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Esophageal Perforation- Presentation, Management, Outcome and Review of Literature

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Abstract:

Objective: *To analyze the indications and outcome for conservative Non-operative treatment (NOT) vs. Operative Treatment (OT) in patients with esophageal perforation with a Secondary intention to analyze the etiology and presentation of patients with esophageal perforation.*

Methodology: *It is a retrospective observational study of all patients admitted with esophageal perforation in the Institute of Surgical Gastroenterology, Rajiv Gandhi Government General Hospital, Madras Medical College, Tamilnadu, India, during the period from January 2012 to December 2017. Records of all these patients were studied retrospectively and their etiology, management and outcome in terms of 30-day mortality, mean hospital stay and overall morbidity and mortality were analyzed.*

Results: *Totally 39 patients with esophageal perforation were analyzed. Of which 15 were early presentation (<24hr), 24 were late presentation (>24hr). Most common etiology was foreign body induced perforation. Based on the level seven were cervical perforation and the remaining thoracic esophageal perforation. 32 patients underwent surgery and seven were managed conservatively. There were five mortality. Out of which four were in the late group. Morbidity and hospital stay were more in the late group when compared to early group.*

Conclusion: *Early diagnosis and management are essential in esophageal perforation. Management should be individualized based on patient presentation and level of perforation.*

Key words: *Esophageal Perforation, Thoracotomy, Cervical Esophagostomy, Esophagectomy, Drainage*

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I. Introduction

Esophageal perforation remains a devastating event that is difficult to diagnose and manage. Today the majority of injuries are iatrogenic and the increasing use of endoscopic procedures can be expected to lead to an even higher incidence of esophageal perforation in coming years. Rapid diagnosis and therapy provide the best chance for survival. Accurate diagnosis and effective treatment depend on early recognition of clinical features and accurate interpretation of diagnostic imaging. Outcome is determined by the cause and location of the injury, the presence of concomitant esophageal disease and the interval between perforation and initiation of treatment. Primary surgical repair with or without reinforcement is the most successful treatment option in the management of esophageal perforation and reduces mortality by 50% to 70% compared with other interventional therapies.

II. Review of literature:

Esophageal perforation is a life-threatening situation requiring early diagnosis and prompt treatment. Sealy has described this condition as 'the most serious perforation of the gastrointestinal tract'[1]. Recognition of the importance of an early diagnosis and intervention has brought about a dramatic decline in the mortality and morbidity related to esophageal perforation. Etiology, time delay between rupture and diagnosis and

location of an esophageal perforation affect management and results[2]. In 559 patients from a recent series, iatrogenic injury to the esophagus was the most frequent cause of esophageal perforation, with instrumentation accounting for 59% of all patients [3]. The majority of esophageal perforations require urgent surgical treatment. The overall mortality rate for patients with esophageal rupture is 22%, but the survival rate nears 95% when the primary repair is completed within 24 hours of rupture[2].

Cervical perforation of the esophagus is generally less severe and more easily treated than intrathoracic or intraabdominal perforation. Intrathoracic perforations rapidly contaminate the mediastinum. Contamination disseminates resulting in sequestration of fluid and hypovolemia. Chest pain, tachycardia, tachypnea, fever and leukocytosis occur during the ensuing inflammatory response and systemic sepsis and shock develop within hours[4].

Options for managing esophageal perforations range from conservative to aggressive management [5, 6]. Altorjay in his article in Annals of surgery stated that 'The place, value and indication of non operative treatment (NOT) in the management of esophageal perforation has not yet been unequivocally defined. During the past 15 years (1979 to 1994), 20 of 86 patients (23.3%) with esophageal perforation have been treated non-operatively from the outset. In this group, perforations were located to the upper, middle, and lower third of the esophagus in 50%, 30%, and 20% respectively[6]. As to the interval between the perforation and the onset of treatment, 14 patients had been diagnosed within 24 hours, whereas in 6 cases treatment had been begun beyond 24 hours. The results of the study were: NOT could be successfully carried out in 16 patients; the decision to use NOT had to be revised in 4 other cases. Two patients were lost; the mortality rate was 10% (2 of 20). The rate of complications was lower in the NOT group (20%) than in the OT group (50%). It is concluded that NOT can be suggested for the treatment of intramural perforations. In the case of transmural perforation, this approach should be taken into consideration if the esophageal lesion is circumscribed, is not in neoplastic tissue, is not in the abdominal cavity, and is not accompanied by simultaneous obstructive esophageal disease; in addition, symptoms and signs of septicemia should be absent. Advocates of aggressive treatment report favorable mortality rates of 1.5% [5]. Also there is a growing enthusiasm for conservative approach because the survival figures are comparable with the results of aggressive surgery. Low mortality rates have been documented in a review of 47 patients undergoing conservative approach and preserving the native esophagus [7].

Orringer and Stirling [8] advocated a aggressive approach and emphasized that in a desperately ill patient with sepsis and thoracic esophageal disruption, closure of the perforation or exclusion may not control the sepsis adequately. Clinicians have long attempted to better assess objectively the severity of an illness and to predict the outcome of therapy based on quantitative changes in measurable physiologic variables. Numeric quantification of these variables in such a disparate group of patients with esophageal perforation resulting from a variety of causes and undergoing conservative (drainage alone, drainage plus endoprosthesis, exclusion, or diversion) [9,10] or radical (resection or resection and repair at one time) surgical procedures is a challenge.

Whether a transthoracic or transhiatal approach is more appropriate for resection of a perforated esophagus is influenced by the age of the perforation, the severity of the concomitant mediastinitis, and the presence of pleural contamination. Transhiatal esophagectomy is an excellent treatment for early esophageal rupture, when pleural contamination is minimal, or when the perforation is confined to the mediastinum only. After extraction of the esophagus, vigorous intraoperative mediastinal and pleural irrigation through the diaphragmatic hiatus and cervical incision as advocated by Orringer and Stirling [8] effectively cleanses the contaminated areas. With an older perforation, particularly in the presence of pleural contamination, the transthoracic approach is preferred. In view of this experience, the following criteria for esophageal resection and reconstruction as treatment of thoracic esophageal perforation are recommended:

1. Concomitant obstructive esophageal disease is present.
2. There is an extensive injury, even one treated within 24 hours, associated with serious mediastinal or intrapleural contamination.
3. The viability of the esophageal tissue at the site of injury is even slightly questionable, and no adequate pedicled tissue flap can be mobilized to cover the suture line.
4. Primary repair would cause a 50% narrowing of the esophageal lumen.
5. There is a spontaneous perforation associated with substantial sepsis.
6. There is circumscribed extravasation caused by a neglected impacted foreign body.

Gupta NM et al in a retrospective review of 57 patients with esophageal perforations [11], observed that Forty-four (77%) perforations were due to iatrogenic causes, spontaneous perforations occurred in six patients (11%). Foreign body ingestion caused perforation in 4 (7%), followed by blunt trauma in 2 (4%) and caustic injury in 1 patient. 6 (11%) patients had cervical injury, 49 (86%) patients had thoracic, and 1 patient had abdominal esophageal injury. Thirty-three (58%) patients underwent emergency esophagectomy, 4 (7%) patients underwent primary repair, and 4 patients (7%) underwent drainage alone, whereas 16 (28%) patients were managed by non-operative treatment. Using these treatment principles, they achieved 86% survival rate for

all patients. Eight (14%) patients died. Spontaneous perforation had the highest mortality (67%). In their conclusion, they reported that esophageal perforation needs aggressive treatment which depends mainly on two factors: perforation in a healthy esophagus and perforation with a preexisting underlying intrinsic esophageal disease causing distal obstruction. Esophageal perforation associated with stenotic lesions (benign or malignant) needs esophageal extirpation. Perforation in a healthy esophagus should be treated by primary closure if encountered early. Non-operative conservative treatment is appropriate when esophageal perforation is encountered late.

Philip A. Linden has presented a large series of patients requiring operative treatment of esophageal perforations with attention to an infrequently used method of dealing with delayed intrathoracic perforations [12]. He concluded that treatment of delayed (more than 24 hours) thoracic esophageal perforations with a controlled fistula through T-tube results in a very low mortality similar to that seen with acute perforations (less than 24 hours). Morbidity and length of stay remain high. Delay in treatment of intrathoracic esophageal perforations beyond 24 and 72 hours results in a doubling of morbidity at each interval.

Amudhan et al reviewed their experience in treating 48 patients with esophageal perforations and evaluated the etiology, management and outcome of intervention in a tertiary center in southern India [13]. Post-dilatation corrosive stricture perforations constituted the major etiology. Thirty (62.5%) patients were diagnosed early (<24 h) and the remaining 18 (37.5%) were late (>24 h). The 30-day mortality was 6.2%, and mean hospital stay was 13 ± 9.3 days. Comparing outcomes between early and late groups, statistically significant difference was observed, with increased mortality ($p = 0.02$) and hospital stay ($p = 0.04$) following late diagnosis. They concluded that early diagnosis decreases mortality and hospital stay in esophageal perforation and preservation of esophagus might be attempted while treating esophageal perforations.

III. Subjects And Methods

All patients admitted with esophageal perforation in the Institute of Surgical Gastroenterology, Rajiv Gandhi Government General Hospital, Madras Medical College, which is a tertiary care center in Tamilnadu, India, during the study period, were included.

Study Design:
Retrospective observational study

Study period:
Jan 2012 to December 2017

IV. Objective

The primary objective was to analyze the indications and outcome for conservative non- operative treatment (NOT) vs. surgical management (OT) in patients with esophageal perforation with a secondary intention to analyze the etiology and presentation of patients with esophageal perforation. Secondary outcomes included identification of risk factors for perforation and effect of perforation on mortality and comparing it with national and international studies. Patients were thoroughly investigated and evaluated by means of clinical presentation, basic blood investigations, radiological investigations (Chest X ray, Contrast enhanced computed tomogram of chest and abdomen, Barium swallow). The management outcome in terms of 30-day mortality, mean hospital stay, and overall morbidity and mortality were analyzed. Comparison of the above-mentioned variables in patients with early and late presentations was done.

V. Statistical Analysis

The statistical analysis was performed with the SPSS software (version 20 for Windows). Clinical variables are given in frequencies with their percentages. The statistical analysis was done using Student's t and X^2tests. P </= 0.05 was considered significant.

VI. Results

There were 29 males and 10 females. Age at presentation ranged from 14 to 80 years. 15 (38%) patients presented early and 24 (61%) patients presented late (>24 hr). The mean age of the study group was 44.6 years

Twenty out of 39 patients had foreign body esophagus with perforation. Six were spontaneous perforations. Eleven patients had iatrogenic cause, corrosive stricture esophagus post dilatation(3 Patients), carcinoma esophagus(7 patients) and one during cricopharyngeal myotomy. One patient got direct perforation due to corrosive injury. In one patient perforation occurred due to tubercular suppurative node. Thirty two were thoracic perforations and seven were cervical perforations (table 1). No perforation at abdominal level was observed.

Table.1 Non operative management compared with operative management

			Non operative treatment(NOT)	Operative treatment(OT)	*p* Value
Mean Age			51.14 ± 15.28	43.19 ± 14.77	-
Sex(M/F)			7/0	22/10	
Early Presentation < 24 Hrs			2	13	-
Late Presentation >24 Hrs			5	19	-
Level Of Perforation	**Cervical**		1	6	-
	Thoracic	**Upper**	1	6	-
		Middle	0	9	-
		Lower	5	11	-
Major Morbidity			1	13	0.49
Mortality			0	5	0.56
Hospital stay days			25.14 ± 11.09	21.63 ± 12.77	0.30

Contrast esophagography confirmed the diagnosis in 9 out of 39 patients and CT scan did it in 24 out of 39 patients. Diagnosis was made by esophagoduodenoscopy in five patients and clinically in one patient at the time of surgery: a case of cricopharyngeal myotomy. Among the 15patients with early presentation, thirteen underwent operative management (OT). One patient with corrosive injury had contained thoracic perforation, underwent non-operative treatment (NOT). Among the twenty four patients who presented late, 19 underwent OT and the rest (5 patients) managed conservatively.

Management:

Thirty two patients had undergone operative treatment in total: 13 in the early group and 19 in the late group (tables 1 and 2). Diversion was done in 12 patients, Cervical exploration with retrieval of foreign body and primary repair was done in 6 patients, Transhiatal esophagectomy was done in six patients, thoracotomy with primary repair of perforation was done in four patients and esophagogastrectomy in two patients. Exploration with drainage was done in two patients.

Table.2 Early presentation versus late presentation

Parameters			**Early Presentation < 24 Hrs**	**Late Presentation >24 Hrs**	***p* Value**
Mean Age			42.7 ± 14.9	45.7 ± 24	-
Sex(M/F)			12/3	17/7	-
Level Of Perforation	**Cervical**		3	4	-
	Thoracic	**Upper**	2	5	-
		Middle	3	6	-
		Lower	7	9	-
Major Morbidity			2	12	0.07
Mortality			1	4	0.63
Hospital Stay days			16.73 ± 7.30	25.71 ± 12.43	0.026

Morbidity:

In this study, major complications were observed in fourteen patients. It included pulmonary complications, wound infection, esophago-pleural fistula and esophago-pleuro-cutaneous fistula. Pulmonary complications such as pneumonitis and atelectasis were seen in around 29% of patients. Ten patients required post-operative ventilatory support.

Hospital stay:

The mean hospital stay for the entire group of patients in this study was 22.26 ± 12.4 days, range 8 to 71 days. In the conservatively managed group the least stay was 8 days. Maximum number of days of stay in patients managed by NOT was 39 days. In those treated by OT, the least stay was 11 days vs. longest stay of 71 days. Time from injury to management had a significant influence on hospital stay. Patients diagnosed late, had a longer hospital stay (mean 25.71 ± 12.43 days) than those with early diagnosis who had a mean hospital stay of 16.73 ± 7.30 days which is statistically significant ($p = 0.026$)

Mortality:

Overall mortality in the entire cohort was five out of 39 patients. Four patients in the late group and one in the early group died. Deaths were due to sepsis and multiple organ dysfunction in four patients and respiratory failure in one patient with malignant perforation.

VII. Discussion

Though post-corrosive stricture dilatation perforation leads the cause in few series from India, foreign body (denture, blade, chicken bone) injury constitutes majority of esophageal perforation in this study [14]. Corrosive ingestion as a cause for esophageal perforation (in the acute stage or later as stricture) forms only 7% of patients in our study. Apart from foreign body and corrosive injury, a variety of etiology has been made out, like carcinoma esophagus, spontaneous perforation, post-myotomy, post-endoscopy and inflammatory pathology.

In our center, the tool for diagnosis of esophageal perforation is CT scan with oral contrast. CT scan is sensitive and specific investigation for esophageal perforation [15]. In twelve of our patients CT scan was instrumental in the diagnosis and effective drainage of pleural and mediastinal collections. CT scan also detects small foreign bodies and make out the extent of esophageal perforation accurately. In ten patients the diagnosis was established by contrast esophagogram alone. In eleven patients with FB ingestion diagnosis had to be confirmed by CT with oral contrast after a false negative contrast esophagogram. According to Gupta and Kaman, esophageal perforation was diagnosed by oral contrast esophagography in all patients except one in their series of 57 patients [11]. They feel that CT is unnecessary if the diagnosis is confirmed by contrast esophagography.

Flexible esophagoscopy provides direct visualization of the perforation and is especially valuable in assessing perforations secondary to external penetrating trauma. In the emergent evaluation of the traumatically perforated esophagus, flexible esophagoscopy is associated with a sensitivity of 100% and a specificity of 83% [16]. The role of esophagoscopy in the evaluation of acute, non-penetrating esophageal perforations has not been established and is highly questionable [17]. Air insufflation, a requirement during flexible esophagoscopy, is contraindicated when small mucosal or submucosal tears are suspected. In this situation, air may dissect intramurally within the esophagus and cause cervical subcutaneous emphysema, giving the impression of a serious perforation and leading to operative intervention when, in reality, conservative treatment is appropriate [17]. In addition to the age and general health of the patient, the damage to surrounding tissues and the presence of concomitant esophageal pathology or injury must be considered before initiating therapy [18]. The objectives of treatment include prevention of further contamination from the perforation, elimination of infection, restoration of the integrity of gastrointestinal tract, and establishment of nutritional support [19].

The overall mortality associated with esophageal perforation in 726 patients from a series between 1990 and 2003 was 18% [20]. The cause and location of the injury, the presence of underlying esophageal pathology, the delay in diagnosis, and the method of treatment determine the rate of morbidity and mortality [14]. Anatomic location affects the mortality associated with esophageal perforation. In 397 patients from seven recent series[14] cervical esophageal perforations were associated with a mortality of 6%, whereas thoracic and abdominal perforations were associated with a mortality of 27%, and 21%, respectively. This difference in mortality results from the containment of contamination by the fascial planes of the neck following cervical perforation. Selection of the proper surgical approach also depends on the location of perforation. Small or well-contained cervical esophageal perforations down to the level of the carina can usually be managed with drainage alone by cervical incision [19]. The best surgical approach to perforations in the middle third of the esophagus is through a right thoracotomy in the sixth intercostal space, and perforations in the lower third are best approached through a left thoracotomy in the seventh intercostal space. An upper midline laparotomy is used to reach the abdominal esophagus. Historically, the use of primary repair following a delay in diagnosis of greater than 24 hours was associated with increased morbidity and mortality [21, 22, 23,24]. Recent evidence, however, indicates that primary repair offers the highest probability of survival regardless of the interval between esophageal perforation and treatment.

Wright and associates [22] reported an overall mortality of 14% following reinforced repair with no deaths resulting from failure of the repair site in a group of 28 patients that included 46% with a delay in diagnosis of greater than 24 hours. Whyte and colleagues reported outstanding results in a group of 22 patients who underwent primary repair without reinforcement [23]. Although surgery was delayed by more than 24 hours in 41% of these patients, the overall mortality was only 5%. According to them primary repair remains the treatment of choice for esophageal perforation in all patients without esophageal malignancy or diffuse mediastinal necrosis, including those seen more than 24 hours after perforation. Esophageal resection resulted in a mortality of 17% in these series. Esophagectomy provides the best treatment option when concomitant obstructive esophageal carcinoma or stricture is present, or when attempted drainage, closure, or exclusion has failed to control sepsis [25, 8, 7]. Other surgical therapies are associated with a higher mortality rate in these reports. The best results were achieved when primary closure was included with exclusion and diversion.

There were five mortality in our study group. All five in the operative group, four of them presented late. The underlying disease could not be considered as the predisposing factor for mortality in this study, in contrast to other reports. In our study, ten patients had undergone primary repair, six cervical and four thoracotomy and primary repair. After thoracotomy, edge of perforation was trimmed and primarily closed

keeping intra-operative endoscope in situ. All of them belonged to late group and are keeping well on regular follow-up. Diversion was done by lateral cervical esophagostomy. One patient (post corrosive stricture dilatation) had 'T' tube diversion at the cervical level. Four of the patients had their foreign body removed endoscopically and managed conservatively.

Esophagogastrectomy was done in one patient who presented late, but the patient succumbed a day later because of multiple organ dysfunction. Esophagogastrectomy in one patient with corrosive injury presented early fared well. Transhiatal Esophagectomy was done in six patients. Exclusive drainage was done in two patients in the overall cohort. One patient who had a foreign body injury (chicken bone) was managed exclusively by intercostal drainage alone. The other patient was the one with a cervical myotomy for neurogenic dysphagia. Conservative treatment was successful in a patient with spontaneous perforation. One patient with malignant perforation managed conservatively, succumbed to the malignancy. Age and underlying disease did not play a role in determining the necessity for ventilatory support. Both morbidity and hospital stay was more in late group. The patient with least stay in the OT group was a case of upper thoracic esophageal perforation occurred during endoscopy for evaluation of GERD for whom a cervical esophagostomy and a drainage procedure was done. Patients who had thoracotomies had a longer hospital stay.

Follow-up:

Thirtyone patients were on regular follow-up. Out of these, 26 were from OT group and five were from NOT group. Three patients with carcinoma esophagus died during follow-up after successful initial diversion for perforation. One patient who had undergone resection had reconstruction in the form of pharyngocoloplasty. One post- stricture dilatation perforation patient had successfully been treated with retrosternal pharyngocoloplasty. Four patients developed grade I to II dysphagia and were managed by endoscopic dilatation. Two patients developed grade III dysphagia and were managed by dilatation using SG dilators.

VIII. Conclusion

Esophageal perforation is a serious problem that is difficult to manage. Foreign body, instrumentation and malignancy caused the majority of cases. Mortality remains close to that of world literature i.e. 15%. Early diagnosis and treatment are essential to reduce mortality significantly. Optimal therapy is determined by various factors including the etiology, time of presentation, site of perforation, co-morbid illness and the available expertise. Non-operative therapy is appropriate in certain well-defined situations. Both morbidity and hospital stay was more in patients who presented late. An individualized approach is required with each case.

List of abbreviations used-

NOT – Non Operative Treatment

OT – Operative Treatment

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