International Surgery Journal
Gani M et al. Int Surg J. 2024 Jun;11(6):918-923
http://www.ijsurgery.com
pISSN 2349-3305 | eISSN 2349-2902

DOI: https://dx.doi.org/10.18203/2349-2902.isj20241390

Original Research Article

Impact of D2 vs D3 dissection in right sided colon cancer, on the mortality and morbidity of patient

Mubashir Gani[1]*, Zahid Kaleem[1], Aizul Khursheed Wani[1], Fazl Qadir Parray[2], Nisar Ahmad Chowdri[2]

[1]Department of General Surgery, SKIMS Medical College, Bemina, Srinagar, Jammu and Kashmir, India
[2]Department of General and Minimal Invasive Surgery, Sher-I- Kashmir Institute of Medical Sciences, Soura, Srinagar, Jammu and Kashmir, India

Received: 08 February 2024
Accepted: 06 March 2024

***Correspondence:**
Dr. Mubashir Gani,
E-mail: mubashir.gani72@gmail.com

ABSTRACT

Background: Colorectal cancer is the third most common type of cancer worldwide. It is more prevalent in elderly age group. Genetic and environmental factors play a role. Extent of lymph node dissection determines the prognosis and overall survival of the patient.
Methods: This study was conducted in colorectal division of Department of General and minimal invasive surgery in SKIMS Soura from June 2020 to May 2023. It was a prospective study comprising of 55 patients. The patients were studied in two groups: D2 and D3, and were compared on the basis of age group, gender, comorbidities, post operative complications, lymph node yield, operative time and mean blood loss.
Results: A total of 56 patients were divided into two groups; Group D2 (n=33) and Group D3 (n=23) with majority having above 70-year age in D2 and 50-59 years of age in D3. There was no predilection for any gender. Hypertension was the most common comorbidity in both the study groups. There were statistically insignificant differences between two groups in terms of post operative complications, mean operative time and mean operative blood loss. Majority of the patients in both the groups had Clavein Dindo Grade I 16 (48.5%) in D2 and 13 (56.5%) in D3. Mean lymph node yield in Group D2 was 14.3±2.27 and in Group D3 lymph node yield was 23.7±4.86.
Conclusions: D3 dissection in colon cancer resulted in a significant higher lymph node yield. Although both the procedures have almost similar complication rate but D3 dissection is an oncologically superior procedure.

Keywords: D3 Dissection, Lymph node, Colorectal cancer

INTRODUCTION

Colorectal cancer is the third most common type of cancer worldwide accounting for 10% of all cancer cases.[1] It is more prevalent in 6th to 7th decade of life, with a higher prevalence in women.[2] However, colorectal cancer is on rise in younger patients, due to risk factors such as obesity, sedentarism, bad nutritional habits (high in fats and proteins), smoking, and the progressive ageing of the population. The clinical presentation of colorectal cancer depends on the location, size, as well as the presence or absence of metastases. The symptoms include; abdominal pain, bleeding per rectum, alteration of bowel habits, involuntary weight loss, nausea, vomiting and malaise.[3] In the last report of GLOBOCAN 2012, Colorectal cancer was reported as the third most common malignancy in men with 1361,000 cases representing 10% of all cancers, and it is the second most common type of cancer in women with 614, 000 cases representing 9.2% of all cancers

Surgical treatment for colon cancer includes standard types of operations. Right hemicolectomy is the procedure of choice for cancers in the caecum, the

ascending colon, the hepatic flexure and in the proximal part of the transverse colon. In distal transverse cancer an extended right hemicolectomy can be done. Left hemicolectomy is the procedure for cancers in the left flexure or the descending colon. Complete mesocolic excision (CME) was first described by Werner Hohenberger.[4] The main background reasoning for CME is that the lymphatic spread of a colon carcinoma follows the lymphatic vessels in the mesentery. These vessels are embedded in the mesentery, which is covered by a thin visceral fascia, like an envelope. If this visceral, peritoneal fascia is not breached, tumour spread will be less likely. The plane between the back side of the colon mesentery and the retroperitoneal area is sometimes called the fascia of Toldt.[5] One major part of a CME-operation is to separate the mesocolic visceral fascia from the retroperitoneal surface in an embryologic plane. In case of a right hemicolectomy, Hohenberger describes mobilization of the duodenum with the pancreatic head (Kocher ‘s manoeuvre) and the mesenteric root up to the origin of the superior mesenteric artery. Then, the uncinate process of the pancreas, with the mesopancreas and part of the duodenum is separated from the mesentery, ensuring access to the mesenteric vein. The other main component of a CME is the central vascular ligation (CVL). When the central vascular anatomy is exposed, the operation includes a central tie and division of the supplying arteries, and veins, ensuring a large resected portion of the mesocolon, containing many lymph nodes. In case of a cancer in the caecum or in the ascending colon, the ileocolic artery (ICA) and the right colic artery (RCA) (if existing) and the corresponding vein(s) are divided where they originate from the superior mesenteric artery (SMA) and the superior mesenteric vein (SMV) respectively and the right branch of the middle colic artery (MCA) should be divided. If the colon cancer is situated in the right flexure, in the transverse colon or in the left flexure, a more proximal division of the MCA is advocated.

Since its first introduction in 1991, laparoscopy in colorectal cancer has increased rapidly, based on its particular benefits, including minimal trauma, decreased postoperative pain, earlier ambulation, faster recovery, and shortened hospital stay.[6-9] Additionally, the oncological outcomes of laparoscopy in colorectal cancer are comparable with those of an open colectomy.[10,11] However, some shortcomings have also been addressed, including prolonged operative time, steep learning curve, and lack of tactile feedback. Thus, despite reports that laparoscopy yields better clinical outcomes, its utilization is estimated to be only 20%-30% in Western countries.[12,13] Lymph node dissection in colon cancer is without a doubt necessary, it is just the extent of that dissection that is still under debate. It has been proven that the T category is directly related to the number and central spread of lymph node metastases. The numbers of dissected lymph nodes and the ratio of involved versus dissected lymph nodes have been used as markers for quality of surgery and histopathological evaluation. Dissection must be performed along the embryologic planes of the mesocolon and leave them intact. Extended lymphadenectomy is oncologically relevant only when it is combined with removal of the primary tumour with adequate longitudinal clearance, an intact complete mesocolon, and high vascular tie. Central ligation of the arteries should remove the highest draining nodes that may harbour occult metastases and thus offer the best chance at successful treatment by the eradication and control of the lymphatic metastasizing process.[14] The aim of our study was to compare D2 and D3 dissection in terms of Lymph node yield, operative time, blood loss, and morbidity and mortality.

METHODS

This was prospective observational study comprising of 55 patients, conducted in colorectal division of Department of General and minimal invasive surgery in SKIMS Soura from June 2020 to May 2023. The patients were divided in two groups. Groups D2 included patients on whom D2 dissection was performed. Group D3 included patients on whom D3 dissection was performed. The procedure performed depended on surgeon ‘s choice and expertise. Post operatively patients were followed and observations were made on basis of early post operative complications and lymph node yield.

Inclusion criteria

Inclusion criteria were; Biopsy proven adenocarcinoma of right colon cancer from cecum to the territory supplied by Middle colic vessels, Elective operations and Stage I-III Colon cancer.

Exclusion criteria

Exclusion criteria were; Left sided tumours, Patients with distant metastases, Complications of tumour (perforation and full bowel obstruction)/ Emergency surgeries, Previous radiotherapy or chemotherapy, Synchronous or metachronous tumours, Women during Pregnancy or breast-feeding period.

Preoperative evaluation

Patients were studied in detail. All base line investigations were done including the tumour markers. A diagnosis of colon cancer was pathologically confirmed before the surgery, using the biopsy specimen acquired from the colonoscopy. A contrast enhanced CT scan of the abdomen and pelvic cavity was performed to localize the lesion. A CT colonography (virtual colono-scopy) or double-contrast barium enema was performed when necessary. A whole-body CT scan was also done to demonstrate any distant metastatic disease, such as liver, lung, and even peritoneal metastases. If necessary, other examinations including abdominopelvic MRI, contrast-enhanced ultrasound of the liver, endoscopic ultrasound, bone scan, and positron emission tomography (PET)-CT

were also done to facilitate the preoperative evaluation. The patients were operated. Open right hemicolectomy or extended right hemicolectomy along with D3 lymphadenectomy was done. Postoperative complications were defined as per Clavien-Dindo classification of surgical complications. The size of the tumor, the distance between the proximal and distal cutting edge to the tumor, and the distance between the most distant free mesocolon and the tumor were also precisely measured. The histopathological examination of the specimen was done, particularly the examination of lymph nodes and data was collected about the total number of lymph nodes removed and the number of nodes having metastatic disease. The postoperative complications that were taken into consideration include post operative bleeding, gastrointestinal bleeding, anastomotic leakage, chylous fistula, surgical site infection, including intra-abdominal infections and wound infection, intestinal obstruction, postoperative diarrhea, and urinary tract infection. The data was collected and subjected to statistical analysis. The recorded data was compiled using SPSS Version 20.0. Continuous variables were expressed as Mean±SD and categorical variables were summarized as frequencies and percentages. Student's independent t test or Mann-Whitney U test, whichever feasible, was employed for comparing continuous variables. Chi-square test or Fisher's exact test, whichever appropriate, was applied for comparing categorical variables. A p value of less than 0.05 was considered statistically significant.

RESULTS

A total of 56 patients were divided into two groups; Group D2 (N=33) and Group D3 (N=23). Majority of patients i.e. 11 (33.3%) in Group D2 were 70 years or more. In Group D3, most of the patients i.e. 9 (39.1%) were 50-59 years of age. The mean age of patients in Group D2 was 59.5±15.64 years with a range of 26-85 years, while as Group D3 had mean age of 55.6±11.75 years with 32 to 78 years range (Table 1).

Table 1: Age distribution of study patients in two groups.

Age (years)	Group D2		Group D3		P value
	N	%	N	%	
<50	8	24.2	5	21.7	0.311
50-59	6	18.2	9	39.1	
60-69	8	24.2	6	26.1	
≥70	11	33.3	3	13.0	
Total	33	100	23	100	
Mean±SD (range)	59.5±15.64 (26-85)		55.6±11.75 (32-78)		

Out of 33 patients in Group D2, 17 (51.5%) were males and 16 were females, while as in Group D3, out of 23 patients 10 (43.5%) were males and 13 (56.5%) were females (Figure 1). Hypertension was the most common comorbidity in both the study groups D2 14 (42.4%) versus D3 9 (39.1%), followed by type 2 diabetes mellitus D2 6 (18.2%) versus D3 5 (21.7%), hypothyroidism D2 2 (6.1%) versus D3 1 (4.3%) and COPD D2 1 (3.0%) versus D3 1 (4.3%) (Table 2). Anastomotic leak was seen in 2 (6.1%) patients in Group D2.

Table 2: Underlying comorbidities of study patients in two groups.

Comorbidity	Group D2		Group D3		P value
	N	%	N	%	
HTN	14	42.4	9	39.1	0.805
T2DM	6	18.2	5	21.7	0.742
Hypothyroidism	2	6.1	1	4.3	0.779
COPD	1	3.0	1	4.3	1.000

Table 3: Calvien-Dindo grade of wound infection in two groups.

Grades	Group D2		Group D3		P value
	N	%	N	%	
I	16	48.5	13	56.5	0.729
II	14	42.5	9	39.1	
IIIa	3	9.1	1	4.3	
IIIb	0	0.0	0	0.0	
Total	33	100	23	100	

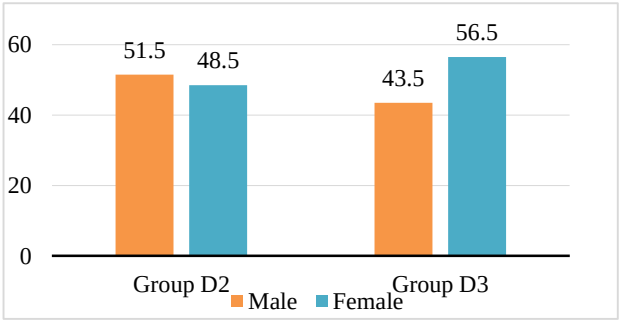

Figure 1: Gender Distribution of two study groups.

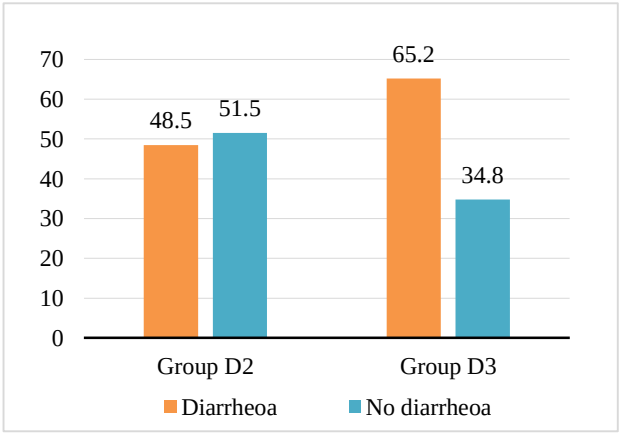

Figure 2: Post-operative diarrhoea in two groups.

Postoperative diarrhoea was observed in 16 (48.5%) patients in D2 group and 15 (65.2%) patients in D3 group

(Figure 2). Chylous ascites was seen only in 1 (4.3%) patient in D3 group. Abdominal collection was seen in 5 (15.2%) patients in Group D2 and 5 (21.7%) patients in D3 group (Figure 3).

Table 4: Comparison based on lymph node yield, operative time (minutes) and blood loss (ml) in two groups.

Variables	Lymph node yield		Operative time (min)		Blood loss (ml)	
	D2	D3	D2	D3	D2	D3
N	33	23	33	23	33	23
Mean	14.3	23.7	129.3	150.4	139.4	141.5
SD	2.27	4.86	10.67	9.41	7.12	9.59
Range	10-19	16-36	115-145	135-165	125-150	130-160
95% CI	13.5-15.1	21.6-25.8	125.6-133.2	146.3-154.5	137.1-142.0	137.4-145.7
P value	<0.001		<0.001		0.376	

Sepsis was observed in 6 (18.2%) and 4 (17.4%) patients in Group D2 and Group D 3 respectively (Figure 4). Urinary tract infection (UTI) was seen in 2 (6.06%) patients in Group D2 and 2 (8.6%) patients in Group D3.

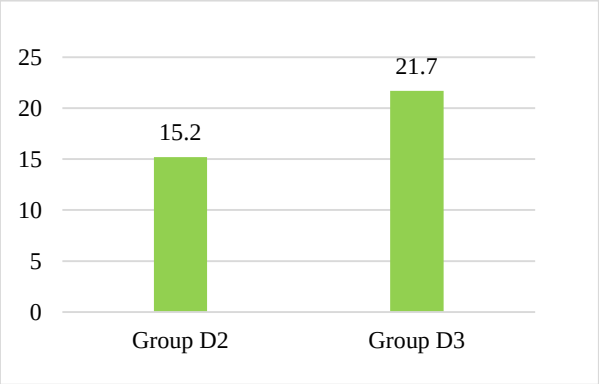

Figure 3: Abdominal collection in two study groups.

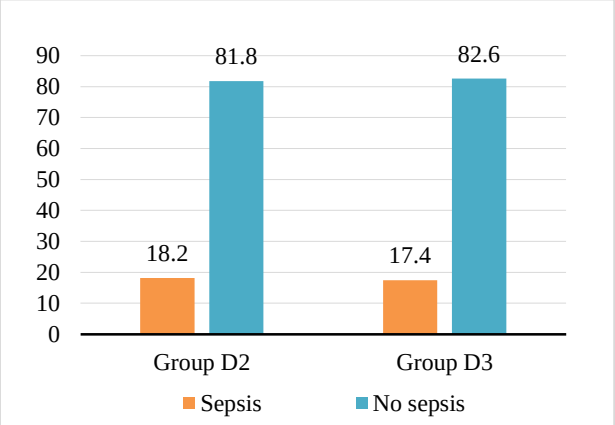

Figure 4: Sepsis in two study groups.

Clavien-Dindo grade was compared between two study groups Majority of the patients in both the groups had Grade I; 16 (48.5%) in D2 and 13 (56.5%) in D3 followed by Grade II; 14 (42.4%) in D2 and 9 (39.1%) in D3, Grade IIIa was observed in 3 (9.1%) patients in group D2 and 1 (4.3%) patient in group D3. None of the patients in either of the groups had Grade IIIb Clavien-Dindo grading (Table 3). Lymph node yield was compared between two study groups and significant statistical difference was observed. Mean lymph node yield in Group D2 was 14.3±2.27 and in Group D3 lymph node yield was 23.7±4.86. Mean operative time taken in Group D2 patients was 129.3±10.67 minutes while as in Group D3 mean operative time was 150.4±9.41 minutes. Mean blood loss observed in Group D2 patients was 139.4+7.12 ml while as in Group D3 mean blood loss observed was 141.5±9.59 ml. There was insignificant statistical difference between the two study groups in relation to the above compared data (Table 4).

DISCUSSION

There are number of surgical factors that are relevant to the prognosis of patients with colorectal cancer in addition to adequate lymph node dissection which include longitudinal and circumferential resection margin, clearance of primary, avoidance of tumor tear, multivisceral en-bloc resection of tumours that supposedly invade other organs, and, the complete mesocolic excision.[14-21] The number of patients in our study were 56, divided into Group D2 (n=33) and Group D3 (n=23). Majority of patients i.e. 11 (33.3%) were in Group D2 were 70 years or more. In Group D3, most of the patients i.e. 9 (39.1%) were 50-59 years of age. The mean age of patients in Group D2 was 59.5±15.64 years with a range of 26-85 years, while as Group D3 had mean age of 55.6±11.75 years with 32 to 78 years. Out of 33 patients in Group D2, 17 (51.5%) were males and 16 were females, while as in Group D3, out of 23 patients 10 (43.5%) were males and 13 (56.5%) were females. Similar results were obtained by Karachun et al.[22] Hypertension was the most common comorbidity in both the study groups D2, 14 (42.4%) versus D3, 9 (39.1%), followed by type 2 diabetes mellitus D2, 6 (18.2%) versus D3, 5 (21.7%), hypothyroidism D2 2 (6.1%) versus D3 1 (4.3%) and COPD D2 1 (3.0%) versus D3 1 (4.3%). Similar results were obtained by Sheng et al.[23] Anastomotic leak was seen in 2 (6.1%) patients in Group D2. None of the patients in Group D3 had anastomotic leak. Sheng et al conducted a study in which anastomotic leak was not seen in any patient in Group D3 which is comparable with the findings of the present study.[23] Postoperative diarrhea was observed in 16 (48.5%) patients in D2 group and 15 (65.2%)

patients in D3 group. Chylous ascites was seen only in 1 (4.3%) D3 patient in D3 group. Abdominal collection was seen 5 (15.2%) patients in Group D2 and 5 (21.7%) patients in D3 group. The difference was statistically insignificant (p=0.527).

Our results are consistent with the findings of Karachun et al.[22] Sepsis was observed in 6 (18.2%) and 4 (17.4%) patients in Group D2 and Group D3 respectively. Urinary tract infection was seen in 2 (6.06%) patients in Group D2 and 2 (8.6%) patients in Group D3. Regenbogen et al conducted a study in which UTI was observed in 4.1% patients.[24] Clavien-Dindo grade was compared between two study groups and insignificant statistical difference was observed. Majority of the patients in both the groups had Grade I, 16 (48.5%) in D2 and 13 (56.5%) in D3 followed by Grade II, 14 (42.4%) in D2 and 9 (39.1%) in D3, Grade IIIa was observed in 3 (9.1%) patients in group D2 and 1 (4.3%) patient in group D3. None of the patients in either of the groups had Grade IIIb Clavien-Dindo grading. Similar results were obtained in the study by Karachun et al.[22] Lymph node yield was compared between two study groups and significant statistical difference was observed. Mean lymph node yield in Group D2 was 14.3±2.27 and in Group D3 lymph node yield was 23.7±4.86. Similar results were observed by Storli et al and Kotake et al in their study.[25,26] Mean operative time taken in Group D2 patients was 129.3±10.67 minutes while as in Group D3 mean operative time was 150.4±9.41 minutes. The difference observed was statistically insignificant with p value of 0.376. Mean blood loss observed in Group D2 patients was 139.4±7.12 ml while as in Group D3 mean blood loss observed was 141.5±9.59 ml. The difference observed was statistically significant with p<0.001. The results are comparable with the study done by Sheng et al.[23]

CONCLUSION

Compared with the standard (D2) approach, introduction of CME (D3) surgical management of colon cancer resulted in a significant higher lymph node yield. Although both the procedures have almost similar complication rate but D3 dissection is an oncologically superior procedure.

Funding: No funding sources
Conflict of interest: None declared
Ethical approval: The study was approved by the Institutional Ethics Committee

REFERENCES

1. Smith RET, Renaud R C, Hoffman E. Colorectal cancer market. Nat Rev Drug Discov. 2004;3:471-2.
2. Galano R, Rodríguez Z, Casáus A. Cancer de colon: Seguimiento posoperatorio. Rev Cubana Cir. 1997;36(1):59-63.
3. Cancer Mondial. Statistical Information System. Int Agency Res Cancer. 1977.
4. Hohenberger W, Weber K, Matzel K, Papadopoulos T, Merkel S. Standardized surgery for colonic cancer: complete mesocolic excision and central ligation-technical notes and outcome. Colorectal Dis. 2009;11(4):354-64.
5. Culligan K, Coffey JC, Kiran RP, Kalady M, Lavery IC, Remzi FH. The mesocolon: a prospective observational study. Colorectal Dis. 2012;14(4):421-8.
6. Zheng MH, Feng B, Hu CY, Lu AG, Wang ML, Li JW. Long term outcome of laparoscopic total mesorectal excision for middle and low rectal cancer. Minim Invasive Ther Allied Technol. 2010;19:329-39.
7. Kang J, Kim IK, Kang SI, Sohn SK, Lee KY. Laparoscopic right hemicolectomy with complete mesocolic excision. Surg Endosc. 2014;28:2747-51.
8. Li JC, Leung KL, Ng SS, Liu SY, Lee JF, Hon SS. Laparoscopic assisted versus open resection of right-sided colonic cancer: a prospective randomized controlled trial. Int J Colorectal Dis. 2012;27:95-102.
9. Lim SW, Kim HR, Kim YJ. Single incision laparoscopic colectomy for colorectal cancer: comparison with conventional laparoscopic colectomy. Ann Surg Treat Res. 2014;87:131-38.
10. Adamina M, Manwaring ML, Park KJ, Delaney CP. Laparoscopic complete mesocolic excision for right colon cancer. Surg Endosc. 2012;26:2976-80.
11. Jayne DG, Thorpe HC, Copeland J, Quirke P, Brown JM, Guillou PJ. Five- year followup of the Medical Research Council CLASICC trial of laparoscopically assisted versus open surgery for colorectal cancer. Br J Surg. 2010;97:1638-45.
12. Alnasser M, Schneider EB, Gearhart SL, Wick EC, Fang SH, Haider AH. National disparities in laparoscopic colorectal procedures for colon cancer. Surg Endosc. 2014;28:49-57.
13. Rea JD, Cone MM, Diggs BS, Deveney KE, Lu KC, Herzig DO. Utilization of laparoscopic colectomy in the United States before and after the clinical outcomes of surgical therapy studygroup trial. Ann Surg. 2011;254:281-8.
14. West NP, Hohenberger W, Weber K, Perrakis A, Finan PJ, Quirke P. Complete mesocolic excision with central vascular ligation produces an oncologically superior specimen compared with standard surgery for carcinoma of the colon. J Clin Oncol. 2010;28(2):272-78.
15. Croner RS, Merkel S, Papadopoulos T, Schellerer V, Hohenberger W, Goehl J. Multivisceral resection for colon carcinoma. Dis Colon Rectum. 2009;52(8):1381-6.
16. Heald RJ. The holy plane of rectal surgery. J Soc Med. 1988;81:503-8.
17. Heald RJ and Ryall RD. Recurrence and survival after total mesorectal excision for rectal cancer. Lancet. 1986;1(8496):1479-82.

18. Quirke P, Durdey P, Dixon MF, Williams NS. Local recurrence of rectal adenocarcinoma due to inadequate surgical resection. Histopathological study of lateral tumour spread and surgical excision. Lancet. 1986;2(8514):996-9.
19. Quirke P, Steele R, Monson J, Grieve R, Khanna S, Couture J, et al. Effect of the plane of surgery achieved on local recurrence in patients with operable rectal cancer: a prospective study using data from the MRC CR07 and NCIC-CTG CO16 randomised clinical trial. Lancet. 2009;373(9666):821-8.
20. West N. Lymph node retrieval in colorectal cancer specimens: national standards are achievable, and low numbers are associated with reduced survival. Colorectal Dis. 2010;12:309-11.
21. West NP, Morris EJ, Rotimi O, Cairns A, Finan PJ, Quirke P. Pathology grading of colon cancer surgical resection and its association with survival: a retrospective observational study.Lancet Oncol. 2008;9(9):857-65.
22. Karachun A, Panaiotti L, Chernikovskiy I, Achkasov S, Gevorkyan Y, Savanovich N et al. Short-term outcomes of a multicentre randomized clinical trial comparing D2 versus D3 lymph node dissection for colonic cancer (COLD trial). BJS. 2020;107:499-508.
23. Sheng QS, Pan Z, Chai J, Cheng XB, Liu FL, Wang JH, et al. Complete mesocolic excision in right hemicolectomy: comparison between hand-assisted laparoscopic and open approaches. Ann Surg Treat Res. 2017;92(2):90-6.
24. Regenbogen SE, Read TE, Roberts PL, Marcello PW, Schoetz DJ, Ricciardi R. Urinary tract infection after colon and rectal resections: more common than predicted by risk-adjustment models. J Am Coll Surg. 2011;213(6):784-92.
25. Storli KE, Søndenaa K, Furnes B, Nesvik I, Gudlaugsson E, Bukholm I, et al. Short-term results of complete (D3) vs. standard (D2) mesenteric excision in colon cancer shows improved outcome of complete mesenteric excision in patients with TNM stages I-II. Tech Coloproctol. 2014;18(6):557-64.
26. Kotake K, Mizuguchi T, Moritani K, Wada O, Ozawa H, Oki I, et al. Impact of D3 lymph node dissection on survival for patients with T3 and T4 colon cancer. Int J Colorectal Dis. 2014;29(7):847-52.

Cite this article as: Gani M, Kaleem Z, Wani AK, Parray FQ, Chowdri NA. Impact of D2 vs D3 dissection in right sided colon cancer, on the mortality and morbidity of patient. Int Surg J 2024;11:918-23.