

Contents lists available at [ScienceDirect](http://ScienceDirect.com)

International Journal of Surgery

journal homepage: www.journal-surgery.net

Original research

Role of diversion ileostomy in low rectal cancer: A randomized controlled trial

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HIGHLIGHTS

- LAR with ileostomy has certain advantages over LAR without ileostomy in terms of anastomotic leak, post operative ileus, resumption of diet, wound infection.
- Stoma related complications were main disadvantage in LAR with ileostomy group.
- A proactive approach needs to be adopted for decreasing problems of skin related local complications and electrolyte related systemic complications.

ARTICLE INFO

Article history:

Received 5 February 2014

Received in revised form

30 April 2014

Accepted 14 July 2014

Available online 16 July 2014

Keywords:

Low rectum

Resection

Ileostomy

RCT

ABSTRACT

Introduction: Rectal cancer continues to be devastating malignancy worldwide. Sphincter preservation is the need of the hour. Distal anastomosis is more prone to leaks. Proximal diversion in form of ileostomy may be used to protect distal anastomosis. **Aim:** To compare two groups of low anterior resection with and without diversion ileostomy in rectal cancer patients. **Material and methods:** A prospective, hospital based study of 78 rectal carcinoma patients were taken for the study. Inclusion criteria was operable rectal cancer 4–12 cm from anal verge. Patients were randomized into two groups. Group – A (34 patient) patients with low anterior resection with ileostomy (LAR with ileostomy); Group – B (44 patients) patients with low anterior resection without ileostomy (LAR without ileostomy). Quality of life was assessed by scoring done by self designed method. A total score of 0–20 given for various parameters. **Results:** Skin excoriation was the commonest complication. Stomal retraction and stomal obstruction was seen in 1 patient each (3%). Hypokalemia was the commonest electrolyte imbalance present in ileostomy group. Anastomotic leak was present in 6% of Group A and 11% of Group B patients. Mean time of closure of ileostomy was 16 ± 4.3 weeks. **Conclusion:** LAR with ileostomy has certain advantages over LAR without ileostomy in terms of anastomotic leak, postoperative ileus, resumption of diet, wound infection, small bowel obstruction and in terms mortality and recurrence. However stoma related complications were main disadvantage in LAR with ileostomy.

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1. Introduction

LAR is generally performed for lesions in the upper third of the rectum and middle and, occasionally, for lesions in the lower third. Restoration of intestinal continuity often results in poor functional outcome as a consequence of alteration of pelvic physiology. The

anastomotic leak ranges from 3 to 11% for middle-third and upper-third anastomosis and to 20% for lower-third anastomosis [1,2]. Proximal diversion in the form of loop ileostomy is adopted because of the high rates of anastomotic complications associated with low colorectal and coloanal anastomosis [3]. The formation of these protective type of stomas for fecal diversion after restorative procedures have been reported to have a great impact on surgical morbidity and mortality of restorative colorectal surgery [4].

Aim: To compare two groups of low anterior resection with and without diversion ileostomy.

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2. Material and methods

This study was a prospective Study from June 2008 to December 2010 for a period of 30 months. Inclusion criteria were all those patients who presented to Department of General Surgery with diagnosis of cancer rectum between 4 and 12 cm from anal verge. Exclusion criteria were all those patients who were otherwise planned for any such procedure (Sphincter saving) but ended up with abdomino-perineal resection, It included a total number of 78 patients. Patients were allocated randomly to two groups; group 'A' and group 'B' by systematic random sampling. Group A Patients comprised of those patients who underwent Low Anterior Resection with Ileostomy (LAR With Ileostomy) and Group B included patients LAR without ileostomy. A detailed history of each patient including age, sex, residence, blood group, presenting complaints with a special stress on history of bleeding per rectum, bowel habits, stool character, abdominal pain or distension and any such history in the family. A thorough physical examination with main emphasis on lymphadenopathy, anemia, edema, ascites or organomegaly. Local examination was emphasized on digital rectal examination (DRE), proctoscopy (PE), sigmoidoscopy or colonoscopy in case needed or in referred patients. A diagnostic preoperative biopsy was taken from the lesion and sent for histopathological examination (HPE). Routine investigations like CBC (Pre-op./Post-op./follow-up), CXR P/A view. Specific investigations like LFT (pre-op./Post-op./follow-up), KFT, and hepatitis B surface antigen. Specialized investigation like CEA levels (pre-op./Post-op./follow-up). Preoperative staging by "Duke's," Multi-slice CT scan, trans-rectal ultrasound or MRI. All patients were discussed with a Medical/Radiation Oncologist for a neoadjuvant/adjuvant therapy Preoperative optimization after admission in patients where it was required like building up Hb%, nutritional status etc. Preoperative bowel preparation with pleglec/coloclean 1 day prior to surgery. In obstructive lesions, no bowel preparation was given. Part preparation done on the evening before surgery and preoperative counseling by a stoma therapist was sought. A preoperative antibiotic in the form of 2nd or 3rd generation Cephalosporin, Metronidazole or Tinidazole on the day of surgery were given at the time of induction and was continued for 5–7 days after surgery. Cross matched whole blood were also reserved for surgery in patients with low hemoglobin and blood transfusion given pre-operatively to raise hemoglobin up to 1° mg per dl. Preoperative counseling and explaining the procedure, possibility of temporary stoma, permanent stoma and anastomotic leak, pelvic sepsis in detail to the patient and his attendants and written consent was taken for all possibilities. All cases were done under general anesthesia Intra-operatively every attempt was made to stick to oncological principles, with stress on the complete resection of the tumor. The operative findings, including the indication and type of procedure, were recorded in all the patients. The restoration of gut continuity i.e. anastomosis was done either by a circular stapler or by hand sewn closure depending upon the level of lesion or availability of stapler. Details of intra-operative findings like TNM staging, status of liver, ascites, Blummer's shelf, any synchronous/metachronous lesion were confirmed. Decision about protective stoma was taken on the basis of criteria already explained. Ileostomy bag was applied preferably on table before extubation. Patient was monitored critically in postoperative ward for 24–48 h and shifted to ward later on. Postoperatively patients were on prophylactic anticoagulants (low molecular weight heparin). Urinary catheter was removed after 5–7 days. All postoperative complications (procedure related/stoma related) were recorded. Any procedure like exploration or stoma revision if needed was performed in the postoperative period. Demonstration of leak or sepsis was confirmed by septic profile, USG abdomen/

pelvis or CT with oral contrast. Patients were assessed in outpatient department after discharge for any wound infection, pelvic sepsis, generalized sepsis, status of anastomotic line by DRE or P/E, stoma condition (moving, edematous, prolapsed, retracted, taken off), stoma appliances (application, any leakages, any other problems, change of bag) and any electrolyte imbalances because of stoma and local skin condition around stoma site. Postoperative/follow-up visits were planned. CBC, LFT, CEA levels were sent on monthly basis on follow-up. USG and CT scan were planned on 3–6 monthly basis on follow up. Stoma closure was done after 12 weeks, after doing a cologram by water soluble contrast somewhere between 4 and 8 weeks. Post-stoma closure follow-ups were planned and all morbidity/mortality were recorded. Ethical clearance was sought from post graduate ethical clearance committee of hospital before undertaking the study. All participants gave written consent before inclusion. A scoring done by self designed method to assess Quality of Life after LAR with ileostomy and LAR without ileostomy was done (Table 1). A total score of 0–20 given for various parameters as explained in table.

Any score >15	Excellent results
10–15	Good results
8,10	Average results
<8	Poor results

Manuscript fully compliant with the CONSORT 2010 statement and reported in line with CONSORT [5]: <http://www.sciencedirect.com/science/article/pii/S1743919111005656#>.

Descriptive statistical method used were chi-square, odds ratio and Mann–Whitney *U* Test. *P*-value <0.05 was considered statistically significant.

3. Results

Total 34 (44%) patients were subjected to LAR with ileostomy while as 44 (56%) patients were subjected to LAR without ileostomy. Majority of the cases (36%) were in the age group of 51–60 years. Male: female ratio was 1.2:1. Bleeding per rectum was the chief complaint in 76 patients (97%) followed by weight loss in 31 patients. Constipation was commonest bowel habit present in 47 patients (60%). Family history of rectal malignancy was present in 10% of cases. On examination pallor was the most frequent finding seen in 81% of patients. Growth was felt on DRE in 72% and blood smearing of finger occurred in 67% patients. Most of the lesions (50%) were at 5–8 cm from anal verge. Synchronous lesion was present in 5% of cases on colonoscopy. CEA levels were in the range of 6–10 ng/ml in 44% of cases in preoperative period. Blood group "O" was the commonest group in the studied subjects. Neoadjuvant treatment was given to 23 (29%) patients. Well differentiated adenocarcinoma was the commonest histopathological variant encountered. Most of the patients presented in T2N0M0 stage. In our series, 13 (17%) patients were in Duke's A stage. 46 (60) patients were in Duke's B stage and 19 patients (23%) were belonging to Duke's C.

Wound infection developed in 11 (32%) patients in Group A (LAR with diversion ileostomy) and in the 8 (18%) patients in group B (LAR without diversion ileostomy). Anastomotic leak were present in 7 patients (9%) of which 2 patients (6%) belonged to Group A (LAR with ileostomy) and 5 patients (11%) had LAR without ileostomy (Group B). Sexual dysfunction was seen in 21% patients. 32% of patients in Group A & 11% of patients in Group B

Table 1
Quality of life in two groups (in diversion ileostomy and without diversion ileostomy).

S. no.	Parameters	Diversion			Without diversion		
		1 month	3 months	6 months	1 month	3 months	6 months
2.	<u>Patient Satisfaction</u>						
	a) Bowel/Stoma evacuation						
	i. Complete – 1						
	ii. Incomplete – 0						
	b) Frequency						
	i. >10 Motions – 0						
	ii. >7 Motions – 1						
	iii. 3–5 Motions – 2						
	iv. 2 or less – 3						
	c) Feeling of well being						
	i. Quite Happy – 3						
	ii. SoSo – 2						
	iii. Not Happy – 1						
	iv. Sad/Miserable – 0						
	d) Surgical Procedures						
	i. Fully satisfied – 3						
	ii. SoSo – 2						
	iii. Not satisfied – 1						
	iv. Sad/Miserable – 0						
3.	<u>Symptomatology of anterior resection syndrome</u>						
	a) Feeling of loss of reservoir function						
	i. Yes – 0						
	ii. No – 1						
	b) Feeling of incomplete bowel evacuation						
	ii. Yes – 0						
	iii. No – 1						
	c) Not soiling						
	i. Yes – 0						
	ii. No – 1						
	d) Incontinence to flatus						
	i. Yes – 0						
	ii. No – 1						
	e) Incontinence to stools						
	i. Yes – 0						
	ii. No – 1						
4.	<u>Functional outcome</u>						
	a) Sexual activity						
	i. Yes – 0						
	ii. No – 1						
	b) Return to Work						
	i. Yes – 0						
	ii. No – 1						
	c) Independent Living						
	i. Yes – 0						
	ii. No – 1						
	d) Socializing						
	i. Yes – 0						
	ii. No – 1						
	e) Recommendation to others						
	i. Yes – 0						
	ii. No – 1						

had sexual dysfunction. Stomal retraction and stomal obstruction was seen in 1 patient each (3%), whereas skin excoriation was commonest complication (Fig. 1). Hypokalemia was the commonest electrolyte imbalance present in ileostomy group. Mean time of closure of ileostomy was 16 ± 4.3 weeks. 3 patients (9%) did not have ileostomy closure. Resumption of diet and bowel movement in Group A was done on 4.1 ± 1.3 days whereas in Group B resumption of diet was started at 5.6 ± 1.7 days. Wound sepsis was the most common complication in the post-op. period followed by small bowel obstruction. Diet was resumed in group A after 4.1 ± 1.3 days & in group B after 5.6 ± 1.7 days. Recurrence rate was slightly higher in group B (7%) as compared to group A (3%). Mean hospital stay of total patients (78) was 12.1 ± 3.7 days. Mean hospital stay in patients who were subjected to LAR with Diversion ileostomy was 9.8 ± 3.3 days and 14 ± 2.9 days in subjects who underwent LAR without ileostomy and was

statistically significant ($p < 0.01$). Total overall QOL score was 13.6 ± 2.5 (Good score). QOL score for group A was 14.1 ± 3.1 & for group B it was 13.2 ± 1.9 (Tables 2–7). Recurrence was slightly higher in LAR without ileostomy group (6.8% vs 2.94%). The difference in mortality between two groups was not statistically significant (Table 8).

4. Discussion

Colorectal cancer (CRC) is the third most common cancer in males and females. The cumulative lifetime risk of developing colorectal cancer is about 6% [6]. A loop ileostomy is constructed to protect a distal colonic anastomosis. Stoma related complications can occur following both the construction and the closure of the stoma and adversely affect the primary surgery. To protect a distal colonic anastomosis and prevent pelvic sepsis, temporary loop



Fig. 1. Showing skin excoriation around ileostomy site.

ileostomy is constructed in LAR. Construction and closure of a defunctioning loop ileostomy are associated with several complications. A high body mass index (BMI), diabetes, use of steroids and immunosuppressive therapy, surgical technique and length of time between construction and closure are factors considered to predispose to stoma related complications.

Anastomotic leak remains the most serious complication following rectal resection for cancer. In this series anastomotic leak more that belonged to Group A (LAR with ileostomy) than who had LAR without ileostomy (Group B). These results are almost at par with those of **Law et al** who had 2 patients out of 42 (4.76%) with anastomotic leak after LAR with ileostomy and that of **Chude et al** who had anastomotic leak in 12 out of 120 patients (10%) with overall anastomotic leak of 8.97% corresponding to that of **Poon Jensen Tc et al** who had anastomotic leak of 21 patients out of 214 patients who had low anterior resection [7–9]. A protective stoma is to be made in patients with high risk of leakage. Faulty technique, hypoalbumenemia, obesity, elderly, and any associated comorbidity could have been precipitating factor for leak in our study.

All those who had postoperative small bowel obstruction were of sub acute type, were in Group B and all were managed conservatively. The incidence and risk factors of small bowel obstruction

following LAR, however, have not been adequately documented. Small bowel obstruction is one of the most common complications associated with temporary ileostomy. **Senepati et al** also found similar results in their study [10]. There are a few risk factors that might predispose patients who have undergone LAR to develop postoperative small bowel obstruction. These include the creation of raw areas in the pelvis by extensive dissection; the subsequent intra-abdominal sepsis and the increased practice of proximal diversion as a result of a high rate of anastomotic leakage; local or intra-abdominal recurrence; and the use of adjuvant radiation therapy. Kink of ileum loop proximal to ileostomy site could be seen as a cause in some cases.

Prolonged postoperative ileus could be contributory factor in small bowel obstruction. Our observation in Group A simulating the observations made by **Lewis et al** who observed ileus in 4 out of 42 patients who had loop ileostomy for rectal cancer [11]. Post-operative ileus is an inevitable in gastrointestinal surgery and prolongs hospital stay with increasing morbidity. The operating time and intra-operative blood loss have been documented independent risk factors for a postoperative ileus in colorectal surgery [12].

The incidence of complications of loop ileostomy in published series ranges from 3 to 93% [13,14]. Dehydration may requiring readmission to the hospital in patients. Septic complications are rare after closure of the loop ileostomy, but bowel obstruction is common. Bowel obstruction rarely requires operative intervention, but it is possible that changing the method of closure may decrease the rate of obstruction. The use of a loop ileostomy to bypass temporarily part of the terminal ileum may have significant metabolic effects. These rates vary due to varying length of follow-up. Age of the patient, urgency of surgery, diagnosis and time of presentation are the factors associated with high levels of morbidity and mortality. Our results with loop ileostomy who had ileostomy related complications are almost same as observed by **Giannakopoulos F et al** who had ileostomy related morbidity in 19% of 119 patients [15]. In this series, skin excoriation was leading complication which is at par with that of other studies reported in literature where skin excoriation was leading complication of post loop ileostomy [16,17]. Those who had stomal retraction and stomal obstruction, had both ileostomy revision. Stoma prolapse is one of the late complications and causes distress to the patients, if the stoma increases in size after maturation requiring change in

Table 2
Spectrum of complications in two management groups.

			LAR with ileostomy (Diversion)	LAR without ileostomy (No diversion)	Total	p Value
Anastomotic leak	Present	N	2	5	7	0.208
		%	5.88	11.36	8.9	
Pelvic collection	Absent	N	32	39	61	0.220
		%	94.1	88.63	91.02	
Interloop collection	Present	N	4	10	14	0.170
		%	11.8	22.7	17.9	
Peritonitis	Absent	N	30	34	64	0.143
		%	88.2	77.3	82.1	
Total	Present	N	1	5	6	0.170
		%	2.9	11.3	7.6	
Peritonitis	Absent	N	33	39	72	0.143
		%	97	88.6	92.3	
Total	Present	N	0	2	2	0.143
		%	0	4.5	2.6	
Total	Absent	N	34	42	76	0.143
		%	100	95.5	97.4	
Total		N	34	44	78	
		% of total	43.6	56.4	100	

All the four complications had a higher frequency in the LAR without ileostomy group though results were not statistically significant.

Table 3
Spectrum of complications in two management groups.

			LAR with ileostomy (Diversion)	LAR without ileostomy (No diversion)	Total	p Value
Postoperative bleed	Present	n	1	1	2	0.980
		%	2.94	2.32	2.56	
	Absent	n	33	43	76	0.454
		%	97.06	97.68	97.44	
Wound sepsis	Present	n	11	8	19	0.143
		%	32.3	18.18	24.3	
	Absent	n	23	36	59	0.674
		%	67.7	86.4	75.7	
Small bowel obstruction	Present	n	0	2	2	0.143
		%	0	4.5	2.5	
	Absent	n	34	42	76	0.674
		%	100	95.4	76	
Postoperative ileus	Present	n	4	5	9	0.674
		%	11.76	11.36	11.53	
	Absent	n	30	39	69	0.674
		%	88.23	88.63	88.47	
Total		n	34	44	78	
		% of total	43.6	56.4	100	

Only two complications (postoperative ileus and small bowel obstruction) had a higher frequency in the LAR without ileostomy group though results were not statistically significant.

Table 4
Spectrum of complications in two management groups.

			LAR with ileostomy (Diversion)	LAR without ileostomy (No diversion)	Total	p Value
Chest infections	Present	n	12	13	25	0.58
		%	35.3	29.5	32.1	
	Absent	n	22	31	53	0.56
		%	64.7	70.5	67.9	
Urinary retention	Present	n	8	8	16	0.56
		%	23.5	18.2	20.5	
	Absent	n	26	36	62	0.74
		%	76.5	81.8	79.5	
UTI	Present	n	12	14	26	0.74
		%	35.3	31.8	33.3	
	Absent	n	22	30	52	0.092
		%	64.7	68.2	66.7	
Sexual dysfunction	Present	n	11	5	16	0.092
		%	32.3	11.36	20.51	
	Absent	n	23	41	68	0.092
		%	67.7	88.64	79.48	
Total		n	34	44	78	
		% of total	43.6	56.4	100	

No difference in the above mentioned complications was found between the two groups.

appliance or surgical treatment. Retraction of stoma, prolapse of ileostomy and transient stomal ischemia are usually sequelae of an improper surgical technique.

Electrolyte imbalance is seen in many patients with a loop ileostomy are known to have episodes with excessive fluid loss electrolyte balance, during the first few postoperative days which

needs great care. Hypokalemia was commonest electrolyte imbalance present. **Ambreen et al** found electrolyte imbalance in 5.8% of patients, needing aggressive fluid and electrolyte which is at par with findings in present study of electrolyte imbalance of 5.1% [18].

Before stomal closure each patient had cologram to check distal patency. The time from formation to closure for the patient with no

Table 5
Electrolyte disturbances in two groups.

			LAR with ileostomy (diversion)	LAR without ileostomy (no diversion)	Total
Electrolyte imbalance	Hypokalemia	n	3	1	4
		%	8.8	2.27	5.1
	Hyponatremia	n	1	1	2
		%	3.03	2.27	2.56
	None	n	30	42	72
		%	88.2	95.45	92.30
Total		n	34	44	78

Hypokalemia was more frequent in ileostomy group.

Table 6
Frequency of stomal complications.

Stomal complications	LAR with ileostomy (diversion)	
	n	%
Stomal obstruction	1	2.9
Stomal retraction	1	2.9
Skin excoriation	5	14.7
Stomal leakage	2	5.9

Skin excoriation was the commonest stomal complication.

adjuvant therapy is 3 months and for those with adjuvant therapy is 7 months [19]. One had recurrence (2.94%) and one did not reported back for follow up and one (2.94%) had marked associated co-morbidity and advanced age which precluded ileostomy closure. Early ileostomy closure (within 3 months after construction) is feasible in most cases and should be encouraged and this will probably reduce stoma related complications and improve the quality of life in our patients. The reversal rate found in this series is almost near to those of **David G et al** who had reversal of ileostomy in 75.1% in 6582 patients following anterior resection [20]. Advancing age and co- morbidity are statistically related to non-reversal similar causes, reasons were present for non-reversal in this study for patients who did not have ileostomy closure. Time between formation and closure of loop ileostomy following anterior resection of rectum is significantly delayed by adjuvant chemotherapy. Prompt stoma closure should be a priority in these patients. There is no recognized optimal timing for reversal of temporary ileostomies. There is no recognized optimal timing for reversal of temporary ileostomies. However, most surgeons would advocate early reversal of ileostomies in medically fit and willing patients. The vast majority of patients experience an overall improvement in quality of life, physical function and social function following stoma reversal.

Post ileostomy reversal complications have been reported to be between 20 and 48% as reported by **Lahat G et al** and **Pokorny H** which correspond to figures present in our series [21,22]. Wound infections and anastomotic leakage being the most common surgical complications. In the present series post reversal complications were managed conservatively in all cases.

Resumption of diet and bowel movement in Group A was done on 4.1 ± 1.3 days whereas in Group B resumption of diet was started at 5.6 ± 1.7 days. This is statistically significant. Mean time for stomal output was 2.8 days. The resumption of a diet is critical to the recovery. There is much variability with regards to restarting enteral nutrition in patients undergoing colorectal surgery; In our study majority of patients tolerated oral intake in the immediate postoperative period, regardless of the presence or absence of traditional markers of normal gastrointestinal function. It reduced postoperative infections, reduced anastomotic complications and shorter length of stay as shown in patients who received immediate postoperative normal diet compared to patients who were fasting until gastrointestinal functions were resumed. Our observations match to those of **Lewis et al** who had return of bowel function and resumption of diet more quickly in patients with ileostomy with anterior resection [11].

Table 7
Time of stomal closure and hospital stay at 2nd surgery.

	N	Range	Minimum	Maximum	Mean	Std. deviation
Time of stoma closure (in weeks)	31	18	12	30	16.8	4.3
Hospital duration for stoma closure (in days)	31	3	3	6	3.6	0.9

Mean time of stomal closure was 16.8 weeks with a minimum of 12 weeks and maximum of 30 weeks. Mean hospital stay for the closure was 3.6 days.

Table 8
Post-stoma closure morbidity in diversion group.

Post-stoma closure morbidity		
	n	%
Small bowel obstruction	3	9.67%
Wound sepsis	5	16.12%
Incisional Hernia	1	3.20%
None	21	67.70%

Wound sepsis was the most common complication in the post-op. period followed by small bowel obstruction.

Mean hospital stay was 12.1 ± 3.7 days. Hospital stay included both primary surgery as well as hospital stay for ileostomy reversal. Minimum hospital stay was 6 days and longest hospital stay was 20 days. In Group A, minimum hospital stay was 6 days and longest was 18 days with a mean of 9.8 ± 3.3 days in comparison to Group where 14 ± 2.9 was mean hospital stay. Patients with low anterior resection with ileostomy required less hospital stay as proved in literature corresponding to our observations [23]. Follow up protocol was after 1 month, 3 months and 6 months.

Recurrent rectal carcinoma following surgery carries an extremely poor prognosis and subsequent intervention is usually palliative. Recurrence rate seen in this study corresponds to recurrence seen in surgery for rectal cancer by **Colombo P et al** and that of **Heald J et al** who had local recurrence following curative surgery ranging from 3.7 to 50% [24,25]. Total of 22 patients received adjuvant therapy. 19 patients received chemo radiotherapy and only 3 had chemotherapy only those who had margin positive, signet ring cell carcinoma, and young patients had recurrence. Local recurrence following rectal cancer surgery has been said to be influenced by many factors including the type of surgery, extent of resection, use of blood transfusion and use of adjuvant radiotherapy and chemotherapy. Mortality and recurrence, which however could not achieve a much statistical significance, probably because of the small sample size and short follow up.

In our study QOL was determined by self designed method. A total score of 0–20 given for various parameters. Those with Any score >15 considered as an excellent, score of 10–15 is Good result and between 8 and 10 is Average result and score of <8 is Poor result.

In total of 78 patients 21 patients (26.92%) had excellent results, out of which 13 were having LAR with diversion and 8 were without diversion. Good results were found in 49 patients, out of which 33 patients were LAR without diversion, 16 were LAR with diversion. Average results were present in 8 patients, the 5 were belonging to Group A. Overall in LAR with diversion had QOL score had mean OF 14.1 ± 3.1 and LAR without ileostomy had QOL of 13.2 ± 1.9 . Total overall QOL was 13.6 ± 2.5 . Patients' scores on the quality of life questionnaires generally report improvement after high anterior resection; however, for patients who underwent low anterior resection, the scores for physical and role functioning before ileostomy closure are worse than the preoperative values. The scores on the quality of life questionnaires generally improved after ileostomy closure. Ileostomy closure required a short hospital stay and was rarely associated with

complications. Our study has observations that QOL score is slightly better in patients of LAR without ileostomy than in LAR with ileostomy as observed by O'Leary et al, Tsunoda A et al and Engel et al [26–28].

5. Conclusion

LAR with ileostomy has certain advantages over LAR without ileostomy in terms of anastomotic leak, postoperative ileus, resumption of diet, wound infection, small bowel obstruction and in terms mortality and recurrence. However, stoma related complications were main disadvantage in LAR with ileostomy group.

Ethical approval

Ethical approval taken from ethical committee of Sheri Kashmir Institute of Medical Sciences.

Funding

None.

Author contribution

Mukhtar Thoker: Substantial contributions to conception and design, acquisition of data, Drafting the article, revising it critically for important intellectual content, Final approval of the version to be published.

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Parvaiz Thoker: Drafting the article, Critical revision of the article, Final approval of the version to be published.

Conflicts of interest

None.

Appendix A. Supplementary data

Supplementary data related to this article can be found at <http://dx.doi.org/10.1016/j.ijssu.2014.07.012>.

References

- [1] L.J. Harris, B.R. Phillips, P.J. Maxwell, G.A. Isenberg, et al., Outcomes of low anterior resection anastomotic leak after preoperative chemoradiation therapy for rectal cancer, *Am. Surg.* 76 (2010) 747–751.

- [2] B.R. Phillips, L.J. Harris, P.J. Maxwell, et al., Anastomotic leak rate after low anterior resection for rectal cancer after chemoradiation therapy, *Am. Surg.* 76 (2010) 869–871.
- [3] S. Farth, L. Hulthen, Loop ileostomy: a superior diverting stoma in colorectal surgery, *World J. Surg.* 8 (1984) 401–407.
- [4] I. Gastinger, F. Marusch, R. Steinert, S. Wolff, F. Koeckerling, H. Lippert, Protective defunctioning stoma in low anterior resection for rectal carcinoma, *Br. J. Surg.* 92 (2005) 1137–1142.
- [5] D. Moher, S. Hopewell, K.F. Schulz, V. Montori, P.C. Gøtzsche, P.J. Devereaux, D. Elbourne, M. Egger, D.G. Altman, CONSORT, CONSORT 2010 explanation and elaboration: updated guidelines for reporting parallel group randomised trials, *Int. J. Surg.* 10 (1) (2012) 28–55.
- [6] E.T. Hawk, B. Levin, Colorectal cancer prevention, *J. Clin. Oncol.* 23 (2) (2005 Jan 10) 378–391.
- [7] W.I. Law, K.W. Chu, J.W. Ho, C.W. Chan, Risk factors for anastomotic leakage after low anterior resection with total mesorectal excision, *Am. J. Surg.* 179 (2000) 92–96.
- [8] G.G. Chude, N.V. Rayate, V. Patris, M. Koshariya, R. Jagad, J. Kawamoto, N.J. Lygidakis, Defunctioning loop ileostomy with low anterior resection for distal rectal cancer: should we make an ileostomy as a routine procedure? A prospective randomized study, *Hepatogastroenterology* 55 (86–87) (2008 Sep–Oct) 1562–1567.
- [9] J.T. Poon, W.L. Law, K.W. Chu, Small bowel obstruction following low anterior resection: the impact of diversion ileostomy, *Langenbecks Arch. Surg.* 389 (4) (2004 Aug) 250–255.
- [10] A. Senapati, R.J. Nicholls, J.K. Ritchie, et al., Temporary loop ileostomy for restorative proctocolectomy, *Br. J. Surg.* 80 (1993) 628–630.
- [11] P. Lewis, D.C. Bartolo, Closure of loop ileostomy after restorative proctocolectomy, *Ann. R. Coll. Surg. Engl.* 72 (1990) 263–265.
- [12] A. Artinyan, J.W. Nunoo-Mensah, S. Balasubramaniam, J. Gauderman, R. Essani, C. Gonzalez-Ruiz, A.M. Kaiser, R.W. Beart Jr., Prolonged post-operative ileus—definition, risk factors, and predictors after surgery, *World J. Surg.* 32 (2008) 1495–1500.
- [13] G.A. Khoury, M.C. Lewis, L. Meleagros, et al., Colostomy or ileostomy after colorectal anastomosis: a randomized trial, *Ann. R. Coll. Surg. Engl.* 69 (1987) 5–7.
- [14] D.P. Edwards, A. Leppington-Clarke, R. Sexton, et al., Stoma-related complications are more frequent after transverse colostomy than loop ileostomy: a prospective randomized clinical trial, *Br. J. Surg.* 88 (2001) 360–363.
- [15] F. Giannakopoulos, A. Veenhof, L. van der Peet, C. Sietses, J. Meijerink, M.A. Cuesta, Morbidity and complications of protective loop ileostomy, *Colorectal Dis.* 11 (6) (2009) 609–612.
- [16] N. Safirullah, A. Jan, S. Ahmed, Complications of intestinal stomas, *J. Postgrad. Med. Inst.* 19 (2005) 407–411.
- [17] T. Hussain, S.N. Alam, S. Manzar, Outcome of ileostomy in cases of small bowel perforation, *Pak. J. Surg.* 21 (2005) 65–71.
- [18] M. Ambreen, S. Razaque, S. Gulshan, A. Qureshi, Various complications in ileostomy construction, *World Appl. Sci. J.* 2 (3) (2007) 190–193.
- [19] G. Vrakas, M.G. Pramateftakis, D. Kanellos, S. Sapidis, P. Hatzigianni, T. Tsachalis, I. Kanellos, C. Lazaridis, Defunctioning ileostomy closure following low anterior resection by chemotherapy, *Tech. Coloproctol.* 14 (1) (November 2010) 77–78.
- [20] G. David, S. Slavin, D. Willmott, J. Corless, A. Khan, R. Selvasekar, Loop ileostomy following anterior resection: is it really temporary? *Colorectal Dis.* 12 (5) (2010) 428–432.
- [21] G. Lahat, H. Tulchinsky, G. Goldman, J.M. Klauzner, M. Rabau, Wound infection after ileostomy closure: a prospective randomized study comparing primary vs. delayed primary closure techniques, *Tech. Coloproctol.* 9 (2005) 206–208.
- [22] H. Pokorny, H. Herkner, R. Jakesz, F. Herbst, Mortality and complications after stoma closure, *Arch. Surg.* 140 (2005) 956–960.
- [23] A.B. Ulrich, C. Seiler, N. Rahbari, J. Weitz, M.W. Büchler, Diverting stoma after low anterior resection: more arguments in favor, *Dis. Colon Rect.* 52 (3) (2009 Mar) 412–418.
- [24] P.L. Colombo, C.L. Foglieni, C. Morone, Analysis of recurrence following curative low anterior resection and stapled anastomosis for carcinoma of the middle third and lower rectum, *Dis. Colon Rect.* 30 (1987) 457–464.
- [25] R.J. Heald, R.D. Ryall, Recurrence and survival after total mesorectal excision for rectal cancer, *Lancet* 2 (1986) 1479–1482.
- [26] D.P. O'Leary, C.J. Fide, C. Foy, M.E. Lucarotti, Quality of life after low anterior resection with total mesorectal excision and temporary loop ileostomy for rectal carcinoma, *Br. J. Surg.* 88 (9) (2001 Sep) 1216–1220.
- [27] A. Tsunoda, Y. Tsunoda, K. Narita, M. Watanabe, K. Nakao, M. Kusano, Quality of life after low anterior resection and temporary loop ileostomy, *Dis. Colon Rect.* 51 (2) (2008 Feb) 218–222 (Epub 2008 Jan 3).
- [28] J. Engel, J. Kerr, A. Schlesinger-Raab, R. Eckel, H. Sauer, D. Hölzel, Quality of life in rectal cancer patients: a four-year prospective study, *Ann. Surg.* 238 (2) (2003 Aug) 203–213.