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Original Research Article

Conduits for esophageal replacement: alternatives

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ABSTRACT

Background: Native esophageal replacement after esophageal resection is a problem that has challenged the surgeons over a century. Conduit must be long enough to bridge between cervical esophagus and abdomen. It must have reliable vascular supply, so that it can perform its function of deglutition. Stomach, colon and jejunum all these are used since long. However, there are times when the stomach is unavailable for use as a conduit. It is in these instances that an esophageal surgeon must have an alternative conduit in their armamentarium. Present study is aimed to discuss technical aspects of stomach, colonic, interposition in 32 cases of benign and malignant pathology, we review recent literature with a focus on outcomes, advantages and disadvantages of all options.
Methods: A retrospective study of 32 cases between 2009 to 2016 at teaching institute in central India. 32 cases of benign and malignant esophageal disease needing esophageal resection and replacement. The record of each patient was reviewed for age, gender, indication for esophageal resection, type of operation, indication for selection of conduit, morbidity and mortality. The patient's gastrointestinal symptoms were graded as excellent, good, fair or poor. Survival was estimated by the Kaplan-Meier method using the date of operation as the starting point.
Results: Study includes 24 males and 8 females, 25 cases cancer esophagus with 6 patients caustic stricture, 1 patient had radiation stricture. Gastric conduit was used in 29 patients while 3 patients had colonic interposition. No complications noted in colonic group, while cervical anastomotic leak along with cardiovascular and respiratory complications noted in 6 patients. Gastric replacement was less time consuming than colonic interposition. There was hospital mortality of 4 patients. There is no difference in survival of these patients whether you use gastric or colonic conduit.
Conclusions: Clinical decision making in the treatment of esophageal cancer consists of balancing the risks of a particular treatment against potential benefits gained in survival and quality of life. The choice of conduit for reconstruction may have significant impact on the quality of life. Stomach is the most commonly used organ for replacement but when it is not available then colon can safely be used as an esophageal replacement.

Keywords: Colon, Conduit, Interposition, Jejunum, Oesophagectomy, Stomach

INTRODUCTION

Oesophagus is the only organ that navigates through three body cavities, it bridges two diverse environments, much like the engineering feats of the steel and concrete structures we trust to walk or drive across. Masterfully engineered organ performs a multitude of complex functions.[1] Establishment of gastrointestinal continuity after esophageal resection is an important determinant in deciding about quality of life.[2] An ideal replacement which mimic and performs function like esophagus does not exist in current scenario. Ideal esophagus replacement must have enough length- to bridge between the cervical esophagus, and abdominal gastrointestinal tract, robust vascular pedicle, which would maintain perfusion along the entire distance of conduit and provide more than

sufficient perfusion of its distal end to minimize anastomotic problems. An ideal esophageal replacement must have coordinated intrinsic motility for propulsion of boluses and minimize the reflux.[3]

Current options for oesophageal replacement includes, stomach, colon (ascending-descending colon) jejunum. Most preferred conduit for oesophageal replacement is stomach. Because of its adequate length, robust and reliable vascularity, and single anastomosis, the stomach is considered as a time-honored and reliable conduit.[2-4] But there are instances when stomach is not available for conduit, as in caustic ingestion, where both stomach and esophagus suffers insult and diseased. Prior gastric surgery, gastro esophageal junction tumors, where the gastric blood supply with right gastroepiploic artery has been sacrificed, precludes the use of gastric tube. In some patients, a previous gastric conduit may fail due to ischemic necrosis and recalcitrant strictures or even recurrent or de novo cancer. Alternative conduit must be selected in such cases. Similarly, diseases like inflammatory bowel disease, mesenteric ischemia can also limit the use of colon and jejunum in such cases.[4,5] We present our experience of 32 such cases treated at tertiary care teaching institute in central India.

METHODS

This is a retrospective observational study carried out from, January 2009 till September 2016 total 32 patients with oesophageal disease of benign or malignant nature, needed esophageal resection. Out of 32 patients 24 were males and 8 were females. The most common cause; cancer esophagus, caustic strictures, radiation stricture. Benign strictures which were not amenable for dilatation were considered for resection and replacement. In all patients a detail history about the disease, and any other abdominal disease is obtained. Patients were also asked about any history related to previous abdominal surgery. The record of each patient was reviewed for age, gender, indication for esophageal resection, type of operation, indication for selection of conduit, morbidity and mortality. All patients investigated for primary disease-causing dysphagia and confirmed the diagnosis by biopsy and histopathology. If the cancer is the indication for resection then the disease is properly staged as per the TNM staging system. In all patients, esophageal resection was done by standard procedure. If the disease is in M/3 then author preferred thoracoscopic/open mobilization of esophagus, gastric tube prepared in abdomen and exploration of cervical esophagus from left side of neck, esophago-gastric anastomosis was done in the neck using a single layer continuous monofilament sutures. We prefer to keep the conduit on the right side of the chest. In the lower third esophagus malignancy author preferred to use (Mark Orringer 1978) Trans hiatal Oesophagectomy, anastomosis done in the neck in the same way as described earlier. If the patient had a diseased esophagus and stomach then we used colon as conduit. As seen 3 of our patients of caustic stricture. In the present study, we did not do any jejunal interposition. Hospital Mortality was defined as death occurring prior to hospital discharge or within 30 days of the procedure. Survival was estimated by the Kaplan-Meier method using the date of operation as the starting point. The influence of variables on survival was analyzed using the log-rank test for discrete variables. The patient's gastrointestinal symptoms were graded as excellent, good, fair or poor. Results were considered excellent if the patient could eat without any symptoms, good if the patient complained of dysphagia or vomiting less than one time per week, fair if the patient complained of dysphagia or vomiting between one time and four times per week, poor if patient had more frequent complaints or required repeated dilatation at the endoscopic clinic. Infection at the anastomotic site as a result of leak, abscess or collections were considered morbidity. Confirmation of leak from anastomotic site was confirmed by Gastrografin studies done on 9th Post-operative day. All patients with upper one third esophageal cancer were excluded from study. But we included 4 patients of cancer esophagus who had preoperative chemo radiotherapy.

Technical considerations

Colonic interposition has been used to replace the native esophagus since early 1900. Either the left or right colon may be utilized and in either case, the transverse colon is always required. One of the benefits of the colon is its resistance to acid and interposition of right colon will have valve of Bauhim which may further decrease the reflux. Disadvantages are it can develop native pathology, there will be loss of absorptive capacity of colon may result in diarrhea. We used isoperistaltic left colon as a conduit in all 3 patients. Mobilization of left colon, confirmation of vascularity by using temporary clamping middle colic, right colic, once the vascularity and viability is assured, colonic transaction at the site of hepatic flexure. Oesophagectomy followed by colonic interposition; colon placed in posterior mediastinum, anastomosed with cervical esophagus.

Thoracoscopic mobilization of esophagus is done in prone position; three ports, dissection up to Azygous vein and then sometimes clipping the azygous vein. After exploration of abdomen and proper assessment of metastasis, Stomach tube is prepared by mobilizing the stomach on the vascular pedicle of right Gastroepiploic and right gastric artery. The short gastric arteries are secured and new lesser curvature is prepared. Pyloroplasty done and tube pulled in neck after esophageal resection, and anastomosed with cervical esophagus. Transhiatal Oesophagectomy is done for lower third esophageal cancers, and here the advantage is mobilization of esophagus is done through hiatus and then from neck, so the morbidity of thoracotomy can be avoided, disadvantage that it is a blind procedure. Author is using laparoscope through hiatus to mobilize the esophagus. Esophagus is exposed in the neck and

stomach tube is pulled in the neck, anastomosed to cervical esophagus.

Figure 1: Pulling gastric conduit in the neck.

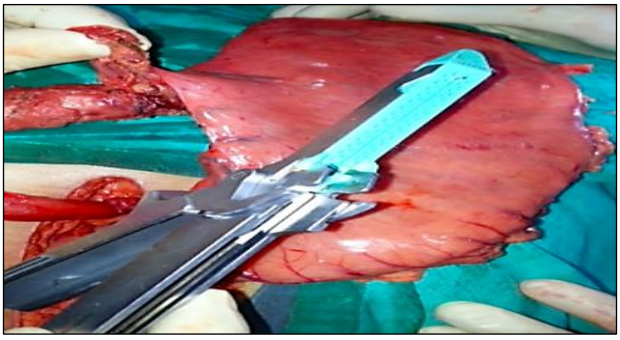

Figure 2: Preparing the gastric conduit by using the stapler.

Figure 3: Resected specimen of esophagus with stricture.

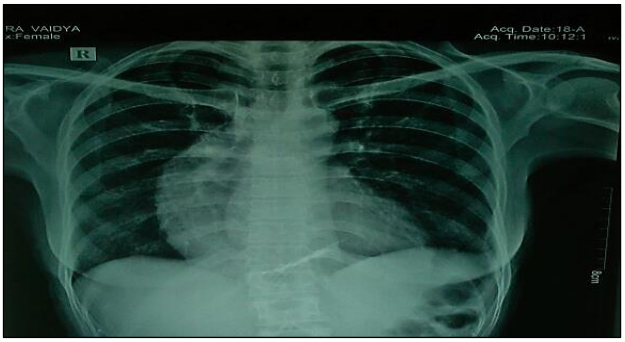

Figure 4: X-ray chest after 5 years of a patient with gastric tube for cancer esophagus. See the gastric conduit is in posterior mediastinum and on right side

Figure 7: Left colon mobilized and the transverse colon, check after temporary clamping of vessels, preparing colonic conduit for esophageal replacement.

For all statistical analysis, we distribute the patients in two groups. Gastric conduit group and Colonic conduit group.

RESULTS

There were 24 males and 8 female patients with median age of 58.5 years. With age ranging from 18 years to 68 years. Out of 32 patients 25 patients, (78.12%) cancer esophagus (middle third, needing gastroesophageal resection and replacement), 6 patients (18.75%) of caustic strictures, 1 patient (3.12%) with radiation stricture. Common site for cancer esophagus in 18 patients (72%) was middle third of esophagus and lower third 7 (28%) patients. We did not include patients who had cancer of upper one third of esophagus, owing to the complexity of the treatment. Of 6 patients of caustic strictures 3 patients (50%) had esophageal and gastric involvement and so instead of stomach, left colon with transverse colon was used as conduit. So, we had in 29 patients who underwent esophageal resection and gastric tube interposition and 3 patients had left colonic interposition after esophageal resection. We made two groups; Gastric conduit group and Colonic Conduit group. The average time required for surgery in Gastric conduit was (median, 225 minutes; range, 150-300 minutes) while for the Colonic interposition it was (median, 270 minutes; range, 220-465 minutes). In few of our patients we used endoluminal staplers for anastomosis and so it saved time of operation. Average blood loss following Gastric conduit was (< 250 ml). In colonic interposition group the blood loss was 300 to 500 ml. In the present study, major complications were not surgery related but medical like Pneumonitis after surgery usually after 4th day and was atypical pneumonitis. Surgery related complications include anastomotic leak, presented as an abscess in the neck. But then healing occurred in all patients. There were 6 (20.6%) patients of gastric conduit group who had

anastomotic leak in the neck diagnosed by Gastrografin studies done on 9th post-operative day. Of 6 patients who developed leak in cervical anastomosis 2 patients developed stricture at the site, needed dilatation. We had 4 deaths (12.5 %). In the present study on post-operative day 4 to day 8. One patient died of Pulmonary embolism on 7th. Post-operative day and remaining 3 patients died of complications like (atypical Pneumonitis, aspiration pneumonia, cardiac arrhythmias) average hospital stay was from 14 to 26 days with mean of 11-13 days. When we analyzed the survival by Kaplan Meier method the hospital mortality was 12%, and overall survival was from 6 months to 21 months. 5-year survival we could record was between 10 to 14%. Positive point was they could eat and had taste of food till the end of their life. In colonic conduit group 3 patients belong to benign disease were esophageal replacement was done all 3 patients are still alive. We did not see any complications related to surgery in terms of anastomotic leak (entero enteric anastomosis) in the abdomen.

DISCUSSION

Though stomach is the most commonly used conduit after esophageal resection, colon is considered a well-functioning and durable esophageal substitute to replace native esophagus after esophageal resection.[1]

In the present study of small number of patients with left colonic interposition there were minor complications, in terms of leak, but no complications like redundancy, intolerance to acid and reflux.[2] Neither we had any cardiac complications as these patients were belonging to benign disease group and younger than those of cancer group. The procedure was done in patients with benign disease, all patients are still alive and well. In few reports the frequency of major complications were 27% and that of anastomotic leak was 7%.[3] Major series report, hospital death rate was 7%.[4] In the present series the hospital mortality was on higher side 4 patients (12.5%) The probable risk factors contributed in the postoperative complications were, preoperative radio chemotherapy.[5] The combined removal of the esophagus and the complete stomach also carries an increased perioperative and postoperative risk.[5,6] The preference for left colonic interposition by many is based on the principle, preference for the vascular anatomy and its natural variation in the colon. According to several autopsy studies, the arterial anastomoses (marginal artery) between the ileocolic and right colic vessels are absent in up to 70% of patients, whereas the collaterals between the left and right colic artery are mostly sufficient.[7,8] Corresponding differences can be found with venous collaterals in the colon. In the left colon, the marginal venous anastomoses are excellent, but ileocolic venous collaterals are insufficient in 20% to 30% of patients.[9] Clinical results appear to support the superiority of left over right colonic interposition.[10] An evaluation of studies that has separate analysis of left or right colon grafts revealed a rate of colon necrosis or ischemia of 4.6% (20/438) with use of the right colon and of 10.8% (13/120) with use of the left.[7,11-12] As per the literature the colonic interposition has a complication rate of 35 to 65% and mortality rate is 0-25%.[13] Our experience with colonic interposition is very much limited as the number of patients are too less to form any concluding remark.

The decision making in the treatment of cancer esophagus is a process of balancing the risk of a particular treatment against the potential benefits gained in survival and quality of life. The choice of conduit reconstruction, it is well established that there is no better native replacement for esophagus than stomach as conduit, though there are situations where stomach is not available and colon is to be used for esophageal replacement.[14,15] The stomach is preferred in esophageal replacement because of simplicity in preparation and reliability compared with colonic interposition.[16] In the present series we always have given a thought to a basic idea that in benign disease of esophagus the life expectancy is normal after replacement, so the stomach must be preserved in its normal position, to perform its function. when the disease is malignancy, then because the life expectancy is short, we prefer to use stomach as a conduit.[13,17] It has been our practice to use the colon for reconstruction only in patients whose stomach was diseased. In the present series jejunum was not used in any patient. As far swallowing is concerned during follow-up, 3 patients in the colon group (100 %) reported good swallowing function and were able to tolerate a normal diet. 3 Patients from gastric conduit group (10.3%) experienced a hold-up sensation with stricture, required therapy. Bowel function was good in patients with colonic interposition. Only 1 patient reported protracted symptoms of diarrhea up to 3 times per day. In major series, the 30-day mortality for the gastric group was 26 patients (2.7%); for the colon group, 2 (4.8%). Hospital mortality rates were 102 patients (10.6%) for the stomach group and 7 (16.7%) for the colon group. Surgical results improved over time. From 1982 to 1990, 75 (15.9%) of 472 patients in the stomach group died in the hospital, compared with 27 (5.5%) of 487 during 1991 to 2000.[17] The respective figures for the colon group were 7 (24%) of 29 and 0 of 13 patients. In the present series, there was no mortality in colon group but 4 patients (12.5%) died in the hospital in the postoperative period. In cancer esophagus, whatever replacement used (esophagus/colon) there is no difference in long-term survival.

CONCLUSION

There are two basic aims in treating patients of cancer esophagus: cure of the disease and relief of dysphagia. Clinical decision making in the treatment of esophageal cancer consists of balancing the risks of a particular treatment against potential benefits gained in survival and quality of life. The choice of conduit for reconstruction may have significant impact on the quality of life. An ideal conduit must have an adequate length, robust

vascular supply, and perform function of swallowing, procedure should have low risk of complications. The study reports that stomach is preferred in esophageal replacement because of its simplicity in preparation and reliability compared to colonic interposition. But it has been our practice to use colon for reconstruction in patients where stomach is diseased or the disease is benign. Mortality and morbidity, such as anastomotic leak, strictures, cardio pulmonary complications, have been prominent in debate that which conduit is best. In specialized centers, use of colonic interposition may be considered safe. A colon conduit has been suggested to be more durable, and the supposed long-term functional benefits of colon interposition make it the preferred esophageal substitute in those with benign disease and in patients whose cancer stage predicts long-term survival. We at our center preferred gastric conduit in esophageal resection for cancer but certainly we would use colon as a conduit for esophageal replacement in patients with benign disease as we expect long term survival in these patients and expect stomach to function to its capacity. Prospective quality of life studies is required to properly asses the long-term function of gastric or colonic conduits. Study also concludes that whatever conduit is used there is no effect in outcomes as far as long-term survival is concerned.

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