

Outcomes of Resection Surgery in Corrosive Esophageal Stricture

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ABSTRACT

Background: Esophageal stricture is a rarely encountered but a significant issue of worry throughout the world. Treatment options for esophageal stricture include endoscopic dilatation and surgery along with proton pump inhibitors. Surgery is performed if there is failure of enough dilatation and if recurrence occurs despite multiple dilatations.

Objective: This study was designed to determine the outcome of resection surgery in adult patients presenting with Corrosive Esophageal Strictures.

Material and Methods: A descriptive cross sectional study was carried out at surgery department, DHQ hospital Gujranwala, from December 2019 to June 2020. 60 consecutive patients, of age 20-60 years of either gender with presence of esophageal strictures caused by intake of corrosive substances and failed to undergo endoscopic dilatation due to difficulty in passing endoscope across the esophageal stricture, were included in the study. All study participants underwent resection surgery procedure under general anesthesia by a single surgical team. The marginal arcade alongside colon was conserved in all cases in which colon was utilized. Feeding jejunostomy was placed in all patients. Duration of surgery was noted. After surgery, patients were followed-up in surgical wards for 48 hours and examined on ultrasound for cervical anastomotic leak. Then patients were followed-up in OPD for 15 days and if dysphagia reoccurred, it was also noted.

Results: The mean age of patients was 31.80 ± 7.74 years. There were 47(78.3%) male and 13(21.7%) female cases. There were 33.3% case who took acid, 16.7% took alkalis, 16.7% cases ingested metal salts, 21.7% had formalin, 6.7% cases had iodine tincture and 5.0% cases had other types of corrosive material. The mean operative time was 3.80 ± 0.80 hours. There were 11(18.3%) cases who had cervical anastomotic leak and 10(16.7%) cases had dysphagia related problem. No statistically significant difference ($p \geq 0.05$) was found in the outcomes of resection surgery across various groups based on age, gender, BMI, duration of corrosive intake, and type of corrosive substance ingested. Also, No significant difference ($p \geq 0.05$) was found in mean operative time in any stratum.

Conclusion: It is concluded that outcome of resection surgery in adult patients presenting with Corrosive Esophageal Strictures was favorable with less complications. Hence these cases can be managed with standard surgical procedure to save their life and improve the quality of life.

Keywords: Corrosives, Esophageal Stricture, Resection Surgery, Dysphagia, Cervical Anastomotic leak

INTRODUCTION

Esophageal stricture, defined as a narrowing of the lumen of the esophagus causing difficulty in swallowing, is a commonly encountered problem in the surgery departments¹. It can be either benign or malignant². Malignant strictures develop as a result of carcinoma whereas benign strictures have various etiologies. Gastroesophageal reflux disease being the most common, accounting for 70 to 80% of all causes^{3,4}. Other etiologies include peptic injury, Schatzki's rings, esophageal webs, injury due to radiation, corrosives ingestion and anastomotic strictures. Corrosive esophageal stricture is an uncommon clinical condition in adult patients. It accounts for less than 5% cases⁵.

Although it is rarely encountered condition, esophageal strictures associated with the intake of corrosive substances stay as a significant issue of apprehension all over the world⁶. They can occur either accidentally or as a result of suicidal attempt⁷. Corrosive materials can either be acidic or alkaline⁸. Tissue proteins are transformed into acid proteins when acid reacts with them. Coagulative necrosis is the mode of injury to the tissue. Whereas proteinases and soaps are formed when ingested alkaline agents reacts with proteins and fats, which induces liquefaction necrosis and ultimately causes transmural injury⁹.

Progressive dysphagia is the most frequent presentation of esophageal stricture, which initiates as a trouble in swallowing solids and later on advances to liquids. Heartburn, chest pain, chronic cough, asthma, severe pain in swallowing, and food adherence in esophagus are some other presentations of esophageal strictures¹⁰⁻¹². Endoscopy is regarded as the most important investigation in the first 12 to 48 hours following corrosive esophageal injuries.

Esophageal stricture needs to be managed to set up ample luminal patency¹. Endoscopic dilatation and surgery in addition to proton pump inhibitors are a few treatment options for esophageal stricture^{13,14}. Even though dilatation or conservative management is the primary treatment of choice, a few patients need surgical

intervention¹⁵. Surgery is indicated only if there is failure to get sufficient dilatation of the esophagus to let solid food go across and if there is recurrence even after multiple dilatations^{16,17}. The fundamental precept of surgical intervention is the native esophageal replacement by the stomach or colon⁶. A study conducted in India reported that mean operating time in the resection surgery for corrosive esophageal sphincter was 4.3 ± 1.5 hours. Cervical anastomotic leak occurred in 12.5% patients and recurrent dysphagia developed in 18.7% patients after surgery¹⁸.

Literature showed that surgery has lesser number of complications. In routine, many cases undergo dilatation, which usually develop post-treatment complications and then patients again undergo dilatation many times or ultimately surgery. But local evidence is missing. So this study was carried out to get local evidence on the outcomes of resection surgery in adult patients presenting with Corrosive Esophageal Strictures. In this way, results of the study in local population can be implemented on general population and better outcomes can be obtained.

MATERIAL AND METHODS

A descriptive cross sectional study was carried out at surgery department, DHQ hospital Gujranwala, from December 2019 to June 2020. The sample size of 60 cases was calculated using 95% confidence level, $d=1\%$ and taking magnitude of mean operative time i.e. 4.3 ± 1.5 hours in patients with corrosive esophageal strictures¹⁸. 60 consecutive patients, of age 18-60 years of either gender with presence of esophageal strictures caused by intake of corrosive substances (that was defined as if patient had history of corrosive intake, esophageal stricture seen on barium swallow and difficulty to pass upper GI endoscope across the stricture (10mm)) and failed to undergo endoscopic dilatation due to difficulty in passing endoscope across the esophageal stricture, were included in the study. Patients having either malignant strictures confirmed by histopathology or benign strictures due to peptic ulcer, congenital esophageal strictures, strictures due to repeated

Endoscopic variceal band ligation were not included in the study (as these may affect Cervical anastomotic leak, Reoccurrence of dysphagia). Patients who were not fit for surgery on clinical examination or had Achlasia cardia on history and clinical examination were also not included.

After getting approval from the institutional ethical committee, 60 patients who fulfilled the inclusion criteria were enrolled in the study from surgical emergency department, DHQ Hospital Gujranwala. Written informed-consent was taken. Demographic information like age, gender, type of corrosive material taken were also obtained. Then all study participants underwent resection surgery procedure under general anesthesia by a single surgical team. The marginal arcade alongside colon was conserved in all cases in which colon was utilized. A trial was put together to conserve the arcade at the area of distal transection of colon. A right colon channel was contingent on the left colic artery's ascending branch, and the left side of the colon was contingent on the middle colic artery's left branch. Feeding jejunostomy was placed in all patients. Duration of surgery was noted. After surgery, patients were followed-up in surgical wards for 48 hours. During 48 hours, patients were examined on ultrasound for cervical anastomotic leak. Then patients were followed-up in OPD for 15 days. During 15 days, if dysphagia reoccurred, it was also noted.

Statistical analysis of the data was performed using SPSS version 21. Mean and standard deviation was calculated for continuous variable like age, body mass index, duration of corrosive intake and operative time. Frequency and percentage was found out for gender, type of corrosive material, cervical anastomotic leak and dysphagia. Data was stratified for age, gender, body mass index, duration of corrosive intake and type of corrosive material. Post-stratification chi-square test was utilized to compare the outcome for categorical variables and independent samples t-test for the outcome of quantitative variables in stratified groups, taking p-value≤0.05 as significant.

RESULTS

The patients' ages ranged from 20 to 49 years with a mean of 31.80±7.74 years. Majority (80.0%) of the patients were aged between 20-39 years. Among 60 patients, 78.33% were males and 21.67% were females. The mean BMI was 28.40 ± 2.65 with minimum and maximum BMI as 24.50 and 33.80. There were 25.0% obese and 75.0% non-obese cases. The mean duration of corrosive intake was 12.80 ± 5.02 hours with minimum and maximum duration as 4 and 21 hours. There were 43.3% cases who had duration of <12 hours of corrosive intake and 56.7%

cases had duration of ≥ 12 hours. There were 33.3% case who took acid, 16.7% took alkalis, 16.7% cases ingested metal salts, 21.7% had formalin, 6.7% cases had iodine tincture and 5.0% cases had other types of corrosive material. The mean operative time was 3.80 ± 0.80 hours with minimum and maximum duration of operation as 1.50 and 6 hours, respectively, as shown in table 1.

Table 1: Baseline characteristics of the study participants (N=60)

Parameters	Frequency	%age
Age of patients* (years)	31.80±7.74	
Age groups (years)	20-39	80.0
	40-60	20.0
Gender	Male	78.3
	Female	21.7
Body mass index* (kg/m ²)	28.40±2.65	
Obese	15	25.0
Non-obese	45	75.0
Duration of corrosive intake* (hours)	<12 hours	43.3
	12 hours or more	56.7
Types of corrosive materials ingested	Acids	33.3
	Alkalis	16.7
	Metal salts	16.7
	Formalin	21.6
	Iodine tincture	6.7
	Others	5.0
Operative time* (hours)	3.88±0.80	

N=Number of study participants; kg/m²=kilograms per meter square; * = continuous data is presented as mean ± standard deviation.

Outcomes of resection surgery in adult patients with corrosive esophageal strictures are illustrated in Table 2. 18.33% cases had cervical anastomotic leak post-operatively while in 16.7% cases had dysphagia redeveloped after surgery.

Table 2: Outcomes of resection surgery in adult patients with corrosive esophageal strictures (N=60)

Outcomes	Yes	Frequency	%age
Cervical anastomotic leak	Yes	11	18.33
	No	49	81.67
Reoccurrence of dysphagia	Yes	10	16.67
	No	50	83.33

N=Number of study participants

No statistically significant difference (p≥0.05) was found in the outcomes of resection surgery across various groups based on age, gender, BMI, duration of corrosive intake, and type of corrosive substance ingested, as exhibited in table 3. Also, No significant difference (p≥0.05) was found in mean operative time in any stratum, as demonstrated in table 4.

Table 3: Comparison of outcomes of resection surgery in adult patients with corrosive esophageal sphincters with respect to age groups, gender, BMI, duration of corrosive intake, and type of corrosive material ingested

Parameters	Cervical anastomotic leak			p-value*	Reoccurrence of dysphagia			p-value*	
	Yes	No	Total		Yes	No	Total		
Age groups (years)									
20-39	8(16.7)	40(83.3)	48(100.0)	0.505	8(16.7)	48(100.0)	48(100.0)	1.000	
40-60	3(25.0)	9(75.0)	12(100.0)		2(16.7)	12(100.0)	12(100.0)		
Total	11(18.3)	49(81.7)	60(100.0)		10(16.7)	60(100.0)	60(100.0)		
Gender									
Male	8(17.0)	39(83.0)	47(100.0)	0.617	7(14.9)	40(85.1)	47(100.0)	0.483	
Female	3(23.1)	10(76.9)	13(100.0)		3(23.1)	10(76.9)	13(100.0)		
Total	11(18.3)	49(81.7)	60(100.0)		10(16.7)	50(83.3)	60(100.0)		
BMI (kg/m ²)									
Obese	3(20.0)	12(80.0)	15(100.0)	0.847	3(20.0)	12(80.0)	15(100.0)	0.689	
Non-obese	8(17.8)	37(82.2)	45(100.0)		7(15.6)	38(84.4)	45(100.0)		
Total	11(18.3)	49(81.7)	60(100.0)		10(16.7)	50(83.3)	60(100.0)		
Duration of corrosive intake (hours)									
<12	5(19.2)	21(80.8)	26(100.0)	0.875	5(19.2)	21(80.8)	26(100.0)	0.641	
≥12	6(17.6)	28(82.4)	34(100.0)			5(14.7)	29(85.3)		34(100.0)
Total	11(18.3)	49(81.7)	60(100.0)			10(16.7)	50(83.3)		60(100.0)
Type of corrosive material ingested									
Acid	2(10.0)	18(90.0)	20(100.0)	0.639	4(20.0)	16(80.0)	20(100.0)	0.927	
Alkalis	2(20.0)	8(80.0)	10(100.0)		1(10.0)	9(90.0)	10(100.0)		
Metal salts	3(30.0)	7(70.0)	10(100.0)		2(20.0)	8(80.0)	10(100.0)		
Formalin	3(23.1)	10(76.9)	13(100.0)		2(15.4)	11(84.6)	13(100.0)		
Iodine tincture	0(0)	4(100.0)	4(100.0)		1(25.0)	3(75.0)	4(100.0)		
Others	1(33.3)	2(66.7)	3(100.0)		0(0)	3(100.0)	3(100.0)		
Total	11(18.3)	49(81.7)	60(100.0)		10(16.7)	50(83.3)	60(100.0)		

BMI=Body mass index; kg/m²=kilograms per meter square; *= χ^2 -Square test was utilized to find out p-value and p-value less than 0.05 was considered significant.

Table 4: comparison of mean operative time of resection surgery with respect to age, gender, BMI, duration of corrosive intake, and type of corrosive material ingested (n=60).

Parameters	Mean operative time	p-value*
Age groups (years)		
20-39	3.95±0.82	0.171
40-60	3.60±0.71	
Gender		
Male	3.90±0.78	0.756
Female	3.82±0.89	
BMI (kg/m ²)		
Obese	3.83±1.03	0.776
Non-obese	3.90±0.72	
Duration of corrosive intake (hours)		
<12	3.84±0.79	0.746
≥12	3.91±0.82	
of corrosive material ingested		
Acid	3.90±1.06	0.866
Alkalis	3.90±0.80	
Metal salts	3.90±0.31	
Formalin	3.85±0.67	
Iodine tincture	4.25±0.33	
Others	3.40±1.25	

N = number of study participants; BMI=Body mass index; kg/m²=kilograms per meter square; *= t -test was utilized to find out p-value and p-value less than 0.05 was considered significant.

DISCUSSION

Ingestion of corrosive substances may result in extensive injury to the gastrointestinal tract, including the lips, oral cavity, esophagus, and stomach. The intake of these harmful substances has most serious and severe injurious impact on esophagus with even worse long term consequences¹. When esophageal dilatation is not possible, esophageal resection surgery should be considered. The morbidity and mortality is comparatively low in resection surgeries for corrosive esophageal strictures, if provided by experts^{19,20}. However, there are several areas of debate and controversy that still ought to be determined. The present study was designed to see the outcomes of resection surgery in corrosive esophageal strictures in DHQ hospital, Gujranwala. 60 patients underwent surgical treatment for corrosive strictures of the esophagus.

The mean age of the patients in the current study was 31.80±7.74 years. It was somewhat different than the study performed by Javed et al. which reported mean age as 24.9 ± 8.6 years¹⁸. In a study conducted by Singh et al. it was noticed that the patients were mostly young with mean age of 28 years⁹. The current study was performed in 78.3% males and 21.7% females. The findings of the current study were somewhat different than findings of the study by Singh et al. which showed that the higher incidence of corrosive ingestion was found in females (59%)⁸. Javed et al. also showed higher incidence in females (54.5%)¹⁸. Whereas the findings of the study by Mohamed et al. showed that corrosive intake was more in males (54%)²¹, comparable to the results of the current study.

Even though, the most commonly ingested agents in the developed world are alkaline in nature²², ingestion of acid is much more frequent in developing countries^{23,24}. Singh et al. reported that 78.9% patients ingested acids while 2.6% had alkaline ingestion. 18.4% patients had ingestion of unknown materials⁸. In the present study, the most frequently ingested material was acid (33.3%), followed by formalin (21.6%), alkalis (16.7%), and metal salts (16.7%).

Although the resection surgery has favorable outcomes in the management of corrosive esophageal stricture^{19,20}, a number of complication of this procedure are also encountered in the surgery departments. Han et al. performed a study to analyze a 30-year historical series of patients managed in hospital, who ingested corrosive substances, and to monitor the effectiveness of surgery

in patients with caustic esophageal strictures. A total of 79 cases of caustic esophageal burns were included. The results showed that more men (n = 61) than women (n = 18) ingested corrosive substances, comparable to the present study. The caustic materials were liquid lye and acids (54 cases and 25 cases, respectively). Esophageal replacement was performed in 86.07% patients with no postoperative death. 17 cases developed postoperative complications making a complication rate of 25%. The most common one was cervical anastomotic leakage²⁵. In a study performed by Javed et al., it was reported that 12.5% patients had post-operative cervical anastomotic leak while recurrent dysphagia developed in 18.7% patients¹⁸. In another study, it was observed that cervical anastomotic leakage occurred in 14.2% patients. The swallowing dysfunction was found in 7.9% patients, postoperatively²⁶. In current study there were 11(18.3%) cases who had cervical anastomotic leak and 10(16.7%) cases had dysphagia related problem after resection surgery. These findings are almost similar to the above studies.

In the present study, when data was stratified for age, gender, BMI, types of corrosive intake and duration of intake, the frequency of cervical anastomotic leak and post-operative dysphagia was statistically same in each stratum, p-value > 0.05. Similarly, the mean duration of surgery was also statistically same in these strata, p-value > 0.05, not discussed in any other study as per author's knowledge.

CONCLUSION

It is concluded that outcome of resection surgery in adult patients presenting with Corrosive Esophageal Strictures was favorable with less complications. Hence these cases can be managed with standard surgical procedure to save their life and improve the quality of life.

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