Through-the-scope Polyethylene Balloon Dilations in Benign Corrosive Esophageal Stricture Complicated with Temporomandibular Joint Dislocation

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ABSTRACT

Esophageal dilation is a non-surgical management for anatomic and functional abnormalities causing both benign and malignant esophageal stricture. The basic goals of stricture dilation include safe and efficacious lumenal enlargement plus prevention of restenosis. These could be achieved using through-the-scope (TTS) balloon dilations, ranged in diameter of 4 to 40 mm, they will allow dilation of previously inaccessible strictures in the esophagus, stomach, small bowel, and colon. There are 5,000–15,000 cases of stricture due to ingestion of corrosive substances in United States every year.

The following case would demonstrate a 28-year-old male with depressive disorder who attempted a suicide by ingesting corrosive substances two months before admission. Subsequently he started having difficulty in swallowing even soft foods. The complaint was gradually increasing until a month before admission he went through endoscopic examination and a corrosive esophageal stricture found. Hence after, he underwent dilation using Savary bouginage with fluoroscopy and through-the-scope (TTS) balloon dilations. The patient underwent a series of dilation treatment and demonstrated vigorous improvement. Problems arised as the patient was complicated with temporomandibular joint (TMJ) dislocation due to traumatic injury after ingesting corrosive substances. The consideration in management of esophageal stricture with complications will be discussed further in this article.

Keywords: *esophageal stricture, corrosive substances, dysphagia, temporomandibular joint dislocation, through-the-scope polyethylene balloon dilation*

ABSTRAK

Dilatasi esofagus merupakan salah satu terapi non-bedah untuk mengatasi gangguan anatomis dan fungsional yang terjadi pada striktur esofagus baik jinak maupun ganas. Tujuan utama dari dilatasi adalah pelebaran lumen yang aman dan memiliki tingkat efikasi yang tinggi, juga mencegah terjadinya stenosis kembali. Salah satu jenis teknik dilatasi yang digunakan adalah dilatasi menggunakan balon through-the-scope (TTS) berdiameter 4-40 mm. Di Amerika Serikat terdapat sedikitnya 5.000-15.000 kasus striktur yang disebabkan zat korosif setiap tahunnya.

Berikut dilaporkan kasus seorang laki-laki berusia 28 tahun dengan gangguan depresi yang berusaha bunuh diri dengan meminum cairan karbol 2 bulan sebelum masuk rumah sakit. Akibatnya pasien mengalami kesulitan menelan bahkan untuk makanan lunak sekalipun. Keluhan semakin lama semakin memberat, hingga akhirnya sebulan sebelum masuk rumah sakit, pemeriksaan endoskopi dilakukan dan ditemukan adanya striktur

esofagus. Selanjutnya dilakukan businasi Savary dengan bantuan fluoroskopi dan dilatasi balon dengan teknik TTS. Pasien juga diketahui mengalami dislokasi sendi TMJ akibat benturan saat terjatuh setelah meminum zat korosif. Pada kasus ini dibahas hal-hal penting yang perlu dipertimbangkan dalam mengelola striktur esofagus dengan penyulit.

Kata kunci: *striktur esofagus, zat korosif, disfagia, dislokasi sendi temporomandibular, dilatasi balon TTS*

INTRODUCTION

Esophageal dilation is a non-surgical management for esophageal stricture caused by both benign and malignant conditions. Benign stricture is caused by the production of fibrotic tissue and collagen deposition, stimulated by deep ulceration and chronic inflammation.[1] There are 5,000–15,000 cases of stricture due to ingestion of corrosive substances in United States every year. The overall male to female ratio is 2 : 1.[1,2] The stricture has been corrected by through-the-scope (TTS) balloon dilation in several stages hence shown improvement. Several things are to be considered in dilation management, especially in cases with complications. The following case will demonstrate an esophageal stricture due to corrosive substances complicated with temporomandibular joint (TMJ) dislocation in a suicide temptation experienced by a patient with depressive disorder.

CASE ILLUSTRATION

A 28-year-old unmarried male complained a difficulty in swallowing 1 week before hospital admission. Recently, he was diagnosed with depressive disorder and suspected to be related with occupational stress. Two weeks ago he was only able to swallow liquid foods, henceafter he went through endoscopic dilation, later on he was able to ingest foods normally but on subsequent days he became unable to swallow solid foods, soft rice, then refined porridge, until one week before admission he was not able to swallow any food at all. He was still able to swallow 100 cc of milk but then vomit it out immediately. Then he became weaker and brought to Cipto Mangunkusumo Hospital Emergency Unit.

Around two months before admission he attempted suicide by drinking floor cleanser in amount of 500 cc and hence unconscious. He was brought to a hospital in Malaysia and got emergency treatment. He also complained difficulty in moving the jaw while eating, then diagnosed with TMJ dislocation by the local doctor. One week after discharged, patient experienced difficulty in swallowing solid foods, hence started to swallow soft foods and porridge, underwent an esophagogram, then a narrowing in the esophagus suspected. Subsequently, he started having difficulty in swallowing soft foods. The complaint was gradually increasing until a month before admission he went through endoscopic examination, and a corrosive esophageal stricture was found. He never experienced any fever, nausea, and vomiting. Defecation and micturition were within normal limits.

On physical examination, the vital signs were within normal limits, with adequate nutritional status. His height is 168 cm and weighted 54 kg. Jaw was asymmetrical, stiff, and shifted to the right. The heart and lungs were within normal limits. The abdomen was flat, supple, with no liver, and spleen enlargements, no abdominal tenderness on palpation. The bowel sound was positive and normal. The extremities were warm with no peripheral edema found.

Laboratory findings were as follows hemoglobin 16.5 g/dL, hematocrite 49%, leukocytes 6,400/mm^3, thrombocytes 325,000/mL, ureum 23 mg/dL, serum creatinine 1.0 mg/dL, sodium 146 mEq/L, potassium 4.2 mEq/L, and chlorine 96.7 mEq/L. Chest X-ray demonstrated a cardiothoracic ratio (CTR) less than 50% and no infiltrates found. Esophagogram and CT-scan results suggested a narrowing caused by suspected esophageal stricture as shown in Figure 1 and 2.

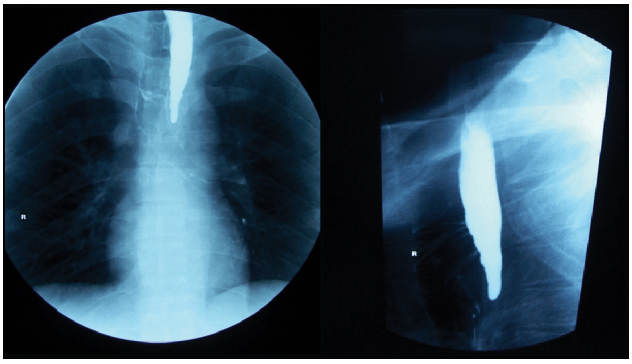

Figure 1. Esophagogram features tapering of esophageal lumen succeeding a barium contrast material swallow

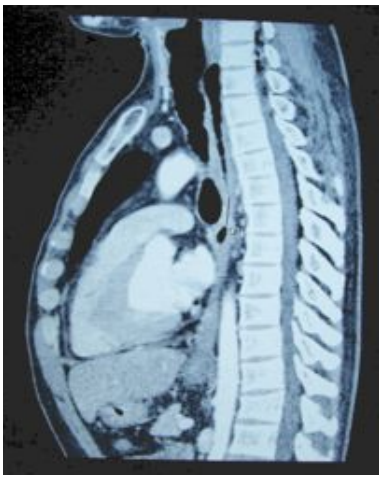

Figure 2. Narrowing of esophageal lumen shown in sagittal view of computed tomography (CT) scan taken in previous hospital

During initial checkup upon admission the following problems arised, i.e., low intake due to esophageal stricture, temporomandibular joint dislocation, suicide temptation. He was then consulted to psychiatry and maxillofacial surgery departments for further evaluations. Infusion with 0.9% NaCl and glucose and amino acid solution was established and 40 mg once time daily proton-pump inhibitor administered parenterally.

Being hospitalized for 2 weeks, he underwent dilation using Savary bouginage with fluoroscopy, balloon dilation, and esophagogastroduodenoscopy examination. The initial endoscopy demonstrated a stenosis on proximal part of the esophagus and a balloon dilation was done using a 12-mm dilator. Thereafter, the patient had underwent a series of fluoroscopy-guided dilation treatment and demonstrated vigorous improvement. During hospitalization, her mental disorder was managed by psychotherapy and the TMJ dislocation was scheduled for reposition. On the most recent dilation session, 18-mm dilator used, and scope could be inserted 28-30 cm distant from the incisivus, as shown sequentially in Figure 3 until Figure 6.

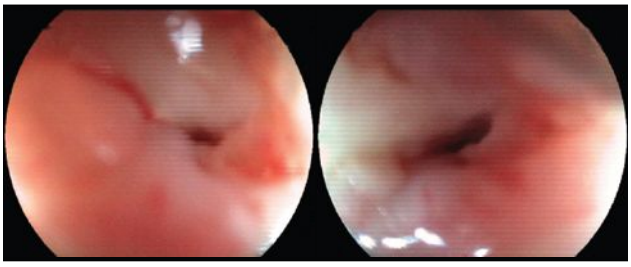

Figure 3. Esophageal images before dilation with an 18-mm TTS polyethylene balloon dilator

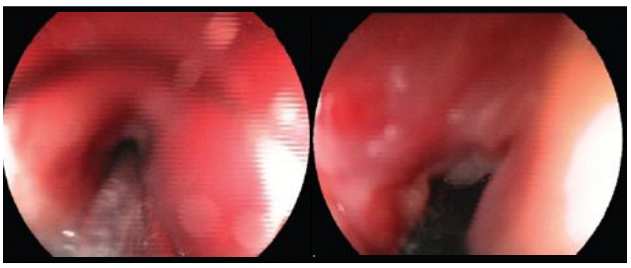

Figure 4. Images of TTS polyethylene balloon dilator while being passed over using a directly through-the-scope endoscopic approach

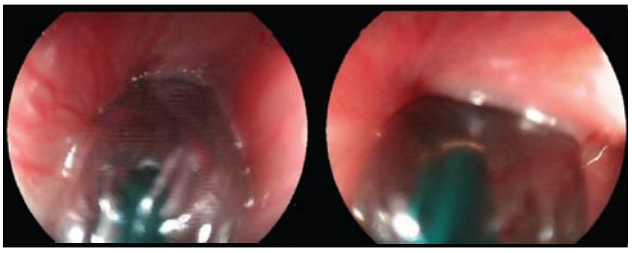

Figure 5. Endoscopic views on the site of esophageal stricture while the TTS polyethylene balloon is being inflated

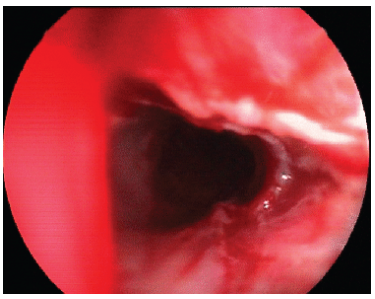

Figure 6. The esophageal lumen after dilation procedure: the stricture considerably shows augmentation compared to antecedent esophageal appearance displayed in Figure 3

DISCUSSION

Esophageal dilation is performed as a management for anatomic and functional abnormalities causing the esophageal stricture.[1,2,3] These abnormalities were caused by various etiologies, either benign or malignant conditions. Structurally, esophageal stricture could be classified into 2 groups, i.e., simple and complex esophageal stricture. Simple stricture is defined when the lesion is symmetrical or concentric with lumen diameter of 12 mm or greater, or when the endoscope is able to be easily passed through the stricture. In addition, complex stricture is considered when there is one or more the following symptoms, i.e., asymmetrical lesion, less than 12 mm in diameter, or the endoscope is difficult to be passed through the stricture.[1,3] It is believed that benign stricture is caused by the formation of fibrotic tissue and collagen deposition stimulated by deep ulcer or chronic

inflammation. The most common form is peptic stricture, which is a sequelae of reflux esophagitis. The other causes include Schatzki-Gary ring, radiation therapy, congenital stricture, anastomosis stricture and corrosive substance ingestion as occur in the presented case. In this case the patient ingested floor cleanser which contains hydrochloric acid. Such chemical trauma causes necrosis and coagulation in the affected area; the coagulation is intended to prevent further penetration. On the other hand, there is liquefactious necrosis i.e., a process that cause protein and collagen dissolution, lipid saponification, tissue dehydration and thrombosis of blood vessels which finally damaging the deeper tissues.

Approximately 85.4% patients who have ingested corrosive substances have abnormalities on distal esophagus and 44.4% further complications such as pyloric or antral stenosis.[4] The characteristic feature experienced by the patients with esophageal stricture is a difficulty more in swallowing solid foods. In contrast, with motility disorder in which the solid foods are relatively easier to pass than the more liquid ones. During hospitalization, the patients could not swallow solid foods, he could only eat porridge and fruit juice, which is consistent with dysphagia grade 3.[5] Moreover, oral nutrition has been given using nasogastric tube to decrease the risk of pulmonary aspiration.

Basic goals of stricture dilation include safe and efficacious lumenal enlargement plus prevention of restenosis. The latter may include proton pump inhibitors after esophageal bougienage for a reflux-induced stricture, placement of a prosthesis after dilation of an esophageal malignancy, or elective surgical resection, plasty, or bypass of a dilated area after dilation or stent placement for an obstructing rectosigmoid malignancy.

There are five types of esophageal dilators i.e.: (1) mercury bougies; (2) guidewire-directed dilators; (3) polyethylene balloons; (4) latex balloons; (5) miscellaneous types.[6] The polyethylene balloons are ranging in diameter from 4 to 40 mm, they allow dilation of previously inaccessible strictures in the stomach, small bowel, and colon. Dilating balloons are fixed on 5F to 7F catheter shafts that range between 100 and 200 cm in length. They can be passed over an endoscopically or radiographically placed guidewire or directly TTS. A full dilation set includes balloons of variable length and diameter, 5- to 30-mL syringes, guidewires, a manometer to delineate balloon pressure during inflation, a dilating gun to maintain pressure, and stopcocks to ensure a constant pressure during inflation are optional. More recent advances in balloon technology are fabrication of low profile and high compliance balloons. The latter can withstand a dilating pressure three- to fourfold higher than previously marketed balloons and have improved results in recalcitrant strictures.[6]

A newer development is the controlled radial expansion (CRE) balloon.[7] These balloons can be passed over a guidewire and variable inflation pressure results in balloons of increasing diameter. A single CRE balloon, contingent upon the pressure used to inflate it, may increase in diameter from 6 to 8, 8 to 10, 10 to 12, 15 to 18, and 18 to 20 mm. The large sizes are usually used for achalasia treatment. The new version of TTS balloon is able to perform expansion in 3 different sizes (1.5 mm increments) without changing the balloon. The only disadvantage is its higher cost. Other literatures classify dilators into 2 categories,[1-3, 8-10] i.e.:(1) push dilators, which can be equipped by weighted bougie (mercury or tungsten-filled rubber bougies) or guidewire-directed dilators (metal olive, Celestine type dilators or polyvinyl bougie); (2) balloon dilators, have been widely used with the size varies from 6 to 40 mm, the large size is usually used for treating achalasia. The new version of TTS balloon is able to perform expansion in 3 different sizes (1.5 mm increase) without changing the balloon. The only disadvantage is its more expensive cost.

Indications for dilation are contingent on the anatomic area involved. In the esophagus, symptoms are most often dysphagia and food impaction, although atypical chest pain, aspiration, and odynophagia may also be observed.[11-14] Contraindications to this procedure might include lack of informed consent, an acute abdomen, or a deeply-ulcerated stenosis for which the risks of dilation outweigh the benefits. There may also be patient and lesion-specific contraindications, such as coagulopathy. Both the physician and the patient must be aware of alternative treatment modalities and the possible need for subsequent long-term ancillary measures such as proton pump inhibitors.[15] Risks of gastrointestinal dilation include problems associated with all endoscopic procedures. The risks usually related with the addition of dilation have usually been defined as an increased incidence of perforation and bleeding, as well as bacteremia.[16-18]

Several considerations should be managed by the operator prior to the procedures, i.e., how large the diameter to be achieved. Benign stricture adequate result is indicated if the esophageal lumenal diameter

has achieved 13 until 15 mm. This size has been recommended, nevertheless it is still possible to perform dilation with higher diameter target for patients with persistent symptoms, also how fast the dilation will be achieved for each procedure session. The level of dilation increment is performed based on the grade of stricture. Initial dilator is selected based on the estimation of stricture diameter. A maxim to be hold in esophageal bougienage is that one should increase a lumenal stenosis by no more than 2 mm (6F) in a single dilation session.[6] It is likely that several dilation sessions will be necessary to achieve adequate result. For simple stricture, dilation by a single balloon of 15 mm diameter or with increased diameter up to 3 mm is still safe. In cases of narrow or complex strictures, the procedure should be performed very advertently.

The next pivotal point is the type of dilator used. Balloon dilators generally will only provide radial pressure, while push dilators also produce longitudinal pressure effect. In most cases, both dilators unveil similar effectiveness. Other issue to be kept in mind is the need of guide wire or endoscopic control, in most cases wire-guided or endoscopically-controlled techniques are necessitated. Dilation equipped with wire guidance provides greater confidence that the dilator has been inserted in line with the esophageal lumen and assures further reduction of the risk of perforation.[2,3,9,10]

Employing the aid of visualization endoscopy, balloon dilation is performed through the scope. Balloon is placed precisely in the middle of the narrowest point of the lumen, henceafter the standard balloon is inflated using the air in addition to contrast substance. Through-the-scope technique contains advantages as follows, direct stricture visualization, improved placement control, and immediate evaluation of the dilated stenosis.[2,3,9,10] Both balloon and dilator shaft should be coated with silicone, and negative pressure should be best applied to the balloon using 10 to 20 mL syringe. The use of a TTS or controlled radial expansion (CRE) dilator requires endoscopic approximation of the stricture size and selection of a balloon which is 1 to 2 mm (3F to 6F) larger. Those measures will avoid excessive angulation of the endoscopic tip and allow dilator passage until all or part of the balloon is visualized as well.

In the next step, the balloon is centered in the stenotic pylorus under endoscopic and fluoroscopic control guidance. A mixture of air with 10 to 25% contrast solution will allow better visualization fluoroscopically and more uniform balloon dilation. No evidence reported that 2 minutes of continued inflation is better than 15 seconds after the balloon waist has been effaced.[19] Zakiah et al, in 2008 recommended 20-60 seconds duration, other evidence support 30 seconds of dilation and then redilate a second or third time after repositioning of the balloon. After dilation has been effected, complete evacuation of the balloon and straightening of the endoscope tip are required to allow smooth retrieval.[20]

Additional, larger dilating balloons can then be used. The degree of lumenal enlargement in a single session remains a matter of common sense and is contingent on size of the initial stenosis, patient discomfort with initial dilation and degree of active ulceration. Achieving this target of treatment sometimes requires two or three dilating sessions separated by an interval of several days if the obstruction is acute or several weeks in chronic cases. The last point to be considered should be the need of radiographic screening. Radiographic screening will provide greater confidence to the operator and better control of dilation process. It may help to convince whether the wire has passed through the area of stricture smoothly and the wire is not bent either at the stricture area or more distal part. It may also function to indicate whether a slip happened during the inflation of balloon. Such radiographic procedure might be a good aide for twisting or complex stricture and patients with diverticles or large hiatal hernia as well.[2,3,9,10]

In this patient he had underwent a series of fluoroscopy-guided dilation treatment and demonstrated vigorous improvement. The initial endoscopy result demonstrated a stenosis on proximal part of the esophagus and a balloon dilation was done using a 12 mm dilator. Thereafter, the patient underwent a series of fluoroscopy-guided dilation treatment and demonstrated vigorous improvement, until the most recent dilation session, 18-mm dilator had already been able to be used, and scope could be inserted 28-30 cm distant from the incisivus, as shown sequentially in Figure 3 until Figure 6.

Due to traumatic fall injury after ingested the floor cleanser, the patient subsequently suffered TMJ dislocation. TMJ is the gliding joint that connect the skull to the lower jaw bone (the mandible) so as to allow the mouth to open and close. A dislocation of the TMJ is defined as the excessive forward movement of the mandibular condyle beyond the articular eminence with complete separation of the articular surfaces and fixation in that position.[21] A dislocation of TMJ represents 3% of all

reported dislocated joints.[22] Several precipitants have been identified for dislocation and can be classified as either traumatic or non-traumatic. Non traumatic precipitants are more common and include laughing, taking a large bite of something, convulsions, and yawning.[22,23] Predisposing factors include poor joint capsule integrity, weak articular eminence morphology, and muscle hypotonicity.[23] The diagnosis of TMJ dislocation is often clinically based in the first instance. Typical signs and symptoms seen in patients with TMJ dislocation include mandibular pain, an inability to occlude the teeth, pre-auricular depressions, and a prominent mandibular head anteriorly (anterior variant). The treatment of a patient with TMJ dislocation entails reduction of the deformity, which can be accomplished in either a ward or the emergency department setting.[24]

The patient in the current case complained difficulty in mastication and the jaw looked asymmetrical, stiff, and shifted to the right. These mandate an immediate closed reduction/reposition since complications such as fracture become increasingly apparent if time is wasted. Furthermore, spasms of both the masseter and pterygoid muscles worsens as time elapses, therefore making the reduction procedure more difficult.[25] Reduction under general anesthesia, even when performed several hours after the initial dislocation, is still a relatively simple and effective procedure.[26] The patient was being under midazolam as the general anesthetics for endoscopic procedure.

In this case the close reduction procedure could be performed concurrently with the endoscopic procedure under the same general anesthesia in endoscopy unit setting. This may decrease the adverse effects from recurrent general anesthesia when the procedures done separately. If open reduction is indicated, C-arms assistance in operating theatre will value the joint procedures more accurate. Prior reduction before dilation procedure is preferred as it may prevent further malposition of TMJ dislocation while opening the mouth to insert the scope and perform dilation maneuvers. Despite the TMJ dislocation complicating this patient, the TTS balloon dilations treatment could be trouble-freely done in several stages. TMJ dislocation reduction under general anesthesia is still a relatively simple and effective procedure, even more valuable if being accomplished concurrently with dilation treatment under the same general anesthesia.

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