

**“Study of Presentation, Management and Outcome of
Esophageal Fistulas”**

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M.Ch BRANCH – VI

SURGICAL GASTROENTEROLOGY

ANDPROCTOLOGY



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CERTIFICATE

This is to certify that the dissertation titled “**Study of Presentation, Management and Outcome of Esophageal Fistulas**” submitted by **Dr. MADHUSUDHANAN J** appearing for **M.Ch. (Surgical Gastroenterology and Proctology)** degree examination in August 2013, is a bonafide record, of work done by him under my guidance and supervision in partial fulfillment of requirement of the Tamil Nadu Dr. M.G.R. Medical University, Chennai. I forward this to the Tamil Nadu Dr. M.G.R. Medical University, Chennai.

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DECLARATION

I solemnly declare that this dissertation titled “**Study of Presentation, Management and outcome of Esophageal Fistulas**” was prepared by me in the Department of Surgical Gastroenterology and Proctology, Center of Excellence for Upper Gastrointestinal Surgery, Madras Medical College & Rajiv Gandhi Government General Hospital, Chennai under the guidance And supervision of **Prof.S.M.Chandramohan**, M.Ch, FACS, Professor & Head of the Department of Surgical Gastroenterology and Proctology, Center of Excellence for Upper Gastrointestinal Surgery, Madras Medical College & Rajiv Gandhi Government General Hospital, Chennai. This dissertation is submitted to The Tamil Nadu Dr. MGR Medical University, Chennai in partial fulfillment of the university requirements for the award of the degree of M.Ch Surgical Gastroenterology and Proctology.

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INTRODUCTION

Esophageal fistulas are a major cause of morbidity and mortality necessitating complex clinical evaluation and decision making for optimal management. It is best treated in a specialty tertiary care setting by a multidisciplinary team approach. Etiology of esophageal fistulas is multifactorial and the presentation can vary from simple external cervical esophageal fistulas to complex tracheoesophageal fistulas and esophagopleurocutaneous fistulas.

Among patients with carcinoma esophagus, the development of airway-esophageal fistulas alters the natural history dramatically with rapid downhill course leading onto mortality in untreated cases.

In acquired non-malignant causes of airway-esophageal fistulas, the patients suffer from significant morbidity due to recurrent pulmonary sepsis.

These diseases are complex and mandates critical preoperative evaluation for optimal management. As we are tertiary surgical center for advanced gastrointestinal surgery, such difficult-to-manage patients are referred from all over the state. We ventured to collect the data of all these patients and analyze them in detail for better understanding of this uncommon disease.

AIM OF THE STUDY

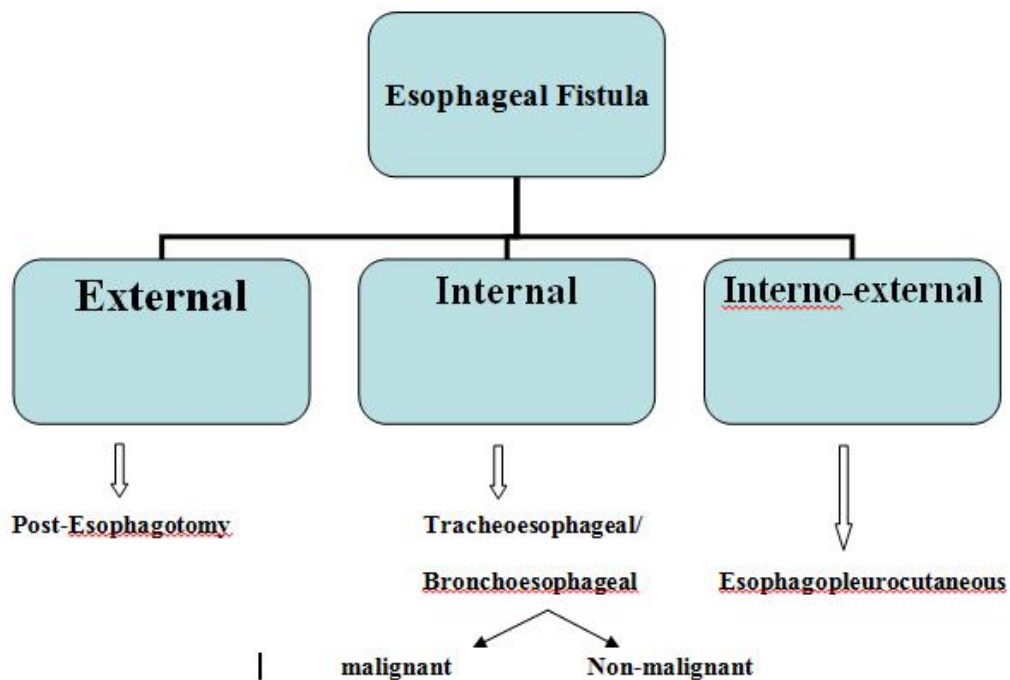
To study the various etiological factors and patterns of clinical presentation of esophageal fistulas.

To study the modes of evaluation and treatment of esophageal fistula.

To analyze the outcome of management of esophageal fistula patients

REVIEW OF LITERATURE

The term ‘fistula’ is an abnormal passage between a hollow or tubular organ and the body surface or between two hollow or tubular organs. Esophageal fistulas can be external, namely the esophagocutaneous fistulas, internal, esophagorespiratory fistulas or interno-external, the esophagopleurocutaneous fistulas. Esophagorespiratory fistula or airway-esophageal fistula represents any communication between the esophagus and the tracheobronchial tree.



Broadly, esophageal fistulas can be classified based on etiology into malignant and nonmalignant fistulas. In most of the existing literature,

tracheoesophageal or bronchoesophageal fistulas arising due to malignant etiology constitute majority of cases. Fistulas arising from other causes are included in 'nonmalignant' category for descriptive purposes. Also, in our department, we see only adult patients with esophageal fistulas and pediatric cases due to congenital TEF are excluded from our study.

Malignant Airway-Esophageal Fistulas

Malignancies resulting in fistula between tracheobronchial tree and esophagus are carcinoma esophagus, bronchogenic carcinoma, carcinoma larynx, tracheal carcinoma, mediastinal lymphoma, and other rare causes like erosion of metastatic nodes eroding into both organs.

Despite any etiology, the development of fistula is a life-threatening complication [1]. It is considered to be a thoracic oncological emergency. Irrespective of the stage of the cancer, patients developing this complication will succumb to this disease due to continuous flow of gastrointestinal secretions into the tracheobronchial tree resulting in unrelenting pulmonary sepsis. Hence, early institution of aggressive treatment is mandatory [2].

The site of fistula along the respiratory passage is tracheal, in more than 50% cases, bronchial in up to 40% cases and a very small number (6%) of patients will have esophagopulmonary fistulas.

It was observed that patients who have fistula in the right bronchus have poorer survival than patients with fistulisation into left bronchus. This is probably due to the fact that left bronchus is anatomically close to esophagus and for occurrence of right bronchial fistula; the disease has to be fairly large.

The incidence of malignant esophagorespiratory fistula is reported to be 4.5% for carcinoma esophagus and 0.3% for lung cancers. The pathogenesis may be due to direct tumor invasion of the tracheobronchial tree or it can occur as a complication of therapy like radiation, chemotherapy or stenting or a combination of these [8].

Clinical features

The patients' symptom is dominated by the presence of respiratory complaints due to aspiration of esophageal contents. The characteristic symptom of cough induced by swallow of oral liquids is pathognomonic and is called the Ono's sign. Patient can have purulent sputum and coughing out of ingested food can also occur. Patient can be debilitated due to loss of food intake, malignant cachexia and chronic pulmonary sepsis. Fever can also occur. On examination, patients have florid lung signs and appear extremely ill.

Diagnosis

The diagnosis of this condition is usually straightforward in a patient with characteristic symptom. However, similar symptoms can occur in patients who have aspiration due to disordered swallowing mechanisms which can coexist in these patients. Also, the near-total luminal occlusions by the tumor can preclude successful endoscopy and visualization of the fistula orifice. Autopsy studies revealed higher incidence of fistulas in patients with advanced cancer esophagus, thus suggesting that fistulas are more common in patients than is usually diagnosed [1].

Barium esophagogram is usually performed in patients suspected to have airway-esophageal fistula. It shows filling of barium in the tracheobronchial tree. In cases where barium is aspirated into the respiratory tract, it will be seen filling the larynx and the entire tracheobronchial tree, a finding which helps in differentiation from TEF. Of particular importance, it should be emphasized that gastrograffin or high osmolar oral contrast agents should not be used in suspicious cases of TEF. If these agents are aspirated in the respiratory tract, they result in pulmonary congestion and necrotizing pneumonitis which may be life threatening.

Contrast- enhanced Computerized Tomography scan (CE CT) of the neck, thorax with or without abdomen is done in most patients. The present day multislice CT with 3D reconstruction can provide us with exquisite images of the fistula, its relation to surrounding structures thereby aids in planning the stent deployment. It also gives information about the primary disease, its stage and degree of sepsis in lung parenchyma.

Management

Any treatment directed towards TEF should principally aim at cessation of spillage of esophageal contents into the respiratory passage. Also, many of these patients are dysphasic due to the presence of malignant stricture in the esophagus. Therefore the goal of treatment is largely palliative. This underlines the fact that management of these already moribund patients should cause minimal distress to them.

Surgical treatment of malignant TEF had been done in the past and ranged from en bloc resection of esophagus and lung to esophageal exclusion procedures. However, the morbidity and mortality of these patients were prohibitively high and therefore largely abandoned. Upper gastrointestinal endoscopy with deployment of esophageal and/or airway stents adequately achieves the therapeutic goals adding very little to the

morbidity and mortality. Hence, endotherapy is considered the first line treatment of this condition.

Stenting for Airway-esophageal fistulas

Before the advent of endoscopic metallic stent insertion, conventional esophageal prosthesis was used for stenting. Lux and Wilson initially reported the placement of Wilson-Cook prosthesis [3] and achieved satisfactory results. However, these conventional prosthesis are known to migrate distally especially in a dilated esophagus and also does not prevent food spilling around the edges of the device and entering the respiratory tree, so-called, 'funnel phenomenon'.

Covered self-expandable metallic stents were introduced in the mid-1990s and have shown to have low rates of migration, low incidence of occlusion due to tumor ingrowth and long term maintenance of adequate patency [18].

In patients with carcinoma esophagus without any fistula into the airway, 16 mm stents are usually deployed. In patients who have coexistent airway-esophageal fistula, 18 mm diameter stents are used.

Other endoscopic methods like instillation of tissue glue in a small fistula tract have been reported to achieve some success [4]. However, they have the disadvantage of occlusion of respiratory tree due to their sealing

effect. With the widespread use of metal stents, all other modalities have gone into disfavor. However, there is paucity of evidence and the net benefit is moderate in terms of morbidity and mortality in the endoscopic palliative management of malignant AEF.

Esophageal Metallic Stent Placement

Esophageal self-expanding metallic stent (SEMS) placement is demonstrated to have maximum therapeutic benefit in patients with TEF [6]. Stenting is associated with low procedure-related complication of 0–17% and mortality rate of 0–2%. [11]

Endoscopic placement of SEMS is technically successful in upto 87-91% of cases and also helps in symptom relief in more than 90% of cases [13].

Complications

Complications of stent placement include perforation when placed in the cervical regions of the esophagus, stridor due to compression of major airways and stent migration. Incomplete closure of the fistula caused by spillage of material through a gap between the proximal stent margin and the esophageal wall can occur and result in persistence of contamination of respiratory passage. This can be managed by glue injection to seal the gap or placement of additional stents [14].

Tracheal Stent Placement

The American College of Chest Physicians guidelines for palliative Care in these patients recommends stent insertion in both the

tracheobronchial tree and the esophagus for adequate symptomatic control [9]. However, the data to support such double stenting is sparse and few studies have found no additional advantage in terms of symptom relief, morbidity and mortality.

One specific situation in which if stenting in one system (usually the esophagus first) does not satisfactorily close the fistula, as demonstrated by dye study during endoscopy or persistence of symptoms, immediately stenting in the other system is indicated[19].

The site of fistula, extent of disease in the trachea and the amount of airway compromise determines the need and choice of tracheobronchial stent. This is best assessed by both bronchoscopy and CT scan of the chest. Generally, if the fistula tract is 2 cm above the level of carina, a self-expandable tracheal stenting is done. Also, usage of Montgomery T tube for similar situation is described as well. If the fistula orifice is at the carina or within 2 cm of carina, a Y stent is preferred.

Tracheal stenting is performed under general anesthesia using a rigid or flexible bronchoscope. The diameter of the prosthesis is based on the largest scope that can pass into the trachea. The length is determined according to the principle that it should be 1 cm longer than the fistula for adequate coverage [20].

In the event that necessitates dual prosthesis in the esophagus as well as the trachea, it is generally recommended that airway stenting is performed first to avoid airway luminal compromise from an expanding metallic stent in esophagus.

Furthermore, in these situations, it has been demonstrated that double stenting has better symptom control compared to single stenting [5].

Stents across GEJ

There may be few patients in this category who need stenting across the gastro esophageal junction because distal esophageal cancers cannot fistulise into the tracheobronchial tree as it ends anatomically well above. Stenting across the gastro esophageal junction (GEJ) has higher incidence of migration and gastro esophageal reflux as the lower esophageal sphincter is lost. Modifications in the make of stents like anti-reflux valve and partially covered stents are employed in this particular setting [7].

Surgical management of malignant airway-esophageal fistulas

Feeding gastrostomy/jejunostomy is considered to be the ultimate choice in treating these patients before the era of endoscopic stenting. It helps in providing nutrition for these patients suffering from dysphagia and to some extent palliates the respiratory infection. In the present day, its role

is very limited and even contraindicated. There are certain situations when stent is not available or not affordable by the patient during which this option is exercised. One study compared these feeding procedures with metal stents and found that stenting improves the patients' quality of life [10]. In another recent study by Choi et al [12], gastrostomy was performed in 20 of 52 patients (38%) of esophageal cancer patients with esophagorespiratory fistulas and compared with patients who undergo stenting. They found that there was no survival difference between the two groups.

There are reports of surgeries like esophageal exclusion, esophageal bypass, or fistula resection and repair for palliation of TEF. Esophageal exclusion included esophagostomy and gastrostomy with closure of the esophagus above and below the fistula site. Esophageal bypass with gastric, colonic, or jejuna interposition has been reported by others But these have very high procedure-related mortality (more than 50%) as these are major surgical undertaking in a patient who is very ill and has advanced malignancy.

In those select few patients who can tolerate the operation these reports favor esophageal bypass as the palliation of choice with a 30-day mortality of 25%. They can have a significantly prolonged survival compared with the supportive care group. Low et al compared the usage of

esophageal stents versus bypass operation and concluded that stents achieve satisfactory results with minimum impact on morbidity and low mortality [17]. It has to be emphasized that in the current era of esophageal and/or airway stents, the role of the above-mentioned surgical procedures is extremely limited.

Best Supportive Care

Supportive care includes intravenous fluids/ total parenteral nutrition, antibiotics for respiratory sepsis, enteral nutritional access by jejunostomy or gastrostomy or nasogastric tube with or without a tracheostomy. In a report from Memorial Sloan Kettering Cancer Center, two groups of patients (n=207) were compared, one receiving specific therapy for esophagorespiratory fistulas and the other group receiving only best supportive care[15]. The arm receiving specific fistula-directed therapy was found to have significant increase in survival compared to those in the supportive care arm. This was a report published in 1991 much before the widespread usage of SEMS.

Radiotherapy for Malignant TEF

Initially, malignant TEF was considered as an absolute contraindication for radiotherapy for the fear of exacerbation of fistula. Contrary to this belief, Yamada et al published their experience in

radiotherapy for malignant esophagorespiratory fistulas. In their report of 14 patients, two were long term survivors with one patient surviving more than 5 years. In 1993, Mayo clinic group reported their experience in using radiotherapy for 10 patients with malignant TEF and concluded that it can be safely administered in this group of patients. In their study, 60% of those patients died of metastatic disease rather than from TEF. Radiation induced soft-tissue swelling in the region of the fistula can result in either temporary closure or substantial narrowing, and therefore, decreased contamination of the respiratory tract.

Follow-up

A close follow-up of patients with esophagorespiratory fistulas is mandatory to identify recurrence of symptoms [21]. This may arise due to non-sealing of a fistula after stent placement or reopening of a fistula after initial sealing and has the potential to cause sudden death of the patient. It is always advisable to perform a barium esophagogram immediately after stenting. It ensures adequate closure of the fistula before starting orals. If still persistent leak into the airway is noted, oral feeds are withheld and barium swallow is repeated after 2-3 days. During this time, it is expected that further expansion of stent can seal off the tract. Also, it is worthwhile to generate a protocol of periodical barium studies during the follow-up period for early identification of recurrent aspiration.

Survival

The survival figures are dismal even after satisfactory palliation of fistula with a median survival ranging from 1 to 6 weeks and less than 5% 1- year survival rate. The most common cause of death in these patients is pulmonary sepsis rather than the advanced malignancy reiterating the fact that this is crucial turning-point in the natural history of cancer esophagus.

Acquired Nonmalignant Esophageal Fistulas

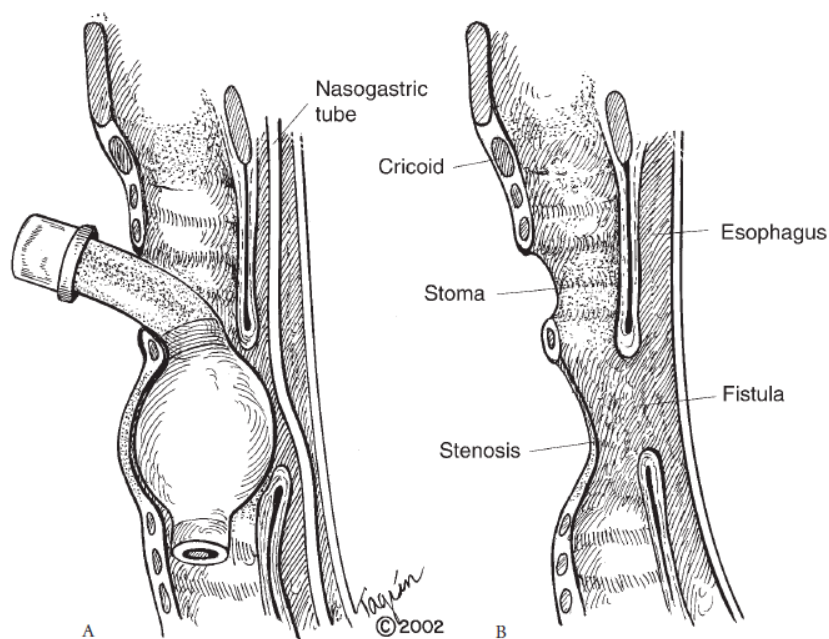
The most common causes of acquired nonmalignant esophageal fistulas are foreign bodies, granulomatous infection like tuberculosis, cuffed endotracheal tubes and traumatic causes like corrosive injury to the upper aerodigestive tract and iatrogenic trauma during surgery in the neck and thorax.

A particular trend was observed in the incidence of TEF related to endotracheal cuff injury. Until late 1960s, the largest series of acquired TEF and BEF patients did not contain single case related to endotracheal cuff trauma [22]. However, quite early in the next decade, a series by Thomas had reported 46 such cases[23].

Post Intubation Tracheoesophageal fistulas

A postintubation fistula occurs due to erosion of the membranous wall of the trachea and the adjacent esophageal wall. The cuff in the

endotracheal tube exerts pressure on the tracheal wall circumferentially and on the anterior wall of esophagus which is adherent to the trachea. The damage is accentuated when there is a nasogastric tube lying in the esophageal lumen. Many of these patients who were either on prolonged ventilator support or on long term tracheostomy tube will usually have a Ryle's tube in place for feeding. Over inflation of a large-volume cuff by even a small, added volume of air makes it into a high pressure cuff which can potentially erode the entire width of the membranous wall. These fistulas are generally large in size and are termed 'giant fistulas'. However these fistulas rarely have mediastinal leak/ sepsis since it progresses over period of time and does not occur acutely. Spontaneous healing of such fistulae never occurs and prevention is the best method to treat them. Usage of low-pressure, large-volume cuffs has reduced the incidence but still, the potential danger exists with prolonged intubation.



Clinical presentation

If tracheoesophageal fistula develops when the patient is on ventilator, sudden increase in secretions is noted coming out of the endotracheal tube which are esophageal contents. Also, it becomes increasingly difficult to maintain a seal with the cuff. This event is followed by appearance of pulmonary infiltrates in the dependent lung fields which soon becomes a patch of pneumonic consolidation. The patient eventually lands up in respiratory failure. Upon ventilation, air can be heard escaping into pharynx and abdomen can become distended as ventilator air enters the gastrointestinal tract. If the patient is on nasogastric tube feedings, these material can be seen entering the endotracheal tube.

Chest x-ray reveals pulmonary infiltrates and the esophagus may appear dilated distal to the fistula and the stomach may be filled with air. A bedside test can be performed by making the patient drink water stained with methylene blue which will be seen to appear in the tracheostomy. Nevertheless, aspiration of the swallowed water into the larynx and trachea can still produce the same results. Hence, this test should be carefully interpreted. In certain cases, the fistula may be visible directly through the tracheostomy orifice itself.

Bronchoscopy is the investigation of choice in patients suspected to have TEF. It can be performed through the endotracheal tube or the tracheostomy tube. The lengths of the fistula and of the normal airway are measured. A postintubation fistula usually lies a 1-2 cm below the level of a tracheostomy, since the fistula is located at the cuff site. Upper GI endoscopy can also be done to visualize the level and extent of the opening on the esophageal side

Tuberculous Tracheoesophageal fistulas

In fistulae due to granulomatous inflammation like tuberculosis, the size of the fistula is usually small as the pathology involves only the membranous portion of trachea[24].

Traumatic fistulae

Traumatic fistulae can be very large as it may be accompanied by mediastinal sepsis also. There may also be an element of tracheal ischemia due to surgical dissection in the vicinity [25]. Sometimes, expandable metal stents in trachea and esophagus can erode and cause TEF[26].

Other rare causes

Certain immunodeficiency states can produce necrotizing esophagitis leading onto tracheo- and bronchoesophageal fistulas with very high mortality rates [27]. This usually requires esophagectomy.

Management

Majority of these patients require surgical management. Adequate control of pulmonary and local sepsis is indispensable for good outcomes. Hence aggressive preoperative preparation is necessary.

The optimum surgical therapy is individualized based on the etiology and the patho-anatomy. Most of the fistulas can be approached by cervical incision. Only supracarinal and bronchoesophageal fistulas need a thoracotomy. It is usually a right thoracotomy for a tracheoesophageal fistula and the side of bronchus determines the side of thoracotomy.

Principles of surgical repair of the TEF were enunciated by Grillo and colleagues and it includes [30]

- a. Complete dissection of the fistula
- b. Division of the tract
- c. Tension-free Tracheal closure without air leak
- d. Two-layered esophageal closure.

It is generally advised to place a vascularized healthy tissue in between the tracheal closure and esophageal suture line to avoid recurrent fistulization. Usually strap muscle in the neck or intercostal muscle in the chest is used for this purpose.

Postsurgical fistulae are treated with respect to the location and size of the fistula, the presence or absence of necrosis in the trachea, mediastinitis, and the severity of symptoms. Treatment usually needs drainage with conservative management.

An attempt to close a *postintubation fistula* in a patient who is still on ventilator is met with failure in almost all cases. Prolonged ventilation after tracheal reconstruction results in dehiscence of suture line and recurrence of fistula. Hence, patients with postintubation TEF are initially managed conservatively and all the effort is directed towards weaning the patient from ventilator. After extubation, the patient is planned for definitive surgical repair. If a nasogastric tube is present, it is removed. The tracheostomy cuff is inflated with minimum pressure possible and sited below the fistula. A venting gastrostomy is created to avoid aspiration of gastric contents and a jejunostomy is placed for feeding. The gastrostomy also helps in keeping the stomach from becoming distended.

The patient is nursed in head-up position. Aggressive chest physiotherapy and other measures for pulmonary toileting are liberally utilized. These aforementioned measures are certainly helpful in most, if not all patients. Still, a small amount of saliva enters the respiratory passage which is amenable to tracheal suctioning. Esophageal diversion is

almost never necessary. Oftentimes, the fistula is located so close to the cricopharyngeus that exteriorized esophagostomy is impossible.

After weaning, surgical correction involves exposure of the tract, disconnection of the same, closure of the esophageal opening in layers, resection of the circumferentially damaged tracheal segment and its reconstruction using interrupted vicryl sutures. The transverse tracheal anastomotic suture line and the vertical esophageal suture line are usually at different levels, even then, it is always safer to use an interposition flap of viable vascularized tissue, which can be raised without any difficulty. In rare situations, tracheal defect may be too long to permit tracheal reanastomosis, the esophagus is closed nonetheless to eliminate the fistula and tracheal patency, and function is restored with a permanent T tube. If laryngotracheal stenosis is present, that is managed in the usual way with resection of the stenotic segment and reanastomosis. All these procedures are performed in a single stage.

Extubation

Early extubation following major tracheal surgery is a debatable issue. There are reports of routine early extubation and selective early extubation as well [28,29]. As the chance of reintubation is very high in certain groups of patients with decreased pulmonary function, high-grade

tracheal stenosis and tracheomalacia, these patients are better extubated after few days of postoperative ventilation.

Results

Three large series of patients with acquired benign TEF , comprising a total of 78 cases was summarized by Darteville and Macchiarini [31]. It showed performance of simple closure of fistula in 29, closure with tracheal resection in 44, and diversion in only 5 patients. Recurrences of TEF were at the rate of 6.4 to 8.3% and mortality was between 6.3 and 12.5% .The authors commented that definitive single stage repair is clearly superior over other types of surgical repairs of varying complexity

Late presentation of Boerhaave's syndrome – Esophagopleurocutaneous fistula

Esophageal barotrauma or Boerhaave's syndrome can have acute, sub-acute, and chronic presentation. Acute perforation presents with symptoms within twenty-four hours after rupture [32]. In sub-acute perforation, symptoms develop between twenty four hours to two weeks following perforation. With chronic perforation, the onset of symptoms is more insidious, often delaying presentation and diagnosis for weeks to months after rupture. Often this group of patients has ICD tube inserted usually on the left side which will be found to drain ingested food

when the patients resumes oral intake. These patients are managed conservatively until the sepsis in the pleural cavity resolves. Oral feeds are eliminated and enteral nutrition through a nasojejunal tube is instituted. Once the patient recovers, which usually takes 4-6 weeks, they are taken up for surgical management. A left or right thoracotomy is done depending on the site of perforation. Usually the perforation is too large to allow primary closure and hence that segment of esophagus bearing the perforation is resected and gastrointestinal continuity is established by esophagogastric anastomosis [33].

MATERIALS AND METHODS

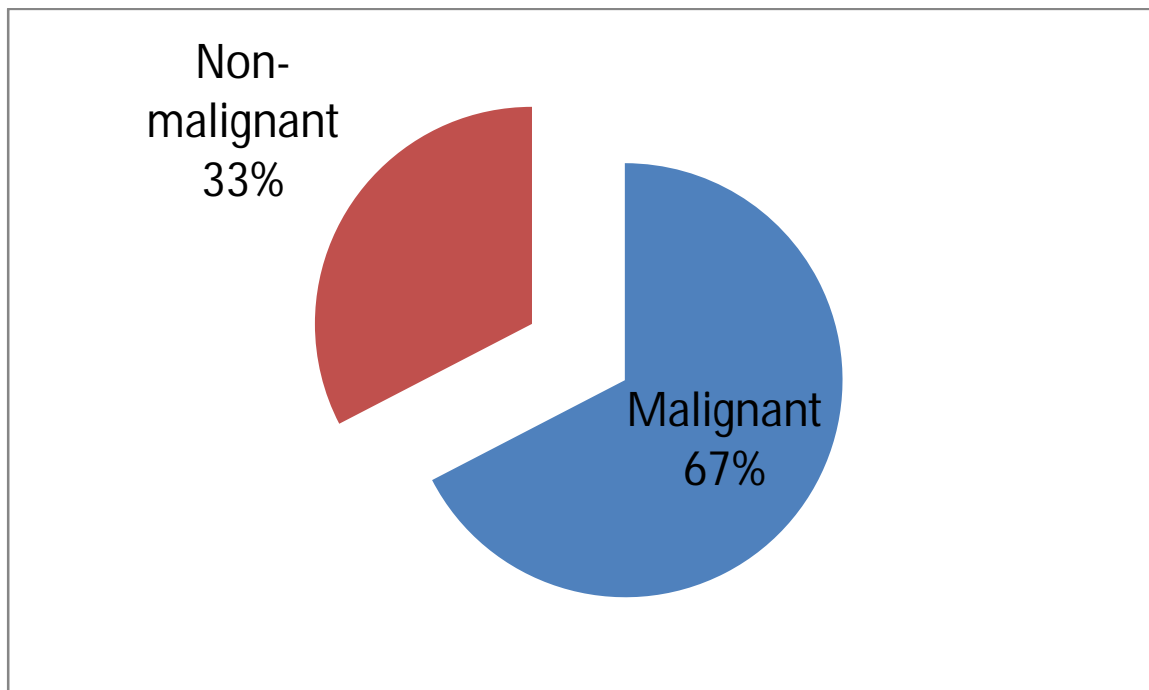
All patients diagnosed with esophageal fistulas during the study period from August 2010 to February 2013 were included in the study. The patients' demographic data including Name, Age, Sex, place of origin and occupation were documented. An accurate history taking was done and recorded systematically. They were examined in detail and findings tabulated. Each patient's clinical course was closely monitored and recorded. The etiology of the fistula, the investigative modalities undergone by the patient and treatment offered to each patient was noted. As part of the study, no special treatment was offered to the patient. Each patient's natural course in the hospital is observed and analyzed.

In general, patients with malignant tracheoesophageal fistula were taken up for endoscopic esophageal stent placement. Before stent placement, the site of the tracheoesophageal fistula (TEF) was assessed by upper gastrointestinal endoscopy which is performed with topical lidocaine spray. A guide wire was inserted through the endoscope and under fluoroscopic guidance, it is passed distal to the tumor and the site of the fistula and a covered metallic stent was placed. In the event of unavailability of stents, they were offered other treatment.

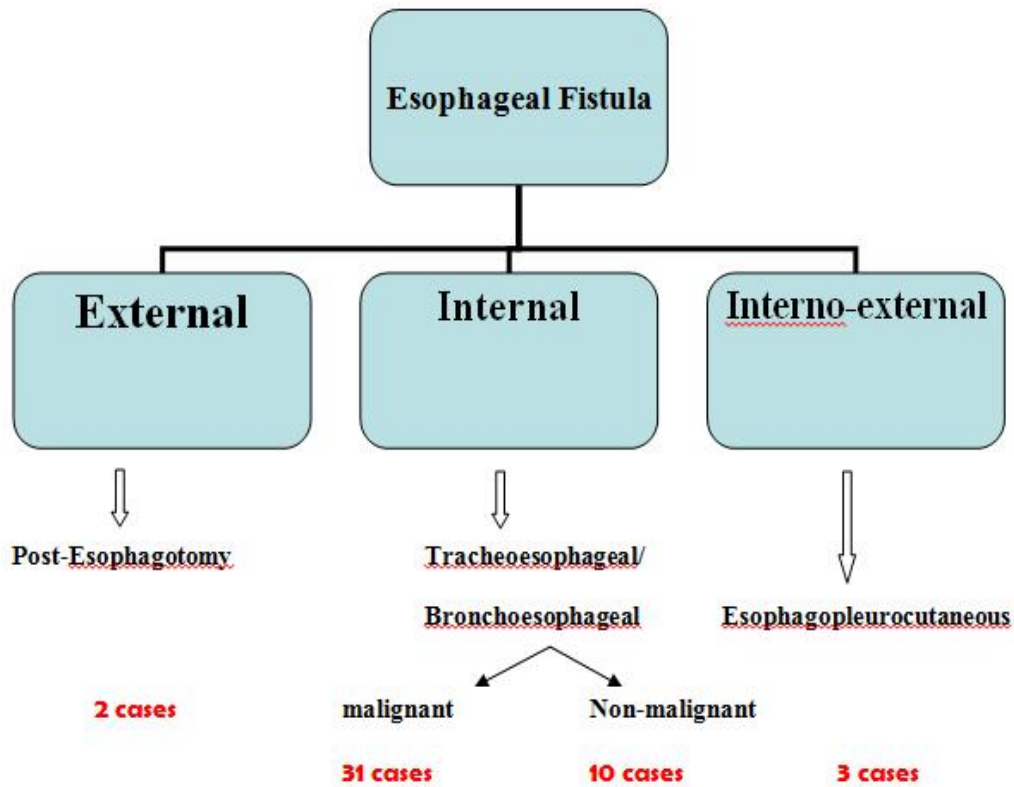
For patients with acquired nonmalignant fistulas, each patient was individually assessed and treatment decisions taken by multidisciplinary team.

RESULTS

A total of 46 patients with esophageal fistula were included in the study. Among the 46 patients, there were 31 patients who had tracheoesophageal fistula due to malignancy and the other 15 patients were due to non-malignant etiologies.



We have classified the esophageal fistula patients we have encountered into three types, viz, External, Internal and Interno-external types depending on whether the esophagus communicates with cutaneous surface, with tracheobronchial tree or external communication through the pleural cavity. The classification system and number of cases we have seen in each category is illustrated in the figure below.



Malignant Tracheoesophageal fistula

The cause of malignant tracheoesophageal fistula was carcinoma esophagus in all 31 cases. Of note, we have not encountered any cases of bronchogenic carcinoma or tracheal malignancy resulting in malignancy. All esophageal cancer patients were histopathologically squamous cell carcinomas. None of the 31 patients were diagnosed with esophageal adenocarcinoma,

ETIOLOGY(All tabulations in this manuscript has number of patients in the right column)

Carcinoma esophagus	31
Bronchogenic carcinoma	0
Tracheal neoplasm	0
Mediastinal lymphoma	0
Others	0

Among patients with carcinoma esophagus who developed fistulisation into the airway, 18 patients had received no treatment previously and their mode of presentation was dysphagia for a short period with new onset cough, especially after water intake. However, 13 patients had been diagnosed with malignancy and had taken some form of treatment including chemotherapy, radiotherapy or both.

PREVIOUS THERAPY

None	18
Radiotherapy only	5
Chemotherapy only	3
Both chemo and radiotherapy	5

EXAMINATION

Performance Status	
1-2	12
3-4	19
Nutritional status	
Good	3
Moderate	8
Poor	20
Pallor	21
Pedal Edema	5
Supraclavicular lymphadenopathy	7

The performance status of patients as assessed by ECOG score (European Cooperative Oncology Group score) were good (1-2) in 12 patients. However, a significant number of patients (19/31) were having poor performance status: confined to bed majority of the time and not able to carry our activities of daily living without help.

Nutritionally, 20 of 31 patients were poor and only 11/31 patients were well-nourished or moderately nourished. One third of patients (21/31) were pale clinically and 5 patients had bilateral pitting pedal edema. Seven of 31 patients had supraclavicular lymphadenopathy, mostly in the left side.

All the patients were subjected to upper gastrointestinal endoscopy. The location of fistula was in the middle third of esophagus in almost all patients (22/31 patients). In the remaining 9 cases, the exact location of fistula was not made out as the growth was occupying the entire lumen not admitting the passage of endoscope. In patients in whom the fistula site was visualized, it was less than 1 cm in 12 patients and large (> 1cm) in 3 patients. However, due to the presence of stenosing ulceroproliferative growth, the size of the fistula was not assessed in 16 cases.

Endoscopic biopsy was done in 18/ 31 cases and proven to be squamous cell carcinomas, while the other 11 patients had biopsy-proven disease already.

FINDINGS ON UGIE

Site of fistula	
Upper third	0
Middle third	26
Lower third	0
Not identifiable	5
Size of the fistula	
<1cm	12
>1cm	3
Not assessed	16
Growth Negotiable	22
Biopsy if any	24

RESPIRATORY SYSTEM

Aspiration	
Right	10
Left	2
Pneumonia - consolidation	7
Lung abscess	2
Pleural effusion	1
Lung metastasis	4

As respiratory system is most commonly affected by the presence of airway-esophageal fistula, we tended to document the findings on chest roentgenogram more diligently. We found features of aspiration pneumonia (fleeting infiltrates in the dependent portions of the lung fields, namely the superior segments of the lower lobes and posterior segments of the upper lobe, usually on the right side due to straighter course of the bronchus) in 12/31 cases. Also, features of consolidation were found in 7 patients. In two patients, a well-defined lung abscess cavity with air-fluid level was seen tracking down from the fistula orifice. In 4 out of 31 cases, there were coin lesions in both lung fields, suggesting metastasis.

BRONCHOSCOPIC FINDINGS

Respiratory location of the fistula	
Above Carina	18
Below Carina	6
Not known	4
Growth seen at the level of fistula	18
Size of the fistula	
<1cm	19
>1cm	4

Twenty eight out of 31 were subjected to fiber-optic bronchoscopy. The other 3 patients were too sick to be shifted to bronchoscopy room. Among them, the opening of the fistula in the airway tract was above the carina in 18 patients and in the right or left bronchus in 6 patients. During the procedure, the site of fistula could not be definitely assessed in 4 patients due to pooling-up of large quantity of esophageal secretions or patient's intolerance during the study. In 18 patients, growth was seen at the fistula, a few with associated bullous edema. However, no attempt at biopsy was done, as many of them had proven malignancy. The size of the fistula was small (<1 cm) in 19 patients and larger than 1 cm in 4 patients.

TREATMENT OFFERED

Esophageal metallic stent	14
Airway stenting	0
Feeding gastrostomy	1
Feeding jejunostomy	7
Best supportive care	3
Surgery	0
Radiotherapy	4
Chemotherapy	2

The treatment offered was esophageal stenting using self-expanding metal stent (SEMS) in 14 patients. In 8 patients, feeding procedure in the form of gastrostomy or jejunostomy was done. Three patients were too sick for any form of treatment and hence were advised best supportive care which included iv fluids, head end elevation, respiratory physiotherapy, bronchodilators and antibiotics. Four patients in whom fistula was small and the lung sepsis was minimal, radiotherapy was offered primarily and two similar patients received chemotherapy only. Of note, none were offered surgery for malignant tracheoesophageal fistula in the form of resection or bypass or exclusion procedures.

CLINICAL OUTCOMES IN PATIENTS UNDERGOING ENDOSCOPIC STENTING

Technical success	86%
Clinical Success	94%
Mean dysphagia score before stenting	3.4
Mean dysphagia score after stenting	1.8

Among patients undergoing esophageal stenting, the technical success rate was 86% (all but one patient could be successfully stented in one or two attempts). A majority of patients (94%) had clinical relief of dysphagia suggested by improvement in the dysphagia scores before and after stenting from 3.4 to 1.8.

STENT PLACEMENT – PROCEDURE RELATED COMPLICATIONS

Pain	2
Perforation	0
Bleeding	1
Aspiration	4
Migration	2

A few patients had complications related to placement of esophageal SEMS. Two out of 14 patients had chest pain following the procedure. No cases of perforation were documented. One patient had mild bleeding from

the tumor during the expansion of the stent which settled spontaneously. Four patients had exacerbation of respiratory signs in the immediate post-procedural period with their chest roentgenograms showing infiltrates suggestive of aspiration. Two patients had distal migration of stent and it was found lying free in the stomach. No specific therapy was done for the same and they were conservatively managed.

TREATMENT AFTER STENTING

Chemotherapy	2
Radiotherapy	1
Both	5
Best supportive care	5

Following stenting, 8 out of 14 patients were further sent for chemotherapy, radiotherapy or both. Five patients were too ill to undergo any specific therapy and were offered only supportive care.

CAUSE OF DEATH

Pulmonary sepsis	4
Bleeding	0
cachexia	1

Among 31 patients with malignant esophagorespiratory fistulas, we had encountered 5 in-hospital deaths, four of them were due to uncontrollable pulmonary sepsis and the other patient died of cancer-related cachexia.

FOLLOW –UP

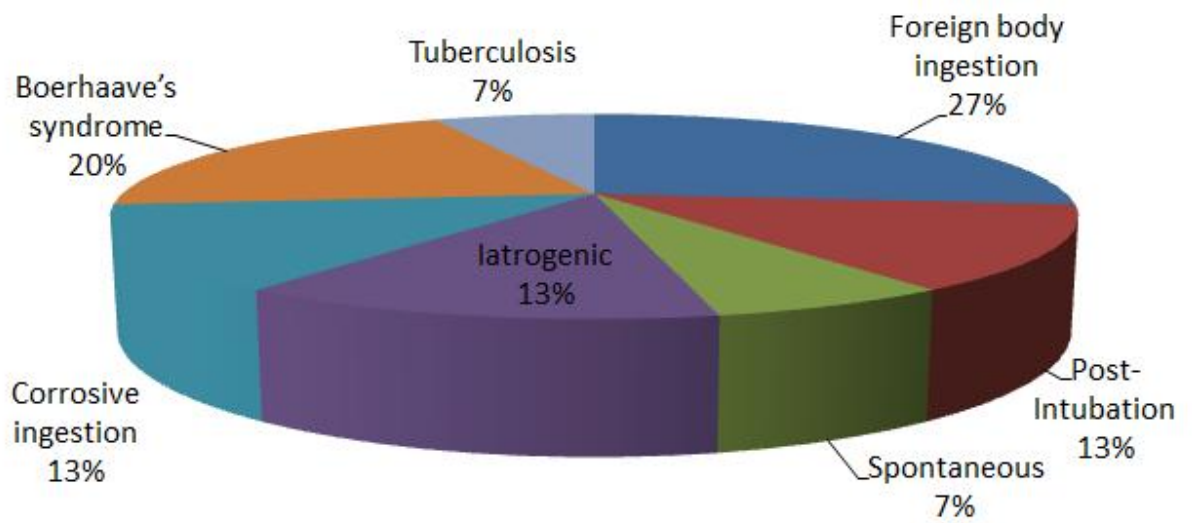
Improvement in dysphagia	13
Control of respiratory infection	4

Upon follow-up, we could note a sustained improvement of dysphagia in 13 patients and good control of respiratory infection in 4 patients.

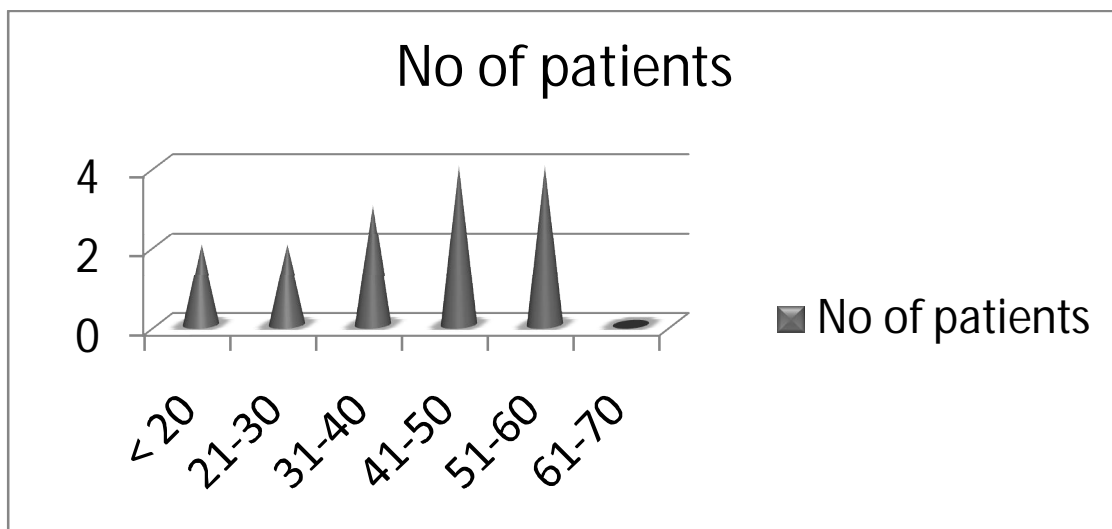
Non-malignant Esophageal fistulas

We had 15 patients with non-malignant esophageal fistulas. The most common etiologies were foreign body ingestion and delayed presentation of Boerhaave’s syndrome in the form of esophagopleurocutaneous fistula. Other less common etiologies were listed in the table given below.

Foreign body ingestion	4
Post-Intubation	2
Spontaneous	1
Iatrogenic	2
Corrosive ingestion	2
Boerhaave’s syndrome	3
Tuberculosis	1

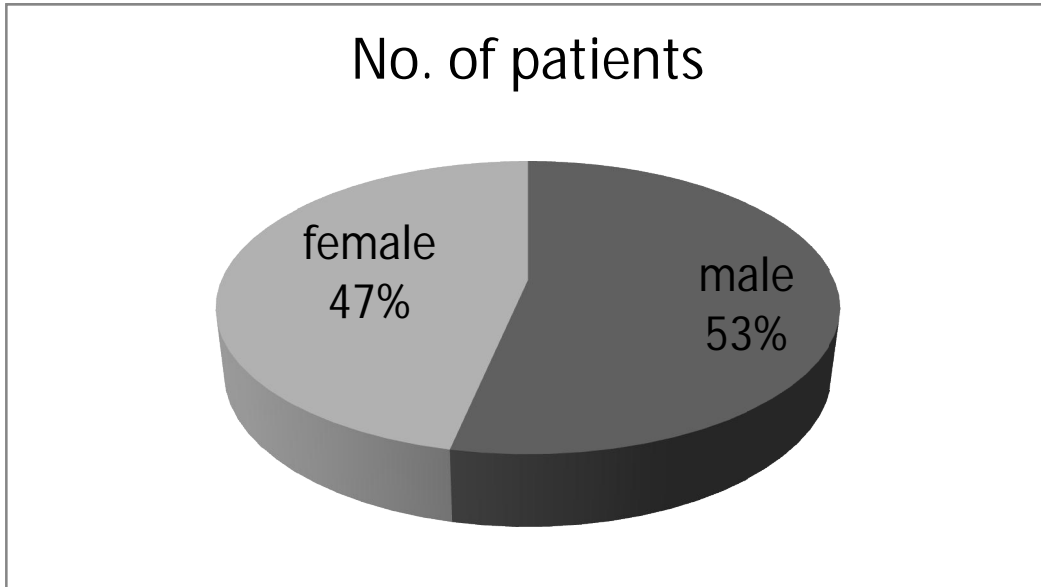


DEMOGRAPHICS



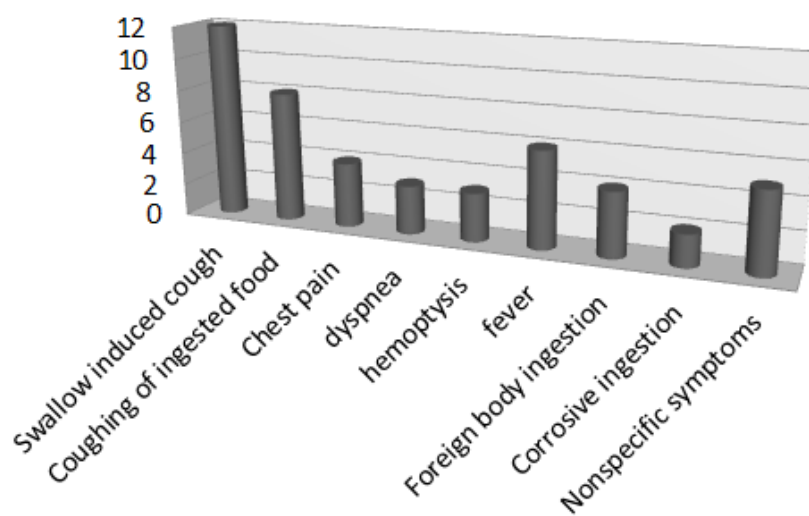
The age distribution of cases of esophageal fistulas in each age group was shown. Of particular mention, patients with foreign body

ingestion and post-intubation TEF were in the 2nd and 3rd decade of life and patients with Boerhaave's syndrome were in 5th and 6th decade of life.



There is almost equal distribution of cases gender-wise with 53% males and 47% females.

SYMPTOMATOLOGY



A majority of patients had the typical swallow-induced cough (12 out of 15 cases), the so-called Ono's sign. Eight patients had complained of coughing of ingested food. Four patients had chest pain. Two patients had dyspnea and hemoptysis. Four patients had reported history of foreign body ingestion and two patients had suicidal ingestion of corrosive liquid (toilet cleaning acid).

CLINICAL EXAMINATION FINDINGS

Built and nourishment	
Mild- Moderate	10
Poor	5
Performance status	
1-2	12
3-4	3
Pallor	3
Pedal edema	1
Tracheostomy	3
Feeding tube in abdomen	4
ICD tube	3

On examination, 5 out of 15 patients were poorly nourished and among them 3 patients were in poor performance status (ECOG scores 3-4). In this group of patients, 3 had tracheostomy tube in situ, 4 had feeding tubes and 3 patients had intercostal drainage tubes in place.

PULMONARY PROBLEMS

Aspiration pneumonia	8
Lung abscess	1
Pulmonary tuberculosis	1
asthma	1
COPD	3
Pleural effusion	3
Consolidation	2
Sudden aspiration and death	1

Respiratory system had the maximum impact due to the presence of fistula with features of aspiration pneumonia seen in 8 of 15 patients. One patient had a abscess cavity. In one patient, the fistula was due to pulmonary tuberculosis. Three patients with delayed presentation of Boerhaave's syndrome had pleural effusion with ICD tube draining it. One patient had succumbed to sudden aspiration of acidic gastric contents (Mendelson syndrome). He was intubated instantly and connected to mechanical ventilator support but could not be salvaged.

WHICH INVESTIGATION ESTABLISHED THE DIAGNOSIS

Barium swallow	5
Upper GI endoscopy	2
Bronchoscopy	2
Gastrograffin swallow	1
CT Chest	5

We made an analysis of which particular upper aerodigestive investigative modality established the diagnosis and found that in most of the patients (10 out of 15 patients) imaging in the form of barium esophagogram or contrast enhanced computed tomography (CECT) of the neck and thorax pinned down the diagnosis. Upper GI endoscopy and Bronchoscopy were employed for the diagnosis in 4 patients.

DIAGNOSIS PLACE

Our department	7
Other department	4
Outside hospital	4

Another observation we liked to analyses was the place of diagnosis of the esophagorespiratory fistula. Seven out of 15 patients were diagnosed in our department and 4 patients each were either diagnosed in other departments in our hospital or referred with the diagnosis from outside hospitals.

FINDINGS ON CHEST X RAY

Visualized foreign body	2
consolidation	6
Pleural effusion	4
Calcified lymphnodes	1

The findings on chest X-rays were recorded among these patients and 6 out of 15 patients had consolidation. Two patients had foreign body visualized on the CXR film. Of particular note, two other patients with foreign body ingestion did not have a radiopaque shadow on the chest film. Four patients had pleural effusion and the patient with tuberculous TEF had calcified hilar lymph nodes.

UPPER GI SCOPY FINDINGS

Level of opening	
Upper third	7
Middle third	5
Lower third	3
Size of the fistula opening	
<1cm	9
>1cm	6
Air escaping through tracheostomy on insufflation	4
Corrosive induced changes	2

All patients were subjected to upper gastrointestinal endoscopy in our department. The site of fistulous opening was in the upper third of the esophagus in 7 of 15 patients and middle third in 5 patients. In those patients with delayed presentation of barotrauma, the fistulous opening was seen in the distal third of esophagus. The size of the opening was less than 1 cm in 9 patients and more than 1 cm in 6 patients. In those patients who had tracheostomy in place, we could observe air that was insufflated on endoscopy escaping through the stoma. In patients with corrosive induced tracheoesophageal fistula, the esophageal mucosal cicatrices were observed.

BRONCHOSCOPIC FINDINGS

Granulation tissue	3
Visualization of fistula orifice	8
ulceration	2
Endobronchial mass	1
Luminal narrowing	3
Site of fistula on tracheobronchial side	
Trachea	7
bronchus	2

Similarly, all of our non-malignant airway-esophageal fistula patients underwent fiberoptic bronchoscopy. Among 15 patients, fistula orifice was observed in 8 patients. The site of fistula was in the trachea in 7

patients and in the bronchus in 2 patients. In those patients who had trachea-esophageal fistula following prolonged intubation, there was associated stenosis of tracheal lumen, especially in the subglottic region.

BARIUM SWALLOW FINDINGS

Foreign body	3
Esophageal stricture (corrosive)	2
Aspiration into tracheobronchial tree	3
Abscess cavities in lung	1

Barium swallows revealed foreign body in 3 patients. Esophageal stricture was seen in patients who had corrosive ingestion. Three patients showed aspiration into the tracheobronchial tree with abscess cavity in lung in a single patient.

FINDINGS ON CT IMAGING

Thickening of esophageal wall	6
Hilar lymphadenopathy	1
Fistula	7
Pleural effusion	5
Mediastinal collection	2
Lung consolidation	6
bronchiecctasis	2
bronchiolith	0

APPROACHES

Cervical incision	6
Sternotomy	0
Right thoracotomy	4
Left thorocotomy	1

Eleven patients out of 15 cases of non-malignant fistulas were treated surgically by various procedures. The approach to the fistula site was dictated by the level of opening on the esophageal and tracheal side. Overall, 6 patients had cervical approach, 4 patients had right thoracotomy and one patient had left thoracotomy approach. Of note, none of the patients had a sternotomy or abdominal exploration.

SURGERY

Excision of the tract	3
Interposition of vascularized tissue	2
Closure of the esophagus	2
Excision of trachea	2
Laryngeal resection	0
Laryngeal release	1
Tracheal anastomosis	1
Difficulty in exposure of the fistula	1
Need for tracheostomy	2
Esophagogastric anastomosis	3

The specific surgical procedure carried out was also a recorded. The tract was excised in three patients and sent for histopathology. The esophageal defect was closed in single or two layers using 3-0 or 4-0 polyglactin 910 (vicryl). The tracheal surgery was individualized. Tracheal resection was done in 2 patients who had subglottic stenosis due to endotracheal or tracheostomy cuff induced pressure necrosis. Tracheal anastomosis was done in interrupted fashion using 3-0 vicryl. For reducing tension at the tracheal anastomosis, laryngeal release was performed in one patient who had excision of 3 rings. After closure of both the tracheal and esophageal defects, vascularized tissue was interposed between the two. In the neck, strap muscle was used and in the chest, pericardium was used. For patients with Boerhaave's syndrome, resection of the esophagus containing the fistula site was done (i.e the lower third esophagus) with gastric tabularization and esophago-gastric anastomosis in chest. This was done using circular EEA stapler 25 mm (Ethicon, MA).

EXTUBATION AT THE END OF SURGERY

Immediate	6
Early	2
Delayed	3

OTHER PROCEDURES DURING SURGERY

Cervical esophagostomy	1
Gastrostomy	1
jejunostomy	6
ICD tube insertion	5

In one patient with foreign body impacted in the cervical esophagus, it was removed and a lateral cervical esophagostomy was done. Feeding procedure in the form of jejunostomy or gastrostomy was done in seven patients.

POSTOPERATIVE PERIOD

Failure of tracheal repair	2
Failure of esophageal repair	3
Aspiration pneumonia	4
Respiratory failure	1
Abdominal distension	1
chylothorax	0
Need for reintubation	1
Need for ICD insertion	1

Many patients who underwent surgical management of non-malignant esophageal fistulas had an eventful postoperative period. In two

patients who had tracheal repair, dehiscence with air leak was observed in the immediate postoperative period. Both patients were taken up for revision in the emergency operation theatre and tracheostomy was performed. Three patients had a trivial leak from the esophageal closure site resulting in cervical salivary fistula which settled with conservative management. Four patients had recurrent aspiration pneumonia progressing onto respiratory failure and necessitating endotracheal intubation. One patient had abdominal distension, possibly due to aerophagy or paralytic ileus. One patient developed pleural effusion which mandated insertion of thorocostomy tube.

MORTALITY CAUSES

Mediastinal sepsis	1
Tracheal dehiscence	1
Aspiration	1

There were three deaths among the non-malignant fistula group. One patient had tracheal dehiscence with respiratory failure. One patient with corrosive induced tracheoesophageal fistula had recurrent lower respiratory infection and succumbed to the same. Another patient died of mediastinal sepsis.

LENGTH OF HOSPITAL STAY

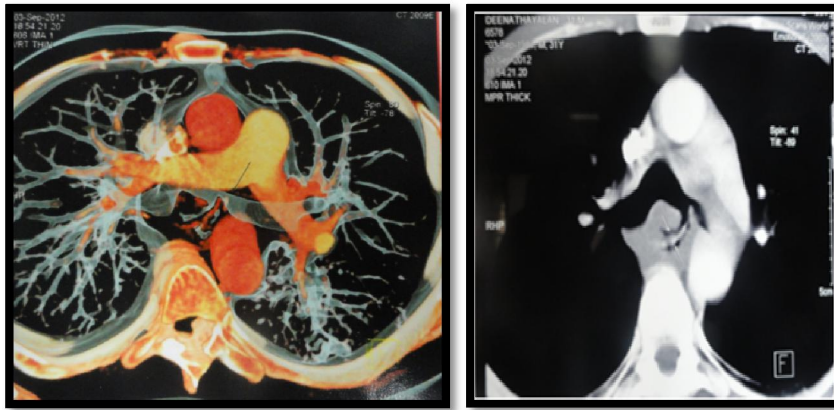
Median length of stay in hospital in preoperative period	12.7 days (range 8 to 76 days)
Median length of stay in ICU	4.1 days
Median length of stay in hospital in postoperative period	16.2days
Median length of stay in hospital (total)	33.8 days

FOLLOW-UP

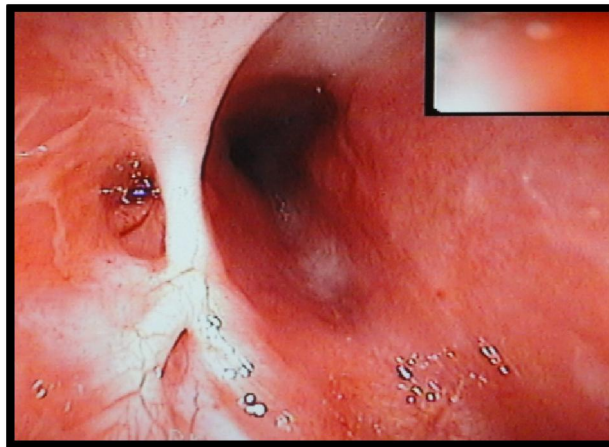
Recurrent TEF	1
Reoperation for TEF	0
Still on tracheostomy	1
Euphagic	7

Patients were followed up for a period of 7.1 months (range, 2 to 21 months). One patient had recurrent TEF and still on follow-up. Another patient who had tracheal anastomotic dehiscence was still on tracheostomy. Seven patients were euphagic and having normal respiratory function.

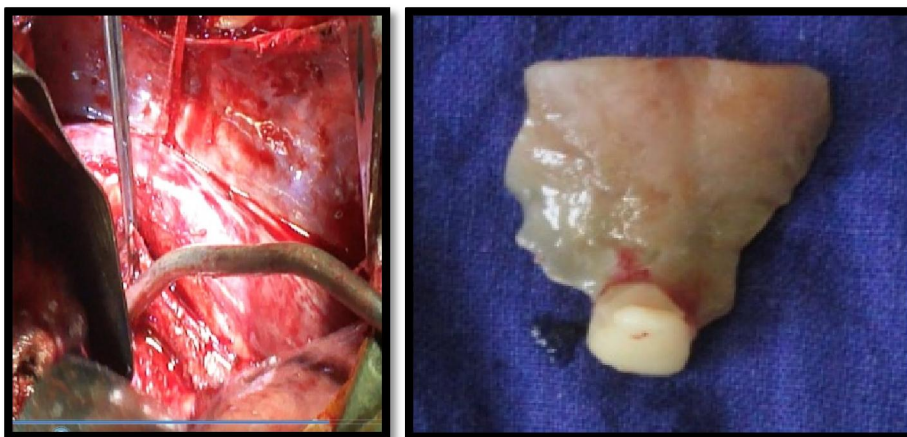
FOREIGN BODY INDUCED BRONCHOESOPHAGEAL FISTULA



CT Chest and Bronchogram – Showing left BEF

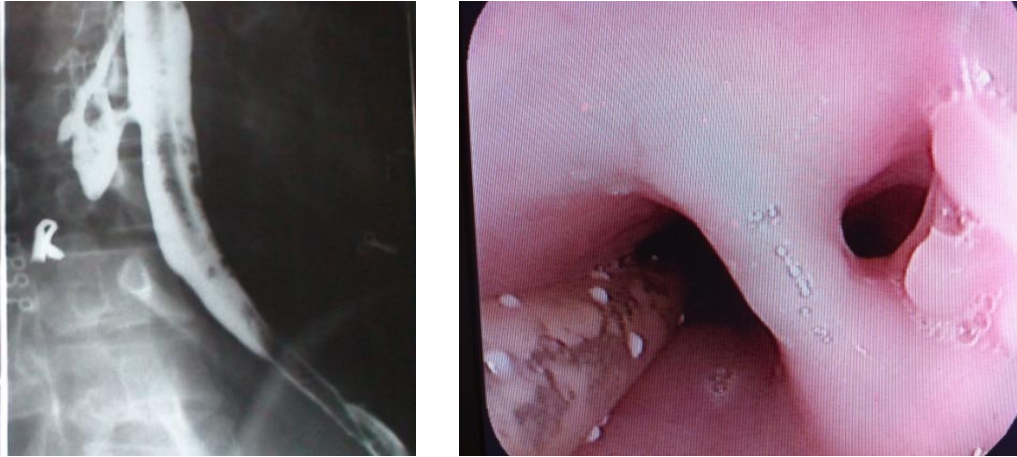


Endoscopic view showing opening in esophagus

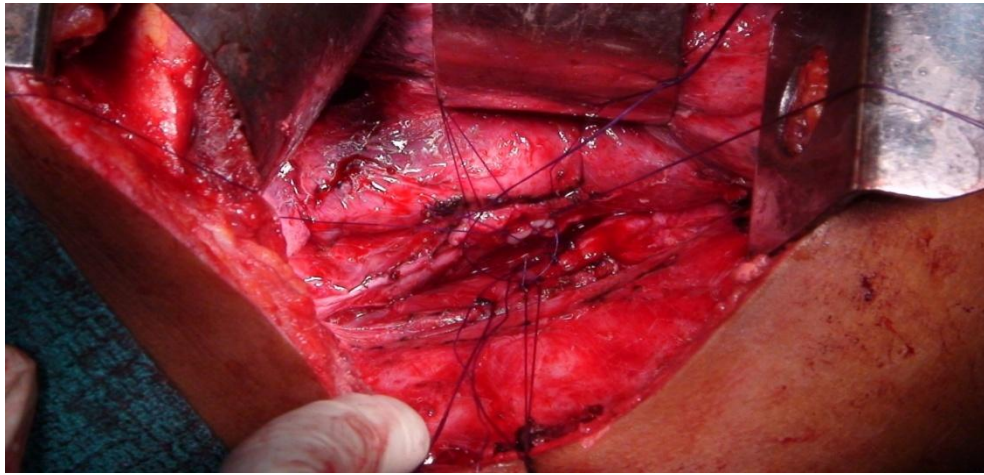


Intraoperative – encircled esophagus; removed denture

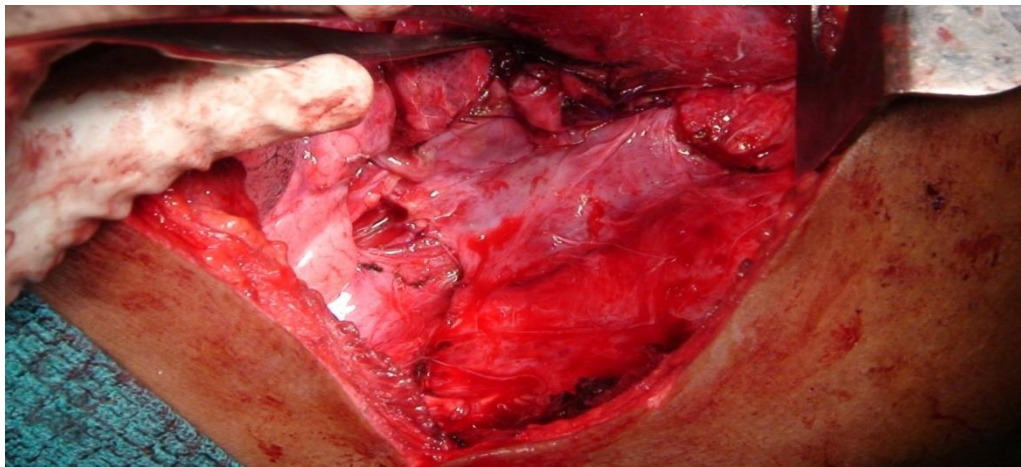
TUBERCULOUS TRACHEOESOPHAGEAL FISTULA



Barium swallow and UGI Scopy showing the fistula



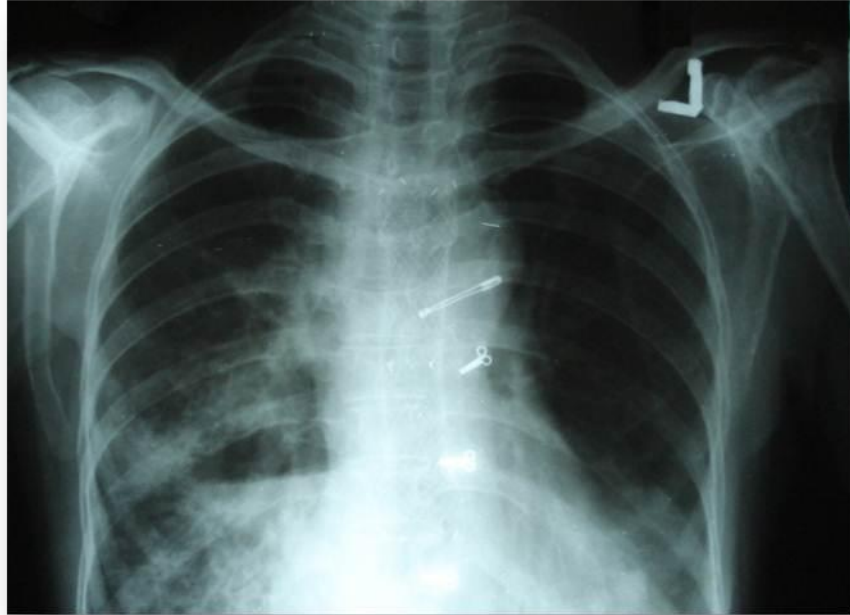
Repair of esophagus



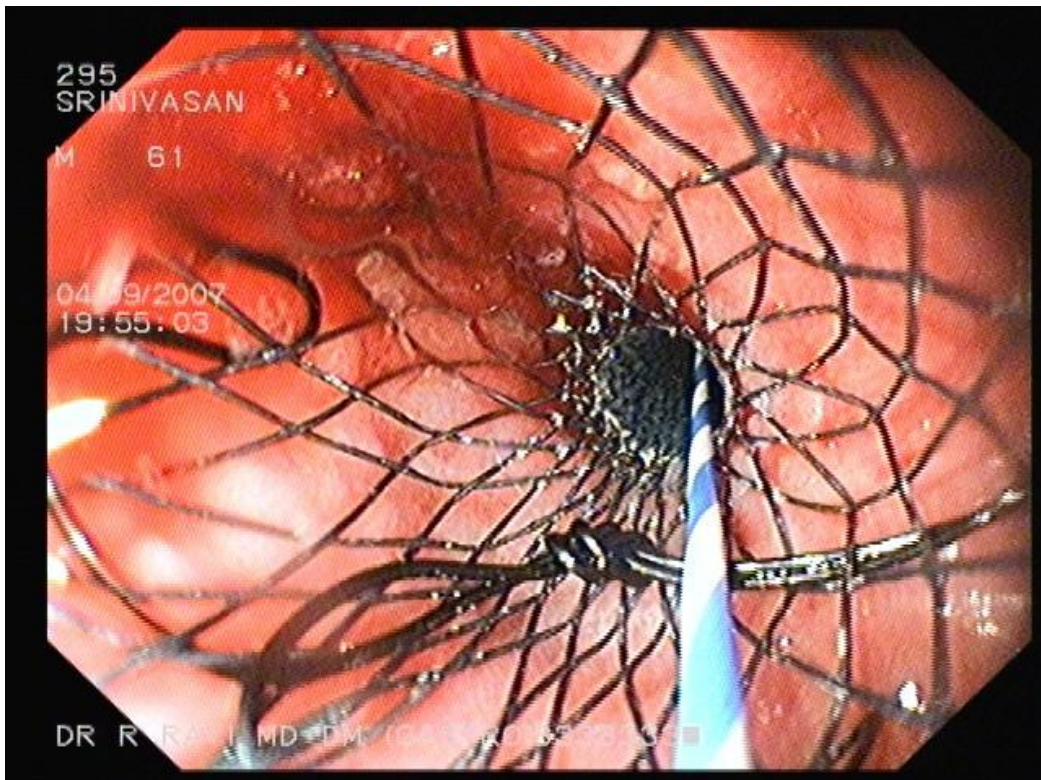
Pleural Patch between esophagus and trachea

MALIGNANT TEF – ENDOSCOPIC STENTING

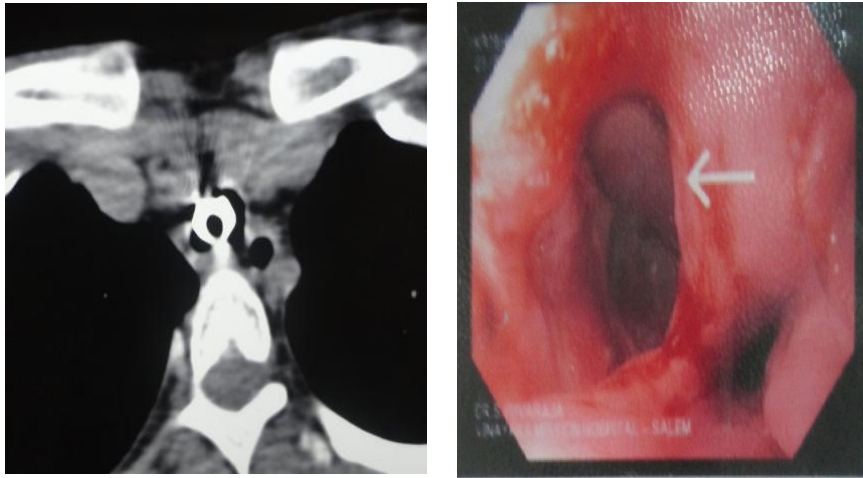
(also shows an abscess cavity in the right lower lung zone)



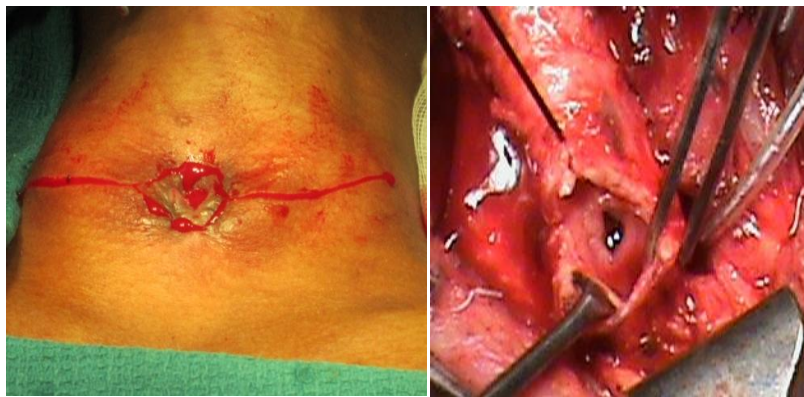
Endoscopic view of guidewire and SEMS



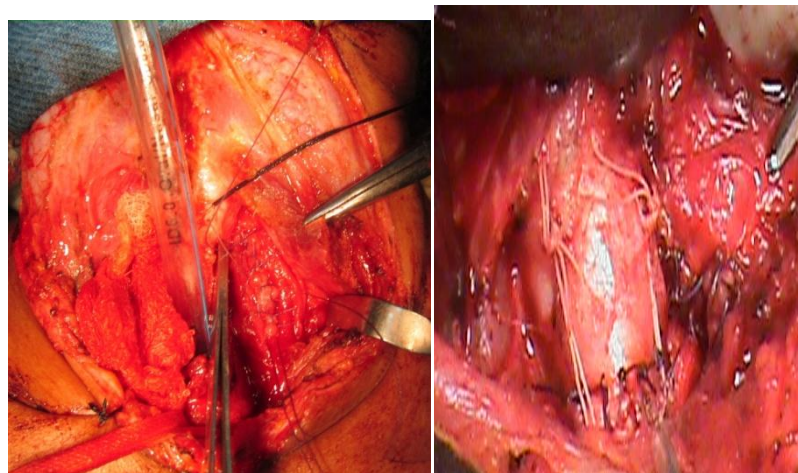
POSTINTUBATION TEF (2 patients)



CT AND ENDOSCOPIC VIEW (Note: tracheostomy tube in situ)



INCISION FISTULA OPENING SEEN THROUGH THE TRACHEA



REPAIR OF ESOPHAGUS AND TRACHEA

DISCUSSION

Esophageal fistulas are complex clinical problems encountered predominately in tertiary care centers. In our hospital, we encountered a total of 46 cases with airway-esophageal fistulas. Among them two-thirds were due to malignancy and one-third are acquired non-malignant causes. This is true even in Western literature as we can observe a majority of cases are due to malignancy. However, acquired causes are important treatable but clinically challenging situations requiring multidisciplinary team management.

Among the various cancers that can potentially cause airway-esophageal fistula, our records show only esophageal malignancy related fistulas in this group. This is probably attributed to the fact that, our department of surgical gastroenterology gets highly selected reference cases. Also, we have other departments of cardiothoracic surgery and medical oncology which admits cases of TEF due to other malignancies. These patients were not included in our study.

After accumulation of cases for our study, we embarked on a classification system for the group of patients we had analyzed. In our study, esophageal fistulas were classified into internal, external and interno-external. The 'internal' group comprises of fistulas between

esophagus and airway (either trachea or bronchi). The 'external' group consists of esophagocutaneous fistulas. And the interno-external type results from delayed presentation of esophageal barotrauma (Boerhaave's syndrome). In such situations, ICD tube is placed for pleural effusion and it starts to drain ingested material, thereby establishing an esophagopleurocutaneous fistula. As found in our study, the 'Internal' type consisted of both malignant and non-malignant fistulas, whereas the other two types were only acquired benign causes.

Among the patients with malignant TEF, 55% presented with fistula at the time of primary diagnosis. However, 45% patients had fistulisation following radiotherapy or chemotherapy or both. It is established in the literature that chemo radiotherapy for cancer esophagus can result in TEF, especially in locally advanced cases with tracheobronchial tree invasion.

One third of patients with malignant TEF was cachectic and had poor performance status. Also 22% patients had supraclavicular lymphadenopathy and hence, stage IV disease.

Because of the proximity of middle third esophagus to trachea, 83% of cases had the level of fistula in the midthoracic esophagus. We did not see any patient with cervical esophageal cancer fistulising into larynx or trachea. In the remaining 17% cases, the stricture's growth was not

permitting passage of endoscope to assess the level of fistula. However, we presume that it should be in mid thoracic esophagus.

The trickle of esophageal contents into the airway is a constant source of pulmonary sepsis as evidenced by our study that 61% cases had either signs of aspiration or pneumonia. We could also note lung metastasis in 4 out of 31 cases (12.8%). Considering supraclavicular node and lung metastasis, overall one third of patients with malignant TEF had stage IV disease.

The location of fistula in the airway was bronchial in 19.3% cases and the remaining were supracarinal fistulas. Especially, one patient with right bronchoesophageal fistula had adjoining abscess cavity.

The treatment offered for these patients was esophageal SEMS in 45%, feeding gastrostomy/ jejunostomy in 25% cases, radiotherapy +/- chemotherapy in 19% cases and the rest were offered best supportive care.

The deployment of esophageal stent was technically successful in all but one patient in whom guide wire could not be passed across the stricture. In 94% of cases, the stent was clinically successful with improvement of dysphagia and control of respiratory infection. The complication rate with stenting was minimal with no perforation and 2 cases of distal migration. However, the patients' tolerability of the

procedure was observed to be good. Of note, two-thirds of patients were sent for further radio chemotherapy following stenting.

The in-hospital mortality rate was 16% among malignant TEF patients with majority of death occurring due to pulmonary sepsis. All patients were followed up for a mean duration of 6.1 months, (range, 2 to 10.2 months) and among those patients who underwent stenting, sustained improvement in dysphagia and respiratory infection was observed. However, four patients (13%) died within 6 months of stenting.

Acquired Non-malignant Esophageal fistulas

In our series, 33% of cases were due to acquired non- malignant causes. The most common cause is foreign body ingestion (27%) closely followed by Boerhaave syndrome (20%). Other causes include post-intubation TEF, corrosive ingestion and post-surgical (13% each). Rarely we did encounter a patient with tuberculous TEF and another patient had a spontaneous TEF without any obvious etiology.

Contrary to malignant TEFs which occurs in 6th or 7th decades of life, these acquired benign cases occur predominantly in patients less than 50 years old. Of note, all the patients with delayed presentation of Boerhaave syndrome were more than 50 years old and chronic alcoholics.

Unlike malignant TEF patients who were ill-nourished and had poor performance status, the patients with benign fistulas were moderately nourished, but had good performance status. As expected, almost all patients had abnormal respiratory system findings and one out of 15 patients died due to sudden massive aspiration of acidic gastric contents (Mendelson syndrome).

We made a special analysis to determine which particular investigation helped in confirmation of diagnosis. We found that in two thirds of patients, imaging study in the form of thin barium swallow or CT scan was fruitful in clinching the diagnosis. Endoscopic studies were not especially helpful for establishing the diagnosis; rather it is used to assess the level and extent of fistula and to look for underlying disease of esophagus or trachea.

Another factor we took into consideration was the place of diagnosis. We observed that equal number of cases was diagnosed in our department and outside our department. This brings into picture the pattern of references we get and usually all those were delayed referrals. This adds to the complexity of diagnosis and management. Those patients diagnosed in our department benefit from early institution of appropriate therapy.

In fistulas arising due to foreign body ingestion, only two foreign bodies were seen on chest roentgenogram. The other two were radiolucent foreign bodies (1 denture and 1 duck bone). In upper GI endoscopy, only esophagopleural fistulas were in the distal esophagus, other cases involved either upper or middle third esophagus. There were two bronchoesophageal fistulas and 7 tracheoesophageal fistulas.

In this group, 60% cases were managed by surgical intervention and the remaining patients were treated conservatively. Cervical incision along the anterior border of left sternocleidomastoid was employed for 6 cases while other patients underwent thoracotomy. Thoracotomy was performed in the right side for all but one patient who had a left bronchoesophageal fistula due to retained foreign body.

Surgery was done with adherence to all the principles of surgery of TEF as outlined by Grillo et al. In patients with postintubation TEF, the tract is dissected; disconnected and esophageal closure was done in two layers. As one of the patients had coexisting subglottic stenosis, resection of tracheal segment consisting two rings was done and end-to-end anastomosis was done with 3-0 vicryl in interrupted fashion. In the other patient with postintubation TEF, after closure of the esophagus, the defect in trachea was too large to achieve satisfactory primary closure. So, it was

converted into a tracheostomy. In the second stage, two months following the first surgery, tracheal closure was performed. In those patients with distal esophageal fistula resulting from delayed presentation of Boerhaave's syndrome, the distal esophagus containing the fistula site was resected and esophagogastric anastomosis was done intrathoracically.

Adjunctive procedures like feeding jejunostomy/ gastrostomy and intercostal drainage tube insertion were utilized as the situation mandated. Extubation at the end of surgery was possible in 40% cases, in the remaining our anesthetist decided to extubate the patient after a period of postoperative ventilation. This however did not have an impact on the dehiscence of tracheal suture line in our patients.

The operative results in this group were satisfactory with all patients operated for Boerhaave's syndrome doing very well at the end of 1 year follow-up. The two patients operated for postintubation TEF had good recovery and feeding orally, but one patient is still on tracheostomy. One patient with retained foreign body- related bronchoesophageal fistula, after removal of the denture, esophageal and bronchial end was closed. The patient recovered and was discharged. A month later, he was admitted in our ward for aspiration due to alcohol intoxication and died of respiratory failure. The sole patient with tuberculous TEF, the fistula persisted despite

completion of anti-tuberculous therapy and she was managed surgically by right thoracotomy, disconnection of the tract and closure of both the passages. She is leading a normal life when she was seen in our out-patient clinic two years after the surgery.

CONCLUSION

In conclusion, we would like to state that esophageal fistulas are complex and heterogeneous disorders. The mode of clinical presentation varies depending on the etiology.

With respect to malignant tracheoesophageal fistulas, stenting of the esophagus and/or the airway is the current standard of care. If the patient presents late in the course of the fistula with pulmonary sepsis, he shall be best managed with supportive care and no heroic measures should be tried. Surgical management of malignant TEF finds very little place in the modern endoscopic stenting era.

With regards to acquired non-malignant esophagorespiratory fistulas, majority of them are managed surgically with strict adherence to well-established principles of operative management. With careful preoperative preparation and diligent postoperative care, results are extremely satisfactory.

We would like to emphasize that these disorders are best managed in tertiary care hospitals where multidisciplinary team management is possible and helps in achieving the best possible results.

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PROFORMA

Name-
Age-
Sex-
IP No:

Address-
Phone Number:
Education status (in years)-
Occupation (level)-

H/o difficulty in swallowing
H/o swallow induced cough
H/o cough with expectoration
H/o difficulty in breathing

H/o foreign body ingestion
Day of ingestion
Day of surgery
Day when leak appeared
Day when stopped

Consumption of acid/alkali
Intention for consumption

H/o prolonged intubation
H/o tracheostomy
Day of leak

H/o fever
H/o loss of appetite
H/o loss of weight

H/o chemotherapy/ radiotherapy

H/o alcohol intake- amount,frequency
H/o smoking
H/o DM,SHT,BA,TB

Examination

General examination
Examination of oral cavity
Local examination
Respiratory system examination
Cardiovascular system examination
Abdominal examination

Investigations

Complete blood count
Serum electrolytes
Renal function test
Liver function test
X ray chest
USG abdomen
Upper gastro intestinal scopy
Barium swallow
Contrast Upper GI series
CECT Neck
CECT Chest and Abdomen
Bronchoscopy

Treatment

Type of Surgical Procedure
Type of Endoscopic procedure

Outcome

In hospital stay
Morbidity
In hospital mortality

MASTER CHART

S. No	Name	Age	Sex	IP Number	DIAGNOSIS	Previous therapy	Performance status	nutritional status	pallor	supraclavicular In	site of fistula on esophag	size of fistula	Respiratory system abno	bronchoscopic location c	treatment offered	no. of days in hospital
1	ramu	50	m	100112	CA ESOPHAGUS	N	1	good	y	y	mid third	< 1 cm	y	above carina	stent	14
2	thulasiraman	62	m	2250	CA ESOPHAGUS	RT	2	good	y	n	mid third	not assessed	y	below carina	fg	13
3	ramachandran	32	m	5411	CA ESOPHAGUS	N	3	moderate	y	y	mid third	> 1 cm	y	above carina	fj	4
4	dharmaraj	22	m	44134	esophagopleurocutaneous fistula	ICD	1	good	n	n	mid third	< 1 cm	y	not relevant	surgery	57
5	deenadayalan	35	m	57654	FB esophagus	N	1	poor	y	n	not assessed	> 1cm	y	below carina	surgery	21
6	rengaraj	66	m	69177	CA ESOPHAGUS	RT	3	poor	y	n	mid third	< 1 cm	y	above carina	stent	8
7	manikkam	63	m	89952	CA ESOPHAGUS	CT	4	poor	y	y	mid third	< 1 cm	y	above carina	bsc	2
8	narayanan	79	m	97287	CA ESOPHAGUS	RT	2	good	n	n	mid third	< 1 cm	y	above carina	fj	21
9	doss	38	m	10260	CA ESOPHAGUS	N	1	good	y	n	mid third	not assessed	y	above carina	stent	15
10	parasuram	40	m	10698	CA ESOPHAGUS	N	2	moderate	y	n	mid third	< 1 cm	y	above carina	stent	8
11	bitchal	57	m	15352	FB esophagus	N	1	good	y	n	upper third	not assessed	y	cervical trachea		27
12	karunakaran	60	m	32390	CA ESOPHAGUS	N	1	good	y	n	mid third	< 1 cm	n	above carina	stent	12
13	saravanan	20	m	34691	spontaneous fistula	N	1	good	y	n	upper third	< 1 cm	y	cervical trachea	conservative	25
14	muthusamy	55	m	44372	CA ESOPHAGUS	N	1	moderate	y	n	not assessed	< 1 cm	y	above carina	ct	12
15	jayapal	42	m	45668	CA ESOPHAGUS	CT	4	moderate	n	n	mid third	not assessed	y	above carina	rt	11
16	arumugam	70	m	54753	CA ESOPHAGUS	N	3	poor	y	n	not assessed	< 1 cm	y	above carina	bsc	4
17	bakyanathan	60	m	54762	CA ESOPHAGUS	N	3	moderate	y	n	mid third	< 1 cm	y	above carina	ct	7
18	babu	43	m	98721	esophagopleurocutaneous fistula	ICD	1	moderate	y	n	lower third	> 1 cm	y	not relevant	surgery	49
19	ramasamy	70	m	58543	CA ESOPHAGUS	N	3	good	n	n	not assessed	not assessed	y	above carina	stent	21
20	ramanathan	63	m	74233	CA ESOPHAGUS	RT	1	good	y	n	mid third	< 1 cm	y	above carina	stent	12
21	subramani	70	m	81632	CA ESOPHAGUS	N	1	good	n	n	not assessed	not assessed	y	above carina	ct	14
22	saravanan	32	m	25432	post surgical pharyngocutaneous fistula	ORTHO	1	moderate	y	n	upper third	not assessed	y	cervical trachea	conservative	17
23	perumal	55	m	110028	CA ESOPHAGUS	CT	2	good	n	y	not assessed	< 1 cm	y	above carina	stent	12
24	ganesan	48	m	116469	CA ESOPHAGUS	CRT	3	moderate	y	n	mid third	not assessed	y	below carina	stent	6
25	krishnamurthy	54	m	41313	CA ESOPHAGUS	N	4	poor	y	n	mid third	< 1 cm	y	above carina	bsc	3
26	sampath	56	m	11290	esophagopleurocutaneous fistula	ICD	1	moderate	n	n	lower third	> 1cm	y	not relevant	surgery	42
27	kasi	62	m	65278	CA ESOPHAGUS	CRT	1	good	y	n	mid third	< 1 cm	y	above carina	fj	11
28	ponnusamy	65	m	85448	CA ESOPHAGUS	CRT	3	good	n	n	mid third	< 1 cm	n	above carina	stent	12
29	padmavathy	70	f	15788	CA ESOPHAGUS	N	2	moderate	y	y	mid third	< 1 cm	y	above carina	fj	16
30	jayagomathi	48	f	22769	CA ESOPHAGUS	N	3	moderate	y	n	mid third	not assessed	y	above carina	stent	15
31	indrani	55	f	28198	CA ESOPHAGUS	N	4	poor	n	n	mid third	not assessed	y	above carina	bsc	6
32	prema	45	f	52336	FB esophagus	N	1	poor	y	n	mid third	< 1 cm	y	above carina	surgery	9
33	amma Pillai	51	f	69834	CA ESOPHAGUS	N	2	good	y	n	mid third	< 1 cm	y	above carina	stent	18
34	legadeeswari	35	f	5595	CA ESOPHAGUS	N	1	good	n	n	mid third	< 1 cm	y	above carina	fj	12
35	kashuri	60	f	12541	CA ESOPHAGUS	N	2	good	y	y	mid third	< 1 cm	n	above carina	fj	16
36	kalyani	54	f	18155	corrosive esophageal perforation	N	3	poor	n	n	mid third	< 1 cm	y	above carina	conservative	32
37	selvi	38	f	52635	TB TEF	ATT	1	good	y	n	mid third	> 1 cm	y	above carina	surgery	41
38	rasia beevi	50	f	50479	CA ESOPHAGUS	N	3	moderate	y	n	mid third	not assessed	y	below carina	fj	12
39	sundarammal	39	f	81647	CA ESOPHAGUS	N	4	good	n	y	mid third	< 1 cm	y	above carina	stent	13
40	senthakkal	70	f	6357	CA ESOPHAGUS	N	4	good	y	n	mid third	not assessed	n	above carina	stent	8
41	krishnaveni	23	f	29140	post-intubation TEF	N	1	moderate	n	n	upper third	< 1 cm	y	cervical trachea	surgery	61
42	saraswathi	38	f	41382	FB esophagus	N	1	moderate	y	n	mid third	not assessed	y	above carina	surgery	32
43	vendamani	43	f	52783	post-intubation TEF	N	1	moderate	n	n	upper third	> 1cm	y	cervical trachea	surgery	8
44	fathima	30	f	59844	CA ESOPHAGUS	N	4	good	y	n	mid third	not assessed	y	above carina	bsc	76
45	gunalan	55	m	3451	post-laryngectomy	LRyx	1	good	y	n	upper third	> 1 cm	y	cervical trachea	conservative	12
46	devamalar	42	f	15231	corrosive esophageal perforation	N	3	poor	y	n	mid third	not assessed	y	above carina	conservative	31

INFORMED CONSENT FORM

Title of the study -

Study of Presentation, Management and outcome of Esophageal Fistulas

Name of the participant: _____

Name of the Principal/Co-Investigator: Madhusudhanan J _____

Name of the Institution: _____ Madras Medical College and Rajiv Gandhi Government General Hospital, Chennai - 03 _____

Name and address of the sponsor / agency(ies), if any: __None_____

I, _____ (name of participant), have read the information in this form (or it has been read to me). I was free to ask any questions and they have been answered. I am over 18 years of age and, exercising my free power of choice, hereby give my consent to be included as a participant in _____ " (title of the study)

- (1) I have read and understood this consent form and the information provided to me.
- (2) I have had the consent document explained to me.
- (3) I have been explained about the nature of the study.
- (4) I have been explained about my rights and responsibilities by the investigator.
- (5) I have informed the investigator of all the treatments I am taking or have taken in the past _____ months including any native (alternative) treatments.
- (6) I have been advised about the risks associated with my participation in the study. *
- (7) I agree to cooperate with the investigator and I will inform him/her immediately if I suffer unusual symptoms. *
- (8) I have not participated in any research study within the past _____ month(s). *
- (9) [I have not donated blood within the past _____ months -- Add if the study involves extensive blood sampling] *
- (10) I am aware of the fact that I can opt out of the study at any time without having to give any reason and this will not affect my future treatment in the hospital. *
- (11) I am also aware that the investigators may terminate my participation in the study at any time, for any reason, without my consent. *
- (12) I hereby give permission to the investigators to release the information obtained from me as result of participation in this study to the sponsors, regulatory authorities, Government agencies, and ethics committee. I understand that they may inspect my original records.
- (13) I understand that my identity will be kept confidential if my data are publicly presented.
- (14) I have had my questions answered to my satisfaction.
- (15) I consent voluntarily to participate as a participant in the research study.

I am aware, that if I have any questions during this study, I should contact the investigators. By signing this consent form, I attest that the information given in this document has been clearly explained to me and understood by me. I will be given a copy of this consent document.

For adult participants

Name and signature / thumb impression of the participant (or legal representative if participant incompetent):

(Name) _____ (Signature) _____ Date: _____

Name and signature of impartial witness (required for illiterate patients):

(Name) _____ (Signature) _____ Date: _____

Address and contact number of the impartial witness: _____

Name and signature of the Investigator or his representative obtaining consent:

(Name) _____ (Signature) _____ (Date) _____

Name and signature / thumb impression of the participant's parent(s) (or legal representative):

(Name) _____ (Signature) _____ Date: _____

(Name) _____ (Signature) _____ Date: _____

Name and signature of impartial witness (required if parents of participant child illiterate):

(Name) _____ (Signature) _____ Date: _____

Address and contact number of the impartial witness: _____

Name and signature of the Investigator or his representative obtaining consent:

(Name) _____ (Signature) _____ (Date) _____

ஆராய்ச்சி ஒப்புதல் கடிதம்

உணவுக்குழாய் ப்ஸ்ளோ (ESOPHAGEAL FISTULA) உள்ள நோயாளிகள் பற்றிய ஆராய்ச்சி

பெயர் : தேதி :
வயது : உள் / புற நோயாளி எண் :
பால் : ஆராய்ச்சி சேர்க்கை எண் :

என்னுடைய சுய நினைவுடனும் மற்றும் முழு சுதந்திரத்துடன் இந்த மருத்துவ ஆராய்ச்சியில் சேர்த்துக்கொள்ள ஒப்புதல் அளிக்கிறேன்.

கீழ்க்காணப்படும் நிபந்தனைகளுக்கு நான் ஒப்புதல் அளிக்கிறேன்.

இந்த ஆராய்ச்சியின் நோக்கமும், சிகிச்சை முறைகளும் எனக்கு திருப்தியளிக்கும் வகையில் அறிவுறுத்தப்பட்டது.

உணவுக்குழாய் ப்ஸ்ளோ (Esophageal Fistula) அதன் அறிகுறிகள், எனக்கு மேற்கொள்ளப்படும் சிகிச்சை முறைகள், அதனால் ஏற்படும் பின்விளைவுகள் அனைத்தையும் நான் அறிவேன்.

என் உடல்நலம் பாதிக்கப்பட்டாலோ அல்லது எதிர்பாராத வழக்கத்திற்கு மாறான நோய்க்குறி தென்பட்டாலோ அதனை உடனடியாக மருத்துவரிடம் தெரிவிக்க சம்மதிக்கிறேன்.

என் மருத்துவ குறிப்பேடுகளை இந்த ஆராய்ச்சியில் பயன்படுத்திக்கொள்ள சம்மதிக்கிறேன். இந்த ஆராய்ச்சி மையமும், ஆராய்ச்சியாளரும் என்னுடைய விவரங்கள் அனைத்தையும் இரகசியமாக வைப்பதாக அறிகிறேன்.

.....
நோயாளியின் பெயர்

.....
கையொப்பம்

.....
தேதி

.....
ஆராய்ச்சியாளரின் பெயர்

.....
கையொப்பம்

.....
தேதி

ஆராய்ச்சி தகவல் தாள்

சென்னை இராஜீவ்காந்தி அரசு பொது மருத்துவனையில் அனுமதி பெரும் உணவுக்குழாய் ப்ஸ்டூளா (Esophageal Fistula) உள்ள நோயாளிகள் பற்றிய ஆராய்ச்சி இங்கு நடைபெற்று வருகின்றது.

நீங்களும் ஆராய்ச்சியில் பங்கேற்க நாங்கள் விரும்புகிறோம். இந்த ஆராய்ச்சியில் உங்களுக்கு நடைபெறும் சிகிச்சை முறைகள் மற்றும் அதன் விளைவுகள் பற்றிய ஆராய்ச்சி செய்ய உள்ளோம். இதனால் உங்களது உடல்நலமோ, மனநலமோ பாதிக்கப்படாது.

முடிவுகளை அல்லது கருத்துகளை வெளியிடும்போதோ அல்லது ஆராய்ச்சியின் போதோ தங்களது பெயரையோ அல்லது அடையாளங்களையோ வெளியிடமாட்டோம் என்பதையும் தெரிவித்துக் கொள்கிறோம்.

இந்த ஆராய்ச்சியில் பங்கேற்பது தங்களுடைய விருப்பத்தின் பேரில் தான் இருக்கிறது. மேலும் நீங்கள் எந்நேரமும் இந்த ஆராய்ச்சியிலிருந்து பின்வாங்கலாம் என்பதையும் தெரிவித்துக் கொள்கிறோம்.

இந்த சிறப்பு அறிவைசிகிச்சையின் பலன்களை/ முடிவுகளை ஆராய்ச்சியின்போது அல்லது ஆராய்ச்சியின் முடிவின் போது தங்களுக்கு அறிவிப்போம் என்பதையும் தெரிவித்துக் கொள்கிறோம்.

ஆராய்ச்சியாளர் கையொப்பம்

பங்கேற்பாளர் கையொப்பம்

தேதி:

INSTITUTIONAL ETHICS COMMITTEE
MADRAS MEDICAL COLLEGE, CHENNAI -3

Telephone No : 044 25305301

Fax : 044 25363970

CERTIFICATE OF APPROVAL

To

Dr.J.Madhusudhanan,
M.Ch. Postgraduate,
Department of Surgical Gastroenterology &
Center of excellence for upper G.I.Surgery,
Madras Medical College & RGGGH, Chennai -3

Dear Dr.J.Madhusudhanan,

The Institutional Ethics committee of Madras Medical College, reviewed and discussed your application for approval of the proposal entitled "Study of presentation, Management and outcome of Esophageal Fistulas" No.12022013.

The following members of Ethics Committee were present in the meeting held on 05.02.2013 conducted at Madras Medical College, Chennai -3.

- | | |
|---|---------------------|
| 1. Dr.SivaKumar, MS FICS FAIS | --- Chairperson |
| 2. Prof. R. Nandhini MD
Director, Instt. of Pharmacology ,MMC, Ch-3 | -- Member Secretary |
| 3. Prof. Shyamraj MD
Director i/c , Instt. of Biochemistry , MMC, Ch-3 | -- Member |
| 4. Prof. P. Karkuzhali. MD
Prof., Instt. of Pathology, MMC, Ch-3 | -- Member |
| 5. Prof. A. Radhakrishnan MD
Prof of Internal Medicine, MMC, Ch-3 | -- Member |
| 6. Prof. S. Deivanayagam MS
Prof of Surgery, MMC, Ch-3 | -- Member |
| 7. Thiru. S. Govindsamy. BABL | -- Lawyer |
| 8. Tmt. Arnold Soulina MA MSW | -- Social Scientist |

We approve the proposal to be conducted in its presented form.

Sd/ Chairman & Other Members

The Institutional Ethics Committee expects to be informed about the progress of the study, and SAE occurring in the course of the study, any changes in the protocol and patients information / informed consent and asks to be provided a copy of the final report.

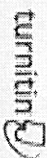
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