https://doi.org/10.33878/2073-7556-2020-19-3-113-125

Translation of the article

ENDOSCOPIC PROCEDURES FOR COLORECTAL ANASTOMOSES STRICTURES (review)

Tatiana V. Kachanova, Viktor V. Veselov, Mikhail A. Tarasov, Alexey A. Likutov, Stanislav V. Chernyshov

Ryzhikh National Medical Research Center of Coloproctology (Salyama Adilya str., 2, Moscow, 123423, Russia)

In the review data concerning modern methods of endoscopic treatment of colonic strictures are presented.
Relevance of this problem, reasons for the development, clinical picture and methods of endoscopic procedures for strictures are presented in detail.
The analysis of Russian and foreign literature with an assessment of the effectiveness and feasibility of various methods of treatment of strictures has been done. Despite the variety of ways of existing methods of stricture's treatment, there are still no evidence-based data on the efficiency and safety of various endoscopic approaches.
Thus, there are a number of unresolved topical issues that require further research.

[Key words: colonic strictures, colorectal strictures, endoscopic bougienage, balloon dilation, endoscopic electric incision, endoscopic colonic stenting]

CONFLICTS OF INTERESTS: The authors declare no conflicts of interest.

For citation: Kachanova T.V., Veselov V.V., Tarasov M.A., Likutov A.A., Chernyshov S.V. Endoscopic procedures for colorectal anastomoses strictures (review). Koloproktologia. 2020; v. 19, no. 3, pp. 113-125. https://doi.org/10.33878/2073-7556-2020-19-3-113-125

Address for correspondence: Kachanova T.V., Ryzhikh National Medical Research Center of Coloproctology, Salyama Adilya str., 2, Moscow, 123423, Russia; e-mail: ka4anova91@mail.ru

Received – 11.03.2020 *Revised – 19.06.2020* *Accepted for publication – 20.08.2020*

To date, the main method of surgical treatment of many diseases of the large intestine is resection [1-3]. Most often, the reason for surgery is colorectal cancer [4].

Thus, according to Globocan, 1.8 million people were ill in the world in 2018, and more than 70 thousand people in the Russian Federation [4,5].

In addition to patients with colorectal cancer, various bowel resections are performed for complicated diverticular disease, for benign tumors, when there is no possibility of endoscopic removal of neoplasms.

In most cases, primary resection of the colon and rectum ends with the hand-sewn or stapler anastomosis.

It should be noted that some patients develop anastomotic strictures. Itsincidence reaches 30% and depends on many factors [6]. As a rule, strictures appear in the first 2-3 months after bowel resection [7].

The development of strictures depends on the technique or type of surgery, the site of the anastomosis, as well as on the presence or absence of a diverting stoma.

Predisposing factors for the strictures are: anastomotic leakage, ischemia of the bowel, stapler use, as well as scar-inflammatory changes in tissues that occur against the background of previous radiation [8,9,10,11]. So, Quin et al., basing on the analysis of the results of a randomized controlled trial, proved a correlation between the stricture rate and the colorectal anastomosis leakage, as well as the preoperative radiation [12].

Along with the advent of stapler technology for anastomosis formation, the number of strictures has also increased significantly, which is confirmed by Polese et al. study [13]. The authors analyzed risk factors for stricture development in 26 patients and found a correlation between the development of postoperative stricture not only with the level of anastomosis location (8-12 cm from the anus), but also with stapler techniques, as well as inflammatory changes in the intestinal wall in patients with complicated diverticular disease [13].

A systematic review and meta-analysis conducted by Neutzlig et al. demonstrate the stricture rate, which

is 8% when using the stapler technique and 2% when using the manual method of suturing [14].

An important risk factor for stricture is the presence of a diverting stoma. Thus, Biraima et al. after examining 76 patients before the elective closure of the preventive stoma, found that every fifth patient had a stricture that required correction. It should be noted that the presence of stricture in the diverted bowel is an obstacle to the stoma takedown.

Discussing the rate of anastomotic strictures without the diverting stoma, it should be noted that there is an evidence that only every third (32%) patient has symptoms of bowel obstruction and only a control colonoscopy is the main method for diagnosing stricture [8].

Clinically, the stricture of the anastomosis manifests cramp-like abdominal pain, prolonged constipation, a feeling of bloating and incomplete bowel emptying. Symptoms may appear in a few weeks or several years after surgery.

So according to Polese et al., in 3 months after surgery, 73% of patients with strictures showed symptoms of bowel obstruction [13].

An endoscopic sign of a stricture is the inability to push a flexible endoscope (12 mm in diameter) beyond the narrowing zone. Various methods are used to determine the length and diameter of the stricture.

As a rule, during colonoscopy, the diameter of the structure is compared with the size of biopsy forceps with open branches, the distance between which corresponds to 6 mm (Fig. 1).

With the help of biopsy forceps, it is also possible to determine the length of the stricture. To do this, the forceps are wound up behind the stricture zone, opened and pulled up.

To measure the size of the stricture, it is possible to use a Seldinger calibration catheter or perform x-ray contrast methods (barium enema, abdominal CT with contrast).

For a long time, patients with strictures of colorectal anastomoses were subjected to surgery with resection of the narrowing zone and subsequent reanastomosis [15].

According to Schlegel et al., 28% of patients with colorectal anastomosis strictures underwent surgery [16].

However, this treatment approach for strictures is complex and has a high risk of postoperative complications, which are fraught with repeated formation of intestinal stoma. In connection with the development of endoscopic surgery and the emergence of new methods for correcting strictures of colonic anastomoses, the therapeutic tactics of this category of patients have changed revolutionarily.

To date, there are various intra-light endoscopic methods of treating strictures.

These include endoscopic bougienage, balloon dilatation, endoscopic electric or laser incision, stenting, transanal endomicrosurgery, and a combination of these techniques.

Bougienage with special bougies is an easy-to-perform, low-cost method of correcting strictures with minimal risk of complications.

However, the use of bougies for dilatation of the stricture is limited to its localization in the rectum [15].

The hardware method of bougienage provides for a sequential change of endoscopes with an increase in their diameter from 6 to 18 mm [7].

It is worth noting that this technique is not available in every medical institution due to the need for a large number of gastro-and colonoscopes of various diameters and the high cost of endoscopic equipment.

Laser coagulation was used as one of the first instrumental methods of stricture correction.

So Loffler et al. in 1986, for the first time conducted a study in 22 patients with postoperative strictures.

Laser coagulation was effective in 21 patients, and 1 patient had a recurrence of stricture.

The above-described method of treatment of intestinal anastomosis strictures is not widely used due to the high cost and inability to control the depth of coagulation of the colon wall, which can lead to perforation [17].

An important role in the treatment of strictures is assigned to endoscopic balloon dilatation, possibly as one of the effective methods of correction. This technique was first used in 1984 [18].

Initially, this method of treatment was carried out only under x-ray control.

However, due to the progress of endoscopic technology, various types of balloons have appeared in the arsenal of the operating endoscopist. Currently, there are 3 types of balloons used for dilatation of colon

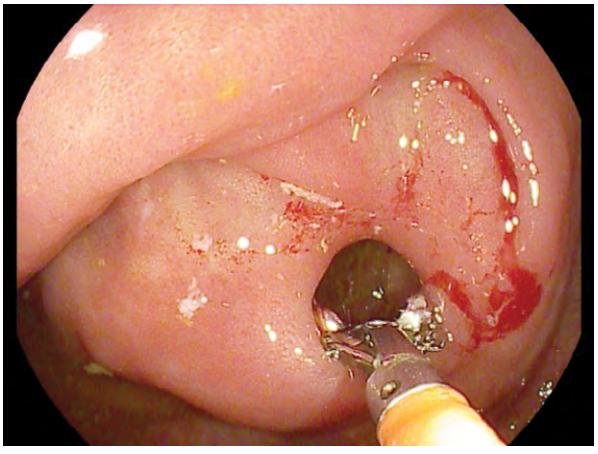

Figure 1. *Determination of the diameter of the residual lumen in the zone of sigmorectal anastomosis using biopsy forceps*

strictures: balloons installed on a wire under x-ray control (over-the-wire balloon; OTW) (Fig. 2).

When using an OTW balloon, the conductor is passed over the area of bowel narrowing through the working channel of the endoscope under visual and X-ray control.

Next, a balloon with special radiopaque marks is carried along the conductor, which is installed in such a way that the stricture falls on its central part.

Then, using a special inflating device, the balloon is filled with water-soluble contrast to a certain pressure. It is maintained for a period of 30 seconds to 2-3 minutes.

As a result, the «waist» on the balloon is visualized in the narrowing area, which disappears after successful dilatation; the balloon is desuffled and removed.

Then the mucosa in the area of the eliminated structure and previously inaccessible proximal parts of the bowel are examined endoscopically.

The second type is balloons that are conducted through the endoscope channel without a conductor only under visual control (through-the-scope balloon; TTS) (Fig. 3).

The balloon of this type is transparent, does not have radiopaque marks and does not require X-ray control. The balloon is installed with its central part in the area of the bowel narrowing, after which it is also filled with water to a certain pressure using a special inflating device.

Then the distal edge of the endoscope is brought close to the wall of the balloon and due to its transparency, visual control of the mucosa in the stricture area is performed.

Successful dilation is judged by the possibility of movement of the balloon in an inflated state through the stricture. Then the balloon is desufflated and removed.

The area of stricture is examined for the presence of mucosal tears and in order to exclude complications of dilation.

The third type of balloons is universal. It combines the first and second types.

A comparison of OTW and TTS balloons is presented in a prospective study by Giorgio et al. based on the results of treatment of 30 patients with colorectal anastomosis strictures after low anterior rectal resection.

The authors divided the patients into 2 groups of 15 people, depending on the type of balloon used.

In the course of the study, it was proved that the use of an OTW balloon with a larger diameter in comparison with a TTS balloon leads to a decrease in the number of necessary balloon dilatations and provides a longer relapse-free response to the treatment [19].

However, due to the larger OTW diameter, the balloon causes more intense stretching of the intestinal wall tissues, and increasing the diameter of the balloon used during a single dilation session increases the risk of perforation.

It is worth noting that the question is still being discussed – to what diameter it is possible to dilate the stricture in one session, and a relatively small number of patients who participated in the studies do not allow to give statistically reliable results.

In addition, the use of an OTW balloon requires dilation under x-ray control, which can be difficult to perform.

There is also an open question about the optimal number of balloon dilation sessions for successful relief of symptoms of intestinal passage disorders in patients with colonic anastomosis stricture.

Figure 2. *Balloon installed on the conductor under x-ray control. Over-the-wireballoon (OTW)*

Figure 3. *Balloon installed under visual control. Through-the-scope balloon (TTS)*

According to Arajio et al., who presented the results of treatment of 24 patients with colorectal anastomosis strictures, in 22/24 (91.7%) cases, the use of balloon dilation showed its effectiveness – ease of execution and good long-term clinical results.

One patient needed 4 stages of dilation, seven patients – 3 stages, eight patients – 2 stages, and only six patients had the stricture dilated in one stage. When evaluating the effectiveness of the treatment, 4/22 patients were found to have recurrent stricture.

Two patients failed to perform repeated balloon dilation due to pronounced narrowing of the intestinal lumen and the inability to conduct the balloon over stricture.

These patients were subject to surgical treatment [11].

According to Kim et al., 74% of patients with strictures after balloon dilation experienced the disappearance of clinical symptoms in a month after treatment.

And in the study of long-term results for 5-138 months, 85.7% of patients showed complete clinical recovery with the disappearance of symptoms of bowel obstruction [20].

Considerable attention in the literature is paid to electric incision of the anastomosis zone, as one of the alternative methods of treatment of strictures. Electric incision is performed using both an IT knife and a papillotomy knife, or the tip of a polypectomy loop.

In this method, the instrument is positioned centrally, after which the electric current is applied, and radial incisions are made. The length and depth of the incisions are determined according to the diameter and length of the stricture [15].

This method of treating strictures of colonic anastomoses was used by Bravi et al., and they proved the effectiveness of the method described above for correcting strictures in one session of electric incision-with the occurrence of the stricture recurrence in only 5% of patients [10].

However, the question of the depth of radial incisions remains unexplored.

With the lack of significant experience of the operating endoscopist, the use of this technique for strictures can lead to the intestinal wall perforation.

Perhaps, the choice of method for stricture treatment, which allows reducing the risk of perforation, is the «ball» coagulation. The use of ball electrodes in the complex therapy of intestinal anastomosis strictures was used in the study by Veselov V.V. et al., which included 26 patients.

The method includes a creating a circular zone of mucosal necrosis in the area of stricture and the formation of a wound surface, which reduced the area of scar connective tissue, initiated mucosa epithelization and contributed to the lumen expansion of the narrowed portion of the bowel.

This method of destruction was used in almost complete obliteration of the lumen and began with electrocoagulation of scar tissue in the central zone of the stricture.

As a result of coagulation necrosis, a wound channel with a diameter of 2-3 mm was formed.

It was subject to further circular coagulation with the expansion of the intestinal lumen in the zone of anastomosis to 4-5 mm.

Further, depending on the anastomosis site, the method of bougienage was chosen.

15/26 patients had electric incisionper formed with ball electrode and the hardware bougienage, 7 patients had electric incision and mechanical bougienage and the remaining 4 patients had electric incision and mechanical bougienage.

In 40% of cases of electric incision of the stricture with a ball electrode in combination with hardware bougienage, one stage was enough for treatment.

In addition, the authors concluded that the success of endoscopic treatment of anastomotic scarring depends on their length, since the results of endoscopic treatment were unsatisfactory for strictures longer than 12 mm [7].

Electric incision with a ball electrode in most cases requires several stages of treatment, since its use affects a significant area of the surface of the mucosa without a deep impact on the submucosal layer, and the main cluster of fibrous fibers is located in the submucosal layer at the border with the circular muscle layer of the intestinal wall.

However, it should be noted that the combined method of stricture treatment by electrocoagulation with a ball electrode in combination with bougienage can be used for dense fibrous strictures, with complete obliteration of the intestinal lumen, as well as in the case of impossibility/inefficiency of balloon dilation [15].

In case of extended strictures of colorectal anastomoses, endoscopic stenting has proved its effectiveness. Currently, various types of stents are used: self-expanding, biodegradable, etc. [12,21,22].

So in the study by Lamazza et al., stenting with a self-expanding metal stent was performed in 10 patients with recurrent strictures after anterior rectal resection.

The length of the strictures ranged from 25 to 40 mm. All the patients had previously undergone several stages of balloon dilation without effect.

When analyzing long-term results 18 months after stenting, it was found that in 70% of cases, symptoms of intestinal passage disorders were eliminated after the stent was installed, only 3 patients had spontane-

ous stent migration with the return of obstruction symptoms [3].

Caruso et al. in a retrospective study showed that all the patients included in the study had decompression of the anastomosis narrowing zone with the elimination of clinical symptoms.

After installing a self-expanding stent, only 3/16 patients experienced spontaneous stent migration [23].

The use of biodegradable stents, as opposed to plastic and metal ones, reduces mucosal trauma, which leads to a reduction in the number of complications such as bleeding and the intestinal wall perforation, and also avoids repeated endoscopic examination associated with stent removal [23].

However, endoscopic stenting is still most often used as a symptomatic treatment and preoperative preparation in patients with stenotic colorectal cancer with signs of colonic obstruction, as well as palliative treatment for incurable patients [1].

Another method for correcting colorectal anastomosis strictures is the use of a platform for transanal endoscopic microsurgery (TEM), which is used for organ-preserving treatment of rectal adenomas and adenocarcinomas [24].

The method is based on circular excision of fibrous tissue using monopolar coagulation or ultrasonic scissors.

So Baatrup et al. reported about 6 patients with strictures, 5 of whom were successfully treated with TEM (treatment efficiency was 83.3%) [25].

In the study by Jakubauskas et al., 4 out of 6 patients with colorectal strictures that could not be treated by balloon dilation were successfully treated with TEM – stricturoplasty.

The authors have shown that TEM-stricturoplasty can be the optimal method of treating low-lying anastomosis strictures, as an alternative to surgical treatment [2].

However, the cost of the method and the dependence of results on the availability of equipment in the clinic does not allow its use wide.

CONCLUSION

To date, the standard in the treatment of limited strictures of colorectal anastomoses is balloon dilation, since this method of correction of strictures allows to achieve an even distribution of the pressure force on all layers of the intestinal wall, causing the lumen to expand due to stretching of the submucosal and muscle layers with the minimal mucosal injury.

Electric incision with the radial incisions is effective for short and dense fibrous strictures.

Electric incisionusing ball electrodes is applicable in the treatment of strictures, almost completely obliterating the bowel lumen.

The use of stents or platform for transanal endomicrosurgery is usually rare and expensive procedure.

However, the relatively small number of publications presented in the literature does not allow us to clearly emphasize the primacy of a particular method, which requires a large prospective study.

THE PARTICIPATION OF THE AUTHORS:

Concept and design of the study: *Chernyshov S.V., Kachanova T.V., Tarasov M.A.*

Collection and processing of the material: *Kachanova T.V.*

Writing of the text: *Kachanova T.V., Likutov A.A.*

Editing: *Chernyshov S.V., Veselov V.V.*

REFERENCES

1. Sokolov V.V. Atlas of videoendoscopic intraluminal operations in clinical oncology: scientific and practical edition. (ed. Trahtenberg A.H., Kaprin A.D., Chissov V.I.) M. *Practical medicine*. 2015; pp. 152. (in Russ.).

2. Jakubauskas M, Jotautas V, Poskus E. et al. Management of colorectal anastomotic stricture with transanal endoscopic microsurgery (TEM). *Techniques in Coloproctology*. 2018;22(9):727-729. DOI: 10.1007/s10151-018-1858-2.

3. Lamazza A, Fiori E, Sterpetti A. et al. Self-expandable metal stents in the treatment of benign anastomotic stricture after rectal resection for cancer. *Colorectal Disease*. 2013;16:150-153. DOI: 10.1111/codi.12488.

4. Bray F, Ferlay J, Soerjomataram I. et al. Global Cancer Statistics 2018: Globocan estimates of incidence and mortality worldwide for 36 cancers in 185 countries. *CA Cancer J Clin*. 2018;0:1-31. DOI: 10.3322/caac.21492.

5. Kaprin A., Starinskii V., Petrova G. Malignant neoplasms in Russia in 2018. The Moscow Oncology research Institute named after Herzen. 2019; pp. 11-14. (in Russ.)

6. Kuzmin-Kruteckii M.I., Hanevich M.A. Endoscopic treatment of colon strictures. *Terra medica*. 1998; no. 3, pp. 26-27. (in Russ.).

7. Veselov V.V., Achkasov S.I., Vaganov Yu.E. Endoscopic treatment of corrosive strictures of intestinal anastomosis. *Koloproktologia*. 2015; no. 1(51), pp. 21-26. (in Russ.).

8. Biraima M, Adamina M, Jost R. et al. Long-term results of endoscopic balloon dilation for treatment of colorectal anastomotic stenosis. *Surg Endosc*. 2016;30:4432-4437. DOI 10.1007/s00464-016-4762-8.

9. Goulder F. Bowel anastomosis: The theory, the practice and the evidence base. *World Journal of Gastrointestinal Surgery*. 2012;4(9):208-213. DOI: 10.4240/wjgs.v4.i9.208.

10. Bravi I, Ravizza D, Fiori G. et al. Endoscopic electrocautery dilation of benign anastomotic colonic strictures: a single-center experience. *Surg Endoscopy*. 2016;30(1):229-232. DOI: 10.1007/s00464-015-4191-0.

11. Araujo S, Costa A. et al. Efficacy and safety of endoscop-

ic balloon dilation of benign anastomotic strictures after oncologic anterior rectal resection. Report of 24 cases. *Surg. Laparosc. Endosc. Percutan. Tech.* 2008;18:565-568. DOI: 10.1097/SLE.0b013e31818754f4.
12. Quin Q, Tenghui M, Yanhong D. et al. Impact of preoperative radiotherapy on anastomotic leakage and stenosis after rectal cancer resection: Post hoc analysis of a randomized controlled trial. *Dis Colon Rectum.* 2016;59:934-942. DOI: 10.1097/DCR.0000000000000665.
13. Polese L, Vecchiato M, Frigo A. et al. Risk factors for colorectal anastomotic stenoses and their impact on quality of life: what are the lessions to learn. *Colorectal Disease.* 2011;14(3):124-128. DOI: 10.1111/j.1463-1318.2011.02819.x.
14. Neutzling C, Luctosa S, Proenca I. et al. Stapled versus handsewn methods for colorectal anastomosis surgery. *Cochrane Database Systematic Reviews.* 2012;15(2):1-51. DOI: 10.1002/14651858.CD003144.pub2.
15. Mtvralashvili D.A., Likutov A.A. Current views on the management of intestinal anastomotic strictures. *Endoskopicheskaya hirurgiya.* 2017; no. 3, pp. 43-48. (in Russ.) DOI: 10.17116/endoskop201723343-48.
16. Schlegel R, Dehni N, Parc R. et al. Results of reoperations in colorectal anastomotic strictures. *Dis. Colon Rectum.* 2001;44(10):1464-1468. DOI: 10.1007/bf02234598.
17. Loffler A, Dienst C, Velasco S. et al. International survey of laser therapy in bening gastrointestinal tumors and stenoses. *Endoscopy.* 1986;18(1):62-65. DOI: 10.1055/s-2007-1018413.
18. Venu R, Greenen J, Hogan W. et al. Endoscopic electrosurgical treatment for strictures of the gastrointestinal tract. *Gastrointestinal Endoscopy.* 1984;30(2):97-100. DOI: 10.1016/s0016-5107(84)72331-5.
19. Giorgio P, De Luca L, Rivellini G. et al. Endoscopic dilation of benign colorectal anastomotic stricture after low anterior resection: a prospective comparison study of two balloon types. *Gastrointestinal Endoscopy.* 2004;60(3):347-350. DOI: 10.1007/s00464-002-8926-3.
20. Kim P, Song H, Park J. et al. Safe and effective treatment of colorectal anastomotic stricture using a well-defined balloon dilation protocol. *Vasc Interv Radiology.* 2012;23:675-680. DOI: 10.1016/j.jvir.2011.12.014.
21. Caruso A, Conigliaro R, Manta R. et al. Fully covered self-expanding metal stents for refractory anastomotic colorectal strictures. *Surg Endosc.* 2015;29(5):1175-1178. DOI: 10.1007/s00464-014-3785-2.
22. Geraghty J, Sarkar S, Cox T. et al. Management of large bowel obstruction with self-expanding metal stents. A multicenter retrospective study of factors determining outcome. *Colorectal Disease.* 2014;16:476-483. DOI: 10.1111/codi.12582.
23. Caruso A, Manno M, Manta R. et al. Alternative management of anastomotic colorectal strictures: our experience of fully covered self-expanding metal stents. *Surg Endosc.* 2013;27:4752-4753. DOI: 10.1007/s00464-013-3113-2.
24. Shelygin Yu.A., Chernyshov S.V., Mainovskaya O.A. et al. Early Rectal Cancer: Can Transanal Endoscopic Microsurgery (TEM) become the standart treatment? *Bulletin of the Russian Academy of medical sciences.* 2016; 71, no. 4, pp. 323-331. (in Russ.). DOI 10.15690/vramn719.
25. Baatrup G, Svensen R, Ellensen V. et al. Benign rectal strictures managed with transanal resection – a novel application for transanal endoscopic microsurgery. *Colorectal Dis.* 2010;12:144-146. DOI: 10.1007/s00464-016-4888-8.