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Minimal Invasive and Open Colorectal Surgeries

A Comparative Study of Minimal Invasive and Open Colorectal Surgeries with Regards To Post-Operative Hospital Stay and Complications

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ABSTRACT

Objectives: To compare outcomes of laparoscopic surgery versus open surgery for colorectal carcinoma in terms of hospital stay and post-operative complications.

Study Design: Cross-sectional analytical study.

Place and Duration of Study: Department of General Surgery, Combined Military Hospital, Rawalpindi, from Mar 2020 to Mar 2021.

Methodology: We studied a total of 114 patients who were diagnosed with colorectal cancer and met the sample selection criteria. Patients with metastatic disease or previous history of abdominal surgery were excluded from the study. Patients were documented for hospital stay and followed for six months for the development of complications. Data was analyzed by SPSS version 26.

Results: We studied a population where 45 (39.5%) were male while 69 (60.5%) were female. The mean age of the sample was 46.96 ± 14.47 years. The study showed that the mean hospital stay was shorter in Group A: 5.40 ± 1.88 days versus 6.59 ± 1.68 days in Group B (p=0.001). Mean blood loss was 65.99 ± 16.41 mL in Group A versus 366.93 ± 95.36 in Group B (p<0.001). The complication rates in Group A and B were 6 (10.5%) and 11 (19.2%), respectively (p=0.18), while the rate of incisional hernia formation was 0 (0%) and 4 (6.9%) (p=0.042).

Conclusion: Laparoscopic surgery is superior to open surgery is the management in terms of shorter in-hospital stay and post-operative complications.

Keywords: Complications, Minimal invasive surgery, Open colorectal surgery, Post-operative hospital stay.

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INTRODUCTION

Colorectal cancer ranks the third most common cause of cancer globally, and is the second most common cause of cancer-related deaths worldwide.[1] In Pakistan, the prevalence of the disease varies between 4-6.8%, with a particularly high incidence in the northern and southwestern parts of the country due to the increased consumption of smoked meat.[2] The primary aim of treatment in resectable disease is to reduce mortality with adjuvant therapy followed by surgery, with a time to initiation of adjuvant therapy from diagnosis being a maximum of 6 weeks, and time to surgery of less than 12 weeks following adjuvant therapy, for 90% of cases.[2] Both open and minimally invasive surgical techniques hare for treatment.[3]

Minimally invasive colorectal is increasingly employed for management of colorectal carcinomas.[4] Purported advantages include shortened length of inhospital stay, decreased requirement for pain relief, quick return of bowel function, and minimal effect on mobility.[5] Benefit is also seen with regards to the oncological results.[6] Surgical resection is the only curative modality for localized and locally advanced colon cancer, with the basic principle of removal of the primary tumor with appropriate margins (a minimum of 10 cm) as well as areas of lymphatic drainage (a minimum of 12 lymph nodes).[7] A number of research protocols have studied the length of hospital stay, incidence of incisional hernias and incidence of surgical site infections with conflicting results, with some reporting comparable or higher rates of complications for open colorectal surgery when compared to laparoscopic surgery.[8-10]

The primary aim of this research was to investigate how laparoscopic colorectal surgery compared to open procedures in terms of post-operative length of hospital stay, development of surgical site infections and incision site hernias as no literature is available for review in the Pakistani population on the subject. The primary hypothesis was based on the thinking that

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open colorectal surgery was associated with a longer hospital stay, a higher risk of development of hernias and an increased risk of surgical site infections as compared to laparoscopic procedures. Highlighting these critical areas will help improve quality of care provided, reduce in-hospital stay duration and the chances of developing hospital acquired infections, reduced risk of hernias and surgical site infections would reduce the need for corrective surgery, resulting in an overall decrease in morbidity and mortality.

METHODOLOGY

This was a cross-sectional analytical study conducted from Mar 2020 to Mar 2021, the venue for which was the Department of General Surgery, Combined Military Hospital, Rawalpindi, after taking permission from Hospital Ethical Review Committee vide letter no. 71/2020/ERC dated 03 May, 2021, on a sample of 114 consenting patients diagnosed with biopsy-proven colorectal malignancies, who were selected via non-probability consecutive sampling. Informed consent was taken from all patients. The WHO sample size calculator was used to calculate the sample size keeping a level of significance (α) of 10%, power of the test (1–β) of 90%, anticipated population proportion 1 of 71.8%, and anticipated population proportion 2 of 48.6 (both population proportions based on incidence of shortened length of hospital stay, for open and laparoscopic procedure, respectively).[11] Patients between the ages of 20-75 years, with ASA class II to IV, who had tumor size T1 to T3 were included in the study. Patients with who had undergone a previous laparotomy, required conversion to open surgery or had metastatic disease were excluded. Patients with diagnosis of hereditary forms of colon cancer were also excluded.

All patients were documented for age, gender, height, weight, body mass index, ASA class and stage of disease using a questionnaire on enrollment in the study. All surgeries were conducted by the same surgical team, and none of the patients received neo-adjuvant chemotherapy for down-staging. Patients were put on clear fluids 24 hours prior to surgery, and were made nil per os 12 hours before surgery. All patients underwent gut preparation 24 hours prior to surgery via and intestinal washout with 3 liters of 0.9% normal saline. Patients were given an enema the night before the surgery and the morning of the surgery. Patients were divided into groups: Group A patients underwent laparoscopic colorectal surgery while Group B patients underwent open colorectal surgery. Patients who underwent laparoscopic surgery received a 1.5 cm supra-umbilical incision and a 12 mm trocar was placed for the laparoscope. Three more 5-mm incisions were made and trocars placed below the umbilicus, left lateral to the umbilicus and on the right side of the abdomen. For specimen retrieval, the supra-umbilical opening was extended laterally. In open surgery, an incision was made along the skin crease on the appropriate side of the abdomen. A covering ileostomy was performed in both groups. Both groups received prophylactic intravenous antibiotics which were discontinued 72 hours post-operatively. All patients were documented for mean operating time, blood loss, surgical site infection, seroma/haematoma formation, as well as duration of hospital stay. Total blood loss was estimated using haemoglobin mass loss method. Follow up was carried out for incisional hernia) at 6 months.

Data was analyzed using SPSS-26. Mean and SD was calculated for quantitative variables like age, body mass index, mean operating time, mean volume of blood loss and duration of hospital stay. Qualitative variables like gender, ASA class, stage of disease, surgical site infection, seroma/haematoma formation and incisional hernia development were recorded in terms of frequency and percentage. Chi square test was applied for all qualitative variables while independent samples t test was applied to all quantitative variable. The p-value of ≤0.05 was considered significant.

RESULTS

We studied a total of 114 patients in our sample: 45 (39.5%) were male while 69 (60.5%) were female. The mean age of the sample was 46.96 ± 14.47 years. Data for pre-surgerical evaluation is shown in Table-I. Gender, age, body mass index, ASA class and tumor stage were statistically similar in both groups. A total of 63 (55.3%) patients had a tumour of size T1, 40 (35.1%) had T2 disease, while 11 (9.6%) had T3 disease.

Total operation time in Group A was 212.28 ± 55.28 mins versus 153.70 ± 51.62 mins in Group B, the difference was statistically significant (p<0.001). A smaller amount of blood loss was seen in Group A: 65.99 ± 16.41 mL versus 366.93 ± 95.36 mL (p<0.001). Total in hospital stay was 5.40 ± 1.88 days in Group A as opposed to Group B which showed a slightly higher mean stay of 6.59 ± 1.68, the difference between the two groups was statistically significant (p=0.001). The total complication rate was comparable in both groups (p=0.18), however the difference in occurrence of incisional hernia was statistically significant between the two groups (p=0.042). Results for surgical and post-surgical parameters are shown in Table-II.

Table-I: Patient pre-surgery characteristics.

Variable	Group A	Group B	*p*-value
Gender			
Male	25 (43.8%)	20 (35.1%)	0.33
Female	32 (56.2%)	37 (64.9%)	
Age (years)	47.51 ± 14.44	46.42 ± 14.61	0.69
Body Mass Index (kg/m²)	24.11 ± 3.38	24.14 ± 2.99	0.97
American Society of Anaethesiology (ASA) Scale			
Class I	16 (28.1%)	20 (35.1%)	0.52
Class II	29 (50.8%)	23 (40.4%)	
Class III	12 (21.1%)	14 (24.5%)	
Tumour Size			
T1	31 (54.4%)	32 (56.1%)	0.26
T2	18 (31.6%)	22 (38.6%)	
T3	8 (14.0%)	3 (5.3%)	

Table-II: Operative and post-operative outcomes.

Variable	Group A	Group B	*p*- value
Operation Time (mins)	212.28 ± 55.28	153.70 ± 51.62	<0.001
Total Blood Loss (mL)	65.99 ± 16.41	366.93 ± 95.36	<0.001
Total Hospital Stay (Days)	5.40 ± 1.88	6.59 ± 1.68	0.001
Long-Term Complications	6 (10.5%)	11 (19.2%)	0.18
Surgical Site Infections	5 (8.7%)	3 (5.3%)	0.46
Seroma Formation	-	2 (3.5%)	0.15
Haematoma Formation	1 (1.8%)	2 (3.5%)	0.558
Incisional Hernia	-	4 (6.9%)	0.042

DISCUSSION

We studied a majority female population with a female to male ratio of 1.53:1, there was no statistical difference in relation to gender between the two groups (p=0.33). Burgdorf *et al* studied a population that was equally divided between males and females, with males accounting for 50.3% of the study sample.[12] Nelson *et al*, also reported on a population that was evenly divided between males and females.[13] We believe the increased number of females maybe due to a selection bias, as our hospital was catering to families of military personnel. Our sample had a mean age of 46.96 ± 14.47 years, and the difference across groups for age was not significant (p=0.69), which was younger than most of the studies reported in literature. Nelson *et al*, reported on a much older population with median ages of 69 and 70 years in open surgery and laparoscopic surgery, respectively,[13] while Sabajo *et al*, reported on a much older population of 73 (66–79) years.[14] Lee *et al*, reported on a slightly younger population of 59.25 ± 17.5 years.[15] The difference in ages is likely attributable to the differences in diet, as well as the small sample size and shorter duration of our study.

The majority of our patients were ASA II 52 (46.1%), followed by ASA I 36 (31.6%), and ASA III 26 (22.8%) cases, the difference was not statistically significant across the two groups (p=0.52). Nelson *et al*, also studied a population which largely fell in ASA I and II classes, 86% of patients in both groups fell in these categories and there was no statistical difference.[13]

The total operation time was 212.28 ± 55.28 minutes in the laparoscopic surgery group while it was 153.70 ± 51.62 minutes in the open surgery group (p<0.001). The duration of surgery was shorter for both groups in Nelson *et al*, than our study, but the difference between open surgery (median 95 minutes with a range of 27-435 minutes) and laparoscopic surgery (median 150 minutes with a range of 35-450 minutes) was still statistically significant (p<0.001).[13] The mean operation time in Moon *et al*, for laparoscopic procedures was 182 (154-210) minutes and for open surgeries was 130 (80-185) minutes, which was more comparable to our study.[16]

Total blood loss per surgery was 65.99 ± 16.41 mL in the laparoscopic surgery group, while it was 366.93 ± 95.36 mL with open surgery in our study (p<0.001). Burgdorf *et al* also reported a significant difference in blood loss (p<0.001), between the two methods: laparoscopic surgeries had a median (range) blood loss of 50 (0–1600) mL, while open surgeries had a higher loss of 200 (0–2700) mL.[12] The total hospital stay was 5.40 ± 1.88 days and 6.59 ± 1.68 days in Group A and B, respectively (p=0.001). Burgdorf *et al*, reported also reported a shortened median hospital stay: 5 (1–55) days in the laparoscopic group versus 8 (2–109) days in the open surgery group (p<0.001).[12] Moon *et al*, reported a median hospital stay of 9.0 (7–11) days in laparoscope surgery while 10.0 (8–13) days was reported for open surgery (p=0.037).[16] Additionally, Huang *et al*, showed that the laparoscopic group received less blood transfusions when compared to open surgery group (29.6% in the open group vs. 19.9% in the laparoscopic group, p=0.02).[11]

Complications were seen in 6 (10.5%) in Group A, and 11 (19.2%) in Group B (p=0.18). There was no difference between the two groups in terms of surgical site infection (p=0.46), seroma formation (p=0.15) and haematoma formation (p=0.558), however, the difference in occurrence of incisional hernias was statistically significant (p=0.042). Nelson *et al*, also reported similar complication rates between the two groups in their

study: 20% in laparoscopic surgery versus 21% in open surgery.[13] Conversely, Braga *et al*, reported a significant difference between infectious complications of both groups: 11% in laparoscopic surgery versus 23.3% in open surgery (p=0.01).[17] We believe this difference can be accounted for by difference is infection control techniques employed in both studies, wherein our study gave a short course of ceftriaxone (3 days) post-surgery whereas Braga *et al* only gave a stat dose of antibiotics. It must be pointed out here that studies have shown that cases operated during acute infections tend to have an increased chance of surgical site infections in laparoscopic surgery but not with open surgery, which was also a difference between our studies.[18]

Laparoscopic colorectal surgical procedures result in a lower rate of complications, less mean operative blood loss and a shortened in-hospital stay as compared to open colorectal surgeries, with the trade off of having a longer mean operative time. Caveats include requiring specialised equipment and personnel which may not be available everywhere. In addition, certain surgeries that start of as laparoscopic procedures may require conversion to open surgeries due to extensive disease or the development of complications such as uncontrolled haemorrhage. All such cases which were converted to open surgery were excluded from the study. Our study had a follow-up period of six months which only looked at short-term complications especially with regards to the development of hernias, further research is required to rule out long-term development of this important complication as well as the effect of the form of surgery on morbidity and mortality of the patient.

CONCLUSION

Laparoscopic colorectal surgery is associated with shorter hospital stays and a smaller incidence of incisional hernias. The rate of other complications occurring is comparable to that in open surgery. It has less blood loss as it is minimally traumatic; comparatively small incisions are given to acquire access to the gut. Disadvantages include a requirement for more technical expertise to operate successfully, and the field of vision is small, making complicated surgeries difficult, also resulting in longer operating times. However, the benefits provided are enormous. Patients have a much smaller in-hospital stay, a lower risk of surgical site infection as well as a lower risk post-operative incisional hernia defect. As such the employment of this method of surgery, where available, should be greatly encouraged which will greatly decrease the already high morbidity in patients with colorectal cancer, and allow for improved outcomes.

Conflict of Interest: None.

Authors' Contribution

MZF: Direct contribution, KM: MAZ: SSC: MFS: TMQ: Intellectual contribution.

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