

15-year Personal Experience of Esophageal Reconstruction by Left Colic Artery-dependent Colic Graft for Caustic Stricture: Surgical Technique and Postoperative Results

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ABSTRACT

AIM: The aim of this retrospective study is to report a 15-year personal experience of surgical management of esophageal caustic stricture by using substernal left colic interposition.

MATERIALS AND METHODS: From 1999 to 2014, 105 patients with esophageal caustic stenosis were managed surgically. There were 90 women and 15 men. Patients aged from 15 to 70 years. Emergency esophago-gastrectomy was performed in 4 patients. Early gastric stenosis was treated before reconstructive surgery by gastro-jejunostomy in 12 patients. Nutritional disorders were corrected before surgery. The thoracic inlet was enlarged in 36 patients. The functional results were evaluated in all patients.

RESULTS: Postoperative death occurred in 3 patients. The complication rate was 26.6%. The transplant necrosis was occurred in 2 patients. Cervical anastomotic leakage occurred in 15 patients. Early reoperation was performed in 4 patients. Cervical anastomosis stricture occurred in 8 patients. The redundancy was occurred in 2 patients. The swallowing function was considered good in 94 patients (92.1%).

CONCLUSION: The early endoscopic evaluation provides accurate diagnosis and permit to define an appropriate therapeutic strategy. The goal of esophageal reconstructive surgery is to restore digestive continuity and good swallowing function. The left colon

graft based on left colic vessels and interposed by substernal route is the technique of choice to reconstruct the scarred esophagus with good results.

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Key Words: Esophageal stricture; Left colon graft; Results

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INTRODUCTION

Potentially catastrophic presentation and lifelong complications resulting from caustic ingestion make it one of the most challenging clinical situations encountered in gastroenterology. Caustic material ingestion in adults is most frequently for suicidal intent^[1,2,3,4]. Destruction of tissues or of these organs may lead to complications, esophageal and gastric perforation, or even death might occur. Stricture formation with inability of swallowing is inevitable in some cases. The first treatment of this stricture is the dilations. The goal of reconstructive surgery of esophagus is to restore both gut continuity and swallowing function with minimal mortality and morbidity.

Using colon as an esophageal substitute became a reliable option when Kelling and Vulliet independently reported experiences with transverse colon graft in 1911^[5,6]. The efficacy of colon graft has been thoroughly evaluated and definitively attested by competent surgeons during the past three decades^[7,8]. However the morbidity still ranges from 20% to 60% in the literature, emphasizing that this procedure should not be underestimated^[9-13]. The success of esophageal reconstruction by colic interposition depends on several factors.

The most important is the accuracy of the surgical technique and the experience of surgeon. The aim of this retrospective study is to report a 15-year personal experience of surgical management of esophageal caustic stricture using substernal left colic interposition.

MATERIALS AND METHODS

From 1999 to 2014, 105 patients with esophageal caustic stenosis were managed surgically in our institution. There were 90 women and 15 men with sex ratio 6, respectively. Patients aged from 15 to 70 years (median = 24 years). Emergency esophago-gastrectomy was performed in 4 patients. Early gastric stenosis was treated before reconstructive surgery by gastro-jejunostomy in 12 patients (table 1). The caustic materials for injuries were liquid lye and acids (80 cases and 25 cases, respectively). The esophageal stenosis was determined by endoscopy and radiological signs. The dilations were performed in 73 patients (70%). The time between the ingestion and the reconstructive surgery ranged from 3 months to 10 years (median = 12 months). Enteral nutrition via catheter-jejunostomy was started 48 h postoperatively. The proximal esophagocolic anastomosis was checked routinely by radiography with water soluble contrast medium on postoperative days (PODs) 8-10. The functional results were evaluated on the basis of pattern of swallowing, on the presence of specific symptoms (aspiration, regurgitation, dysphagia), weight change and reoperations for late complications. The patients were reviewed regularly in out-patient department at 3, 06, 12, 24, 36 months after discharge from hospital. The patients were clinically examined and some exams were done in symptomatic patients when necessary in order to detect eventual complication.

Preoperative Evaluation

The colon was evaluated preoperatively by colonoscopy in patients aged 45 or older or were at high risk for of associated colic diseases such as chronic ischemia, cancer, or diverticulosis. A mesenteric angiography can be helpful in outlining the vascular arcade of the segment of bowel to be interposed. Only one of these patients underwent preoperative mesenteric angiography to delineate the colonic blood supply in this series.

The nutritional status of patients was evaluated and Nutritional disorders were corrected before surgery by parenteral and enteral nutrition (gastrostomy or jejunostomy).

The bowel preparation consisted of 3 days of a clear liquid diet, followed by two mild water enemas for large bowel preparation the day before operation. All patients received perioperative antibiotic prophylaxis with metronidazole.

Operative technique of colonic interposition

As colonic interposition was mostly used in our study and the surgical procedure was prescribed. The operation was carried out through an upper abdominal incision and a left cervical incision along the inner border of the sternocleidomastoid muscle in 105 patients and in 2 patients with a right thoracotomy. The cervical esophagus was explored and it was transected in the level that esophagus was normal. In case the cervical esophagus was thickened and stiff in consistency, indicating that the organ was too extensively injured, it was resected and a hypopharyngocolostomy had to be performed.

The entire colon was freed from its attachments and mobilized largely that it could be placed outside the peritoneal cavity for inspection of its vascular blood supply by palpation and transillumination of the mesentery (Figures 1 and 2).

The middle and left colonic arteries were identified and freed

Table 1 Surgical procedures.

Procedures	No. of patients (%) n = 105
Esophago-gastrectomy	4 (3.8)
Gastro- entero-anastomosis	12 (11.4)
Cervical anastomosis	
Pharyngo-esophageal	12 (11.4)
Esophago-colic	93 (93.6)
Cologastric anastomosis	
Anterior side	12 (11.4)
Posterior side	89 (84.7)
Colojejunal anastomosis	4 (3.8)
Enlargement of thoracic inlet	36 (34.2)

respectively. The left colonic vessels were evaluated and chosen as the preferred pedicle for the transposed colonic segment. The evaluation of the marginal arcade and the venous drainage is recommended. The root of the middle and right colic arteries were clamped with bulldog clamps for about 15 min. In the same time, the estimated ends of graft were clamped with intestinal clamps and watched. If the colon acted as replacement graft expressed normal in colour, peristalsis and adequate blood flow as ascertained by the presence of a pulsatile flow in the marginal artery (especially those in both ends of the selected segment), the clamped vessels were divided and tied. Then the colon was transected at its ascending part upstream of the right colonic flexure as well as at the splenic flexure. The colonic segment used in all these patients consisted of left colon was maintained by a double vascular pedicle based on the left colic vessels and the marginal paracolic arcade via the sigmoid vessels (Figures 3 and 4).

The graft used was pulled to the neck in isoperistaltic direction. The substernal route was used exclusively in 103 patients and posterior mediastinum in 2 patients. When the colon is elevated behind the sternum, constant checking of the position of the vessels is required because minimal twisting that does not impede the arterial supply may represent a significant obstacle to the venous flow, which is thought to be the usual precipitating event for necrosis.

In the beginning of our experience, we enlarge the thoracic inlet by resection of manubrium and the head of left clavicle when the thoracic inlet was jugged too narrow. Currently, we systematically associate this additional procedure to any substernal colic interposition in order to avoid or decrease compression on the proximal colonic graft at the level of the thoracic inlet. This associated procedure was done in 36 patients.

The scarred esophageal and pharyngeal tissue was resected completely and proximal cervical anastomosis was performed on healthy tissue in an end-to-end fashion with hand-suturing single-layer technique in all patients. Pharyngo-colic anastomosis with pharyngoplasty was performed in 11 patients.

The cologastric anastomosis was performed on the posterior wall of the stomach to prevent gastro-colic reflux however in case of stomach stenosis; the anastomosis was performed on the anterior wall. When the stomach was not available, the anastomosis was performed between the distal portion of graft and a Roux en y loop of jejunum. Enteral nutrition via catheter-jejunostomy was started 48 h postoperatively. The proximal esophago-colic anastomosis was checked routinely by radiography with water soluble contrast medium on postoperative days (PODs) 8-10.

RESULTS

The dilation was performed in 73 patients (70%) and it was begun 4 weeks after ingestion in earlier stenosis. None of these patients

had presented any complication linked to dilation. Reconstructive surgery was required in 105 patients. There were no intraoperative deaths. The main intraoperative complication was pneumothorax

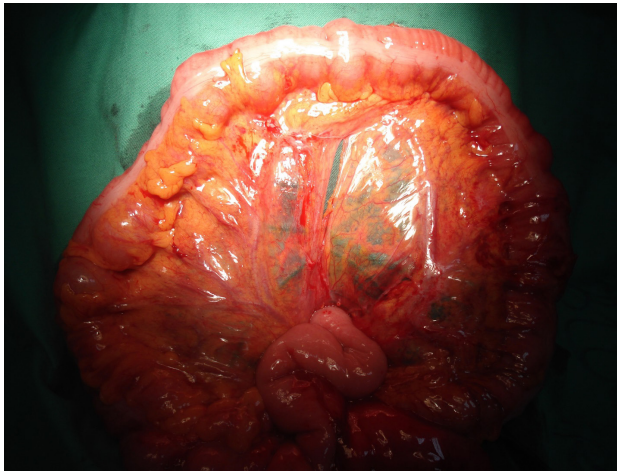


Figure 1 Entire colon freed and outside the peritoneal cavity.

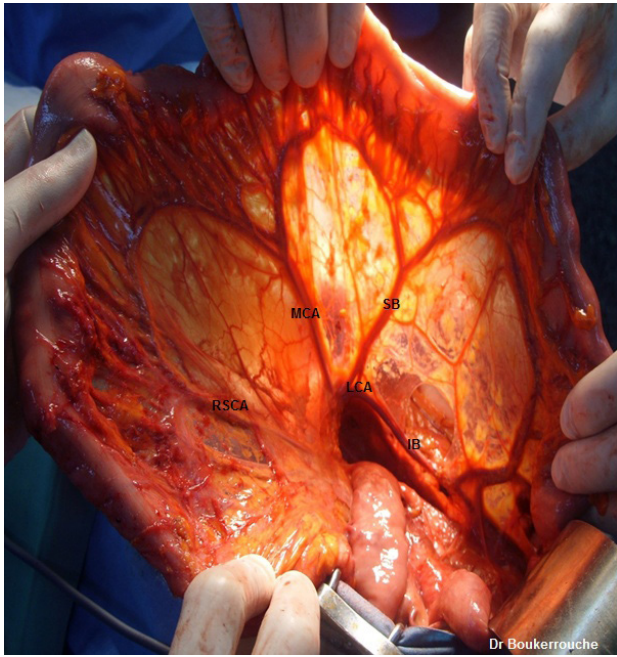


Figure 2 Transillumination of the mesentery. RSCA: right superior colic artery, MCA: middle colic artery, LCA: left colic artery, SB: superior branch, IB: inferior branch.

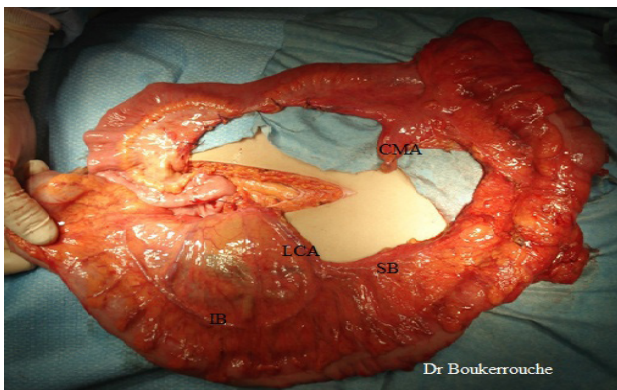


Figure 3 Double vascular supply of the Graft, CMA: colica media artery, LCA: left colic artery, SB: superior branch, IB: inferior branch.

caused by inadvertent lesion of the mediastinal pleura during the blunt dissection of the substernal space. Postoperative death occurred in 3 patients at 1, 3 and 25 postoperative days. The causes were pulmonary emboli, myocardial infarcts and severe infectious complication with multi-organ failure.

Twenty eight patients developed postoperative complications making a complication rate of 26.6 % (Table 2). The transplant necrosis was occurred in 2 patients (1.9%). It diagnosed at 1 and 2 postoperative days. The most common complication was cervical anastomotic leakage, which occurred in 15 patients (14.2%) of this series. The postoperative complications are listed in Table 2.

The leak was managed conservatively in all patients and conservative treatment consisted of continuous nutritional support, cessation of oral feeding in some patients and daily wound local care. The complete healing was obtained about 7 to 14 days. Early reoperation was performed in 6 patients (Table 3). The causes were cervical hematoma ($n=2$), ischemic necrosis of graft ($n=2$) and intra-abdominal bleeding ($n=2$). Cervical anastomotic stricture occurred in 8 patients (7.6%). The redundancy was occurred in 2 patients and it was treated by resection of redundant colon with colo-colic anastomosis end-to-end (Table 3). The functional results were evaluated in all the patients during follow-up periods ranging from 6 to 13 years (median 5 years). All patients had exclusively an oral feeding. The body weight, compared to that before surgery, was increased in all patients. Gastro-colic reflux developed in 5 patients and was managed with medical treatment and lifestyle modification such as elevating the head of the bed on 4- to 6-inch blocks and avoiding recumbency for 2-3 h after meals.



Figure 4 Isoperistaltic left colic graft.

Table 2 Postoperative morbidity.

Complication	No. of patients (%) $n = 105$
Overall morbidity	28 (26.6)
Pneumothorax	3 (2.8)
Early complications	
Cervical anastomotic leakage	14 (13.3)
Lower anastomotic leakage	5 (4.7)
Graft necrosis	2 (1.9)
Late complications	
Cervical anastomotic stricture	8 (7.6)
Redundancy	2 (1.9)

Table 3 Postoperative re-operation.

Re-operation	No. of patients (%) $n = 105$
Early re-operation	6 (5.7%)
Cervical hematoma	2
Graft necrosis	2
Intra-abdominal bleeding	2
Late re-operation	4 (3.8%)
Cervical anastomotic stricture	2
Colic redundancy	2

Dysphagia secondary to anastomotic stricture was noted in 8 Patients. The dysphagia was elective for solid and semisolid meals however oral intake of liquid diets was maintained in these dysphagic patients. The stricture was successfully treated by dilations in 6 patients however surgery had been an ultimate solution in the 2 others patients. At last follow-up, an excellent long-term functional results were observed in 85.2 % of our patients ($n=87$). In 15 patients (14.7%), an improvement of symptoms was noted after an appropriate treatment which consisted of administration of antireflux drugs, endoscopic dilations and re-operation. We had not noted any difference in term of functional results in patients with esophago-colostomy and those with pharyngo-colostomy.

DISCUSSION

In this series, caustic injury was the main cause for esophageal reconstruction and the most common caustic agent used was alkali, usually sodium hydroxide. Sodium hydroxide is a clear liquid that could be mistaken for water. The second corrosive agent used is the chloride acid. The ingestion was voluntarily and in suicidal intent in the most situations (75%). This indicates that such patients require a multidisciplinary therapeutic approach including psychiatric support. A successful management of corrosive injury involves prompt recognition and early treatment particularly in severe injury which can lead to death resulted from complications. These complications, represented by mediastinitis and peritonitis, are due to digestive perforation (esophagus, stomach). The stricture was observed more frequently in patients who ingested a large amount of concentrated caustic substances for suicidal intent. Every effort should be made to retain the native esophagus in these patients with benign esophageal disease. So the first treatment of esophageal caustic strictures are the endoscopic dilations. Seventy eight of our patients (75%) underwent endoscopic dilations. Failure of dilations was defined by persistent or early recurrent stricture after four to five dilations or by perforation during dilation. Arbitrarily, strictures longer than 5 cm were judged unsuitable for dilation. Unfortunately, it is sometimes not possible to maintain an adequate esophageal lumen diameter despite all the measures (medical therapy, stent and repeated dilations). Reconstructive surgery of esophagus was indicated when the stricture was so severe with swallowing difficulties and important weight loss, or when the dilatation had failed. However and in some cases, surgery can be the first therapeutic option for severe and longer stricture. The time of esophageal reconstructive surgery for caustic stricture is still under controversy. The scar retraction began as early as the end of the second week, and lasted for about six months. It took about 6-12 months before full fibrosis stopped to develop after the injury which showed that the edge of the stricture in the esophagus might not be confirmed until then^[14,15]. A too earlier operation, when the scar has not completely formed, may promote the risk of anastomotic leak and stenosis. However the minimal delay for esophageal reconstructive surgery after corrosive injury is 3 months, but, it is believed that to increase the chance of successful surgical management, the operation must be carried out at least six months after the injury. So we think that the most beneficial time for surgery after the injury is no less than 3 months for the esophagus and 6 months for the pharynx. In case of cervical esophageal stenosis, most of authors suggest to resect the scarred esophagus and to perform the esophagocolic anastomosis on healthy tissue^[13,16].

Twelve patients had developed both esophageal and gastric stricture. The gastric stricture was occurred early after injury. The

esophageal stricture was treated initially by dilations with partial response permitting liquid oral intake. In order to facilitate the introduction of oral intake; the gastric stricture was treated surgically by performing a gastro-jejunostomy on the posterior side of gastric wall. The median time between caustic ingestion and gastric surgery was 45 days. This delay was too short because gastric stricture, compared to that of esophagus, occurred early after caustic injury. The esophagus was explored in these 12 patients before gastric surgery by flexible paediatric endoscope or radiography with water soluble contrast medium. These exams were performed after dilations in order to show the obtained diameter of scarred esophagus and to evaluate the efficacy of such treatment. The reconstructive surgery was indicated in these 12 patients after failure of dilations.

Choice of replacement organs

The organs used for esophageal replacement in patients with caustic stricture included stomach, jejunum and colon^[17,18]. The decision of which conduit to use is based on multiple factors including the required length, the blood supply of the intended conduit, the local anatomy, which conduits are available and the experience of the surgeon. Orringer and Stirling^[19,20], and others^[21,22] concluded that gastric interposition was the procedure of choice for most patients with benign disease. Other authors have suggested that the colon is the best conduit to restore swallowing function mainly because of an increased incidence of aspiration and reflux with gastric conduit^[23,24].

Stomach has the disadvantages of long term gastro-esophageal reflux which can lead to complications such esophageal ulceration and anastomotic stenosis^[25]. In case of diffused injuries with pharyngo-esophageal stenosis, the stomach is not sufficient long to reach the basis of the tongue to realize pharyngoplasty. In massive caustic ingestion, the stomach is often injured and its use as an esophageal substitute is impossible. In our experience, the esophago-gastrostomy was performed only in 3 patients of our series.

Jejunal interposition is seldom used because of the difficulty for operation since blood vessels of jejunum are too thin and easier to be affected after anastomosis. Furthermore; the jejunum is fragile to the erosion of acid in a long run, so the jejunum should not be the first choice. The best indication of jejunal transplant is the partial reconstruction of the esophagus particularly the cervical by free jejunal graft with micro vascular anastomosis. In our study, we had performed only one jejunal interposition for caustic stenosis of colon transplant after recurrence of caustic ingestion because the stomach was unavailable and the colon was not enough long to use.

Despite the increased operative time and number of anastomoses, the advantages of a colon graft become apparent including its relatively straight mesentery, its status as a enough long transplant organ to be pulled to the neck, its low incidence of disease, and the long-term good functional results and protection from chronic gastroesophageal reflux. So colon could offer potential advantages over other organs^[17,26], and it is believed to be an ideal and excellent organ for esophageal reconstruction.

We used exclusively the isoperistaltic left colonic transplant supplied by the left colic artery in esophageal reconstruction for caustic stricture. So our preference for a left colonic segment lies in the near-invariability of the left colonic artery (which has been present in all the patients of our series except in one patient, it had too reduced size and unusable) in contrast with the vascular pattern of the right colon, the better plasticity of its mesocolon, and its smaller lumen. Finally, we have encountered no problems with ischemia of the left colonic graft linked to blood insufficiency. The right colon graft was used only in one situation because the left colon was unusable (left colic artery had a much reduced size). The colon graft

could always be used in an isoperistaltic direction when possible. However, efforts to prevent the colon graft redundancy are important.

Preoperative colonoscopy was performed in a small number of patients because the great number of our patients was aged less than 40 years. This exam is necessary when the patient is at risk for colonic diseases or is older than 45 years. The preoperative mesenteric angiography is performed to explore the vascular anatomy of the colon. Therefore the arterial abnormalities are identified to influence the choice of digestive transplant or the vascular pedicle for the graft in a small percentage of patients^[27]. The decision about which colic segment to use, is made intraoperatively and depends on anatomic conditions, vessels clamping test and the surgeon's preferences and experience. Most centers, including ours, do not perform systematically preoperative mesenteric angiography. The angiography is recommended electively in patients with a history of a previous colonic resection during which major colonic vessels have been ligated. This invasive exam had been performed in one of our patients who had undergone firstly a substernal colic interposition and had been planned for a re-reconstructive surgery for caustic stricture of the interposed colic graft.

The mortality reported in the literature after colonic interposition varied from 2.5 to 10%^[28]. The mortality rate in our series was 2.8% ($n=3$) and it was comparable to the rate reported in many series. The causes were pulmonary emboli, myocardial infarcts and severe infectious complication with multi-organ failure. Nevertheless, the morbidity rate is still high and it ranges from 20% to 60% in the literature^[12,14,16,17]. The morbidity in our series was 26.6% ($n=28$).

The most severe complication was necrosis of the transplanted colon and it was occurred in two patients. This disastrous complication is associated with high rate of death in absence of early diagnosis and adequate management. The cute management of graft necrosis consisted of the removal of the necrotic part, performing a cervical esophagostomy, large drainage, antibiotics and inserting a catheter-jejunosomy with introduction of an adapted nutritional supplementation. We use exclusively enteral nutrition via tube-jejunosomy because it is more physiologic. The operative findings confirmed that necrosis was secondary to venous obstruction by compression on the graft at the upper thoracic inlet that had not been enlarged in these two cases. A slightly higher rate of ischemic necrosis after using the left colon graft has been reported by some authors. Davis *et al* reported an rate of 2.4% of colon ischemia after right colon interposition^[29], whereas DeMeester *et al* reported a rate of 4.7% of intraoperative graft ischemia after left colon interposition^[16]. The reported rates of left colonic graft necrosis vary from 3 to 9%^[30,31,32]. In our series, it was 1.9% ($n=2$), being comparable to that of right colonic graft necrosis.

The graft necrosis is associated with very lower rate of further restoration of gut continuity. Further digestive re-reconstruction is not well codified and requires a panel of complex surgical procedures. So the difficulty is how to restore the gut continuity and which digestive organ is available. In this situation, a more complex reconstruction procedure should be considered. In the 2 cases of our series, the digestive continuity was established by substernal interposition of anti-peristaltic gastric graft through triple incision cervicotomy, sternotomy and laparotomy 3 and 6 months later respectively. To prevent the graft necrosis associated with this mode of esophageal reconstruction, the anatomic variations in the number, size, and distribution of the colonic vessels are the rule. So meticulous dissection and complete mobilization of the colon are required with the guidance of transillumination of the mesentery, palpation of pulsatile flow in the vessels, or intraoperative Doppler

examination with a fatty mesentery^[12]. Also when the colon is pulled up to the neck through a substernal route, constant checking of the position of the vessels is required. Minimal twisting may represent a significant obstacle to the venous flow with occurrence of venous congestion which is the usual precipitating event for necrosis^[33]. In substernal colon interposition, it is important to ensure there is no compression on the transposed colon at the thoracic inlet because venous drainage is very sensitive to a mechanical obstacle^[33]. We feel so it is essential to enlarge the thoracic inlet in order to avoid any cervical compression on the transposed colon graft.

The most routes used for esophageal reconstruction is the mediastinal and substernal route. The posterior mediastinum is the shortest route and its use needs the ablation native esophagus. In case of esophageal caustic stricture, the scarred esophagus adheres to adjacent organs that make its dissection risky and hemorrhagic. Indeed the substernal route is thus commonly used as an alternate. Initially, we enlarged the thoracic inlet when it was jugged to narrow. Currently, we do it routinely in all patients undergoing a substernal colonic interposition. This associated procedure is recommended by many surgeons when using the substernal approach for esophageal reconstruction^[34-40].

The cervical anastomotic leakage is the most common complication encountered in esophageal reconstruction. The cervical leak rates for substernal reconstruction vary from 10% to 47%^[41]. It occurred in 15 patients (14.2%) of our series and it diagnosed between 7 and 9 postoperative day (POD). The leak was clinically evident, and it was managed conservatively by opening the cervical wound in all patients. The healing of leak was obtained between 7 and 10 days. The most patients operated for esophageal caustic stricture was accompanied with bad nutritional status because oral intake was often interrupted. The malnutrition affects the healing process of anastomosis. So these patients were at high risk to develop postoperative complications. The nutritional status of patients was evaluated to determine the severity of an malnutrition by using specific markers, biomass index (BMI), weight loss, serum level of albumin and total protein. Good nutritional condition may reduce the risk to developing infectious complications particularly anastomotic leakage. The nutritional disturbances were corrected before surgery and both enteral and parenteral nutritional supports were used. As previously reported^[42], we prefer enteral nutrition via tube-jejunosomy and parenteral nutrition was used when enteral nutrition was impossible or not tolerated.

Placement of the graft seems to affect the early morbidity. Placing the transplant through a substernal route was associated with high rate of cervical leak as compared with placement in the PM^[16] and the substernal route (RS) was identified statistically significant to be the independent risk factor predisposing to cervical leakage^[43]. The opening of the upper thoracic inlet may decrease the cervical anastomotic complications, and it is associated with a lower rate of cervical leakage^[44]. The cervical leak was occurred only in 5 patients of 36 patients in whom the thoracic inlet was enlarged. We have observed a lower rate of cervical leak in group with enlarged thoracic inlet. Osteomyelitis of clavicle and sternum had not been observed in any patient of our series, therefore the risk to develop such complication is minor and we did not notice any report of case of osteomyelitis after thoracic inlet opening in literature. The cervical anastomotic stenosis occurred in 7.6% of our patients ($n=8$). The cervical leak is the clinical expression of a poorly anastomotic healing and nearly 60% of anastomotic stricture resulted of healed leak. Cervical anastomosis stricture occurred in 8 patients and 5 patients (62.5%) who developed this anastomotic complication

had previously a cervical leakage which healed spontaneously. Nevertheless in 6 patients the stenosis resolved with conservative treatment, mostly after a limited number of endoscopic dilatations. However the surgical revision was necessary in 2 patients and the treatment consisted of resection of stricture and realization of a new end-to-end anastomosis.

As reported in literature, the main late complication of colonic interposition is the redundancy of the interposed colon^[45]. The redundancy was occurred in 2 patients (1.9%). The colon graft used acts mainly as passive conduit and the food bolus travels mainly through the colic transplant by gravity^[33,46]. To reduce the occurrence of redundancy, it is important to make graft straight and to resect the excess part of conduit. The need for reoperation after colon interposition ranges from 15% to 30%^[47] and reoperation was frequently performed for redundancy of the colic graft. Redundancy leads to retention of food and liquid in the graft, regurgitation, and nocturnal aspiration. Excision of the redundant colon with anastomosis of the colon end-to-end is usually successful. This operative technique was performed in two patients. However, care must be taken to avoid injury to the vascular pedicle supplying the graft.

Scarred esophagus

Ablating the scarred esophagus during esophageal reconstruction remains controversial. Many studies have focused on the relation between esophageal injury and carcinoma. As reported, the interval between the caustic injury and the diagnosis of scar carcinoma is to be as long as 30-46 years, and the highest incidence of scar carcinoma was to be 7.2%^[48-51]. Considering the incidence of scar carcinoma, some surgeons perform simultaneous resection of the scarred esophagus^[47,48]. However, others preserve it for fear of neighboring organ damage because the injured esophagus adheres to the adjacent mediastinal organs extensively and densely^[52]. So the resection of scarred esophageal might result in massive bleeding and trauma to contiguous vital organs and its resection should be seriously considered. We had ablated the scarred esophagus in 2 patients in whom we had performed a partial esophageal reconstruction with intrathoracic anastomosis.

The functional results after esophageal reconstructive digestive surgery has been widely investigated^[53-56]. The functional results were evaluated on the basis of the pattern of swallowing, on the presence of specific symptoms like regurgitation, aspiration, dysphagia, weight change and reoperations for late complications. At the last follow-up, the overall functional evaluation demonstrated an excellent functional result in 85.2% ($n=87$) and an improvement was obtained after treatment in the 15 symptomatic patients (14.7%). Our functional results are comparable to those reported in literature^[53-57].

This present experience shows that substernal left colic interposition for esophageal caustic stricture is a technique of choice in the esophageal reconstruction. When performed by experienced surgeons, the mortality associated with this surgical procedure is very low, the morbidity is acceptable and the long-term functional results are good.

Keys for success of surgical procedure

The successful esophageal reconstruction is a challenge. The good nutritional status of the patient and the expertise and the experience of the surgeon in such surgery are the main condition of success. Nutritional evaluation of the patient and corrections of malnutrition are important for the healing process of anastomosis. Enteral nutrition by gastrostomy or jejunostomy and parenteral nutrition must be introduced to improve the nutritional status of patients candidate to surgical procedure of reconstruction. However enteral nutritional

supports are physiologic and more preferred than the parenteral ones. In addition to an effective nutritional support, meticulous surgical technique are important and the pivotal keys for a successful surgical procedure are the adequate and good vascular supply of the colic graft, as well as the absence of tension at the anastomosis by preparation of a graft adequate in length. Enlargement of the thoracic inlet by resection of the left half of manubrium and the left clavicle should be considered for substernal colonic interposition to avoid compression on the graft colon. Regarding to lower mortality and acceptable morbidity and good long-term functional results of referent and expert centres, esophageal reconstructive surgery performed by expert surgeons is a good surgical method to treat esophageal caustic stricture.

CONCLUSION

The most severe caustic injuries are caused by Strong acid or alkali ingestion especially in suicide attempts. The early endoscopic evaluation of patients provides accurate diagnosis and permit to define an appropriate therapeutic strategy to prevent complications (early operation). The dilations constitute the first treatment of esophageal stricture. Esophageal reconstructive surgery was indicated when stricture was so severe and after ineffectiveness or lack of dilations. The goal of this surgery is to restore digestive continuity and good swallowing function with acceptable mortality and morbidity. Performed by experienced surgeons, the left colon graft based on left colic vessels and interposed by substernal route is the technique of choice to reconstruct the scarred esophagus with low mortality, acceptable morbidity and good functional results.

CONFLICT OF INTERESTS

The authors declare that they do not have conflict of interests.

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