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Which type of resection is better for splenic flexure colon tumors, segmental or extended?

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Abstract

Splenic flexure tumours account for between 2% and 8% of all colorectal tumours. Splenic flexure tumours can be approached with different surgical techniques. To compare between segmental colon resections and extended hemicolectomy in the treatment of splenic flexure colon cancer. This comparative study was conducted at Tobruk Medical Center during the period from January 2022 to December 2023. This study was conducted on 50 patients with splenic flexure colon cancer, divided into two groups: Group (1): 25 patients underwent Segmental Colonic Resection and Group (2): 25 patients underwent Extended hemicolectomy. There was no statistically significant difference between segmental colonic resection and extended hemicolectomy groups regarding demographic data (Age, gender and ASA score), comorbidities, operative time, laparoscopy, laparotomy and other resections, postoperative complications, postoperative data stay and 30-day mortality. While, there was highly statistically significant difference regarding to elective surgery and there was statistically significant difference regarding Lymph nodes harvested and Lymph nodes n° ≥ 12. In the treatment of splenic flexure colon cancer, segmental colon resections have similar oncologic outcomes when compared to extended hemicolectomy.

Keywords: Splenic flexure, colon cancer, segmental colon resections, extended hemicolectomy

Full length article **Corresponding Author*, e-mail: dr.fathi@surgeon.ly

1. Introduction

Splenic flexure tumours account for between 2% and 8% of all colorectal tumours [1-3]. They tend to present at a more advanced stage and are associated with high rates of obstruction and lymphatic invasion [2-4]. Their prognosis is poor compared with other sites of colonic cancer [1, 4]. The heterogeneity of blood supply and lymphatic drainage of the splenic flexure makes the surgical management of splenic flexure tumours challenging [5], and the most appropriate surgical approach for these tumours remains the subject of debate. Splenic flexure tumours can be approached with different surgical techniques. An extended right hemicolectomy (ERH) allows a tension-free ileocolic anastomosis to be made and provides it with a good blood supply [5, 6]. The alternatives to ERH are usually an oncological left hemicolectomy (LH) or segmental colectomy (SC). LH includes either high ligation of the inferior mesenteric artery and ligation of the left branch of the middle colic artery, followed by a transverse–rectal anastomosis [7], or the selective ligation of the left colic artery with a transverse–sigmoid anastomosis [8]. SC includes ligation of the left colic artery and left branches of the middle colic artery with formation of a colo-colonic anastomosis after resection of the distal part of the transverse colon, the splenic flexure and the proximal descending colon. In addition to the aforementioned techniques, splenic flexure tumours can be treated by subtotal colectomy, especially in the emergency setting with intestinal obstruction. Nevertheless, the extent of the surgical resection performed for splenic flexure tumours has been arbitrary rather than evidence based [9]. Our study aimed to compare between segmental colon resections and extended hemicolectomy in the treatment of splenic flexure colon cancer.

2. Materials and Methods

This comparative study was conducted at Tobruk Medical Center during the period from January 2022 to December 2023. This study was conducted on 50 patients with splenic flexure colon cancer, divided into two groups: Group (1): 25 patients underwent Segmental Colonic Resection and Group (2): 25 patients underwent Extended hemicolectomy.

2.1. Sample size calculation

This study based on study carried out by Bono et al. [10] Epi Info STATCALC was used to calculate the sample size by considering the following assumptions: - 95% two-

sided confidence level, with a power of 80%. & α error of 5%. Mean Lymph nodes harvested was 13 ± 5.28 and 19.3 ± 8.01 in Segmental colonic resection group and Extended hemicolectomy group respectively, the final maximum sample size taken from the Epi- Info output was 41. Thus, the sample size was increased to 50 subjects to assume any drop out cases during follow up .Segmental colonic resection group: 25 and Extended hemicolectomy group: 25

2.2. Inclusion criteria

We included patients who had undergone an elective surgery for a malignant neoplasm of the splenic flexure for which nodal harvest results were available and patients with splenic flexure colon cancer.

2.3. Exclusion criteria

We excluded patients with metastasis, metachronous or synchronous colorectal cancers, R1 resection on final pathological report, colic polyposis and patients operated on for benign lesions. Moreover, we excluded patients undergoing palliative resection and/or emergency surgery because of perforation or acute obstruction.

2.4. Ethical Consideration

Approval and Ethics Committee was taken before preceding the study. The informed consent was obtained. The routine preoperative evaluations included physical examination, serum carcinoembryonic antigen (CEA), colonoscopy with biopsy, whole body computed tomography (CT). The CT scan was integrated to a virtual colonoscopy in cases of incomplete endoscopic exam. Preoperative endoscopic tattooing was performed if cases of unclear cancer location and in patients with planned laparoscopic approach. Patient characteristics were registered as follows: age, sex, American Society of Anesthesiologists (ASA) score, kind of resection, operative details and postoperative outcomes. Postoperative surgical outcomes included complication and mortality rate within 30 days from the surgery.

2.5. Surgical technique

No patient received mechanical oral bowel preparation. All patients received perioperative antibiotic and antithrombotic prophylaxis.

Extended right hemicolectomy involves resection of the right and transverse colon, a part of the descending colon, and regional lymph nodes. The ileocolic, right colic, middle colic, and left colic vessels were ligated at their origins. An ileocolic mechanical end-to-side anastomosis was typically performed.

Extended left hemicolectomy resects the colonic segment between the left third of the transverse colon and the colorectal junction. The inferior mesenteric and middle colic vessels were ligated at their origins.

Segmental splenic flexure resection involves reshaping the colonic segment between the distal transverse colon and the first descending segment, involving the ligation of the left branch of middle colic and left colic vessels at their origin, and typically performed through mechanical side-to-end colo-colic anastomosis. If feasible, the entire regional mesocolon was resected in an intact peritoneal package. Extended resection is typically recommended for T4 stage tumors with metastatic regional lymph nodes, clear vascular involvement, and large tumor size. The preoperative plan was confirmed intraoperatively and usually relates to the tumor site (distal third of the transverse colon - ERH versus proximal descending colon - ELH). In cases of proximal dilated colon, an ERH was indicated. In cases of adjacent organ involvement for malignant or inflammatory adhesions, an en-bloc resection was performed.

2.6. Statistical analysis

Recorded data were analyzed using the statistical package for social sciences, version 22.0 (SPSS Inc., Chicago, Illinois, USA). The quantitative data were presented as mean± standard deviation. Also, qualitative variables were presented as number and percentages. Comparison of quantitative variables was done using student t test for normally distributed data. For comparing categorical data, Chi square ($\chi 2$) test was performed. The p-value was considered significant as the following: P-value <0.05 was considered significant, P-value <0.001 was considered as highly significant, P-value >0.05 was considered insignificant.

3. Results and discussion

According to demographic data, table 1 shows that there was no statistically significant difference between Segmental Colonic Resection and Extended hemicolectomy groups. According to comorbidities, table 2 shows that there was no statistically significant difference between Segmental Colonic Resection and Extended hemicolectomy groups. According to intraoperative data, table 3 shows that there was no statistically significant difference regarding to operative time, laparoscopy, laparotomy and other resections associated while there was highly statistically significant difference regarding to elective surgery between segmental colonic resection and extended hemicolectomy groups. According to postoperative complications, table 4 shows that there was no statistically significant difference between segmental colonic resection and extended hemicolectomy groups. According to postoperative data, table 5 shows that there was no statistically significant difference between segmental colonic resection and extended hemicolectomy groups. According to Histopathological characteristics, table 6 shows that there was no statistically significant difference regarding T, N and Stage while there was statistically significant difference regarding Lymph nodes harvested and Lymph nodes n° ≥ 12 between Segmental Colonic Resection and Extended hemicolectomy groups. There is no consensus on the appropriate extent of oncological resection for tumours of the transverse colon. Concerns regarding tumour factors such as pattern of lymph node spread and technical factors such as anastomotic perfusion led to a variety of procedures being performed. Operations such as sub-total colectomy, extended right hemicolectomy, left hemicolectomy, transverse colectomy and segmental resection are all frequently performed for tumours of similar location [11].

The number of lymph nodes evaluated following colonic resection for cancer has been shown to correlate with long-term oncological outcomes [12]. The arterial blood supply of the transverse colon is variable compared to a consistent ileocolic artery for the right colon and a similarly consistent inferior mesenteric artery for the left colon [13]. Variations in supply of the transverse colon can give rise to aberrant lymphatic spread. Transverse colon tumours may even spread to foregut lymphatics due to their close proximity to foregut structures [14]. Extended colectomy for transverse colon tumours is more likely to yield higher nodal counts but with highly variable lymphatic drainage into all three embryological planes it is uncertain if this will result in better long-term outcomes [15]. The extent of resection for transverse colon cancer is also influenced by the perfusion of the divided bowel which will be used for anastomosis. Transverse or segmental colectomy has been suggested to have higher leak rates than other types of resections [16, 17]. According to demographic data, and comorbidities this study showed that there was no statistically significant difference between Segmental Colonic Resection and Extended hemicolectomy groups. According to, this study showed that there was no statistically significant difference between Segmental Colonic Resection and Extended hemicolectomy groups. Our results supported with Nyam et al. [18] who aimed to compare complications and flmctions following either radical extended right colectomy without colonic decompression or radical segmental left colectomy with intraoperative decompression for obstructed left-sided colonic carcinomas. The authors reported that there were 57 males and 46 females with a median age of 65 (range, 24-89) years and a median follow-up of 31 (range, 2-59) months. Forty-four of these patients underwent a radical extended right colectomy (subtotal colectomy), and 59 had radical segmental left colectomy. They demonstrated that there was no significance between the studied groups regarding age, and sex. As well, our results supported with Ozgur et al. [19] who aimed to o compare short- and long-term results, including oncological outcomes of patients undergoing extended versus segmental colonic resection with curative intent in the treatment of splenic flexure colon cancers. The authors reported that there was no significance between the studied groups regarding age, sex, and ASA. Also, our results supported with de'Angelis et al. [20] who reported that there was no significance between the studied groups regarding age, sex and ASA. They also demonstrated that there was no significance between the studied groups regarding comorbidities except diabetic mellitus. The current study showed that there was no statistically significant difference regarding to Operative time, Laparoscopy, Laparotomy and Other resections associated while there was highly statistically significant difference regarding to Elective surgery between Segmental Colonic Resection and Extended hemicolectomy groups. Our results supported with Nyam et al. [18] who demonstrated that the median operating time was two hours, eight minutes for segmental left colectomy (range, 1 hour, 10 minutes to 4 hours) and two hours, five minutes (range, 1 hour, 15 minutes to 6 hours, 45 minutes) for extended right colectomies. The authors reported that there was no significance between the studied groups regarding operative time. As well, our results supported with Ozgur et al. [19] who demonstrated that Operative time, Laparoscopy, and Laparotomy. Furthermore, de'Angelis et al. [20] who reported that there was no statistically significant difference regarding to Operative time, Laparoscopy, Laparotomy and other resections associated. According to Postoperative Complications, this study showed that there was no statistically significant difference between Segmental Colonic Resection and Extended hemicolectomy groups. Our results supported with Nyam et al. [18] who demonstrated that there does not seem to be significant differences between functional outcomes or complications between extended right or segmental left colectomies. Moreover, our results supported with Ozgur et al. [19] who demonstrated that there was no statistically significant difference between the studied groups regarding estimated blood loss, hospital length of stay, and postoperative complication rates. In contrast with our results de'Angelis et al. [20] who reported that there was statistically significant difference between the studied groups regarding Postoperative Complications. Our findings showed that there was no statistically significant difference between Segmental Colonic Resection and Extended hemicolectomy groups according to Postoperative data. Our results supported with Nyam et al. [18] who demonstrated that the median hospital stay was 14 days for both groups, with a range of 8 to 36 days and 7 to 44 days for those who had segmental left colectomy and extended right colectomies, respectively. This difference was not statistically significant. The authors reported that there was no significance between the studied groups regarding mortality, and morbidity (Wound infection, Urinary tract infection, Chest infection, Anastomotic Leaks or intra-abdominal sepsis, prolonged ileus, and Overall morbidity). In contrast with our results de'Angelis et al. [20] who reported that there was no statistically significant difference between the studied groups showed that ERC are characterized by higher values for hospital stay, time to regular diet and time to flatus, and also higher values for operative blood loss and operative time. The current study showed that there was no statistically significant difference regarding T, N and Stage while there was statistically significant difference regarding Lymph nodes harvested and Lymph nodes n° ≥ 12 between Segmental Colonic Resection and Extended hemicolectomy groups. Our results supported with Nyam et al. [18] who demonstrated that there was no significance between the studied groups regarding T, N and Stage. They concluded that there does not seem to be significant differences between functional outcomes or complications between extended right or segmental left colectomies. Moreover, our results supported with Hajibandeh et al. [21] who aimed to compare the out-comes of extended right hemicolectomy (ERH), left hemicolectomy (LH) and segmental colectomy (SC) forthe surgical management of splenic flexure tumors. The authors reported that there is no difference between ERH, LH and SC in terms of postoperative morbidity and mortality, lymph node yield and cancer survival.

Table 1. Distribution of demographic data between studied groups.

	Segmental colonic Resection N=25	**Extended hemicolectomy N=25**	**test**	**P value**
Age (years) mean± SD	69.20 ±11.55	70.58 ±11.48	0.179	0.67
Gender				
Male	16 (64%)	15 (60%)	0.08	0.77
Female	9 (36%)	10 (40%)		
ASA score, n (%)				
1	2 (8%)	6 (24%)	2.3	0.30
2	18 (72%)	15 (60%)		
3	5 (20%)	4 (16%)		
4	0 (0%)	0 (0%)		

P value >0.05: Not significant, P value <0.05 is statistically significant, p<0.001 is highly significant., SD: standard deviation, t: T test, X2: Chi-square test

Table 2. Distribution of comorbidities between studied groups.

	Segmental colonic Resection N=25	**Extended hemicolectomy N=25**	**test**	**P value**
Diabetes, n (%)	4 (16%)	5 (20%)	0.136	0.71
Cardiopathy, n (%)	21 (84%)	19 (76%)	0.5	0.479
Hepatopathy, n (%)	0 (0%)	1 (4%)	1.02	0.31
Pneumopathy, n (%)	3 (12%)	2 (8%)	0.22	0.63
Use of anticoagulants n (%)	11 (44%)	13 (52%)	0.32	0.571

P value >0.05: Not significant, P value <0.05 is statistically significant, p<0.001 is highly significant., SD: standard deviation, t: T test, X2: Chi-square test

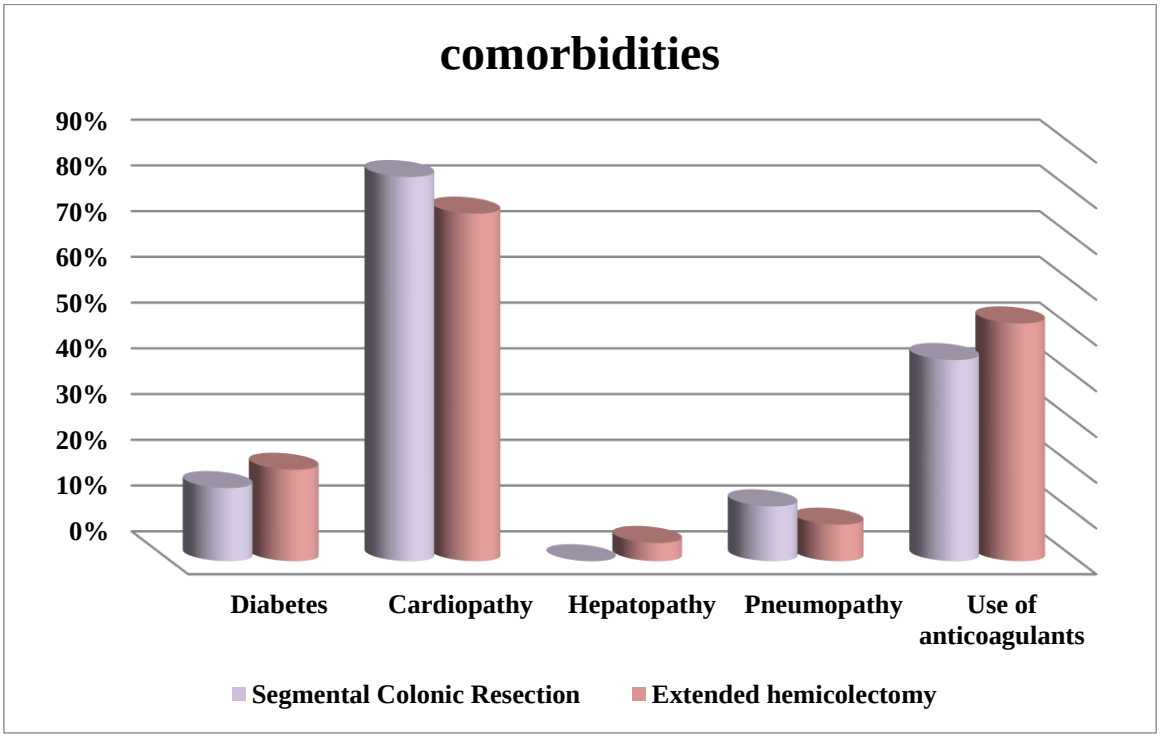
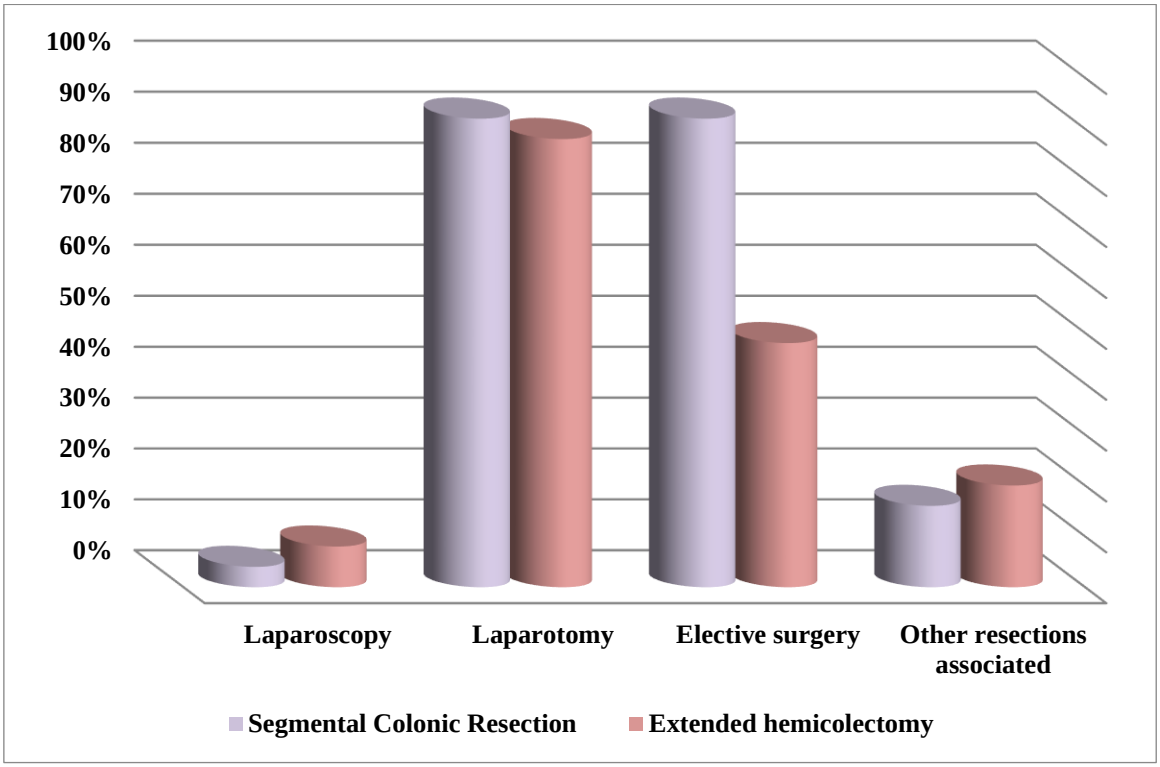


Figure 1. Shows distribution of comorbidities between studied groups

Table 3. Distribution of Intraoperative data between studied groups.

	Segmental colonic Resection N=25	**Extended hemicolectomy N=25**	**test**	**P value**
Operative time, minutes mean± SD	195.82 ±58.7	210.15±71	0.604	0.44
Laparoscopy, n (%)	1 (4%)	2 (8%)	0.355	0.55
Laparotomy, n (%)	23 (92%)	22 (88%)	0.222	0.63
Elective surgery, n (%)	23 (92%)	12 (48%)	11.52	≤0.0001*
Other resections associated, n (%)	4 (16%)	5 (20%)	0.136	0.71

P value >0.05: Not significant, P value <0.05 is statistically significant, p<0.001 is highly significant. SD: standard deviation, t: T test, X2: Chi-square test.



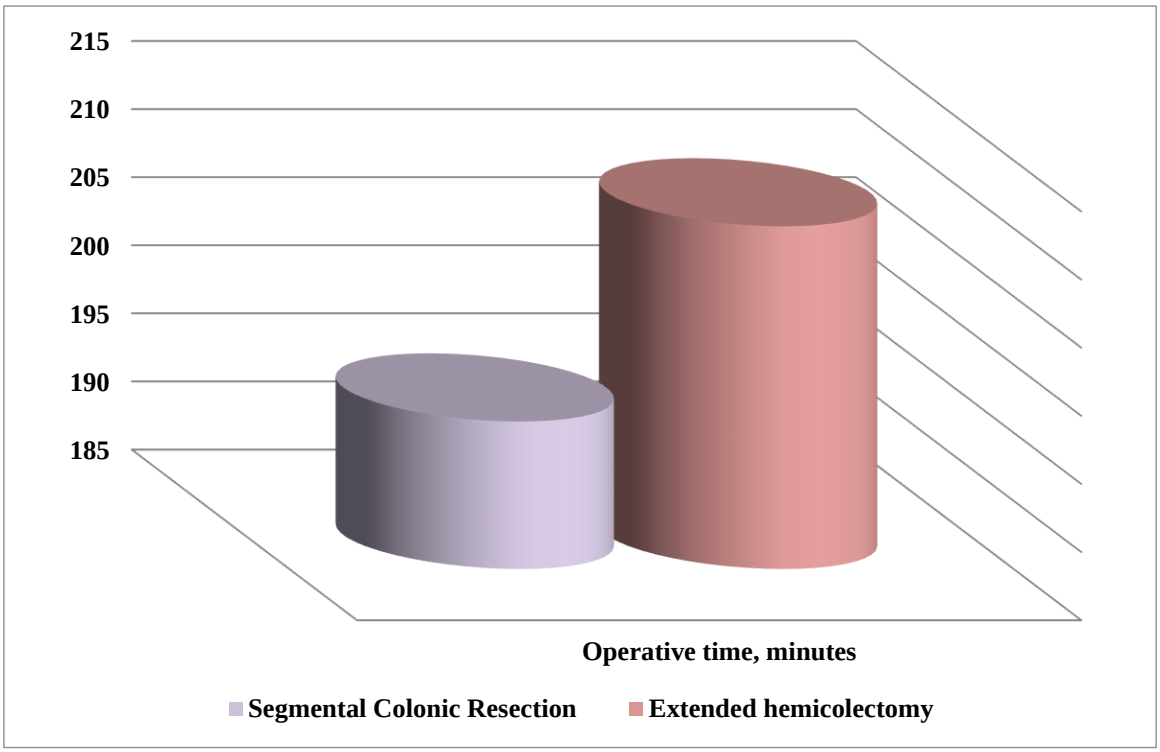


Figure 2. Show distribution of Intraoperative data between studied groups

Table 4. Distribution of postoperative complications between studied groups

	Segmental colonic Resection N=25	Extended hemicolectomy N=25	test	P value
Global complications, n (%)	6 (24%)	4 (16%)	0.5	0.47
Clavien -Dindo ≥ 3 n (%)	3 (12%)	5 (20%)	0.59	0.44
Anastomotic dehiscence, n (%)	2 (8%)	4 (16%)	0.758	0.38
Intestinal obstruction, n (%)	0 (0%)	0 (0%)	0	1
Superficial SSI, n (%)	1 (4%)	0 (0%)	1.02	0.31
Hemoperitoneum, n (%)	0 (0%)	0 (0%)	0	1
Paralytic ileus (>4 days), n (%)	0 (0%)	0 (0%)	0	1
Deep SSI, n (%)	2 (8%)	1 (4%)	0.35	0.55
Pulmonary complications, n (%)	1 (4%)	0 (0%)	1.02	0.31
Renal complications, n (%)	0 (0%)	0 (0%)	0	1
Cardiac complications, n (%)	1 (4%)	0 (0%)	1.02	0.31
Hematological complications, n (%)	0 (0%)	0 (0%)	0	1

Table 5. Distribution of postoperative data stay and 30-day mortality between studied groups.

	Segmental colonic Resection N=25	Extended hemicolectomy N=25	test	P value
Postoperative stay, days mean± SD	13.50 ±12.42	14.95 ±11.758	0.179	0.67
30-day mortality (%)	1 (4%)	0 (0%)	1.02	0.31

P value >0.05: Not significant, P value <0.05 is statistically significant, p<0.001 is highly significant., SD: standard deviation, t: T test, X2: Chi-square test

Table 6. Distribution of histopathological characteristics between studied groups.

	Segmental colonic Resection N=25	**Extended hemicolectomy N=25**	**test**	**P value**
Lymph nodes harvested mean± SD	13 ± 5.67	18.3 ±8.71	6.50	0.01*
Lymph nodes n° ≥ 12, n (%)	15 (60%)	24(96%)	9.44	0.002*
T, n (%)				
0	2 (8%)	0 (0%)	4.79	0.44
1	1 (4%)	0 (0%)		
2	3 (12%)	1 (4%)		
3	14 (56%)	17 (68%)		
4a	3 (12%)	5 (20%)		
4b	2 (8%)	2 (8%)		
N, n (%)				
0	18 (72%)	14 (56%)	1.87	0.391
1	5 (20%)	6 (24%)		
2	2 (8%)	5 (20%)		
Stage, n (%)				
0	2 (8%)	0 (0%)	7.89	0.54
I	3 (12%)	1(4%)		
II a	6 (24%)	11(44%)		
Il b	1 (4%)	2 (8%)		
II c	0 (0%)	1 (4%)		
III a	2 (8%)	0 (0%)		
III b	6 (24%)	5 (20%)		
III c	2 (8%)	2 (8%)		
IV a	2 (8%)	2 (8%)		
IV b	1 (4%)	1 (4%)		

P value >0.05: Not significant, P value <0.05 is statistically significant, p<0.001 is highly significant., SD: standard deviation, t: T test, X2: Chi-square test

4. Conclusions

In the treatment of splenic flexure colon cancer, segmental colon resections have similar oncologic outcomes when compared to extended hemicolectomy.

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