcinoma, carcinoid tumour, and malignant melanoma.[7,8] Although uncommon, these rare variants are important to recognise for proper diagnosis and treatment planning.[9]

In addition to cancers, precursor lesions of the oesophagus also have clinical importance. Barrett's oesophagus, which is a metaplastic change in the lining of the lower oesophagus, is the most important precursor of adenocarcinoma.[10] Similarly, long-term irritation of the oesophageal mucosa due to tobacco, alcohol, or chronic inflammation may lead to squamous cell carcinoma.[1,2] Identifying these precursor changes is important as they provide useful information about disease progression and may help in preventive strategies. The present study was conducted at a tertiary care centre in South India to investigate the histopathology of oesophageal carcinomas and their precursor lesions. This study aimed to record the incidence of oesophageal carcinomas over two years, study the age and sex distribution of the histological variants, and analyse the anatomical distribution of carcinomas and precursor lesions in this group of patients.

MATERIALS AND METHODS

In this retrospective study, 136 specimens, including endoscopic biopsies of the oesophagus and oesophagectomy samples, were retrieved from the archives over a two – year period .Clinical details were obtained from requisition form and case records. Histopathology slides and paraffin blocks were retrieved from the departmental archives. Where necessary, fresh sections were cut and stained with hematoxylin and eosin.

Inclusion and exclusion criteria

All endoscopic biopsy and oesophagectomy specimens received from the gastroenterology and surgical departments, showing clinical suspicion of oesophageal lesions, were included. Cases with adequate tissue for examination and clear clinical data were considered, while specimens with insufficient tissue, autolysed samples, or inconclusive histology were excluded.

Methods

Clinical information, such as age, sex, symptoms, site of the lesion (upper, middle, lower oesophagus, or gastroesophageal junction), and endoscopic findings, was collected. Histopathology slides and paraffin blocks were retrieved from the departmental archives. Where necessary, fresh sections were cut and stained with hematoxylin and eosin.

Special stains, such as Alcian blue-PAS staining, highlighted goblet cell metaplasia in Barrett's oesophagus, with goblet cells staining blue for sialomucin and the surrounding cells showing PAS-positive neutral mucin (Figures1 and 2). Tumours were classified according to the WHO guidelines, noting the type, subtype, and grade for each case(Figures1-22) and all analyses were performed using IBM SPSS Statistics v25.0.

RESULTS

Out of 136 patients, 101 were male and 35 were female, giving a male-to-female ratio of 2.89:1. The peak frequencyof squamous cell carcinoma occurred in patients over 60 years of age, whereas females showed an earlier peak at 36–40 years.

Of the 136 specimens, the incidence of site involvement was analysed in 130 cases, excluding biopsies that were negative for malignancy (6 specimens excluded due to negative/insufficient tissue).Among these, 120 (92%) were diagnosed with carcinoma, 3 (2%) with carcinoma in situ, 4 (3%) with high-grade squamous intraepithelial lesions, 2 (2%) with low-grade lesions, and 1 (1%) with Barrett's oesophagus (Figures 1,5,6,7).Regarding location, 10 (7.7%) cases involved the upper third of the oesophagus, 58 (44.61%) the middle third, 53 (40.77%) the lower third, and 9 (6.92%) were at the oesophagogastric junction (OGJ). [Table 1]

Table 1: Distribution of oesophageal lesions and site involvement

Variables		N (%)
Lesion Diagnosed	Carcinoma	120 (92%)
	Carcinoma in situ	3 (2%)
	High-grade squamous intraepithelial lesion (HSIL)	4 (3%)
	Low-grade squamous intraepithelial lesion (LSIL)	2 (2%)
	Barrett's oesophagus	1 (1%)
Site	Upper 1/3rd	10 (7.7%)
	Middle 1/3rd	58 (44.61%)
	Lower 1/3rd	53 (40.77%)
	Oesophago-gastric junction (OGJ)	9 (6.92%)

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The distribution of oesophageal lesions showed that squamous cell carcinoma was most common in the middle third (54 cases), followed by the lower third (39 cases) and upper third (8 cases) (Figures 8-11). The basaloid variant was found in the upper third and OG junction, whereas the spindle cell variant appeared in the middle and lower thirds (Figures 12 and 13).Adenocarcinomas were mainly located in the lower third (five cases) and the OG junction (eight cases), with one case each of adenosquamous and undifferentiated carcinoma in the lower third (Figures 14-20).Carcinoma in situ was evenly distributed across the upper, middle, and lower thirds, whereas Barrett's oesophagus was found in the lower third, and high- and low-grade squamous intraepithelial lesions were present in the middle and lower thirds (Figures 1,4,5-7,20and Table 2). [Table 2]

Table 2: Site-wise distribution of oesophageal lesions

Lesion Type	Upper	Middle	Lower	OGJ
Squamous cell carcinoma	8	54	39	-
Basaloid variant SCC	1	-	-	1
Spindle cell variant SCC	-	1	1	-
Adenocarcinoma	-	-	5	8
Adenosquamous carcinoma	-	-	1	-
Undifferentiated carcinoma	-	-	1	-
Carcinoma in situ	1	1	1	-
Barrett's oesophagus	-	-	1	-
HSIL	-	1	3	-
LSIL	-	1	1	-

Among the 105 squamous cell carcinomas, most were moderately differentiated (G2, 85.71%), with fewer well-differentiated (G1, 10.48%) and poorly differentiated (G3, 3.81%) cases. [Figures4, and 8-11] Of the 13 adenocarcinomas, equal numbers were well and moderately differentiated (46.15% each), and one was poorly differentiated (7.7%). [Figures 14-19and Table 3]

Table 3: Histological grade distribution of oesophageal carcinomas

Carcinoma Type	Well (G1)	Moderate (G2)	Poor (G3)
Squamous cell carcinoma	11 (10.48%)	90 (85.71%)	4 (3.81%)
Adenocarcinoma	6 (46.15%)	6 (46.15%)	1 (7.7%)

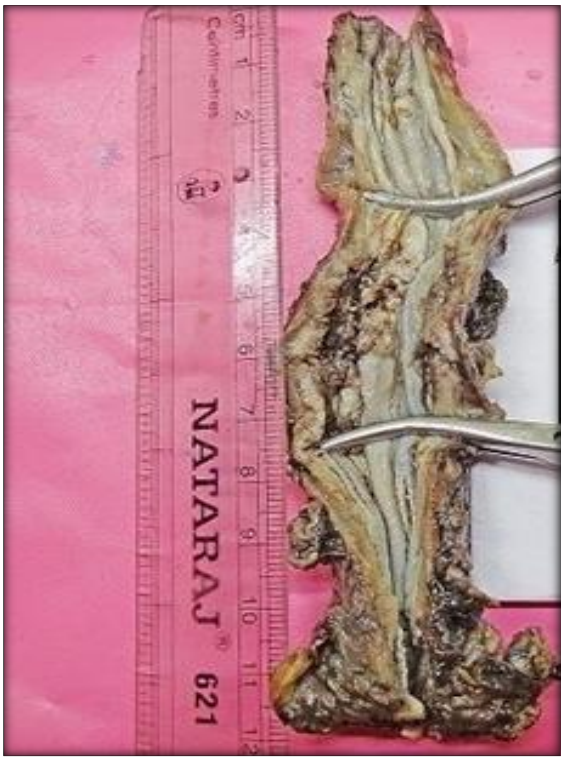

Figure 1: Ulceroproliferative Lesion Measuring 4x3 Cm in The Middle One Third of Oesophagus

Figure 2: Ulceroproliferative lesion in the lower portion of oesophagus measuring 6x5 cm, grossly infiltrating up to the serosa, lesion involves the cardiac end of stomach

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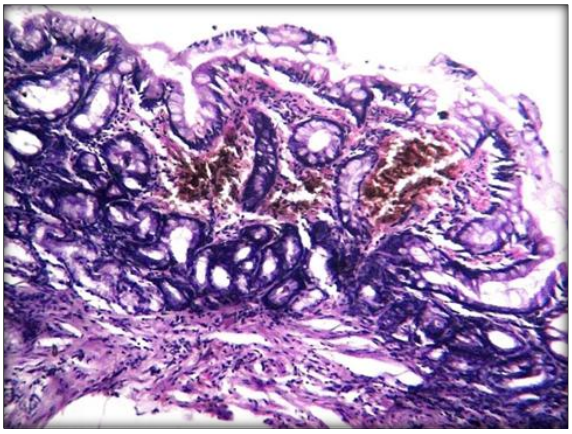

Figure 3: Barrett'soesophagus-Columnar Cell Metaplasia of the Squamous Lining with Numerous Goblet Cells(10X)

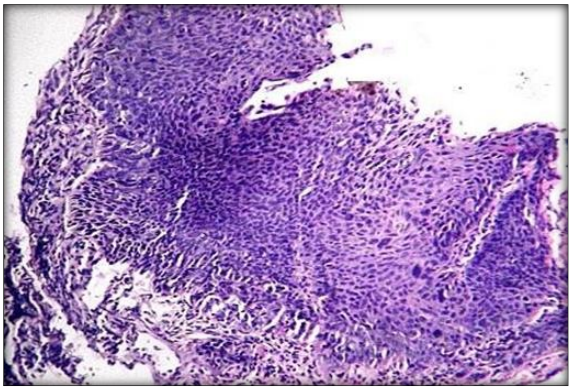

Figure 4: Carcinoma in Situ –Showing Dysplasia in the Entire Thickness of the Epithelium, Limited by the Basement Membrane, no Invasion into the Stroma (10X)

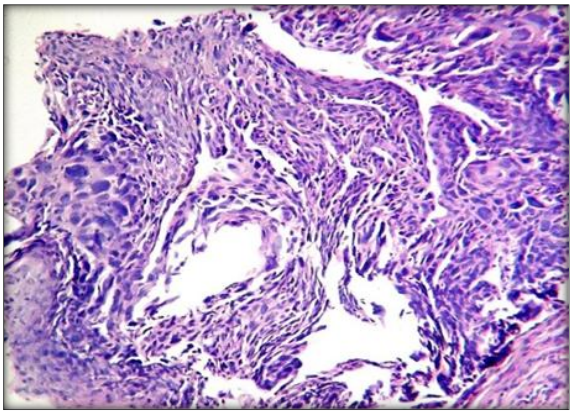

Figure 5: Squamous Cell Carcinoma with Pleomorphic Squamous Cells with Moderate Amount of Eosinophilic Cytoplasm in Sheets Infiltrating the Stroma –G2, Moderately Diffrentiated (10X)

DISCUSSION

This study aimed to analyse the histopathological patterns of oesophageal carcinomas and their precursor lesions, including their anatomical distribution and differentiation, in a tertiary care centre in South India. The present study showed a male majority, with squamous cell carcinoma occurring more often in older men, whereas women developed the disease at a younger age than men. Similarly, Samarasam reported a male-to-female ratio of 3:1, and Ansari and Rai noted a ratio of 1.8:1, with a mean age of 50–52 years.[11,12] The male predominance and age variation reflect known risk factors, including tobacco and alcohol exposure, justifying targeted awareness and screening.

In our study, most oesophageal biopsies showed malignant lesions, whereas a few revealed precursor changes, such as intraepithelial lesions and Barrett's oesophagus. Similarly, Yang et al. reported 43% invasive SCC, 43.8% high-grade intraepithelial neoplasia, and 11.6% low-grade neoplasia.[13] Niu et al. reported in a large study that 116 cases were invasive oesophageal squamous cell carcinoma, 321 were high-grade intraepithelial neoplasia, and 1,874 were low-grade neoplasia, with the remaining showing oesophagitis or normal mucosa.[14] Precursor lesions are less frequent but clinically important for early detection and prevention of progression to invasive carcinoma.

In our study, squamous cell carcinoma mainly involved the middle and lower oesophagus, whereas adenocarcinoma and other rare variants were mostly in the lower third and OG junction, with precursor lesions showing a similar distribution. Similarly, Alema and Iva reported 66 SCC (92.96%), 6 upper, 37 middle, 23 lower, and 5 AC (7.04%), 1 middle, 4 lower; overall, 6 upper, 38 middle, and 27 lower.[15] Cherian et al. found 55% lower/OG junction, 40% middle, 5% upper, and SCC predominating. Sixteen BSC cases were mainly in the middle third.16Jain and Dhingra reported SCC mostly in the middle third, basaloid and spindle-cell variants in specific regions, AC in the lower third and OG junction, and precursor lesions (CIS, HSIL, LSIL) distributed across all thirds.[17] The histological subtype influences the anatomical location, reinforcing the need for site-specific diagnosis and tailored management strategies.

In our study, most squamous cell carcinomas were moderately differentiated, whereas adenocarcinomas showed an almost equal distribution between well- and moderately differentiated types, with only a few poorly differentiated cases. Similarly, in a study of 326cases of oesophageal squamous cell carcinoma, Deng et al. found that 21.5% were well-differentiated, 50.6% were moderately differentiated, and 27.9% were poorly differentiated.[18] In a study of 56 oesophageal adenocarcinomas, Mahmoud et al. found that 60.9% were moderately differentiated, 32.6% were poorly differentiated, and 6.5% were well differentiated, showing a predominance of moderate differentiation.[19] Moderate differentiation predominance suggests intermediate tumour aggressiveness, highlighting the importance of grade assessment in prognosis and treatment planning.

Our study confirmed male predominance, middle and lower oesophageal involvement, and moderate differentiation as key features of oesophageal carcinoma in this population. Although less common,

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precursor lesions are significant for early detection. These findings emphasise the role of histopathology in the diagnosis, site-specific surveillance, and management of oesophageal cancers in South India.

Limitations

This study includes its retrospective design, which may limit control over data quality and completeness; the relatively small sample size, restricting generalisability to the wider population; potential selection bias, as only patients undergoing endoscopy or surgery were included; lack of long-term follow-up to assess survival or recurrence; and limited molecular or immunohistochemical analysis.

CONCLUSION

Our study highlights that oesophageal carcinoma in South India predominantly affects males, with the middle and lower thirds of the oesophagus being the most commonly involved sites of the disease. Squamous cell carcinoma is the most frequent type, while adenocarcinoma and rare variants are mainly found in the lower third of the oesophagus and at the esophagogastric junction. Most squamous cell carcinomas are moderately differentiated, whereas adenocarcinomas are equally distributed between well-and moderately differentiated types. Although less common, precursor lesions are important for early detection and prevention. These findings emphasise the value of histopathological evaluation for the accurate diagnosis, site-specific assessment, and effective management of oesophageal cancers in this region.

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