

THE DISSERTATION ON
THE SURGICAL MANAGEMENT PROTOCOL FOR CORROSIVE
STRICTURES OF THE OESOPHAGUS AND THE STOMACH

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SURGICAL GASTROENTEROLOGY& PROCTOLOGY



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CERTIFICATE

Certified that this dissertation entitled “**THE SURGICAL MANAGEMENT PROTOCOL FOR CORROSIVE STRICTURES OF THE OESOPHAGUS AND THE STOMACH**” is the bonafide work done by **Dr.R.R KANNAN**, during the period 2004- 2007 ,done under my guidance and supervision and is submitted in partial fulfilment of the requirement for the M.Ch (Branch-VI) -Surgical Gastroenterology & proctology of The Tamilnadu Dr.M.G.R Medical university, August 2007 examination .

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INTRODUCTION

The commonest cause of benign obstruction of oesophagus in Southern parts of India is corrosive strictures. The most vulnerable age groups are children less than five years who often ingest accidentally and adults who take with suicidal intention. In India, acid ingestion is more common nearly Seventy to Eighty percentage than alkali ingestion compared to west. The acid ingestion causes coagulation necrosis, which are seldom deep and alkali produces liquefaction necrosis. The late complications of corrosive burns of upper gastrointestinal tract are stricture and cancer. Effective surgical management is necessary in addition to medical treatment in those who fail to respond to them at appropriate times.

This is a prospective study of twentynine cases in which surgical management protocol is designed for corrosive stricture of esophagus and stomach. Nutritional assessment and methods to improve nutritional status are discussed. The management of corrosive stricture oesophagus and stomach are best individualized and tailored according to mode of presentation at the time of onset of symptoms, organ (s) involved by stricture, organ of substitute available, mental state of the patient, facilities available and experience of the surgeon. Overall Twenty to forty percentage of patient with second and third degree injuries develop stricture and out of which Twenty five to Fifty percentage require surgery (Howel & Collegues)

AIM

To study the surgical management of corrosive strictures of oesophagus and stomach

PATIENTS AND METHODS

This prospective study conducted in the Department of Surgical Gastroenterology, Madras Medical College & Government General Hospital Chennai from the period of 2004 to 2007.

In this study, the age group commonly affected was between Twelve to Twenty years and commonly affected sex were males (M/F:1:0.7). as shown in figure 1 & 2.

Figure 1

AGE INCIDENCE

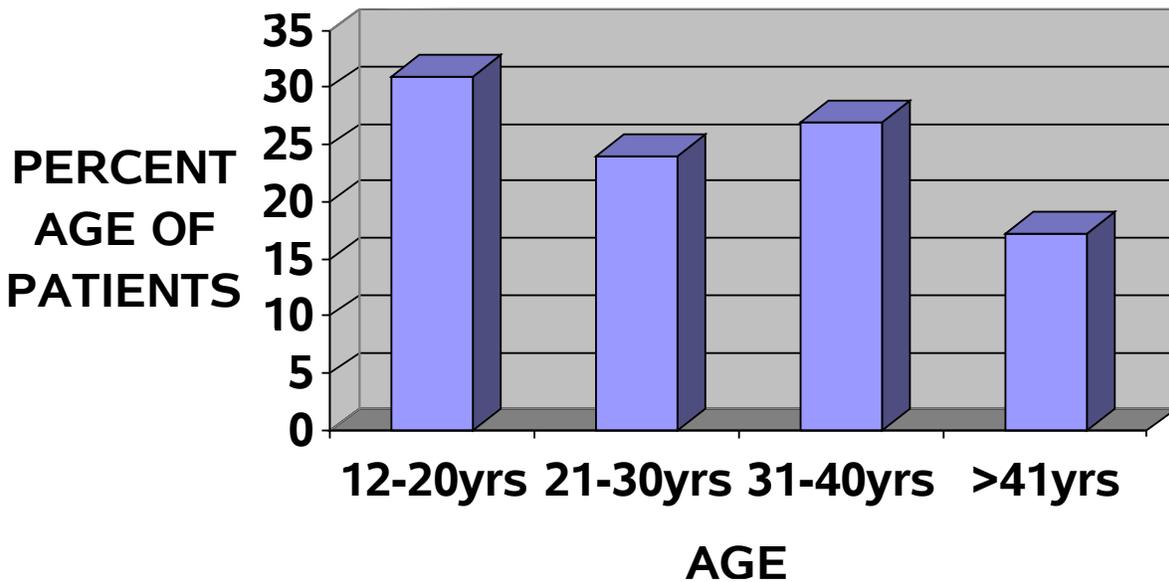


Figure 2

SEX INCIDENCE

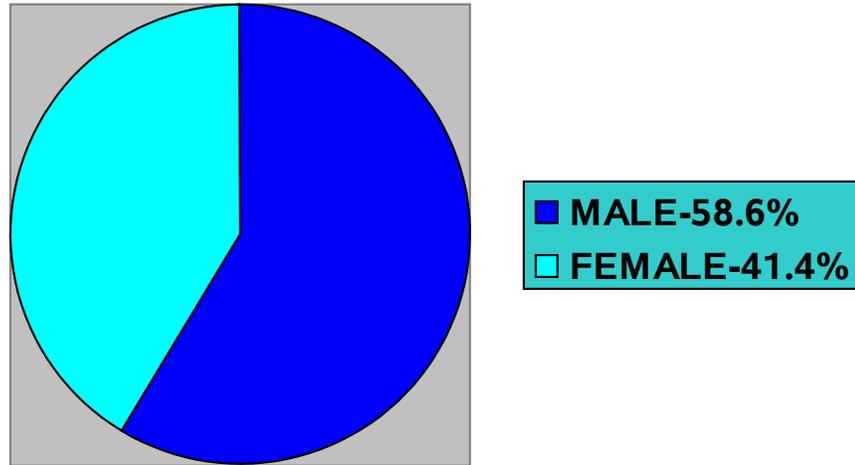


Figure 3

TYPES OF CORROSIVE AGENTS

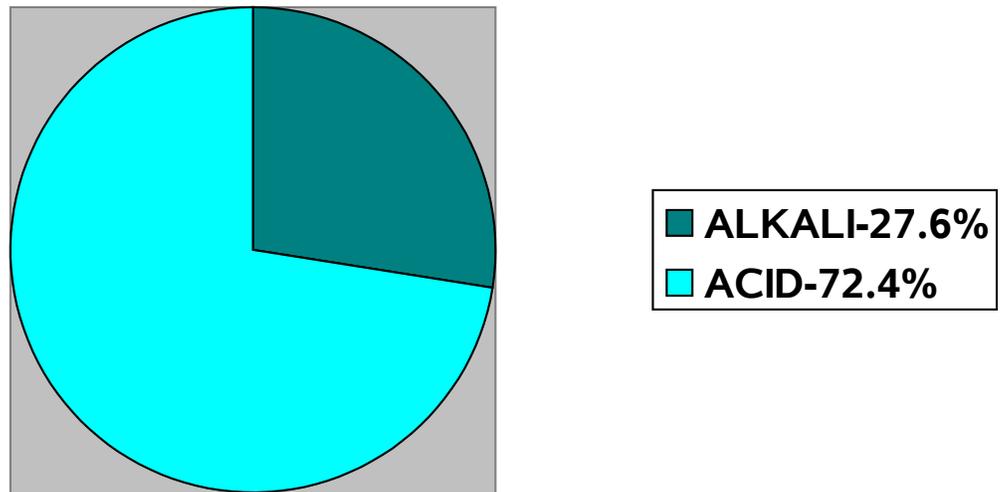


Figure 4

S- Suicidal
A- Accidental

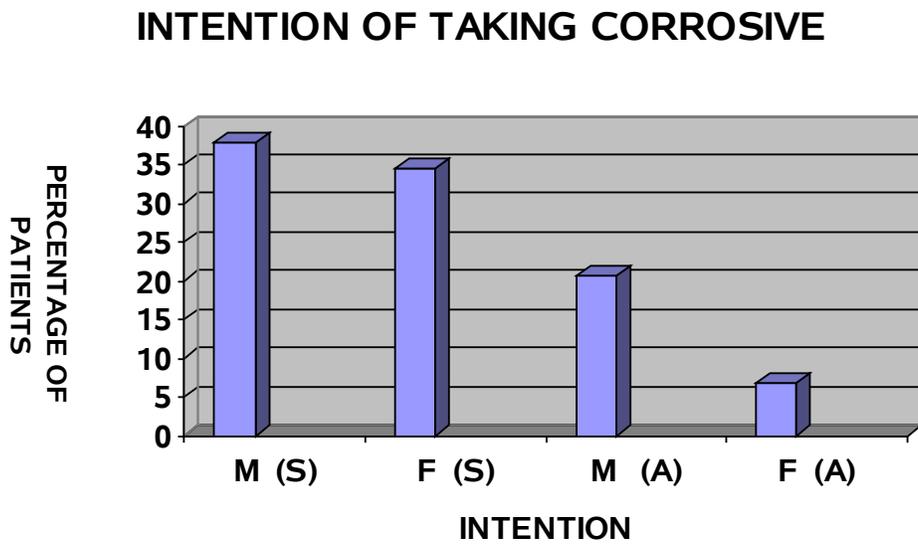


Figure 5

OCCUPATION

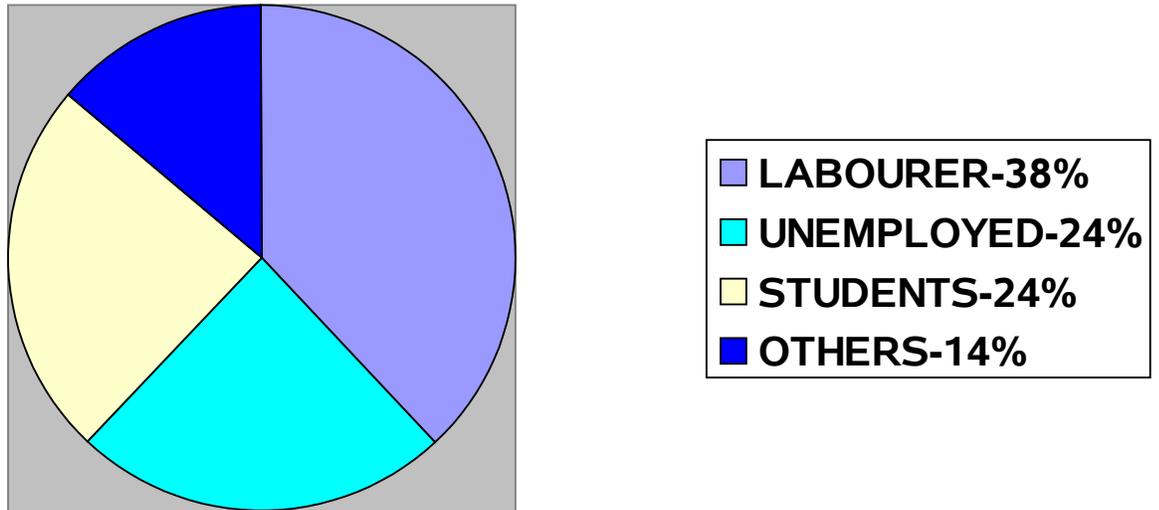
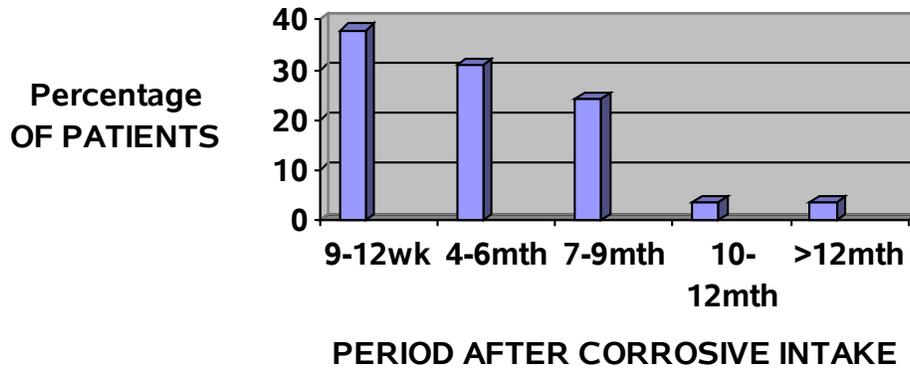


Figure 6

TIME INTERVAL BETWEEN CORROSIVE INTAKE AND SURGERY



CLINICAL FEATURES AT PRESENTATION

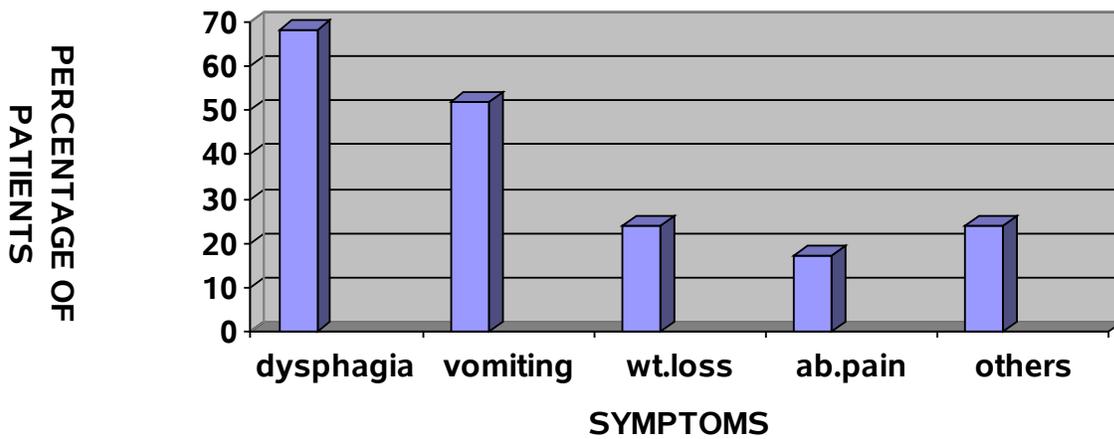
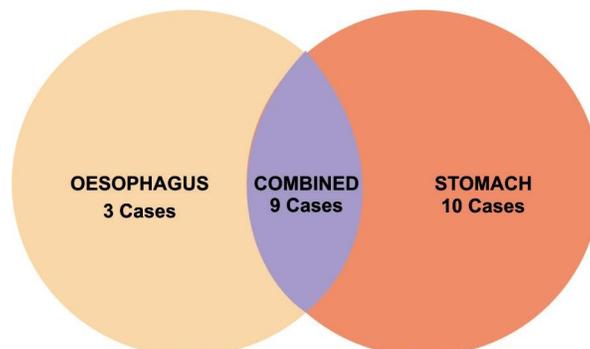


Figure 7

Figure 8

ORGANWISE INJURY IN ELECTIVE SURGICAL CASES



Acid ingestion was more common than alkali ingestion as shown in figure 3. All the patients had undergone hospital admission during the acute phase elsewhere. When presented to our department, they were at various grades of dysphagia. The time interval between corrosive ingestion and admission varied from patient to patient (Figure 6).

The ingestion was accidental in Eight cases (27.6%) and was suicidal in Twenty One cases (72.4%) as shown in figure 4. Occupation wise labourers had high incidence of intake of corrosive intake as shown in figure 5. Few patients had undergone evaluation of the upper gastrointestinal tract elsewhere and referred for surgical management. Sixteen patients had undergone feeding jejunostomy. One patient had undergone emergency tracheostomy during management of acute phase.

The main presenting complaints were dysphagia 69% , (grade II & III-58.3%, grade IV & above 41.7%) vomiting 51%, significant weight loss in 24% of cases as shown in figure 7. General condition including body build, nourishment and hydration were assessed. Complete physical examination, routine blood and urine examination were done for all cases.

Nutritional assessments were done by recording anthropometric measurement like body mass index (B.M.I). Total lymphocyte count and serum albumin were estimated. Monitoring of body weight at periodic

intervals were done preoperatively and postoperatively for all the cases. The average weight on admission for males was 43 kgs and for females was 36.5 kgs. Based on the above available data, patients were categorized into mild, moderate, severe malnutrition. Those with moderate and severe malnutrition feeding jejunostomy was done.

The timing of surgery after corrosive injury varied with the site of injury, nutritional status of patient and fitness to undergo surgery. In patients with documented antral stricture, the definitive procedures were done in the period ranging from eight weeks to one and half years. In those patients with esophageal injury requiring esophageal substitute, the decision for surgery was deferred till completion of six months from the time of injury. The investigations necessary to know the extent of injury and to evaluate esophageal substitutes available were done. Investigations to assess the general condition of the patient to undergo major procedures like ECG, echo cardiography and Pulmonary function tests were done concurrently. All patients and family members underwent psychiatric evaluation and counselling.

Investigations to know the extent of injury like barium swallow and endoscopy were done. Barium swallow was done to evaluate the site, length, number of strictures of esophagus, to assess the distal flow, stomach

capacity, deformity and evidence of gastric outlet obstruction. In this study, we have grouped the corrosive strictures of upper gastrointestinal tract into three groups. They are those with corrosive strictures of esophagus only (three cases), strictures affecting only the stomach with gastric outlet obstruction (Ten cases) and strictures involving both esophagus and stomach (Nine cases).

Upper gastrointestinal scopy was done in all feasible cases following barium study. This is to assess the mucosa, site of narrowing, number of strictures – dilatable / non dilatable, level of narrowing, mucosal lesion of stomach, capacity, evidence of gastric outlet obstruction and status of antrum and duodenum. Otorhinolaryngologist's opinion was obtained for all cases. Barium enema and colonoscopy were done to assess the colon in patients planned for oesophageal substitutes. Mesenteric angiography was not routinely done for all the cases in our series.

RESULTS (table :1)

ELECTIVE SURGICAL PROCEDURES DONE IN OUR STUDY

Out of Twenty Nine cases admitted in our department, five cases underwent emergency procedure and remaining Twenty four cases were taken up as elective procedure.. Out of five cases taken up for emergency surgery, Three patients had oesophageal perforation following endoscopic dilatation presented with effusion, sepsis and toxemia. They underwent cervical oesophagostomy, intercostal drainage and feeding jejunostomy. One patient had conduit necrosis following gastric pullup for which excision of necrosed conduit and oesophageal diversion were done. One patient who had anastomotic leak in the abdomen following coloplasty underwent exteriorization. All emergency cases were excluded from the study.

Out of Twenty four cases planned for elective definitive surgery, Two cases planned for colonic pull up were excluded from the study because of unfavourable intraoperative mesenteric vascular anatomy.

Of the remaining Twenty Two cases, three cases had esophageal stricture, ten cases had only gastric stricture and nine cases had combined esophageal and gastric strictures as shown in figure 8. Out of Twelve cases of esophageal strictures, four had long stricture and two had multiple

stricture which had the risk of perforation were not planned for dilatation and they underwent surgery. Two cases who failed to respond to dilatation were taken up for surgery. Four cases of dilatable oesophageal stricture with antral stricture underwent endoscopic dilatation and Billroth I gastrectomy. Various grades of combinations of severities involving variable portions of oesophagus and stomach were managed appropriately as shown in the table . The average time interval between the intake of corrosive agent to elective surgical procedures were Nine to Twelve weeks in Eleven cases (50%), Four to Six months in Nine cases (40.8%), Seven to Nine months in Seven cases (32%) and more than Ten months in Two cases.

OESPHAGEAL STRICTURE

As indicated above, in patients with failed dilatation, multiple strictures, a long stricture, esophageal replacement was done with stomach which is our first choice. When stomach was not available, colon was used. Our preferred route of pullup was retrosternal. Patients with non dilatable strictured oesophagus with normal stomach (Three cases) underwent retrosternal gastric pullup. Strictured native esophagus was not removed in any of the cases.

In one case, esophagocoloplasty was done as a second surgery following gastric conduit necrosis . In one case where stomach was not available, coloplasty was planned and that too was deferred because of anomalous blood supply.

COMBINED OESOPHAGEAL AND GASTRIC STRICTURE

In patients with strictured antrum of stomach with dilatable stricture of oesophagus (Four cases) underwent endoscopic oesophageal dilatation and Billroth I gastrectomy. Patients with low capacity,unhealthy stomach with nondilatable oesophageal stricture (Three cases) underwent colon substitute for oesophagus with colojejunal anastomosis. Patients with antral stricture with dilated stomach and nondilatable oesophagus (Two cases) underwent colonic substitute with Billroth I gastrectomy. Retrosternal route was used for coloplasty. Native strictured oesophagus was not removed.

CORROSIVE CICATRIZATION OF STOMACH

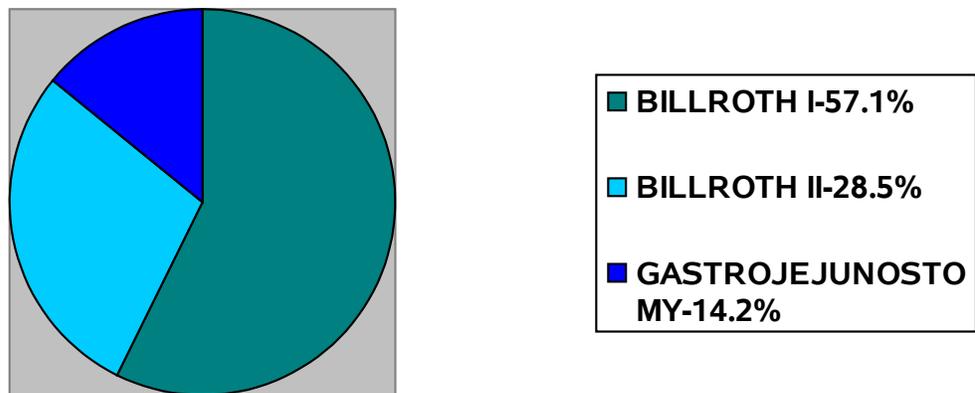
Eight cases of antral stricture underwent antrectomy and Billroth I anastomosis. Four patients with distal body and antral stricture underwent distal Gastrectomy with Billroth II anastomosis. In all Four cases, truncal vagotomy was done. Peroperative assessment includes looking for inflamed ,edematous, thick stomach wall, duodenum first part whether normal, supple, and narrowed ,so that risk of leak after anastomosis is

avoided. Number of cases as shown in figure 9.

We prefer to do resection rather than bypass of antral stricture. In Two cases, where the patient's general condition was poor with co- morbid illness gastrojejunostomy were done.

Figure 9

TYPES OF GASTRIC SURGERIES DONE



In nutritionally poor patients, feeding jejunostomy as an enteral access to improve the general condition including serum protein levels were done and patients were taken up for surgery after 8 weeks. Out of Twenty four cases, Sixteen underwent enteral access.

POST OPERATIVE PERIOD

Patients who underwent reconstructive procedures were managed at intensive surgical care unit in immediate post operative period. Elective ventilation was planned for coloplasty ,and gastric pullup cases for first twentyfour hours .Extubation was planned thereafter depending on patient's general condition in consultation with anaesthesiologist. Intense monitoring of patients with basic blood investigations and arterial blood gas analysis were done periodically for the patients on mechanical ventilator. Intravenous fluids were given accordingly to C.V.P. Bed side chest radiograph were taken.

Chest physiotherapy was started when patient becomes stable. In gastric pullup procedures. jejunostomy feeding started as soon as bowel sounds were heard. Oral fluids are started after checking the intactness of the anastomosis by giving gastrograffin as oral contrast.

In Two cases of coloplasty, the neck wound was not closed primarily, Vaseline gauze dressings were done till the edema, bulkiness and congestions were reduced. Neck wound was sutured secondarily under local anesthesia.

COMPLICATIONS

Out of Three cases of gastric pull up, one case developed gastric conduit necrosis which was recognized by drastic colour change and other evidences of necrosis on the fourth post operative day. Immediate laparotomy and resection of gastric conduit, tube gastrostomy, and cervical esophagostomy was done.

Out of Five cases of coloplasty, one case had mild cervical anastomotic leak on fourth postoperative day which settled conservatively. One patient on tracheostomy insitu who underwent coloplasty had swallowing difficulty due to aspiration. Patient was managed by changing to cuffed tracheostomy tube and inflating the cuff during swallowing. Swallowing improved with training.

Out of Three cases of esophagogastric anastomosis, one case developed delayed gastric emptying which was managed conservatively. Pyloroplasty / pyloromyotomy were not done in our series.

Out of Eight cases of distal Gastrectomy with billroth I anastomosis, one patient developed anastomotic leak on fourth postoperative day which was managed by conservative treatment.

Out of Twenty Two cases, Two patients had severe pulmonary infections which were managed with bronchodilators, antibiotics and chest Physiotherapy Six Cases developed wound infection. .

MORBIDITY IN OUR SERIES

S.No.	COMPLICATIONS	NUMBER OF PATIENTS
1	Severe pulmonary infection	2
2	Wound Infection	6
3	Leak in neck anastomosis	1
4	Delayed gastric emptying (gastric pullup)	1
5	Intra abdominal leak (Coloplasty)	1
6	Gastric conduit necrosis	1
7	Leak following Billroth I gastrectomy	1

DISCUSSION

Corrosive ingestion is a common mode of poisoning ^{1,2}. In adults suicide attempts accounts to Ninety two percentage in France and Sixty one percentage in Denmark remaining cases were accidental ingestion by alcoholics³. The same trend occurs in India also. Acid ingestion is more common than alkali ingestion in India⁴ This is the result of the fact that concentrated acids are much cheaper than alkaline toilet cleaner. Up to 85% of patients in India with acid ingestion may have esophageal injuries along with gastric /duodenal injuries. Up to Thirty percentage of patients with esophageal injury may develop stricture.⁴ Studies from various parts of India have shown more incidence than this.

The extent of corrosive injury depends on two factors. One is the concentration of the corrosive and second is the duration of exposure.⁵ The role of steroids in the management of acute phase remains controversial. Summaries of Thirteen publications have shown that steroids have no benefit in grade I injuries and do more harm in grade III injuries (like perforation, infection) ⁶.

Acid ingestion results in higher incidence of stricturing and has a graver prognosis than cases with caustic ingestion. The common belief of – Acid licks the oesophagus and bites the stomach- does not always hold good as for as corrosive injury is concerned as the grade of severity and extend of injury depends on various factors.

MORBIDITY AND MORTALITY OF CORROSIVE INGESTION

Corrosive Agent	Cases (n)	Burns (%)	Strictures (%)	Mortality
Lye	3000	28	4	2
Acid	366	-	33	18
Sodium hypochlorite (5-6%)	857	8.8	13	-

After tucker and Yerington.⁷

Howell and colleagues calculated Nineteen percentage stricture rate with patients with steroids versus Forty One percentage those who were not receiving steroids. Second and third degree injuries develop strictures. In addition to infection at the ulcerated area of injured site, acid reflex produces intense reaction leading to stricture formation within Three weeks to Three months.⁸.

Axial shortening of the esophagus results in hiatus hernia and gastroesophageal reflex disorder (GERD) and may worsen the original corrosive injury.⁹. Thirty to fifty percentage of patients will respond to endoscopic dilatation ¹⁰.Endoesophageal resection ¹¹ and laser resection ¹². for selected short strictures has been reported.

OESOPHAGEAL STRICTURE

The most common sites of injuries in esophagus following caustic ingestion are the three natural points of anatomic narrowing in the esophagus

- (1). The cricopharyngeus
- (2). The aortic arch
- (3). the cardia

but no area is immune to injury. Acid is said to “Lick the esophagus and bite the pyloric antrum” .Alkali tends to cause more uniformly severe mucosal injury to the esophagus ¹³. This is not always true. Ingested acid tend to cause significant gastric damage sparing esophagus, although severe

esophageal injuries can occur ¹⁴. Other reasons believed to be causing more gastric damage than esophagus are esophageal squamous cell lining are relatively resistant to acid, reflex pyloric spasm in response to content causing pooling of the corrosive resulting in antral strictures. Zargar study states almost one third of these patients went on to develop esophageal stricture ⁴. The reason attributed was the ingestion of large volume of concentrated acid with suicidal intent ⁴. Endoscopic grade of injury were also found to be similar in acid versus alkali ingestion 39% versus 45% in grade II esophageal injuries and 48.8 versus 54.8 in grade III injuries ⁴.

The development of dysphagia after the initial injury may be multifactorial, rather than due to stricture alone. Dantas and mamede reported disordered esophageal motility in almost all patients studied One to Fifty Three years after their injury ¹⁵. Because strictures take approximately Three weeks to Three months to become manifest, patients are to be reevaluated with barium swallow to know the development and extent of stricture¹⁶.

If barium swallow alone is used, it can lead to false result. The reason is that if the lumen of the esophagus is severely compromised, little barium gets through the stricture and may give a false impression of a long stricture. To define the precise length of the stricture, a technique of a barium filled penrose drain is followed ¹⁷.

MARCHAD'S GRADING OF CORROSIVE OESOPHAGEAL STRICTURE

<i>GRADE</i>	<i>FEATURES</i>	<i>PROGNOSIS</i>
1	Short linear shelf less than circumferential	No dysphagia No permanent stricture No progression
2	Short annular, circumferential strictures, minimal fibrosis	No dysphagia, Occasional bolus obstruction No progression Easy dilatation
3	Dumb-bell shape dense annular stricture Length < 1cm Fibrotic wall	Dysphagia May require frequent dilatation
4 (a)	Tubular < 1cm in length	No progressive narrowing Easy dilatation
4 (b)	Tubular > 1cm in length Densely fibrotic, narrow lumen	Difficult dilatation Bypass operation necessary

Marchand et al ¹⁸

Because early dilatation are associated with an increased risk of perforation, dilatation should not be instituted until at least Six to Eight weeks after the injury, when reepithelisation as documented by endoscopy has occurred¹⁹

Strictures that are not dilatable or that remain refractory to dilatation after Six to Twelve months necessitates esophageal substitution ²⁰. It is not possible to define exactly the number of dilatation that will bestow normality

and how much disability is tolerable for the patients. The decision to replace the esophagus is therefore a joint one made by the patient and surgeon ²¹.

DILATATION OF OESOPHAGEAL STRICTURE

Esophageal dilatation antegrade or retrograde has remained the mainstay of treatment for corrosive esophageal stricture. From 50-75% of all strictures, especially those that are limited in length can be managed by repeated bouginage. For antegrade dilatation Olive tipped, Savary or Hurst mercury bougies are preferable. Suggested regimen for dilatation of corrosive stricture are dilatation to be done monthly for a year, Two to Three months for another two years before the scar becomes stable (Anantha Krishnan et al). In this study, patients with combined injuries -dilatable oesophageal stricture and antral stricture (Four cases) underwent endoscopic

dilatation with Billroth I gastrectomy In our study we have come across Three cases of perforation of oesophagus following endoscopic dilatation done elsewhere presented with mediastinitis, pleural effusion with sepsis. Favourable outcome for endoscopic dilatation are age less than Eight years, length of stricture less than Five centimeter and stricture at upper One Third of esophagus. Strictures due to lye and extensive strictures are associated with an unfavorable outcome (Anantha Krishnan et al)

INDICATIONS FOR SURGERY OF OESOPHAGEAL STRICTURE

Twenty to Fifty percentage of patients with corrosive strictures of oesophagus will require surgery. The indications are

- Need for excess dilatation
- Inability to dilate to a sufficient diameter ⁸
- Long extensive strictures
- Multiple strictures
- Failed dilatation
- Patients with previous complications of dilatation such as esophageal
- perforation.

TIMING OF SURGERY

Decision for esophageal replacement is done after six months because intrathoracic strictures may yield to dilators as the scar softens, four to six months after the burns and scar formation continues for at least six months and scarring in the upper esophagus may complicate the performance of an anastomosis to the esophageal substitute ²¹. In our series, we follow this protocol of decision to go for surgery after six months following the improvement of the nutritional status.

GASTRIC STRICTURE / CICATRIZATION

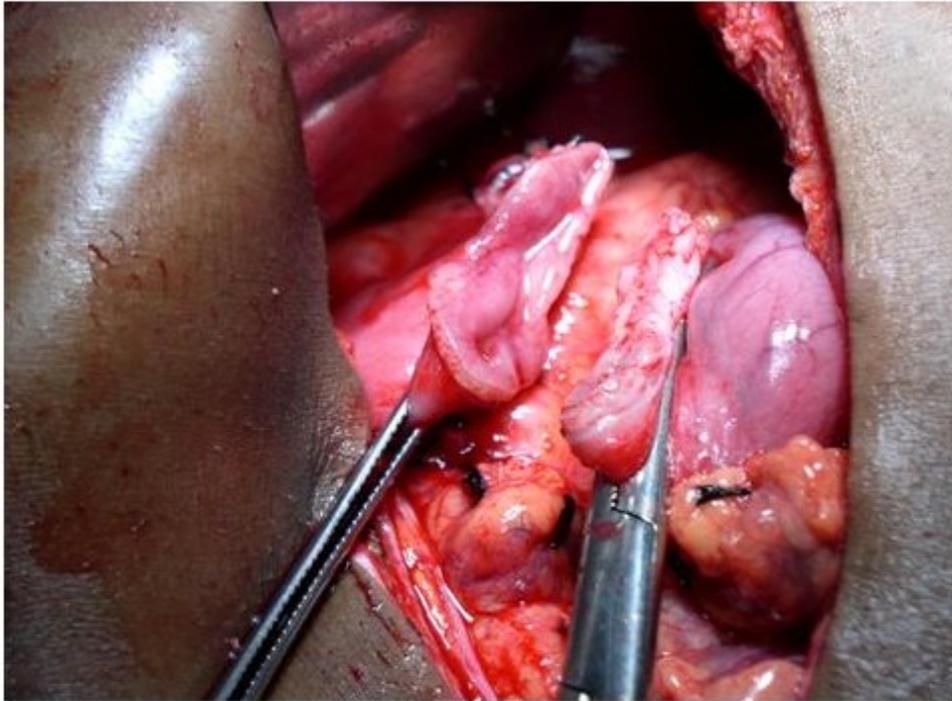
Either acid or alkali produces reflex pyloric spasm leading to pooling of acid leading to antral stenosis, hourglass type of deformity or Linitis plastica ²⁰. The effect of corrosive is more aggressive on empty stomach. Zargar et al noted that acute gastric injury was present in 85.4% of their patients who had ingested acid involving mainly the distal half of stomach with 44.4% having late complications in the form of pyloric or antral stenosis and linites plastica. The relative sparing of duodenum is thought to be due to pyloric spasm induced by the irritant acid in the antrum and the alkaline pH of the duodenum.

TIMING & TYPE OF SURGERY FOR GASTRIC CICATRIZATION

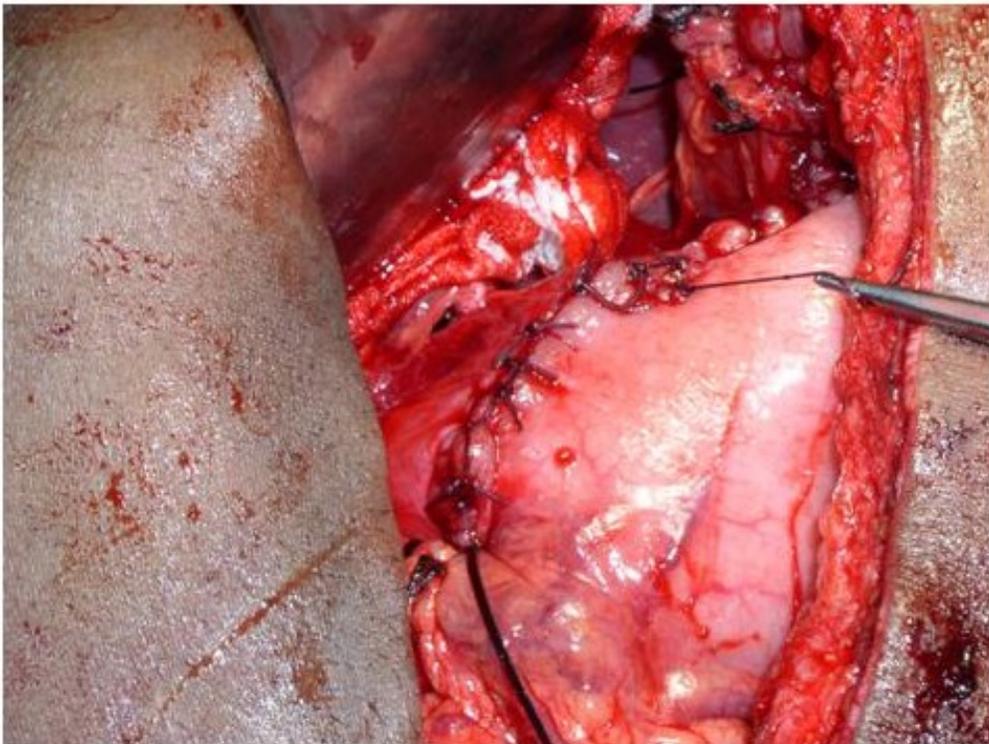
Optimal timing and type of surgery for gastric cicatrization are still unclear ²². In corrosive stricture of stomach, surgery tailored according to the extend of gastric involvement and presence of associated esophageal strictures gives excellent result ²³. The risk of gastric carcinoma is less known. Grey and Holmes first reported in 1948, findings of squamous metaplasia in the stomach of a patient who had ingested acid ²⁴. OD'onnall and Eaton confirmed it ²⁵. Some surgeons are more aggressive of the involved part by resection of subsequent gastric metaplasia ²⁶. The strictured stomach may lead to protein losing gastropathy. For these reasons resectional surgeries for cicatrized stomach is preferred to bypass procedures.

Antral strictures are best treated by truncal vagotomy and antrectomy ^{27,28}. Subtotal gastrectomy and even total gastrectomy can be done depending on the extend of involvement of stomach. Although pyloroplasty and gastroenterostomy have been used successfully, recurrent structuring and stomal ulceration are possible with these techniques ^{29,30}. Successful results of Y-V advancement antropyloplasty for corrosive antral stricture in children has been reported ³¹. Endoscopic ballon dilatation of antral stricture may be done with some satisfactory result. Feasibility of laparoscopic distal gastrectomy has been reported ³².

BILLROTH I GASTRECTOMY-EXCISION



BILLROTH I GASTRECTOMY-ANASTOMOSIS



COMBINED OESOPHAGEAL AND GASTRIC CICATRIZATION

Antral stricture with dilatable esophageal stricture can be managed with antrectomy and dilatation of esophageal stricture, and follow up. Un dilatable or multiple esophageal stricture with antral stricture are managed with coloplasty (esophagocolic and cologastric anastomosis) with distal gastrectomy. Patients with nondilatable or multiple stricture esophagus with coexisting distal diffuse stricture and/ or deformity of stomach are managed by Billroth I gastrectomy and coloplasty (esophagocolic and colojejunal). In our study we have done all these procedures.

NUTRITIONAL ASSESMENT AND MANAGEMENT

Nutrition assessment is a critical step in nutritional care. Nutritional assessment combines data from the initial picture with information from a physical examination, body composition and evaluation of immune status. Various formulae involving several nutritional parameter are there .To predict the nutritional status of these ,easily applicable formula proposed by seltzer et al for instant nutritional assessment has been followed.

INSTANT NUTRITIONAL ASSESMENT (by seltzer et al)

CATEGORY	% OF WT LOSS	S. ALBUMIN	TOTAL LYMPHOCYTE COUNT
MILD	< 10%	3.5 - 3	1800 – 1500
MODERATE	10 - 20%	3.5 - 2.5	1500 – 900
SEVERE	> 30%	< 2.5	< 900

Apart from assessing the nutritional deficits, the nutritional requirement to withstand the subsequent major surgery is to be assessed. This is the goal of nutritional assessment. Based on the nutritional assessment, the patient may be classified into mild, moderate and severe malnutrition.

The following parameters are used for nutritional assessment

1. Body mass index = weight (Kg) / Height(m²)
2. Midarm circumference
3. Triceps skin fold thickness
4. Serum albumin levels
5. Total lymphocyte count
6. Candida skin test
7. Nitrogen balance studies

ANTHROPOMETRIC MEASUREMENTS IN ADULTS

(MORGAN AND WEINSIER)

%STANDARD	MEN	WOMEN	INTERPRETATION
MIDARM MUSCLE CIRCUMFERENCE (CM)			
100	25.5	23	Adequate
80	20	18.5	Borderline
60	15	14	Depletion
40	10	10	Severe depletion
TRICEPS SKIN FOLD (MM)			
100	12.5	23	Adequate
50	6	8	Borderline
20	2.5	3	Severe depletion

NUTRITIONAL REQUIREMENT

Energy requirements are calculated depending on the degree of malnutrition over the normal requirement at rest of Thousand five hundred to Two thousand calories per day. The protein requirement for an average hospitalized patient would be 1-1.5gm of protein / Kg / day. Stressed patients may require up to 2gm / Kg / day. Nitrogen requirement to maintain positive nitrogen balance is about 35-40gms of protein. In hypercatabolic state requirement may rise up to Three to Four times. Non-protein calories to nitrogen ratio of 150: 1 is optimal for patients with mild and moderate stress levels and 100: 1 ratio for severe stress. Fluid requirement would be 30-35ml / Kg / day for most patients with adequate hydration. Vitamins and mineral requirement for hospitalized patients are not known. Most patients with corrosive injury are unable to maintain nutrition and are best nourished

by enteral access.

FEEDING GASTROSTOMY

In patients with corrosive injuries, gastrostomy is best avoided for feeding purpose since stomach may be involved in disease process and it can be used as an ideal organ for replacement of esophagus if required in future. The advantages of gastrostomy are its better toleration, duodenal secretion not being bypassed, using of blenderised home diet is possible and maintenance of reservoir function and can be fed intermittently.

FEEDING JEUNOSTOMY

Witzel's jejunostomy and needle catheter jejunostomy may be done even under local anesthesia. The disadvantage includes intolerance to feed and constant rate of continuous administration are needed. Diarrhoea is common. Recent studies suggest that osmolality, electrolyte content and volume of the feed is not implicated in the onset of diarrhea. It is now probable that bypassing of the cephalic phase of feeding when a tube is insitu results in suppression of distal colonic motor activity with the onset of diarrhea.

The regimen to be followed to avoid diarrhea, is to commence with half strength feed and increase slowly to standard concentration over days given at a slow, constant rate, avoiding milk because of possible lactose intolerance and a high fat content giving steatorrhoea. The optimal

osmolality of a feeding jejunostomy feed is around 300 mosml with a caloric load of about Thousand calories and Twenty grams of protein per liter.

Patients with normal digestive capacity may be given blenderized diets, which are the regular hospital diets formulated for each patient cooked and meshed to a liquid form which are administered intermittently.

Elemental diet are predigested feeds containing peptides or aminoacids as an end product which are in a better absorbable forms.

High cost and nonavailability are their disadvantages.

In this study, feeding jejunostomy was done as an enteral access in Sixteen cases before definitive procedure.

TOTAL PARENTERAL NUTRITION

Whenever possible enteral alimentation is preferred to parenteral nutrition since they maintain secretory IgA production in GI tract, causes less gut bacterial translocation ,macromolecular permeability and sepsis . There is no catheter related risks and are available at lower cost. Those patients with severe malnutrition and who are intolerant to enteral feeds may need total parenteral nutrition. The required amount of calories and nitrogen are administered through a central vein, controlling the rate and concentration of administration there by minimizing metabolic complications.Special care to be taken regarding requirement of vitamins,

minerals and trace elements.

ASSESSMENT OF CARDIOPULMONARY STATUS

Assessment of the patient's cardiopulmonary reserve is essential before any major surgical undertaking such as gastric pullup. A thorough history is obtained with specific concentration on respiratory difficulties at rest or with exertion, exercise tolerance, chest pain and fatigability. Physical examination should concentrate on cardiopulmonary findings. When a question exists about coexistent cardiac or pulmonary disease based on patient's age, co-morbid conditions, physical signs or symptoms, formal physiologic testing should be pursued. Pulmonary function testing including expiratory flow, lung volumes and diffusion capacity, can objectify the severity of concomitant obstructive or restrictive lung disease. Lung function should be optimized through smoking cessation, bronchodilators, expectorants, antibiotics and pulmonary rehabilitation, as necessary. Cardiac imaging and stress testing can elicit subtle changes in cardiac function suggestive of ischemia, cardiomyopathy, or valvular heart disease. When coronary artery or valvular pathology is deemed significant, interventions such as angioplasty, coronary stenting, or even open heart surgery should be completed before elective oesophageal surgery in an effort to minimize perioperative risk at the time of major surgery.

One advantage of oesophageal surgery in the setting of benign

disease like corrosive strictures versus malignancy is that surgery can often be delayed pending optimizing of cardiopulmonary issues, nutrition ,or other co-morbid diseases. Although the patient and treating physicians may feel a time pressure to treat an oesophageal malignancy, end stage oesophageal disorders like corrosive stricture tend to be long standing problems that can be temporized while a thorough workup is completed and risk factors addressed. Although no absolute thresholds exist for abandoning surgery because of pulmonary or cardiac compromise, such objective information can often assist the surgeon quite significantly in making a decision for or against oesophageal reconstruction and in the type of operation chosen.

PREOPERATIVE PREPARATION

An aggressive Two to Three weeks preoperative out patient programme of pulmonary physiotherapy using an incentive spirometer are given. Physical conditioning by walking between One to Two miles a day when possible are initiated in patients. Complete abstinence from cigarette smoking is mandatory. Corrections of anemia, dehydration, electrolyte imbalance, respiratory tract infections are done. The karnoffky performance status of at least Seventy was achieved in all patients with target preoperative serum albumin of 3.5gm%. Nutritional is calculated so that patient of average nutritional status gets Two Thousand to Three Thousand

calories per day through enteral and parenteral route. Patients with gastric outlet obstruction stomach lavage and decompression done a day before surgery.

In patients planned for gastric pullup, in addition to stomach, colon is prepared by mechanical bowel preparation and antibiotics. Bowel preparation followed in our department for coloplasty are clear fluids through jejunostomy tube avoiding mild and high residue diets for Four days before surgery.. Day before surgery polyethylene glycol with electrolyte solution two liters is given through jejunostomy tube until the rectal effluent is clear. Intraluminal antibiotic consisting of erythromycin and neomycin are given on previous day. After induction of anesthesia and just before incision, parenteral antibiotics consisting of cefotaxime 1gm and metronidazole 500mg are given.

FATE OF DISEASED / STRICTURED OESOPHAGUS

When oesophageal substitution is required for a stricture resulting from caustic ingestion, the need for concomitant resection of the damaged esophagus is controversial. Mark B Orringer advocates diseased esophagus to be resected for the following reasons.

1. Prevents formation of retention cysts / abscess.
2. Reflex oesophagitis, if esophagus still attached to stomach
3. Prevents risk of malignancy

4. Provides space at original esophageal bed – short route to neck
5. Prevents disruption of excluded esophagus forming abscess Orringer et al³³

STRICTURED OESOPHAGUS – TO BE RESECTED OR NOT

Because of risk of carcinoma developing in caustic strictured esophagus, there is a theoretical advantage in performing prophylactic excision. Actual risk seem to be very low and less than 5%. Bigelow studies show that interval from injury to development of cancer was 24-45.8yrs and patient's age group was between Fourty Eight to Fifty Three years ³⁴. In reported series of carcinoma esophagus, a history of caustic ingestion was noted in One to Four Percentage of patients.

There is a Thousand fold increased risk of developing oesophageal carcinoma after caustic injury with an incidence of 0.8 to 4%, often after a latent period of Twenty to Fourty years ^{35,36,37,38}. There is an increased risk from surgical resection of the fibrotic and adherent oesophagus for injury to bronchi, aorta recurrent laryngeal nerves. Removing the oesophagus increases morbidity rate exceeding Five Percentage. Retaining esophagus preserves the vagus thus avoiding the distressing sequel of gastric atony and / or disturbance of intestinal motility which affect the result of oesophagoplasty (Anantha Krishnan et al). Other authors including mark B

Orringer have not found excision to be hazardous ^{39,40}

The carcinoma arising from the scarred esophagus has better prognosis than primary esophageal carcinoma for the following reasons. Patients with corrosive stricture would be under constant surveillance, carcinoma from oesophagus spreading through the fibrotic reaction surrounding it at a late stage.

Patients who have a retained esophagus with a caustic stricture should be followed carefully for the development of malignancy for the rest of their lives (Mark B Orringer). In our study we do not remove the diseased esophagus.

POSITIONING OF THE CONDUIT

Criteria for a satisfactory position

1. Substituted organ should lie in a straight line
2. Should not encroach on the lumen of the viscous
3. No compromise of the blood supply

Three commonly used positions are

1. **Presternal subcutaneous route** – This route is easy for construction, avoids encroachment on heart or lungs and facilitates early detection of graft failure. But cosmetically unacceptable and difficult to dilate when they develop anastamotic stricture.

2. **Posterior mediastinal route** – It is the shortest and direct route preferred by Orringer after excision of the corrosive esophagus. But this procedure may be difficult in corrosive stricture oesophagus patients who have inflamed scarred mediastinum
3. **Retrosternal route** – Easy to construct and useful when mediastinum is unavailable. Only disadvantage are that it is a longer route, can produce graft angulations and venous compression by thoracic inlet. Resection of the ipsilateral half of the mediastinum, the clavicular head of sternomastoid muscle and anterior portion of the first rib will open up the thoracic inlet and avoid compression.

The choice of position of conduit depends on the status of the mediastinum, length of the conduit available and experience and preference of the operating surgeon. We routinely use retrosternal route for the oesophageal reconstruction for all cases.

OESOPHAGEAL SUBSTITUTES

Replacement of the oesophagus remains a challenge for surgeons specializing in oesophageal disease. The ideal conduit should restore normal swallowing, maintain active peristalsis, protect from acid reflex, be of sufficient length to replace as much of the esophagus as necessary, have a reliable arterial and venous supply and should not interfere with the function of the rest of the alimentary tract. No substitute satisfies all these criteria.

None allows for normal swallowing. These principle observations are reason enough to preserve the esophagus whenever possible, particularly in benign disease like corrosive stricture esophagus.

Each of the available conduits (.i e, stomach, colon and jejunum) has certain features that make it suitable for esophageal replacement. Certain circumstances may dictate the use of one conduit and exclude others. The surgeon treating esophageal disease must be familiar with all options. Successful replacement requires in depth understanding of the technical aspects of each individual procedure. Proper patient selection and strict attention to preoperative and post operative care ensures the greatest chance for a successful outcome and near normal swallowing.

Three standard visceral substitutes used for replacing the esophagus in the order of both frequency and preference of usage are stomach, colon and jejunum. With Eight Percentage of heart burn and up to Fourty Percentage patients requiring endoscopic dilation for dysphagia, Bender et al concluded that an intrathoracic esophagogastric anastomosis is inappropriate for benign disease ⁴¹ .

FACTORS OF THE IDEAL OESOPHAGEAL SUBSTITUTE

- Technically simple to construct
- Minimal incision
- Minimal number of anastomosis

- Adequate length
- Reliable blood supply
- Allows normal swallowing
- Does not alter gastrointestinal function
- Resistant to (or able to prevent) acid reflex
- Durable with no long term complication

FACTORS DETERMINING THE CHOICE OF SUBSTITUTE

1. Availability, related to prior surgical resection.
2. Anomalous anatomic variants including blood supply.
3. Pathologic processes in organ under consideration.
4. Technical reliability of blood supply.
5. Experience of operating surgeon. ⁴²
6. Ability to carry out normal functions of esophagus.
7. Morbidity and mortality of the procedure itself. ⁴³

Out of above factors, first and foremost requisite for successful replacement of the esophagus is adequate circulation both arterial input and venous drainage in the substituting organ ⁴².

STOMACH AS OESOPHAGEAL SUBSTITUTE

Esophagogastroplasty is a popular procedure because of its simplicity.

The liberal blood supply of the stomach and adequate length makes it the

most reliable organ for esophageal substitute. Other favourable factors are closed anatomical proximity, single anastomosis and fewer incidence of leak. The disadvantages are long suture line, acid production and reflex, loss of reservoir function, diameter mismatch and the carcinoma arising from corrosive injury itself. The stenosis of the gastric outlet can occur several months after bypass of the oesophagus and present with vomiting and dilatation of the conduit. A high rate of concomitant or delayed corrosive stricture formation and shortening of stomach requiring treatment may preclude the possibility of esophagogastroplasty. In spite of these disadvantages, stomach is considered to be the conduit of choice if it is unaffected by corrosive at the time of surgery. In this series, we used stomach as esophageal substitute in Three cases.

TYPES OF GASTRIC CONDUIT

There are four types

1. Stomach as a whole
2. Greater curvature tube
3. Reversed gastric tube
4. Non reversed gastric tube

Whole stomach conduit

The advantages of stomach as a whole include no technical difficulty and disadvantages are bulky ness and reflex risk.

Greater curvature tube

This is based on right gastroepiploic vessels after excising upper two third of lesser curvature. The contributions of right gastric artery are insignificant ⁴⁴. Disadvantage of this tube are few including the possibility of dehiscence of long suture line but over all functional results are satisfactory (Orringer et al 1999)

Reversed gastric tube

Invented by Beck and Corrol (1905) and rediscovered by Gavriiliu ⁴⁵ (1965) . The advantages are the ability to reach the pharynx via any route, absence of kinking and satisfactory restoration of swallowing. Blood supply depends on microcirculation plus micro vascular diameter, which are nothing but communication between left and right gastroepiploic vessels ⁴⁴. The disadvantages include long suture line and limited blood supply. In this study one patient underwent Gavriiliu's reversed gastric tube. But unfortunately gastric conduit necrosed which was removed on Fifth postoperative day. This patient underwent coloplasty later.

Non-Reversed gastric tube

Described by Postlewait (1986) is an isoperistaltic greater curvature tube based on right gastroepiploic artery. Vagal nerves are preserved and so no need for pyloroplasty. Mostly used in children. Disadvantages include long suture line ⁴⁶.

NEED FOR DRAINAGE OR NOT

It is a matter of debate for patients who undergo gastric pull up. Studies have shown four times delay in gastric emptying without draining procedure following gastric pull up ⁴⁷. Patients with significant gastric outlet obstruction may have impaired nutrition due to inability to eat and fatal outcome due to disastrous aspiration pneumonia. There is no morbidity from pyloroplasty ⁴⁸. Reoperation for gastric outlet obstruction may be difficult after gastric pull up since the stomach will be in the thoracic cavity. From a physiologic stand point, gastric drainage procedures make eminently good sense. Either pyloromyotomy or pyloroplasty are advocated and former is preferred because the length of the stomach is preserved and some retained pyloric muscle prevents reflux.

In contrary, Huang and colleagues in a prospective study of pyloroplasty versus no pyloroplasty after esophagectomy showed no difference in gastric emptying time ⁴⁹. There are studies to show that esophagogastric anastomosis without a concomitant drainage procedure does

not develop difficulty with gastric outlet obstruction ^{47,49,51}. In our studies, we don't do any drainage procedure.

COMPLICATIONS FOLLOWING GASTRIC PULL UP

EARLY COMPLICATIONS

Cervical anastomotic leak

A cervical oesophageal anastomosis leak seldom occurs after the Tenth post operative day. Leak in neck anastomosis produces a cervical salivary fistula. The cause of leak is due to ischemia of the conduit which may be due to poor technique in harvesting the interposing organ, decreased arterial perfusion of compression by the narrow thoracic inlet, causing venous congestion and poor healing ⁵². Hypoalbuminaemia plays an important role in pathogenesis of leak ⁵³. Dewar et al registered a statistically significant correlation with serum albumin ⁵⁴.

CLASSIFICATION OF CERVICAL ANASTOMOTIC LEAK

(After Vigneswaran W T) ⁵⁵

TYPES	CLINICAL FEATURES	FATE AND MANAGEMENT
I	Clinically silent, discovered during routine post operative contrast study	Small contained leaks heals spontaneously without complication
II	Fever, Erythema and pain in neck purulent discharge from the wound	Opening neck wound resulting fistula heals in Two to Three weeks. Anastomotic strictures

		occur
III	Characterized by gastric ischemia due to vascular complication	Dismantling anastomosis, cervical esophagostomy, resection of necrotic stomach tube gastrostomy (if feasible) and feeding jejunostomy.

Cervical leaks do not warrant contrast examination for detection as they are clinically evident by the presence of saliva ⁵².

CONDUIT COMPLICATIONS

A longer length of conduit is dependent up on perfusion from the main pedicle which remains in the abdomen. Moreover it is also vulnerable to extrinsic compression and twisting. Injury during manipulation to neck and vascular insufficiency leads to graft necrosis. In postoperative period, unexplained tachycardia, low grade fever, aspiration of foul – smelling secretion / blood from nasogastric tube are signs that call for immediate evaluation of conduit. Confirmation is done by endoscopy showing dusky, discoloured mucosa. Once diagnosed, the graft is excised and a cervical esophagostomy done. When transthiatal oesophagectomy was done injury to thoracic duct azygus vein tracheobronchial tree and postoperative hiatal hernia may be expected.

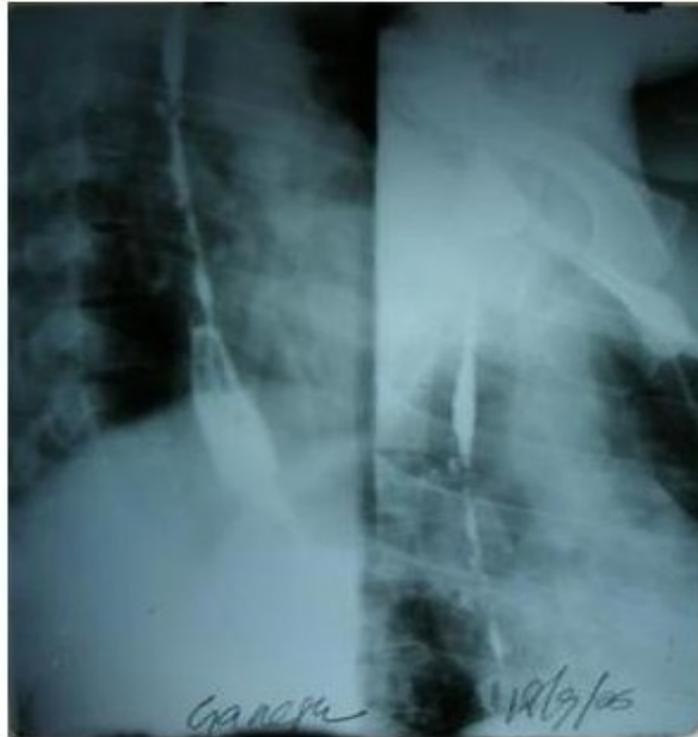
LATE COMPLICATIONS

Anastomotic stricture are usually due to wound healing and incidence increases if there was anastomotic leak post operatively and stapling esophagogastric anastomosis was done. Other causes may be due to benign anastomotic stricture due to reflux esophagitis⁵⁶. They need dilatation.

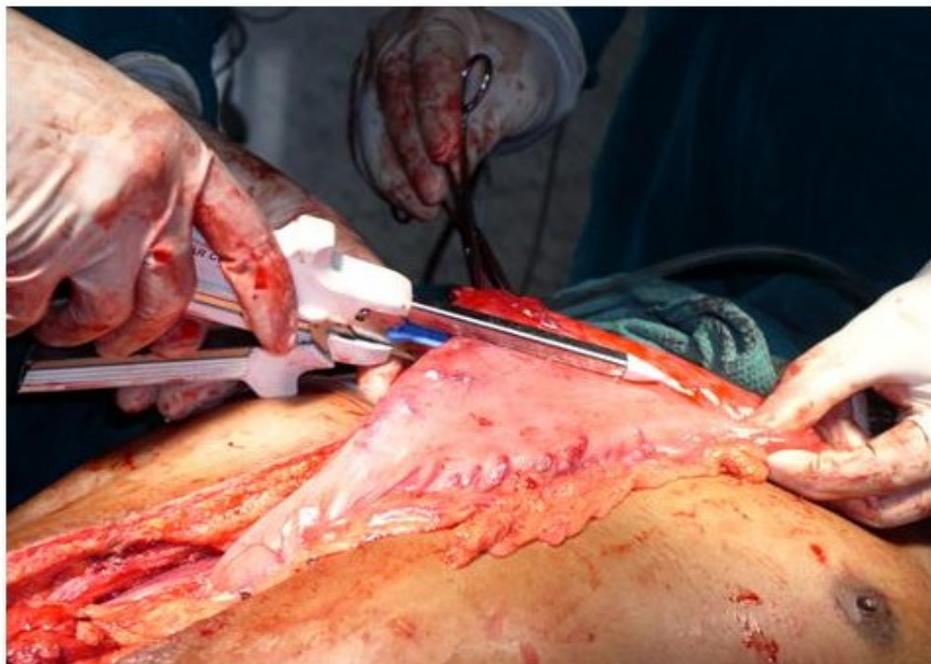
Dumping syndrome can occur as a complication. The mechanism includes rapid hyperglycemia followed by reactive hypoglycemia, jejunal distension due to rapid gastric transit, fluid sequestration in jejunum and disturbed intestinal adaptation. Rarely it is severe in One Percentage. Can be controlled by dietary modification by eating slowly, chewing food well, frequent small meals and avoiding mild and high carbohydrate meal. The symptoms usually subsides after one year.

Delayed gastric emptying may occur in few case of gastric pull that have not undergone gastric drainage procedure. There is considerable evidence to show that vagotomy results in enhanced emptying of liquids (as a result of loss of accommodation) and receptive relaxation and in stasis of solids (because of lack of active propulsion)⁵². Erythromycin a motilin receptor agonist is useful to correct the delay⁵⁷. Patient not responding may be planned for endoscopic dilatation. Reoperation is difficult and it is undertaken as a final resort.

STRICTURE OESOPHAGUS-ORAL CONTRAST STUDY



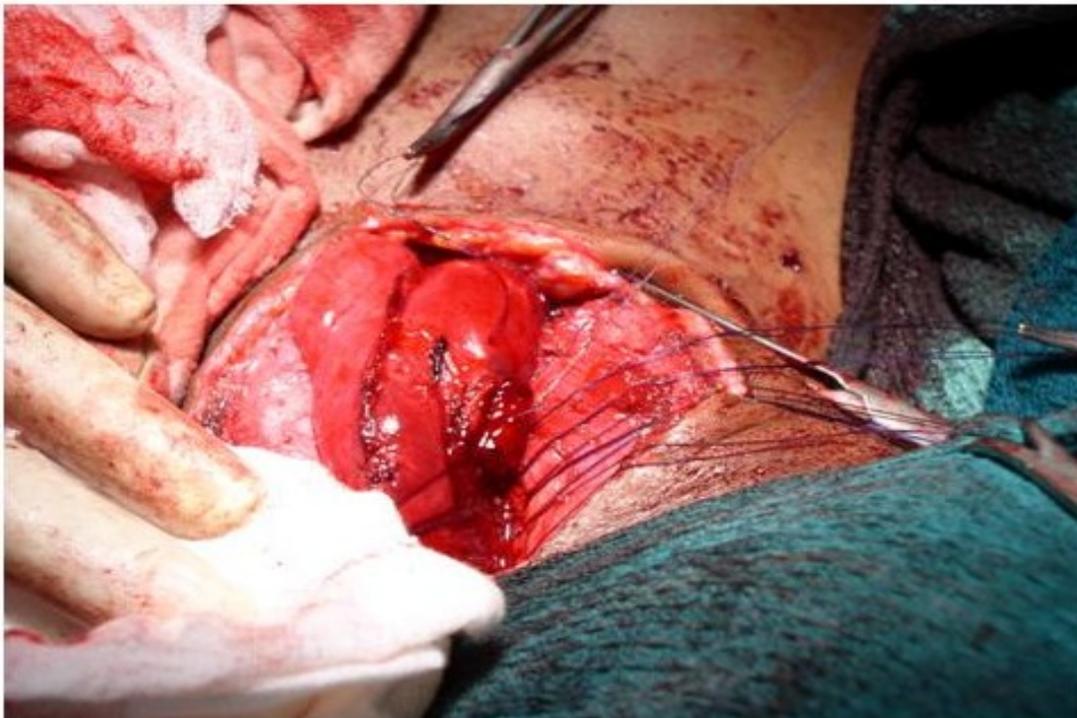
GASTRIC PULLUP-CREATION OF STOMACH TUBE



GASTRIC PULLUP-RETROSTERNAL ROUTE



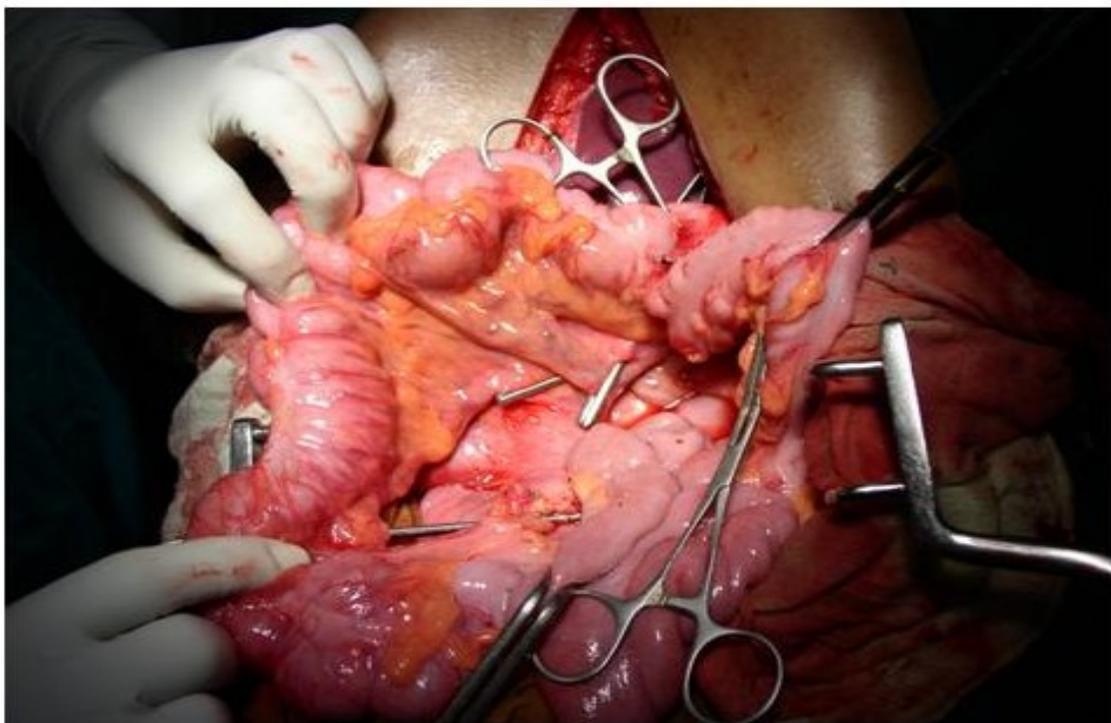
GASTRIC PULLUP-OESOPHAGOGASTRIC ANASTOMOSIS



GASTRIC PULLUP DONE- AFTER THREE MONTHS



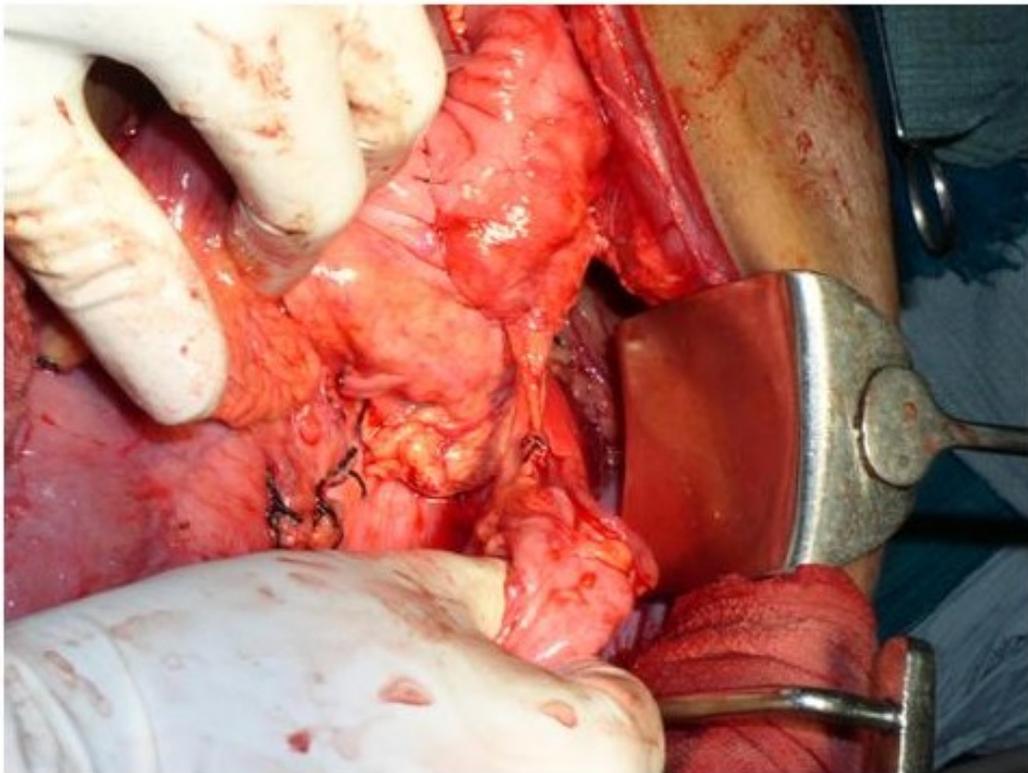
COLOPLASTY-ASSESSMENT OF COLON VASCULARITY



COLOPLASTY



AUGMENTATION COLOPLASTY



OESOPHAGOCOLIC ANASTOMOSIS



COLOPLASTY DONE -AFTER THREE MONTHS



COLON AS OESOPHAGEAL SUBSTITUTION

When stomach is not available, next choice would be colon. Left colon, right colon and transverse colon can be used as a conduit. The advantages of using colon are adequate length, good diameter match, preservation of gastric reservoir, no acid production and may be constructed in isoperistaltic manner. Only disadvantages are multiple anastomosis and less reliable blood supply. Contraindications of colon interposition are anatomical discontinuity of marginal artery, intrinsic colonic pathology, mesenteric endarteritis and subnormal colonic motility. When the colon is being considered as a potential oesophageal substitute, colonoscopy is performed to evaluate the status of colonic mucosa. Mild diverticular disease is not generally a contraindication to the use of colon as an oesophageal replacement, although extensive diverticulosis, frank diverticulitis or inflammatory fibrosis may preclude colon interposition. Similarly, the presence of few colonic polyps, whether adenomatous or hyperplastic, that can be removed before surgery does not preclude the use of the colon. The presence of extensive polyposis or malignancy, however, is an absolute contraindication.

Some controversy exists regarding the necessity for routine preoperative mesenteric arteriography when colonic interposition is planned.

Because use of colon critically depends on adequate vasculature, the surgeon should have a low threshold to perform such studies.

When arteriography is performed, selective injection of the celiac, superior mesenteric (SMA) and inferior mesenteric (IMA) arteries should be undertaken, including lateral views, with particular attention paid to any anatomic aberrancy. When left colon is to be used for interposition, the most important angiographic finding is the status of the IMA, especially at its origin, which can be stenosed in elderly individuals or in those with peripheral vascular disease. Because the blood supply of the left colon interposition critically depends on adequate inflow from the IMA, significant stenosis of this vessel is a contraindication to use of the left colon oesophageal reconstruction. A right colon interposition, based on middle colic branch of the SMA, can be used in this situation because it is not dependent on IMA inflow. Other angiographic features thought important to successful use of the left colon for interposition include a visible ascending branch of the left colic artery, a well defined anastomosis between left colic and middle colic systems (along the marginal artery of Drummond), and a single middle colic trunk before division in right and left branches. Because of its more reliable and predictable arterial inflow and venous outflow, not to mention its better size match to the native oesophagus, left colon is generally preferred over the right colon for oesophageal replacement.

Because the patients undergoing foregut reconstruction have not uncommonly undergone multiple previous operations, mesenteric angiography can help to define the resultant vascular anatomy and ascertain that vessels supplying planned oesophageal substitutes are patent and not disrupted by previous surgeries. In particular, previous operations involving greater curvature of the stomach may have disrupted the right gastroepiploic artery, critical to the blood supply of the planned gastric pullup, or the middle colic artery and marginal artery of Drummond, critical to the blood supply of the planned colon interposition. Long term sequelae include redundancy and anastomotic stricture.

LEFT COLON

Left colon is based on the ascending branch of the left colic vessels. Left colon is preferable to right for the following reasons. Its small diameter matches esophagus, the more constant and reliable blood supply from the left colic artery, better ability to propel solid bolus. Other advantages are usefulness as peristaltic substitute for propelling a solid bolus⁵⁸ and mucous shield to protect from reflux⁵⁹.

RIGHT COLON

Isoperistaltic bowel based on middle colic artery is used when stomach and left colon is unavailable. Main problem with right colon consists of lack of marginal artery in two third of cases and taut sheath of the right colic and ileocolic vessels that set the upper limit of the organ's usefulness.

A preoperative angiographic study has shown that marginal artery was present in only Thirty percentage on the right colon and up to Hundred percentage in left colon ⁶⁰. In our study, two patients aged above Forty five years in whom coloplasty was planned, procedure was deferred because of the anatomic discontinuity of the marginal artery preoperatively after clamping the appropriate vessels and middle colic vessels arising as Three trunks from superior mesenteric vessel. In this study, left colon was used in Four cases and right colon in one case.

COMPLICATIONS FOLLOWING OESOPHAGOCOLOPLASTY

1. Necrosis of transplant

The common cause of necrosis of the transplant is technical mismanagement of the vascular pedicle like torsion excess handling inadequate exposure and failure to observe mesenteric endarteritis, anomalies of vascular anatomy. Clinically patient have toxemia, fetor and

regurgitation of foul-smelling secretion confirmation are by endoscopy. Once confirmed, immediate surgery consisting of resection of conduit, closing of gastric stump cervical esophagostomy and feeding jejunostomy reoperation after Three to Six months. Ischemic complications of oesophagocolonic anastomosis may be reduced by supercharging (augmenting) the colonic arterial supply and venous drainage with microvascular anastomosis of cervical vessels to colonic mesenteric vessels (Golshani at al,1999). Colonic vascularity may be augmented distally by maintaining the continuity of the sigmoid vessels in the mesentry if feasible. In this series, augmentation coloplasty was in two cases.

2. Anastomotic fistulae

Higher incidence of fistulae at esophagocolic anastomosis compared to gastric pull up. Contrast study reveals the diagnosis in asymptomatic patient. Because of the nonerosive nature of colonic secretion, these fistulae heal spontaneously with lower morbidity compared to oesophagogastric fistulae. In our series one patient had mild leak on Fifth post operative day which settled conservatively.

3. Wound infection is an uncommon problem.
4. Anastomotic stricture: can be avoided by doing in meticulous way.
5. Herniation of small intestine through the mesocolon.

6. Paracolic hiatal herniation.
7. Progressive fibrostenosis in the proximal end of the transplant is due to reaction to chronic venous engorgement, which is preventable one. Management consists of dilatation. If not responding surgical resection of narrowed segment and reanastomosis is done.
8. Sluggish colon which accounts to 15% of colon are detected preoperatively and surgery are avoided in them.
9. Redundancy of the colon in the thorax causing kinking and obstruction can be avoided by intraoperative tailoring of the length of colon. Redundancy below diaphragm rarely causes symptoms.
10. Gastrocolic reflex and peptic colitis were first described by Malcolm (1968). They are common with cologastric anastomosis done at Cardia, at the apex of the fundus of stomach or on the anterior surface of the stomach. This complication can be avoided by anastomosing to the posterior aspect of the stomach near the greater curvature at a point one third of the length of the fundopyloric distance distal to the fundus and retaining Eight to Twelve centimeters of the transplant in infradiaphragmatic high pressure region to create an antireflex mechanism. Studies regarding the cause of peptic colitis have shown the site of cologastric anastomosis either in anterior or posterior wall is immaterial ²¹.

POST OPERATIVE MORTALITY IN COLONIC INTER POSITION

In a study by Postlewait (1983), the operative mortality was 4.9% in 474 patients operated. Ronald H.R. Belsaj also gives the same result. The general consensus is that the operative mortality should be less than 5% in cases of benign disease ⁶¹.

In this study out of Five cases, one patient expired on first postoperative day due to nonsurgical complication. Another patient had anastomotic leak with sepsis in abdomen on Twenty Sixth postoperative day managed by exteriorization and laparostomy expired after Ten days. Long term sequelae after Sixty nine long segment colon interpositions (Jayasingham et al) ⁶²

SEQUELE	NUMBER
Esophagocolic anastamotic stricture	4
Thoracic inlet obstruction	2
Colonic adeno carcinoma	1
Supra aortic redundancy	4
Supra diaphragmatic redundancy	11
Hiatal obstruction	2
Sub diaphragmatic redundancy	2
Colo gastric anastomotic stricture	7
Peptic ulceration	1

Anastomotic hemorrhage	1
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JEJUNUM AS CONDUIT

Jejunum is the third alternative for oesophageal replacement. Jejunum is easy to harvest and there is luminal match between jejunum and residual esophagus, besides, the jejunal mucosa is more resistant to ulceration. Acid is cleared rapidly back into the stomach due to efficient isoperistaltic jejunal peristalsis ⁴³.

Out of three types of jejunal substitutes, Roux loop jejunum and jejunal interposition are useful for substitution of lower third of esophagus in adults. But caustic strictures tend to involve the entire length of the esophagus and rarely isolated to the distal esophagus. For this reason, jejunum is used infrequently in adults but it may be suitable in children. Ring and associates stated that jejunum is the first choice in children where they have done esophagojejunostomy as staged procedure ⁶³.

The main limitations for its use by above methods are limited graft length without revision of pedicle or bowel and requiring 2-3 anastomosis. There is high rate of stenosis, fistula and graft necrosis.

In cervical esophagojejunoplasty, the vascular enhancement can be done by microvascular anastomosis of the internal mammary artery or a

branch of a carotid artery to the jejunal mesenteric arterial arcade. A suitable vein must also be identified and anastomosed.

The third technique of using jejunum is the popular free jejunal transfer technique. The advent of microsurgical technique has revolutionized pharyngolaryngeal reconstruction. These single stage procedures enable maintenance of oral sections and rapid return of oral feeds and swallowing with minimal mortality and morbidity. They are indicated in treatment of circumferential or partial defects of the esophagus or short segment strictures not amenable to dilatation. They are contraindicated in patients with chronic intestinal disease (e.g. crohn's disease), grave medical conditions, and chronic liver disease with ascitis. The lack of available recipient vessels in neck also precludes free jejunal transfer. The microvascular anastomosis involves anastomosing available arteries in the neck – inferior thyroid, transverse cervical or common carotid artery and veins – facial vein, middle thyroid vein or one of the jugular veins.

Joseph J Disa and colleagues (2003) demonstrated 98% flap success rate, early complication rate in Eleven percentage and fistula formation in Ten percentage and stricture formation in Eight percentage⁶⁴. The advantage includes decreased flap failure, decreased fistula formation, decreased hospital stay and earlier resumption of oral alimentation.

Comparisons of the complication rates of free jejunal reconstruction of cervical esophageal defects with gastric pull up procedures published by Schusterman demonstrate significant advantage of the former ⁶⁵.

FREE INTESTINAL TRANSFER TECHNIQUES

The free jejunal transfer is most ideal and preferred as mentioned above. Other organs used are colon and stomach however the skill required for the procedures preclude its use as the procedure of choice.

ROLE OF SKIN AND MYOCUTANEOUS FLAPS

Flaps of skin, subcutaneous tissue and muscle represent option for repair of a short circumferential gap or for the repair of secondary leaks or fistulae. The flaps can be pectoralis major myocutaneous flap, radial forearm free flap, and lateral thigh free flap, of which radial forearm free flap have excellent result ⁶⁶.

SURGERY FOR PERFORATION FOLLOWING ENDOSCOPIC DILATATION

In this series, three cases with middle onethird thoracic esophageal stricture who were on regular dilatation, presented Thirty six hours after dilatation with signs of perforation and sepsis. Cervical esophagostomy, intercostal drainage and feeding jejunostomy was done as emergency. The definitive procedure was planned after six months.

OTHER SURGICAL PROCEDURES DONE FOR CORROSIVE STRICTURE OESOPHAGUS

Surgical procedure may be necessary to release the adhesions between the tongue, floor of mouth and soft palate. Tracheostomy is needed in cases where there are laryngeal lesions. The need for tracheostomy does not indicate that this will necessarily be permanent because the vocal cords may be preserved.

Pharyngoplasty may be indicated for the stenosis in pharynx and an assistance of a competent otorhinolaryngologist is essential in planning treatment.

If protective laryngeal reflex and the phonatory and respiratory functions are irreversibly damaged and larynx is completely stenosed, laryngectomy may be done for an excellent exposure for pharyngeal anastomosis (Thomas et al). Laryngectomy is only used as a final resort.

GENERAL POST OPERATIVE COMPLICATIONS

Aspiration during swallowing has been major cause of concern in these patients postoperatively. Loss of sensation in the hypopharynx and supraglottic larynx, concomitant injury to glottic mechanism and discoordinate swallowing following long periods of absolute dysphagia are factors reported to affect deglutition ^{67,68}. Reconstruction of pharynx and hypopharynx with an innervated flap has been used to help return some

sensation to the injured area ^{68,69} The site of anastomosis i.e., pharynx, hypopharynx and cervical esophagus has not been found to alter the incidence of aspiration.

PSYCHIATIC COUNSELLING AND FOLLOWUP

It is important to remember that these patients will require understanding, on encouragement, psychotherapy and psychiatric counseling to assist them to endure the prolonged treatment which is often necessary. All the family members are to be interrogated and counselling to be given individually.

Patients were followed up at regular intervals in the outpatient department by the way of clinical examination, history of change in grade in dysphagia, aspiration ,weight gain, return to job etc,. Endoscopy and contrast study of the gastrointestinal tract were done at three and six months postoperatively ,then if necessary later .

CONCLUSION

The extensive studies on corrosive stricture in our patients have certain definite implications to suggest

- To get detailed patient's history and relevant investigation and management done during acute phase.
- To critically assess the patient's nutritional status and extent of severity of corrosive injury.
- To have Endoscopy and contrast study at early period and at periodic intervals.
- Dilatation for the eligible appropriate cases.
- To define where dilatation is effective.
- To select right procedures and intervene at the appropriate time.
- To improve the nutritional status by enteral and parenteral routes to withstand the surgical procedure.
- Recently jejunal free flaps using micro vascular anastomosis have gained momentum when stomach, colon are not available.
- To have adequate regular follow up.
- To declare safety precautions in labeling & storing of corrosives agents.
- To have strict legislation to avoid sale of corrosive agents across the

counter.

- Last but not the least, psychiatric counselling to the patient and their relatives.

MASTER CHART

s.no	IP.no	age	sex	occu	acid	alkali	suicidal	accidental	Inj.oeso	Inj.stom	Both inju	emergy	Bill I	Bill II	AGJ	gasticpull	coloplast	Oeso.dilata	Remarks
1	66893 2	24	F	L	✓	-	✓	-	✓	✓	✓		✓	-	-	-	-	✓	
2	68872 3	36	M	U	✓	-	✓	-	✓	✓	✓		✓	-	-	-	-	✓	
3	71203 7	26	M	L	✓	-	✓	-	✓	✓	✓		✓	-	-	-	-	✓	
4	84546 8	60	M	L	✓	-	✓	-	-	✓	-		-	-	✓	-	-	-	
5	74854 2	28	M	L	✓	-	✓	-	-	✓	-		✓	-	-	-	-	-	
6	64916 0	21	F	U	✓	-	✓	-	-	✓	-		-	✓	-	-	-	-	
7	782119	38	M	L	✓	-	✓	-	-	✓	-		-	✓	-	-	-	-	
8	81213 5	24	F	U	✓	-	✓	-	✓	✓	✓		✓	-	-	-	✓	-	
9	75071 8	19	M	S	✓	-	-	✓	✓	-	-		-	-	-	✓	-	-	
10	74945 9	20	M	S	✓	-	✓	-	✓	✓	✓		✓	-	-	-	-	✓	
11	72716 0	22	F	S	✓	-	✓	-	-	✓	-		✓	-	-	-	-	-	
12	76198 8	45	F	L	-	✓	✓	-	-	✓	-		✓	-	-	-	-	-	
13	79571 0	33	M	O	-	✓	-	✓	-	✓	-		-	-	✓	-	-	-	
14	75779 2	20	F	S	-	✓	-	✓	-	✓	-		-	✓	-	-	-	-	
15	75071 8	19	M	U	✓	-	-	✓				✓							Conduit nec
16	75906 8	38	M	L	✓	-	✓	-	-	✓	-		-	✓	-	-	-	-	
17	71083 1	19	F	O	✓	-	✓	-	✓	✓	✓	✓	-	-	-	-	-	-	D.S later
18	66413 2	32	M	U	✓	-	-	✓	✓	✓	✓	✓	-	-	-	-	-	-	D.S later
19	76682 2	48	M	O	✓	-	-	✓	✓	✓	✓	-	-	-	-	-	-	-	Vess.anamaly
20	70109 8	19	F	S	✓	-	✓	-	✓	✓	✓	-	-	-	-	-	-	-	Vess.anamaly
21	80203 0	20	M	U	✓	-	-	✓	✓	✓	✓	-	-	-	-	-	✓	-	

22	02384 6	38	M	L	✓	-	-	✓	✓		✓	✓	-	-	-	-	-	-	D.S-later
23	01967 5	20	F	S	-	✓	✓	-	-	✓	-	-	✓	-	-	-	-	-	
24	021134	33	F	L	-	✓	✓	-	✓	-	-	-	-	-	-	✓	-	-	
25	01237 8	35	F	U	-	✓	✓	-	✓	✓	✓	-	-	-	-	-	✓	-	expired
26	01782 3	20	M	S	-	✓	✓	-	✓	✓	✓	-	-	-	-	-	✓	-	
27	01326 4	30	F	U	✓	-	✓	-	✓	✓	✓	-	✓	-	-	-	✓	-	
28.	01643 8	42	M	L	✓	-	✓	-	✓	-	-	-	-	✓	--	-		-	
29	01432 6	42	M	O	✓	-	✓	-	✓	-	-	✓	-	-	-	-	-	-	expired

M-male,F-female,L-laborers,S-students U-unemployed,,O-others,,D.S-definitive surgery

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