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RESEARCH

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Priority dissecting of the inferior mesenteric artery combined with complete medial approach: a novel laparoscopic approach for left-sided colon cancers

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Abstract

Purpose To explore the application effect of the technique of "priority dissecting of the inferior mesenteric artery combined with complete medial approach (IMA-CMA)" in laparoscopic left-sided colon cancer radical resection.

Methods A total of 99 patients who underwent laparoscopic left-sided colon cancer radical resection with splenic flexure mobilization between September 2021 to May 2023 were included. Sixty-eight of these patients were analyzed after propensity score matching (PSM). The perioperative characteristics were compared.

Results Among these enrolled patients, 45 underwent the traditional approach, and 54 underwent IMA-CMA approach. After PSM, the patients were matched to include 34 patients in each group, with no significant differences in the sex ($p=0.618$) or location of tumor ($p=0.798$) between the two groups. The patients in IMA-CMA group had shorter operating time ($p=0.032$), less intraoperative blood loss ($p=0.003$), a higher number of harvested lymph nodes ($p=0.044$) and center group lymph nodes($p=0.037$), and a shorter postoperative hospital stay ($p=0.011$). Number of positive lymph nodes and postoperative complications were not significantly different between the two groups.

Conclusions The technique of IMA-CMA for splenic flexure mobilization is safe and feasible. It can reduce operating time, intraoperative blood loss and postoperative hospital stay, which is conducive to achieving a thorough D3 lymphadenectomy without increasing the incidence of perioperative complications.

Keywords Left-sided colon cancer, Laparoscopic colon cancer radical resection, Priority dissecting of the inferior mesenteric artery, Complete medial approach, Splenic flexure mobilization

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Introduction

Laparoscopic left-sided colon cancer radical resection is primarily employed for the treatment of tumors located in the splenic flexure of colon, descending colon, and proximal segment of the sigmoid colon. Numerous factors impact the difficulty of surgery, with research suggesting that mobilization of the splenic flexure independently predicts longer operative times in laparoscopic left-sided colon cancer radical resection [1]. Splenic flexure mobilization is independently associated with an increased risk of splenic injury, which contributes to elevated short-term and long-term mortality risks in patients [2]. The crucial aspect of radical surgery is complete mesocolic excision (CME) with central vascular ligation and the Japanese D3 lymphadenectomy [3–6]. For tumors located in descending colon and sigmoid-descending junction, the lymph node dissection range includes the central lymph node group (No.253) at the root of the inferior mesenteric artery (IMA) [7]. In cases of cancer in the left half of the transverse colon or in the splenic flexure of colon, in addition to IMA root lymph node dissection, it is imperative to perform dissection of lymph nodes (No.223) at the root of the middle colic artery (MCA) [3].Therefore, for laparoscopic left-sided colon cancer radical resection, ensuring the safety of splenic flexure mobilization and maintaining the quality of lymph nodes dissection are both crucial.

Currently, traditional surgical approaches for laparoscopic left-sided colon cancer radical resection include the medial approach, lateral approach, anterior approach, and various combinations of these methods. Due to variations in anatomical understanding, many teams propose the combined application of multiple approaches, each demonstrating a certain level of safety and feasibility. Naoki Matsumura et al. employed the lateral-medial approach to address the left-sided transverse mesocolon and the medial–lateral approach for the left mesocolon [8]. Yu-Jen Hsu et al. applied standardized 4-step technique of laparoscopic left hemicolectomy, ligation vessel pedicle—retroperitoneal dissection—mobilization of lateral attachment of bowel—bowel anastomosis, [9]. Besides, Tarek S. Hany et al. proposed the extraperitoneal approach which can identify important structures behind the peritoneum early in the procedure [10].

Based on the understanding of anatomy and surgical experience, our team has made a series of improvements of the trocar layout and surgical steps of laparoscopic left-sided colon cancer radical resection, including three key techniques: (1) the "3–1-1" trocar layout; (2) IMA prioritized ligation under the perspective as laparoscopic rectal surgery; (3) complete medial approach (CMA) for splenic flexure mobilization. Consequently, our team labels this approach for laparoscopic left hemicolectomy as "priority dissecting of the IMA combined with complete medial approach" (IMA-CMA).

In this study, the short-term outcomes of IMA-CMA technique is compared with the traditional approach (TA) in laparoscopic left-sided colon cancer radical resection. The goal is to offer a new, optimized, and reproducible surgical procedure for less common left-sided colon tumors.

Patients and methods

Patients

The initiation of this study obtained ethical approval from the institutional review board of the medical units where the patients originated. Clinical data were collected from patients undergoing laparoscopic D3 lymphadenectomy surgery for left-sided colon cancer with splenic flexure mobilization in the same treatment group at the Cancer Hospital, Chinese Academy of Medical Sciences and Peking University First Hospital from September 2021 to May 2023. The exclusion criteria are as follows: (1) emergency surgery for acute intestinal obstruction or intestinal perforation; (2) patients in cT4b stage undergoing surgery involving combined visceral resection; (3) individuals undergoing palliative surgical resection.The flow chart of screening patients is shown in Fig. 1.This study was approved by the Medical Ethics Review Panel of the Cancer Hospital of the Chinese Academy of Medical Sciences (ethics no. NCC-1973939). The agreement of all participants was obtained and the Declaration of Helsinki was adhered to.

Among these, 99 patients finally enrolled in this study, categorized into the IMA-CMA group and the TA group based on the different surgical approaches. Diverse clinicopathological parameters, including sex, age, body mass index (BMI), preoperative bowel obstruction, history of abdominal surgery, location of the tumor, diameter of the tumor were collected. We also recorded perioperative outcomes, including the operating time, intraoperative blood loss, number of harvested lymph nodes, number of positive lymph nodes, number of central group lymph nodes, postoperative complications which were defined as grade II or above according to the Clavien-Dindo classification and postoperative hospital stay. To achieve intergroup comparability, we conducted propensity score matching (PSM) for patients based on the above baseline data in a 1:1 ratio, with a caliper set at 0.2.

Surgical procedures

All surgical procedures (the TA group and the IMA-CMA group) were performed by the same team with extensive experience in laparoscopic colorectal cancer surgery. After general anesthesia induction, patients were

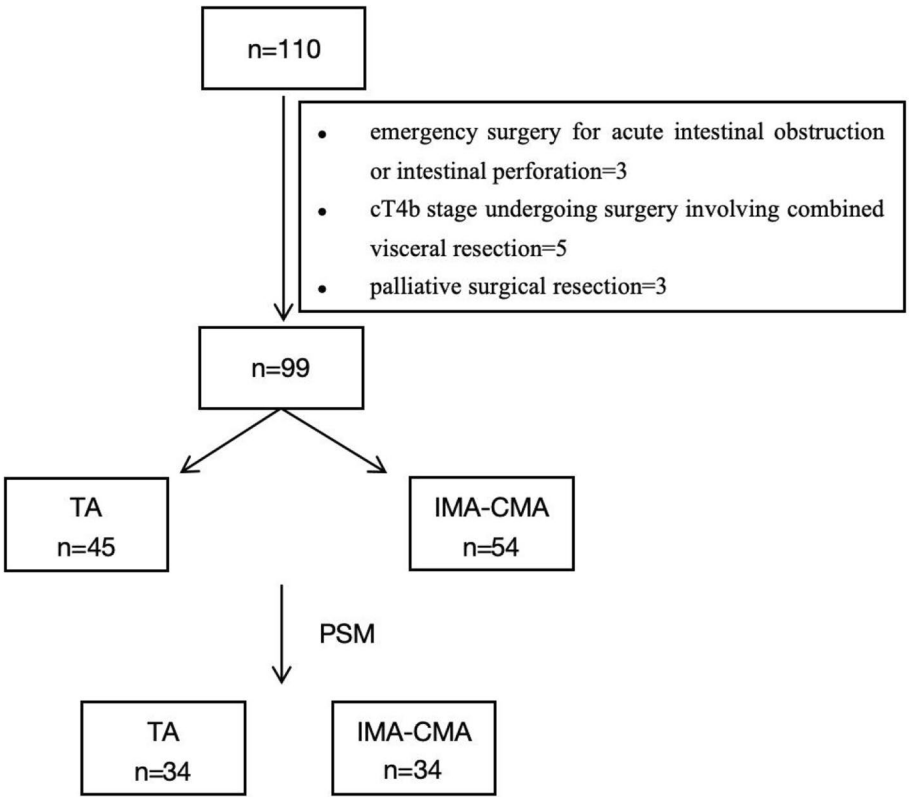

Fig. 1 Flow chart of selected patients

positioned in the modified Lloyd-Davis position, inclined 15° to the right.

In the TA group, trocars were arranged using the "2–1–2" method, with the surgeon on the right, the assistant on the left, and the camera holder on the caudal side (Fig. 2A,C). The inferior mesenteric vein was first ligated at the base of the lower margin of the pancreas, the left Toldt fascia space was expanded from the medial to the lateral and from the head to the caudal side, and the IMA branch or trunk and the starting part of IMV were ligated. 253 groups of lymph nodes were dissected, the sigmoid colon was freed, the lateral peritoneum of the descending colon was incised to the splenic flexure of the colon, the left gastrocolic ligament and the left transverse mesocolon were severed to the splenic flexure of the colon, and the splenic flexure of the colon was "wrapped" in three directions from "middle—lateral—cephalic" (Fig. 3). The method was combined with the principle of local membrane anatomy of splenic flexure, and a total of 3 times were entered into the omental sac: (1) The first time was entered into the omental sac: into the left Toldt's space, 253 groups lymph nodes were dissected, and the transverse mesocolic root was severed; (2) The second entry into the omental sac: the gastrocolic ligament is severed; (3) Enter the omental sac for the third time: cut the Toldt white line of the descending colon from bottom to bottom, cut the left lateral peritoneum, and sever the diaphragmatic colic ligament and splenic ligament. From the inner, upper and outer three ways to finally complete the spleen flexure free. (Fig. 4)

In the IMA-CMA group, trocars were placed using the "3–1-1" method. During the mobilization of the rectum and sigmoid colon, the patient was placed in the Trendelenburg position with a 15-degree head-down tilt. When mobilizing the left half of the colon (including the splenic flexure), the patient was placed in the reverse Trendelenburg position with a 15-degree head-up tilt (Fig. 2 B).

The trocars were placed as follows: Trocar A was located 2 cm below the costal margin along the right midclavicular line. Trocar B was 7 cm to the right of the umbilical level. Trocar C was 2 cm medial to the right anterior superior iliac spine, Trocar D was positioned above the umbilical ring, and Trocar E was 7 cm to the left of the umbilical level (Fig. 2B). The surgeon was on the patient's right, the assistant on the left, and the camera holder on the cranial side (Fig. 2D).Following the perspective of laparoscopic rectal surgery, the root of the IMA was exposed and D3 lymph nodes dissection was performed with Trocar B, C, D and E. For tumors at the splenic flexure, the left colonic artery (LCA) was

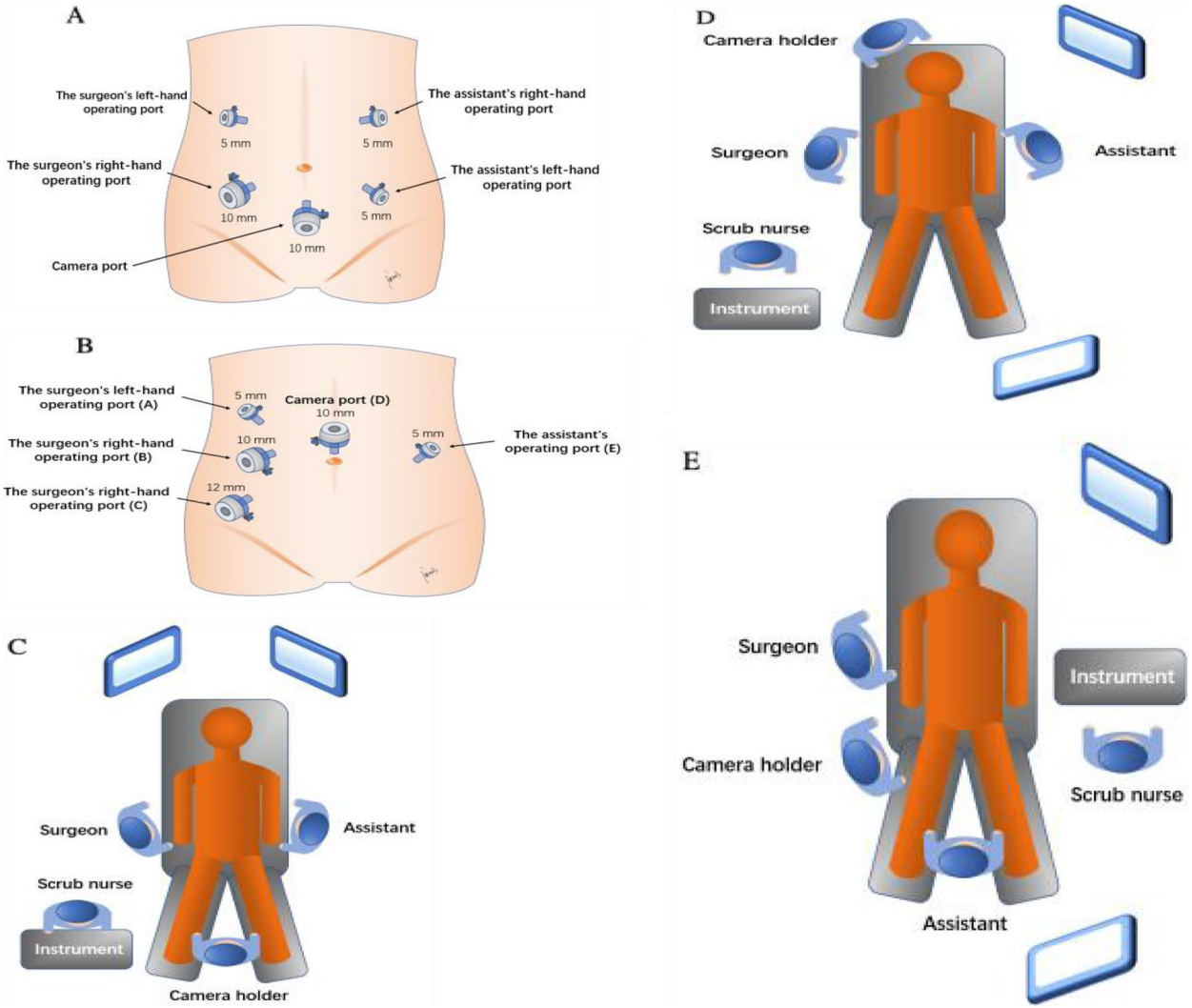

Fig. 2 Trocar layout and surgeon position diagram of TA and IMA-CMA group**. A** Trocar layout diagram of TA group. **B** Trocar layout diagram of IMA-CMA group. **C** Schematic diagram of the surgeon's position in TA group. **D** Schematic diagram of the surgeon's position in IMA-CMA group during the process of submesenteric vessels. **E** Schematic diagram of the surgeon's position in IMA-CMA group during mobiling splenic flexure

ligated. For tumors in the middle and lower segments of the descending colon, the LCA and sigmoid artery were ligated, or the root of the IMA was ligated. In cases of proximal tumors in the sigmoid colon, the LCA and sigmoid arteries were ligated, preserving the main stem of the IMA. Following that, the congenital adhesions of sigmoid colon were mobilized and the descending colon was partially dissected, with the sigmoid mesocolon trimmed to 10 cm distal to the tumor.

Afterwards, the patient was shifted to the reverse Trendelenburg position while maintaining the right tilt. In this arrangement, the assistant was positioned on the caudal side, and the camera holder and surgeon were together on the patient's right side (Fig. 2E). Trocar B served as the surgeon's right-hand operating port, Trocar A as the surgeon's left-hand operating port, Trocar E as the assistant's right-hand operating port, and Trocar C as the assistant's left-hand operating port. With the assistant raising the left transverse mesocolon and IMA stump cranially to reveal the Treitz ligament and the left boundary of the descending mesocolon, the transverse mesocolon was incised along the upper margin of the Treitz ligament to enter the omental bursa, revealing the posterior wall of the stomach and the pancreas. Then Toldt's space was extended laterally to the left abdominal wall and cranially to the inferior margin of the pancreas. The inferior mesenteric vein (IMV) was ligated at the inferior pancreatic margin. Along the middle colonic artery (MCA), the

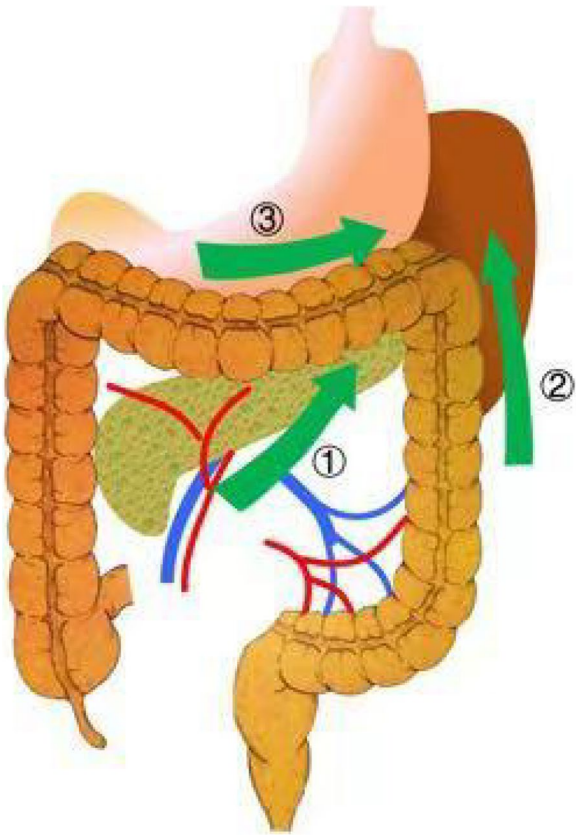

Fig. 3 The surgical procedure diagram of TA group

central lymph nodes of MCA were dissected, with the left branch ligated. Incising the splenocolic ligament from the medial side, the splenic inferior pole was revealed. Then, the paracolic recess was mobilized caudally to join the previous surgical plane. Using the pancreas as an anatomical landmark, the transverse mesocolon was incised rightwards to reach the splenic flexure of the colon, which was eventually mobilized through a complete medial approach, fully exposing the mesenteric bed of the left colon and the lower edge of the pancreatic body and tail. At this point, only the greater omentum was connected to the left colon. After the gastrocolic ligament was incised, dissection continued along the gastroepiploic vascular arch, achieving complete mobilization of splenic flexure. Caution should be taken to avoid damaging the main branch of the left gastroepiploic vessel, since the ligation of the colonic branches towards the splenic flexure is sufficient (Fig. 3). The anastomosis method (laparoscopic anastomosis or extracorporeal anastomosis through an auxiliary incision) depends on the remaining lengths of the sigmoid colon and rectum.

Outcome measures

Intraoperative conditions: operating time, intraoperative blood loss, splenic bleeding events, number of total harvested lymph nodes, number of central group lymph nodes and number of positive lymph nodes.

Postoperative recovery: postoperative hospital stay, occurrence of Clavien-Dindo grade II or above postoperative complications.

Propensity score matching

Because of the retrospective nature of the study, some baseline characteristics of patients significantly differed between IMA-CMA group and TA group, including sex and location of the tumor. To minimize such differences, we applied propensity score matching (PSM). Propensity scores were calculated for each patient with bivariate logistic regression based on the covariates. The propensity scores were used to match patients in the IMA-CMA approach group with patients in the TA group at a 1:1 ratio. We applied the nearest available Mahalanobis metric matching within calipers defined by the propensity score (caliper = 0.2).

Statistical analysis

IBM SPSS Statistics 27 (IBM, Inc., Armonk, NY) was used to perform statistical analyses. For normally distributed quantitative data, mean and standard deviation ($x \pm s$) were used, and between-group comparisons were performed using independent sample t-test. Skewed distributed quantitative data were represented as medians and quartiles (Q_L, Q_U), and between-group comparisons were conducted using the Mann–Whitney U test. Count data were presented as frequencies and percentages, and between-group comparisons were performed using $\chi 2$ test, corrected $\chi 2$ test, or Fisher's exact test. Differences with a P-value < 0.05 were considered statistically significant.

Results

Patient and tumor characteristics before and after PSM

Ninety-nine patients underwent laparoscopic left-sided colon cancer radical resection with splenic flexure mobilization. The clinicopathologic characteristics of 54 patients using the IMA-CMA approach were compared with 45 patients in the TA group. Patients in both groups successfully underwent surgery without conversion to open surgery, and there were no perioperative deaths in either group. Before PSM, the IMA-CMA group included higher proportions of males ($p = 0.005$) and more patients with tumors located above the splenic flexure ($p = 0.026$). After PSM, no significant differences were identified between the two groups, and the patients were well matched (Table 1).

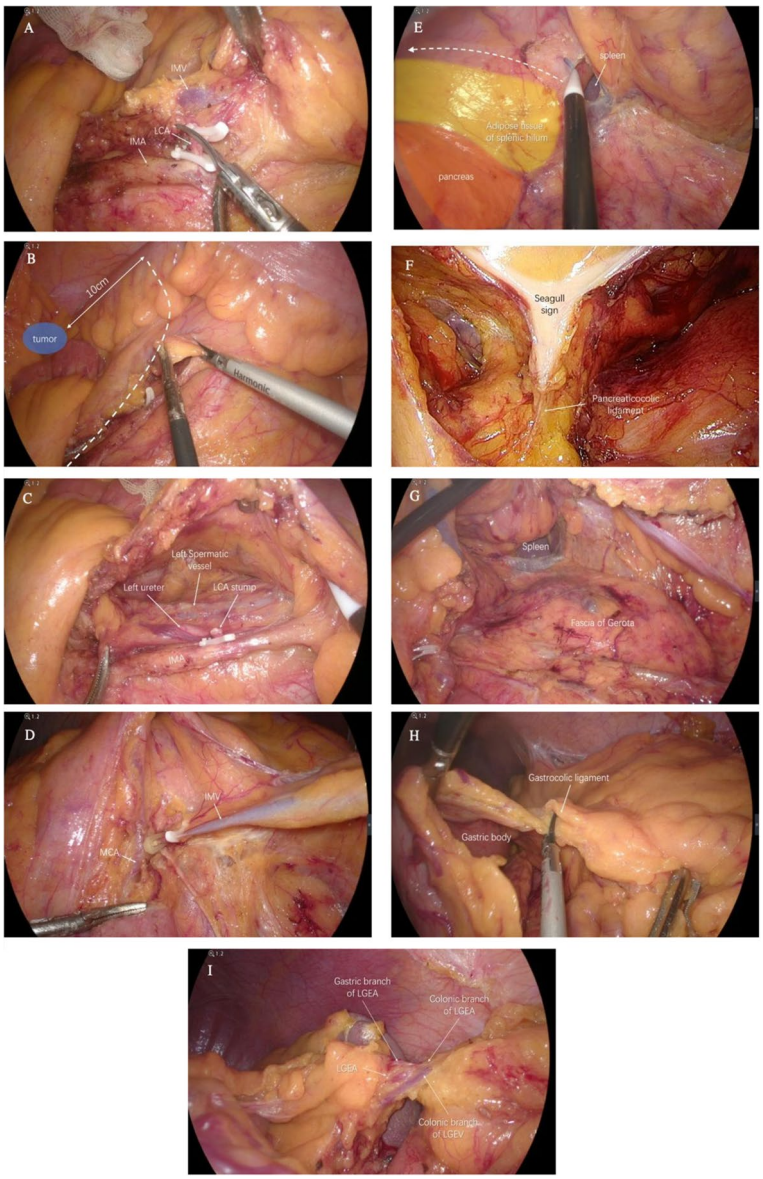

Fig. 4 The main procedure of laparoscopic left-sided colon cancer radical resection with IMA-CMA**. A** Ligate LCA,dissect central group lymph nodes and selectively preserve superior rectal artery. **B** Nake distal bowel duct. **C** Expand the left Toldt gap. **D** High ligate IMV. **E** Dissociate along the the lower margin of pancreas and expose the lower pole of the spleen. **F** Incise the left colon pancreas ligament. **G** Visual field after splenic flexion mobilization by medial approach**. H**. Incise the left gastrocolic ligament. **I** Ligate the left branch of the gastroepiploic vessels

Perioperative outcomes

Compared to the TA group, the IMA-CMA group exhibited significantly less operation time (240.5 min vs. 197.5 min, $p=0.032$), intraoperative blood loss (100 ml vs. 30 ml, $p=0.003$), shorter postoperative hospital stay (9 d vs. 7 d, $p=0.011$), more number of harvested lymph nodes (16 vs. 19, $p=0.044$) and center group lymph nodes(1 vs. 2, $p=0.037$). One case of splenic bleeding occurred in the TA group. Both TA group and IMA-CMA group experienced 4 cases of Clavien-Dindo grade II or higher postoperative complications, all of which were improved with conservative treatment. In TA group, 3 of the 4 cases complications were intestinal obstruction, and the other was abdominal infection. The IMA-CMA group had 2 cases of intestinal obstruction. There were no statistically significant differences between the two groups in the rates of postoperative complications (all $p>0.05$), as shown in Table 2.

Table 1 Clinicopathologic characteristics of patients before and after PSM

	before PSM			after PSM		
	TA (45)	IMA-CMA (54)	*p*	TA (34)	IMA-CMA (34)	*p*
Male sex, no. (%)	21(46.7%)	40(74.1%)	0.005*	20(58.8%)	22(64.7%)	0.618
Age > 60yrs,no. (%)	28(62.2%)	27(50.0%)	0.223	21(61.8%)	21(61.8%)	> 0.999
BMI > 25kg/m^2,no. (%)	19(42.2%)	24(44.4%)	0.555	16(47.1%)	12(35.3%)	0.324
Preoperative intestinal obstruction, no.(%)	36(80.0%)	49(90.7%)	0.219	29(85.3%)	30(88.2%)	0.720
History of abdominal operation,no.(%)	30(66.7%)	41(75.9%)	0.420	25(73.5%)	24(70.6%)	0.787
loction of tumor, no.(%)			0.026*			0.798
above splenic flexure of colon	21(46.7%)	14(25.9%)		11(32.4%)	13(38.2%)	
descending colon	16(35.6%)	18(33.3%)		15(44.1%)	15(44.1%)	
proximal segment of sigmoid colon	8(17.8%)	22(40.7%)		8(23.5%)	6(17.6%)	
Diameter of tumor > 5 cm,no.(%)	8(17.8%)	12(22.2%)	0.583	6(17.6%)	8(23.5%)	0.549

* indicates *p* value < 0.05, with statistical difference

Table 2 Perioperative outcomes of patients after PSM

	TA(34)	IMA-CMA(34)	*p*
Operation time/min	240.5(187.8,280.5)	197.5(164.3,226.3)	0.032*
Intraoperative blood loss/ml	100(50.0,102.5)	30.0(20.0,100.0)	0.003*
Number of harvested lymph node	16(11,20)	19(13,24)	0.044*
Number of positive lymph nodes/n	3.00(1.25,5.75)	3.50(1.00,5.75)	0.711
Number of central group lymph nodes/n	1.0(1.0,2.0)	2.0(1.0,2.0)	0.037*
Splenic bleeding/n	1	0	> 0.999
Postoperative complication/n			
Intestinal obstruction	3	2	> 0.999
Abdominal infection	1	0	> 0.999
Postoperative hospital stay/days	9(7,11)	7(5,11)	0.011*

* indicates *p* value < 0.05, with statistical difference

Discussion

Compared to colorectal cancers in other locations, the incidence of left-sided colon cancer is lower, leading to inadequate understanding of its anatomical structure and bias on surgical approaches, creating certain blind spots, and resulting in limited clinical research [11]. Laparoscopic left hemicolectomy requires the mobilization of the splenic flexure and the descending colon. Due to the close relationship between the splenic flexure of colon and the pancreas and spleen, incidents of splenic bleeding, pancreatic injury, and the need for conversion to open surgery are not uncommon. For advanced tumors, D3 lymphadenectomy of the middle colonic vessels or IMA is also necessary [1, 2, 12]. Therefore, our team has systematically improved the surgical technique of laparoscopic left hemicolectomy and proposed the "priority anatomy of the inferior mesenteric artery under the perspective of laparoscopic rectal surgery combined with complete medial approach" technique for mobilizing the splenic flexure.

Different from traditional approaches that involve placing two trocars on each side of the abdomen, we employ the "3–1-1" trocar layout method, placing three trocars on the right abdomen and one trocar on the left abdomen. Traditional approaches to mobilizing the splenic flexure may have some limitations, and various factors during surgery may impact the treatment outcome. Cassar et al. summarized and analyzed relevant literature, finding that the incidence of splenic injury in left hemicolectomy with splenic flexure mobilization is 1% to 8%, which is a significant factor leading to the conversion to open surgery during laparoscopic procedures [13]. The application effectiveness of medial, lateral, and anterior approaches in splenic flexure mobilization was compared by Benseler et al. [14]. For the medial approach, separation of residual adhesions between the greater omentum

and transverse colon may require combination of the lateral approach. A major technical drawback of the lateral approach lies in the surgical difficulties due to the curvature of splenic flexure and adhesions between the colon and the spleen. Despite better visualization of the pancreas and the spleen with the anterior approach, it may affect the surgical exposure due to the hypertrophic greater omentum in obese patients or transverse colon diverticula. Other approaches include the complete central approach and omental sac approach, which involve initial manipulation of the transverse mesocolon on the pancreatic surface, posing challenges in cases with obesity and mesenteric thickening, which may lead to inadvertent damage to adjacent vessels and organs. Compared to these traditional approaches, the surgeons who use the IMA-CMA approach can utilize the upper two trocars on the right abdomen, which brings the operating position closer to the splenic flexure during the mobilization. This approach avoids difficulties in mobilizing the splenic flexure caused by the low location of main operating port, and facilitates the procedure to reduce secondary injuries caused by traction or tearing, especially splenic injuries.

Literature reports indicate that a thorough D3 lymphadenectomy can effectively reduce the risk of tumor recurrence and metastasis. In traditional laparoscopic left hemicolectomy, differences in trocar layout and the laparoscopic perspective can lead to challenges in dissecting IMA branches and increased difficulty in D3 lymphadenectomy. However, under the perspective of laparoscopic rectal surgery which is more familiar to surgeons, it is feasible to proficiently dissect IMA branches with targeted preservation which contributes to an effective clearance of center group lymph nodes, and operation time can be reduced. In this study, the number of both harvested lymph nodes and center group lymph were increased in the IMA-CMA group, which revealed the advantage of IMA-CMA technique in the thoroughness of D3 lymphadenectomy. Besides, following the handling of IMA branches, the IMA-CMA approach facilitates the elevation of the transverse mesocolon and the opening of the descending mesocolon, allowing for convenient dissection and ligation of the IMV below the pancreatic margin.. As a comparison, in traditional approaches, when attempting to ligate the IMV during the initial phase, surgeons need to struggle to provide sufficient tension, which leads to blocked blood reflux, local congestion, bleeding during the procedure, and increased intraoperative blood loss.

Following the ligation of the mesentery vessels, dissection continues upwards and leftwards along the previously separated Toldt's space, which constitutes the key step in the "complete medial approach" for mobilizing the splenic flexure proposed by our team. Traveling along the correct anatomical plane within Toldt's space, this approach allows upward mobilization to the lower margin of the pancreas, the attachment site of the transverse mesocolon posterior leaf, and leftward and upward mobilization to the splenic flexure, revealing the splenic inferior pole as a landmark. The pancreaticocolic ligament is subsequently incised near the surface of the pancreas, exposing the lower margin of the pancreatic body and the mesenteric bed of the left colon. We believe that this approach decreases patient position adjustments and avoids the repeated manipulation of the greater omentum and transverse colon. By focusing on a clear anatomical plane during dissection, it also minimizes inadvertent injuries to the greater omentum and the splenocolic ligament. The results of this study indicate that the IMA-CMA group exhibited lesser median intraoperative blood loss and shorter postoperative hospital stays. Furthermore, patients in the IMA-CMA group did not experience spleen bleeding events.

In terms of surgical safety, Benseler et al. summarized clinical data from 303 patients undergoing splenic flexure mobilization, primarily using the middle-to-lateral approach. They found that 13.2% of patients experienced intraoperative complications such as abdominal bleeding and splenic injuries, while 16.2% encountered postoperative complications during the perioperative period, including bleeding, anastomotic leakage, and intestinal obstruction [14]. In our study, using the "complete medial approach" for splenic flexure mobilization in left-sided colon cancer radical surgery, the incidence of Clavien-Dindo II or higher complications was 5.9% (2/34), including two cases of intestinal obstruction. All cases were successfully managed with conservative treatment, and no anastomotic leakage occurred, demonstrating a relatively ideal level of surgical safety.

Conclusion

In conclusion, the "priority dissection of the IMA under perspective of laparoscopic rectal surgery combined with complete medial approach" for splenic flexure mobilization exhibits a relatively ideal level of safety and effectiveness. The handling of the left colon vessel root and the clearance of lymph nodes at the IMA root are convenient under the perspective of laparoscopic rectal surgery, offering advantages in terms of reducing operation time, intraoperative bleeding and postoperative hospital stay, and increasing the amount of harvested lymph nodes compared to traditional approaches.

Limitation

The limitations of this article lie in the small sample size and retrospective study. The surgical effectiveness of IMA-CMA needs to be confirmed by larger sample sizes, more surgical teams, and randomized controlled studies.

Supplementary Information

The online version contains supplementary material available at https://doi.org/10.1186/s12957-025-03652-1.

Supplementary Material 1.

Acknowledgements
Not applicable.

Authors' contributions
All authors contributed to the study conception and design. Material preparation, data collection and analysis were performed by YHW and GH. The first draft of the manuscript was written by YHW, GH and BT. All authors commented on previous versions of the manuscript. Critical revision of manuscript was made by JQT. All authors read and approved the final manuscript.

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Data availability
The data that support the findings of this study are available on request from the corresponding author, Jianqiang Tang, upon reasonable request.

Declarations

Ethics approval and consent to participate
This study was approved by the Medical Ethics Review Panel of the Cancer Hospital of the Chinese Academy of Medical Sciences (ethics no. NCC-1973939). The agreement of all participants was obtained and the Declaration of Helsinki was adhered to.

Consent for publication
All authors of the manuscript have read and agreed to its content and are accountable for all aspects of the accuracy and integrity of the manuscript in accordance with ICMJE criteria.

Competing interests
The authors declare no competing interests.

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References

1. Akiyoshi T, Kuroyanagi H, Oya M, Ueno M, Fujimoto Y, Konishi T, Yamaguchi T. Factors affecting difficulty of laparoscopic surgery for left-sided colon cancer. Surg Endosc. 2010;24(11):2749–54. https://doi.org/10.1007/s00464-010-1039-5.
2. Wang JK, Holubar SD, Wolff BG, Follestad B, O'Byrne MM, Qin R. Risk factors for splenic injury during colectomy: a matched case-control study. World J Surg. 2011;35(5):1123–9. https://doi.org/10.1007/s00268-011-0994-x.
3. Hohenberger W, Weber K, Matzel K, Papadopoulos T, Merkel S. Standardized surgery for colonic cancer: complete mesocolic excision and central ligation–technical notes and outcome. Colorectal disease : the official journal of the Association of Coloproctology of Great Britain and Ireland. 2009;11(4):354–65. https://doi.org/10.1111/j.1463-1318.2008.01735.x.
4. West NP, Sutton KM, Ingeholm P, Hagemann-Madsen RH, Hohenberger W, Quirke P. Improving the quality of colon cancer surgery through a surgical education program. Dis Colon Rectum. 2010;53(12):1594–603. https://doi.org/10.1007/DCR.0b013e3181f433e3.
5. West NP, Hohenberger W, Weber K, Perrakis A, Finan PJ, Quirke P. Complete mesocolic excision with central vascular ligation produces an oncologically superior specimen compared with standard surgery for carcinoma of the colon. Journal of clinical oncology : official journal of the American Society of Clinical Oncology. 2010;28(2):272–8. https://doi.org/10.1200/JCO.2009.24.1448.
6. Kobayashi H, West NP, Takahashi K, Perrakis A, Weber K, Hohenberger W, Quirke P, Sugihara K. Quality of surgery for stage III colon cancer: comparison between England, Germany, and Japan. Ann Surg Oncol. 2014;21(Suppl 3):S398–404. https://doi.org/10.1245/s10434-014-3578-9.
7. Bertelsen CA, Kirkegaard-Klitbo A, Nielsen M, Leotta SM, Daisuke F, Gögenur I. Pattern of Colon Cancer Lymph Node Metastases in Patients Undergoing Central Mesocolic Lymph Node Excision: A Systematic Review. Dis Colon Rectum. 2016;59(12):1209–21. https://doi.org/10.1097/DCR.0000000000000658.
8. Matsumura N, Tokumura H, Saijo F, Katayose Y. Strategy of laparoscopic surgery for colon cancer of the splenic flexure: a novel approach. Surg Endosc. 2018;32(5):2559. https://doi.org/10.1007/s00464-017-5870-9.
9. Hsu YJ, Chern YJ, Jhuang JR, Tsai WS, Chiang JM, Hung HY, Tsai TY, You JF. Efficient and Safe Method for Splenic Flexure Mobilization in Laparoscopic Left Hemicolectomy: A Propensity Score-weighted Cohort Study. Surgical laparoscopy, endoscopy & percutaneous techniques. 2020;31(2):196–202. https://doi.org/10.1097/SLE.0000000000000884.
10. Hany TS, Jadav AM, Lamoon C, Cassidy K, Bhowmick AK. The Extraperitoneal Approach to Left-Sided Colorectal Rectal Resections: EXPERTS Procedure. Ann Surg Oncol. 2023;30(3):1739–40. https://doi.org/10.1245/s10434-022-12848-8.
11. Dewulf M, Kalmar A, Vandenberk B, Muysoms F, Defoort B, Claeys D, Pletinckx P. Complete mesocolic excision does not increase short-term complications in laparoscopic left-sided colectomies: a comparative retrospective single-center study. Langenbecks Arch Surg. 2019;404(5):557–64. https://doi.org/10.1007/s00423-019-01797-8.
12. Manceau G, Mori A, Bardier A, Augustin J, Breton S, Vaillant JC, Karoui M. Lymph node metastases in splenic flexure colon cancer: Is subtotal colectomy warranted? J Surg Oncol. 2018;118(6):1027–33. https://doi.org/10.1002/jso.25169.
13. Cassar K, Munro A. Iatrogenic splenic injury. J R Coll Surg Edinb. 2002;47(6):731–41.
14. Benseler V, Hornung M, Iesalnieks I, von Breitenbuch P, Glockzin G, Schlitt HJ, Agha A. Different approaches for complete mobilization of the splenic flexure during laparoscopic rectal cancer resection. Int J Colorectal Dis. 2012;27(11):1521–9. https://doi.org/10.1007/s00384-012-1495-6.

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