New Colorectal Stents: What Will We Have Tomorrow?

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Introduction

A common complication of colorectal cancer is malignant large bowel obstruction. In the past, this complication was the surgical emergency requiring colostomy and secondary resection. However, over the past 20 years endoscopic stenting has become the standard treatment for emergent decompression.\(^1\)

The use of self-expanding metal stents (SEMS) has been implemented more frequently both as a bridge to surgical resection, as well as for palliation in advanced colorectal cancer and in patients who are poor surgical candidates.\(^2\)

Stent occlusion, stent migration, and colon perforation are the negative outcomes associated with stent placement for colorectal use. Uncovered stents are associated with frequent stent occlusion by tumor ingrowth and less stent migration, whereas covered stents have the advantage of less frequent stent occlusion by tumor ingrowth but have the disadvantage of being associated with an increased risk of stent migration.\(^3\) Most stents for colorectal placement are uncovered because of the high migration rate of covered stents.

Pain and alterations in bowel habits is most often seen when stents are placed within 5 cm of the anal verge.

Therefore, it is necessary to develop a new stents and insertion technique in order to overcome a number of problems of current colorectal stenting.

Development of new stent

1. Modification of uncovered stent

There is no way to prevent tumor ingrowth with the change of the structure of uncovered stent. Colonic peristalsis and poor stent conformability may be responsible for this high incidence of migration. Axial force, the force exerted by SEMS to recover to a straight position after bending, was considered to influence conformability in the colon and the rest of the digestive tract. The conventional TTS braided stent is made with a mesh of single-strand wires and is associated with significant foreshortening and relatively frequent migration.

The individual cells of the uncovered D-Weave stents (Niti-s enteral stenting, Taewoong) are unfixed because of a mesh of double strands of nitinol wires. The unfixed individual cells of this stent allow the cells to overlap with each other over a highly curved area when bent. This design feature gives the uncovered D-Weave stent
greater flexibility and conformability than conventional TTS stents, and is expected to reduce stent-related negative outcomes such as stent migration and colon perforation.4

2. Modification of covered stent

The one major disadvantage of uncovered stents is the higher frequency of tumor ingrowth, which can precipitate stent occlusion. Even though covered type stent is not approved by FDA because of the frequent stent migration, covered stent has the powerful advantage to almost completely prevent tumor ingrowth.

Some researchers looked at outcomes of using a novel double-layered combination covered stent, with an internal membrane to prevent tumor in-growth and an external uncovered wire that should embed itself into the surrounding tumor. However, this stent, still showed an increased rate of migration when compared to uncovered stent, although not as high as documented in prior studies. Therefore, further innovation is necessary to design a stent such as with combination of the advantage of covered and uncovered stents to optimize its efficacy. Other anti-migration techniques for esophagus and gastric outlet obstruction can be applied for colon stenting. Flip-flop type of circumferential antimigration ring attached to the proximal stent portion (Ella-CS, Hradec Kralove, Czech Republic) and proximal big cup structure may be candidate technologies which can be applied to colorectal stenting.5,6

3. Fusion of uncovered and covered stent

Double stent method-inner covered stenting in outer uncovered stent was tried. The lower early migration rate in our study compared with the rates reported by previous studies can be possibly explained by tissue reactions induced by incorporation of flares in the inner and outer stents, and augmentation of the radial force by the presence of double stents. Double stent method could not prevent delayed stent migration. Debulking effect of primary lesion with or without chemotherapy may have reduced the external radial tensile force surrounding the double stent leading to stent migration. Modification of stent may have limited effect to delayed stent migration, which can be influenced by the systemic factor.7

Development of new insertion technique

1. Lower rectal lesion

Placement of an SEMS is contraindicated for malignant rectal obstructions within 5 cm of the anal verge because of the potential problems of anal pain and tenesmus from rectal irritation by the stent. Most SEMSs are released by pulling the cover sheath. PRDS (proximal releasing delivery system) is designed to be released by pushing the cover sheath. Accurate placement of stent at proximal side is available with PRDS. Modification of stent releasing method can be the resolution to overcome the contraindication of the lesion at lower rectum.8

2. Right colon and IC valve

Malignant colon obstruction in right-sided colon is technically difficult to reach the lesion, especially in those with a tortuous colon or poor bowel preparation. Additionally, insertion of a thin-caliber endoscope to pass through a severe stenosis site and reach the oral side is more difficult in the right colon, because the thin scope
tends to easily bend and make a loop. Double balloon enteroscope (DBE) was developed for the evaluation of small bowel. After DBE insertion to the lesion, next, the DBE was removed and the overtube left remaining with an inflated balloon. With the help of overtube, stent could be inserted to the lesion though the guidewire inserted with ultrathin endoscope.\(^9\)

**Conclusions**

SEMS have become the standard technique as palliative treatment as well as being bridge therapy to surgery. Covered and uncovered stents have their own advantage and disadvantage and the incidence of adverse events have been reported up to 25%. More efforts are needed to improve treatment outcome and to reduce the occurrence of complications.

**References**