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Original Research Article

Study on risk factors for mortality and morbidity in patients undergoing surgery for colorectal cancer

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ABSTRACT

Background: The goal of surgery for colorectal cancer is cure, but post-operative mortality occurs. In evidence-based medicine, knowledge of the estimated risk associated with an operation might be an important factor to consider when a surgeon and patient consider surgery. This study aims to identify co-morbidity and causes of mortality in relation to direct technical complications of surgery.
Methods: All consecutive patients who underwent surgery for colorectal cancer were included. Co-morbidity was determined. The postoperative course was studied and cause of death within 30 days was determined. The clinical and pathologic characteristics of patients were recorded by using detailed questionnaire.
Results: 50 consecutive patients who underwent surgery for colon and rectal cancer were studied, out of which 3 died (6.45%). Most common cause for mortality was anastomotic leak and faecal peritonitis. 3 patients did not have any co-morbidities. In 14 patients (28%), duration of surgery was <3 hours, while in 36 patients (72%) operative time was >3 hours. No significant association was found between mode of surgery.
Conclusions: The knowledge of independent perioperative risk factors responsible would help the surgeons to take the appropriate measures and shorten the stay and reduce post op mortality and morbidity.

Keywords: Colorectal cancer, Co-morbidity, Morality, Risk factors

INTRODUCTION

Knowledge of the true frequency of both mortality and morbidity is crucial in planning health care and research and identifying risk factors. Despite improvement in surgical technique, bowel preparation, and prophylactic antibiotics, colorectal surgery was associated with a 5% to 6% mortality rate and a 20% to 40% morbidity rate 1-3. Colorectal cancer is one of the most common malignancies in the world. Patients undergoing surgical resection for malignancy of the colon often have an increased risk of developing complications. Many patients are elderly and others have associated comorbid conditions such as diabetes mellitus, hypertension, or atherosclerotic vascular disease, all of which amplify the morbidity and mortality of operative procedures.

However, most studies about outcomes after potential colorectal resection have been retrospective analyses from highly specialized centers and often lack detailed information on how preoperative variables affected morbidity and mortality risks.

Colorectal cancer is the second most common malignancy in the developed world and in some parts, of Asia, but it is relatively uncommon in the Indian subcontinent.[1,2] Surgical resection is the mainstay of treatment for patients with non-metastatic colorectal carcinoma.[3]

About 90% of patients with colorectal cancer require surgery, which is usually carried out with a curative intent. Despite refinements in surgical techniques, bowel preparation patterns, prophylactic antibiotics and postoperative care, colorectal surgery is associated with a 3%–6% mortality rate and a 20%–40% morbidity rate.[4,5] The situation is further complicated by the fact that colorectal cancer is a disease of the elderly, with only 5% of cases recorded among those below 40 years of age.[6] The identification of risk factors and optimized preoperative care of colorectal carcinoma patients may play a role in improving early postoperative outcomes.[7,8] In evidence-based medicine, knowledge of the estimated risk associated with an operation might be an important factor to consider when a surgeon and patient consider surgery. Objectives of this study were to determine risk factors for both mortality and morbidity in patients undergoing surgery for colorectal cancer.

METHODS

This was a prospective study of 50 patients undergoing surgery for colorectal cancer, either open or laparoscopic surgery on elective or emergency basis, during a period of two years from January 2016 to December 2018 from tertiary care centre were included in the study. Both postoperative mortality and morbidity were defined as in-hospital death and specific complications, respectively.

Wound infection was defined as evidence of a purulent discharge observed by attending surgeon or recorded in the patient's chart, or a diagnosis of deep- seated infection such as intra-abdominal abscess made by the attending Surgeons on clinical or radiological basis.[9]

All wound infections were confirmed by performing culture study of the purulent discharge.

Inclusion criteria

Inclusion criteria were all consecutive patients undergoing open or laparoscopic surgery (electively or on emergency basis) for colorectal cancers; both postoperative mortality and morbidity were as in-hospital death and specific complications within 30 days postoperative period.

Exclusion criteria

Exclusion criteria were patients receiving chemoradiation treatment as neodjuvant therapy for colorectal cancer; long term morbidity was not considered.

Pre-operative factors

Age, sex, smoking, alcoholism, BMI, ASA score, co morbidities, hemoglobin, serum albumin, creatinine, potassium, CEA level, blood transfusion, DVT prophylaxis, antibiotic prophylaxis, bowel preparation

Intraoperative factors

Nature of surgery, mode of surgery, location of tumor, involvement of adjacent structures, metastasis, type of resection, type of anastomosis, technique of anastomosis, abdominal drain, duration of surgery, blood loss and intraoperative blood transfusion.

Postoperative factors

Onset of feeding postoperatively, prolonged ileus, early ambulation, readmission, reintervention and staging.

End points

30-day mortality, anastomotic leak, surgical site infections, wound dehiscence, systemic complications and duration of postoperative stay.

Procedure

The postoperative course of each surgical patient was studied and the cause of death within 30 days after surgery was determined. The clinical and pathologic characteristics of these patients were recorded by using detailed questionnaire, which included the patients' demographics, associated co-morbid conditions, serum albumin levels for nutritional status, mode of admission (elective or emergency), site of tumour (descending colon and rectosigmoid tumours were grouped together as left sided colonic tumours, whereas caecum, ascending colon and transverse colon tumours were considered right-sided colonic lesions), TNM staging and the number of lymph nodes that were positive for tumour metastasis. Early postoperative morbidity was defined as any untoward event developing within 30 days of surgery that changed the usual course of recovery.

Statistical analysis

Descriptive statistics such as mean, SD and percentage was used to present the data. Tables were constructed by using Microsoft excel. Association of mortality and Anastomotic leak with different parameters was analysed by chi-square test; and Fisher's exact test for small sample. A p value less than 0.05 were considered as significant. Data analysis was performed by using software SPSS v16.0.

RESULTS

27 patients (54.8%) were in the age group of 51-70 years, and 14 patients (27.9%) were in age group of 31-50 years. 4 patients (7.5%) were below 30 years of age and 5 patients (9.6%) were above 70 years of age. 32 patients (64.5%) were males and 17 patients (34.5%) were females. 10 patients (19.3%) were smokers and 4 patients (7.5%) were alcoholics. Majority of patients i.e. 27 patients (54.8%) fell in normal BMI group and 17 patients (34.4%) were underweight (BMI<18.5). 2

patients (3.2%) were obese and 4 patients (7.5%) were overweight. 9 patients (17.2%) underwent emergency surgery, most of which presented with feature of bowel obstruction, and were taken up for surgery after preoperative resuscitation. One case developed intestinal obstruction after mechanical bowel preparation and one case developed endoscopic iatrogenic perforation and were operated on emergency basis.

Table 1: Demographic and clinical characteristics of patients.

Characteristics	Number of cases	Percentage (%)
Age groups (years)		
<30	4	7.5
31–50	14	27.9
51–70	27	54.8
>70	5	9.6
Gender		
Male	32	64.5
Female	17	34.5
Addiction		
Smokers	10	19.3
Alcoholics	4	7.5
Body mass index		
Underweight	17	34.4
Normal	27	54.8
Obese	2	3.2
Overweight	4	7.5
Nature of surgery		
Elective	41	82.8
Emergency	9	17.2

29 patients (57%) had no associated comorbidities, while 3 patients (7.5%) were diabetics, 8 patients (16.15%) were hypertensive and 10 patients (19.3%) had other comorbidities which included ischemic heart disease, COPD/bronchial asthma, neurological, psychiatric, renal failure. Oral antibiotic prophylaxis as an adjunct to mechanical bowel preparation was given preoperatively in only 4 patients (8.6%) for 3 days in the form of oral erythromycin and metrogyl.

Table 2: Co-morbidities.

Co-morbidities	Number of cases	Percentage (%)
None	29	57
Diabetics	3	7.5
Hypertensive	8	16.15
Other (ishaemic heart disease, COPD/ bronchial asthma, neurological, psychiatric, renal failure)	10	19.3

48 patients (96.8%) underwent laparotomy for colorectal resection, one patient underwent laparoscopic resection and one surgery was laparoscopy assisted. With respect to location of tumor, 19 patients (38.7%) had carcinoma in rectum, 17 patients (34.4%) had left sided malignancies which included sigmoid colon, recto-sigmoid, descending colon and splenic flexure. 12 patients (23.7%) had right sided colonic malignancies which included hepatic flexure, ascending colon and caecum, whereas 2 patients (3.2%) had malignancies located at multiple sites in the colon.

Table 3: Surgery related parameters.

Parameters	Number of cases	Percentage (%)
Mode of surgery		
Laparotomy	48	96.8
Laparoscopic resection	1	2.2
Laparoscopy assisted	1	1.1
Location of tumour		
Rectum	19	38.7
Left sided	17	34.4
Right sided	12	23.7
Multiple	2	3.2
Duration of surgery		
<180 min	14	28.0
>180 min	36	72.0
Post operation stay (days)		
0-8	3	5.4
9-16	37	73.1
17-24	8	17.2
>25	2	4.3

In 14 patients (28%), duration of surgery was <3 hours, while in 36 patients (72%) operative time was >3 hours.

37 patients (73.1%) had duration of the post op stay in a range of 9-16 days, while 9 patients (17.2%) had post op stay in a range of 17-24 days, 2 (4.3%) patients stayed for more than 25 days postoperatively.

Table 4: Pathological Astler Coller staging.

Staging	Number of cases	Percentage (%)
Not staged	5	11.8
A	0	0.0
B1	8	15.1
B2	12	23.7
C1	4	7.5
C2	21	41.9

By pathological Astler Coller staging, 21 patients (41.93%) were staged as AC stage C2, 12 patients (23.7%) were staged as AC stage B2. 8 patients (15.1%) were staged as AC stage B1, 4 patients (7.5%) were

staged as AC stage C1. 5 patients (11.82%) were not staged as resection was not done in these cases. 3 patients (6.45%) died postoperatively. Mortality rate of 6.45% was observed on our study.

Table 5: Association of mortality with different parameters.

Factors	Mortality		P value
	Yes	No	
Co-morbidities			
No	3	50	0.7
DM	0	7	
HTN	2	13	
Others	1	17	
Serum potassium level			
<3.5	3	8	0.04
3.6-5.0	3	75	
>5.1	0	4	
Nature of surgery			
Elective	2	75	0.007
Emergency	4	12	
Mode of surgery			
Laparotomy	6	84	0.99
Laparoscopy	0	2	
Laparoscopy assisted	0	1	

Table 6: Association of anastomotic leak with different parameters.

Factor	Anastomotic leak			P value
	Enterocutaneous fistula	Yes	No	
Serum albumin				
<3.5	3	3	26	0.01
>3.6	0	0	61	
Potassium				
<3.5	1	1	9	0.04
3.6-5.0	2	1	75	
>5.1	0	1	3	
Technique of anastomosis				
Handsewn	2	1	41	0.13
Stapled	1	2	15	
None	0	0	31	
Intra op blood transfusion				
Yes	3	2	40	0.04
No	0	1	47	
Reintervention				
Yes	2	2	12	0.01
No	1	1	75	

In the present study, as opposed to other studies, mortality showed no significant association with preoperative comorbidities. Others consists of IHD, COPD/bronchial asthma, neurological, nephrological, psychiatric 28% of patients with potassium level below 3.5 died, while only 3.84% patients with normal potassium level died. 66% mortality occurred due to Emergency surgery.

In the present study, no significant association was found between mode of surgery (laparotomy, laparoscopic, or laparoscopic assisted) and post-operative mortality. This may probably be because of very low number of laparoscopic procedures performed.

About 93% patients did not have anastomic leak and out of which 70% had albumin level >3.6%. 18.75% of patients with low serum albumin developed anastomotic leak or EC fistula. While none of the patient with albumin level >3.5 gm/dl developed anastomotic leak.

18% patients with low potassium level (<3.5 mEq/l) developed leak or EC fistula but 3.84% patients with normal potassium level developed leak or EC fistula.

11.1% patients with intraoperative blood transfusion developed anastomotic leak/EC fistula, while 2% patients with no intraoperative transfusion developed anastomotic leak/EC fistula.

66.6% of patients who developed Anastomotic leak or EC fistula underwent some reintervention, while 33.33% patients were managed conservatively.

DISCUSSION

50 consecutive patients who underwent surgery for colon and rectal cancer were studied, out of which 3 died (6.45%). Most common cause for mortality was anastomotic leak and faecal peritonitis. 3 patients did not have any co-morbidities. Similar findings of mortality was reported by Ansari (6.5%), and Longo (5.7%).[1,10]

Anastomotic dehiscence was defined as leak of luminal content from surgical joint between two hollow viscera. Luminal content may emerge through the wound or at drain site, or may collect near the anastomosis, causing fever, abscess, septicaemia, metabolic disturbance and/or multiple organ failure.[9]

Out of 93 patients, 16 patients underwent abdomino-perineal resection, 4 patients were inoperable, 7 patients underwent construction of stoma only but no resection of colon or rectum, and 2 patients underwent abdomino-perineal resection with TAH+BSO (total abdominal hysterectomy with bilateral Salpingo oophorectomy). Naturally, in these patients anastomosis was not constructed.

Effectively, 29 patients had no anastomosis constructed. 6 patients (6/64- 9.3%) developed anastomotic leak, either in the form of only leak or with formation of an enterocutaneous fistula. In the present anastomotic leak was found 9.3%, whereas Paul was found 3.6% and Mcardle was found 4.2%.[11,12] As other studies did, our present study did not observe a significant association of

mortality with ages equal to or older than 70 years.[2,3,13] Sex was also not associated with significant mortality in our study. Comorbidities, including cardiorespiratory, neurologic, liver diseases, corticosteroid, diabetes mellitus, and prior radiotherapy, have been reported in several studies as independent risk factors for postoperative mortality.[3,10,13] In our study none of these comorbidities showed independent association with mortality. Malnutrition is a risk factor of postoperative mortality. Malnutrition may be evaluated either by a weight loss of more than 10% within the past 6 months, or by serum albumin level, as Longo et al and our study did.[10] Gibbs et al reported that serum albumin level was a strong predictor of mortality, and it is the best prognostic indicator of nutritional status.[14]

In our study, hypoalbuminemia was one of the risk factors of morbidity (anastomotic leak). Our results emphasized the need for careful preoperative assessment of nutritional status before colectomy. A recent prospective randomized study reported that the administration of a supplemented diet before and after surgery was beneficial to outcomes for patients with cancer who were malnourished and undergoing major elective surgery. Perioperative treatment with immuno-nutrition seemed to be the best strategy to reduce complications and length of hospital stay.[15]

Whereas anastomotic dehiscence following colorectal surgery represented the first etiology of deaths, accounting for 20% to 33% of all of the deaths, 6 patients (12%) died with an anastomotic leakage in our study.[16]

CONCLUSION

Malnutrition may be evaluated either by a weight loss of more than 10% within the past 6 months, or by serum albumin level. Serum albumin level was a strong predictor of mortality, and it is the best prognostic indicator of nutritional status. Malnutrition is a risk factor of postoperative mortality. Hypoalbuminemia was one of the risk factors of morbidity (anastomotic leak). Further, it is emphasized the need for careful preoperative assessment of nutritional status before colectomy.

The knowledge of independent perioperative risk factors responsible for mortality and morbidity after colorectal cancer surgeries would help the surgeons to take the appropriate measures and shorten the stay and reduce post op mortality and morbidity.

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