

Strategies in the Management of Failed Neck Anastomosis in Pharyngo Esophageal Reconstructions after Corrosive Injury Esophagus

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Abstract:

AIM: To analyze and describe our management strategies of failed neck anastomosis in pharyngo esophageal reconstructions after corrosive injury esophagus. **MATERIAL AND METHODS:** About 23 patients who underwent conduit interposition for corrosive stricture esophagus presented with various complications. At the end of study, type of corrosive ingested, type of conduit and techniques used in primary surgery, etiology of failed neck anastomosis and mode of management were analyzed. **RESULTS:** Most of the patients consumed acid substance (95%), and only one patient consumed alkali (18.75%). Among 23 patients, the corrosive ingestion was suicidal in 20 patients and in three patients, it was accidental. Most common conduit was colon (87%). Of 20 patients who underwent colon bypass, Pharyngocolic type of anastomosis performed in 16 patients, esophagocolic anastomosis in 4 patients, 2 patients underwent esophagogastric anastomosis and one patient referred to our center with failed jejunal interposition for reconstruction. The frequent long term complication following esophageal replacement was an anastomotic stricture that occurred in 17 patients, in which 7 patients were managed by bougie dilatation and 10 patients with severe intractable stricture, revision was done using various surgical techniques. Swallowing function was restored in 20 of 23 patients. **CONCLUSION:** Esophageal reconstruction remains a major therapeutic challenge for surgeons, as morbidity rate continues to be high, inspite of major advances in intraoperative and postoperative care. Patients after such procedures should follow up in specialized centers and periodic examinations will be helpful in maintaining the function of conduit and quality of life.

Keywords: failed neck anastomosis, stricture esophagus, esophageal replacement, acid substance

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I. Introduction

Caustic ingestion can produce a progressive and devastating injury to the esophagus and stomach. Accidental or suicidal ingestion of acids is encountered more often in our country, whereas lye or alkaline corrosive injuries are more frequent in developed countries. Stricture formation with dysphagia after the injury is unavoidable in some cases. In severe strictures, due to the complications and the ineffectiveness of the dilatation, esophageal replacement is often required¹. Stomach and Colon interposition is a reliable esophageal replacement but colon is the most preferred conduit after caustic esophageal injury. It provides extended conduit length, reliable blood supply and long term function². Complication following conduit interposition requiring intervention may be acute or chronic. Surviving patients suffer from anastomotic leaks followed by stricture formation and loss of intestinal continuity due to resection following conduit ischemia. A stricture that are not amenable for dilatation and short segmental loss of conduit following conduit necrosis require complex procedures to re-establish swallowing and management will vary according to etiology³. From this study, we are trying to provide management strategies for failed neck anastomosis after pharyngo-esophageal reconstructions in corrosive injury esophagus.

II. Material And Methods

All Patients who had undergone pharyngo-esophageal reconstruction for corrosive stricture esophagus presenting with complication related to the conduit and neck anastomosis that are managed in our tertiary care hospital were included in the study. Patients underwent esophageal replacement for other etiologies such as

esophageal malignancy, benign disorders of esophagus, esophageal perforation etc, were excluded. Patients have been investigated to identify the cause of conduit dysfunction with barium swallow, upper GI endoscopy mainly and Contrast enhanced CT scan of the neck and chest when and where it is necessary. At the end of the study following data were analyzed: Demographic data such as age and sex, type of corrosive ingested, type of conduit and techniques used in primary surgery, etiology of failed neck anastomosis, investigations and mode of management.

III. Management Principles

The principle of management is to identify and treat complications as early as possible during the acute phase, and to avoid the formation of intractable strictures in the esophagus and stomach, and to replace or bypass the diseased organ to allow oral intake of food in the later phase.

The management of caustic ingestion can be subdivided into three phases: The early phase, where patients presenting in the emergency department, immediate assessment of ABC and early resuscitation followed by the extent of injury by checking the airway, oral cavity, neck for crepitus and tenderness and the abdomen for tenderness. The intermediate phase involves dealing the patient in hospital with issues such as electrolyte imbalance, sepsis, respiratory complications, maintenance of nutrition, and managing the patient through a potentially complicated postoperative course after emergency surgery such as resection of esophagus and/or stomach. The chronic phase is aimed at function restoration after recovery from the acute attack, such as repeated endoscopy for stricture, and major reconstructive surgery of the oropharynx and upper digestive tract.

During the acute phase, Endoscopy is performed if a patient presents before 72hrs of consuming corrosive agents to assess the depth of injury otherwise it is usually performed after 6 weeks. Patients may be fed via an indwelling nasogastric tube for fairly short periods of time, but if dysphagia persists, we perform feeding jejunostomy to maintain nutrition of the patient. Caustic esophageal injury results in esophageal shortening due to lower esophageal sphincter (LES) damage and leads to gastroesophageal reflux (GER)⁴ and injury to the stomach with antro- pyloric stenosis. Acid suppression has been generally recommended to avoid such exacerbations. Early dilation and stenting are sometimes recommended as a means to reduce the severity of future stricturing. It seems intuitive that if the contraction of collagen could be prevented in the first few weeks after injury, stricture severity could be reduced⁵. However, the progression to stricture is likely to be determined by the initial injury rather than the treatment. Stricturing begins within the first 2 to 3 weeks and may progress rapidly. In recent times, flexible endoscopy and through-the-scope balloon dilation have become the commonest treatment, but passing Savary-type bougies over an endoscopically placed guidewire is also effective and considerably cheaper.

Dilatation of esophageal stricture can be done by using Savary-Gilliard bougies and usually starts after 6 weeks on a weekly or biweekly basis and continued upto 6 months. It is essential that dilatation should be gradual and considered adequate when the dilatation of the esophageal lumen achieves 12 mm diameter with complete symptomatic relief⁶. The other method of dilatation of the oesophageal stricture is by balloon dilatation under endoscopic guidance and fluoroscopy. Advantages are that the procedure can be performed under control and the forces are exerted radially. Complication such as perforation, bleeding, sepsis may occur⁷. An adequate lumen of the required diameter can be achieved within 6 months to 1 year with progressive increase in the interval between the need for dilatations. Surgery should be considered when adequate lumen cannot be established or maintained by dilatation therapy.

Indication for surgery includes:

- Complete stricture of the esophagus, in which all attempts to establish a lumen have failed
- Multiple, tortuous, or very long strictures.
- Severe mediastinitis, and development of complication such as Tracheo-esophageal fistula.
- Patients who are unable or refuses to undergo prolonged periods of dilatation.

Surgical Intervention

Most beneficial time for esophageal replacement surgery after corrosive injury is still controversial. When perforation is demonstrated emergency surgical exploration is indicated. After the injury, full fibrosis stopped in about 6-12 months⁸, and the level and length of stricture in the esophagus cannot be assessed till that period. If surgery is performed too early when the scar has not completely formed, risk of anastomotic stenosis is high and when the operation is carried out at least six months after the injury, the results of successful surgical management is greater. Esophageal bypass avoids the need to dissect out a densely scarred esophagus with the attendant risk of injury to the great vessels, thoracic duct, and the trachea or left main bronchus, and the inevitable consequence of vagal injury. The disadvantage of bypass is that the remaining esophagus is prone to undergo cystic dilation, with occasional rupture⁹. It is inaccessible to endoscopic examination. There is an increased risk of cancer in the esophagus after caustic injury. The magnitude of the risk is debated, but it is 1000

times that in the general population. It tends to present more than 30 years after injury¹⁰. Resection of the esophagus after transmural caustic injury can be a formidable undertaking. It usually requires thoracotomy because the dense periesophageal scarring, both as a result of the injury itself and possibly superimposed microperforations from numerous dilations, makes it difficult and dangerous to accomplish via the transhiatal route.

Gastric pull-up requires only one anastomosis, is generally quicker, and easy to perform. However the functional results tend to deteriorate with time, with the development of symptomatic reflux, stricture, and columnar metaplasia above the anastomosis in the proximal esophageal remnant. In contrast, colon interposition is a more extensive procedure requiring three anastomoses, but the functional results remain stable or improve with time. In a long-term study of anastomotic stricture after esophagectomy, the colon interposition had a lower incidence of stricture than gastric pull-up¹¹. When applied to caustic stricture, there are even stronger grounds for preferring colon interposition, because the stomach has often been damaged by the caustic agent and is scarred and foreshortened. When the pharynx and laryngeal mechanism are spared and the esophageal stricture is located well below the cricopharyngeus, surgical treatment differs little from standard principles of esophageal replacement for other more common diseases, with the caveat that a transthoracic rather than transhiatal approach is preferred. In the case of the patient with a caustic ingestion, there is an especially high risk of developing anastomotic stricture due to progressive scarring in the proximal esophageal stump and may be tension on the anastomosis¹².

Strictures high in the esophagus and pharynx are much harder to manage than those in the tubular esophagus or stomach. This is because of the difficulty of restoring swallowing without creating intractable aspiration. The laryngeal or subglottic stricture is characterized by progressive dysphonia eventually mandating tracheostomy. Direct laryngoscopy shows that the epiglottis is scarred and deformed and adherent to the pharyngeal wall. The vallecula and one or both Piriform sinuses may be occluded by scarring. In this situation, the chances of restoration of speech are so remote that the patient is better off with a primary laryngectomy and end tracheostomy. For patients with pharyngeal involvement but with limited damage to the laryngeal mechanism, the ultimate goal of therapy is the preservation of both swallowing and speech. The difficulty is not simply the physical provision of a conduit, the problem is that intractable aspiration occurs. If both Piriform sinuses are open, the prognosis for safe swallowing is relatively good. If one Piriform sinus is preserved, it may still be possible to perform a safe anastomosis. When both are occluded by scarring, the larynx is also severely damaged. Once this key decision is made, a colon interposition or gastric pull-up can then be performed to the base of the tongue, and even the impaired pharyngeal apparatus that remains can generally be sufficient to permit the patient to have adequate swallowing to maintain nutrition without tube feeding. Many ingenious surgical solutions have been proposed, including anastomosis to the piriform sinus as advocated by Tran Ba Huy et al¹³, or the pharyngocoloplasty as described by Popovici, a Romanian surgeon with a personal series of 253 esophageal reconstructions for caustic injury.

Reconstruction techniques of Colon substitution

Abdominal part

A long midline incision is used, extending from the xiphoid process to below the umbilicus. The colon is then mobilized from the ascending to the sigmoid level. Total detachment of the omentum from the colon, leaving it attached to the stomach. Mobilization of the splenic flexure is unnecessary and it avoids injury to the left colic vessel. Although left hemicolon has more reliable blood supply and an advantageous size match, an isoperistaltic placement of the right colon segment is preferred based on left colic vessels. We preserve middle colic vessel wherever possible, as bifid origin of the right and left branches of the midcolic artery does not permit retrograde blood flow all the way from the left colic artery to the hepatic flexure, and the marginal artery between the left branch of the midcolic artery and the ascending portion of the left colic artery is critical. Blood supply from the left colic artery is tested with non-traumatic vascular bull-dog clamps occluding temporarily the right and middle colic arteries as well as the colic arcade at both ends of the foreseen colonic graft before ligation and division. For complete mobility of the hepatic flexure, the right colic vessels often must also be divided. The colon is divided using the GIA stapler both at this point and at the distal transverse colon. The colon can then be passed over the stomach. This maneuver allows the vessels to extend for shortest distance and prevents angulation or potential compression by a dependent full stomach. With a viable colon segment, the second team can begin the cervical incision and the abdominal team can start to bluntly develop the retrosternal tunnel. The colon segment is then gently drawn upward by means of a guiding Ryle's tube with heavy silk thread, taking care to keep its mesentery on the right without any twist. The viability of the upper end of the segment must be verified not only by visual inspection of its color but also by palpable observation of arterial pulsation. The cologastric anastomosis is carried out end-to-side to the anterior aspect of the midportion of the stomach, The pylorus is palpated to determine the need for a pyloric drainage procedure. An end-to-end,

two-layer, inverting ileocolic anastomosis. Another important step is the closure of the colon mesentery to minimize the likelihood of internal herniation of the small intestine.

Cervical part

A left-sided oblique cervical incision is a useful approach to the cervical esophagus. It requires dividing the omohyoid muscle, retracting the sternocleidomastoid muscle laterally, dividing the inferior thyroid artery and often the middle thyroid vein, detaching the sternal insertions of the peritracheal muscles, and entering the avascular prevertebral plane. The esophagus if available is encircled, taking care not to damage the membranous portion of the trachea or the recurrent laryngeal nerves. The critical esophagocolic anastomosis is carried out in the end-to side fashion by Hand sewn or by stapling technique. If esophagus is not available pharyngocolic anastomosis can be done by side to side anastomosis either by hand sewn or 25mm circular stapler . The nasogastric tube is withdrawn and is replaced distally into the colon bypass . The neck is closed without drains unless there is persistent oozing or contamination.

Gastric substitution

The initial step in mobilizing the stomach is the division of the greater omentum outside the gastroepiploic arcade, which is formed by the right gastroepiploic artery from the gastroduodenal artery at the pyloric end of the stomach and the left gastroepiploic artery from the splenic artery toward the proximal stomach. The dissection is then directed toward the spleen, where the left gastroepiploic artery is ligated at the upper end of the arcade above the segmental artery to the stomach. The short gastric (gastrolial) arteries are divided carefully between hemostatic clamps and ligated securely. Left gastric vessels are ligated and divided and gastric tube is carefully constructed with multiple application of GIA 55mm and 75mm stapler. Anastomosis in the neck is either end-to-side or side to side (esophagus-to-stomach) technique using either hand sewn or stapling technique. A point on the stomach is selected on its anterior aspect at least 2 cm from the gastric transection line in the fundus of the stomach toward the greater curvature and securing the neck anastomosis with sutures at thoracic inlet and at the hiatus to prevent herniation of abdominal contents. The nasogastric tube is directed downward through the anastomosis to the level of the gastric antrum.

Jejunal Substitution

Jejunum represents the third alternative for esophageal replacement. Jejunum is most frequently used as a short-segment interposition graft after resection of a distal esophageal stricture. The anatomy of its mesentery makes long-segment interposition difficult, although in children a Roux-en-Y loop readily reaches the neck. As an autograft, free graft with microvascular anastomosis is used for short cervical esophageal stricture or for augmentation of a failed colonic esophageal bypass¹⁴.

IV. Observation And Results

A total number of 23 patients who underwent conduit interposition for corrosive stricture esophagus presented with complications were included in the study.

Table-1: Age Groups

Age groups	Number
5-15	1
16-25	7
26-35	10
36-45	4
46-55	1

The age of the patients ranged from 10 to 50yrs. Most of the patients were young at age 16 to 35 years (74%).

Table-2: Sex Distribution

Sex	Number	Percentage
Male	10	43.5
Female	13	56.5

Out of 23 patients, 13 were females (56.5%) and 10 were males (43.5%).

Table-3: Type of corrosive substance

Type of corrosive substance	Number	Percentage
Acid	22	95.6
Alkali	1	4.4

Most of the patients consumed acid substance (95%), and only one patient in our study consumed alkali (4.4%).

Table-4: Mode of injury

Mode of injury	Number	Percentage
Suicidal	20	87
Accidental	3	13

In 23 patients, the corrosive ingestion was suicidal in 20 patients (87%) and in three patients, it was accidental (13%).

Table-5: Type of conduit

Type of conduit	Number	Percentage
Colon	20	87
Stomach	2	8.6
Jejunum	1	4.4

Stomach and colon were used as conduits for esophageal replacement. Most common conduit was colon (87%).

Table-6: Type of primary reconstruction

Type of primary reconstruction	No.of cases
Pharyngocolic	16
Esophagocolic	4
Esophagogastric	2
Jejunal interposition	1

Of 20 patients who underwent colon bypass, Pharyngocolic type of anastomosis performed in 16 (70%) patients and esophagocolic anastomosis in 4 patients. 2 patients underwent esophagogastric anastomosis and one patient was referred to our center with failed jejunal interposition for reconstruction.

Table-7: Technique of anastomosis

Technique of anastomosis	Number	Percentage
Hand sewn	10	43.5
Stapler	13	56.5

In the neck, Proximal anastomosis was either performed with single layer interrupted hand suturing technique with 000 Vicryl sutures or stapling technique using 25 mm circular stapler in 10 and 13 cases respectively.

Types of complications that needed operative intervention (Tab.8) and various techniques used for revision procedures were described (Tab.9)

Table-8: Types of Complications

Complications	No.of cases
Anastomotic stricture	17
Conduit necrosis with loss of intestinal continuity	2
Chronic cervical fistula	3
Failed jejunal interposition	1

Table-9: Various techniques used for revision procedures

Techniques	No of cases
Resection and anastomotic revision	3
Stricturoplasty	2
Retrograde dilatation	2
Perianastomotic fibrolysis	2
Fistula repair and primary closure	3
Advancement coloplasty	3
Subcutaneous coloplasty	1

The most frequent long term complication following esophageal replacement was an anastomotic stricture that occurred in 17 patients. Of 17 patients with anastomotic stricture, 7 patients were managed by dilatation therapy with Savary Gilliard bougie . In the remaining 10 patients with severe intractable stricture, surgical revision was done. Stricturoplasty, and perianastomotic fibrolysis was done in 2 patients each. 3 patients deferred dilatation and underwent resection and reconstruction of anastomosis. 2 patients who lost follow up presented later with undilatable stricture and undergone neck exploration and retrograde dilation through colotomy in one patient who had colon conduit and gastrotomy in a patient with gastric conduit . In one patient with long stricture, resection resulted in short segment loss of conduit and hence continuity was restored by advancement coloplasty technique. 2 patients presented with short segment conduit loss due to ischemic necrosis of distal part of the conduit were managed by advancement coloplasty. 3 patients who presented with

chronic cervical fistula were managed by neck exploration and fistula repair with primary closure. In a patient referred with failed jejunal interposition, intestinal continuity was restored with subcutaneous coloplasty. Upper GI endoscopy and barium swallow study was the most important investigation used to diagnose the complication that needed revision surgery. However in patients with loss of intestinal continuity due to conduit necrosis, Contrast enhanced CT was done to assess the remnant length and vascularity of the conduit.

Outcome

Swallowing function was restored in 20 of 23 patients (87%). One patient died on postoperative day 7 due to coagulopathy who underwent advancement coloplasty with sternotomy. Failure occurred in two patients which included aspiration following stricturoplasty for intractable anastomotic stricture and persistent pharyngeal stricture secondary to alkali injury.

V. Discussion

Management of complications following esophageal replacement surgery is a challenging problem for esophageal surgeons. Reports are limited to case reports or as outcome measures following conduit interposition for various etiologies. Colon is the preferred substitute for conduit interposition after caustic esophageal injury. Ischemic necrosis of the colon graft is a dreadful complication after esophageal replacement surgery and best prevented by careful intraoperative preparation of the colon conduit during primary reconstruction¹⁵. We prefer the isoperistaltic right colon in most of our cases based on the left colic artery with preservation of middle colic artery if possible. Vascular pedicles are handled carefully and conduit was placed in such a way to avoid torsion and tension. Adequate dissection of the substernal path and the thoracic inlet is important to avoid compression and sometimes it may be necessary to remove a plate of left lateral end of manubrium and medial end of clavicle to create enough space at the thoracic inlet. The incidence of compression can be reduced by these strategies during reconstructive surgeries.

When there is loss of intestinal continuity then the management is a big challenge and reconstructive options are often limited. Graft necrosis can be total or partial and in most cases distal cephalic portion of the graft is often compromised and the remaining graft can be salvaged. Location and length of intestinal defect, and remaining colon conduit should be assessed before reconstruction. Sepsis should be controlled, conduit bed should be free of inflammation and the patient should be nutritionally resuscitated before reconstruction. For successful revision, thorough understanding of the patient's anatomy and vascular supply of the conduit, exploration of various options for reconstruction are required in re-establishing swallowing function. For short segment loss of graft in the neck, re-anastomosis after mobilization of preserved conduit through sternotomy can be done. Small gaps can also be bridged with free jejunal transfer with the help of a reconstructive surgeon. In our study, two patients had short segment loss of colonic conduit in the neck due to ischemic necrosis and restoration of swallowing was established by mobilization and re anastomosis of preserved colon conduit from the neck and thorax through median sternotomy.

One patient was referred to our center, for whom jejunal interposition was attempted and completed proximal pharyngojejunal anastomosis, but distal end was brought out as end jejunostomy subcutaneously over the manubrium sternum due to misjudgement in the assessment of length of the esophageal stricture. We restored continuity with colon interposition through subcutaneous route and anastomosed with the lower end of the jejunal graft.

The most common complication following esophageal replacement surgeries is benign strictures and most of them can be successfully managed with dilatation and in few patients, long term serial dilatation is required. The probable reason includes distal graft ischemia, cicatrization following anastomotic leaks, the high proximal anastomosis in the pharynx due to ongoing inflammation and fibrosis. Wain et al. reported an incidence of 12 out of 50 patients with dilatable anastomotic strictures after colonic bypass for caustic injuries of the esophagus. Surgical revision was required later in two patients. Curret-Scott and colleagues also reported 7 intractable strictures with colon bypass in a series of 53 patients¹⁸. Demeester et al and Jeyasingham reported 4 anastomotic revisions in 92 patients and 8 revisions for anastomotic stricture in 365 patients respectively^{16,17}. In our series, anastomotic strictures were seen in 17 patients and most stricture occurred in patients who underwent pharyngo colic anastomosis. 7 of 17 patients, anastomotic stricture were managed successfully by Savary Gilliard bougie dilatation. 4 patients needed 5 sessions of endoscopic dilatation with 2 weeks interval postoperatively and symptoms got relieved. 3 patients required long term serial dilatation for persistent dysphagia and were taught self dilation technique using Foley's catheter.

Resection of the stricture and re-anastomosis can be done after careful lysis of adhesions with preservation of the vascular pedicle. Our approach for revision surgery in intractable anastomotic strictures are patients with long strictures and densely fibrotic short strictures that are not amenable for dilatation. 10 of 17 patients underwent revision surgery for intractable stricture. 3 patients with short stricture underwent resection of the stricture and reanastomosis was performed. In one patient with long stricture, resection of the stricture

lead to short segment loss of conduit and needed advancement coloplasty. This technique was done by complete mobilization of remnant conduit through median sternotomy without disturbing its vascularity and reanastomosis was done in the pharynx. For short stenoses, an alternative technique is stricturoplasty in which the stricture is opened in a longitudinal fashion and closed transversely using single layer interrupted fine vicryl sutures. We used stricturoplasty in 2 of 10 patients with short focal anastomotic strictures and found to have excellent functional results. In 2 cases where transoral antegrade dilatation was not possible because of complete anastomotic stricture, we have done neck exploration followed by colotomy in a patient who had colon conduit and gastrotomy in a patient with stomach conduit through which guidewire was passed and retrograde dilatation was done using Savary Gillard bougie. In 2 cases, neck exploration and perianastomotic adhesiolysis allowed transoral antegrade dilatation and got relieved of dysphagia postoperatively.

Three patients who presented with leak in the postoperative period developed chronic cervical fistula. Repair was done with neck exploration followed by identification and excision of fistulous communication and primary closure of the defect.

Many literatures from western countries reported redundancy as the most common long term complication followed by intractable stricture and most complications occurred in patients who underwent long segment colon bypass. Incidence of redundancy of colonic conduit occurred in 27 out of 29 patients in Belsy's group³. 20 of 92 patients in Demeester group¹⁶ and 37.5% in Currett- Scott and colleagues. In our center the incidence of redundancy that needed revision surgery was rare as we use isoperistaltic right colon based on left colic artery with intact middle colic artery and cologastric anastomosis was done without redundancy.

VI. Conclusion

Esophageal reconstruction remains a major therapeutic challenge for surgeons involved in the care of patients with corrosive injury esophagus. Despite major advances in intraoperative and postoperative care, morbidity rates continue to be high. Whichever conduit is chosen, the operation requires careful planning and preparation of the patient, strict attention to the technical details of the operation, and dedicated postoperative care. With the above, good function of the esophageal substitute may be achieved in about 50–65% of patients. Esophageal reconstructions often burdened with a significant percentage of postoperative complications. Management of both acute and long term complication following reconstruction is often complex and there is only limited experience about the strategies in the management of failed pharyngo esophageal reconstructions after corrosive injury esophagus in the literature. We have collected our experience regarding these complex problems and described our management strategies. Many of these repairs represent unique solutions tailored to the each type of complications that result in conduit dysfunction.

It should be emphasized that patients after such procedures should have long term follow up in specialized centers so that periodic examinations will be helpful in maintaining the function of conduit and quality of life with expert assistance and medical care.

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