Reconstruction Procedures in High
Stricture of the Esophagus

(A report of 19 cases)

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Regardless of the method of therapy employed, initially, a certain number of patients with lye stricture of the esophagus fail to respond to conservative treatment and ultimately come to surgery for a definitive procedure. The reconstruction of a conduit between the proximal esophagus and the upper digestive tract in such patients poses a difficult problem, taxing the ingenuity and patience of the surgeon. A successful outcome to such a reconstructive operation, however, is most gratifying, particularly in patients with benign stricture of the esophagus who have a normal life expectancy once an adequate food passage has been reestablished.

As a substitute for the esophagus, an ideal passage should fulfill the following requirements: 1) it must be physiologically and functionally sound; 2) it must be well tolerated by the patient; 3) the procedure must involve minimal risk, and 4) it should be cosmetically acceptable. Although over-all results have improved over the years, a really satisfying method has yet to be developed. This is attested to by the fact that numerous procedures, in groups or in succession, have been developed, none of which seems to fulfill all the requirements just enumerated. Recently, segments of small(Finnerty, 1954; Yudin, 1944) and large bowel have been utilized with gratifying results, and the use of the large bowel, in particular, seems to hold real promise from a functional and physiologic standpoint (Neville et al., 1956; Scelion and Stanley, 1958). It is the purpose of this paper to present our experience in 19 operative cases of high esophageal stricture who had not responded to conservative measures. Some of these cases have been reported previously (Hong and Chu, 1958; Kim and Hong, 1959). We have gone through at least three major phases in working out techniques of reconstruction, namely, esophago-gastrostomy, esophago-jejunostomy and, finally, esophago-colo-gastrostomy. Two features in the use of the colon, though minor, seem to have influenced the outcome of operations in a significant way. These modifications include 1) the use of the right colic artery, along with the middle colic artery as the source of blood supply for the transposed colon and 2) the deliberate use of the terminal ileum as the proximal portion of the conduit.

MATERIALS

In the four-year period from January, 1956, to December, 1959, 19 patients with benign stricture of the esophagus have been operated on at the Severance Hospital in Seoul, Korea. In all but one case, stricture resulted from the ingestion of lye; in one remaining case, the patient swallowed concentrated hydrochloric acid. In 3 children, lye was swallowed by accident; in the remaining 16 cases, the caustic agent was ingested with suicidal intent. There were three times as many female patients as male. Patients ranged from 4 to 37 years of age.
the majority of them were young adults. The pertinent data on these cases are summarized in Table 1.

The interval between the time of lye ingestion and the time of definitive surgery ranged from 5 months to 10 years; all but 2 cases had stricture at least one year before surgery. Prior to surgery, 9 patients had undergone repeated esophageal dilations either with a plumber dilator or with Tucker retrograde dilators; 2 of these patients sustained an acute perforation of the esophagus following dilatation from above, which was successfully treated with closed drainage of the pleural cavity, gastrostomy tube feeding and nothing by mouth for a week or more. In 9 patients, it was impossible to pass a piano wire guide under esophagopy or to have the patient swallow a thread down to below the stricture. Most of these patients were referred to us without having had proper management in the acute phase, and it was either impossible or very difficult to initiate dilatation when first seen by us. Almost all patients had gastrostomies to facilitate feeding or dilatation prior to esophageal reconstruction.

Fifteen of these cases had their highest point of obstruction at or above the level of the aortic notch. Many of them had two or more areas of constriction with normal-appearing esophagus in between; but for the purpose of reconstruction, the uppermost level of obstruction was of primary importance. In the remaining 4 cases, 3 had obstruction at the level of the aortic arch, and in one, the obstruction was mid-esophageal.

The reconstructive procedures employed in these cases are divided into three main categories: esophageal-gastrectomy, esophago-jejunostomy, with Roux-Y anastomosis, and esophago-colo-gastrostomy. Cases 1 to 3 had an esophago-gastrectomy: one in the neck, and two in the right chest. These are the earlier cases in this series. Two of these patients later developed stenosis at the site of the anastomosis, and reoperation became necessary. One of these two cases also had a stenosis at the pylorus, and a gastro-jejunostomy was carried out later to overcome this difficulty. Six cases (Cases 4-9) had substernal cervical esophago-jejunostomy with a Roux-Y anastomosis, bypassing the stomach. Of these, one patient (Case 8) died suddenly a few hours following surgery, presumably from respiratory obstruction. In one patient, the procedure failed because of necrosis of the proximal end of the transplanted jejunal segment. In the last cases (Cases, 10-19), the right colon was utilized and this was anastomosed proximally to the cervical esophagus and distally to the stomach after drawing it upward through a substernal tunnel. In the last 5 cases, several inches of the distal ileum were included with the right half of the colon; this permitted a better blood supply to the isolated segment by preserving continuity of the right colic artery as well as of the middle colic artery, with gratifying results. Among those cases where the colon was utilized, there was one immediate postoperative death; another case failed because of insufficient blood supply to the cecum when it was brought up into the neck. In all but one case, isoperistaltic anastomosis was employed. In the one case (Case 14) where an antiperistaltic anastomosis was used, there was some regurgitation of the food following surgery; this patient also developed stenosis at the site of anastomosis, requiring subsequent revision. In 17 cases, the procedure was completed in one stage; in the remaining two, it was carried out in two stages. Leakage at the site of the upper anastomosis developed in 5 cases, 2 in the esophago-jejunostomy series and 3 in the esophago-colo-gastrostomy series. All these leaks were temporary and sealed off readily without further treatment. Stenosis at the site of anastomosis was seen in 3 cases, 2 in the esophagogastrostomy cases and one in the esophago-gastrostomy cases. This was a more serious problem, and all of these cases had to be reoperated to correct the stenosis; a longitudinal incision with a transverse closure was all that was necessary to obtain an adequate lumen. When the stenotic anastomosis was in the neck, it was a relatively simple matter to reopen the wound; but when a thoracic esophago-gastrostomy had been performed, as in Case 2, the revision required another thoracotomy, thereby making the problem more complex. Pneumothorax during the process of developing the substernal tunnel occurred in 3 cases.
In 2 cases, the rent was small and these posed no particular problem, requiring only water-seal drainage during the post-operative period. However, in one case (Case 13), the rent was so large that the bowel segment tended to slip into the pleural cavity; this rent had to be repaired under direct vision after splitting the struma and the bowel could be replaced in the tunnel without compromising the blood supply. This occurred in a woman with a long, narrow mediastinum. Necrosis of the subternally-placed bowel segment occurred in 2 cases, one with an esophago-jejunostomy and the other with an esophago-colo-gastrostomy. It was possible to save these patients by early recognition of the condition and adequate drainage, though a functioning lumen was lost. There were 2 postoperative deaths in this series, both of which occurred within a few hours following the operation. An autopsy could not be obtained in these cases, but it was assumed that these patients succumbed to acute respiratory embarrassment resulting from pressure on the trachea by the bowel segment.

Of the 3 patients who had esophago-gastrostomy, 2 obtained a satisfactory result and the remaining one only a fair result. Even these satisfactory patients were conscious of some reflux esophagitis. Of the 6 patients with esophago-jejunostomy, 4 had good results; there was one failure and one death. Of the 10 esophago-colo-gastrostomy cases, 7 obtained satisfactory results, leading to a normal life; the one patient with an antiperistaltic esophago-colo-gastrostomy had the problem of regurgitation. There was one failure and one death in this series. From the standpoint of final functional results, esophago-colo-gastrostomy seemed to be the best procedure; esophago-jejunostomy was next best; esophago-gastrostomy gave the poorest results. In the 5 last cases where the terminal ileum was used along with the right colon and the right colic artery was spared, the results were uniformly satisfactory.

The case histories of 3 patients will be presented to illustrate some of the salient points in the management of these patients: Case 14 (SH 4683-57). This 4 year old boy was first admitted to Severance Hospital on September 9, 1957, with the chief complaint of dysphagia. The patient accidentally swallowed liquid lye 13 months prior to admission and was treated at another hospital with periodic esophageal bougirage. With this treatment, he had been able to swallow solid food up to two months before admission; then rather severe dysphagia ensued. Esophagoscopy on admission revealed stenosis beginning at the level of the aortic arch. He underwent dilatations with plummer dilators and was able to swallow solid food again, then was discharged on October 10, 1957. Periodic dilatations were continued after discharge in the hopes that an adequate passage might be established. However, in April, 1958, following a plummer dilatation, the patient developed sudden dyspnexia and chest pain. An esophageal perforation was discovered and the patient was readmitted for gastrostomy and closed drainage of the right pleural cavity. He recovered readily, and no further attempt was made to dilate the esophagus.

The 3rd admission was for reconstruction surgically. On December 11, 1958, under endotracheal anesthesia, the right half of the colon was mobilized and brought through a subternal tunnel into the right neck. The mid-colic and the right colic arteries were found to be rather small and were not considered adequate as the source of blood supply to the isolated colon; consequently, the ileocolic artery was utilized. This meant that anastomosis had to be antiperistaltic in direction, with the distal end anastomosed to the cervical esophagus and the proximal end to the anterior wall of the stomach near the antrum. Postoperatively, the patient did well except for a minor leak in the neck in the site of anastomosis, which leaked closed spontaneously on the 22nd post-operative day. Following discharge on January 6, 1959, the patient was able to swallow solid food, but with some regurgitation which seemed to improve slowly. He was readmitted on March 4, 1959, because of stenosis at the site of anastomosis. The stenotic area was resected and the ends reanastomosed. Following this procedure, he developed another minor leak at the site of anastomosis, but this closed spontaneously in a few weeks, and the patient was discharged on March 24, 1959.
RECONSTRUCTION PROCEDURES OF THE ESOPHAGUS

When last seen, the patient was doing well, though there was some intermittent regurgitation of food. This case was the only one in which an antiperistaltic segment of bowel was used to re-establish esophageal continuity, and it is apparent that this mode of anastomosis should be avoided whenever possible.

Case 15 (SH 11392-59). This 22-year-old female patient was admitted to the hospital on June 29, 1959, with the history of having swallowed solid red dye wrapped in a vegetable leaf in attempted suicide about 3 months prior to admission. Up to about 3 weeks before hospitalization, the patient had been able to swallow liquid or semi-liquid diet; but at the time of admission, she was unable to swallow anything. A light barium x-ray study of the esophagus revealed irregular narrowing of the esophagus below the sternal notch with proximal dilatation. It was impossible to initiate dilatation in this patient.

On July 6, 1959, the right colon was mobilized together with the terminal ileum, and this was brought up into the neck through a substernal tunnel. Its proximal end (terminal ileum) was anastomosed end-to-end to the cervical esophagus and its distal end (colon) to the anterior wall of the stomach. In this instance, only the middle colic artery was utilized as the source of the blood supply to the right colon and ileum. A Stamm gastrostomy and a routine ileotransversecolostomy were performed. The left pleural cavity was accidentally entered while developing the substernal tunnel, but this was handled successfully with closed drainage during the immediate postoperative period. The postoperative course was rather stormy. Besides a minor wound infection, the patient had profuse bleeding from the upper gastrointestinal tract on the 9th postoperative day. She vomited blood and bright red blood kept draining through the gastrostomy tube. She went into mild shock and was treated with continuous whole blood transfusions, intravenous fluid, vitamin K and nasal oxygen. In 48 hours, the hemorrhage stopped spontaneously. The source of bleeding was never determined but it was believed that it came either from the large bowel or from the stomach at the site of anastomosis. Following this episode, the patient complained of severe cramping abdominal pain with nausea but without vomiting. The important physical findings were hyperactive peristalsis and moderate tenderness in the right lower quadrant. X-ray studies of the abdomen failed to show evidence of mechanical obstruction. The third time the patient complained of abdominal cramps, it was associated with chills and fever. This time malaria was demonstrated by blood smear. Despite these complications, the patient was discharged on August 18, 1959, in good condition and was able to swallow solid foods without difficulty. A postoperative barium study showed satisfactory functioning of the substernally placed bowel.

Case 17 (SH 11719-59). This 28-year-old female was admitted to Severance Hospital in July, 1958, 40 days after having swallowed dye in an attempt of suicide. A barium study of the esophagus showed a stricture located high above the sternal notch, approximately at the level of the thyroid cartilage. A gastrostomy was made and Tucker retrograde bouginage was initiated during this admission. The patient was followed in the outpatient clinic and dilatation was repeated at periodic intervals but it was impossible to maintain an adequate lumen with dilatation alone. She was readmitted, and on July 27, 1959, reconstructive surgery was performed. The right half of the colon and the distal 10 cm of the ileum were brought up into the neck through a substernal tunnel and the terminal ileum was anastomosed to the proximal esophagus end-to-end. This high anastomosis was made approximately 2 cm below the hypopharynx.

In this case, both the middle colic and the right colic arteries were preserved, while only the ileocolic artery was divided. The usual colo-gastrostomy and ileotransversecolostomy were done. The postoperative course was essentially uneventful, and the patient was discharged on August 28, 1959. She was able to swallow a regular diet without difficulty. A postoperative barium x-ray study showed satisfactory functioning of the substernally placed bowel. When the
patient was last seen in the clinic, she was free of complaints. The gastrostomy tube was removed 2 months after operation.

DISCUSSION

In reviewing these cases, it is apparent that regardless of the procedure employed, the following conditions must be met before success can be anticipated.

1) One must be certain that conservative measures will not provide an adequate esophageal lumen before a decision for surgery is made. It is generally agreed that prompt and sustained dilatation of the esophagus during the early period of chemical burn will, in many cases, prevent obstruction of the esophagus and provide an adequate lumen so that the patient can be spared extensive reconstruction surgery (Hollinger, 1954; Finnerty, 1954). It has been our policy to attempt dilatation as soon as the patient is first seen by us, using either Plum or Tucker dilators. Whenever this is possible, dilatation is carried out at regular intervals until no longer needed or until it becomes obvious that further dilatation is futile. These dilatations have been kept up for at least 6 months in most cases before making a final decision for or against reconstructive surgery. In those patients who have had inadequate treatment before visiting our hospital, it has usually been impossible to initiate dilatation; such patients have been subjected rather early to a reconstructive procedure. In two patients where acute perforation of the esophagus followed attempts to dilate the esophagus, further dilatations became impossible; surgical reconstruction was then carried out as soon as the perforation had been controlled by closed drainage of the pleural cavity and by gastrostomy tube feeding and had healed.

2) The pharynx and larynx must not be involved, and the mechanism of swallowing must be intact. In one case who was not included in this series, there was extensive scarring of the larynx and hypopharynx with a pinpoint opening at the pyriform sinus and constant aspiration of saliva. It seemed impossible, therefore, to solve this problem by reconstructive surgery. Furthermore, a minimal length of proximal esophagus must be available for a successful anastomosis. Initially, we had felt that the proximal limit of the obstruction should be at the level of the sternal notch or below; but as our experience increased, we found that it was possible to anastomose successfully at much higher levels, up to 2 or 3 cm from the hypopharynx.

3) It is generally wise to wait until at least 6 months or preferably one year following the original injury before reconstructive surgery is undertaken. This is to permit time for the active scarring process in the burned esophagus to subside completely; for any further scarring and narrowing of the proximal esophagus after reconstruction becomes a distressing problem. In Cases 15 and 18, reconstruction was carried out only 4 and 5 months after the burn; these patients had swallowed solid lye wrapped in a vegetable leaf, and on careful examination the upper esophagus was found to be free of scarring. These two cases were, therefore, exceptions to this general principle.

4) It is needless to say that to enhance the success of surgery, the general condition of the patient should be at its optimum and the patient free of any serious systemic disease. In contrast to the experience of those in Western countries, we have had much difficulty in building up these patients by gastrostomy feedings alone. Many of our patients have belonged in the lower social and economic brackets, and it was difficult for them to provide themselves a high-protein, high-vitamin diet for tube feeding. Fortunately, all of our patients were young; and although the nutritional state was far from ideal, we did not believe it to be an important cause of some of the failures that were encountered.

The surgical procedures that have been utilized in these patients can be divided into three main groups, roughly according to their chronological appearance at the hospital.

The results of esophago-gastrostomy were evaluated in the first 3 cases. This procedure has been widely used in carcinoma of the esophagus (Sweet, 1946, a,b). The procedure has the following disadvantages: (a) In high obstruction of the esopha-
gus at or above the sternal notch, it is very difficult to mobilize sufficient length of the stomach to bring the cardiac end to the neck. This is particularly true in patients who have had gastrostomy prior to surgery. (b) Also, the stomach which is brought up to the upper chest or to the neck does not seem to function normally as a digestive organ. (c) Furthermore, reflux esophagitis, either alone or in combination with stenosis at the anastomotic site, is all too frequently encountered in these patients (Replay et al., 1952). In contrast to those patients with carcinoma, these patients are young and have a relatively long life expectancy once their difficulty is overcome. Because of these disadvantages, esophago-gastrostomy has been entirely abandoned in our clinic for these patients in recent years.

Subternal cervical esophago-jejunostomy has certain desirable features when compared to esophago-gastrostomy. In the earliest cases, reconstruction of the esophagus with jejunum used a Roux-Y jejunal segment brought up through a subcutaneous tunnel either alone or in combination with a skin tube (Yudin, 1944); later the jejunum was carried toward the neck through the chest (Rienhoff, 1946) rather than under the skin. These procedures either bypass the stomach, or the distal portion of the jejunum was anastomosed to the stomach so that food could pass through a more physiological channel. More recently, Robertson and Sargeant (1950) advocated the use of a subternal tunnel in the esophago-jejunostomy, which is by far the shortest route between the neck and the abdomen. The main disadvantage of this procedure is that it is difficult to obtain a long enough jejunal segment to reach the neck without seriously compromising the blood supply of the transplanted segment. It has been a common experience to see the proximal end of the jejunal segment turn dusky toward the end of the procedure. In addition, in cases where the stomach was bypassed, a serious nutritional disturbance has been reported (Gross, 1953); however, in all of our cases where the stomach was bypassed, no nutritional problem has been encountered postoperatively. The only complaint of our patients has been that they had to eat small meals at frequent intervals. In our series, no antiperistaltic anastomosis of jejunum was done; the ill effect of such a procedure has been reported by others (Yudin, 1944).

Using part of the colon to reconstruct the esophagus was attempted by various surgeons in the past (Dale and Sherman, 1935; Neville et al., 1956; Sherman and Mahoney, 1954), but it was not until a few years ago that an esophago-colo-gastrostomy using a substernal placement of the right half of the colon was developed and its advantages evaluated (Hong and Lee, 1959; Scanlon and Stanley, 1958). This procedure offers several desirable features, chief among which are the abundant blood supply to the isolated segment of colon, a more physiological passage of food through the stomach and duodenum and the better resistance of the colonic mucosa to peptic digestion by the stomach contents. In the majority of these cases, the colon of the colon remained excellent throughout the procedure; postoperatively, these patients were able to resume normal eating habits. An early disadvantage of this procedure was the bulk of a cecum which lay at or just above the sternal notch where the passage is the narrowest. Many candidates for this procedure are young women who have a narrow thoracic inlet, and it was very difficult, or even impossible in some cases, to pull the cecum through this narrow channel without seriously compromising the blood supply, as was evidenced by a poor venous return. In some cases, a portion of the mesentery and the proximal end of the clavicle were removed; in one case, a mesenteric vein was anastomosed to a systemic vein in the neck. In spite of precautions one patient developed necrosis of the cecum, resulting in complete failure of the procedure.

In order to solve this early problem of cecal bulk at the thoracic inlet, we have now added two features to the use of right colon: these were employed in our last five cases, and the results have been rewarding. The first feature has been the deliberate use of the terminal portion of the ileum along with the right half of the colon to prevent squeezing a bulky cecum into a narrow thoracic inlet. The second feature has to do with supplying adequate circula-
tion to this terminal ileum, which is the portion of bowel farthest from the source of blood supply; here the right colic and the middle colic artery were both used as the source of the blood supply to the transplanted bowel.

Among the complications there have been leakage at the site of anastomosis and injury to the recurrent laryngeal nerve; these have been transitory in all cases and have required no definite treatment. Stenosis at the site of anastomosis has been a more difficult problem, requiring reoperation in each case where it has occurred. This complication occurred in two of the three cases of esophago-gastrostomy and in the four-year-old boy in whom the right colon was utilized. In this last case, the anastomosis was anti-peristaltic and was followed by regurgitation of food and by temporary leakage at the anastomotic site during the postoperative period. It is probable that the stenosis developed in this case because of reverse peristalsis and resulting leakage. In view of this experience, anti-peristaltic anastomosis has been abandoned in our clinic.

Because autopsy was not permitted, the cause of death in the two cases who died suddenly within a few hours after operation is difficult to determine. The operations themselves were uneventful in both cases, and the patient’s condition during the recovery period seemed satisfactory until they suddenly died. One of these patients (Case 8) suddenly sat up in bed, pounded her chest and expired. It is thought that both of these patients died from acute obstruction of the respiratory tract. In case 5, who had a similar difficulty following operation, bronchoscopy revealed definite evidence of extrinsic pressure on the trachea at the level of the anastomosis; and in another case not included in this series who died following substernal esophagoplasty as a preliminary step for radical surgery for carcinoma of the esophagus, it was found at autopsy that his whole tracheobronchial tree was obstructed by mucopurulent material; it was obvious that this patient died from asphyxiaton. To prevent this difficulty, we now perform tracheostomy far more frequently in these cases.

**SUMMARY AND CONCLUSIONS**

Nineteen cases of high benign stricture of the esophagus who underwent various reconstructive procedures have been presented. Esophago-gastrostomy was performed in the first three, substernal cervical esophago-jejunostomy with a Roux-Y anastomosis in the next six and reconstruction of the esophagus utilizing the right half of the colon with or without the terminal segment of the ileum in the last ten cases. In cases where the terminal ileum was utilized, both the right colic and the middle colic arteries were kept intact as the source of blood supply.

The most serious complication was stenosis developing at the site of anastomosis, and this was most commonly seen with esophago-gastrostomy. The cause of death in the two cases who died shortly after substernal esophagoplasty was discussed. To prevent respiratory obstruction, which presumably was the cause of death in these two cases: we now resort to tracheostomy at the end of operation if the slightest doubt exists.

At the present time, reconstruction of the esophagus utilizing the right half of the colon and a small length of the terminal ileum, preserving the middle colic and right colic vessels as the source of blood supply, seems to offer the best chance of success in these cases. The main advantages of such a procedure may be listed as follows:

1. An ample length of bowel can be obtained with abundant blood supply, and this is particularly well-adapted for high anastomosis in the neck.
2. Anastomosis is technically easier because the diameter of the esophagus and the terminal ileum are comparable in size.
3. The ileocecal valve does not seem to offer obstruction to the passage of food. With the use of the reconstruction, an extra suture line in the ileocecal junction can be avoided.
4. The ileum has less bulk than the cecum, and this is of particular advantage in neck anastomosis in females who generally have a relatively small thoracic inlet which tends toward constriction.
5. The colon is more resistant to the peptic action
of gastric juice than is the jejunum or esophagus, and consequently there is less chance of ulcer formation near the suture line.

6. The food passes through a more physiologic route, and the storage and digestive functions of the stomach are retained. Reconstruction of the esophagus in cases of high stricture is admittedly a difficult problem and it requires further study and improvement. However, the use of colon as a substitute for the esophagus has opened a new phase in this field. Many patients who failed to respond to the dilatation of benign esophageal strictures can now be restored to normal eating and to useful living.

Table 1. Pertinent Data on 19 cases of Esophageal Reconstruction

<table>
<thead>
<tr>
<th>Case No</th>
<th>Sex</th>
<th>Age</th>
<th>Duration of Disease</th>
<th>Length and Method of Dilatation</th>
<th>Level of Obstruction</th>
<th>Procedures</th>
<th>Complication</th>
<th>Final Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Male</td>
<td>23</td>
<td>over 1 yr.</td>
<td>Irregular</td>
<td>Sternal notch</td>
<td>Cervical esophago-gastrostomy</td>
<td>Stenosis at anastomotic site</td>
<td>Good</td>
</tr>
<tr>
<td>2</td>
<td>Female</td>
<td>19</td>
<td>3 yrs.</td>
<td>Irregular</td>
<td>Mid thoracic esophagus</td>
<td>Thoracic esophago-gastrostomy</td>
<td>None</td>
<td>Good</td>
</tr>
<tr>
<td>3</td>
<td>Female</td>
<td>25</td>
<td>1 &amp; ½ yrs.</td>
<td>None</td>
<td>Aortic arch (?)</td>
<td>Thoracic esophago-gastrostomy</td>
<td>Anastomotic stenosis repaired; Pyloric obstruction treated by gastrojejunostomy</td>
<td>Good</td>
</tr>
<tr>
<td>4</td>
<td>Male</td>
<td>13</td>
<td>Unknown</td>
<td>4 mos. Plummer</td>
<td>Sternal notch</td>
<td>Substernal esophagojejunostomy</td>
<td>Anastomotic leak; sealed in 19 days; transient hoarseness</td>
<td>Good</td>
</tr>
<tr>
<td>5</td>
<td>Female</td>
<td>18</td>
<td>2 yrs.</td>
<td>2 mos. Tucker</td>
<td>Sternal notch</td>
<td>Substernal esophagojejunostomy</td>
<td>Right pneumothorax; tracheostomy for respirator; obstr.: exploratory laparotomy to divide hepatic round ligament to relie-jejunostomy obstruction; transient anastomotic leak</td>
<td>Good</td>
</tr>
<tr>
<td>6</td>
<td>Male</td>
<td>19</td>
<td>10 yrs.</td>
<td>None</td>
<td>Sternal notch</td>
<td>Substernal esophagojejunostomy</td>
<td>None</td>
<td>Good</td>
</tr>
<tr>
<td>7</td>
<td>Male</td>
<td>25</td>
<td>2 yrs.</td>
<td>None</td>
<td>Sternal notch</td>
<td>Substernal esophagojejunostomy</td>
<td>Necrosis of jejunal segment</td>
<td>Failure</td>
</tr>
<tr>
<td>8</td>
<td>Female</td>
<td>15</td>
<td>3 yrs.</td>
<td>None</td>
<td>Sternal notch</td>
<td>Substernal esophagojejunostomy</td>
<td>Postoperative death; respiratory obstruction (?)</td>
<td>Death</td>
</tr>
<tr>
<td>9</td>
<td>Female</td>
<td>22</td>
<td>3 yrs.</td>
<td>2 mos. Tucker</td>
<td>Sternal notch</td>
<td>Substernal esophagojejunostomy (in 2 stages)</td>
<td>None</td>
<td>Good</td>
</tr>
<tr>
<td>10</td>
<td>Female</td>
<td>26</td>
<td>5 mos.</td>
<td>None</td>
<td>Aortic arch</td>
<td>Substernal esophagojejunostomy using right colon</td>
<td>Postoperative death; respiratory obstruction (?)</td>
<td>Death</td>
</tr>
<tr>
<td>11</td>
<td>Female</td>
<td>11</td>
<td>2 yrs.</td>
<td>1 yr. Tucker</td>
<td>Sternal notch</td>
<td>Substernal esophagojejunostomy using right colon</td>
<td>Temporary leak at anastomosis</td>
<td>Good</td>
</tr>
<tr>
<td>12</td>
<td>Female</td>
<td>26</td>
<td>10 mos.</td>
<td>1 mos. Tucker</td>
<td>Sternal notch</td>
<td>Substernal esophagojejunostomy using right colon</td>
<td>Necrosis of cecum, second attempt utilize jejunum also failed because of insufficient length</td>
<td>Failure</td>
</tr>
<tr>
<td>13</td>
<td>Female</td>
<td>26</td>
<td>5 yrs.</td>
<td>None</td>
<td>Sternal notch</td>
<td>Substernal esophagojejunostomy using right colon</td>
<td>Right pneumothorax; postoperative bleeding from subternal space, controlled by reoperation, wound infection</td>
<td>Good</td>
</tr>
<tr>
<td>14</td>
<td>Male</td>
<td>4</td>
<td>2 ½ yrs.</td>
<td>6 mos. Plummer</td>
<td>Aortic arch</td>
<td>Substernal esophagojejunostomy using right colon (antiperistaltic anastomosis)</td>
<td>Temporary leak at anastomosis; stenosis, revised 4 mos. later evidence of regurgitation</td>
<td>Fair</td>
</tr>
<tr>
<td>Patient</td>
<td>Gender</td>
<td>Age</td>
<td>Lesion Site</td>
<td>Surgery</td>
<td>Complications</td>
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<tr>
<td>15</td>
<td>Female</td>
<td>4 mos.</td>
<td>None</td>
<td>Sternal notch</td>
<td>Subternal esophagoplasty using terminal ileum and right colon in 3 stages</td>
<td>Good</td>
<td></td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>Female</td>
<td>11 mos.</td>
<td>5 mos. Tucker</td>
<td>Sternal notch</td>
<td>Subternal esophagoplasty using terminal ileum and Rt. colon</td>
<td>Good</td>
<td></td>
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</tr>
<tr>
<td>17</td>
<td>Female</td>
<td>1 yr.</td>
<td>8 mos. Tucker</td>
<td>Thyroid cartilage</td>
<td>Subternal esophagoplasty using terminal ileum and right colon (in 2 stages)</td>
<td>None</td>
<td></td>
<td></td>
</tr>
<tr>
<td>18</td>
<td>Female</td>
<td>5 mos.</td>
<td>None</td>
<td>Sternal notch</td>
<td>Subternal esophagoplasty using terminal ileum and right colon</td>
<td>Good</td>
<td></td>
<td></td>
</tr>
<tr>
<td>19</td>
<td>Male</td>
<td>14 mos.</td>
<td>7 mos. Tucker</td>
<td>Sternal notch</td>
<td>Subternal esophagoplasty using terminal ileum and Rt. colon</td>
<td>Right pneumothorax</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**REFERENCES**


