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Colon Interposition via the Retrosternal Approach without Enlargement of the Thoracic Inlet for the Management of Esophageal Stricture

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결장간치술을 이용한 식도부식증의 재건

백민관 · 우주현 · 한승욱 · 김동영

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Background and Objectives To report our experience of colon interposition without thoracic inlet widening for the management of esophageal stricture.
Subjects and Method Between 2005 and 2012, five patients underwent esophageal replacement using colon graft. Clinical data, such as surgical techniques including thoracic inlet widening, surgical outcomes, and patient's age and gender were retrospectively analyzed. The follow-up period ranged from 10 months to 5 years.
Results All five patients had corrosive esophageal stricture and underwent colon interposition without thoracic inlet widening; four underwent pharyngocologastrostomy and one total laryngopharyngectomy and pharyngocologastrostomy. No major complications, such as aspiration, dysphagia, reflux, or swallowing disorder developed during the postoperative long term follow-up.
Conclusion A colon graft without enlargement of the thoracic inlet is an excellent esophageal substitute for patients with an esophageal corrosive stricture. Further surgical experience and more long-term follow-up data are required to produce more precise and statistically meaningful results. Korean J Otorhinolaryngol-Head Neck Surg 2014;57(11):769-73

Key Words Colon interposition · Esophageal stricture · Thoracic inlet.

Introduction

The accidental or intentional ingestion of a caustic substance is common in Eastern Europe, South America, and Asia and corrosive strictures appear in up to 85% of cases.[1,2] Prognosis is influenced by the type, concentration, and amount of the caustic material ingested. Esophageal replacement is managed using colon, small bowel, stomach, gastric tubes, segments of skin, or a myocutaneous flap.[3,4] In particular, colon interposition is a useful treatment option when esophageal replacement is necessary. The retrosternal passage of a colon graft usually requires enlargement of the thoracic inlet to minimize potential compression of the colon graft or its blood supply. In fact, many surgeons consider that this maneuver is essential to obviate any compression of the upper aspect of the colon graft above the thoracic inlet.[5] However, we have achieved good results for colon interposition for esophageal reconstruction without enlargement of the thoracic inlet. In this retrospective study, we reviewed the records of patients that underwent esophageal replacement using colon and a retrosternal approach without enlargement of the thoracic inlet.

Subjects and Method

Between 2005 and 2012, 5 patients underwent esophageal replacement using colon. Clinical data, such as, surgical tech-

niques and outcomes and patients' ages and genders were retrospectively analyzed. The follow-up period ranged from 10 months to 6 years (median follow up 34 months). All 5 patients were female, and three had a depressive disorder. Four of the 5 patients had undergone bougienage dilatations before surgery, and the other patient had undergone total laryngopharyngectomy.

Various corrosive agents caused the esophageal caustic strictures. Lye (a concentrated alkaline) was ingested by 3 patients, hydrochloric acid by one, and glacial acetic acid and lye were ingested at the same time by the other. Intent to commit suicide was the motive for corrosive agent ingestion in 4 patients, whereas ingestion occurred accidentally in one (Table 1).

Times elapsed between caustic agent ingestion and esophageal reconstruction ranged from 4 months to 60 years. Esophageal reconstruction was performed between 4 and 6 months after corrosive agent ingestion in 3 patients. The other 2 patients underwent reconstructive surgery 12 and 60 years after ingestion. All 5 patients all underwent retrosternal placement of colon, for which blunt two finger dissection was performed to create a substernal tunnel. The transverse colon was used in all cases without enlargement of the thoracic inlet (Table 2). A long-term follow up was performed using annual evaluations of early and late complication, digestion, weight gain, and quality of life.

Results

Early postoperative complications occurred in all patients. Two patients developed pneumonia, which responded to antibiotics. One patient had a feeding jejunostomy abscess and another patient had leakage of the feeding jejunostomy, both were treated by surgical drainage. One patient had ileus which was treated conservatively (Table 3).

The most frequently late postoperative complication was aspiration, which occurred in 3 patients. It was treated conservatively by swallowing training and responded in 4 months in the 3 patients. Two patients had dysphagia which responded to conservative management, and one patient had reflux, which was treated with esophagotomy and L-tube insertion, and the reflux resolved 6 months later (Table 4).

The 5 patients underwent an early and late postoperative barium contrast study to evaluate anastomosis site leakage, postoperative stricture, and graft redundancy. There was no evidence of any severe complication, such as, leakage, stenosis, redundancy, graft necrosis, or pulmonary complication (Figs. 1 and 2). Regarding cosmetic problems, 2 patients complained of bulging of the neck in the location of the colon graft.

Follow-up results were evaluated annually (10 months to 6

Table 3. Early complication and their treatment in esophageal reconstruction

Cases	Early complication	Treatment of complication
1	Aspiration pneumonia	Antibiotics
2	Feeding jejunostomy abscess	Incision and drainage
3	Feeding jejunostomy leakage	Drainage
4	Pneumonia	Antibiotics
5	Ileus	Ambulation, prokinetics with stool softner

Table 1. Age, sex, psychiatric history, motive and corrosive agents

Cases	Age	Sex	Psychiatric hx	Moment suicide accident	Agent
1	41	Female	MDD	Suicide	Hydrochloric acid
2	45	Female	−	Suicide	Lye
3	50	Female	MDD	Suicide	Glacial acetic acid, lye
4	52	Female	MDD	Suicide	Hydrochloric acid
5	71	Female	−	Accident	Lye

MDD: major depressive disorder

Table 2. Treatment of esophageal stricture

Cases	Bougienage	Reconstruction	Reconstruction time from ingestion	Interposition route	Colon substitute
1	+	Pharyngocologastrostomy	12 years	Substernal	T-colon
2	+	Pharyngocologastrostomy	5 months	Substernal	T-colon
3	−	Total laryngopharyngectomy, pharyngocologastrostomy	6 months	Substernal	T-colon
4	+	Pharyngocologastrostomy	4 months	Substernal	T-colon
5	+	Pharyngocologastrostomy	60 years	Substernal	T-colon

T-colon: transverse colon

Table 4. Late complication, treatment, following up period and prognosis

Cases	Late complication	Treatment of complication	Time from the operation to recover	f/u period	Prognosis
1	Aspiration	Swallowing training	4 months	10 months	Good
2	Reflux	Esophagotomy and levin tube insertion	6 months	2.5 years	Good
3	Dysphagia	Swallowing training	f/u loss	3 months and f/u loss	Fair
4	Dysphagia	Swallowing training	3 months	6 years	Good
5	Aspiration	Swallowing training	2 months	4.5 years	Good

f/u: follow up

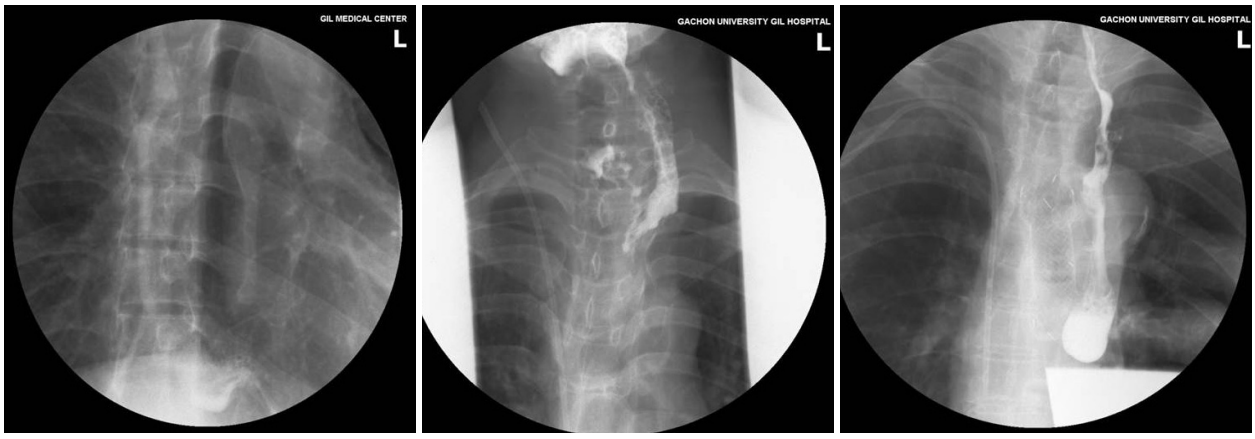

Fig. 1. Post operative esophagography. There is no evidence of anastomotic leakage, stenosis, graft redundancy in all patients.

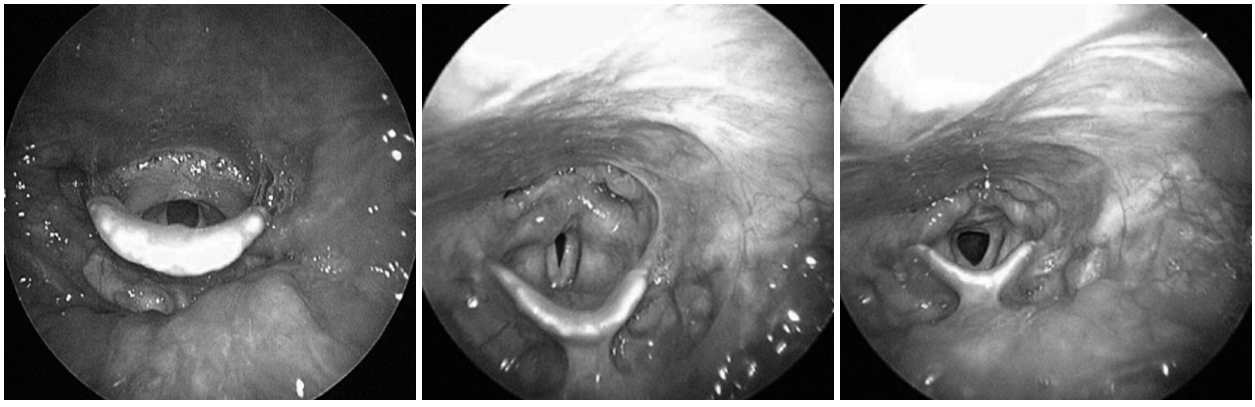

Fig. 2. Post operative laryngoscopic examiation of larynx and pharynx. We can see the pharyngocolic anastomotic orifice on the hypopharyngeal lateral wall. There is no evidence of leakage, stenosis on anastomotic site.

years, median 2.8 years). Four patients had good results, that is, symptom free swallowing and eating, gained weight, and achieved normal activity levels. On the other hand, one patient had a fair result and complained of a feeling of fullness after meals, pain, no weight gain, and a diminished working capacity despite normal swallowing and eating (Table 4).

Discussion

The colon, stomach, jejunum, pectoralis major muscle and forearm free flap can be used to reconstruct the esophagus. The pectoralis major muscle, forearm free flap and jejunal free flap are useful for partial esophageal reconstructions. The gastric pull-up and colon have been used as the most common substitutes for total or subtotal esophageal reconstructions.[6] The colon has a number of attributes that make it an excellent option in esophageal replacement. Advantages include long length and commonly excellent blood supply. Since colon is acid resistant, and by virtue of its long length, it prevents exposure of esophageal mucosa to refluxed gastric juice, thereby decreasing the risk of Barrett's metaplasia developing in the residual esophagus. Disadvantages of colon interposi-

tion include the fact that use of colon also requires preoperative cleaning, additional operative time for colon mobilization, and that three anastomosis, rather than one which is required for the gastric pull-up.[2)]

The substernal route is preferred for esophageal reconstruction. In fact, we consider the subcutaneous route should be abandoned because of its length, poor functional and aesthetic results, and requirement for a longer colon segment. On the other hand, the posterior mediastinum route for colon graft transposition is reserved for patients that undergo esophagectomy.[1)]

Oida, et al.[7)] retrospectively studied 30 patients who underwent esophagectomy with colon interposition. These patients were divided into 2 groups based on the reconstruction route: the retrosternal route or subcutaneous route (A group), or the posterior mediastinal route (R group). Anastomotic leakages were observed in 4 patients (26.7%) in the A group and in 1 patient (6.7%) in the R group.

Sundaresan[5)] commented that retrosternal passage of a colon graft usually requires enlargement of the thoracic inlet. The skin incision is extended vertically in midline over the sternum to the manubrial-sternal junction. The skin and sternocleidomastoid muscle are reflected laterally to expose the clavicular head and the medial end of the first rib. The left half of the manubrium, clavicular head, and medial end of the first rib are then excised as one piece extrapleurally, to avoid injury of internal mammary vessels beneath that might be used later as a blood supply source for free jejunal transfer is case of failure.[8)] The clavicle is divided just lateral to its sternal head by passing a Gigli's saw just underneath it at the angle made, with the first rib. The bone is then cut as close as possible to this angle to preserve the costoclavicular ligament, which anchors remaining clavicle to the first rib. This maneuver is essential to obviate any compression of the upper aspect of the colon graft above the thoracic inlet and to facilitate bolus transport into the thorax without retention.

This maneuver is performed routinely during colon interposition if the substernal route is chosen.[9)] However, we do not resect a portion of the clavicle/first rib/manubrium and simply construct the tunnel using a blunt technique. Digital dissection is used to develop a tunnel in a caudad direction from the suprasternal notch behind the manubrium. A curved Kaiser-Pilling ring forceps is passed from the neck incision and along the dissected tunnel to grasp the upper end of the colon graft. The pharyngocolic anastomosis performed in a single layer fashion using permanent 4-0 monofilament interrrepted sutures between hypopharyngeal lateral wall and the end of colon. Even without thoracic inlet widening maneuver, complications, including delayed conduit emptying, bothersome regurgitation and graft compression effect were not observed. Two patients complained of temporary bulging of the cervical lesion due to graft volume, but the bulging subsided within a few months. Enlargement of thoracic inlet has some disadvantages, such as, bleeding, the risk of iatrogenic injury of the internal mammary artery and veins, extending operating time, increasing the risks of infection and cosmesis issues. In our cases, the postoperative complications were; pneumonia, aspiration, dysphagia, reflux, ileus, and feeding tube problems. However, those complications could not be attributed to non-enlargement of the thoracic inlet, and were resolved by conservative management or by surgical intervention.

According to one report, some patients experience bulging of the neck and another had a deformity of the thorax with bulging at the 3rd and 4th costal space after operations including enlargement of the thoracic inlet.[10)] Knezević, et al.[1)] reported that thoracic inlet compression occurred in 2.08% of their patients that received enlargement of thoracic inlet. In addition, it was found that colon graft necrosis occurred in 2.38%, but etiologies were not obviously attributable to thoracic inlet compression or poor blood supply or drainage.[1)]

Cervical leakage is the most common complication and has been reported to have an incidence rate as high as 70%.[11,12)] The majority healed without stricture by appropriate drainage; cervical anastomotic strictures have been shown to be well correlated with cervical leakage.[13)]

Chirica, et al.[9)] reported that the absence of thoracic inlet opening is related to a high rate of cervical anastomotic stenosis; only 12% of patients that underwent reconstruction with a thoracic inlet opening experienced anastomotic stenosis at 6 months postoperatively in a group of 246 patients (111 patients with thoracic inlet opening versus 112 patients without thoracic inlet opening).

Shim, et al.[6)] reported a case of total pharyngo-laryngo-esophagectomy and colon interposition for hypopharynx cancer in subtotal gastrectomised patient for the first time in Korea. They used the posterior mediastinal route for colon interposition.

When we checked our patients postoperatively by esophagography, no evidence of cervical leakage or stricture was found. Poor swallowing function after colon interpositions depend primarily on the type of etiologic injury rather than the conduit per se.[14,15)] However, good swallowing was not achieved

during the early postoperative period in any patient. Supraglottic strictures require several months or even a whole year of exercise in order to achieve exclusive oral alimentation.[2)]

In conclusion, we have found that a colon graft provides an excellent esophageal substitute for patients with an esophageal corrosive stricture. When conducted by an experienced surgical team, colon interposition without enlargement of the thoracic inlet provides a low rate of postoperative morbidity and mortality, and long-term good and functional results. According to our experiences, the retrosternal technique, which involves enlargement of the thoracic inlet, should not be viewed as a routine maneuver. Further surgical experiences and long-term follow-up are needed to provide more precise statistically based results.

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