Colon Patch Esophagoplasty: A Clinical Study For Chemical Burn Esophageal Stricture

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Citation

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Abstract

The stricture of esophagus could be a sequela of corrosive ingestion and sometimes surgical intervention is mandatory. The authors report the result of Colon Patch a Esophagoplasty (C. P. E.) performed in 25 children who were suffering from caustic esophageal burn. Age range was 3-8 years (Mean 4.7 years). These patients had severe esophageal stricture, which were resistant to repeated dilatations. Due to that reason, 8-15 months later, the patients underwent C. P. E. A segment of the left or transverse colon was tailored to the length and shape of the opened stricture and was anastomosed side to side to the esophagotomy. Sixteen patients had been followed regularly one and three years of post-operation with barium swallow and endoscopy. Four patients developed early postoperative stricture (16%), which was relieved after 2-3 sessions dilatation. One patient was steno tic in one year and two patients in three years post-operation. Nissen fundoplication showed necessary in two children. Further evaluations of patients revealed excellent results. Two patients had a very rough post operation in Barium swallow.
It could be a procedure of choice when we are considering reestablishing a conduit instead of a normal functional esophagus. C. P. E. introduce a surgical alternative, which preserves two major functions of an intact esophagus i.e. peristalsis and antireflux architecture.

INTRODUCTION

A wide variety of biologically harmful products, ranging from arsenic, found in ant killers, to sodium hydroxide and other caustics found in drain cleaners are available in every home and workplace.

Children are at highest risk for accidental ingestion of these products. Severe damage to the upper gastrointestinal tract may occur within seconds ([1]).

Finally, some of these patients will be affected by esophageal stricture ([1]). Available methods of esophageal substitution do not satisfactorily replace the peristaltic and antireflux properties of the native esophagus ([2]). Since 1980, the technique of colon-patch esophagoplasty (C. P. E.) has been employed for surgical correction of intermediate and long segment benign esophageal stricture ([3]). This study reveals the long term follow-up of the C. P. E., as a method with few complication in Iran.

PATIENTS AND METHODS

This is study has been accomplished in Amirkabir Children Hospital, Tehran University of medical sciences, through eighteen years in (1980-1998). During this period, 35 children have been operated for correction esophageal and stricture, due to caustic ingestion, but only 16 cases were included in this report.

They have been between 3 and 8 years old (Mean 4.7 years). Male to female ratio was 1.7 (64% male and 36% female). Most cases have low socioeconomic class and usually with dull, careless and illiterate parents. The patient's first presentation was not classic, because usually they have been referred from general hospitals or primary care centers to our center, for sometime after incident. Dysphagia (mainly) and ""odynophagia were the most common symptoms of these cases.

Chemical nature of ingested substances were strong alkali in 64%, weak alkali in 20%, and strong acids in 16%. Initial endoscopies and Barium studies revealed usually catastrophic damages to the esophagus. In the most of them, the extent and depth of burn were so extensive that the repeated dilatation seemed worthless.

Preoperative Barium swallow of patient is shown in figure 1. By close follow-up of the patients, the stricture formations

were apparent between 4 to 6 weeks after ingestion of material. Few days after first notice of symptomatic stricture, we scheduled children for program of antegrade balloon dilatation. Average number of dilatations were 8.5 times. During these procedures, 8% of cases developed iatrogenic esophageal perforation (Two patients). Time intervals from ingestion of caustic substances to the time of operation were various (Mean 11.7 months).

Figure 1

Figure 1: Pre-operative view of one patient.

Figure 2

Figure 2: Post-operation view of the same patient in figure one

During the course of treatment, an adequate lumen did not establish or maintain, i.e. more difficult passing of balloons. Among our cases, those were major indication for reconstructive surgery, followed by noncompliance of patients and their parents. There is few surgical method for repair of this defect. They are colon interposition, gastric tube, ileocolon interposition, jejunal pedicled segment ($_4$) and C. P. E. We pay attention to detail of our method, i.e. colon patch esophagoplasty.

At first, abdomen was opened by a midline incision. Vascular anatomy of the colon (Right and left sites) was examined carefully. Depending on vascular bed of middle colic artery (M. C. A.), left or transverse colon would be considered for patching. Exact part for harvesting of patch was ruled by the distance measure on M. C. A. and the part

of the colon that was suitable, was assigned.

Measurement was done through esophageal hiatus along mesenteric side of colon ([2]). Desired length of colon was divided with preservation of vascular system and after release of M.C.A. it was passed behind the stomach through hiatus of esophagus. Colonic part with its vascular pedicle was then delivered to the right. Chest end to end anastomosis of colon was done and the abdomen was closed ([5]).

The patient was repositioned for right posteriolateral ""thoracotomy the bed of the 6th rib. Esophagus at the side of stricture was opened longitudinally from anteriolateral aspect, 2 cm above and below the actual stricture. Making the extension of the esophagotomy well past the proximal and distal margins of the stricture was critical. The delivered part of colon to the chest was opened from antimesentric face and was tailored according to esophageal defect to be covered. The patch must be made long enough. A narrow patch was better, because colon patch potentates the formation of a diverticulum. Then the patch, which was of elliptical shape, was trimmed carefully and anastomosis would be performed by 3/0 silk sutures ([5]).

RESULTS

The results were desirable, and 1 year and 3 year follow-up of the patients showed no serious sequela (table1). Nine patients had no regular follow-up, because of low socioeconomic status. Table 2, shows early postoperative complications of C. P. E. four patients needed early postoperative dilatation (2-3 times). One patient needed reoperation, due to anastomotic failure (4%).

Figure 3

Table 1: One and three year post-operative endoscopy and barium swallow of children

Result	After one year		After three year	
	No.	%	No.	%
Good	14	87.5	12	75
Desirable	1	6.25	2	12.5
Stenotic	1	6.25	2	12.5
Total	16	100	16	100

Figure 4

Table 2: Early post-operative complication of CPE

Complications	No.	%
Wound infection	2	8
Anastomotic failure	1	4
Cardiopulmonary arrest	1	4
Total	4	16

Some operations with C. P. E. was necessary, that are shown in table 3.

Tissue biopsies, one year post-operation of 16 patients, showed reepithelealization in 15 cases and poor healing in one case. After 3 years, 2 patients had been stenotic, which were corrected with dilatation.

Figure 5

Table 3: Relevant operation with CPE

Operation	No.	%
Antireflux procedure	2	8
Pyleroplasty	12	48
Partial gastrectomy	1	4
Only C.P.E.	10	40
Total	25	100

Two patients had diverticulum in Barium swallow, one year post-operations. One of them, who had severe diverticulum, was corrected and another one, which was mild, had been followed that had no problem.

Sixteen patients with regular follow-up, had desirable growth and development, with no symptoms of swallowing difficulties, only two patients had symptom of gastroesophageal reflux.

DISCUSSION

Immediate therapy of caustic injury to esophagus consisted of nothing, bougienage alone, steroid alone, antibiotic alone or steroid and antibiotic, but the therapy did not prevent the development of stricture ([6]).

There are many indications for this operation but, the most common ones are caustic and peptic esophageal stricture. Chemical injury to the esophageal is now the most common indication for esophageal reconstruction in children ([7]).

The practical esophageal substitutes were constructing from 4 viscera: 1- stomach; 2-jejunum; 3-ileo-colon 4-colon. Although all of these viscera may not be with same frequencies there are no large series to compare the superiority of one to another procedure. The colon is preferred as an esophagus replacement, as it is more resistant

to peptic ulceration, because of mucus production ([5]). Replacement of esophagus with a segment of colon was attempted as early as 1911 by G. kolling, of Dersden, Germany, succeeded in bringing transverse colon under the skin to the anterior chest ([8]). The preference is influenced by: 1-length and segment of strictured esophagus; 2- anomalies or diseases associated with the esophageal problem and 3-the adequacy of blood supply to the portion of G. I. tract to be used as the esophageal substitute.

Ashcroft rules for esophageal replacement: 1-a near normal esophagus without cancerous potential is the best way for delivering ingested materials to the stomach; 2-using, as we can, a straight conduit; 3-avoiding situation which increase reflux to the lumen; and 4-any malfunctioning of the substitute must be considered serious and need surgical correction, except in very rare occasions ([9]).

C. P. E. had the least complications in carefully selected cases. However, it is clear that, any choice for esophageal substitute could not be complete and perfect, including C. P. E. As all other methods, an esophageal resection or inversely, bypassing of esophagus is not needed. It shortens overall hospital course and the complex problems in concern with a bypassed, damaged esophagus could be avoided. These are, ulceration from gastroesophageal reflux, periesophagitis and multiple blind sacs and subsequent development of mediastinal abscesses ([10]).

The role of peristalsis for a normally functioning esophagus is regarded in this method, i.e. by preserving of esophagus in its native place, peristalsis in above and below of the scar tissue could present a near normal esophagus ([2]). Another point is conserving complex structures in distal end of esophagus, and in this way preserving of esophagus L. E. S. It decreases G. E. reflux (which prevent esophagitis), subsequent stricture formation in interposed segment (e.g. colon), and save the regional anatomy, if an antireflux procedure would be needed. It is not necessary to scarify vagus nerves and removes the gastric reservoir.

A serious debate in this issue, is that, increased risk of esophagus cancer in this patients by 1,000 times ([1],[11],[12]). It is a correct objection to this procedure, but not as serious as to cause to quit C. P. E. The mean time interval for development of cancer in these patients is 41 years ([12]). In one study, it was shown that only 7.2% of patients with esophageal cancer gave a prior history of lye ingestion ([13]). It is important to notice, that increased risk of development of esophageal cancer is also true for those patients who responded successfully to esophageal dilation and have not needed corrective surgery. Fortunately, those carcinomas that develop in scar tissue appear to behave less aggressively than the usual esophageal cancer, possibly because the developing scar inhibits outward invasion and the resultant intraluminal proliferation produces early obstructive symptoms. Meanwhile, our experience and others work have proved that the injured mucosa heals and re-epithelializes ([2],[15],[3]).

A patient, with a chronic lye injury, specially one of more than 16 years duration, with inability to dilate a chronic stricture, that has previously responded to treatment or late radiographic evidence of progressive stenosis, strongly suggest malignant change ([16]). They usually develop the condition at the tracheal bifurcation and at the level of pick aortic arch ([12],[14],[17]). Biopsies performed through esophagoscope can easily miss the tumor in such cases, because the carcinoma may be located distal to the area of stenosis and be inaccessible to the biopsy forceps. In these circumstances, therefore, negative biopsy specimens must be considered inconclusive ([16]).

When compared with the difficulties that, colon interposition bring up, including, 1- changing to a redundant and very adynamic tract ([18]); 2-destroying L. E. S. in most cases; and 3-stricture at either end of anastomosis by repeated acid exposure in long term ([9]), we can conclude, that C. P. E. makes better quality of life for these patients.

There is also another new method of esophageal reconstruction, which seems promising and is more or less similar to C. P. E. It is replacement of the strictured esophagus by a jejunal pedicled segment (graft), based on the superior thyroid artery. It has provided excellent results ([4]).

At the end, when we faced with a severely strictured esophagus, by attention to the disadvantage of a (repeated recurrences, cost and risk of repeated anesthesia and physical and psychological trauma to the child) and complications of esophageal dilatation including perforation, mediastinitis and brain abscess, it is advisable not to hesitate too much for a corrective surgery. Although C.P.E. is not technically easy, it is safe and yielding in skillfully selected patients.

References

1. Moore W.P., Caustic ingestion: Pathophysiology, diagnosis, and treatment. Clin. Pediatr., 25 192-196 1986.
2. Kennedy A.P., et al, Colon patch esophagoplasty for

caustic esophageal stricture. J. Pediatr. Surg., 30(8); 1242-1245,1995.
3. Mehrabi V. et al, Further look at colon patch esophagoplasty in benign stricture of esophagus in children. Z. Kinderchir, 44(4) 221-7 1989.
4. Nishihara T., et al: Esophageal Reconstruction. Reconstruction of the thoracic esophagus with jejunal pedicled segments for cancer of the thoracic esophagus. Dis. Esophagus: 8; 30, 1995.
5. Gundogdu H.Z., et al, Colonic replacement for treatment of caustic esophageal stricture in children. J. Pediatr. Surg. 27(6);771-4 1992.
6. Ashcraft K., et al: Pediatric Surgery, 3th ed. W.B. Saunders Co. P. 327, 2,000.
7. Ashcraft K., Pediatric Esophageal Surgery. Grune and Stratton Co. p. 89-93 1986.
8. Roffensperger J. et al, Intestinal bypass of the esophagus. J. pediatr. Surg. 31(1) 38-47 1996.
9. Ashcraft K., et al, Pediatric Surgery 2nd ed. W.B. Saunders Co. P. 228-236, 1993.
10. Schwartz S., et al Principles of Surgery.7th ed. Mcgraw-Hill Inc. 1158-1161, 1999.
11. Moazam F., et al, Caustic ingestion and its sequelae in children. South. Med. J. 80(2); 187-190, 1987.
12. Applequist P., et al, Lye corrosion carcinoma of the esophagus a review of 63 cases. Cancer, 45(10) 2655-8 1980.
13. Csikos M. et al, Late malignant transformation of chronic corrosive esophageal strictures. Langenbecks Arch. Chir., 365(4) ;231-8 1985.
14. Hopkins P.A. et al. Caustic burn and carcinoma of esophagus. Ann. Surg. 194(2); 146-8 1981.
15. Otherson H.B., et al, Save the child's esophagus part II: colicpatch repair. J. Pediatr Surg. 32(2); 328-33 1997.
16. Sabiston D.C. et al, Textbook of surgery. 15th ed. Harcourt Co. 784-788, 1997.
17. Ahmed A. et al, The outcome of colonic replacement of the esophagus in children. Prog. Pediatr. Surg. 19; 37-54 1986.
18. Imre J. et al, Arguments against long term conservative treatment of esophageal stricture due to corrosive burn. Thorax. 27(5); 594-798 1972.

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