ROLE OF SURGERY IN CARCINOMA OESOPHAGUS – CURRENT STATUS

Dissertation Submitted for

MS DEGREE (BRANCH I) GENERAL SURGERY

APRIL 2012

The TamilnaduDr.M.G.R.Medical University

Chennai – 600 032.

MADURAI MEDICAL COLLEGE, MADURAI.

APRIL 2012

CERTIFICATE

This is to certify that this dissertation titled **"ROLE OF SURGERY IN CARCINOMA OESOPHAGUS – CURRENT STATUS "** submitted by **DR.A.JAGADISH SINGH** to the faculty of General Surgery, The TamilNadu Dr. M.G.R. Medical University, Chennai in partial fulfillment of the requirement for the award of MS degree Branch I General Surgery, is a bonafide research work carried out by him under our direct supervision and guidance from August 2009 to August 2011.

Prof.Dr. M.GOBINATH, M.S.,
Professor and Head of the Department,
Department of General Surgery,
Madurai Medical College,
Madurai.

Prof. Dr.D. Soundararajan, M.S.,
Professor & Unit Chief,
Department of General Surgery,
Madurai Medical College,
Madurai.

DECLARATION

I**, DR.A.JAGADISH SINGH** solemnly declare that the dissertation titled **"ROLE OF SURGERY IN CARCINOMA OESOPHAGUS – CURRENT STATUS "**has been prepared by me.This is submitted to **The TamilNadu Dr. M.G.R. Medical University, Chennai,** in partial fulfillment of the regulations for the award of MS degree (Branch I) General Surgery.

Place: Madurai **DR.A.JAGADISH SINGH**

Date:

ACKNOWLEDGEMENT

I wish to express my sincere gratitude to my chief Prof. Dr. D. Soundararajan, M.S., Professor of Operative surgery, Department of General Surgery, Madurai Medical College, Madurai for his excellent guidance in making this study, inspirational and encouragement he rendered at every stage of this study, without which this dissertation would not have been possible.

My sincere thanks to Prof.Dr. M. Gopinath, M.S., Professor and Head of the Department of Surgery, Govt. Rajaji Hospital and Madurai Medical college, for his able guidance in doing this project.

I am greatly indebted to Prof.Dr.A.EDWIN JOE, M.D (FM),B.L., DEAN, Madurai Medical College &Government Rajaji Hospital, Madurai and Prof.Dr.T.SWAMINATHAN, M.S, FICS., MEDICAL SUPERINTENDENT, Government Rajaji Hospital, Madurai for their kind permission to allow me to utilize the clinical material from the hospital.

I thank the former Professor and Head of the Department of Surgical Oncology, Dr. B. K. C. MOHAN PRASAD,M.S.,M.Ch., for providing me the proper guidance in this study.

I thank former Prof. Dr. Muthukumarasamy,D.M.,M.D, Head of the Department of Medical Oncology, Govt. Rajaji Hospital Madurai Medical College,Madurai.

I also thank my Assistant Professors Dr.V.Selvaraj,M.S., Dr. S.Santhi Nirmala,M.S., Dr. K.Saravanan,M.S.,and Dr.P.Muniasamy, M.S., for their valuable guidance.

I also wish to record my deep sense of appreciation and gratitude to the patients who have co-operated with enthusiasm and rendered themselves for this study.

CONTENTS

INTRODUCTION

Oesophageal cancer is unique among the gastrointestinal tract malignancies because it embodies two distinct histopathologic types, squamous cell carcinoma and adenocarcinoma.(Fig. 1). Which type of cancer occurs in a given patient or predominates in a given geographic area depends on many variables, including individual lifestyle, socioeconomic pressures, and environmental factors. The United States, along with many other Western countries, has witnessed in recent decades a profound increase in incidence rates of adenocarcinoma, whereas squamous cell carcinoma continues to predominate worldwide, particularly in India(1,2,3).. Although it would seem appropriate to individualize treatment of these tumors, often they are managed as a single entity(4) . A more thorough understanding of nature and types of surgery and its successes and failures will hopefully spawn a new era of therapy effectively targeting both adenocarcinoma and squamous cell carcinoma of the oesophagus.

EPIDEMIOLOGY

Table. 1 Trends in age-adjusted incidence rates for Oesophageal cancer in India.

ETIOLOGIC FACTORS AND PREDISPOSING CONDITIONS

Squamous cell carcinoma and adenocarcinoma of the oesophagus share some risk factors, whereas other risk factors are specific to one histologic type or the other.

Tobacco and Alcohol Use

Tobacco and alcohol use are considered the major contributing factors in the development of oesophageal cancer worldwide. It is estimated that up to 90% of the risk of squamous cell carcinoma of the oesophagus in India be attributed to tobacco and alcohol use.5 Population-based studies demonstrate that tobacco and alcohol use are independent risk factors and their effects are multiplicative, as evidenced by the association of the highest risk of developing oesophageal cancer with heavy use of both agents. Approximately 65% of squamous cell carcinomas of the oesophagus have been attributed to smoking tobacco for longer than 6 months. Cigarette smoking is also a risk factor in the development of adenocarcinoma of the oesophagus, leading to a twofold increase in risk for heavy smokers (more than one pack per day).7,8 Although the effect is less for adenocarcinoma than for squamous cell carcinoma, quitting smoking does not appear to decrease the risk of adenocarcinoma, which remains elevated for decades after smoking cessation.

The consumption of alcoholic beverages is a major contributing factor in the increased risk of oesophageal squamous cell carcinoma in Western countries. A dose-response relationship exists between the amount of alcohol ingested and the risk of developing squamous cell carcinoma, and the benefit of cessation of drinking alcohol varies in specific geographic areas.9,10 Although specific carcinogens may be present in a variety of alcoholic beverages, in all likelihood it is alcohol itself, either as a mechanical irritant, promoter of dietary deficiency, or contributor to susceptibility to other carcinogens, that leads to carcinogenesis.

Diet and Nutrition

For both squamous cell carcinoma and adenocarcinoma of the oesophagus, case-control studies provide evidence of a protective effect of fruits and vegetables, especially those eaten raw.7,11 These food groups contain a number of micronutrients and dietary components such as vitamins A, C, and E, selenium, carotenoids, and fiber that may prevent carcinogenesis. Deficiencies of the aforementioned nutrients and dietary components have been associated with increased risk of oesophageal squamous cell carcinoma in some parts of the world.

Socioeconomic Status

Low socioeconomic status as defined by income, education, or occupation is associated with increased risk for oesophageal squamous cell carcinoma and, to a lesser degree, for adenocarcinoma.

Obesity

Increased body mass index is a risk factor for adenocarcinoma of the oesophagus, and individuals with the highest body mass index have up to a sevenfold greater risk of oesophageal cancer than those with a low body mass index.7,16,17,18 The mechanism by which obesity contributes to an increased risk of oesophageal adenocarcinoma is uncertain, although the linkage between obesity and gastro-oesophageal reflux disease is presumed to be a chief, but not the sole, factor. Because of the influence of nutritional and socioeconomic factors, the risk of squamous cell carcinoma of the oesophagus increases with decreasing body mass index.

Gastrooesophageal Reflux Disease

Gastrooesophageal reflux disease has been implicated as one of the strongest risk factors for the development of adenocarcinoma of the oesophagus.19,20 Chronic reflux is associated with Barrett's oesophagus, the premalignant precursor of oesophageal adenocarcinoma.

Helicobacter Pylori Infection

Infection with Helicobacter pylori and particularly with cagA+ strains is inversely associated with the risk of adenocarcinoma of the oesophagus.

Barrett's oesophagus

A diagnosis of Barrett's oesophagus confers a 40- to 125-fold higher risk of progressing to oesophageal carcinoma compared with the risk in the general

population and is the single most important risk factor for developing adenocarcinoma.25,26 The absolute risk that any single patient with Barrett's oesophagus will develop adenocarcinoma in a year is approximately 1 in 200 (absolute risk, 0.5% per patient-year).26,27,28,29

Tylosis

Patients with this condition exhibit abnormal maturation of squamous cells and inflammation within the oesophagus and are at extremely high risk of developing oesophageal cancer.

Plummer-Vinson/Paterson-Kelly Syndrome

Approximately 10% of individuals with Plummer-Vinson/Paterson-Kelly syndrome develop hypopharyngeal or oesophageal epidermoid carcinomas. The mechanisms by which these tumors arise have not been fully defined, although nutritional deficiencies as well as chronic mucosal irritation from retained food particles at the level of the webs may contribute to the pathogenesis of these neoplasms.

Caustic Injury

Squamous cell carcinomas may arise in lye strictures, often developing 40 to 50 years after caustic injury. The majority of these cancers are located in the middle third of the oesophagus.

Achalasia

Achalasia is an idiopathic oesophageal motility disorder characterized by increased basal pressure in the lower oesophageal sphincter, incomplete relaxation of this

sphincter after deglutition, and aperistalsis of the body of the oesophagus. A 16- to 30-fold increase in oesophageal cancer risk has been noted in achalasia patients.

Human Papillomavirus Infection

Several studies suggest that human papillomavirus (HPV) infection may contribute to the pathogenesis of oesophageal squamous cell cancers in high-incidence areas in Asia and South Africa. This oncogenic virus, which has been associated with cervical and oropharyngeal cancers, encodes two proteins (E6 and E7) that sequester the Rb and p53 tumor suppressor gene products..

Prior Aerodigestive Tract Malignancy

Carcinomas of the aerodigestive tract arise as a consequence of multistep processes in cancerization fields. Patients with upper aerodigestive tract cancers develop second primary cancers at a rate of approximately 4% per year. Nearly 10% of secondary neoplasms arising in patients with prior histories of oropharyngeal carcinoma arise in the oesophagus. Levi et al. observed that approximately 10% of second primary cancers in patients with prior histories of lung carcinoma arose in the oesophagus. The increased risk of second primary tobacco-related carcinomas warrants close surveillance of patients with histories of aerodigestive tract malignancy.

APPLIED ANATOMY AND HISTOLOGY

Anatomy

The oesophagus bridges three anatomic compartments: the neck, thorax, and abdomen. The oesophagus extends from the cricopharyngeus muscle at the level of the cricoid cartilage to the gastrooesophageal junction(Fig. 2)31. The borders of the cervical oesophagus are the cricopharyngeus to the thoracic inlet (approximately 18 cm from the incisors). The remainder of the oesophagus is commonly divided into thirds, with the upper third extending from the thoracic inlet to the carina (approximately 24 cm from the incisors), the middle third extending from the carina to the inferior pulmonary veins (32 cm from the incisors), and the distal oesophagus traversing the remaining distance into the abdomen to the gastrooesophageal junction (40 cm from the incisors)(Fig. 3). Squamous cell carcinoma of the oesophagus is the predominant histology in the cervical oesophagus and upper and middle thirds of the thoracic oesophagus, whereas adenocarcinoma predominates in the distal oesophagus.

Refer Fig 3. Anatomy of oesophagus

Knowledge of the lymphatic drainage of the oesophagus is critical to understanding how the numerous surgical approaches for oesophageal cancer have evolved and explains why some surgeons recommend a specific procedure based on tumor location in the oesophagus tumors of the cervical and upper third of the thoracic

oesophagus drain to cervical and superior mediastinal lymph nodes. Tumors of the middle third of the oesophagus drain both cephalad and caudad with lymph nodes at risk in the paratracheal, hilar, subcarinal, perioesophageal, and pericardial nodal basins. Lesions in the distal oesophagus primarily drain to lymph nodes in the lower mediastinum and celiac axis region (Fig. 4). Due to the extensive lymphatic network and rich mucosal and submucosal lymphatics within the wall of the oesophagus, skip metastases for upper third lesions have been noted in celiac axis nodal basins, and likewise, cervical lymph node metastases have been noted in as many as 30% of patients with distal oesophageal lesions. This forms the basis for some surgeons' recommendation of a more thorough oncologic procedure, a combined transthoracic and abdominal approach for lesions of the mid- and distal oesophagus,31,32 and for others' recommendation of a three-field (cervical, mediastinal, and abdominal) lymphadenectomy for all tumors of the mid- through distal oesophagus.32,33 However, lymphatic spread correlates with pathologic T category of the primary oesophageal tumor, and lymph node metastases are initially limited in an overwhelming majority of patients to regional lymph nodes. Lymph node involvement in lymphatic basins distant from the primary tumor are rarely identified unless metastases to regional lymph nodes have already occurred. These data challenge the validity of extensive lymphadenectomy and also suggest the potential value of sentinel lymph node sampling to direct surgical dissection.

Refer Fig. 4. Lymphatic drainage of oesophagus

HISTOLOGY

The overwhelming majority of oesophageal malignancies may be classified as either squamous cell carcinomas or adenocarcinomas. Squamous cell carcinomas account for majority of oesophageal malignancies diagnosed in the India(Fig. 5) . Approximately 60% of these neoplasms are located in the middle third of the oesophagus, whereas 30% and 10% arise in the distal third and proximal third of the intrathoracic oesophagus, respectively.32,33 Typically, these tumors are associated with contiguous or noncontiguous carcinoma in situ as well as widespread submucosal lymphatic dissemination.35,36

Refer. Fig. 5 Squamous cell carcinomas showing epithelisation, inter cellular bridges and cytokeratin

Adenocarcinomas frequently arise in the context of Barrett's oesophagus; because of this, these tumors tend to be localized in the distal third of the oesophagus and may be fungating or stenotic in appearance.(Fig 7,9,10,)38,39. The vast majority of the tumors are associated with intestinal metaplasia or dysplasia. No significant survival differences have been noted in adenocarcinoma patients compared with individuals with similarly staged squamous cell cancers.41,42

Refer. Fig. 6. Adenocarcinoma

Several rare cancers of the oesophagus have been described, including squamous cell carcinoma with sarcomatous features, as well as adenoid cystic and

mucoepidermoid carcinomas.[43,44,45,46,47] These neoplasms are indistinguishable clinically and prognostically from the more common types of oesophageal carcinoma.

ORIGIN OF STUDY

In the absence of medical contradications for surgery, resection remains the main stay of treatment for localized oesophageal cancer even upto stage IV A, but overall 5 year survival remains disappointing which is less than 25% , but still this survival rate is superior to other modalities like chemo-radiation. The pros and cons of various surgical procedures like Trans-hiatal oesophagectomy and IVOR-LEWIS operation are discussed in this paper.

REVIEW OF LITERATURE

NATURAL HISTORY AND PATTERNS OF FAILURE

Natural history data and patterns of failure after specific treatment modalities provide insight into the biologic tendencies of oesophageal carcinoma and suggest potential therapeutic avenues to explore. At presentation, the overwhelming majority of patients have locally or regionally advanced or disseminated cancer, irrespective of histologic type. The lack of a serosal envelope and the rich submucosal lymphatic network of the oesophagus provide a favorable milieu for extensive local infiltration by tumor and lymph node involvement. If distant disease is not clinically evident at the time that patients are initially diagnosed with oesophageal carcinoma, evidence suggests that occult micrometastases are invariably present, and recurrence patterns confirm that distant failure is a significant and universally fatal component of relapse. The lung, liver, and bone are the most common sites of distant disease with depth of tumor invasion and lymph node involvement predictive of tumor dissemination.

Refer. Table. 2. Surgery vs surgery and chemotherapy showing increased mortality with increased survival in surgery and chemotherapy receiving patients.

Median survival after esophagectomy for patients with localized disease is 15 to 18 months with a 5-year overall survival rate of 20% to 25%. Patterns of failure after esophagectomy suggest that both location of tumor and histologic type may

influence the distribution of recurrence. In patients with cancers of the upper and middle thirds of the oesophagus, which are predominately squamous cell carcinomas, local-regional recurrence predominates over distant recurrence, whereas in patients with lesions of the lower third, where adenocarcinomas are more frequently located, distant recurrence is more common. Although one of the rationales for a three-field lymph node dissection for oesophageal cancer is evidence of metastases in up to 30% of cervical lymph nodes, only a very small percentage of patients (fewer than 5%) develop clinically evident recurrence at cervical sites.

Refer. Table. 3. Surgery vs surgery and radiotherapy showing better survival and less mortality in surgery alone patients.

The addition of chemotherapy, radiotherapy, or chemoradiotherapy to surgery may alter patterns of failure, although reported results are not consistent. Preoperative radiotherapy and preoperative chemoradiotherapy may reduce the rate of local-regional recurrence but has no obvious effect on the rate of distant metastases. In two prospective randomized trials of preoperative chemotherapy plus surgery versus surgery alone, one study showed a slight but non statistically significant decrease in distant relapse with chemotherapy (Table.2), whereas the other demonstrated equivalent distant recurrence rates in both the preoperative chemotherapy and surgery-alone arms. Similarly addition of preoperative radiotherapy is also of not much advocated in many trials.(Table.3) Treatment

failure patterns after definitive chemoradiotherapy without surgical resection reveal that concurrent administration of chemotherapy and radiotherapy provides better local control than radiotherapy alone but that distant recurrence was not significantly affected and was the major contributor to death.(Table 9.) Although the addition of surgery further reduces local failure from 45% to 32%. These patterns of relapse suggest that any further improvement in overall outcome for patients with oesophageal cancer will be achieved through advances in surgical techniques.

CLINICAL PRESENTATION

The symptoms most commonly associated with oesophageal cancer are dysphagia and weight loss. Unfortunately, in most instances dysphagia signifies locally advanced disease or distant metastases or both. At presentation, patients usually describe progressive dysphagia, with difficulty initially in swallowing solids, then liquids, and, in the most extreme circumstances, their own saliva. Taking into account that cure is an unlikely end result with even the most aggressive forms of treatment, palliation of this single symptom impacts most on the patient's quality of life. Other symptoms and patient demographic characteristics are closely aligned with the underlying histology. Patients with squamous cell carcinoma of the oesophagus more often are of low socioeconomic class, and have a history of tobacco or alcohol abuse or both. Substantial weight loss accompanying dysphagia is seen in approximately 90% of patients with squamous cell carcinoma. Patients

with adenocarcinoma of the oesophagus tend to be males from middle to upper socioeconomic classes who are overweight, have a history of symptomatic gastro oesophageal reflux, and have been treated with antireflux therapy.

Approximately 20% of patients experience odynophagia. Additional presenting symptoms may include dull retrosternal pain resulting from invasion of mediastinal structures, bone pain secondary to bone metastases, and cough or hoarseness secondary to paratracheal nodal or recurrent laryngeal nerve involvement. These types of symptoms suggest unresectable locally advanced disease or metastases. Unusual presentations are pneumonia secondary to trachea esophageal fistula or exsanguinating hemorrhage due to aortic invasion.

DIAGNOSTIC STUDIES AND PRETREATMENT STAGING

Patients who present with symptoms suggestive or pathognomic of cancer of the oesophagus should undergo upper endoscopy to determine whether a mass is present, and biopsy to establish a tissue diagnosis. A focused history taking should elicit information on predisposing factors for oesophageal cancer, including tobacco use, alcohol use, symptomatic reflux, diagnosis of Barrett's oesophagus, and history of head and neck malignancy. Prior surgery on the stomach or colon should be documented because it may influence the choice of reconstructive conduit to restore alimentary continuity at the time of oesophagectomy. Findings on physical examination that would prompt further diagnostic testing or tissue sampling include

hoarseness due to recurrent laryngeal nerve involvement, cervical or supraclavicular lymphadenopathy, pleural effusion, and new onset of bone pain.

Refer. Fig. 7 Barium swallow study showing irregular tapering borders.

Routine chest radiography should be performed (Fig.8). Oesophagogastroscopy allows precise evaluation of the extent of oesophageal and gastric involvement and can precisely measure the distance of the tumor from the incisors to appropriately categorize the tumor's location. Upper endoscopy also allows identification of malignant lesions or second primaries as well as indicating the presence and extent of Barrett's oesophagus(Fig.10) . In addition, dilation of a stenotic lesion visualized at endoscopy may provide relief, albeit temporarily, from dysphagia. In the event the strictured area cannot be successfully dilated at endoscopy, a barium swallow test(Fig.7) can provide information regarding extent of disease. Bronchoscopy should be reserved for those patients with tumors of the mid- and upper oesophagus to rule out invasion of the membranous trachea and possible tracheo- oesophageal fistula. In the absence of symptoms, bone scans should not be part of the routine workup because their yield is extremely low.

Refer. Fig. 10. Upper oesophagogastroduodenoscopy showing irregular polypoidal lesions in various positions of oesophagus.

On completion of the initial diagnostic workup and after a tissue diagnosis of oesophageal cancer, pretreatment staging procedures are essential to accurately determine the depth of oesophageal wall penetration, the status of regional lymph

node basins, and the presence or absence of distant metastases so that patients can be guided to the appropriate treatment options and provided with prognostic information. All patients should undergo a computed tomography (CT) scan of the chest, abdomen, and pelvis as the initial evaluation for extent of disease. CT scans are highly accurate (approaching 100%) in detecting liver or lung metastases and suggesting peritoneal carcinomatosis (ascites, omental infiltration, peritoneal tumor studding, etc.). Accuracy for detecting aortic involvement or tracheobronchial invasion exceeds 90%. Because of this, initial staging by CT renders further, more costly staging studies unnecessary and avoids consideration of patients with obvious metastatic disease for resection. CT is inaccurate in determining T stage, because it cannot define individual layers of the oesophageal wall and will miss small T1 and T2 tumors. CT assessment of regional or distant lymph nodes is hindered by relatively low sensitivity (50% to 70%) due to its reliance on size criteria (larger than 1 cm) alone.48,49,50,51,52,53,54,55. Because lymph node involvement is frequently seen in small or normal-size lymph nodes, the false-negative rate is high, and despite a reasonable specificity of 85%, accuracy in determining lymph node involvement is limited (approximately 60%).

Endoscopic ultrasonography (EUS) (Fig.11) and EUS-guided fine-needle aspiration (FNA) are now considered to be invaluable tools for accurate pretreatment staging of oesophageal cancer (Fig 11) . The accuracy of EUS in determining both T and N stage is a function of its ability to clearly delineate the multiple layers of the

oesophageal wall and its reliance on multiple criteria, including shape, border pattern, echogenicity, and size, to determine lymph node involvement. Numerous studies have demonstrated that EUS is superior to CT in both T and N staging of Oesophageal cancer.65,66 In these studies the overall accuracy for T staging is approximately 85% and for N staging is approximately 75%. The accuracy of determining lymph node involvement has been increased with the use of linear-array EUS with a channel that allows passage of a needle to perform tissue aspiration for cytology. Studies of EUS FNA report an overall accuracy of 85% to 100% with sensitivity and specificity of more than 90%. EUS is as accurate as CT in identifying aortic invasion and can detect distant metastases to lung, liver, and peritoneum (ascites, omental implantation, etc.) but with less accuracy than CT. EUS is highly operator dependent with regard to procurement of adequate images and correct interpretation. EUS is also limited in its ability to define relatively superficial lesions as either T1 or T2.56,57,58,59,60,61,62,63.

Refer. Fig. 11 Endoscopic ultrasonogram showing five layers .

Making this distinction is critical because it may allow the use of minimal resection techniques for T1 lesions and avoidance of potentially toxic preoperative chemoradiotherapy for both T1 and T2 tumors. To address this issue, miniprobe high-frequency (20-MHz) sonographic catheters that can be passed through the working channel of the standard endoscope are now being used and provide improved accuracy.64,65. A new generation of endoscopes that are thin caliber and

can be passed over a guidewire can traverse almost all obstructing lesions, allowing EUS assessment for proper staging. Although it is a relatively recent addition to the armamentarium of staging procedures for oesophageal cancer, [^{18}F]fluorodeoxyglucose (FDG) positron emission tomography (PET) is being widely used, both appropriately and inappropriately, in the management of oesophageal cancer. The accuracy of FDG-PET in assessing regional lymph nodes falls somewhere between the low and high accuracy of CT and EUS, respectively, and therefore its value in this respect is uncertain. This translates into the detection of unsuspected metastatic disease (up-staging) in approximately 15% of patients and refutation of suspected disease (down-staging) in 10%, which leads to alteration of the intended treatment plan in at least 20% of patients. FDG-PET appears to have some value in evaluating response to chemotherapy and radiotherapy. Minimally invasive surgical techniques (laparoscopy, thoracoscopy, or both) are being used for staging of both local-regional and distant disease. Performing laparoscopy as the initial procedure at the time of planned esophagectomy adds little in the way of time and cost to the procedure and allows detection of unsuspected distant metastases, which spares the morbidity of laparotomy in 10% to 15% of cases. Luketich et al.,in a study comparing staging laparoscopy and thoracoscopy with CT and EUS in 53 patients with oesophageal cancer, demonstrated either up-staging or down-staging in 32% when the combined laparoscopic and thoracoscopic technique was used. The same group from the University of Pittsburgh, using minimally invasive staging

techniques to assess the utility of FDG-PET scans, noted that minimally invasive techniques were superior, showing greater sensitivity than FDG-PET. Krasna et al. reported improved accuracy in evaluating local invasion, lymph node metastases, and distant metastases with thoracoscopic and laparoscopic staging.

Refer. Fig. 12 Video-assisted thoracoscopy (V.A.T)

Although these studies suggest improved pretreatment staging with the minimally invasive surgical approaches, such approaches have not been embraced as standard staging procedures by most surgeons due to the morbidity, length of hospital stay, and cost associated with what is considered an additional procedure.

Pathologic Staging

The guidelines established by the American Joint Committee on Cancer for staging of oesophageal cancer are outlined in Table.4 and Table.5. 75 The primary tumor (T) stage is based on depth of tumor invasion into and through the wall of the oesophagus. The nodal (N) stage is determined by the presence of involved regional lymph nodes. The designation of a lymph node as regional is based on its relationship to the location of the primary tumor. For primary tumors located in the distal oesophagus, celiac lymph node involvement is considered distant metastasis and designated as M1A. For tumors located in the upper thoracic oesophagus metastases to cervical lymph nodes also carry the designation M1A. Any other lymph nodes involved by tumor are classified with other distant sites of involvement as M1B. It has been recommended that lymph node status be based on

examination of at least 6 lymph nodes in the resected specimen; however, one analysis noted an improvement in sensitivity to over 90% when 12 or more lymph nodes were examined as is recommended for colorectal carcinoma.

TABLE 4. Tumor (T), Node (N), Metastasis (M) Staging System for oesophageal Cancer

PRIMARY	
TUMOR (T)	
TX	Primary tumor cannot be assessed
T0	No evidence of primary tumor
Tis	Carcinoma *in situ*
T1	Tumor invades lumina propria or submucosa
T2	Tumor invades muscularis propria
T3	Tumor invades adventitia
T4	Tumor invades adjacent structures
	T staging of the oesophagus
	CT cannot delineate the component layers of the oesophageal wall and therefore is unable to differentiate between T1 and T2 lesions. CT cannot detect microscopic invasion in T3 tumours and differentiating macroscopic T3 from focal tumour bulging or juxtalesional lymphadenopathy can be impossible, particularly

in cachectic individuals. Understaging is more common than over staging. CT findings suggesting T4 involvement of the aorta, tracheobronchial tree, and crura are well documented but the signs are “soft” leading to poor sensitivity when compared with EUS. However, CT can predict mediastinal invasion in over 80% of patients.

REGIONAL LYMPH NODES (N)

NX	Regional lymph nodes cannot be assessed
N0	No regional lymph node metastasis
N1	Regional lymph node metastasis
N Ia	1-2 nodes
N Ib	2-4 nodes
N Ic	4-6 nodes

N staging

CT scanning

Size is the only criterion for assessment of lymph nodes and is a poor predictor of involvement, particularly in the chest, where large nodes may be reactive. The accuracy of CT

diagnosis of mediastinal node involvement ranges from 38% to 70%. If nodes over 8 mm in diameter are considered abnormal in the coeliac axis, a sensitivity of 48% and a specificity of 93% is achieved. Identification of more distant nodal groups is of particular importance as these nodal groups may not be amenable to evaluation with EUS and will often be outside the borders of even a radical resection.

DISTANT METASTASIS (M)

MX Distant metastasis cannot be assessed

M0 No distant metastasis

M1 Distant metastasis

Tumors of the lower thoracic oesophagus

M1a Metastasis in celiac lymph nodes

M1b Other distant metastasis

Tumors of the mid-thoracic oesophagus

M1a Not applicable

M1b Nonregional lymph nodes and/or other distant metastasis

Tumors of the upper thoracic oesophagus

M1a Metastasis in cervical lymph nodes

M1b Other distant metastasis

M staging

In a newly diagnosed oesophageal cancers

revealed that 18% have metastases at presentation , 45% of metastases were in abdominal lymph nodes and 18% in cervical lymph nodes. In addition, 35% of metastases were hepatic, 20% pulmonary, 9% bone, 5% adrenal, 2% peritoneal, and 2% cerebral. As all patients with bone and brain

metastases were associated with metastatic disease in the abdomen and thorax, hence in the absence of clinical indications, evaluation of metastatic disease should be focused on examination of the thorax and abdomen.

TABLE.5 Classification of Stage Groupings for Oesophageal Cancer

Stage Groupings	*TNM Classifications*		
0	Tis	N0	M0
I	T1	N0	M0
IIA	T2	N0	M0
	T3	N0	M0
IIB	T1	N1	M0
	T2	N1	M0
III	T3	N1	M0
	T4	Any N	M0
IV	Any T	Any N	M1
IVA	Any T	Any N	M1a
IVB	Any T	Any N	M1b

Successive pathologically determined stage groups are predictive of length of survival. It has been suggested that extensive nodal disease may be associated with better survival than visceral metastases, and it does appear that survival with stage IVA disease more closely mimics that with stage III disease than that with stage IVB disease.

TREATMENT

Optimal treatment of oesophageal cancer in every major stage grouping (premalignant or intramucosal lesions, localized resectable tumors, and unresectable metastatic disease) remains elusive and a work in progress that continues to engender substantial controversy. The paucity of appropriately designed studies to scientifically determine the most effective therapeutic strategy for any given clinical situation fuels the ongoing debate and undermines the potential for achieving consensus. Although there is no disagreement that oesophageal resection prevents progression from high-grade dysplasia to invasive carcinoma and is curative for T1 lesions limited to the mucosa, the morbidity and mortality associated with oesophagectomy has created enthusiasm for alternative approaches such as mucosal ablation and endoscopic resection. Surgery has always been considered the most effective way of ensuring both local-regional control and long-term survival for patients with tumors invading into or beyond the submucosa with or without lymph node involvement. Some investigators suggest that extending the limits of resection will further improve outcome. However, surgery alone or any other single modality fails in the vast majority of patients, which has led many oncologists to embrace combined modality therapy and some to question the necessity for surgical intervention. Despite the lack of convincing evidence to support its use, chemoradiotherapy with or without resection is the most common therapeutic regimen offered to patients with oesophageal carcinoma in the United States. A full

understanding of these issues and others regarding the treatment of carcinoma of the oesophagus requires careful scrutiny of the available literature with an attempt to separate bias from fact in developing a rational therapeutic approach for patients regardless of the stage of their disease.

TREATMENT OF PREMALIGNANT AND T1 DISEASE (LOCALIZED TO THE MUCOSA ONLY)

Pathologic confirmation of high-grade dysplasia in Barrett's oesophagus is the most powerful predictor of subsequent invasive adenocarcinoma and therefore warrants instituting a therapeutic plan. The rationale for oesophagectomy is that resection completely eradicates the mucosa at risk, which prevents progression to invasive carcinoma. This approach is further supported by numerous surgical series reporting that, for patients with high-grade dysplasia who undergo oesophagectomy, previously unidentified invasive cancer is present in up to 40% of resected specimens. Patients with superficial invasive tumors confined to the mucosa have little or no risk of lymph node metastases and are considered candidates for potentially less morbidity-producing resection methods.

Ablative Methods

The mechanism of action of all mucosal ablative techniques, including photodynamic therapy (PDT), laser ablation, and argon plasma coagulation, is destruction of the mucosal layer. The premise for managing high-grade dysplasia with endoscopic ablative therapy is that mucosal injury in an acid-controlled

environment eliminates the premalignant mucosa and resurfaces the oesophageal lining with regenerated squamous epithelium.

Endoscopic Mucosal Resection

Endoscopic mucosal resection (EMR) is a relatively recent addition to the endoscopic therapeutic options available for patients with either high-grade dysplasia or superficial oesophageal cancers. EMR technique involves the submucosal injection of fluid to lift and separate the lesion from the underlying muscular layer, which allows full resection and tissue retrieval for appropriate histologic examination. The complete remission rate in patients with less favorable lesions was 59%, which emphasizes the need to adhere to strict criteria to optimize disease eradication. This technique is feasible for treatment of high-grade dysplasia and carcinoma limited to the mucosa and provides an alternative to oesophagectomy, especially in those patients considered high risk for surgical intervention.

Minimally Invasive oesophagectomy

There is little debate that oesophageal resection is the most definitive intervention for eliminating high-grade dysplasia and is extremely effective treatment for carcinoma limited to the mucosa. However, the substantial morbidity and potential for mortality associated with oesophagectomy, even in the most experienced hands, has resulted in considerable controversy regarding its acceptance as optimal therapy in this setting. In an attempt to reduce morbidity and mortality while achieving an

equivalent oncologic outcome, minimally invasive techniques for oesophageal resection have been designed and are being investigated. A variety of minimally invasive approaches have been used for oesophagectomy, including laparoscopic, thoracoscopic, combined laparoscopic and thoracoscopic, and hand-assisted techniques 67,68,69,70. These procedures have been applied to the treatment of all stages of potentially resectable oesophageal cancer but would seem to be most applicable in the management of premalignant and early-stage disease. Median operative time was 7.5 hours, median length of hospital stay was 7 days, and a 30-day perioperative mortality was zero. Median follow-up was 20 months, and a 3-year survival of 90% was achieved in patients with either high-grade dysplasia or stage I disease.

Refer. Fig. 13. Minimally invasive oesophagectomy

Refer. Fig. 14. Thorocoscopic view of oesophagus

TREATMENT OF LOCALIZED DISEASE

Surgery has traditionally been the treatment of choice for patients with localized, resectable carcinoma of the oesophagus and continues to be a component of a more comprehensive approach to oesophageal cancer in a substantial number of patients. Failure of surgery alone to significantly alter the natural history of oesophageal cancer has resulted in considerable enthusiasm for combined modality therapy. The

shift toward multimodal treatment, although theoretically sound, is not convincingly supported by data from phase III clinical trials comparing preoperative therapeutic regimens (radiation, chemotherapy, or chemoradiotherapy) to surgery alone. Similarly, although it is appropriate to question the role of surgery in a multimodal approach to treatment of oesophageal cancer, no data are currently available from studies designed to examine the necessity of surgery, and therefore the wisdom of eliminating resection from the treatment algorithm is questionable.

Surgical Resection

Many controversies exist regarding the surgical treatment of oesophageal cancer, including the optimal surgical approach, the extent of local resection and lymph node retrieval, selection of a reconstructive conduit, and location of the anastomosis. Decisions regarding surgical technique are routinely based from personal bias, comfort level of the surgeon, and a subjective view of tumor biology, because solid evidence from scientifically designed trials is marginal and, in most instances, nonexistent. However, there is a growing body of evidence which suggests that outcome after oesophagectomy is directly related to both surgeon and hospital volume. Numerous studies that used health services linked databases have demonstrated a statistically significant association between performance of surgery in hospitals designated as high-volume oesophagectomy institutions and lower complication and mortality rates.71,72,73,74. Although this link has been shown for

other complex surgical procedures, the association between volume and outcome for oesophageal resection appears to be one of the strongest.

TRANSHIATAL OESOPHAGECTOMY. The transhiatal route for oesophageal resection has gained favor, especially among surgeons in the developed countries , concurrent with the rising incidence of adenocarcinoma of the distal oesophagus, which is readily approachable and effectively dissected through the diaphragmatic hiatus . It is prudent to initially perform laparoscopic exploration to rule out disseminated disease and, if it is confirmed, to abort the intended resection before exposing the patient to the risks of laparotomy. Through a midline incision, the stomach is mobilized by dividing all vascular attachments while preserving the right gastroepiploic and right gastric vessels on whose pedicle the reconstructive conduit will be based. The duodenum is fully mobilized via a Kocher maneuver and a pyloric drainage procedure is performed, which has been demonstrated in prospective randomized trials to reduce gastric stasis and minimize pulmonary complications such as aspiration.75,76 Cautery division of the diaphragmatic crus allows wide access to the mediastinum and dissection under direct vision of the middle and lower third of the oesophagus. A left cervical incision provides exposure to the cervical oesophagus, and circumferential dissection of the cervical oesophagus is carried down to below the thoracic inlet to the upper thoracic oesophagus, with care to avoid injury to the recurrent laryngeal nerve. The

remainder of the dissection at the level of and superior to the carina is completed by blunt dissection through the oesophageal hiatus. The cervical oesophagus is then divided, the stomach and attached intrathoracic oesophagus are delivered through the abdominal wound, and a gastric tube, which will serve as the reconstructive conduit, is fashioned using multiple applications of a linear stapling device. The gastric tube is then transposed through the posterior mediastinum to the cervical wound, where a cervical oesophagogastric anastomosis is performed. The stomach is considered by most surgeons as the replacement conduit of choice for the resected oesophagus. A segment of colon, usually based on the ascending branch of the inferior mesenteric artery, is an effective oesophageal substitute if for any reason the stomach is deemed unsuitable for reconstruction or the surgeon prefers. Although the original intent of this approach was not to perform a methodical lymph node dissection, a standard two-field lymphadenectomy (abdominal and lower mediastinal) can readily be achieved, and for that matter, if the surgeon is so inclined, a radical en bloc resection can be performed

Refer. Fig. 15. Trans-hiatal surgery.

TABLE.6 Conventional Approaches to Oesophageal Resection for Cancer

TRANSHIATAL
Laparotomy and cervical approach

Peritumoral or two-field lymph node dissection

En bloc resection feasible for distal Oesophageal tumors

Cervical anastomosis

TRANSTHORACIC

Ivor Lewis

Right thoracotomy and laparotomy

Peritumoral or two-field lymph node dissection

En bloc resection feasible for mid-/distal thoracic tumors

McKeown Oesophagectomy

Right thoracotomy, laparotomy, cervical approach

Peritumoral, two-field or three-field lymph node dissection

En bloc resection feasible for mid-/distal thoracic tumors

Cervical anastomosis

Left thoracotomy

Left thoracotomy with or without cervical approach

Peritumoral lymph nodes dissection

Intrathoracic or cervical anastomosis

Left thoracoabdominal

Left thoracoabdominal approach

Peritumoral or two-field lymph node dissection

Intrathoracic anastomosis

The stated advantages attributed to the transhiatal approach to oesophagectomy include avoidance of a thoracotomy incision, which thereby minimizes pain and subsequent postoperative pulmonary complications; elimination of the lethal complications of mediastinitis associated with an intrathoracic anastomotic leak; and a shorter duration of operation, which results in decreased morbidity and mortality. Limitations and disadvantages of transhiatal oesophagectomy include poor visualization of upper and mid-thoracic oesophageal tumors, increased anastomotic leak rate with subsequent stricture formation, possibility of chylothorax, and possibility of recurrent laryngeal nerve injury. The largest experience with transhiatal oesophagectomy was reported by Orringer et al. and included 800 patients with oesophageal cancer, 69% of whom had adenocarcinoma and 28% of whom had squamous cell carcinoma. Tumors were located in the lower third of the oesophagus in 74.5%, in the middle third in 22%, and in the upper third in 4.5%. In-hospital mortality was 4.5%. The most common complications were anastomotic leak (13%) and recurrent laryngeal nerve palsy (7%). Leak of a cervical oesophageal gastric anastomosis was handled simply in the vast majority of patients with opening of the cervical wound, followed by local wound care. Hoarseness from recurrent laryngeal nerve injury resolved spontaneously in 99% of cases. Overall 5-year survival was 23%, and stage-specific 5-year survival was 59% for stage I, 22% for stage II, 29% for stage IIB, and 10% for stage III. These results reflect those reported from other surgical series of transhiatal oesophagectomy

TABLE.7 Results of Transhiatal Oesophagectomy for Oesophageal Cancer

Study	*Year*	*Patients (n)*	*Histologic Type*	*Perioperative Mortality (%)*	*5-Y Survival (%)*
Gelfand et al.	1992	160	A	0.9	21
Gertsch et al.	1993	100	A/S	3	23
Vigneswaran et al.	1993	131	A/S	2.3	21
Dudhat and Shinde	1998	80	S	7.5	37
Orringer et al.	1999	800	A/S	4.5	23
Bolton and Teng	2002	124	A/S	1.6	27.3

A, adenocarcinoma; S, squamous cell carcinoma.

TRANSTHORACIC OESOPHAGECTOMY. Transthoracic oesophagectomy has been the most common surgical approach used to resect carcinomas of the oesophagus Although a left thoracotomy provides adequate exposure to tumors of the distal oesophagus, a right thoracotomy affords access to upper, mid-, and distal

oesophageal lesions and is the preferred route for transthoracic exposure. A right thoracotomy combined with an upper midline laparotomy (Ivor Lewis oesophagectomy) is the technique most commonly used for oesophageal resection and is briefly described here. The abdominal portion of the procedure duplicates that of the transhiatal approach detailed earlier in Transhiatal Oesophagectomy and includes mobilization of the stomach and distal oesophagus, upper abdominal lymphadenectomy, pyloromyotomy, and placement of a feeding jejunostomy before abdominal wound closure and repositioning for the thoracic component of the procedure. A muscle-sparing right lateral thoracotomy is performed through the fifth or sixth intercostal space. The azygos vein is divided, the mediastinal pleura incised, the intrathoracic oesophagus mobilized, and a mediastinal lymph node dissection performed. After division of the proximal oesophagus in the chest ensuring an adequate margin, the gastro oesophageal junction and stomach are pulled into the thoracic cavity. The stomach is then divided with a linear stapler, the specimen is removed and an oesophagogastric anastomosis performed. An alternative approach has been described in which the right thoracotomy is the initial stage of the procedure followed by repositioning of the patient supine for an abdominal and left cervical incision to achieve a cervical oesophagogastric anastomosis.84,85

The transthoracic approach provides direct visualization and exposure of the intrathoracic oesophagus facilitating a wider dissection to achieve a more adequate

radial margin around the primary tumor and more thorough lymph node dissection, which theoretically results in a more sound cancer operation. In patients with significant comorbid conditions, the combined effects of an abdominal and thoracic incision may compromise cardiorespiratory function. An intrathoracic anastomotic leak can lead to mediastinitis, sepsis, and death. In addition, oesophagitis in the nonresected thoracic oesophagus may occur secondary to bile reflux. The three-incision (cervical, thoracic, and abdominal) modification of the procedure effectively eliminates the potential for complications associated with an intrathoracic oesophagogastric anastomosis.

Numerous authors have reported results of transthoracic oesophagectomy; however, most, if not all, of these reports include patients who were resected via other surgical approaches and underwent a more extended lymphadenectomy. 93,94,95,96,97,98 . Suffice it to say that both overall and stage-specific 5-year survival rates were similar to those seen with transhiatal oesophagectomy. The cleanest data may be derived from prospective randomized trials exploring the role of induction therapy before oesophagectomy in which there is a surgery-alone control arm. In only one of those trials, that conducted by Bossett et al.,96 was a transthoracic approach the only surgical procedure allowed. In that trial, 139 patients were randomly assigned to the surgery-alone group. Median survival time was 18.6 months and 5-year survival rate was 26%.

TABLE .8 . Results of Transthoracic Oesophagectomy for Oesophageal Cancer

Study	*Year*	*Patients (n)*	*Histologic Type*	*Perioperative Mortality (%)*	*5-Y Survival (%)*
Wang et al.284	1992	368	S	6.5	7.6
Lieberman et al.285	1995	258	A/S	5	27
Adam et al.283	1996	597	A/S	6.9	16.3
Sharpe and Moghissi281	1996	562	A/S	9	18
Bossett et al.286	1997	139	S	3.6	26
Ellis282	1999	455	A/S	3.3	24.7

A, adenocarcinoma; S, squamous cell carcinoma.

TRANSHIATAL VERSUS TRANSTHORACIC OESOPHAGECTOMY. The controversy regarding the optimal surgical approach for oesophageal cancer remains unresolved. Proponents of transthoracic oesophagectomy claim superior oncologic outcome secondary to wider tumor clearance and more thorough lymphadenectomy. Supporters of transhiatal oesophagectomy argue that a

cervicoabdominal approach minimizes postoperative morbidity and mortality and is oncologically equivalent to the transthoracic approach.

Two large metaanalyses have compared transhiatal oesophagectomy to transthoracic oesophagectomy based on collective reviews of numerous individual studies.Both reports include studies that compared transhiatal to transthoracic oesophagectomy, studies of transhiatal oesophagectomy only, and studies of transthoracic oesophagectomy only. The vast majority of these studies were retrospective and were not standardized with regard to techniques used, use of additional therapy, and results reporting. The collective review by Rindani et al. encompassed 5483 patients from 44 series published between 1986 and 1996. Perioperative mortality was significantly higher in the transthoracic oesophagectomy group than in the transhiatal group (9.5% vs. 6.3%), whereas overall perioperative complications were not significantly different in the two groups. Patients who underwent transhiatal oesophagectomy had a higher incidence of anastomotic leak, anastomotic stricture, and recurrent laryngeal nerve injury. Overall 5-year survival was similar for the two groups: 24% for the transhiatal oesophagectomy group and 26% for the transthoracic oesophagectomy group. Hulscher et al.98 performed a collective review of 50 studies performed between 1990 and 1999 yielding 7527 patients for comparison of the transthoracic versus the transhiatal route. Postoperative mortality was significantly greater in the transthoracic group than in transhiatal group (9.2% vs. 5.7%). Transthoracic

oesophagectomy was associated with a significantly higher risk of pulmonary complications (18.7% vs. 12.7%), whereas patients treated with transhiatal oesophagectomy had a higher anastomotic leak rate (13.6% vs. 7.2%). Five-year survival was not significantly different, with 23% 5-year survival for transthoracic oesophagectomy and 21.7% 5-year survival with transhiatal oesophagectomy. A prospective database based on the Veterans Administration National Surgical Quality Improvement Program was used to analyze perioperative outcome in 945 patients, 562 who underwent transthoracic oesophagectomy and 383 who underwent resection through a transhiatal approach. There was no difference in overall mortality (10% for transthoracic approach vs. 9.9% for transhiatal approach) or morbidity (47% for transthoracic vs. 49% for transhiatal).

Four phase III trials have prospectively examined the outcomes for patients randomly assigned to undergo either transhiatal or transthoracic oesophagectomy. No definitive conclusions can be drawn from three of these trials due to the extremely small sample size. The trial in the Netherlands, however, deserves special attention. Hulscher et al. randomly assigned 220 patients with mid- or distal oesophageal carcinoma to undergo either transhiatal esophagectomy or transthoracic esophagectomy. The transthoracic group underwent a systematic mediastinal and upper abdominal lymph node dissection. Although the number of lymph nodes retrieved was significantly higher in the transthoracic group (31 vs. 16; $P < .001$), there was no difference in the radicality of the two procedures with

equivalent R0, R1, and R2 resections. Postoperative pulmonary complications, ventilatory time, intensive care unit stay, and hospital stay were significantly higher in those patients assigned to the transthoracic group. Despite the higher perioperative morbidity, there was no statistically significant increase in in-hospital mortality (4% vs. 2% for transthoracic vs. transhiatal oesophagectomy, respectively; P <.5). At a median follow-up of 4.7 years, there were no significant differences between the transhiatal and transthoracic oesophagectomy groups with respect to median disease-free interval (1.4 vs. 1.7 years, respectively) and median overall survival time (1.8 vs. 2.0 years, respectively). Likewise, no significant differences were noted in local-regional recurrence, distant recurrence, and combined local-regional and distant recurrence for patients randomly allocated to the transthoracic or transhiatal oesophagectomy arm. The investigators point out that a trend toward improved disease-free survival (39% vs. 27%) and overall survival (39% vs. 29%) at 5 years favored the transthoracic approach group.

From the data presented, one could reasonably conclude that either the transhiatal or transthoracic procedure can be performed with acceptable morbidity and mortality in experienced hands and that, with either technique, the outcome is remarkably similar that is, poor.

COMPARISON OF DEFINITIVE CHEMORADIATION AND SURGERY. Although there are a number of trials comparing preoperative chemoradiation with surgery alone, there is no trial that directly compares the two standard treatments for nonmetastatic oesophageal cancer: nonoperative chemoradiation and surgery alone. It is an important issue for the practicing oncologist and for the establishment of standards of care. The positive results of RTOG 85-01, demonstrating a 27% 5-year survival rate for patients treated with definitive chemoradiation compared with no 5-year survival after treatment with radiotherapy alone, is a major advance. This treatment option has influenced the selection of patients for nonsurgical management because it provides an alternative for restoring swallowing function in patients with locally advanced disease for whom resection would likely be palliative.

For patients with earlier-stage disease that appears resectable, definitive chemoradiation may also be appropriate treatment; however, prospective trials comparing this approach with surgery, stratified by stage, have yet to be performed. Nonetheless, contemporary series suggest that the nonsurgical approach offers a survival rate that is the same or better than that achievable with surgery alone. For example, the median survival time and 5-year survival rate were 14 months and 27%, respectively, in the chemoradiation arm of RTOG 85-01 and 20 months and 20%, respectively, in INT 0122.394 In comparison, the median survival in the surgical control arm of the Dutch trial reported by Kok et al.306 was 11 months,

and the median survival time and 5-year survival rate in the surgical control arm of INT 0113 were 16 months and 20%, respectively. Likewise, the local failure rates were similar. The incidence of local failure (local recurrence plus local persistence of disease) as the first site of failure was 45% in RTOG 85-01 and 39% in INT 0122. Although local failure as the first site of failure was 31% in INT 0113, this analysis was limited to patients who underwent a complete resection with negative margins (R0 resection). Because an additional 30% of patients had residual local disease, if one were to score these patients also as having locally persistent disease (as was done in the RTOG 85-01 analysis), the comparable local failure rate with surgery alone would be 30% + 31% = 61%. The treatment-related mortality rates were also similar (2% in RTOG 85-01, 9% in INT 0122, and 6% in INT 0113).

In summary, the local failure, survival, and treatment-related mortality rates for nonsurgical and surgical therapies are similar. Although the results are comparable, it is clear that both the nonsurgical and surgical approaches have limited success.

Refer. Table. 9. Surgery vs chemoradiation.

NECESSITY FOR SURGERY AFTER CHEMORADIATION. Two trials examine whether surgery is necessary after chemoradiation. The Federation Francaise de Cancerologie Digestive (FFCD) trial addresses the issue of whether patients who respond midway through chemoradiation should continue with the treatment or undergo surgery.The German Oesophageal Cancer Study Group

examined the question of whether chemoradiation followed by surgery is equivalent to nonoperative chemoradiation.

In the FFCD 9102 trial, all 445 patients with clinically resectable T3 to 4 N0 to 1 M0 squamous cell carcinoma or adenocarcinoma of the oesophagus received chemoradiation; however, the randomization was limited to patients who responded to initial chemoradiation. Patients initially received two cycles of 5-FU and cisplatin plus concurrent radiation (either 46 Gy at 2 Gy/d or a split-course regimen of 15 Gy in weeks 1 and 3). The 259 patients who had at least a partial response were then randomly assigned to receive surgery or additional chemoradiation, which included three cycles of 5-FU and cisplatin, plus concurrent radiation (either 20 Gy at 2 Gy/d or split-course 15 Gy). There was no significant difference in 2-year survival (34% for those undergoing surgery vs. 40% for those receiving chemoradiation; P = .56) or median survival (18 months for the surgery group vs. 19 months for the chemoradiation group). The data suggest that patients who initially respond to nonoperative chemoradiation should complete chemoradiation rather than stop and undergo surgery. As measured using the Spitzer index, there was no difference in global quality of life; however, a significantly greater decrease in quality of life was observed in the postoperative period in the surgery arm (7.52 vs. 8.45; P <.01).

The German Oesophageal Cancer Study Group compared preoperative chemoradiation followed by surgery with chemoradiation alone. In this trial, 177 patients with T3N0M0 squamous cell cancers of the oesophagus were randomly

assigned to receive preoperative therapy (three cycles of 5-FU, leucovorin, etoposide, and cisplatin, followed by concurrent etoposide and cisplatin, plus 40 Gy of radiation) followed by surgery or chemoradiation alone (the same chemotherapy regimen, but the radiation dose was increased to 60 Gy). Despite an improvement in local control for those who were randomly assigned to receive preoperative therapy followed by surgery compared with those receiving chemoradiation alone (81% vs. 64%), there was no significant difference in 3-year survival (28% vs. 20%). Although the difference in the radiation dose in the two arms makes the interpretation of the data difficult, there does not appear to be a benefit to surgery after nonoperative chemoradiation.

STAGE-DIRECTED TREATMENT RECOMMENDATIONS

Although, in many clinical situations, level I evidence is lacking to support ironclad recommendations regarding the most effective treatment of patients grouped by stage, reasonable trial-generated information exists to suggest appropriate therapeutic interventions for patients catalogued under broad staging categories.

Resection remains the standard by which all other treatment options must be measured for patients with high-grade dysplasia in the setting of Barrett's oesophagus or T1 disease limited to the mucosa with the caveat that esophagectomy-associated mortality must be extremely low. With more experience and longer follow-up data, ablative methods or the more attractive therapeutic option, EMR, may become universally accepted as treatment alternatives

considered comparable to surgery. Intensive long-term endoscopic surveillance for patients with Barrett's oesophagus associated high-grade dysplasia is necessary to limit both cancer- and treatment-related mortality.

Esophagectomy is an appropriate method for treating patients with stage I, II, III, and select IVA disease. Alternatively, definitive chemoradiation is a therapeutic option for patients with stage II and III disease and the majority of those with stage IVA lesions, especially those who are not considered surgical candidates or who have squamous cell carcinoma at or above the carina. The high rate of persistent or recurrent local-regional disease after definitive chemoradiation suggests that additional local therapy in the form of surgery may be necessary and beneficial. This potential benefit may only be realized if perioperative mortality is minimized. Although preoperative chemoradiotherapy has not been definitively proven to be more effective than surgery alone, it remains an attractive approach that has been embraced by oncologists for patients with resectable stage IIB, III, and selected IVA oesophageal cancers and should continue to be examined in well-designed clinical trials. Postoperative chemoradiotherapy should be reserved for patients with resected adenocarcinoma of the gastrooesophageal junction. All patients with unresectable or stage IV disease are ideally suited for clinical trials exploring novel therapeutic agents and approaches.

AIMS AND OBJECTIVES

Cancer oesophagus, is such surgery dependant disease, since surgery is used in investigational, curative and palliative purposes. To outline the various types of surgery done in the management of carcinoma oesophagus- a prospective study summarizing the effectiveness of various surgery with response to survival, particularly Trans Hiatal oesophagectomy versus Trans Thoracic oesophagectomy was studied.

MATERIALS AND METHODS

A prospective analysis of cancer oesophagus patients treated at Department of Surgery and Surgical oncology between 2010-2011 in our institutions are taken into study.

Patient Selection: All Patients who attend surgery OPD in hospital and found to have Carcinoma oesophagus in the OGD and who do not have any other associated upper G.I pathology. Radical surgery recommended for patients with localised (T1, T2) tumours who are sufficiently fit to tolerate the procedure.

Criteria for Inclusion in the study:

1) patients age >12 years and < 65 yrs.
2) Has underwent OGD scopy.
3) Histologically proven carcinoma.
4) Performance status 1-2.

Criteria for exclusion:

1) patients < 12 years of age >65 yrs of age.

Data collection: By direct interview of the patients/relatives and by OGD, biopsy, CT scan of the chest/abdomen.

Methods

Protocol on arrival: patients were examined in detail in the ward along with OGD and biopsy and coexistent medical conditions.

Investigations:

- Complete hemogram
- Urine routine
- Blood glucose profile, renal function tests, liver function tests and electrolytes
- Chest x-ray
- ECG in all leads.
- HIV BY ELISA
- Upper GI endoscopy(flexible) with biopsy report
- CT SCAN abdomen and chest.

ETHICAL CLEARANCE OBTAINED : Ref.No. 15806/E4/2010

.

Consent forms: obtained from all patients included in the study.

Statistical Analysis: prospective analysis.

Conflict of Interest:Nil

Financial support: Nil

OBSERVATION AND RESULTS

During the period of study there were 27 cases of cancer oesophagus admitted in various surgery units and speciality wards. Of these 18 were squamous cell carcinoma(SCC) and 9 were adenocarcinoma(ACA). Due to non availability of ENDOSCOPIC USG , we did OGD scopy with biopsy and CT chest/abdomen , combined by which 12(all were SCC) were found to be middle third ,10(9 were ACA and 1 SCC) found in lower third and 5 (all were SCC) in the upper third approximately.

By preparing the patient for surgery and assessing them, we could perform 14 trans hiatal(THS) and 8 trans thoracic surgeries(TTS). Rest of the patients(five) who were found to operable by CT SCAN were found to be locally advanced and non-resectable and in upper one third lesions hence refered to referred to chemo/radiation units(stage migration). Of the total 22 defnitive surgeries performed 3/14 patients in THS arm(21.4% mortality) died post-operatively and 3/8 patients in TTS arm(37.5% mortality) died in post-op. Both the arm patients required more than 14 days stay in hospital with particular TTS patients requiring post operative ventilators in most of the patients. There were no reports of anastomotic leakage in all 5 patients in TTS arm , one patient had prolonged fever for more than 10 days in THS arm which subsided after full survey. 4/11 patients had cervical anastomotic leak in THS arm, but all of healed by self in the next 21 days. We could not do BARIUM SWALLOW for all our patients who underwent

definitive surgery as few were lost to our follow up. In THS arm all 11 patients were relieved of dysphagia to a major extent, the oesophago-gastric anastomotic site by barium swallow done after 4 weeks in the TTS arm was found to adequate in 2/5 patients.

Follow-up upto a year was possible in 13/16 patients, as 3 patients were lost to follow up (2 in THS and 1 TTS 3/9 patients who developed local recurrence were referred to chemo/radiation units in THS arm and one developed distant metastasis and all 4 patients in TTS arm were found to be disease free upto 1 year.

Refer. Table. 10. TTS versus THS – a comparison

- Mortality rates were although higher in TTS arm, but they were not statistically significant($p>.01$).
- Incidence of anastomotic leak was significantly higher in THS arm($p<.01$), even though they are self-limiting.
- Anastomotic stricture were although seen in TTS arm, they required just endoscopic dilation in most of the patients .
- THS arm patients developed significant local/distal recurrence as patients were not properly selected due to non availability of ENDOSCOPIC USG (Endoscopic USG is sensitive in detecting T3 from T4) .
- Patients in TTS arm were disease-free upto 1 year of follow, signifying TTS is a better surgery from oncological point of view.

- All the patients were alived up to 1 year of follow up.
- Disease free survival up to 1 year in the study was 77% (10/13)

Refer. Table. 11.- Post – operative complications

Hence the morbidity due to TTS was weighed before disease free survival, it was found that with proper patient selection, vigourous respiratory exercise preoperatively , good intensive respiratory units, by adding scopy to the thoracotomy component and using staplers for anastomosis we can perform Trans Thoracic Surgery better with least morbidity and mortality. Trans Hiatal Surgery may be technically easier than Trans Thoracic surgery , but if patients are fit enough TTS can be attempted in an otherwise blind THS procedure since the mediastinal lymphadenectomy is not enough to be disease free. All the previous literatures report equal morbidity and mortality in both surgeries, but the present one goes one step further by favouring TTS.

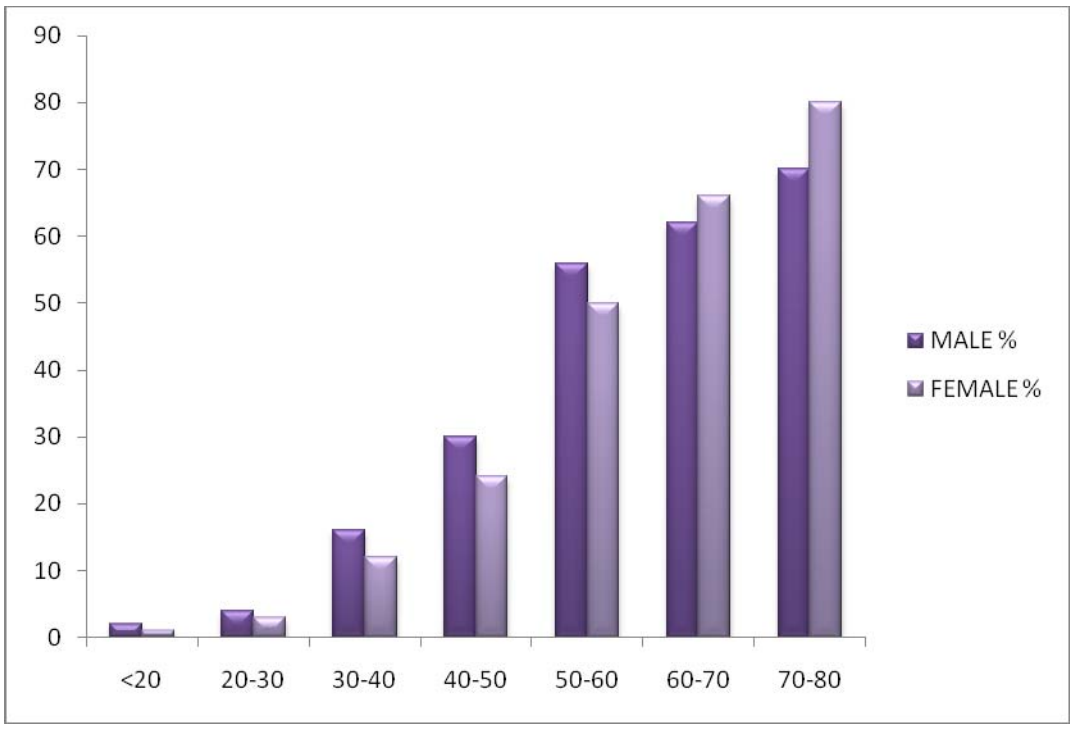


Table. 1 Trends in age-adjusted incidence rates for Oesophageal cancer in India.

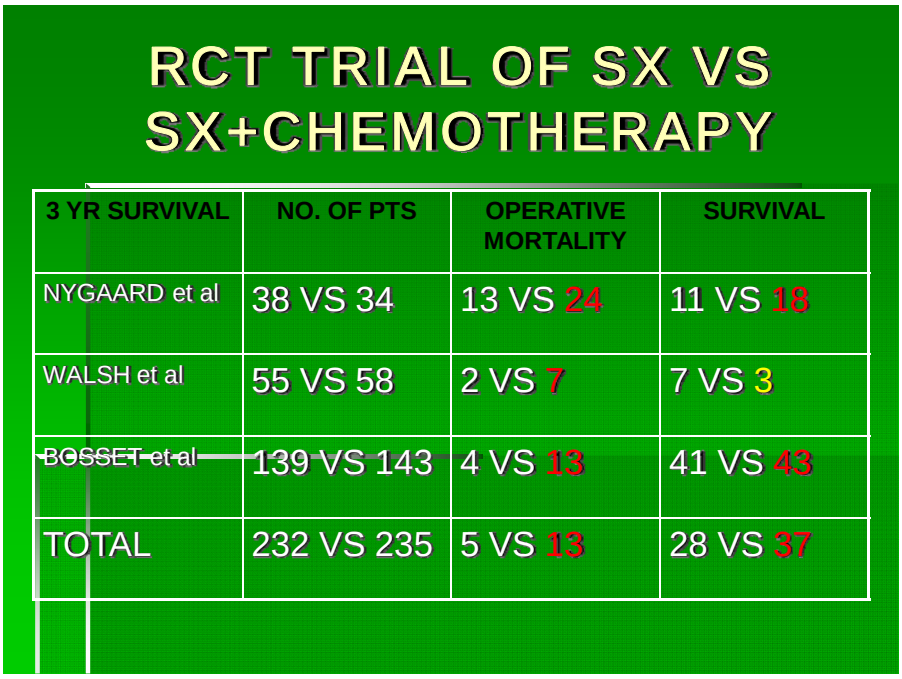


Table. 2. Surgery vs surgery and chemotherapy showing increased mortality with increased survival in surgery and chemotherapy receiving patients.

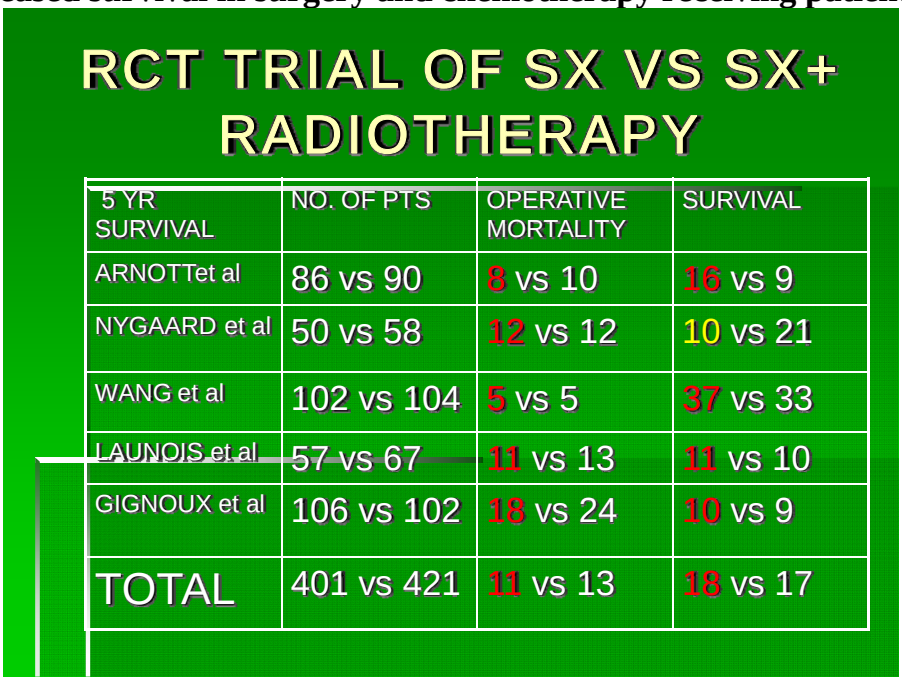


Table. 3. Surgery vs surgery and radiotherapy showing better survival and less mortality in surgery alone patients.

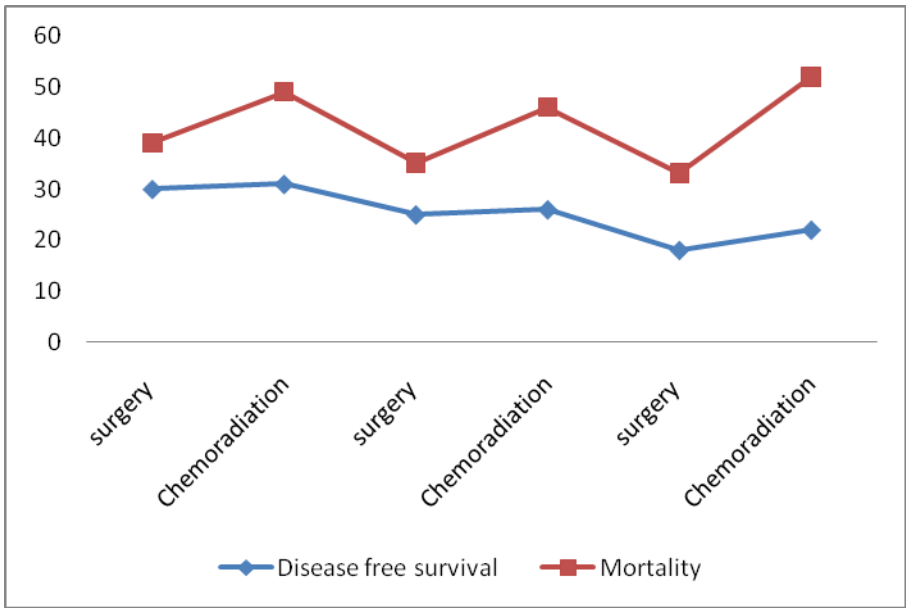


Table. 9. Surgery vs chemoradiation.

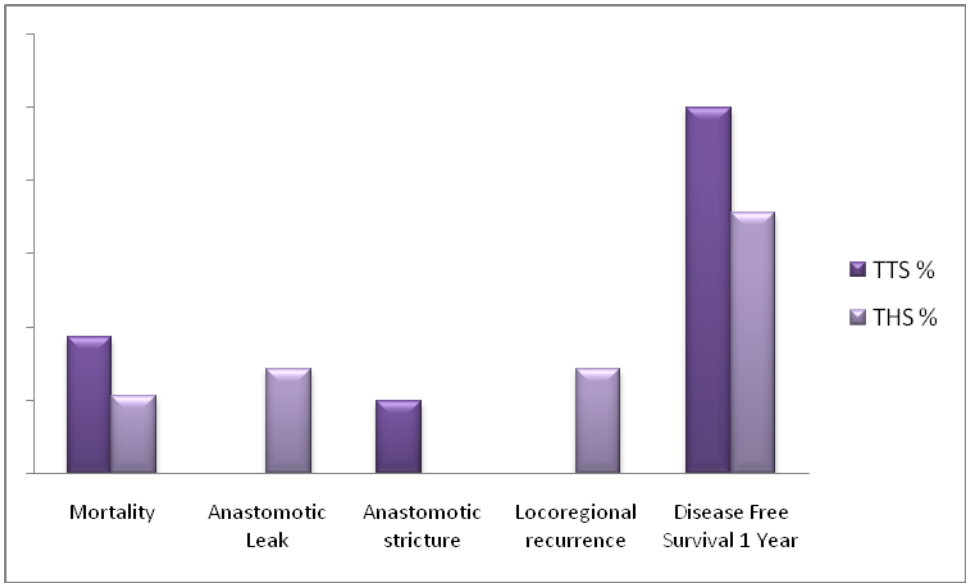


Table. 10. TTS Versus THS – A Comparision

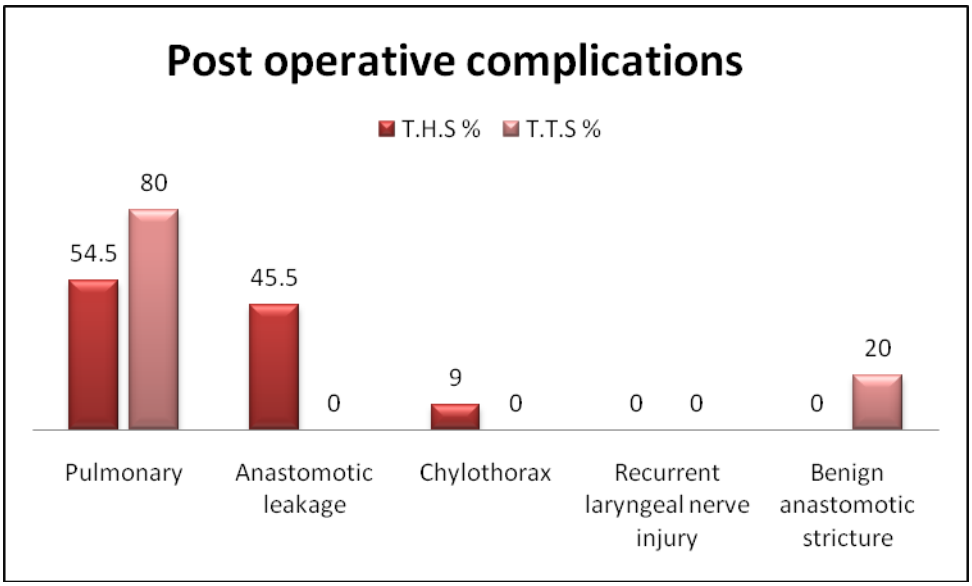


Table. 11. Post operative complications

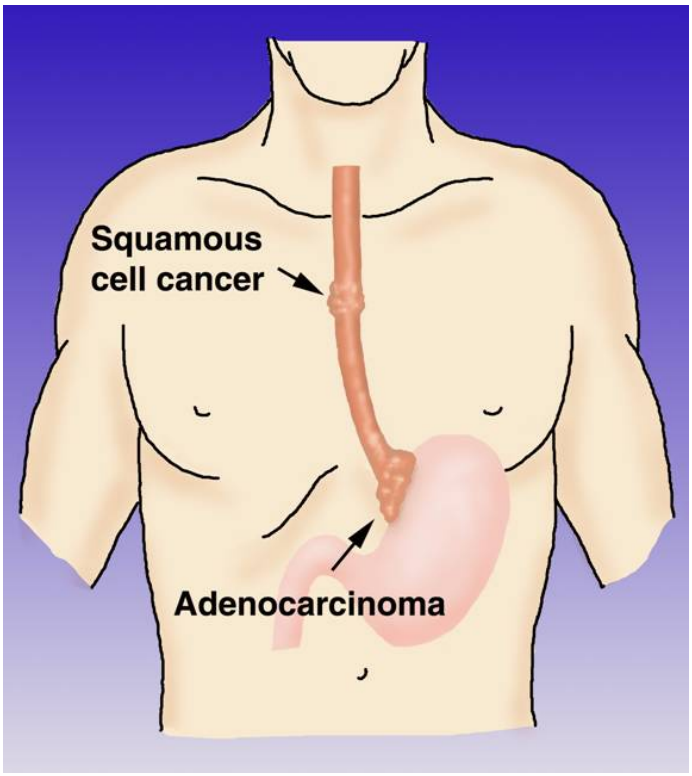

Squamous
cell cancer
Adenocarcinoma

Fig – 1

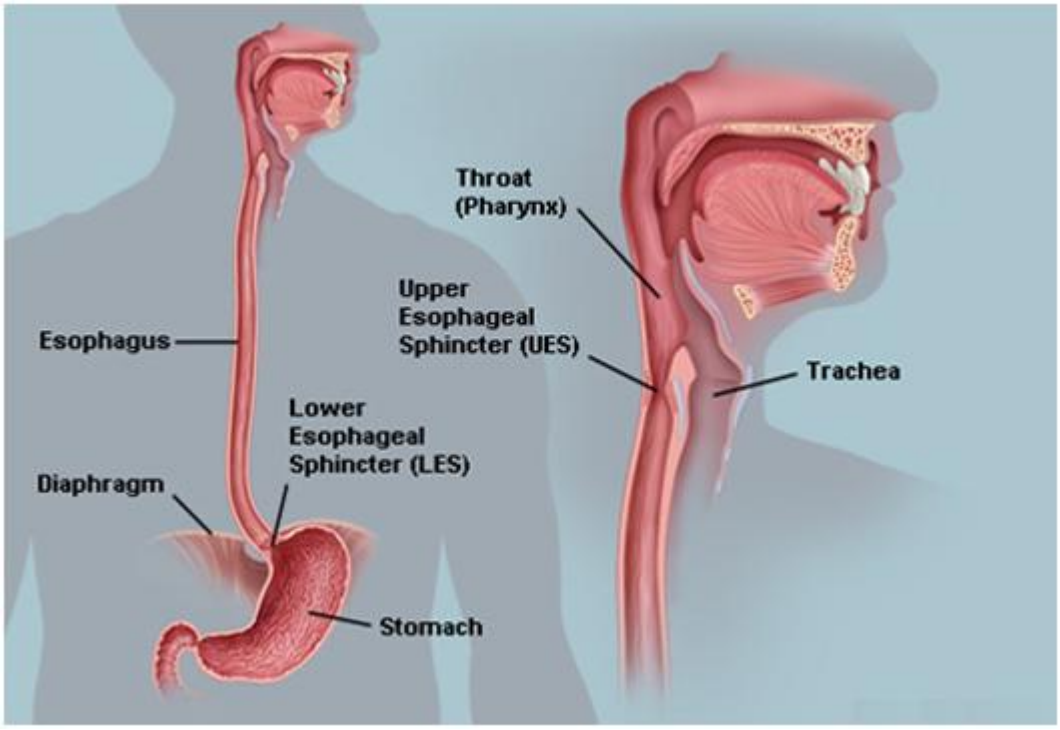

Throat
(Pharynx)
Upper
Esophageal
Sphincter (UES)
Esophagus
Trachea
Lower
Esophageal
Sphincter (LES)
Diaphragm
Stomach

Fig – 2

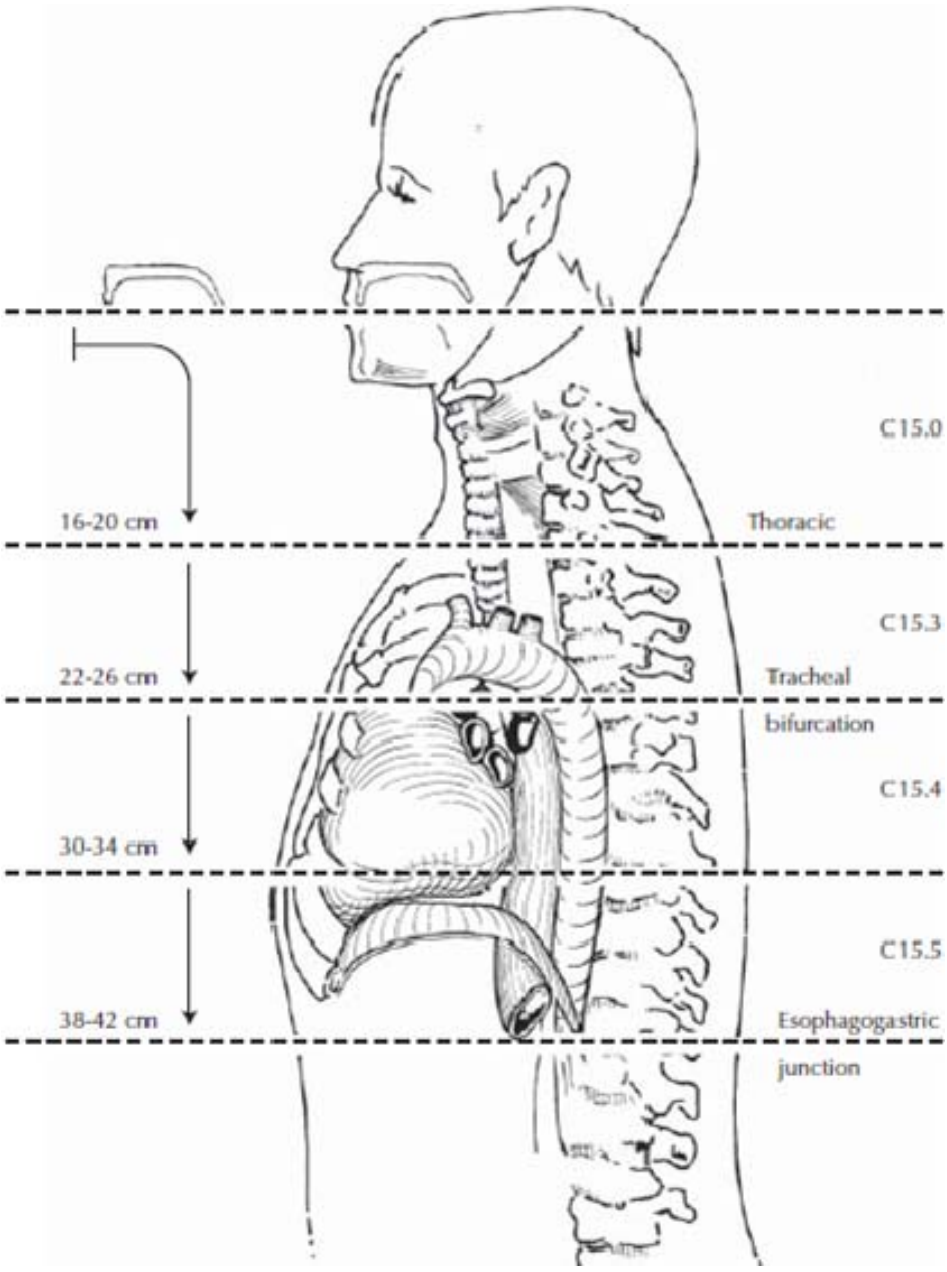


Fig 3. Anatomy of Oesophagus

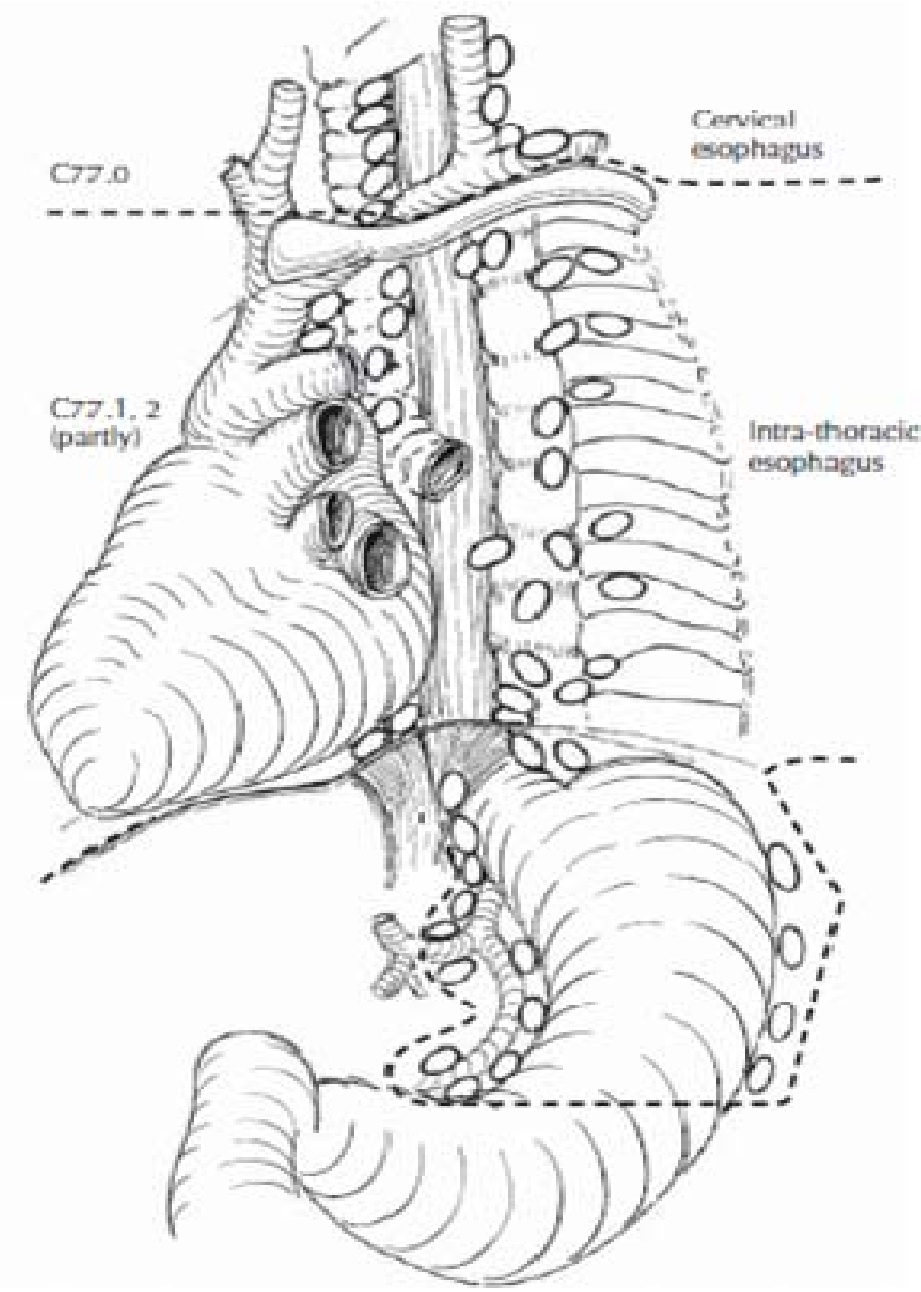


Fig 4. Lymphatic drainage of Oesophagus

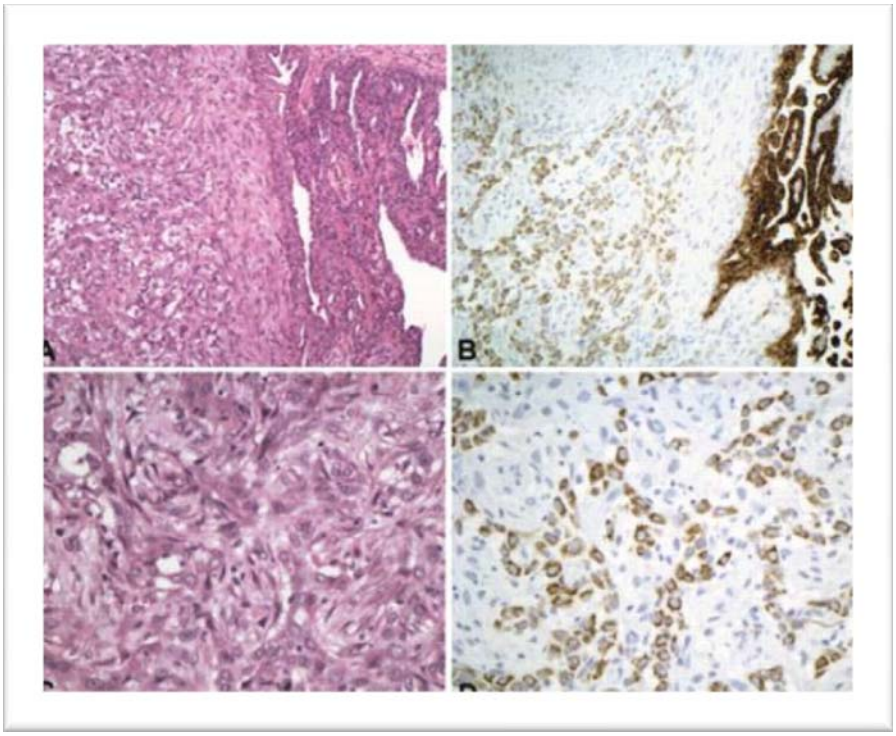


Fig. 5 Squamous cell carcinomas showing epithelisation, inter cellular bridges and cytokeratin

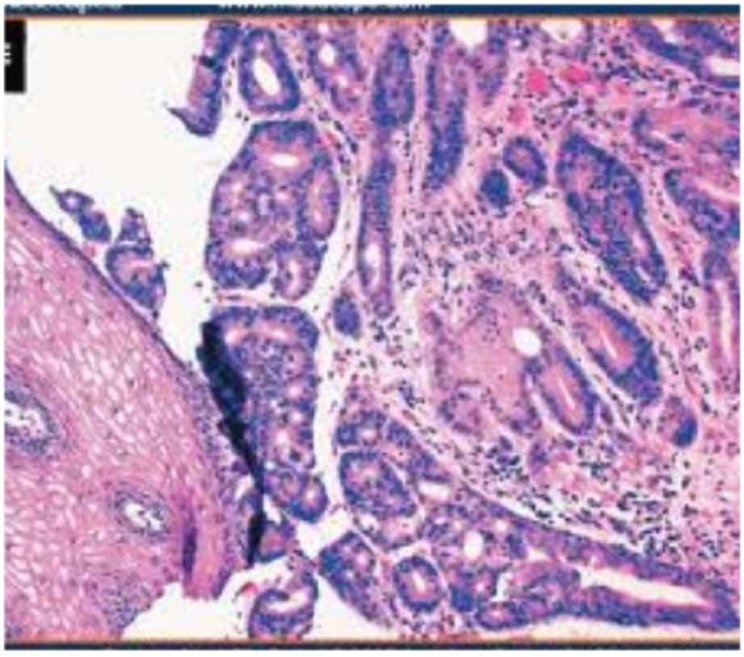


Fig. 6. Adenocarcinoma

Fig. 7 Barium swallow study showing irregular tapering borders.

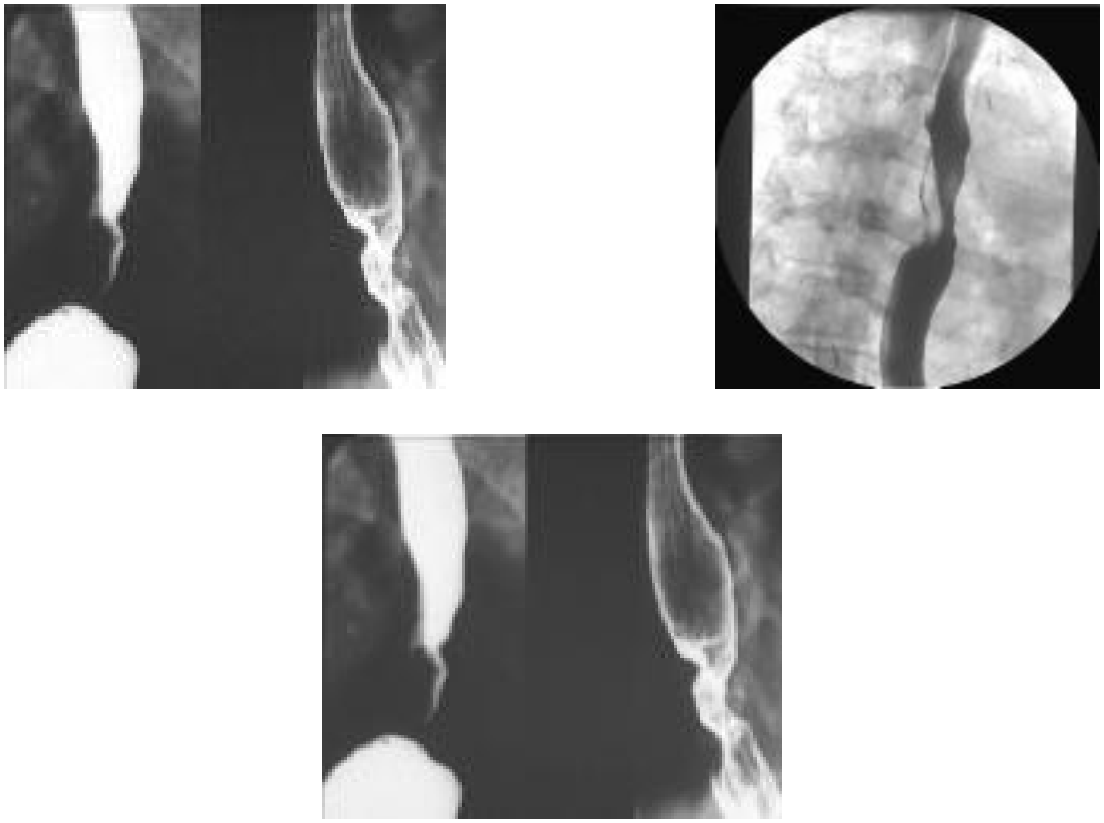


Fig -8: Chest X-ray

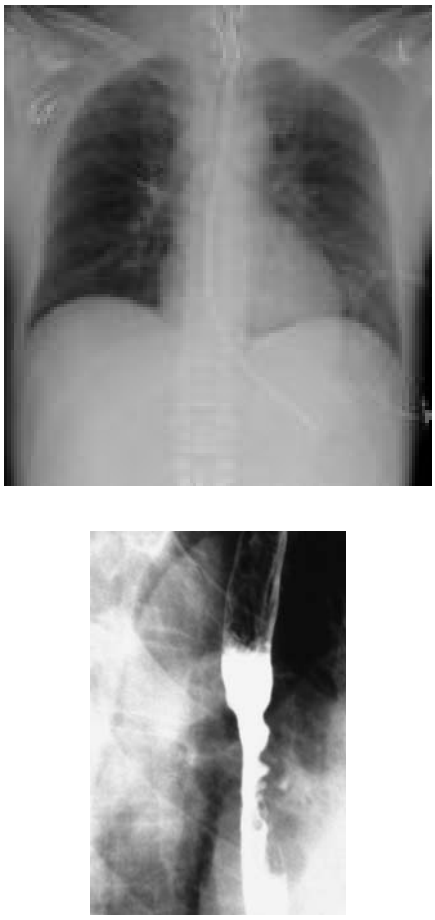
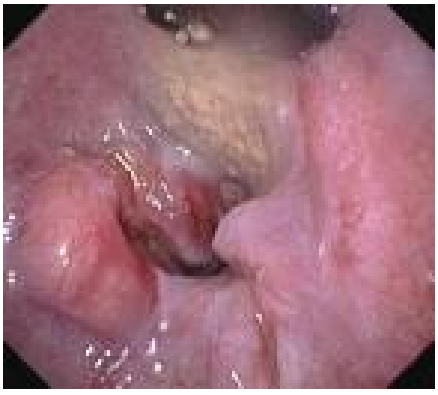
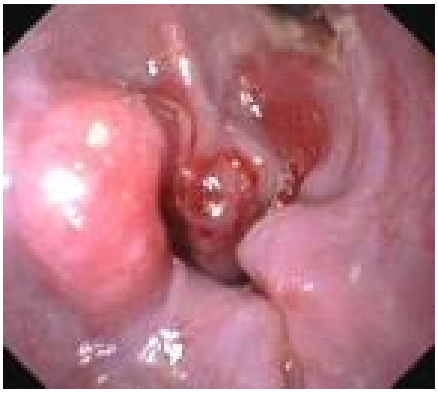


Fig -9 : Oesophagogram





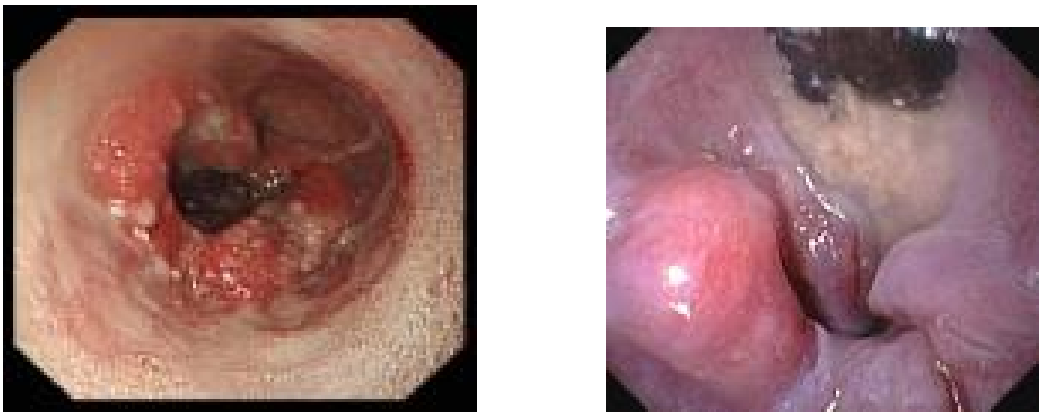


Fig. 10. Upper oesophagogastroduodenoscopy showing irregular polypoidal lesions in various positions of oesophagus.

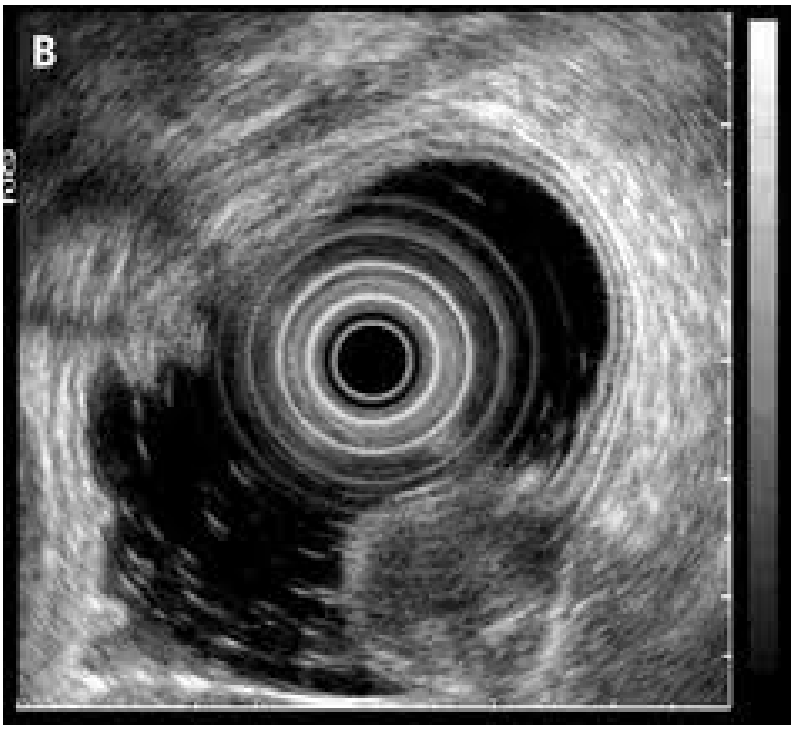


Fig. 11 Endoscopic ultrasonogram showing five layers .

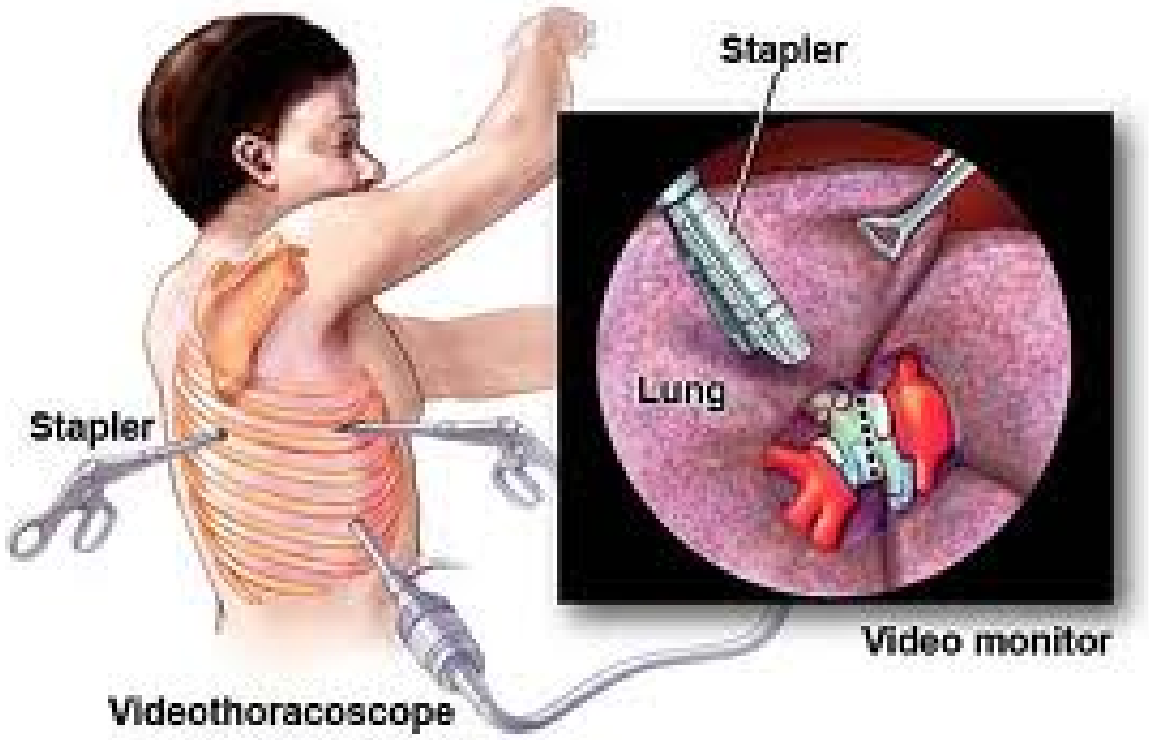


Fig. 12 video-assisted thorascopy (V.A.T)

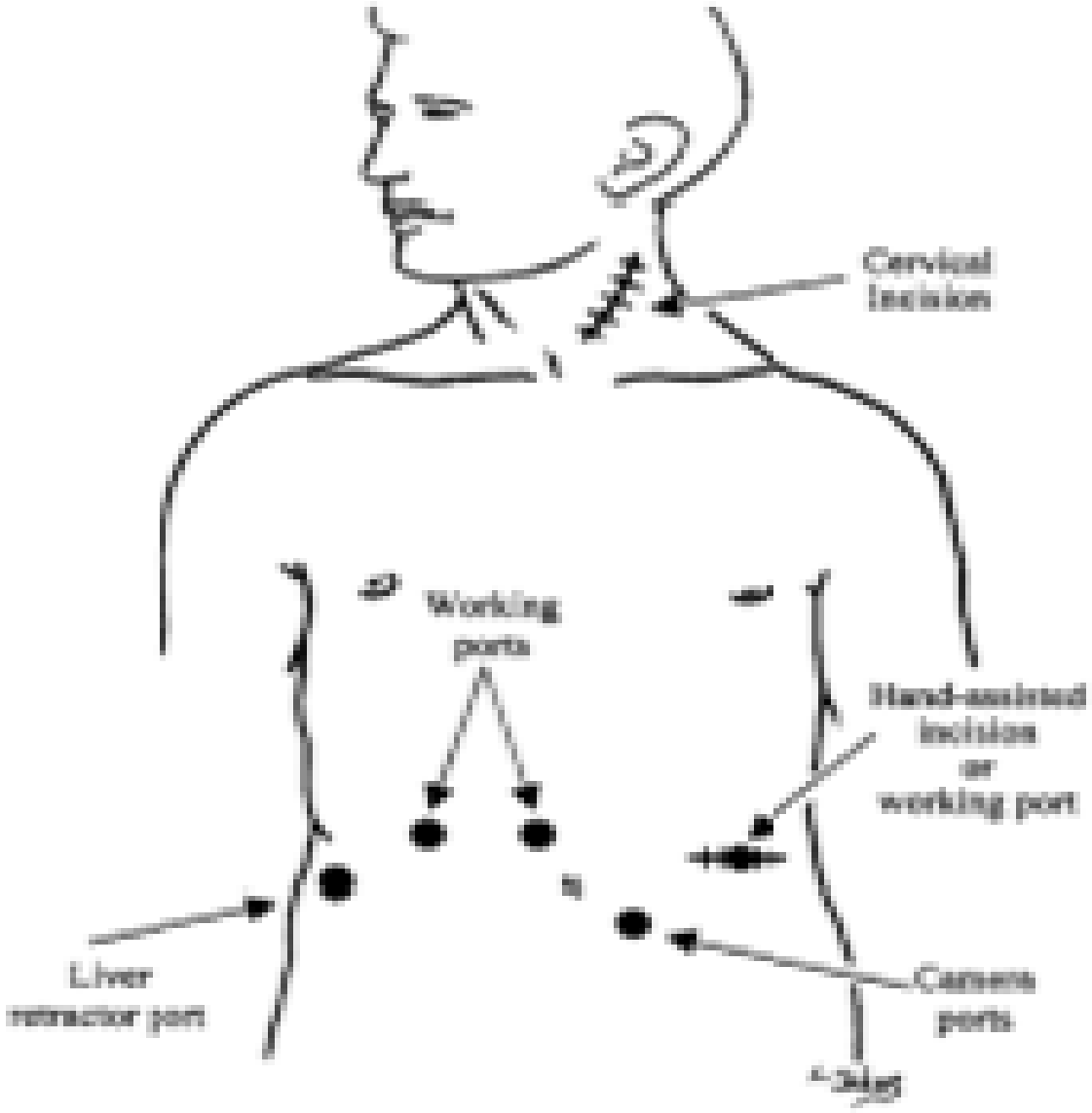


Fig. 13. Minimally invasive Oesophagectomy

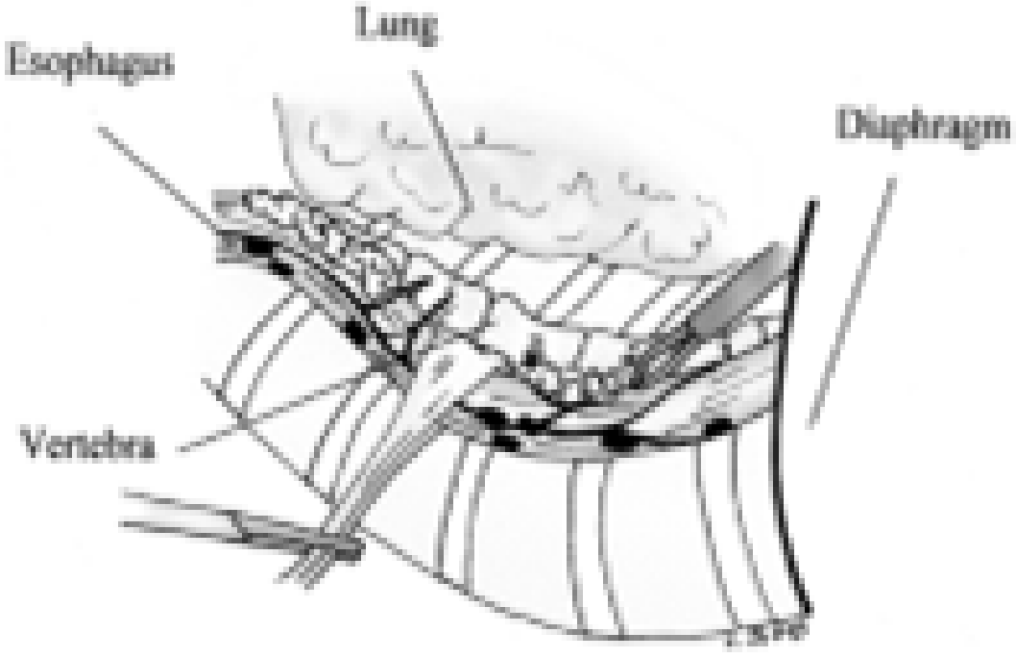


Fig. 14. Thorocoscopic view of Oesophagus

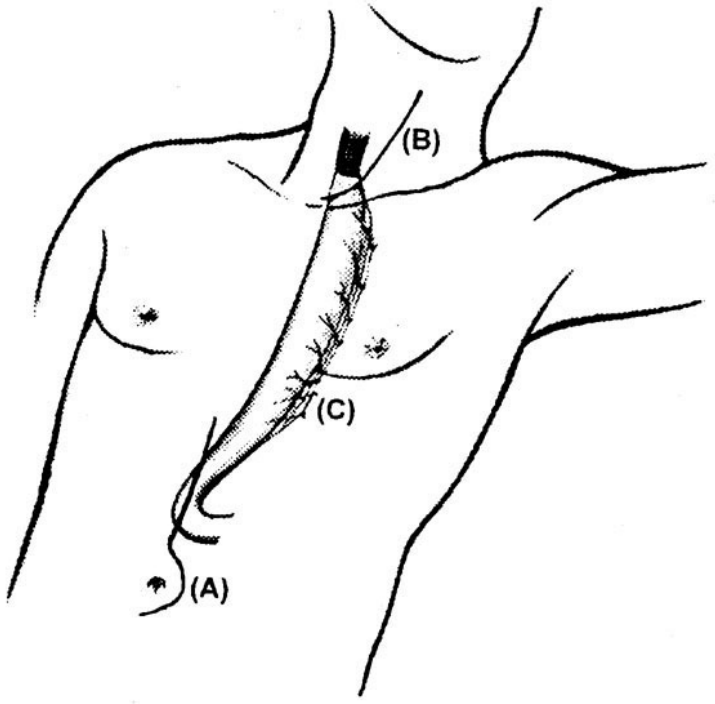


Fig. 15. Trans-hiatal surgery.

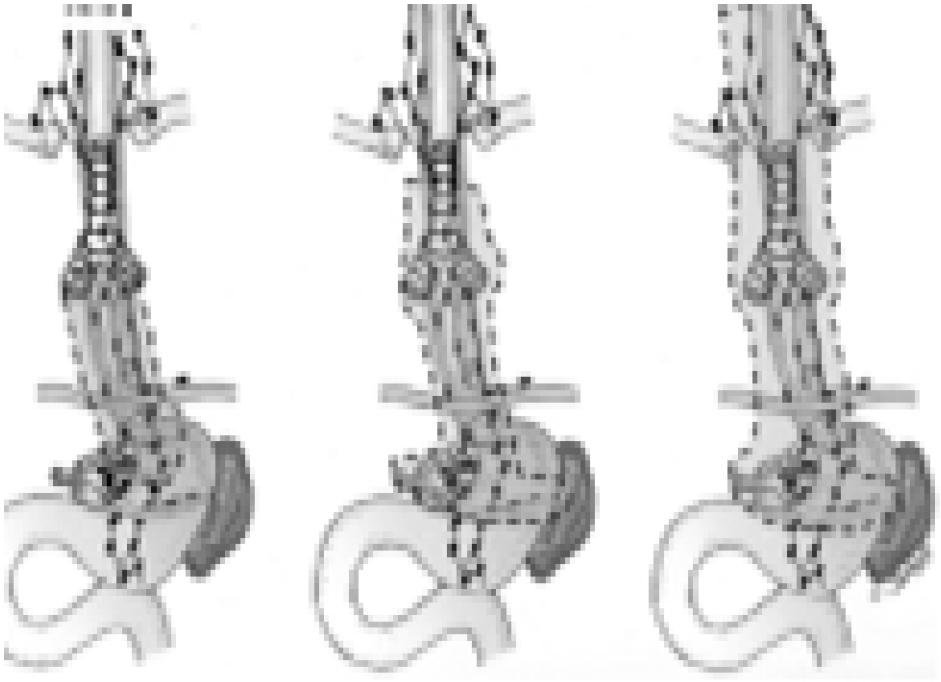


Fig -16 : Single / Two / Three – Field Lymphadenectomy

DISCUSSION

Selection of patients for surgery

Twenty seven patients were selected for radical intervention based on the stage and spread of the tumour and the general and specific medical fitness of the patient. A specialist surgeon cancer team in discussion with the patient and his/her family made treatment decisions. Patients for whom radical intervention is inappropriate (T4 tumours) may be best treated in local cancer units. However, the specialist surgeon cancer team supervises in developing an appropriate care plan for these patients . Combination therapy considered for T2 tumours. Similarly patients with only middle and lower one third oesophageal cancer were only included into the study.

Choice of operative approach

The histological tumour type, its location, and extent of the proposed lymphadenectomy determine the operative approach. Adequate mediastinal lymphadenectomy is done in SCC and extended to the abdomen in junctional ACA. We did not perform transhiatal oesophagectomy for SCC in lower one-third oesophageal cancers.. Since left thoracoabdominal approach is limited

proximally by the aortic arch which may compromise the proximal limit of resection, tumours which lie at the level of the arch are difficult to deal with from the left side and this approach was avoided when the tumour lies at this level or higher. The most widely practised approach is the two phase Lewis-Tanner, with a

preliminary laparotomy and construction of a gastric tube and a right thoracotomy to excise the tumour and perform an oesophagogastric anastomosis at the apex of the mediastinum. A third cervical phase was added in the case of proximally situated tumours in order to achieve the requisite degree of longitudinal clearance.

All operations were done with particular attention to the local tumour to minimise the risk of local recurrence and permit an adequate lymphadenectomy, which will reduce the risk of staging error. The extent to which lymphadenectomy per se minimises the risk of symptomatic local recurrence is not known, but there is evidence that more thorough lymphadenectomy is associated with better survival . Longitudinal submucosal spread is characteristic of all types of oesophageal carcinoma. Proximal extent of resection should ideally be 10 cm above the macroscopic tumour and 5 cm distal to it, when the oesophagus is in its radiotherapy natural state. Hence SCC of the upper one third lesions were given adjuvant radiotherapy. ACA of the lower oesophagus commonly infiltrates the gastric cardia, fundus, and lesser curve. Some degree of gastric excision is essential to accomplish an adequate lymphadenectomy in the abdomen and this should be created in such a way as to obtain a minimum distance of 5 cm beyond the distal extent of the macroscopic tumour . Most of these patients do not die from symptomatic locoregional recurrence. Adequate radial margins clearance were

given and contiguous excision of the crura and diaphragm was considered, particularly for junctional tumours.

Standards of lymphadenectomy

The majority of patients who undergo surgery for either ACA or SCC of the oesophagus will have lymph node metastases. The principal aims of lymphadenectomy should be to minimise staging error, reduce locoregional risks of recurrence and, by increasing the number of patients undergoing an R0 resection, increase five year survival (R0 resection: complete macroscopic and microscopic clearance). In SCC, when a methodical approach to lymphadenectomy is applied, the numbers of lymph nodes involved are of prognostic significance as is the ratio of invaded to removed nodes. Although there is considerable enthusiasm for the performance of lymphadenectomy in three fields (abdomen, thorax, and neck) in Japan, this approach has not been adopted . Abdominal single field node dissection involves dissection of the right and left cardiac node, the nodes along the lesser curvature, left gastric, hepatic, and splenic artery territories. Two field dissection additionally embraces thoracic lymphadenectomy and includes the para-aortic nodes along with the thoracic duct, para-oesophageal nodes, right and left pulmonary hilar nodes, those at the tracheal bifurcation. Three field dissection extends the lymphadenectomy to the neck to clear the brachiocephalic, deep lateral, and external cervical nodes, and the deep anterior cervical nodes adjacent to the recurrent laryngeal nerve chains in the neck. A number of studies have shown that

two field lymphadenectomy can be carried out without any significant increase in operative morbidity or mortality. Conversely, although the three field operation is advocated in Japan for SCC, its benefits may simply reflect the reduction in staging error, as nearly a quarter of all Japanese patients will have cervical lymph node metastases. There is no evidence that three field lymphadenectomy improves survival in patients with ACA and it must be accepted that the operation is associated with a higher risk of postoperative morbidity.

Refer. Fig. 16. Single/Two/Three-field lymphadenectomy

Choice of conduit, route, and anastomosis

The commonest conduit is the stomach. The function of the intrathoracic stomach as an oesophageal replacement has been extensively studied. The necessary vagotomy can produce troublesome gastric paresis, hence we did pyloromyotomy. A prospective randomized trial suggested that the addition of a drainage procedure did not affect gastric emptying or clinical outcome although it was too small to reach statistical significance. Thus since the morbidity of pyloroplasty is small, its addition should be considered. Colon interposition is the next most suitable conduit when the stomach is not available. Again, functional performance has been studied in detail. Most surgeons favour a prevertebral route for reconstruction and this was shown to be superior to an anterior reconstruction in one randomised study although another small prospective randomised comparison with a retrosternal gastric tube

showed no differences in technical complications or functional outcome. The level at which the anastomosis is performed is the subject of continued debate. There are no randomised trials to compare subtotal oesophagectomy with anastomosis in the neck or oesophagogastrectomy with anastomosis in the superior mediastinum. Each has its proponents. Until and if such a trial is undertaken, the fundamental premise must be the presence of clear longitudinal resection margins and an acceptable morbidity and mortality.

Both retrospective and prospective studies comparing manual versus mechanical oesophagogastric anastomosis have shown no difference in leak rates or other complications. Fewer strictures occur with handsewn anastomoses particularly single layer anastomoses.

Postoperative management

Meticulous attention to the maintenance of fluid balance and respiratory care were essential in the immediate postoperative period. Pain control and pulmonary physiotherapy are crucial. Although some authors advocate the routine use of a feeding jejunostomy, there have been no prospective trials to examine its value. Nearly all cases we did feeding jejunostomy, taking consideration into the nutritional built of our population. Early mobilisation is important in the prevention of venous thrombosis and pulmonary embolism.

SUMMARY AND CONCLUSION

- Surgery was the only curative option for loco-regional disease (>20%) in western data & it is treatment of choice for T1 disease. In my study the loco regional control was 77% at 1 year and sugery can be considered as primary modality of treatment for disease up to T3 levels. But more number of patients and longer period of follow up in necessary to justifiy the results.
- Preoperative radiation had no role in western setup in the stages II , III, IVA disesase . In our study as there was 25 % local recurrence pre operative radiotherapy may have a role as many of surgeries were trans-hiatal and histologically many were SCC.(lymph node metastasis is more common in SCC than in ACA.
- Wherea as the comparison study of TTS and THS showed no conclusion in the available literature, in my study Trans thoracic oesophagectomy was the standard surgical procedure against which any other surgery is compared and although its mortality and morbidity are more than tran hiatal oesophagectomy , newer methods of reducing its morbidity and mortality can be safely adopted making it the best oncological procedure and TTS can be even adopted for middle third oesophageal cancer lesions .
- Average disease free survival was 15-18 months with 25% loco-regional control in the western data whereas with the loco-regional control of 77% in my study patients can be expected to live longer .

- Taking consideration in tho the fact that SCC are more common in india in the middle third of oesophagus and lymph node metastasis are common TTS can be considered as the best oncological surgery with extensive two – field lymphadenectomy exposure.

REFERENCES

1. Brown LM, Devesa SS. Epidemiologic trends in esophageal and gastric cancer in the United States. Surg Oncol Clin N Am 2012;11:235.
2. Brown LM, Devesa SS, Fraumeni JF. Epidemiology of esophageal cancer. In: Posner M, Vokes EE, Weichselbaum RR, eds. Cancer of the upper gastrointestinal tract. Hamilton, Ontario, Canada: BC Decker, 2012:1.
3. Ries LAG EM, Kososy CL, et al. Cancer statistics review SEER 1973â€“1998, 2011.
4. Jemal A, Murray T, Samuels A, et al. Cancer statistics, 2003. CA Cancer J Clin 2008;53:5.
5. Schottenfeld D. Epidemiology of cancer of the esophagus. Semin Oncol 1984;11:92.
6. Brown LM, Hoover R, Silverman D, et al. Excess incidence of squamous cell esophageal cancer among US Black men: role of social class and other risk factors. Am J Epidemiol 2011;153:114.
7. Kabat GC, Ng SK, Wynder EL. Tobacco, alcohol intake, and diet in relation to adenocarcinoma of the esophagus and gastric cardia. Cancer Causes Control 1993;4:123.

8. Gammon MD, Schoenberg JB, Ahsan H, et al. Tobacco, alcohol, and socioeconomic status and adenocarcinomas of the esophagus and gastric cardia. J Natl Cancer Inst 1997;89:1277.
9. Castellsague X, Munoz N, De Stefani E, et al. Independent and joint effects of tobacco smoking and alcohol drinking on the risk of esophageal cancer in men and women. Int J Cancer 1999;82:657.
10. Castellsague X, Munoz N, De Stefani E, et al. Smoking and drinking cessation and risk of esophageal cancer (Spain). Cancer Causes Control 2000;11:813.
11. Yu MC, Garabrant DH, Peters JM, et al. Tobacco, alcohol, diet, occupation, and carcinoma of the esophagus. Cancer Res 1988;48:3843.
12. Munoz N, Day NE. Esophageal cancer. In: Schottenfeld D, Fraumeni JF, eds. Cancer epidemiology and prevention, 2nd ed. New York: Oxford University Press, 1996:681.
13. Castellsague X, Munoz N, De Stefani E, et al. Influence of mate drinking, hot beverages and diet on esophageal cancer risk in South America. Int J Cancer 2010;88:658.

14. Gorey K, Vena JE. Cancer differentials among US blacks and whites: quantitative estimates of socioeconomic-related risks. J Natl Med Assoc 1994;86:209.
15. National Center for Health Statistics. Health, United States 2000, with adolescent health chart book. Hyattsville, MD: NCHS, 2000.
16. Vaughan TL, Davis S, Kristal A, et al. Obesity, alcohol, and tobacco as risk factors for cancers of the esophagus and gastric cardia: adenocarcinoma versus squamous cell carcinoma. Cancer Epidemiol Biomarkers Prev 1995;4:85.
17. Brown LM, Swanson CA, Gridley G, et al. Adenocarcinoma of the esophagus: role of obesity and diet. J Natl Cancer Inst 1995;87:104.
18. Chow WH, Blot WJ, Vaughan TL, et al. Body mass index and risk of adenocarcinomas of the esophagus and gastric cardia. J Natl Cancer Inst 1998;90:150.
19. Lagergren J, Bergstrom R, Lindgren A, et al. Symptomatic gastroesophageal reflux as a risk factor for esophageal adenocarcinoma. New Engl J Med 1999;340:825.

20. Chow WH, Finkle WD, McLaughlin JK, et al. The relation of gastroesophageal reflux disease and its treatment to adenocarcinomas of the esophagus and gastric cardia. JAMA 1995;274:474.
21. Chow WH, Blaser MJ, Blot WJ, et al. An inverse relation between cagA+ strains of Helicobacter pylori infection and risk of esophageal and gastric cardia adenocarcinoma. Cancer Res 1998;58:588.
22. Cameron AJ. Management of Barrett's esophagus. Mayo Clin Proc 1998;73:457.
23. Spechler SJ. Clinical practice. Barrett's esophagus. N Engl J Med 2002;346:836.
24. SSampliner RE. Updated guidelines for the diagnosis, surveillance, and therapy of Barrett's esophagus. Am J Gastroenterol 2002;97:1888.
25. Cameron AJ, Ott BJ, Payne WS, The incidence of adenocarcinoma in columnar-lined (Barrett's) esophagus. N Engl J Med 1985;313:857.
26. Drewitz DJ, Sampliner RE, Garewal HS. The incidence of adenocarcinoma in Barrett's esophagus: a prospective study of 170 patients followed 4.8 years. Am J Gastroenterol 1997;92:212.

27. O'Connor JB, Falk GW, Richter JE. The incidence of adenocarcinoma and dysplasia in Barrett's esophagus: report on the Cleveland Clinic Barrett's Esophagus Registry. Am J Gastroenterol 1999;94:2037.
28. Spechler SJ, Lee E, Ahnen D, et al. Long-term outcome of medical and surgical therapies for gastroesophageal reflux disease: follow-up of a randomized controlled trial. JAMA 2001;285:2331.
29. Shaheen NJ, Crosby MA, Bozymski EM, et al. Is there publication bias in the reporting of cancer risk in Barrett's esophagus? Gastroenterology 2000;119:333.
30. Rudolph RE, Vaughan TL, Storer BE, et al. Effect of segment length on risk for neoplastic progression in patients with Barrett esophagus. Ann Intern Med 2000;132:612.
31. Hagen JA, DeMeester SR, Peters JH, et al. Curative resection for esophageal adenocarcinoma. Analysis of 100 en bloc esophagectomies. Ann Surg 2001;234:520.
32. Altorki NK, Girardi L, Skinner DB. En bloc esophagectomy improves survival for stage III esophageal cancer. J Thorac Cardiovasc Surg 1997;114:948.

33. Akiyama H, Tsurumaru M, Udagawa H, et al. Radical lymph node dissection for cancer of the thoracic esophagus. Ann Surg 1994;220:364.
34. Altorki N, Kent M, Ferrara C, et al. Three-field lymph node dissection for squamous cell and adenocarcinoma of the esophagus. Ann Surg 2002;236:177.
35. Sons HU. Esophageal cancer: autopsy findings in 171 cases. Arch Pathol Lab Med 1984;108:983.
36. Anderson LL, Lad TE. Autopsy findings in squamous-cell carcinoma of the esophagus. Cancer 1982;50:1587.
37. Mandard A, Tourneux, J, Gignoux, M, et al. In situ carcinoma of the esophagus. Macroscopic study with particular reference to the Lugol test. Endoscopy 1980;12:51.
38. Mandard AM, Marnay J, Gignoux M, et al. Cancer of the esophagus and associated lesions: detailed pathologic study of 100 esophagectomy specimens. Hum Pathol 1984;15:660.
39. Begin LR. The pathobiology of esophageal cancer in thoracic oncology. In: Roth JA, Ruckdeschel JC, Weisenburger TH, eds. Philadelphia: WB Saunders, 1995:288.

40. Steiger Z, Wilson RF, Leichman L, et al. Primary adenocarcinoma of the esophagus. J Surg Oncol 1987;36:68.
41. Haggitt RC, Tryzelaar J, Ellis FH, et al. Adenocarcinoma complicating columnar epithelium-lined (Barrett's) esophagus. Am J Clin Pathol 1978;70:1.
42. Altorki NK, Skinner DB. Occult cervical nodal metastasis in esophageal cancer: preliminary results of three-field lymphadenectomy. J Thorac Cardiovasc Surg 1997;113:540.
43. Lerut T, De Leyn P, Coosemans W, et al. Surgical strategies in esophageal carcinoma with emphasis on radical lymphadenectomy. Ann Surg 1992;216:583.
44. Caldwell CB, Bains MS, Burt M. Unusual malignant neoplasms of the esophagus. Oat cell carcinoma, melanoma, and sarcoma. J Thorac Cardiovasc Surg 1991;101:100.
45. Osamura RY, Shimamura K, Hata J, et al. Polypoid carcinoma of the esophagus. A unifying term for â€œcarcinosarcomaâ€□ and â€œpseudosarcoma.â€□ Am J Surg Pathol 1978;2:201.

46. Matsusaka T, Watanabe H, Enjoji M. Pseudosarcoma and carcinosarcoma of the esophagus. Cancer 1976;37:1546.
47. Sweeney EC, Cooney T. Adenoid cystic carcinoma of the esophagus: a light and electron microscopic study. Cancer 1980;45:1516.
48. Burt M. Unusual malignancies. Esophageal surgery. In: Pearson F, Deslauriers J, Ginsberg RJ, et al., eds. New York: Churchill Livingstone, 1995.
49. Lea JW, Prager RL, Bender HW Jr. The questionable role of computed tomography in preoperative staging of esophageal cancer. Ann Thorac Surg 1984;38:479.
50. Quint LE, Glazer GM, Orringer MB. Esophageal imaging by MR and CT: study of normal anatomy and neoplasms. Radiology 1985;156:727.
51. Watt I, Stewart I, Anderson D, et al. Laparoscopy, ultrasound and computed tomography in cancer of the oesophagus and gastric cardia: a prospective comparison for detecting intra-abdominal metastases. Br J Surg 1989;76:1036.

52. Becker CD, Barbier P, Porcellini B. CT evaluation of patients undergoing transhiatal esophagectomy for cancer. J Comput Assist Tomogr 1986;10:607.
53. Vilgrain V, Mompoint D, Palazzo L, et al. Staging of esophageal carcinoma: comparison of results with endoscopic sonography and CT. AJR Am J Roentgenol 1990;155:277.
54. Picus D, Balfe DM, Koehler RE, et al. Computed tomography in the staging of esophageal carcinoma. Radiology 1983;146:433.
55. Yoon YC, Lee KS, Shim YM, et al. Metastasis to regional lymph nodes in patients with esophageal squamous cell carcinoma: CT versus FDG PET for presurgical detection prospective study. Radiology 2003;227:764.
56. Romagnuolo J, Scott J, Hawes RH, et al. Helical CT versus EUS with fine needle aspiration for celiac nodal assessment in patients with esophageal cancer. Gastrointest Endosc 2002;55:648.
57. Rosch T, Endosonographic staging of esophageal cancer: a review of literature results. Gastrointest Endosc Clin N Am 1995;5:537.

58. Vazquez-Sequeiros E, Norton ID, Clain JE, et al. Impact of EUS-guided fine-needle aspiration on lymph node staging in patients with esophageal carcinoma. Gastrointest Endosc 2001;53:751.
59. O'Toole D, Palazzo L, Arotcarena R, et al. Assessment of complications of EUS-guided fine-needle aspiration. Gastrointest Endosc 2001;53:470.
60. Chak A, Canto M, Gerdes H, et al. Prognosis of esophageal cancers preoperatively staged to be locally invasive (T4) by endoscopic ultrasound (EUS): a multicenter retrospective cohort study. Gastrointest Endosc 1995;42:501.
61. Fockens P, Kisman K, Merkus MP, et al. The prognosis of esophageal carcinoma staged irresectable (T4) by endosonography. J Am Coll Surg 1998;186:17.
62. Souquet JC, Napoleon B, Pujol B, et al. Endoscopic ultrasonography in the preoperative staging of esophageal cancer. Endoscopy 1994;26:764.
63. Yoshikane H, Tsukamoto Y, Niwa Y, et al. Superficial esophageal carcinoma: evaluation by endoscopic ultrasonography. Am J Gastroenterol 1994;89:702.

64. McLoughlin RF, Cooperberg PL, Mathieson JR, et al. High resolution endoluminal ultrasonography in the staging of esophageal carcinoma. J Ultrasound Med 1995;14:725.

65. Heitmiller RF, Redmond M, Hamilton SR. Barrett's esophagus with high-grade dysplasia. An indication for prophylactic esophagectomy. Ann Surg 1996;224:66.

66. Falk GW, Rice TW, Goldblum JR, et al. Jumbo biopsy forceps protocol still misses unsuspected cancer in Barrett's esophagus with high-grade dysplasia. Gastrointest Endosc 1999;49:170.

67. Nigro JJ, Hagen JA, DeMeester TR, et al. Occult esophageal adenocarcinoma: extent of disease and implications for effective therapy. Ann Surg 1999;230:433.

68. Swanstrom LL, Hansen P. Laparoscopic total esophagectomy. Arch Surg 1997;132:943.

69. Luketich JD, Schauer PR, Christie NA, et al. Minimally invasive esophagectomy. Ann Thorac Surg 2000;70:906. P.905

70. Posner MC, Alverdy J. Hand-assisted laparoscopic surgery for cancer. Cancer J 2002;8:144.

71. Osugi H, Takemura M, Higashino M, et al. Video-assisted thoracoscopic esophagectomy and radical lymph node dissection for esophageal cancer. A series of 75 cases. Surg Endosc 2002;16:1588.
72. Swisher SG, Deford L, Merriman KW, et al. Effect of operative volume on morbidity, mortality, and hospital use after esophagectomy for cancer. J Thorac Cardiovasc Surg 2000;119:1126.
73. Begg CB, Cramer LD, Hoskins WJ, et al. Impact of hospital volume on operative mortality for major cancer surgery. JAMA 1998;280:1747.
74. Birkmeyer JD, Siewers AE, Finlayson EV, et al. Hospital volume and surgical mortality in the United States. N Engl J Med 2002;346:1128.
75. Dimick JB, Pronovost PJ, Cowan JA, et al. Surgical volume and quality of care for esophageal resection: do high-volume hospitals have fewer complications? Ann Thorac Surg 2003;75:337.
76. Fok M, Cheng SW, Wong J. Pyloroplasty versus no drainage in gastric replacement of the esophagus. Am J Surg 1991;162:447.
77. Urschel JD, Blewett CJ, Young JE, et al. Pyloric drainage (pyloroplasty) or no drainage in gastric reconstruction after esophagectomy: a meta-analysis of randomized controlled trials. Dig Surg 2002;19:160.

78. Bumm R, Feussner H, Bartels H, et al. Radical transhiatal esophagectomy with two-field lymphadenectomy and endodissection for distal esophageal adenocarcinoma. World J Surg 1997;21:822.
79. Orringer MB, Marshall B, Iannettoni MD. Transhiatal esophagectomy: clinical experience and refinements. Ann Surg 1999;230:392.
80. Gelfand GA, Finley RJ, Nelems B, et al. Transhiatal esophagectomy for carcinoma of the esophagus and cardia. Experience with 160 cases. Arch Surg 1992;127:1164.
81. Vigneswaran WT, Trastek VF, Pairolero PC, et al. Transhiatal esophagectomy for carcinoma of the esophagus. Ann Thorac Surg 1993;56:838.
82. Gertsch P, Vauthey JN, Lustenberger AA, et al. Long-term results of transhiatal esophagectomy for esophageal carcinoma. A multivariate analysis of prognostic factors. Cancer 1993;72:2312.
83. Bolton JS, Teng S. Transthoracic or transhiatal esophagectomy for cancer of the esophagusâ€"does it matter? Surg Oncol Clin N Am 2002;11:365.
84. Dudhat SB, Shinde SR. Transhiatal esophagectomy for squamous cell carcinoma of the esophagus. Dis Esophagus 1998;11:226.

85. McKeown KC. Total three-stage oesophagectomy for cancer of the oesophagus. Br J Surg 1976;63:259.
86. Linden PA, Sugarbaker DJ. Section V: techniques of esophageal resection. Semin Thorac Cardiovasc Surg 2003;15:197.
87. Sharpe DA, Moghissi K. Resectional surgery in carcinoma of the oesophagus and cardia: what influences long-term survival? Eur J Cardiothorac Surg 1996;10:359.
88. Ellis FH Jr. Standard resection for cancer of the esophagus and cardia. Surg Oncol Clin N Am 1999;8:279.
89. Adam DJ, Craig SR, Sang CT, et al. Oesophagogastrectomy for carcinoma in patients under 50 years of age. J R Coll Surg Edinb 1996;41:371.
90. Wang LS, Huang MH, Huang BS, et al. Gastric substitution for resectable carcinoma of the esophagus: an analysis of 368 cases. Ann Thorac Surg 1992;53:289.
91. Lieberman MD, Shriver CD, Bleckner S, et al. Carcinoma of the esophagus. Prognostic significance of histologic type. J Thorac Cardiovasc Surg 1995;109:130.

92. Bosset JF, Gignoux M, Triboulet JP, et al. Chemoradiotherapy followed by surgery compared with surgery alone in squamous cell cancer of the esophagus. N Engl J Med 1997;337:161.
93. Rindani R, Martin CJ, Cox MR. Transhiatal versus Ivor-Lewis oesophagectomy: is there a difference? Aust N Z J Surg 1999;69:187.
94. Hulscher JB, Tijssen JG, Obertop H, et al. Transthoracic versus transhiatal resection for carcinoma of the esophagus: a meta-analysis. Ann Thorac Surg 2001;72:306.
95. Goldminc M, Maddern G, Le Prise E, et al. Oesophagectomy by a transhiatal approach or thoracotomy: a prospective randomized trial. Br J Surg 1993;80:367.
96. Jacobi CA, Zieren HU, Muller JM, et al. Surgical therapy of esophageal carcinoma: the influence of surgical approach and esophageal resection on cardiopulmonary function. Eur J Cardiothorac Surg 1997;11:32.
97. Chu KM, Law SY, Fok M, et al. A prospective randomized comparison of transhiatal and transthoracic resection for lower-third esophageal carcinoma. Am J Surg 1997;174:320.

98. Hulscher JB, van Sandick JW, de Boer AG, et al. Extended transthoracic resection compared with limited transhiatal resection for adenocarcinoma of the esophagus. N Engl J Med 2002;347:1662.

PROFORMA

1. **NAME:**
2. **AGE:**
3. **SEX:**
4. **Inpatient No.:**
5. **Unit /ward:**
6. **Chief Complaints:**
7. **O.G.D :**
8. **CT SCAN REPORT:**
9. **USG ABDOMEN:**
10. **HISTOLOGICAL TYPE:**
11. **SURGERY PERFORMED:**
12. **POST-OPERATIVE EVENTS:**
13. **ADJUVANT TREATMENT :**
14. **NEO-ADJUVANT TREATMENT:**
15. **FOLLOW-UP AFTER 4 WEEKS:**
16. **FOLLOW-UP AFTER 1 YEAR**:

17. MASTER CHART

S.No	NAME	AGE/SEX	Position of tumour in oesophagus	SURGERY	DEATH	BARIUM SWALLOW-UP 4 WKS	FOLLOW-UP 1 YR
1	Patinettampadi	40/M	M 1/3	THS		YES	YES
2	Subramaniam	53/M	M 1/3	THS		YES	YES
3	Thangaraj	57/M	L 1/3	Inoperable			
4	Panajavarnam	45/F	L 1/3	TTS		NO	YES
5	Athiyadevar	30/M	M 1/3	THS	DEAD		
6	Selvi	40/F	M 1/3	THS		YES	NO
7	Meena	49/F	M 1/3	THS		YES	YES
8	Gurusamy	62/M	L 1/3	Inoperable			-
9	Adampatela	45/M	L 1/3	TTS		NO	YES
10	Muthu	49/M	M 1/3	THS	DEAD		
11	Packiyalaxmi	56/F	L 1/3	TTS		YES	YES
12	Muharkali	60/M	M 1/3	THS		YES	YES
13	Bose	56/M	U 1/3	THS	DEAD		
14	Dhanasekaran	56/M	L 1/3	TTS		NO	NO
15	Alexandar	30/M	M 1/3	THS		YES	YES

16	Pungudi	51/M	M 1/3	THS		YES	NO
17	Gandi	42/M	L 1/3	TTS	DEAD		
18	Suseela	40/F	M 1/3	THS		YES	YES
19	Rajendran	57/M	U 1/3	Inoperable			-
20	Selvi	43/F	M 1/3	THS		YES	YES
21	Karupaih	42/M	L 1/3	TTS	DEAD		
22	Pandi	55/M	U 1/3	THS		YES	YES
23	Pandiammal	31/F	L 1/3	TTS		NO	YES
24	Alagu	62/F	U 1/3	Inoperable			-
25	Vellaisamy	60/M	M 1/3	THS		YES	YES
26	Puspam	42/F	L 1/3	TTS	DEAD		YES
27	Alagiri	73/M	U 1/3	Inoperable			