DOI: 10.23934/2223-9022-2019-8-1-74-80

Minimally Invasive Methods of Temporary Decompression of the Colon with Obturation Colonic Obstruction: a Literature Review

D.I. Petrov[1]*, P.A. Yartsev[1, 2], D.A. Blagovestnov[1], V.D. Levitsky[2], B.T. Tsuleiskiri[2, 3], I.I. Kirsanov[2], M.M. Rogal[2]

Department of Energency and General Surgery
[1] Russian Medical Academy of Continuing Professional Education of the Ministry of Health of the Russian Federation
2/1 Barrikadnaya St., Moscow 125993, Russian Federation
[2] N.V. Sklifosovsky Research Institute for Emergency Medicine of the Moscow Healthcare Department
3 Bolshaya Sukharevskaya Square, Moscow 129090, Russian Federation
[3] A.I. Yevdokimov Moscow State University of Medicine and Dentistry of the Ministry of Healthcare of the Russian Federation
20 Delegatskaya St., b. 1, Moscow 127473, Russian Federation

*** Contacts:** Demyan I. Petrov, postgraduate student of the Department of Energency and General Surgery RMACPE. Email: demyan-petrov@mail.ru

ABSTRACT Colorectal cancer is one of the most common oncological diseases. In 40–60% of cases, patients with colorectal cancer enter general surgical hospitals with complications. Obstructive colonic obstruction is the most common complication of colorectal cancer. The radical operation against the background of colonic obstruction is associated with a high postoperative lethality, ranging from 5% to 34%. To improve the results of surgical treatment of patients with colorectal cancer complicated by obturation colonic obstruction, various minimally invasive methods of temporary decompression have been proposed, followed by radical surgery, which significantly reduce the risk of complications and mortality.

Keywords: colorectal cancer, colonic obstruction, emergency surgery, colorectal stent, colostomy, temporary decompression

For citation Petrov D.I., Yartsev P.A., Blagovestnov D.A., et al. Minimally invasive methods of temporary decompression of the colon with obturation colonic obstruction: a literature review. *Russian Sklifosovsky Journal of Emergency Medical Care.* 2019; 8(1): 74–80. DOI: 10.23934/2223-9022-2019-8-1-74-80 (In Russian)

Conflict of interest Authors declare lack of the conflicts of interests

Acknowledgments The study had no sponsorship

Affiliations

Demyan I. Petrov	postgraduate student of the Department of Energency and General Surgery RMACPE, ORCID: 0000-0001-7665-0163.
Pyotr A. Yartsev	Dr. Med. Sci., professor, Head of the Department of Emergency Surgery, Endoscopy and Intensive Therapy, N.V. Sklifosovsky Research Institute for Emergency Medicine, ORCID: 0000-0003-1270-5414.
Dmitry A. Blagovestnov	Dr. Med. Sci., professor, Dean of the Surgery Faculty, Head of the Departmrnt of Energency and General Surgery RMACPE
Vladislav D. Levitsky	Cand. Med. Sci., Leading Researcher of the Department of Emergency Surgery, Endoscopy and Intensive Therapy, N.V. Sklifosovsky Research Institute for Emergency Medicine
Bakur Y. Tsuleiskiri	Cand. Med. Sci., Senior Researcher of the Department of Emergency Surgery, Endoscopy and Intensive Therapy, N.V. Sklifosovsky Research Institute for Emergency Medicine
Ilya I. Kirsanov	Cand. Med. Sci., Senior Researcher of the Department of Emergency Surgery, Endoscopy and Intensive Therapy, N.V. Sklifosovsky Research Institute for Emergency Medicine
Mikhail M. Rogal	Researcher of the Department of Emergency Surgery, Endoscopy and Intensive Therapy, N.V. Sklifosovsky Research Institute for Emergency Medicine

Colorectal cancer is one of the most common cancers [1]. In Russia, colorectal cancer occupies the 3rd place (11.3%) in the structure of cancer incidence. The average age of patients with an established diagnosis of colon cancer is 68.1 years (66.9 years for men and 69.0 years for women) [2].

In 40–60% of cases, patients with complicated forms of colorectal cancer are admitted to general surgical hospitals [3–7]. Complications include: obturation intestinal obstruction (20–85.5%), bleeding from a tumor (1–14.7%), perforation of a colon tumor with peritonitis (1–18%), perifocal inflammatory processes (paracolitis, perinephritis, abdominal phlegmon, retroperitoneal phlegmon) (5–30%) [3-5, 7]. Thus, obturation colonic obstruction is the most common complication of colon cancer [3-5].

Despite the improvement of primary anastomosis in obturation colonic obstruction, the incidence of intestinal anastomoses sutures failure remains high, reaching 17% [8–10] with right-sided tumor location and over 20% with its left-sided llocation [8, 11–15]. Radical operations on the background of acute intestinal obstruction are associated with high postoperative mortality, ranging from 5 to 34% [12, 16–20]. At the same time, the frequency of postoperative complications and mortality in patients with colorectal cancer when performing emergency operations on the large intestine significantly exceeds that in comparison with planned surgery.

Thus, to reduce the frequency of complications and mortality in this category of patients, it seems promising and quite reasonable to resolve acute obstruction of the colon and transfer emergency surgery to delayed or planned.

Two-stage operations (by type of Hartmann's operation) are currently the most widespread in connection with radicalism, the rapid resolution of intestinal obstruction, the lack of risk of anastomotic failure and the possibility of mastering the operation by young surgeons. However, patients are forced to live with the presence of colostomy, which significantly reduces their adaptation in the social environment. The terms of repeated reconstructive operations for closing a colostomy are from 1 to 24 months [21–23], and in 40–70% of cases the recovery phase of the operation cannot be performed [24, 25].

Among single-stage operations with removal of the tumor and restoration of the continuity of the colon, two options of interventions are most often used: 1. Subtotal colectomy with ileosigmoid/ileorectal anastomosis; 2. Segmental resection of the colon with its intraoperative mechanical preparation. Each of these operations has a number of advantages and disadvantages.

Studies have shown that during the subtotal colectomy in patients with obturation colonic obstruction, a lower incidence of suture failure is observed during the formation of the ileocolonic anastomosis, which is 10% less than during the formation of colocolonic anastomosis formed during segmental resection of the colon, where the incidence of sutures failure reaches 18–20% [26]. Another advantage of subtotal colectomy compared to segmental resection of the colon with the conduction of a primary anastomosis is the radical removal of an unprepared, overstretched segment of the intestine, which may include areas of ischemic damage or contain synchronous tumors not detected during the surgery. At the same time, the consequence of a radical removal of the colon is the development of postcollectomy syndrome, which manifests itself in persistent diarrhea, which significantly reduces the social and labor rehabilitation of patients [15, 26, 27].

In order to reduce the risk of sutures failure after resection of the colon with the restoration of its continuity and complete or partial violation of the passage, various mechanical methods of intraoperative bowel cleansing are currently used. This approach avoids the formation of colostomy and is an alternative to two-stage treatment (for example, Hartmann's operation). In this case, the mechanical preparation of the intestine allows to remove feces and decompression of the enlarged colon before the formation of the anastomosis. At the same time, the available literature data at the moment do not allow making an unequivocal conclusion about the advantages of this method before operations performed without prior preparation of the large intestine.

In 1988, an experimental randomized study conducted by *Ravo et al.* [28], showed that if the intestinal contents in contact with the anastomosis are removed, the latter can be safely applied even in peritonitis. Several methods of mechanical preparation of the intestine during emergency surgery have been described. The most acceptable are intraoperative colon lavage or mechanical decompress anastomosis failure [29–32]. In 2004, a systematic review of *Trompetas* [15] concluded that there was no evidence to state that mechanical preparation of the intestine lead to a decrease in the risk of the anastomosis failure after surgery. So, according to *Ortiz et al.* [31], resection of the intestine and primary anastomosis can be safely performed without mechanical preparation.

Considering the above , the described methods of surgical treatment of patients with colon cancer complicated by obturation obstruction do not allow to achieve the shortest possible time to restore the continuity of the gastrointestinal tract in cases of two-stage operations or satisfactory results after one-stage operations with a primary anastomosis.

Alternatively, in the treatment of this pathology, various minimally invasive methods of temporary decompression of the colon at the first stage were suggested, followed by radical surgery and the formation of a primary interintestinal anastomosis.

With the development of technology, tools, experience, there have been reports of video-assisted colostomy. The method of temporary decompression, based on the loop colostomy from a mini-access, that is, performing video-assisted colostomy, allowed to resolve intestinal obstruction at the first stage of treatment, and perform a radical surgical intervention in relation to intestinal tumors at the second stage. Thus, temporary decompression from a mini-access, according to A.V. Pugayev and E.E. Achkasov, allowed to reduce the frequency of postoperative complications to 7.2% at the first stage, and the mortality rate at this stage was 1.8%. Also, the authors note 100% absence of postoperative intestinal paresis and early activation of patients. Radical operations were performed in 90.7% of patients with a total postoperative mortality of 6.5%. The authors emphasize that performing a colostomy from a mini-access allows resolving acute obturation colonic obstruction and preserving the life of 98.2% of patients, compensating for water and electrolyte disorders and adequately preparing the patient for a radical operation [33]. The advantage of the method is also the additional diagnosis of both local and distant tumor process. V.A. Osipov reported successful laparoscopic colostomy in 16 patients. No deaths at the decompression stage indicate good immediate results [34].

The use of endoscopic methods allowed to decompress the colon in patients with acute obturation colonic obstruction. However, the work of recent years shows that endoscopic methods are technically acceptable and clinically effective if the intraluminal length of a tumor does not exceed 3–5 cm [35, 36].

The method suggested in the 80s of the last century, based on the hyper- or hypothermic destruction of a tumor using laser, cryosurgical techniques or argon plasma coagulation, proved to be very successful [37, 38]. Some of the best indicators were observed when performing laser photocoagulation (the effect of manipulation averaged 90%) [37]. However, one of the drawbacks of this approach is the need to perform repeated manipulations every 5–9 weeks to avoid recurrence of obstruction [38]. It is also necessary to note the fact that this method of temporary decompression should be performed for patients who are not supposed to undergo radical surgery in the future, since its local spread may occur due to the destruction of the tumor tissue. Complications of these manipulations: perforation (4.1%), fistula (3.2%), abscess (1.7%), bleeding (4.1%) [37]. As noted by S.Y. Dvoretsky et al ., the complete or partial recanalization of the tumor in 21 patients out of 31 (67.7%) allowed to conduct a full preoperative preparation and perform a planned surgical intervention [39, 40].

In the late 80s - early 90s of the last century, domestic scientists offered methods for endoscopic recanalization with a drainage tube. In particular, it concerns the works of prof. Y.V. Sinev and prof. G.V. Pakhomova [41, 42]. In the early 2000s, works from abroad appeared reporting endoscopic recanalization with a drainage tube during colonic obstruction *(transanal drainage tube)*. Technical (possibility of installing a drainage tube) and clinical (eliminating the symptoms of obstruction) success of the method was 93.9% and 86.4%, respectively. According to various authors, the frequency of perforations after endoscopic recanalization reached 4.5–8.5%, and overall mortality ranged from 1.5% to 9.8% [43–46].

In the 1990s, self-expanding metal stents [15, 47] were developed for the palliative treatment of inoperable patients [15, 47], which are installed endoscopically with the help of a guide through tumor contraction. A number of authors who support the concept of stents as a temporary "bridge to surgery", argue that the method allows to compensate for water-electrolyte and nutritional disorders in a patient, manage the associated diseases, clarify and finalize the diagnosis, involve specialists from related fields. The first studies of this method showed extremely encouraging results:

a reduction in the incidence of complications and mortality, an increase in the percentage of completion of primary anastomoses and minimally invasive operations [48–50].

However, when the results of 6 existing randomized studies using stents as a “bridge to surgery” [51–56] were analyzed, it was very difficult to draw general conclusions from these studies, especially given that 3 of them were not completed [51, 55 , 56].

In 2009, *Cheung et al.* [52] studied the question whether it is possible to underwent laparoscopic resection of colon and primary anastomosis without making the stoma. All patients in their study were operated on by one surgical team, the result - 67% of operations were performed laparoscopically with a primary anastomosis, almost a third of patients in both groups underwent Hartmann's operation.

The purpose of the *Pirlet* study *et al.* (2011) [56] was to identify the possibility of placing the stent as the first stage before a radical surgery. Elimination of the symptoms of obstruction in patients after installation of a stent reached only 40%, while the number of complications was 50%. The stoma rate was 43% in the stents group and 57% in the surgical group. Given the large number of complications in the stents group, the study was discontinued.

The study *van Hooft et al.* [55] was ended beforehand by the Data Safety Monitoring Committee due to the high number of complications in the stenting group as compared to conventional emergency surgery.

Alcantara et al. [51] randomized 28 patients. The study was ended beforehand due to a higher level of failure of the anastomosis in the emergency surgery group (30.7%).

In 2011, *Ho et al.* [54] noted that the rate of clinical success in tumor stenting was 70%. The incidence of complications in the stenting group was 35% compared to emergency surgery, where it was 58%. Fatalities in the stenting group were not observed, in the emergency surgery group the mortality rate was 16%.

In a clinical study conducted by *Ghazal et al.* (2013) [53], the endoscopic stenting followed by a planned colectomy (left-sided hemicolectomy or anterior resection) was compared to a total colectomy with ileorectal anastomosis under conditions of emergency surgery. In our opinion, in this study the types of operations performed in two groups are not comparable, and the results of surgical intervention are controversial.

As for the survival, the results are similar in patients undergoing stenting as a “bridge” to surgery as compared to emergency surgery [57-59]. At the same time, early metastasis is more common in patients with stents [60]. When patients with stents were compared with elective (without obstruction) colon cancer patients, differences in 5-year survival were not observed (60% vs. 58%, respectively) [60].

In the process of accumulating clinical experience and publishing a huge amount of work, certain shortcomings and constraints of the unambiguous use of self-expanding stents as a staged treatment were identified. Constraining factors are the cost of colorectal stents, and one of the main conditions for successful stenting is the conduction of the procedure at the multidisciplinary hospital with the participation of experienced endoscopists [18].

There is no doubt that more research is needed before installation of stents may be considered as a standard technique. The longer hospital stay of such patients, on the one hand, and the possibility of performing a video-laparoscopic radical operation with a primary anastomosis, on the other hand, require careful individual approach to each patient.

CONCLUSION

Thus, over the past few decades, the treatment of complicated colorectal cancer has qualitatively changed. For lesions of the right half of the colon, the standard treatment is right-sided hemicolectomy with the formation of the primary ileaocolonic anastomosis. Currently, modern minimally invasive methods that allow temporary colon decompression and subsequent surgery with a primary anastomosis, significantly reducing mortality, the incidence of complications, and improving the social and labor rehabilitation of patients, are promising for lesions of the left colon. At the same time, the lack of comparative data regarding the effectiveness of various temporary methods of decompression of the colon in acute obturation colonic obstruction determines the relevance of the development of this area.

REFERENCES

1. Ferlay J., Shin H.R., Bray F., et al. Estimates of worldwide burden of cancer in 2008: GLOBOCAN 2008. *Int J Cancer*. 2010; 127(12): 2893–2917. PMID: 21351269. DOI: 10.1002/ijc.25516.
2. Kaprin A.D., Starinskiy V.V., Petrova G.V., eds. *Malignant neoplasms in Russia 2015 (Morbidity and mortality)*. Moscow: MNIOI im PA Gertsena — filial FGBU NMIRTS Minzdrava Rossii Publ., 2017. 250 p. (In Russian).
3. Kızıltan R., Yılmaz Ö., Aras A., et al. Factors affecting mortality in emergency surgery in cases of complicated colorectal cancer. *Med Glas (Zenica)*. 2016; 13(1): 62–67. DOI: 10.17392/831-16.
4. Yaitskiy N.A., Sedov V.M., Vasil’yev S.V. Colon tumors. Moscow: MEDpress-inform Publ., 2004. 376 p. (In Russian).
5. Teloken P.E. Spilsbury K., Levitt M., et al. Outcomes in patients undergoing urgent colorectal surgery. *ANZ J Surg*. 2014; 84(12): 960–964. PMID: 26191078. DOI: 10.1111/ans.12580.
6. Runkel N.S., Hinz U., Lehnert T., et al. Improved outcome after emergency surgery for cancer of the large intestine. *Br J Surg*. 1998; 85(9): 1260–5. PMID: 9752872.
7. Kim J.S., Hur H., Min B.S., et al. Oncologic outcomes of self-expanding metallic stent insertion as a bridge to surgery in the management of left-sided colon cancer obstruction: Comparison with nonobstructing elective surgery. *World J Surg*. 2009; 33(6): 1281–1286. PMID: 19363580. DOI: 10.1007/s00268-009-0007-5.
8. Gainant A. Emergency management of acute colonic cancer obstruction. *J Visc Surg*. 2012; 149(1): e3–e10. PMID: 22189474. DOI: 10.1016/j.jviscsurg.2011.11.003.
9. Teixeira F., Akaishi E.H., Ushinohama A.Z., et al. Can we respect the principles of oncologic resection in an emergency surgery to treat colon cancer? *World J Emerg Surg*. 2015; (10): 5. PMID: 26191078. DOI: 10.1186/1749-7922-10-5.
10. Frago R., Biondo S., Millan M., et al. Differences between proximal and distal obstructing colonic cancer after curative surgery. *Colorectal Dis*. 2011; 13(6): 116–122. PMID: 21564463. DOI: 10.1111/j.1463-1318.2010.02549.x.
11. Ansaloni L., Andersson R.E., Bazzoli F., et al. Guidelenines in the management of obstructing cancer of the left colon: consensus conference of the world society of emergency surgery (WSES) and peritoneum and surgery (PnS) society. *World J Emerg Surg*. 2010; (5): 29. PMID: 21189148. DOI: 10.1186/1749-7922-5-29.
12. Breitenstein S., Rickenbacher A., Berdajs D., et al. Systematic evaluation of surgical strategies for acute malignant left-sided colonic obstruction. *Br J Surg*. 2007; 94(12): 1451–1460. PMID: 17968980. DOI: 10.1002/bjs.6007.

13. Finan P.J., Campbell S., Verma R., et al. The Management of Malignant Large Bowel Obstruction: ACPGBI Position Statement. *Colorectal Dis*. 2007; 9 (Suppl 4): 1–17. PMID: 2007458420. DOI: 10.1111/j.1463-1318.2007.01371.x.
14. Cuffy M., Abir F., Audisio R.A., Longo W.E. Colorectal cancer presenting as surgical emergencies. *Surgical Oncology*. 2004; 13(2–3): 149–157. PMID: 15572097. DOI: 10.1016/j.suronc.2004.08.002.
15. Trompetas V. Emergency management of malignant acute left-sided colonic obstruction. *Ann R Coll Surg Engl*. 2008; 90(3): 181–186. PMID: 18430330. DOI: 10.1308/003588408X285757.
16. Amelung F.J., de Beaufort H.W., Siersema P.D., et al. Emergency resection versus bridge to surgery with stenting in patients with acute right-sided colonic obstruction: a systematic review focusing on mortality and morbidity rates. *Int J Colorectal Disease*. 2015; 30(9): 1147–1155. PMID: 25935448. DOI: 10.1007/s00384-015-2216-8.
17. Öistämö E., Hjern F., Blomqvist L., et al. Emergency management with resection versus proximal stoma or stent treatment and planned resection in malignant left-sided colon obstruction. *World J Surg Oncol*. 2016; 14(1): 232. PMID: 27577887. DOI: 10.1186/s12957-016-0994-2.
18. Tan C.J., Dasari B.V., Gardiner K. Systematic review and meta-analysis of randomized clinical trials of self-expanding metallic stents as a bridge to surgery versus emergency surgery for malignant left-sided large bowel obstruction. *Br J Surg*. 2012; 99(4): 469–476. PMID: 22261931. DOI: 10.1002/bjs.8689.
19. Boyle D.J., Thorn C., Saini A., et al. Predictive factors for successful colonic stenting in acute large-bowel obstruction: A 15-year cohort analysis. *Dis Colon Rectum*. 2015; 58(3): 358–362. PMID: 25664716. DOI: 10.1097/DCR.0000000000000243.
20. Guo M., Feng Y., Liu J.Z., et al. Factors associated with mortality risk for malignant colonic obstruction in elderly patients. *BMC Gastroenterology*. 2014; (14): 76. PMID: 24735084. DOI: 10.1186/1471-230X-14-76.
21. Pomazkin V.I. The analysis of postoperative complications in the recovery stage of two-stage treatment of malignant colonic obstruction. *Annaly khirurgii*. 2016; 21(3): 193–198. (In Russian).
22. Malakhov Yu.P., Lysenko M.V. Reconstructive operations on colonic left part after radical interventions for its 20 tumoral obstruction. *Voyenno-meditsinskiy zhurnal*. 2006; (8): 20–26. (In Russian).
23. Gataullin I.G., Khalikov M.M. Analysis of short and long-term results of reconstructive- restorative phase after the operations like hartmann. *Koloproktologiya*. 2016; 1(55): 22–25. (In Russian).
24. Cherkes V.L. Reconstructive surgery as a method of rehabilitation of patients with colostomy. In: *Colorectal cancer: collection*. Moscow: ONTS im NN Blokhina RAMN Publ. 2000: 4–7. (In Russian).
25. Sprangers M.A.,Taal B.G., Aaronson N.K., et al. Quality of life in colorectal cancer. Stoma vs. nonstoma patients. *Dis Colon Rectum*. 1995; 38(4): 361–369. PMID: 7720441.
26. Hennekinne-Mucci S., Tuech J.J., Bréhant O., et al. Emergency subtotal/total colectomy in the management of obstructed left colon carcinoma. *Int J Colorectal Dis*. 2006; 21(6): 538–541. PMID: 16228180. DOI: 10.1007/s00384-005-0048-7.
27. Torralba J.A., Robles R., Parrilla P., et al. Subtotal colectomy vs. intraoperative colonic irrigation in the management of obstructed left colon carcinoma. *Dis Colon Rectum*. 1998; 41(1): 18–22. PMID: 9580083.
28. Ravo B., Metwally N., Castera P., et al. The importance of intraluminal anastomotic fecal contact and peritonitis in colonic anastomotic leakages. An experimental study. *Dis Colon Rectum*. 1988; 31(11): 868–871. PMID: 3180959.
29. Guenaga K.K., Matos D., Wille-Jorgensen P. Mechanical bowel preparation for elective colorectal surgery. *Cochrane Database Syst Rev*. 2009; 1: CD001544. PMID: 19160198 DOI: 10.1002/14651858.CD001544.pub3.
30. Kam M.H., Tang C.L., Chan E., et al. Systematic review of intraoperative colonic irrigation vs. manual decompression in obstructed left-sided colorectal emergencies. *Int J Col Dis*. 2009; 24(9): 1031–1037. PMID: 19415306. DOI: 10.1007/s00384-009-0723-1.
31. Ortiz H., Biondo S., Ciga M.A., et al. Comparative study to determine the need for intraoperative colonic irrigation for primary anastomosis in left-sided colonic emergencies. *Colorectal Dis*. 2009; 11(6): 648–652. PMID: 18624813. DOI: 10.1111/j.1463-1318.2008.01617.x.
32. Slim K., Vicaut E., Panis Y., Chipponi J. Meta-analysis of randomized clinical trials of colorectal surgery with or without mechanical bowel preparation. *Br J Surg*. 2004; 91(9): 1125–1130. PMID: 15449262. DOI: 10.1002/bjs.4651.
33. Pugayev A.V., Achkasov E.E. *Obturation tumor colonic obstruction*. Moscow: Profil' Publ., 2005. 224 p. (In Russian).
34. Osipov V.A., Abdulayev MA., Avdeyev A.M., et al. Results of surgical treatment of patients with the colorectal cancer complicated by intestinal impassability and bleeding. *Vestnik Sankt-Peterburgskogo universiteta*. 2014; (3): 104–117. (In Russian).
35. Kuwai T., Yamaguchi T., Imagawa H., et al. Factors related to difficult self-expandable metallic stent placement for malignant colonic obstruction: A post-hoc analysis of a multicenter study across Japan. *Digestive Endoscopy*. 2018; 0–2. PMID: 30113095. DOI: 10.1111/den.13260.
36. Schoonbeek P.K., Genzel P., Van Den Berg H., et al. Outcomes of Self-Expanding Metal Stents in Malignant Colonic Obstruction are Independent of Location or Length of the Stenosis: Results of a Retrospective, Single-Center Series. *Digestive Surgery*. 2018; 3(35): 230–235. PMID: 28810253. DOI: 10.1159/000477821.
37. Gevers A.M., Macken E., Hiele M., Rutgeerts P. Endoscopic laser therapy for palliation of patients with distal colorectal carcinoma: analysis of factors influencing long-term outcome. *Gastrointest. Endosc*. 2000; 51(5): 580–585. PMID: 10805846.
38. Courtney E.D., Raja A., Leicester R.J. Eight years experience of high-powered endoscopic diode laser therapy for palliation of colorectal carcinoma. *Dis Colon Rectum*. 2005; 48(4): 845–850. PMID: 15747077. DOI: 10.1007/s10350-004-0833-3.
39. Kuz'min-Krutetskiy M.I., Belyayev A.M., Degtyarev D.B., Dvoretskiy S.YU. Endoscopic recanalization of a tumour of the colon complicated by acute intestinal obstruction. *Meditsinskiy akademicheskiy zhurnal*. 2007; (3 Suppl 10): 282–283. (In Russian).
40. Dvoretskiy S.Yu., Belyayev A.M. The possibilities of non-standard approaches to the treatment of acute colonic obstruction. Meditsinskiy akademicheskiy zhurnal. 2007; (3 Suppl 10): 270–271. (In Russian).
41. Sinev Yu.V., Kovanev A.V., Pakhomova G.V. Role of endoscopy in the therapeutic and diagnostic process in acute colonic obstruction. *Acute surgical diseases of the abdominal cavity. Abstracts of the Plenum of the USSR AMS Commission and the all-Union conference on emergency surgery*. Rostov-on-Don. 1991; 122–123. (In Russian).
42. Sinev Yu.V., Kovanev A.V., Pakhomova G.V. Endoscopic examination in acute colonic obstruction. *Khirurgiya*. 1987; (3): 27–30. (In Russian).
43. Xu M., Zhong Y., Yao L., et al. Endoscopic decompression using a transanal drainage tube for acute obstruction of the rectum and left colon as a bridge to curative surgery. *Colorectal Dis*. 2009; 11(4): 405–409. PMID: 18513190. DOI: 10.1111/j.1463-1318.2008.01595.x.
44. Yamada T., Shimura T., Sakamoto E., et al. Preoperative drainage using a transanal tube enables elective laparoscopic colectomy for obstructive distal colorectal cancer. *Endoscopy*. 2013; 45(4): 265–271. PMID: 23322477. DOI: 10.1055/s-0032-1326030.
45. Zhang N., Zhou Z.L., Xie J.L. Application of transanal ileus tube in acute obstructive left-sided colorectal cancer. *Int J Clin Exp Med*. 2015; 8(8): 14024–14029. PMID: 26550362.
46. Shigeta K., Baba H., Yamafuji K., et al. Outcomes for Patients with Obstructing Colorectal Cancers Treated with One-Stage Surgery Using Transanal Drainage Tubes. *J Gastrointese Surg*. 2014; 18(8): 1507–1513. PMID: 24871080. DOI: 10.1007/s11605-014-2541-1.
47. Dohmoto M., Hünerbein M., Schlag P.M. Application of rectal stents for palliation of obstructing rectosigmoid cancer. *Surg Endosc*. 1997; 11(7): 58–61. PMID: 9214327.
48. Khot U.P., Lang A.W., Murali K., et al. Systematic review of the efficacy and safety of colorectal stents. *Br J Surg*. 2002; 9(89): 1096–1102. PMID: 12190673. DOI: 10.1046/j.1365-2168.2002.02148.x.
49. Sebastian S., Johnston S., Geoghegan T., et al. Pooled analysis of the efficacy and safety of self-expanding metal stenting in malignant colorectal obstruction. *Am J Gastroenterol*. 2004; 10 (99): 2051–2057. PMID: 15447772. DOI: 10.1111/j.1572-0241.2004.40017.x.
50. Saito S., Yoshida S., Isayama H., et al. A prospective multicenter study on self-expandable metallic stents as a bridge to surgery for malignant colorectal obstruction in Japan: efficacy and safety in 312 patients. *Surg Endosc*. 2016; 9 (30): 3976–3986. PMID: 26684205. DOI: 10.1007/s00464-015-4709-5.
51. Alcántara M., Serra-Aracil X., Falko J., et al. Prospective, controlled, randomized study of intraoperative colonic lavage versus stent placement in obstructive left-sided colonic cancer. *World J Surg*. 2011; 35(8): 1904–1910. PMID: 21559998. DOI: 10.1007/s00268-011-1139-y.
52. Cheung H.Y., Chung C.C., Tsang W.W., et al. Endolaparoscopic approach vs conventional open surgery in the treatment of obstructing left-sided colon cancer: a randomized controlled trial. *Arch Surg*. 2009; 144(12): 1127–1132. PMID: 20026830. DOI: 144/12/1127 [pii]\r10.1001/archsurg.2009.216.

53. Ghazal A.H.A., El-Shazly W.G., Bessa S.S., et al. Colonic Endolumenal Stenting Devices and Elective Surgery Versus Emergency Subtotal/Total Colectomy in the Management of Malignant Obstructed Left Colon Carcinoma. *J Gastrointest Surg*. 2013; 17(6): 1123–1129. PMID: 23358847. DOI: 10.1007/s11605-013-2152-2.
54. Ho K.S., Quah H.M., Lim .JF., et al. Endoscopic stenting and elective surgery versus emergency surgery for left-sided malignant colonic obstruction: A prospective randomized trial. *Int J Colorect Dis*. 2012; 27(3): 355–362. PMID: 22033810. DOI: 10.1007/s00384-011-1331-334.
55. van Hooft J.E., Bemelman W.A., Oldenburg B., et al. Colonic stenting versus emergency surgery for acute left-sided malignant colonic obstruction: A multicentre randomised trial. *Lancet Oncol*. 2011; 12(4): 344–352. PMID: 21398178. DOI: 10.1016/S1470-2045(11)70035-31.
56. Pirlet I.A., Slim K., Kwiatkowski F., et al. Emergency preoperative stenting versus surgery for acute left-sided malignant colonic obstruction: A multicenter randomized controlled trial. *Surg Endoscop*. 2011; 25(6): 1814–1821. PMID: 21170659. DOI: 10.1007/s00464-010-1471-6.
57. Dastur J.K., Forshaw M.J., Modarai B., et al. Comparison of short-and long-term outcomes following either insertion of self-expanding metallic stents or emergency surgery in malignant large bowel obstruction. *Tech Coloproctol*. 2008; 12 (1): 51–55. PMID: 18512013. DOI: 10.1007/s10151-008-0399-5.
58. Kavanagh D.O., Nolan B., Judge C., et al. A comparative study of short- and medium-term outcomes comparing emergent surgery and stenting as a bridge to surgery in patients with acute malignant colonic obstruction. *Dis Colon Rectum*. 2013; 56(4): 433–440. PMID: 23478610. DOI: 10.1097/DCR.0b013e3182760506.
59. Tilney H.S., Lovegrove R.E., Purkayastha S., et al. Comparison of colonic stenting and open surgery for malignant large bowel obstruction. *Surg Endoscop*. 2007; 21(2): 225–233. PMID: 17160651. DOI: 10.1007/s00464-005-0644-1.
60. Kim H.J., Choi G.S., Park J.S., et al. Higher rate of perineural invasion in stent-laparoscopic approach in comparison to emergent open resection for obstructing left-sided colon cancer. *Int J Cololorectal Dis*. 2013; 28(3): 407–414. PMID: 22885839. DOI: 10.1007/s00384-012-1556-x.

Received on 12.10.2018

Accepted on 26.11.2018