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Original Research Article

Early Postoperative Outcomes in Patients Undergoing Laparoscopic Versus Open Surgeries for Colorectal Malignancies

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Abstract

Objective: To compare whether laparoscopic surgeries have an advantage over open surgeries for colorectal malignancies with respect to early postoperative clinical outcomes like postoperative pain, bowel recovery time and duration of hospital stay.

Methods: The people who have undergone laparoscopic or open colorectal surgeries for colorectal malignancies and consented to the study in the time frame of the study will be included in the study. The primary aim of colorectal surgeries is to excise all the tumour and loco regional lymph nodes. This involves resecting the primary tumour with sufficient longitudinal and radial margins to ensure complete excision of any microscopic tumour cells, to reduce the risk of local recurrence and, in the absence of distant metastatic disease, to achieve a curative resection. Resecting the colonic mesenteric lymph nodes enable the removal of metastatic deposits of tumour contained in them, to increase the chance of curative resection. This would logically improve the survival of the patients in whom lymph nodes were excised compared to leaving them unexcised.

Categorical and quantitative variables were expressed as frequency (percentage) and mean ± SD respectively. Independent tests were used to compare quantitative parameters between categories. Chi-square test was used to find association between categorical variables. Mann-Whitney U Test was used to compare ordinal parameters between groups. For all statistical interpretations, 0.05 was considered the threshold for statistical significance. Statistical analyses was performed by using a statistical software package SPSS, version 20.0.

Results: A total of 41 patients were included in the study, among them 29 patients underwent laparoscopic surgery and 12 open surgery. The disparity in number of patients were attributed to surgeon's expertise, patient's preference and widely recognised advantages of laparoscopic surgery. Postoperative pain on day 0,1,3 were less for laparoscopic group compared to their counterpart ($p<0.01$). Both the groups had comparable pain score on discharge. The bowel recovery in terms of reappearance of bowel sounds, passage of flatus and faeces were earlier in the laparoscopic group than the open group which was found to be statistically significant. The total number of hospital stay was lower for the laparoscopic group than the open group, owing to their early return of bowel functions and better early post-operative outcome.

Conclusion: Our findings indicate that the laparoscopic group of patients had better early postoperative outcome which is reduced postoperative pain, lesser need of analgesics, faster bowel recovery with respect to early reappearance of bowel sound, passage of flatus and faeces and shorter hospital stay.

Keywords: Colorectal Malignancies; Laparoscopic Resection; Open Colorectal Surgery; Postoperative Outcome.

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Introduction

Colorectal cancer is one of the major malignant tumors threatening human health. Around 10% of all cancer cases globally are colorectal cancer, making it the third most frequent cancer worldwide and the second leading cause of cancer-related fatalities [1] lymph nodes that might be removed .4Some of the first series of laparoscopic surgery published in the 1990s revealed a high number of metastases in the abdominal wall, and specifically into laparoscopic ports. This raised concerns about the appropriate use of minimally invasive techniques in the treatment of gastrointestinal tumours. Numerous experimental research examined the association between various aspects of the laparoscopic technique (pneumoperitoneum), the most cases include adults 50 years of age and beyond, and it primarily affects older people. There were significant regional differences in the rates of incidence and mortality. Eastern Europe had the highest rates of mortality, while Europe, Australia, and New Zealand had the highest incidence rates. [1] According to India's population-based cancer

registry (PBCR), colon cancer is ranked eighth among males and rectal cancer is ranked ninth. In India, rectal cancer is more common than colon cancer. According to population-based studies, the incidence of colorectal cancer is on the rise. India has a significantly lower incidence rate of colorectal cancer (4.3 and 3.4/100,000) than other Asian nations. Cancers of the colon and rectum have shown a marked rise in incidence rates among both genders between 1982 and 2010. The Northeast and South areas of India have higher incidence. The prevalence of colorectal cancer in men is twice that of women. [2]

The majority of colon cancers are sporadic, with about 5 percent resulting from genetic mutations inherited from Lynch syndrome, familial adenomatous polyposis (FAP) and other syndrome related group of cancers. Normal colon epithelium gives way to invasive cancer over a period of years, usually in a sequence marked by genetic mutation accumulation, adenoma development, and subsequent carcinogenesis (adenoma-carcinoma sequence). Alternative pathways include such those involving DNA mismatch repair (MMR) and the BRAF gene mutations. [3]

Surgery plays a pivotal role in the management of colorectal malignancies. There can be open approach and minimally invasive approach.

Laparoscopic surgery is a less invasive approach and it is associated with less postoperative pain, lower morbidity, faster return of bowel functions and shorter hospital stay than open surgery.

The patients who had laparoscopic-assisted surgery showed significant advantages due to the minimally invasive quality of the surgery in contrast to those who underwent open surgery, namely, less blood loss, shorter time to flatus, bowel movement and liquid diet intake, earlier ambulation time, shorter length of incision and a shorter post-operative hospital stay. Randomized controlled trials and meta-analysis have found no difference in long term outcome and survival after laparoscopic resection of colon cancer compared with open surgeries. The procedure can be technically difficult and time consuming, adequate training and experience are necessary.

For many years, there was debate about how long-term oncological outcomes from laparoscopy were affected, particularly in light of port-site metastases and worries about the decreased number of tumour (manipulation, degree of differentiation, stage), and the host (immune and inflammatory variables). [5] The term "chimmey effect" describes how CO2 leaks next to trocars, creating a strong gas flow at the trocar locations and aerosolisation of tumour [6]. Nevertheless, well-designed prospective randomised multicentre trials have shown no major differences in the incidence of metastasis in the surgical wound as well as in oncological outcomes when the laparoscopic approach was compared to open surgery, despite this initial worry regarding the oncological safety of the laparoscopic approach. Today, laparoscopy is accepted as a treatment option for colorectal cancer worldwide. [7]

Materials and Methods

Prospective Observational study for 12 months after obtaining clearance from Institutional Review Board of patients admitted from February 2023 to January 2024 with histologically proven colorectal malignancies for laparoscopic or open surgeries at the Department of General Surgery, Government Medical College, and Kottayam. Based on study conducted by Jake Jordan, Henry Dowson and et al in south England to compare the early postoperative outcomes in laparoscopic versus open surgeries for colorectal malignancies, standard deviation and mean were derived from the number of days of hospital stay.

Sample size is calculated using the formula

$$N = (Z\alpha + Z\beta)^2 \times 2 \times \frac{SD^2}{(M1 - M2)^2};$$

$$SD^2 = \frac{(SD1^2) + (SD2)^2}{2}$$

Zα = 1.96

Zβ = 0.84

1st group-laparoscopic surgery 2nd group open surgery

SD1=2.64, SD2=2.52

M1=4 Days, M2=6.15 Days M=Mean,

D= Standard deviation n = 50.9

Sample size of the study is 41.

Total sample size is calculated to be 41.

Study Tool: Post-operative pain-visual analogue score was used.

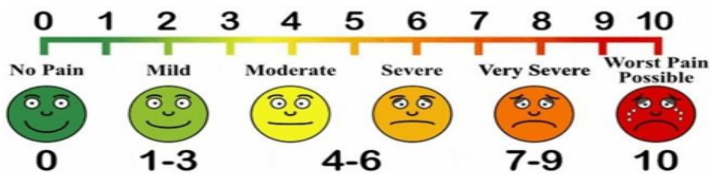

Figure 1:

Proforma including a list of questionnaires to assess the bowel recovery in terms of reappearance of bowel sounds, passage of flatus, and passage of stools. The people who have undergone laparoscopic or open colorectal surgeries for colorectal malignancies and consented to the study in the time frame of the study were included in the study. Follow up the patient for a period of hospital stay to look into postoperative pain, bowel recovery, and hospital stay.

Results

Back ground characteristics of patients with colorectal surgery for colorectal malignancies.

Table 1: Comparison of age based on type of surgery

	Lap		Open	
Age	**Count**	**Percent**	**Count**	**Percent**
50 - 60	16	55.2	4	33.3
60 - 70	13	44.8	8	66.7
Mean ± SD	60.3 ± 6.1		61.9 ± 6.3	

t = 0.74, p = 0.46

Table 2: Comparison of sex based on type of surgery

	Lap		Open			
Sex	**Count**	**Percent**	**Count**	**Percent**	**□2**	**p**
Male	15	51.7	7	58.3		
					0.15	0.699
Female	14	48.3	5	41.7		

Table 3: Comparison of smoking based on type of surgery

	Lap		Open			
Smoking	**Count**	**Percent**	**Count**	**Percent**	**□2**	**p**
Yes	9	31.0	4	33.3		
					0.02	0.886
No	20	69.0	8	66.7		

Table 4: Comparison of diabetes based on type of surgery

	Lap		Open			
Diabetes	**Count**	**Percent**	**Count**	**Percent**	**□2**	**p**
Yes	9	31.0	4	33.3		
					0.02	0.886
No	20	69.0	8	66.7		

Table 5: Comparison of hypertension based on type of surgery

	Lap		Open			
Hypertension	**Count**	**Percent**	**Count**	**Percent**	**□2**	**p**
Yes	8	27.6	3	25.0		
					0.03	0.865
No	21	72.4	9	75.0		

Table 6: Comparison of pain based on type of surgery

		Lap		Open			
Pain		**Count**	**Percent**	**Count**	**Percent**	**□2**	**p**
	Mild pain	7	24.1	0	0.0		
Post-Operative day 0	Moderate - severe pain	22	75.9	0	0.0		
						5.52	p<0.01
	Very severe pain	0	0.0	12	100.0		
	Mean ± SD	4.2 ± 0.9		8.1 ± 0.9			
	Mild pain	12	41.4	0	0.0		
Post-Operative day 1	Moderate - severe pain	17	58.6	7	58.3		
						3.73	p<0.01
	Very severe pain	0	0.0	5	41.7		
	Mean ± SD	3.7 ± 0.7		6.1 ± 1.4			

Post-Operative day 3	Mild pain	29	100.0	0	0.0		
	Moderate - severe pain	0	0.0	12	100.0	6.32	p<0.01
	Mean ± SD	1.7 ± 0.8		4.9 ± 0.9			
	Mild pain	29	100.0	12	100.0		
On discharge	Moderate - severe pain	0	0.0	0	0.0	0	1.000
	Mean ± SD	2 ± 0.7		2.2 ± 0.6			

Table 7: Comparison of reappearance of bowel sound based on type of surgery

Reappearance of bowel sound	Lap		Open			
	Count	Percent	Count	Percent	Z#	p
2	11	37.9	0	0.0		
3	12	41.4	2	16.7		
					3.88	p<0.01
4	6	20.7	7	58.3		
5	0	0.0	3	25.0		

#Mann-Whitney U Test

Table 8: Comparison of passage of flatus based on type of surgery

	Lap		Open			
Passage of flatus					Z#	p
	Count	Percent	Count	Percent		
2	7	24.1	0	0.0		
3	10	34.5	2	16.7		
4	9	31.0	6	50.0	2.75**	0.006
5	3	10.3	2	16.7		
6	0	0.0	2	16.7		

#Mann-Whitney U Test

Table 9: Comparison of passage of faeces based on type of surgery

	Lap		Open			
Passage of faeces	Count	Percent	Count	Percent	Z#	p
2	5	17.2	0	0.0		
3	4	13.8	0	0.0		
4	10	34.5	3	25.0		
5	7	24.1	1	8.3	3.38	p<0.01
6	3	10.3	5	41.7		
7	0	0.0	2	16.7		
8	0	0.0	1	8.3		

#Mann-Whitney U Test

Table 10: Comparison of hospital stay based on type of surgery

	Lap		Open		
Hospital stay				Z#	p
	Count	Percent	Count	Percent	
4 - 6	12	41.4	1	8.3	
7 - 8	16	55.2	6	50.0	
				3.01**	0.003
9 - 10	1	3.4	5	41.7	
Mean ± SD	6.6 ± 1.4		8.3 ± 1.4		

 # Mann-Whitney U Test, **: - Significant at 0.01 level

Discussion

A total of 51 patients with operable colorectal malignancies were included in the study. Among them 29 patients underwent laparoscopic surgery and 12 underwent open surgery.

The disparity in number of patients in each group were attributed to the surgeon‘s expertise, patient‘s preference and widely recognized advantages of laparoscopic surgeries. When population characteristics were compared in patients who underwent open and laparoscopic cases, age group of people with CRC were comparable in both group of patients with mean age of 60 years, same was

noticed for the distribution of male and female sex in both laparoscopic and open group. Percentage of people with CRC who were smokers were less in laparoscopic group (31%) compared to open group (33.3%).Similar scenarios were observed while percentage of CRC patients with diabetes mellitis was compared in both groups. This might be due to the larger number of patients in laparoscopic group (29) than in open group (12). On postoperative day 0, patients who underwent open surgery experienced severe pain with mean pain score of 8.1+/-0.9 and in laparoscopic group had mild to moderate pain with mean pain score of 4.2+/- 0.9 ($p < 0.01$). On postoperative day 1, mean pain score in open group was 6.1+/-1.4 with moderate to severe pain and 3.7 ± 0.7 in laparoscopic group with mild to moderate pain ($p<0.01$). Postoperative day 3 showed reduction in pain in both group of patients with moderate pain and mean pain score of 4.9+/-0.9 in patients who underwent open surgery and mild pain with mean pain score of 1.7+/-0.8 in laparoscopic group ($p<0.01$). On the day of discharge both groups of patients had comparable pain score which was only mild.

On comparing the reappearance of bowel sounds in patients who underwent laparoscopic and open surgeries, laparoscopic group of patients had early reappearance of bowel sounds which was mostly on post-operative day 2 while in open group the reappearance of bowel sound was majorly on postoperative day 3 and 4 ($p<0.01$). In laparoscopic group, 34.5% of people passed flatus on postoperative day 3, 31% passed on post-operative day 4 while in open group 50% on postoperative day 4 and 16.7% on postoperative day 6 which was much later compared to the former group of patients.

On comparison, in both laparoscopic group and open group, passage of faeces occurred earlier in laparoscopic group with 34.5% on postoperative day 4 and 24.1% on postoperative day 5 and in open group 41.7 % on postoperative day 6, 25% on postoperative day 4, 16.7% in postoperative day 7 and 8.3% in day 8.

The mean length of hospital stay was 6.6 ± 1.4 days in laparoscopic group and 8.3 +/- 1.4 days in open group. The duration of hospital was less for patients who underwent laparoscopic surgery compared to open surgery as the former group of patients had an early bowel recovery and better postoperative outcome.

The long-term or oncological outcome of both the groups were not included in our study. Our study was a comparative study where we analysed the early post-operative outcome in terms of postoperative pain, bowel recovery time and length of hospital stay following surgery, in two groups of patients, the patients who underwent laparoscopy and others who underwent open surgery. Our study came to the conclusion that the former group of patients had a better early postoperative clinical outcome with respect to postoperative pain, bowel recovery (reappearance of bowel sound, postoperative day on which flatus and faeces were passed) and length of hospital stay following the procedure .

Our results were consistent with the body of literature which support the superiority of laparoscopic surgery in colorectal surgeries. These findings attributed to the minimally invasive nature of laparoscopic procedures which resulted in less surgical trauma and fast healing.

Previous studies as mentioned earlier in review of literature reported similar findings. Laparoscopic surgery for colorectal surgery arguably had a superiority over conventional open surgeries. Patient selection and surgical expertise remain the key to successful laparoscopic surgery. Our finding regarding reduced postoperative pain and lesser need for analgesics in patients undergoing laparoscopic surgery are consistent with the results reported by Kitona et al. The smaller incision lengths contribute to lesser postoperative pain in the laparoscopic group [9].

Guojun Tong and colleagues demonstrated that the laparoscopic group when compared to the open group had earlier bowel recovery time such as passing of flatus far sooner than the latter group of patients which correlated with the inference of our study [10].

Meta-analysis by Jun kang khao detected better postoperative bowel recovery in terms of earlier intestinal peristalsis, passage of flatus and faeces, time of consuming food and independent ambulation time in laparoscopic group when compared to its counterpart which are in agreement with the findings in our study where there was quicker bowel recovery time in laparoscopic group when juxtaposed with open surgery [11]. Antonio Biondi and team conducted a comparative study where they pitted laparoscopic colorectal surgery against open surgery, the former group of patients were able to consume regular diet, pass gas more quickly, decreased demand for analgesics and reduced hospital recovery time than the latter group of patients .Due to the minimally invasive nature of laparoscopic surgery, our study had similar results [12]. A Comparison of Laparoscopic and Open surgery by Surgical Therapy Study Group by Heidi nelson revealed that the laparoscopic surgery group experienced a quicker perioperative recovery than the open-colectomy group, as evidenced by a lower median length of hospital stay and a shorter duration of parenteral narcotic and oral analgesic use. As we followed up both the group of patients for their period of stay in the hospitals, we

experienced similar outcomes in terms of postoperative pain and hospital stay between the two groups [7]. The return of the bowel functions, return to diet and length of hospital stay was earlier in patients who underwent laparoscopic surgery than in patients who underwent conventional open surgery in our study as well as a systemic review done by Jin bo jiang and et al. They also looked into the number of harvested lymph nodes, distal resection margin, local and distant recurrence, the disease survival and overall survival which were not included in our study [13]. The alignment of our results are consistent with Marco braga et al's findings, where there was lower rate of postoperative complications like reduction in postoperative pain and analgesic use, quicker recovery of bowel functions in laparoscopic group of patients when compared to the open group [14]. Several patient specific, disease related factors, severe comorbidities and hospital facilities can have an impact on the success of laparoscopic surgery. It can be overcome by safe and pre planned approach, surgical expertise and well equipped operation theatres. The learning curve for laparoscopic surgery is steep, proper surgical training is required to achieve the skills. Open surgeries still hold an important role in colorectal malignancies in case of complex disease, patient specific and disease specific factors.

Conclusion

Our findings indicated that the patients undergoing laparoscopic colorectal surgeries have a clear advantage over the patients undergoing the conventional open colorectal surgeries for colorectal malignancies due to its minimally invasive, improved visualisation, reduced complications, better early postoperative outcome, shorter hospital stay, faster return to normal activities.

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