

The Clinical Application of Colonic Stent

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【 Abstract 】

The application of colonic stent for treating acute intestinal obstruction was begun in the 90s of the 20th century. It has already been widely used in obstructive diseases caused by benign or malignant colonic lesions. The stent is placed with the aid of the radiography or colonoscopy. Compared to the traditional colostomy, stent placement has various outstanding advantages, such as minimal invasion to patients, few complications and cost effectiveness. It has a wide range of clinical applications.

【 Key words 】

Colonic obstruction; Stent; Clinical application

1 Introduction

Stent placement technology has been widely used in the treatment of gastrointestinal obstructive diseases. With the continuous advances in material science and endoscopic technology, stent plays a more and more important role especially in treating acute obstruction and stenosis with various factors. In 2008, a multi-center prospective study by Repici A et al [1] showed that the technically success rate and clinically success rate of stent treatment applied to intestinal obstruction due to malignant lesion were 93% and 95%, respectively. The clinical remission of palliative care group could be maintained for 6 months.

Currently, the commonly used metal stents are mainly the balloon-dilating stents and self-expanding metal stents (SEMS). SEMS is easy to unfold with high compliance and will not hinder normal intestinal peristalsis. It is easy to cause tumor infiltration and ingrowth. Therefore, some mesh stents are coated with polyester or other material, known as stent-graft. The stent-graft can resist from tumor infiltration and ingrowth. However, it is rather hard with poor stability, requires a large stent delivery system, and

easy to be migrated. In addition, it is difficult to unfold when it passes through the bending delivery path to the distal site. Non-covered stents are more flexible, it is able to pass through the work channel of colonoscope. However, when it is used for long-term palliative care, it cannot resist from tumor infiltration and ingrowth, which lead to re-obstruction. Nowadays, the commonly used SEMS are made from stainless steel or nickel-chromium alloys, which have a function of shape-memory. Once the stent unfolds, it will recover to pre-defined shape completely. It is suitable for the enteric application.

2 The operation method of stent placement

Stent placement technology is growing very rapidly, and a special delivery device used in colon has been developed. For the descending colon, doctor can carry out the stent placement without the aid of radiography or colonoscopic guidance. However, it is difficult to reach the ascending colon, so both the radiography and colonoscopic guidance are needed.

Prior to stent placement under radiography, all cases

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should have radiographic examinations such as contrast-enhanced radiography and/or colonoscopy to determine the length of the tumor and the distance between the stricture and the anus, and specimens tests. By contrast-enhanced radiography, the length and diameter of the stricture or obstruction can be defined, and patients can adjust their positions to make the stricture vertically exposed under X-ray fluoroscopy. After all of the above are ready, a catheter is placed via anus to inject contrast agent. When the catheter cannot move forward, a hydrophilic guide wire can be inserted for guiding the catheter to pass through the stricture. Attention should be paid on perforation. An appropriate stent's length should be selected for covering the whole lesion. It must be noted that it is not advocated to apply dilation before and after stent placement because perforation could be occurred easily. The stent placement under radiography should be carried out before colonoscopy applies. The stent passes through the cartilage's marks under X-ray. When the colonoscope reaches to lesion section, a series of operations such as placing guide wire, catheter, injection of contrast agent, the release of stent through the colonoscope's working channel could be completed. Stent deployment and adjustment should be supervised under radiography and colonoscopy to ensure a correct positioning. After stent placement, the medication and the subsequent surgical operation should be followed. Those who are not appropriate for surgical operations, a palliative care with a low-fiber dietary and mineral oil should be recommended to reduce stent restenosis or obstruction. In order to avoid stent migration, intestinal perforation or obstruction symptoms, a periodically radiography are recommended.

3 Clinical applications

Currently, colonic stents serves two purposes and they are preoperative transitional relieve of obstruction and late palliative care for acute colonic obstruction induced by malignant tumor. Its advantages include: (1) It is a minimally invasive surgery and it can relieve obstruction rapidly, thus some potential symptoms may be reduced; (2) It is a transitional method before the surgery. Patient can take more time for selecting therapeutic methods; (3) It reduces the complexity of surgical treatment as the radical resection could be achieved up to the 2nd phase. (4) It is a more cost-effective way. (5) It gains a high acceptance in patients. In addition, colonic stents are

used not limited in colonic malignant obstruction, but also can be used in colonic benign obstruction. It is applicable throughout all the colorectal sections.

3.1 Application to malignant obstruction of the descending colon

Descending colonic obstruction caused by tumor is a difficult problem for surgeons. Although some reports highlighted that the mortality of such patients after operation could be reduced to 3% now. Due to the differences in operating conditions and clinical experiences, this figure is between 7.2% and 22.4%. The symptom of descending colonic obstruction in these patients is often a significant indicator of late-staged tumor. Traditionally, colostomy is the only viable and inevitably treatment option for many late-staged cancer patients with inoperable tumors, or for patients with intestinal oppression due to extensive abdominal cancer metastasis. Moreover, most of the patients are elderly, associated with other diseases, with poor health status or an unstable condition etc., all these increase the risk of surgery. In addition, even if colostomy is operated successfully, it will greatly reduce patient's quality of life and result in significant psychological problems. Therefore, finding a better treatment for such patients to improve quality of life and life expectancy becomes many clinicians' objective of the study.

Recently, the descending colonic obstruction caused by malignant tumor is the most important indication of stent placement. Extensive literature shows that the application of colonic stent can significantly reduce hospital stay compared with intestinal fistula decompression. It is no significant difference in the complication rate and mortality^[2] between them. During 2007-2008, three multi-center prospective studies also showed similar results^[3-5], the success rates of stent placement were 92.6%, 93%, 97% respectively, and clinical remission rates were 81%, 85.1%, 95% respectively. One of the studies, 94% of patients had an average elective surgery of 11 days after stent placement. In the palliative care group, the clinical remission of 58%-67% patients was sustainable more than 6 months. When applying colonic stent in long-term decompression, Faragher IG, etc.^[6] had a retrospective study on 55 colon cancer patients with obstruction, they found that in the palliative treatment with stent placement, the survival rate was similar with that of surgery treatment (14 months vs. 11 months), the median length of stay was decreased (4 days vs. 13.5 days), and

fewer cases of complications (2 cases vs. 14 cases). Similar studies in China [7,8] also showed that the treatment by stent placement in acute colorectal malignant obstruction could effectively relieve symptoms, avoiding from the colostomy, significantly lower patients' pain, as well as improving quality of life. In addition, the stent placement is also suitable for acute obstruction induced by external intestinal tumors [9] which cannot take surgical treatment and gynecological tumors [10].

In addition, the palliative treatment of malignant descending colonic obstruction, the stent is also placed as a transitional means beyond surgery. Patients with colonic malignant obstruction are often associated with a high morbidity of complications and mortality after an emergency surgery, even higher than that of non-emergency surgery. Also, the effect of Phase I surgery is significantly better than Phase II and III [11]. Therefore, stent can relieve all symptoms related to acute colonic obstruction. It acts as a "bridge" connecting to surgery and becomes a viable option even for the phase II surgery into one-step radical resection. According to three non-randomized clinical trials [12-14], colonic stent placement is a transitional means of selective surgery with a higher success rate and lower mortality. It significantly increases the success rate in the subsequent surgery, with less complications and shortened hospital stay compared with those of the emergency operation. In addition, colonic stent placement is more cost-effective than that of emergency surgery. By comparison, Siddiqui A, etc. [15] found that if a patient suffered from colonic cancer metastasis and acute intestinal obstruction, the stent placement was more cost-effective than that of having surgery alone. Farrell JJ [16] thought that the preoperative usage of stent as a means for obstructive decompression was more economical and effective way than traditional methods, and it was beneficial for patients undergoing surgery.

3.2 The application in malignant obstruction of ascending colon

In recent years, with the improvements of the stent technology, in particular the application of through-the-scope (TTS) stent, the stents are used in the ascending colon, hepatic flexure of colon and transverse colon. Nowadays, most of reports mentioned a case study on stent application to proximal colonic lesions in the literature [17], with very limited sample size. However, all showed that the application had a significant effect. Shim

CS et al [18] placed TTS dual-stent in seven patients with acute colonic obstruction due to malignant lesions, they found that 6 were successfully placed in the proximal colonic location; one case could not pass through hepatic flexure and became failure. There were neither perforation nor bleeding occurred during and after the operation, nor the occurrence of other stent-related complications. On average of 13-month follow-up, stent migration or tumor-infiltration was not being found. Elsberger B [19] placed the stent in seven cases of patients with proximal colonic obstruction, 6 cases were permanent palliative treatment, and 1 case was used the pre-operation transitional purpose. They found that 6 patients (86%) were successfully placed, in one case the stent failed to unfold. 24h after the placement, 1 patient occurred minor abdominal pain without other complications. All stents were kept until the patients died, 3 patients were still alive at the time of report. In 2007, a retrospective study on 21 cases with stent placement in the proximal colon found [20] its technical success rate (95%), obstruction remission (85%) and long-term complications were close to those of distal colonic stent placement.

3.3 Application in benign colonic obstruction

Colonic stent is not only for long-term placement in the palliative treatment of advanced cancer patients. It can also be applied as a tentative means to treat stenosis due to benign lesions in the colon (diverticular disease, anastomotic stricture, primary rectal stricture, rectal endometriosis, volvulus, etc.) [21]. Geiger TM et al [22] analyzed previous literatures and found that, in the applications of stents for obstruction due to benign lesions in the colon, the patency rate was 71%, the migration rate was 43%, the treatment was safe and effective. However, different stents had different patency rates. The application in benign colonic obstruction is more limited mainly due to a higher incidence of complications and difficult to removal under colonoscopy. A recent survey of 23 patients with stent placement after obstruction complication of benign colon diseases showed that [23], success rate was 100%, clinical remission achieved in 22 cases (95%), 38% of the patients developed complications, including 2 cases of migration, 4 cases of re-obstruction and 2 cases of perforation, 87% of complications occurred in 7 days after placement. Stent placement of benign colonic obstruction had a higher incidence of migration as the benign obstructive conditions are improved.

4 Complication and appropriate treatment

According to the literature, the technical success rate of colonic stent placement, that is the stent was placed and unfolds successfully, was from 92%^[24] to 100%^[25-27]. While the failure was often due to guide wire, which could not pass through the narrow bending lumen, stent length was not enough to cover all lesions, the length of delivery system was not long enough and too soft, as well as the stent unfolded inappropriately. Complication of colonic stent varies with time; Lopes CV, etc.^[28] reported that the total incidence of complications was 26.6%; long-term rate was 21.3%. Most complications were relatively minor, mainly including minor rectal bleeding, anal pain, temporary fecal incontinence, fecal impaction, and tenesmus etc. Minor rectal bleeding was often limited and may be due to stimulating the rectal mucosa, stent compression or tumor fragmentation. Anal pain was minor, usually temporary, lasting 3-5 days, and easy to be controlled. Tenesmus may occur in the 48h after stent placement. Sometimes, it was due to the position of stent placement, which was too near to rectum.

Stent migration, intestinal restenosis and perforation are common complications reported in the literature in recent years. The incidence of stent migration was as high as 40%, usually found within one week follow-up after placement. Main reason for migration is improper stent selection, such as stent-graft or stent that is too small in diameter, intestinal conditions and the application of radiotherapy and chemotherapy after placement. The tumor size reduced after mentioned treatment and intestinal obstruction is relieved. The stent do not anchored in the lumen firmly. In order to prevent the occurrence of migration, the placed stent may be needed to re-adjust. Stent exchange or replacement under colonoscopy is necessary.

Intestinal restenosis is often due to the stent migration, fecal impaction, and the tumor ingrowth and infiltration. Therefore, the stent placement must strictly meet the requirements. After placement, the patient should eat low-fiber dietary and take mineral oil to soften the stool in order to reduce the incidence of obstruction. Tumors ingrowth is the main cause of restenosis. A second stent placement is required when necessary.

Perforation is the most serious one among all the complications, some of which happen in the operation of the guide wire and catheter, and patient cannot have any symptoms as the hole is very small. Some occurred after the stent placement, mainly due to the thin edge, a layer of serous membrane of malignant lesions which is oppressed by the stent. After stent placement, this thin rim connects with fibrosis and causing direct pressure, stretch and ischemia. As a result, for those patients with potential complications, such as advanced cancer patients, etc., must be closely observed after stent placement. In addition, as stent materials and designs^[29] are different, rate of complications is also different. As a whole, using the delivery system with a smaller diameter and the proper preoperative preparation can greatly decrease the occurrence of perforation, and the incidence of perforation can be reduced without balloon dilatation when placing the stent .

5 Conclusion

Currently, there are many problems in the clinical application of colonic stent, such as inconsistent technical standards. The stent may increase the probability of metastatic spread, which is needed further research to confirm. In addition, there are still many limitations of the stent placement in the ascending colonic obstruction, such as a lack of uniform standards in choosing stent type against indications, the time and method of follow-up after complications. They are the open topics to be discussed. The related literature is really limited at present, only a few prospective studies and the sample size of which is very limited. With the continuous development of material technology and the colonoscopic techniques, the new multi-functional stents and less invasive method of delivering system will be continuously developed. More and more doctors will tend to accept colonic stent to treat various kinds of acute obstructions resulting from malignant or benign lesions. In the future, such stent will not be used only for palliative treatment. It can carry drugs or radioactive material to apply to the lesion directly, so as to achieve the purpose of healing.

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