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# Role of Barium Esophagography and Computed Tomography in the Evaluation of Esophageal Carcinoma

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**Abstract:** ***Background: Carcinoma of esophagus remains one of the most lethal of all cancers. Its late presentation and extramural spread lead to poor long term prognosis. Hence barium esophagography and Computed Tomography help in detecting the lesion at an early stage and pre-treatment staging of the tumour. Aims and Objectives: To correlate CT scan findings with barium esophagography in Carcinoma Esophagus. To compare those studies with histopathology findings. To stage the disease using world wide accepted criteria of TNM staging system. Design: A cross-sectional study using barium esophagography and Computed Tomography in the evaluation of Esophageal Carcinoma. Materials and methods: The study was conducted from October 2014 to October 2016 and included 30 cases who were admitted in Justice K S Hegde Charitable hospital, Deralakatte, Mangalore. Cases presenting with dysphagia and those suspected of having esophageal carcinoma were examined radiologically . Barium swallow study were performed in all cases as an initial mode of investigation. After initial diagnosis by barium swallow study, the diagnosis was confirmed by an endoscopy with biopsy. Computed tomography was then done for pre-therapy staging and management planning. Results: Carcinoma of esophagus was common in age group between 40-60 years with male predominance.The disease presented as filling defect mainly in mid and distal esophagus on barium esophagography and CT provided information about the length and width of the tumour, lymph node involvement and metastatic disease. All the cases were Squamous Cell Carcinomas. Conclusion: Barium esophagography should be routinely used as a screening modality in conjunction with endoscopy and biopsy followed by CECT scan for appropriate staging of the disease.***

**Keywords:** Esophageal Carcinoma, Contrast Enhanced Computed Tomography, Barium Esophagography, TNM staging, Distant metastasis, Lymphadenopathy.

## 1. Introduction

Carcinoma of esophagus remains one of the most lethal of all cancers. It is the eighth most common cancer in the world and sixth most common cause of cancer death1,2. Its late presentation and extramural disease spread lead to poor long term prognosis with a 5 year survival of less than 10%.The American cancer society estimates that 17,900 persons in United States has developed esophageal cancer in 2013 with 15,210 deaths. Squamous cell carcinoma accounted for 95% of esophageal malignancies over the past two decades3. However, there has been a dramatic increase in the incidence of adenocarcinoma arising in columnar lined Barrett's mucosa4-8. In patients squamous cell carcinoma and adeno carcinoma of esophagus have different demographic, pathologic, therapeutic and prognostic features.

The utmost importance of a radiologist lies in detecting the lesion at an early stage by Barium Esophagography and staging the tumour which can be done by Computed Tomography.

In my study of 30 cases of esophageal cancer, an attempt has been made to delineate the pathology by various radiological manifestations in arriving at a diagnosis with importance to pretreatment staging by Computed Tomography.

## 2. Methodology

This study was conducted from October 2014 to October 2016 and included 30 cases who where admitted in Justice K S Hegde Charitable hospital, Deralakatte, Mangalore. Cases presenting with dysphagia and those suspected of having Carcinoma esophagus were examined radiologically. Only those cases which fulfilled both inclusion and exclusion criteria were included in this study. Relevant details of the individual cases were recorded in proforma . All the cases were thoroughly investigated, chest Xray was taken in all cases to rule out any associated diseases. Barium swallow study was done in all cases as priliminary imaging modality. After initial diagnosis by barium swallow study, the diagnosis was confirmed by an Endoscopy with biopsy. The Computed Tomographic scan was then done for pre-therapy staging and management planning.

**Method of Collection of Data**

All these patients presenting with complaints suggestive of esophageal disease underwent the following radiological investigations.

1) Plain x-ray chest PA view.
2) Barium swallow examination.
3) Computed Tomography

Plain x-rays were taken with Skanray 800MA xray machines.

Following inclusion and exclusion criteria were used for selection of cases for the present study.

**Inclusion Criteria**

1) Clinically suspected cases of esophageal carcinoma.

**Exclusion Criteria**

1) Patient who had prior history of allergy to contrast materials.
2) Patient whose histopathology findings are not available for correlation.
3) Patients who are not willing for the study.

## 3. Results

**Age and Sex Distribution**

The following data was collected with relation to the age and sex of the onset of the disease. The youngest patient was of 38 years and the oldest 74 years, showing a disparity of 36 years.

**Table 1:** Age Disribution

| | Frequency | percent |
|---|---|---|
| 50 and below | 6 | 20 |
| 51 - 60 | 12 | 40 |
| 61 - 70 | 7 | 23.3 |
| Above 70 | 5 | 16.7 |
| Total | 30 | 100 |

| | *n* | *minimum* | *Maximum* | *Mean* | *Std. Deviation* |
|---|---|---|---|---|---|
| Age | 30 | 38 | 74 | 57.97 | 10.108 |

**Table 2:** Sex Distribution

| | *Frequency* | *Percent* |
|---|---|---|
| F | 9 | 30 |
| M | 21 | 70 |
| Total | 30 | 100 |

**Table 3:** Site of Lesion

| | *Frequency* | *Percent* |
|---|---|---|
| Distal | 11 | 36.7 |
| Mid | 10 | 33.3 |
| Mid and distal | 4 | 13.3 |
| Proximal | 4 | 13.3 |
| Proximal and mid | 1 | 3.3 |
| Total | 30 | |

**Table 4:** Degree of Wall Thickening

| | *Frequency* | *Percent* |
|---|---|---|
| Below 10 | 7 | 23.3 |
| 10 - 15mm | 18 | 60 |
| Above15mm | 5 | 16.7 |
| Total | 30 | 100 |

**Table 5:** Length of Involvement

| | *Frequency* | *Percent* |
|---|---|---|
| Below 10cm | 20 | 66.7 |
| 10 and above | 10 | 33.3 |
| Total | 30 | 100 |

**Table 6:** Invasion of Adjacent Structures

| *Direct invasion of* | *No. of cases* | *Percentage* |
|---|---|---|
| Pericardium | - | - |
| Tracheo-Bronchial tree | 5 | 16.67 |
| Aorta | 12 | 40 |
| Other structures | 3 | 10 |

**Table 7:** Metastases

| Metastasis | Frequency | Percent |
|---|---|---|
| Liver | 5 | 16.7 |
| Lungs | 8 | 26.7 |
| bones | 1 | 3.3 |
| adrenals | 1 | 3.3 |
| None | 15 | 50 |
| Total | 30 | 100 |

**Table 8:** Lymphadenopathy

| | *Frequency* | |
|---|---|---|
| Nil | 1 | 3.3 |
| Present | 29 | 96.7 |
| Total | 30 | 100 |

**Lymph Node Distribution**

| | *Frequency* | *Percentage* |
|---|---|---|
| Mediastinal | 24 | 80 |
| Celiac axis | 6 | 20 |
| Perigastric | 5 | 16.6 |

**Table 9:** Histopathological Diagnosis

| | No. of cases | Percentage |
|---|---|---|
| Poorly differentiated | 7 | 23.3 |
| Moderately differentiated | 17 | 56.7 |
| Well differentiated | 6 | 20 |

**Table 10:** TNM Group Staging

| *Stage* | *Frequency* | *Percentage* |
|---|---|---|
| II | 1 | 3.3 |
| III | 17 | 57 |
| IV | 12 | 40 |

## 4. Discussion

In this study of 30 patients with clinical features suggestive of esophageal carcinoma were investigated further to establish an accurate diagnosis and staging using barium esophagography and Computerised Tomography.

**Age and Sex**

Thompson et al. in their study of pretherapy staging had patients with age range of 48-77 years(mean 60).Three were women out of the 102 patients. Moss et al. in their CT pretherapy staging study had 41 males and 11 women aged 45-84 years (mean 63.4).

In our study, the age of the patients varied from a minimum of 38 years to a maximum of 74 years with a mean age on 57 years.

In study of 198 cases by Dr.D.Baruah, the peak age incidence is around 40-70 years; the incidence of carcinoma esophagus increasing in frequency with age.

In our study, the number of male patients were 21 and the females were 9 in number. The male to female ratio being 2.3:1
Dr Baruahs study of 198 cases showed a male to female ratio of 3:1.

**Barium Swallow Studies**

In Dr.Baruah‘s studies 28% of his cases occurred in the upper third, 40% in the middle third and 32% were lower third lesions. In a series by Dr.Farooq P. Agha the middle third showed the maximum lesion(45.5%), 36% in the lowest third and 19.5% in the upper third.

Our study reveals most number of lesions in the lower third 37%, followed by mid third showing 33%, the upper third showing 13% and multisegmental in about 17% of cases.

In our study all the cases showed significant filling defect with mucosal irregularity, prestenotic dilatation and shouldering of the esophageal segment involved.

**Histopathological Findings:**
On histopathological examinations, all the cases were of squamous cell carcinoma.

Dr. Robert E. Kohler et al. conducted studies on nine cases and found all of them to be squamous cell carcinomas with no incidence of adenocarcinomas.

Dr. Baruah in his series observed squamous cell carcinoma of 75.8%, adenocarcinoma of 14% and the anaplastic carcinoma of 7.6%.

**Esophageal Wall Thickening:**
In a study of 200 cases CT evaluation for wall thickness was done by Dr. James W. Reining et al. They stated that localised wall thickening of 3 – 5 mm would be stage 1 of the disease. As it becomes larger, it becomes circumferential, and only esophageal wall thickening more than 20 mm is specific for esophageal carcinoma on CT.

Moss et al in their study show that maximum diameter was 0.8-5cm(3.2cm average).

In our study most cases were between 1-1.5 cm in thickness and there are 5 cases of more than 1.5 cm wall thickness.
The minimum thickness in dimension was 0.6 cm and the maximum thickness was 3.2 cm with a mean thickening being 1.2cm +/- 4.9 mm.

**Tumour Size :**
Albert A. Moss et al, in a study for pretherapy staging of esophageal carcinoma found that length of the tumour as judged by CT was 1.0 - 1.4 cm.

Thompson et al, in their study of pretherapy CT staging found that full length values as discordant by as much as 2 - 3 cm in some cases.

In my study, the tumour length at its maximum was 15 cm and at its minimum was 3 cms.

**Tracheobronchial Invasion**
Moss et al in their study of 52 patients found tracheo-bronchial invasion in 24 patients(46%).

Thompson et al . in their study found that tracheo-bronchial invasion in 34 out of 76 patients with esophageal carcinoma(45%).

In my study, 5(17%) out of 30 patients had direct tracheobronchial invasion.

**Aortic Invasion**
Aortic invasion of more than 900 in our study was seen in 12 (40%) out of 30 cases , these tumours being mostly in middle, lower and multisegmental .

Thompson et al., found aortic invasion in 26 of 76 patients studied at a percentage of 34.2.

Moss et al. in 52 patients found direct invasion of aorta in 17(32.6%) patients.

**TNM Staging of Esophageal Carcinoma**

Thompson et al. used TNM classification to stage 76 patients. 6 patients had stage I disease(7.6%), 6 had stage II (7.8%), and 37 with stage III(48.6%) disease.

Moss et al. out of 52 patients studied on CT found that no patient had stage I disease. 7 had stage II(13.4%), 33 with stage III(63.4%) and 12 with stage IV disease(23%).

In our study 17 patients(56.7%) had stage III disease, 12(40%) had stage IV disease and only 1 patient(3.3%) had stage I disease.

**Metastases**

In our study, metastases was seen in 15 out of 30 patients out of which most common was in the lungs which constituted about 26.7%, followed by liver(16.7%).

Two cases also showed metastases into bone and adrenals. There were no cases which showed metastases in the kidneys

Lymphadenopathy was seen in most of the patients, commonly in the mediastinal nodes(80%). 6 out of 30 patients showed lympadenopathy in the celiac nodes.

## 5. Conclusion

Inspite of advances in the diagnostic modalities and therapeutic techniques the survival rate of the patients with carcinoma esophagus for five years continues to be disappointing. The diagnosis of esophageal carcinoma is usually made too late, because the symptoms of early cancers are minor or completely absent, however the prognosis of esophageal cancer primarily depends on the time of detection. Early diagnosis is the only reliable means of treating esophageal carcinoma successfully.

Barium esophagography is routinely the initial examination in the evaluation of a patient with esophageal symptoms as it can assess both morphology and motility. It is the study of choice for characterisation of strictures and can successfully detect malignant disease in most cases.

Contrast-enhanced CT remains as the imaging investigation of choice in preoperative esophageal cancer staging since it is rapid and non invasive modality to evaluate local extension of tumour , to detect lympadenopathy and metastatic disease which is vital in determining resectability and in radiation therapy planning.

In our study of 30 cases, malignancy was detected on barium esophagography in all the cases. All the cases were histologically proven to be squamous cell carcinomas.

The results in my study indicate that Barium esophagography should be routinely used as a screening

modality followed by CT for staging before the surgery or radiation therapy in patients with esophageal carcinoma.

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