Introduction

Stricture is one of the important pathological conditions in the small intestine that may require urgent and adequate treatments. Strictures of the small bowel can be induced by various kinds of diseases. One of the most important factors for the choice of treatment of the stricture of the small bowel is to determine whether neoplasm is involved in the stricture. Endoscopic observation as well as biopsy sampling is very helpful regarding the choice of treatment for the strictures in the small bowel.

Development of double-balloon enteroscopy (DBE) followed by single-balloon enteroscopy (SBE) revolutionized the management of small intestinal diseases. It enabled not only endoscopic examination but also endoscopic treatment such as balloon dilation and stent placement for the strictures of the small intestine.

In this lecture, practical application and secrets in endoscopic dilation and stenting using DBE will be explained.

Basic principles

For the proper use of DBE, it is important to understand how DBE works. For the detail, please see the abstract for “Therapeutic applications of wired enteroscopy: when & how?”

Indication and efficacy of endoscopic balloon dilation in the small intestine

Endoscopic balloon dilation is generally indicated for symptomatic benign strictures of the small intestine. Before application of balloon dilation, neoplastic involvement should be ruled out. Even for strictures associated with benign diseases such as Crohn’s disease, neoplastic changes such as carcinoma and lymphoma at the strictures should be considered carefully. Evaluation with CT, direct endoscopic observation of the strictures as well as biopsy sampling are useful to rule out neoplastic involvement.

In Crohn’s disease, a typical benign stricktruring disease in the small intestine, relapsing nature of the inflammation often causes recurrence of the strictures. When considering the relapsing and recurrent nature of the disease, it is clear that surgery does not represent curative therapy. Most recurrences develop at the anasto-
motile site and require repeated surgery. To safeguard the patients’ quality of life (QOL), it is important to avoid frequent surgical therapy. Endoscopic balloon dilatation is performed for Crohn’s strictures as a therapeutic option that is believed to enable avoiding frequent surgeries.\(^7\)

In our experience, endoscopic balloon dilation can be performed safely regardless the location of the strictures in the small intestine by using DBE. Crohn’s strictures were located in the ileum in 63% (80/126) and the jejunum in 33% (42/126). Overall cumulative frequency of patients being surgical free in 5 years was 71% (Figure 1). When the patients were divided into non-fistula and fistula group, cumulative frequency of patients being surgery-free in 3 years were significantly higher in non-fistula group (88%) than in fistula group (34%) (Figure 2). Perforation occurred during dilation therapy in 2 of 203 procedures (1.0%). No other complications occurred in this group.

Endoscopic balloon dilation is indicated for small intestinal benign strictures in the following conditions.
1. Strictures without significant active inflammation and/or ulceration.
2. Length of strictures \(\leq 5\) cm
3. Strictures without fistula
4. Strictures without sharp curve

**Tips & Tricks for effective dilation**

1. **Avoid making complicated loops**

Small intestine can make complicated loops. If complicated loops are made, endoscopic control becomes difficult. With complicated loops, insertion of a balloon dilator also becomes difficult with excessive friction in the accessory channel. The configuration of the endoscope can be optimized under fluoroscopy by retracting the endoscope and the overtube with both balloons inflated. Jiggling movement during the retraction is useful to simplify the shape of the endoscope shaft. It is important to arrange the endoscope shape before performing balloon dilation.

2. **Avoid over dilation**

Strictures in the colon are often dilated up to 18-20mm. However, intestinal content in the small intestine is
usually in liquid state. Therefore, dilation size required to control obstructive symptoms in the small intestine is smaller than in the colon. To avoid perforation, target size of dilation for strictures in the small intestine should be limited up to around 12-15mm.

3. Use of olive oil

When the insertion of balloon dilators is difficult due to friction, a small amount of olive oil can be injected through the accessory channel for lubrication.

4. Use of transparent hood

Endoscopic evaluation and dilation of strictures become easier with a 4-mm transparent hood mounted to the tip of the endoscope. The hood minimizes the need for air insufflation and maintains the endoscopic view by keeping the endoscope tip a fixed distance from the target. A small-caliber-tip transparent hood (ST hood) (Figure 3) for DBE is especially useful in complicated cases with inflammatory polyps.

CO2 insufflation

In BAE, insufflated gas is trapped by the balloons. The trapped gas in the small intestine hampers the shortening of the small intestine. Because CO2 is absorbed rapidly from the intestinal lumen, effective shortening of the small intestine can be easily achieved by using CO2 insufflation.

Effective shortening of the small intestine enables better arrangement of the shape of the endoscopic shaft, which provides better control of the endoscope tip and accessory devices in therapeutic application.

Patient's discomfort due to bowel distention after the procedure can be avoided by CO2 insufflation.

Stent placement

For malignant strictures, balloon dilation is not effective. Placement of self-expandable metallic stent has been attempted in malignant strictures in the small intestine using DBE. Metallic stents for intestinal strictures are too large for the accessory channel of DBE. Therefore, endoscope-withdrawal technique is used in the stent placement. After a DBE tip reaches the stricture, the endoscope is then removed, leaving a guide-wire inserted through the stricture in place together with the overtube and its dilated balloon. Using fluoroscopic guidance, a metallic stent of appropriate length is inserted over the guide-wire, through the overtube and released across the stricture.

Recently, use of biodegradable stents (Figure 4) for the treatment of benign stenoses of the small and large intestines was reported. Endoscopic insertion of the biodegradable stents for small intestinal stenoses were performed using the above mentioned endoscope-withdrawal technique of DBE. They successfully placed the stent
at the first attempt in all patients except one (10/11). They reported a promising outcome in this study. Biodegradable stent might have better efficacy than balloon dilation in selective cases of benign strictures in the small intestine.

**Balloon dilation and stent placement for biliary strictures in patients with Roux-en-Y anastomosis**

Endoscopic retrograde cholangiopancreatography (ERCP) is technically challenging in patients with altered gastrointestinal anatomy such as Roux-en-Y anastomosis. DEB enables endoscopic access to the biliary tract through the afferent limb of Roux-en-Y anastomosis. A large case series of effective "short" DBE for diagnostic and therapeutic ERCP in patients with altered gastrointestinal anatomy has been reported.5

**Conclusions**

DBE enabled endoscopic treatment such as balloon dilation and stent placement for small intestinal strictures. Endoscopic evaluation of stricture is important before the treatment to rule out malignant strictures. Transparent hood, especially ST hood, is useful in dilation therapy. CO2 insufflation is useful in therapeutic DBE such as balloon dilation. Dilation size in the small intestine is usually limited up to 12-15mm. Short DBE is useful in biliary dilation and stenting in patients with Roux-en-Y anastomosis.

**References**


