



Citation article: Kubrak, M., Zavgorodnii, S., & Danilyk, M. The use of laparoscopic technologies in the treatment of patients with complicated forms of colon cancer. *Futur Med* [Internet]. 2025;4(3): 23-29. Available from: <https://doi.org/10.57125/FEM.2025.09.30.02>

The Use of Laparoscopic Technologies in the Treatment of Patients with Complicated Forms of Colon Cancer

Mykhailo Kubrak^{1*}, Serhiy Zavgorodnii¹, Mykhailo Danilyk¹

¹Zaporizhzhia State Medical and Pharmaceutical University, Zaporizhzhia, Ukraine

Abstract

Aim of the study. To analyze the outcomes of using laparoscopic methods in the treatment of patients with complicated forms of malignant colon diseases.

Materials and Methods. A prospective cohort study included 109 (100 %) patients with complicated forms of colon cancer. 74 (67.89 %) patients had tumor-induced acute intestinal obstruction (AIO); 21 (19.27 %) had tumor perforation; 6 (5.50 %) had acute gastrointestinal bleeding (GIB); 3 (2.75 %) had both AIO and perforation; and 5 (4.59 %) had both AIO and bleeding.

Results. Emergency surgeries were performed in 18 (16.51 %) patients, urgent surgeries in 17 (15.60 %), and delayed surgeries in 74 (67.89 %). Laparoscopic techniques were used in 31 (28.44 %) cases. In 71 (65.13 %) patients, laparotomy was performed. Postoperative complications occurred in 6 (19.35 %) laparoscopic cases, compared to 32 (41.03 %) laparotomy cases ($p = 0.0286$). Wound complications (seromas, hematomas, infiltrates, infections, dehiscence) were more frequent in the laparotomy group – 17 (21.79 %) vs. 1 (3.23 %) in the laparoscopic group ($p = 0.0083$). Mortality was 5 (16.13 %) in the laparoscopic group and 18 (23.08 %) in the laparotomy group ($p = 0.3781$). Average hospital stay: 10.00 (8.00; 13.00) days for laparoscopy vs. 19.00 (13.00; 27.00) days for laparotomy ($p = 0.0011$).

Conclusions. Laparoscopic surgery methods can be applied in treating all types of complicated colon cancer. This type of surgery reduced postoperative complications and hospital stay in research group.

Keywords: colon cancer; complication; laparoscopy; surgery

Received: May 3, 2025

Revised: May 19, 2025

Accepted: August 2, 2025

Published: August, 27, 2025

Introduction

Malignant diseases of the colon rank among the leading oncological pathologies in Ukraine and worldwide [1 - 3].

In Ukraine, there is a negative trend in terms of screening detection of colon cancer (CC), resulting in every second patient with this pathology undergoing surgery at the stage of complicated disease progression [4, 5].

* **CONTACT:** braviorio@gmail.com

DOI: <https://doi.org/10.57125/FEM.2025.09.30.02>

With such a high frequency of occurrence, this formidable complication also has a high level of postoperative mortality, which is 42.0 - 57.0% [6, 7].

This explained primarily by the fact that most patients with this pathology are elderly and senile and have a number of concomitant somatic diseases, which often decompensate against the background of the course of complications [8-10].

Given this, most doctors prefer emergency surgery, the main goal of which is to eliminate intestinal obstruction and save the patient's life, without taking into account the possibilities of radical surgical treatment [11, 12].

However, these operations give negative both early postoperative and long-term results of the treatment of colon cancer - the level of perioperative complications and mortality remains consistently high, and survival rates are extremely low [13, 14].

Laparoscopic treatment methods have taken a leading place among scheduled oncological surgeries for patients with CC. However, despite numerous recommendations developed by leading global associations of emergency surgeons (World Society of Emergency Surgery) and oncologists (National Comprehensive Cancer Network), the possibility of using minimally invasive laparoscopic techniques in the treatment of patients with complicated forms of colon cancer remains debated [15, 16].

Therefore, studies aimed at assessing the feasibility and safety of using these methods in the treatment of patients with complicated forms of CC are relevant in today's urgent surgery and oncological surgery.

Aim of the study

To analyse the outcomes of using laparoscopic methods in the treatment of patients with complicated forms of malignant colon diseases.

Materials and Methods

A prospective cohort study was conducted at the surgical departments of the Municipal Emergency and Ambulance Hospital and the Municipal Hospital No. 7 in Zaporizhzhia between 2020 and 2023. The study group included 109 (100 %) patients with complicated forms of colon cancer.

The gender structure of the group showed a predominance of female patients – 57 (52.29 %), while males accounted for 52 (47.71 %). The mean age of the patients was 69.78 ± 16.37 years.

The inclusion criteria in the study were: age over 18 years, presence of malignant disease of the colon with one of the complications (perforation, intestinal obstruction, intestinal bleeding) or a combination of these conditions, and consent to participate in the study.

The exclusion criteria were: age under 18 years, presence of malignant disease of the rectum with complications, presence of synchronous cancer of another location, refusal to participate in the study, participation in another study, and death before the time of surgery.

Upon hospitalisation, patients were examined according to existing protocols for the diagnosis and treatment of complicated colorectal cancer. Diagnostic methods included abdominal and retroperitoneal ultrasound, chest and abdominal X-ray, colonoscopy, and contrast-enhanced abdominal CT. Laboratory diagnostics included complete blood and urine tests, blood biochemistry, and coagulation profile.

At the time of hospitalisation, all 109 (100 %) patients were assessed using the qSOFA (Quick Sequential Organ Failure Assessment) scale [11]. If the score was < 2 , the condition was considered stable with a low risk of preoperative mortality. A score ≥ 2 indicated a critical condition with high mortality risk, prompting minimal diagnostic efforts and immediate treatment.

In terms of tumor localization: cecal tumors were found in 13 (11.93 %) patients; ascending colon – 12 (11.01 %); hepatic flexure – 8 (7.34 %); transverse colon – 4 (3.67 %); splenic flexure – 2 (1.83 %); descending colon – 12 (11.01 %); sigmoid colon – 43 (39.45 %); rectosigmoid junction – 13 (11.93 %), figure 1.

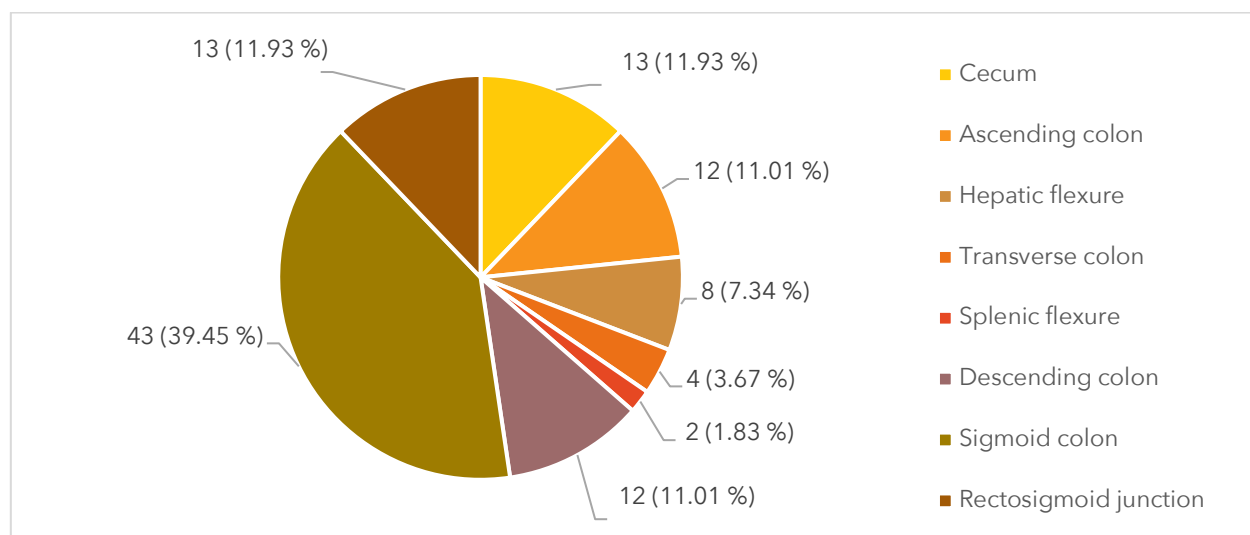


Figure 1. Structure of malignant colon diseases in the study group by localization, n = 109

Among complications: 74 (67.89 %) patients had tumor-induced acute intestinal obstruction (AIO); 21 (19.27 %) had tumor perforation; 6 (5.50 %) had acute gastrointestinal bleeding (GIB); 3 (2.75 %) had both AIO and perforation; and 5 (4.59 %) had both AIO and bleeding.

Preoperative examination and preparation followed a comprehensive perioperative strategy for managing patients with complicated CC [17].

Statistical analysis was carried out using STATISTICA 13.0 (TIBCO Software Inc.) and MICROSOFT EXCEL 2013. Data are presented as mean $\pm$ standard deviation ($M \pm m$) for normally distributed data and median Me (Q1; Q3) for non-normally distributed data. Differences between groups were evaluated using the Mann-Whitney U test. A result was considered statistically significant at $p < 0.05$.

Results

Emergency surgeries were performed in 18 (16.51 %) patients, urgent surgeries in 17 (15.60 %), and delayed surgeries in 74 (67.89 %).

Laparoscopic techniques were used in 31 (28.44 %) cases: 19 (25.68 %) with AIO, 7 (29.17 %) with perforation, and 5 (45.45 %) with GIB.

In 71 (65.13%) patients, laparotomy was performed; 7 (6.42%) laparoscopic procedures were converted to open surgery due to technical limitations. Among these, 55 (74.32%) had AIO, 17 (70.83%) had perforation, and 6 (54.55%) had GIB.

Among laparoscopic cases: 24 (77.42 %) were primarily radical operations, 5 (16.13 %) were palliative, and 2 (6.45 %) were symptomatic surgeries.

Colostomies were created in 6 (16.13 %) patients. A small-to-large bowel anastomosis was performed in 4 (12.90%) cases, and a large-to-large bowel anastomosis in 22 (70.97%) cases. To protect the primary anastomosis, 7 (22.58 %) patients received a temporary ileostomy, which was closed within 2 – 3 weeks.

Among 78 (71.56 %) laparotomy patients, 38 (48.72 %) had primarily radical surgeries ($U = 19.5$; $p = 0.0169$); 31 (39.74 %) had palliative ($U = 42.0$; $p = 0.0432$); and 9 (11.54 %) had symptomatic ($U = 54.5$; $p = 0.0602$).

Colostomies were performed in 23 (29.49 %) of these patients ($U = 51.0$; $p = 0.0491$). Small-to-large bowel anastomosis – 11 (14.10 %) ($U = 183.0$; $p = 0.6279$); large-to-large – 44 (56.41 %) ($U = 120.5$; $p = 0.3981$); protective ileostomies – 19 (24.36 %) ($U = 278.0$; $p = 0.7378$), table 1.

Table 1. Comparison of laparoscopic and open surgical interventions in the study group by main indicators, n = 109

Nº	Indicator	Laparoscopic operations, n = 31	Laparotomy operations, n = 78	p
1.	Radical operations	24 (77.42 %)	38 (48.72 %)	0.0169
2.	Palliative operations	5 (16.13 %)	31 (39.74 %)	0.0432
3.	Symptomatic operations	2 (6.45 %)	9 (11.54 %)	0.0602
4.	Colostomy	6 (16.13 %)	23 (29.49 %)	0.0491
5.	Enterocolic anastomosis	4 (12.90 %)	11 (14.10 %)	0.6279
6.	Colonocolic anastomosis	22 (70.97 %)	44 (56.41 %)	0.3981
7.	Protective ileostomy	7 (22.58 %)	19 (24.36 %)	0.7378

Postoperative complications occurred in 6 (19.35 %) laparoscopic cases, compared to 32 (41.03 %) laparotomy cases ($U = 37.5$; $p = 0.0286$).

Wound complications (seromas, hematomas, infiltrates, infections, dehiscence) were more frequent in the laparotomy group – 17 (21.79 %) vs. 1 (3.23 %) in the laparoscopic group ($U = 19.0$; $p = 0.0083$).

The overall complication structure was similar between groups, table 2.

Table 2. Comparison of laparoscopic and open surgical interventions in the study group by complications, n = 109

Nº	Indicator	Laparoscopic operations, n = 31	Laparotomy operations, n = 78	p
1.	Wound complications	1 (3.23 %)	17 (21.79 %)	0.0083
2.	Overall complications	5 (16.12 %)	15 (19.24 %)	0.7326

Mortality was 5 (16.13 %) in the laparoscopic group and 18 (23.08 %) in the laparotomy group ($U = 134.0$; $p = 0.3781$).

Average hospital stay: 10.00 (8.00; 13.00) days for laparoscopy vs. 19.00 (13.00; 27.00) days for laparotomy ($U = 9.5$; $p = 0.0011$).

Discussion

Complicated forms of colon cancer remain a pressing and unresolved surgical and oncological challenge [18].

The widespread adoption and improvement of endoscopic techniques have transformed them from purely diagnostic tools into therapeutic-diagnostic complexes, capable of resolving some complications of colon cancer without surgery. This approach facilitates optimal preparation for one-stage radical surgery [19, 20].

The widespread use of laparoscopic technologies has made it possible to perform primary radical surgery even in complicated forms of colorectal cancer with minimal trauma to the patient, which allows for faster postoperative rehabilitation of patients, quicker return to work, fewer complications and the earliest possible initiation of specific treatment for the pathology - chemotherapy [22, 23].

Numerous studies emphasise that the presence of complications of malignant colon disease does not affect the long-term prognosis for patient survival. The primary criterion is the performance of oncological radical surgery, which can be achieved even in cases of complicated tumour forms [24].

Lygre KB, with coauthors, in a study involving 273 patients, indicates that postoperative complications occurred in 42.8% of patients treated with open surgery and 38.4% of patients treated using laparoscopic surgery, $p = 0.3720$. There were no grade IV or V Clavien-Dindo complications, and no reoperations due to anastomotic leakages [25].

Li YS with coauthors in systematic review and meta-analysis of 26 studies involving a total number of 3410 participants shows that the open resection was associated with a shorter length of surgery (MD: 48.63, 95% CI: 30.15-67.12; $p = 0.00001$) whereas laparoscopic intervention was associated with a shorter hospital stay [MD (-3.09), 95% CI [-5.82 to (-0.37)]; $p = 0.03$]. Their analysis also showed 30-day re-admission and re-operation, and mortality to be similar between laparoscopic and open surgery for right colonic carcinoma resection. However, surgical wound infection (RR: 0.65, 95% CI: 0.50-0.86; $p = 0.002$) was significantly higher in patients undergoing open surgery. In conclusion, they say that laparoscopic surgery was almost comparable to open surgery in terms of post-operative outcomes for right-sided colonic cancer resection and was not associated with higher unwanted outcomes [26].

Podda M, with coauthors, made a systematic review and meta-analysis of 24 observational studies (21 retrospective and 3 prospective cohort studies), analysing a total of 18 123 patients: 9024 received laparoscopic colectomy and 9099 underwent open surgery. In their analysis laparoscopic colectomy was associated with lower rates of mortality (RR 0.48, 95 % CI 0.41 to 0.56; $p < 0.001$; $I^2 = 0$ %, fixed-effect model; QoE moderate) and complications (RR 0.61, 95 % CI 0.49 to 0.76; $p < 0.001$; $I^2 = 20$ %, random-effects model; QoE very low) compared with an open procedure [27].

Our findings confirm the advantages of laparoscopy over laparotomy and support its inclusion in treating complicated colon cancer with proper patient selection and adequate preoperative preparation.

Conclusions

1. Laparoscopic surgery methods can be applied in treating all types of complicated colon cancer.
2. The use of laparoscopic technologies reduces postoperative complications, especially wound-related ones (seromas, hematomas, infiltrates, infections, dehiscence) from 21.79 % to 3.23 %, $p = 0.0083$.
3. Laparoscopic operations significantly reduce hospital stay from 19.00 (13.00; 27.00) days to 10.00 (8.00; 13.00) days, $p = 0.0011$.

Prospects for further research

The comparative analysis of the results of the use of laparoscopic techniques for the surgical treatment of patients with complicated forms of colon cancer compared to laparotomies made it possible to indicate the advantages of laparoscopic operations clearly. Expanding the indications for the use of minimally invasive methods will significantly improve the long-term treatment outcomes for patients in this category.

Author Contributions

Kubrak M. A., PhD, Associate Professor, Department of General Surgery and Postgraduate Surgical Education, ZSMPhU. Research concept development, data collection and processing, and article writing. ORCID ID: 0000-0003-4051-9336.

Zavhorodnii S. M., Doctor of Medical Sciences, Professor, Head of the Department. Participation in article concept development and manuscript editing. ORCID ID: 0000-0003-3082-3406.

Danyliuk M. B., Candidate of Medical Sciences, Associate Professor. Text editing. ORCID ID: 0000-0003-4515-7522.

Data Availability Statement

The data presented in this study are available on request from the corresponding author. The data are not publicly available due to privacy.

Funding

Funding information is not available.

Institutional Review Board Statement

The study was conducted in accordance with the Declaration of Helsinki and approved by the Institutional Review Board (or Ethics Committee) of the Zaporizhzhia State Medical and Pharmaceutical University (protocol # 2163 from 04/05/2025).

Informed Consent Statement

Informed consent was obtained from all subjects involved in the study

Conflicts of Interest

The author declares that there is no conflict of interests regarding the publication of this manuscript. In addition, the ethical issues, including plagiarism, informed consent, misconduct, data fabrication and/or falsification, double publication and/or submission, and redundancies have been completely observed by the authors

Reference

1. Sung H, Ferlay J, Siegel RL, Laversanne M, Soerjomataram I, Jemal A, Bray F. Global Cancer Statistics 2020: GLOBOCAN Estimates of Incidence and Mortality Worldwide for 36 Cancers in 185 Countries. *CA Cancer J Clin*. 2021 May;71(3):209-249. <https://doi.org/10.3322/caac.21660>
2. Sharma R, Abbasi-Kangevari M, Abd-Rabu R, Abidi H, Abu-Gharbieh E, Acuna JM, Adhikari S, Advani SM, Afzal MS, Aghaie Meybodi M, Ahinkorah BO, Ahmad S, Ahmadi A, Ahmadi S, Ahmed H, Ahmed LA, Ahmed MB, Al Hamad H, Alahdab F, Alanezi FM, Alanzi TM, Alhalaiqa FA, Alimohamadi Y, Alipour V, Aljunid SM, Alkhayat M, Almustanyir S, Al-Raddadi RM, Alvand S, Alvis-Guzman N, Amini S, Ancuceanu R, Anoushiravani A, Anoushirvani AA, Ansari-Moghaddam A, Arabloo J, Aryannejad A, Asghari Jafarabadi M, Athari SS, Ausloos F, Ausloos M, Awedew AF, Awoke MA, Ayana TM, Azadnajafabad S, Azami H, Azangou-Khyavy M, Azari Jafari A, Badiye AD, Zoladl M. Global, regional, and national burden of colorectal cancer and its risk factors, 1990-2019: a systematic analysis for the Global Burden of Disease Study 2019. *Lancet Gastroenterol Amp Hepatol [Internet]*. Apr. 2022 [Cite 30 Jul. 2025]. Available on: [https://doi.org/10.1016/s2468-1253\(22\)00044-9](https://doi.org/10.1016/s2468-1253(22)00044-9)
3. Fedorenko ZP, Hulak LO, Mykhaylovykh YUY. Rak v Ukraini, 2018 – 2019. *Zakhvoryuvani, smertnist', pokaznyky diyal'nosti onkologichnoyi sluzhby. Byuleten' natsional'noho kantser-reyestru Ukrainy [Internet]*. Oct. 2020 [Cite 30 Jul. 2025];21. Available on: http://www.ncru.inf.ua/publications/BULL_21/index.htm
4. Gutierrez CS, Passos SC, Castro SM, Okabayashi LS, Berto ML, Lorenzen MB, Caumo W, Stefani LC. Few and feasible preoperative variables can identify high-risk surgical patients: derivation and validation of the Ex-Care risk model. *Br J Anaesth*. Oct. 2020;126:525-32. <https://doi.org/10.1016/j.bja.2020.09.036>
5. GBD 2019 Diseases and Injuries Collaborators. Global burden of 369 diseases and injuries in 204 countries and territories, 1990-2019: a systematic analysis for the Global Burden of Disease Study. *Lancet*. 2020;396:1204-22. [https://doi.org/10.1016/S2468-1253\(22\)00044-9](https://doi.org/10.1016/S2468-1253(22)00044-9)
6. Jesinghaus M, Schmitt M, Lang C, Reiser M, Scheiter A, Konukiewicz B, Weichert W. Morphology matters. *American Journal of Surgical Pathology*. 2021;45(7):969-78. <https://doi.org/10.1097/pas.0000000000001692>
7. Bielikova IV, Khorosh MV, Radchenko NR, Lyakhova NA. STATE OF ORGANIZATION OF PROVIDING ONCOLOGICAL MEDICAL CARE TO THE POPULATION OF UKRAINE. *Pol Merkur Lekarski*. 2023;51(6):638-645. <https://doi.org/10.36740/Merkur202306110>
8. Biondo S, Gálvez A, Ramírez E, Frago R, Kreisler E. Emergency surgery for obstructing and perforated colon cancer: patterns of recurrence and prognostic factors. *Tech Coloproctol*. 2019 Dec;23(12):1141-1161. <https://doi.org/10.1007/s10151-019-02110-x>
9. Benson AB, Venook AP, Al-Hawary MM, Arain MA, Chen YJ, Ciombor KK, Cohen S, Cooper HS, Deming D, Farkas L, Garrido-Laguna I, Grem JL, Gunn A, Hecht JR, Hoffe S, Hubbard J, Hunt S, Johung KL, Kirilcuk N, Krishnamurthi S, Messersmith WA, Meyerhardt J, Miller ED, Mulcahy MF, Nurkin S, Overman MJ, Parikh A, Patel H, Pedersen K, Saltz L, Schneider C, Shibata D, Skibber JM, Sofocleous CT, Stoffel EM, Stotsky-Himelfarb E, Willett CG, Gregory KM, Gurski LA. Colon Cancer, Version 2.2021, NCCN Clinical Practice Guidelines in Oncology. *J Natl Compr Canc Netw*. 2021 Mar 2;19(3):329-359. <https://doi.org/10.6004/jnccn.2021.0012>
10. Pavlidis ET, Galanis IN, Pavlidis TE. Management of obstructed colorectal carcinoma in an emergency setting: An update. *World J Gastrointest Oncol*. 2024 Mar 15;16(3):598-613. <https://doi.org/10.4251/wjgo.v16.i3.598>
11. Itonaga S, Hamada S, Ihara E, Honma H, Fukuya H, Ookubo A, Sasaki T, Yoshimura D, Nakamuta M, Sumida Y, Harada N. Importance of preoperative total colonoscopy and endoscopic resection after self-expandable metallic stent placement for obstructive colorectal cancer as a bridge-to-surgery. *BMC Gastroenterol*. 2023 Jul 24;23(1):251. <https://doi.org/10.1186/s12876-023-02888-z>
12. Spannenburg L, Sanchez Gonzalez M, Brooks A, Wei S, Li X, Liang X, Gao W, Wang H. Surgical outcomes of colonic stents as a bridge to surgery versus emergency surgery for malignant colorectal obstruction: A systematic review and meta-analysis of high quality prospective and randomised controlled trials. *Eur J Surg Oncol*. 2020 Aug;46(8):1404-1414. <https://doi.org/10.1016/j.ejso.2020.04.052>
13. Balciscueta I, Balciscueta Z, Uribe N, García-Granero E. Perineural invasion is increased in patients receiving colonic stenting as a bridge to surgery: a systematic review and meta-analysis. *Tech Coloproctol*. 2021 Feb;25(2):167-176. <https://doi.org/10.1007/s10151-020-02350-2>

14. Russo S, Conigliaro R, Coppini F, Dell'Aquila E, Grande G, Pigò F, Mangiafico S, Lupo M, Marocchi M, Bertani H, Cocca S. Acute left-sided malignant colonic obstruction: Is there a role for endoscopic stenting? *World J Clin Oncol*. 2023 May 24;14(5):190-197. <https://doi.org/10.5306/wjco.v14.i5.190>
15. Vogel JD, Felder SI, Bhamra AR, Hawkins AT, Langenfeld SJ, Shaffer VO, Thorsen AJ, Weiser MR, Chang GJ, Lightner AL, Feingold DL, Paquette IM. The American Society of Colon and Rectal Surgeons Clinical Practice Guidelines for the Management of Colon Cancer. *Dis Colon Rectum*. 2022 Feb 1;65(2):148-177. <https://doi.org/10.1097/DCR.0000000000002323>
16. Argilés G, Tabernero J, Labianca R, Hochhauser D, Salazar R, Iveson T, Laurent-Puig P, Quirke P, Yoshino T, Taieb J, Martinelli E, Arnold D; ESMO Guidelines Committee. Electronic address: clinicalguidelines@esmo.org. Localised colon cancer: ESMO Clinical Practice Guidelines for diagnosis, treatment and follow-up. *Ann Oncol*. 2020 Oct;31(10):1291-1305. <https://doi.org/10.1016/j.annonc.2020.06.022>
17. Kubrak MA, Zavgorodniy SM, Danylyuk MB, Chemerys YuO. A comprehensive individualized approach to the treatment of patients with acute intestinal obstruction of tumor origin. *Ukrainian Journal of Clinical Surgery*. 2025;92(1):27-30. <https://doi.org/10.26779/2786-832X.2025.1.27>
18. van Hoof JE, Veld JV, Arnold D, Beets-Tan RGH, Everett S, Götz M, van Halsema EE, Hill J, Manes G, Meisner S, Rodrigues-Pinto E, Sabbagh C, Vandervoort J, Tanis PJ, Vanbiervliet G, Arezzo A. Self-expandable metal stents for obstructing colonic and extracolonic cancer: European Society of Gastrointestinal Endoscopy (ESGE) Guideline - Update 2020. *Endoscopy*. 2020 May;52(5):389-407. <https://doi.org/10.1055/a-1140-3017>
19. Otani K, Kawai K, Hata K, Tanaka T, Nishikawa T, Sasaki K, Kaneko M, Muroto K, Emoto S, Nozawa H. Colon cancer with perforation. *Surg Today*. 2019 Jan;49(1):15-20. <https://doi.org/10.1007/s00595-018-1661-8>
20. Gosavi R, Chia C, Michael M, Heriot AG, Warriar SK, Kong JC. Neoadjuvant chemotherapy in locally advanced colon cancer: a systematic review and meta-analysis. *Int J Colorectal Dis*. 2021 Oct;36(10):2063-2070. <https://doi.org/10.1007/s00384-021-03945-3>
21. Aliseda D, Arredondo J, Sánchez-Justicia C, Alvarellos A, Rodríguez J, Matos I, Rotellar F, Baixauli J, Pastor C. Survival and safety after neoadjuvant chemotherapy or upfront surgery for locally advanced colon cancer: meta-analysis. *Br J Surg*. 2024 Jan 31;111(2):znae021. <https://doi.org/10.1093/bjs/znae021>
22. Huijts DD, Dekker JWT, van Bodegom-Vos L, van Groningen JT, Bastiaannet E, Marang-van de Mheen PJ. Differences in organization of care are associated with mortality, severe complication and failure to rescue in emergency colon cancer surgery. *Int J Qual Health Care*. 2021 Mar 11;33(1):mzab038. doi: 10.1093/intqhc/mzab038
23. Degett TH, Dalton SO, Christensen J, Søgaard J, Iversen LH, Gögenur I. Mortality after emergency treatment of colorectal cancer and associated risk factors-a nationwide cohort study. *Int J Colorectal Dis*. 2019 Jan;34(1):85-95. <https://doi.org/10.1007/s00384-018-3172-x>
24. Seo SY, Kim SW. Endoscopic Management of Malignant Colonic Obstruction. *Clin Endosc*. 2020 Jan;53(1):9-17. <https://doi.org/10.5946/ce.2019.051>
25. Lygre KB, Eide GE, Forsmo HM, Dicko A, Storli KE, Pfeffer F. Complications after open and laparoscopic right-sided colectomy with central lymphadenectomy for colon cancer: randomized controlled trial. *BJS Open*. 2023 Jul 10;7(4):zrad074. <https://doi.org/10.1093/bjsopen/zrad074>
26. Li YS, Meng FC, Lin JK. Procedural and post-operative complications associated with laparoscopic versus open abdominal surgery for right-sided colonic cancer resection: A systematic review and meta-analysis. *Medicine (Baltimore)*. 2020 Oct 2;99(40):e22431. <https://doi.org/10.1097/MD.00000000000022431>
27. Podda M, Pisanu A, Morello A, Segalini E, Jayant K, Gallo G, Sartelli M, Coccolini F, Catena F, Di Saverio S. Laparoscopic versus open colectomy for locally advanced T4 colonic cancer: meta-analysis of clinical and oncological outcomes. *Br J Surg*. 2022 Mar 15;109(4):319-331. <https://doi.org/10.1093/bjs/znab464>