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Colorectal Cancer: Laparoscopic versus Open Surgery

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Abstract

Many studies have suggested that laparoscopic surgery is superior to open surgery. However, the acceptance of laparoscopic surgery for colorectal cancer has been rather slow in clinical practice. The present study aimed to compare the clinical outcomes of laparoscopic versus open surgery for colorectal cancers. A randomised control trial was conducted including 100 patients of colorectal cancer who were randomly divided into two groups: 50 patients who underwent laparoscopic colorectal surgery (Group A) and 50 patients who had undergone conventional open colorectal surgery (Group B). Patient's clinico-pathological characteristics, hospital stay, postoperative morbidity and mortality and short-term oncological outcomes including pathological staging were compared. The results showed that the operation time was significantly longer in Laparoscopy group when compared with open surgery group ($p < 0.05$). Total amount of blood loss was significantly higher in Group B when compared with Group A. Despite the similar stay in intensive care unit, total hospital stay was significantly longer for open surgery group than laparoscopy group ($p < 0.05$). No significant difference was seen between two groups regarding post-op complications ($p > 0.05$). These findings indicated that laparoscopic surgery for colorectal cancer had the clear advantages of a minimally invasive surgery and relative disadvantage with longer surgery time and exhibited similar pathologic parameters compared with open surgery.

Keywords: Colorectal Cancer, Laparoscopic Surgery, Open colorectal surgery, Post-op Complications

Introduction

Colorectal cancer (CRC) is the third most common cancer in men (10.0% of the total cancers) and the second in women (9.4% of the total cases) worldwide ¹. Within Asia, the incidence rates of CRC vary widely and are uniformly low in all south Asian countries and high in all developed Asian countries. The burden of CRC has risen rapidly in some economically developed Asian countries like Japan, South Korea and Singapore ^{1,2}. Fortunately, the age adjusted incidence rates of CRC in all the Indian cancer registries are very close to the lowest rates in the world ². Hospital based and population based data also show that the incidence rates for rectal cancer is higher than colon cancer in all parts of India ^{2,3}. Limited data from the rural population based registries indicate that the incidence rates of colon cancer is very low in the rural settings. However the incidence rates of rectal cancer is disproportionately higher in rural India ²⁻⁴. Population based time trend studies show a rising trend in the incidence of CRC in India ⁵.

Over last four decades the 5 year survival rate of CRC has improved from 30% to about 45%. First line of attack on carcinoma is early diagnosis and treatment. The earlier the treatment, the better is the prognosis. For incurable disease palliative procedures improve outcome of life. There has been considerable improvement in knowledge regarding pathogenesis of colorectal carcinoma. If diagnosed in early stage this common malignancy is highly curable by surgical treatment with minimum morbidity and mortality ⁶.

In the 1980s, Heald and Ryall ⁷ introduced a new surgical technique of complete removal of the fatty envelope surrounding the rectum (mesorectum), called Total Mesorectal Excision TME. The adoption of total mesorectal

excision combined with neoadjuvant chemoradiotherapy in selected patients has reduced locoregional recurrence rates to below 10% and improved cancer-free survival rates to more than 70%⁸⁻¹¹. Laparoscopic surgery has progressively replaced open colonic surgery in recent decades owing to favorable short-term outcomes, such as less pain, reduced blood loss, and improved recovery time¹². Initially, there was concern regarding the safety of laparoscopic colectomy after reports of cancer recurrence in the abdominal wall^{13,14}. In various trials in which patients with colon cancer were randomly assigned to undergo either open or laparoscopic surgery, evidence was obtained that laparoscopic surgery was associated with similar disease-free and overall survival rates as open surgery^{15,16}. However, evidence is lacking from large, randomized clinical trials indicating that survival after laparoscopic resection of rectal cancer is not inferior to open surgery. Thus the aim of this study is compare the open approach and laparoscopic resection of colorectal cancer treatment.

Materials and Methods

A randomised control trial was conducted including 100 patients of stage I–III colorectal cancer admitted in the department of Surgery of NIMS hospital, Jaipur, India. Patients were randomly divided into either of two groups: 50 patients who underwent laparoscopic colorectal surgery (Group A) and 50 patients who had undergone conventional open colorectal surgery (Group B).

All patients had histologically verified carcinoma of the colon or rectum. Demographic data, operative details and postoperative early outcomes, outpatient follow-up, pathologic results, and stages of the cancer of all patients were reviewed. The definitive staging in all patients was established via pathological examination of the resected specimens. Operative time was calculated as the time between laparotomy and skin suture for open surgery and pneumoperitoneum induction and port-site closure for laparoscopic surgery.

Patients with synchronous tumors, tumors located in the transverse colon, stage 0 and IV tumors and those requiring total colectomy, abdominoperineal resections, or urgent surgery were excluded. All patients and their families were correctly informed and gave their full consent before surgery.

Statistical Analyses

Clinico-pathological characteristics, hospital stay, postoperative morbidity and mortality and short-term oncological outcomes including pathological staging were compared. The mean values were compared using unpaired Student's *t*-test. The frequency distributions were compared using chi-squared test. Statistical significance was assumed when the *p* value was <0.05. These analyses were performed using SPSS 10.0 software (SPSS, Chicago, IL, USA).

Results

Baseline characteristics, including age, sex, surgical risks as assessed by the American Society of Anesthesiologists (ASA), tumor location, histological differentiation and tumour's stage were similar between the two groups. The proportion of patients submitted to neoadjuvant chemotherapy was also similar between the two groups (table 1).

The operation time was significantly longer in Laparoscopy group when compared with open surgery group. Total amount of blood loss was significantly higher in group B when compared with Laparoscopy group (Group A). Despite the similar stay in intensive care unit, total hospital stay was significantly longer for open surgery group than laparoscopy group (Table 2).

No intra-operative complications were reported in both groups. One postoperative death was observed in open surgery group due to a severe pneumosepsis. No significant difference was seen between two groups regarding post-op complications (table 3).

Discussion

This study compares the surgical outcomes of 100 consecutive patients undergoing open or laparoscopic surgery for colorectal cancer. Compared with open surgery, laparoscopic surgery was associated with longer operative time, faster postoperative recovery, lower postoperative ileus.

Laparoscopic colorectal surgery has risen since last decade after multiple, large, randomized, controlled trials in colorectal cancer have displayed that this approach is safe and have equal oncological results as open surgery¹⁷⁻¹⁹. Despite similar outcomes and postoperative advantages in laparoscopic surgery, most colorectal cancers are still treated by open surgery. The main barrier to widespread adoption has been the technical difficulty of these operations²⁰.

Laparoscopic colorectal surgery demands not only the experiences in open surgery of colon and rectum but also skills in advanced laparoscopic techniques. At the beginning, operation time is the one of the much discussed subjects in laparoscopic surgery. When 4125 cases which were collected from the related randomised clinical studies were evaluated, it was seen that the operation time in laparoscopic surgery is significantly longer than open surgery²¹. When we look at the progress of the laparoscopic surgery teams, it is clearly seen that the operation time can be significantly decreased with the experience²². In our study, the mean time difference between laparoscopy and open surgery was around 42 minutes.

In previous studies, it was found that intra-operatively the amount of blood loss in laparoscopic surgery was significantly less than in the open surgery^{21,23}. Although measurement of intra-op blood loss is hard to standardize, it is obvious that blood loss is minimal because of high definition and large view and fine dissection in laparoscopic surgery. Similar to the previous studies, the amount of blood loss was lower in laparoscopy group in our study.

In our study, anastomotic leak rate was overall low (5%), with two patients in the group A and three patients in the group B. Leak rates for open surgery ranges from 2.4% to 6.8%^{24,25}. In meta-analyses comparing outcomes in laparoscopic colorectal surgery by Kelly and colleagues, the overall rate of anastomotic leak rate was 2.7%²⁶. It is well documented that postoperative complications are decreasing with the increased surgical experience especially anastomosis leakage, intra-abdominal infection, and mortality^{20,27}.

Large number of randomized controlled trials comparing laparoscopic to open surgery for colon cancer have established better short-term results, less pain, shorter length of stay, faster return of bowel function, and equivalent oncological outcomes^{23,28}. Laparoscopic rectal surgery is still developing with promising short-term benefit, although it largely depends on the skills and techniques of the surgeon²⁷. According to the COLOR study, the increased number of the patients treated with laparoscopy at an institution closely related with the improved short-term results of the operations²⁹. In our study, the benefits of laparoscopic colorectal surgery are seen in terms of reduced blood loss, fewer surgical complications and shorter hospital stay.

Conclusion

It has been demonstrated in the literature that laparoscopic colorectal surgery is safe and feasible with comparable oncological adequacy with open approach. But open surgery is still performed more frequently worldwide. Operating time may represents a disadvantage for laparoscopic surgery, but this can be overcome with increased experience. The results of this study shows that laparoscopic colorectal surgery is convenient and less invasive and probably could be the first choice of intervention for colorectal cancers.

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Tables

Table 1. Distribution based on Patient's & Tumor's Characteristics

Variable		Group A (n-50)	Group B (n-50)	p- value
Age (Mean ± SD)		53.2 ± 7.8	57.3 ± 6.3	0.63
Gender	Male	31	33	0.83
	Female	19	17	
ASA	I	13	14	0.65
	II	22	25	
	III	15	11	
Tumor Distribution	Colon	23	33	0.07
	Rectum	27	17	
Chemotherapy	Yes	16	11	0.36
	No	34	39	
Pathological Differentiation	Well Differentiated	12	11	0.91
	Moderately Differentiated	22	21	
	Poorly Differentiated	11	14	
	Others	5	4	
Tumour's Stage	I	4	3	0.85
	II-A	11	9	
	II-B	13	14	
	III-A	6	10	
	III-B	11	8	
	III-C	5	6	

Table 2. Distribution based on operative and postoperative results

Variable	Group A (Mean ± SD)	Group B (Mean ± SD)	p- value
Operation time (min)	223.3 ± 51.6	181.3 ± 44.3	< 0.05
Operative blood loss (mL)	153.4 ± 30.2	215.4 ± 42.2	< 0.05
Stay in ICU (d)	2.5 ± 1.9	2.2 ± 2.4	0.32
Total hospital stay (d)	4.5 ± 4.0	6.2 ± 5.3	< 0.05

Table 3. Distribution based on post-operative morbidity and mortality

Complications	Group A (n-50)	Group B (n-50)	p- value
Anastomotic leakage	2	3	1.00
Postoperative ileus	1	4	0.35
Major Medical Complication	2	3	1.00
Death	0	1	1.00