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Review Article

Surgery Section

Laparoscopic Colorectal Surgery: An Update (with Special Reference to Indian Scenario)

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ABSTRACT

Laparoscopic cholecystectomy, being already declared as gold standard technique, laparoscopic surgery has advanced far and wide, touching almost every corner of the abdomen. This advancement has gradually expanded to colorectal surgery which is done for malignant diseases as well. However, laparoscopic colorectal surgery has not been accepted as quickly as was laparoscopic cholecystectomy. This is because of its steep learning curve, concerns with oncological outcomes, lack of randomized control trials (RCTs) and initial reports on high port site recurrences which occurred after curative resections. But all these initial concerns have been overcome by doing a series of RCTs globally, in the past decade, that revealed that laparoscopic colorectal surgery for malignant disease offered short term benefits without compromising on oncological principles of radicality of resection, tumour resection margins and completeness of lymph node harvesting as compared to those of open surgery. Favourable post-operative results with respect to less blood loss, less pain, lesser surgical site infections, lesser requirement of analgesics, early return of bowel function and shorter hospital stay in patients who underwent laparoscopic colorectal resections were obtained in studies done on individual series, including those done in India and more recently, in large trials. An update on recent studies done on laparoscopic colorectal surgery by reviewing many RCTs and individual series, including our experiences, was made, to support the advantages of this procedure which were obtained when it was carried out by skilled hands.

Keywords: Laparoscopic colorectal surgery, RCTs, Review, Personal series, Advantages

INTRODUCTION

Laparoscopic or laparoscopic assisted colorectal surgery which is done for malignant diseases is gaining momentum, though initially the procedure had met with considerable reservation because of concerns which related to the adequacy of resection, oncological principles, inhibition on the part of surgeon, steep learning curve, atypical patterns of recurrence, lack of desired equipments and health care cost considerations. Initial reports on port site metastasis were as high as 21% [1] and it was hypothesized that cancer cell implantation took place during the release of pneumoperitoneum, direct tumour implantation from contaminated instruments or extraction of specimen through a small incision and following stimulation by insufflating Carbon dioxide (CO_2) gas, but none have been proved scientifically.

Jacobs et al., [2] reported the first series of laparoscopic colonic resections which were done in 20 patients. The first RCT, which studied late outcome of laparoscopic surgery done for colon cancer was reported by Lacy et al., [3]. A total of 219 patients with colon cancer who attended a single institute between 1993-1998 were randomized into two groups – laparoscopic resection (n=111) and open resection (n=108). The authors found significant advantages with regards to reduced blood loss, early return of intestinal motility, lower overall morbidity and shorter duration of hospital stay in laparoscopic assisted group. The analysis of the study also revealed a significantly better, cancer-related survival in the laparoscopic group.

A prospective evaluation of Laparoscopic Bowel Surgery Registry, done jointly by Society of Colon and Rectal Surgeons, the American College of Surgeons, Society of American Gastro-intestinal Endoscopic Surgeons, which was initiated in the year 1992, revealed port site metastasis which was as low as 1.1% (Vukasin P et al.,) [4].

In India, unlike west, incidence of colorectal cancer is low, but as there is an increased trend of rectal cancer, specifically among younger age groups, laparoscopic colorectal surgery for colonic carcinoma is gradually picking up at different centres. However, reports on collective data and RCTs, that reflect current national trends or status of laparoscopic colorectal surgery, are still lacking.

Robotic surgery is an emerging field with rapid acceptance, because of the 3-dimensional image which is obtained, dexterity of instruments and autonomy of camera control, and as difficult colorectal surgeries can be performed much easier.

In order to evaluate the results of studies which compared laparoscopic and open colon resections, short term results and complications, intra-operative findings, survival and oncological outcomes , an update review was undertaken, which incorporated some reputed RCTs, some previous review literatures and individual series, including data of the authors.

METHODS

An extensive search for relevant RCTs, review articles, individual series, rare case reports, and novel techniques for laparoscopic colorectal surgeries, with or without comparison with open surgery for colorectal cancers, was made by using Pubmed, Medline and Cochrane database from 1991 to July 2013. As it is practically not possible to include all available literatures for review, we picked up some RCTs of international repute and individual series that merited attention for inclusion in this update study. Inclusion criteria were elective resections of colonic malignancies in adult patients and comparison between laparoscopic and open technique. All other studies done on colon and rectal resections, even from smaller series, novel techniques, rare case reports, were taken into account if the comments and findings were relevant for laparoscopic colorectal surgeries and they were cross referred. The results of the outcomes of these RCTs, systemic reviews or large retrospective studies have been reported.

RESULTS

The COST (Clinical Outcome of Surgical Therapy) study [5] had reported on the outcomes of 872 patients with colon cancer, who had been randomized into two groups (laparoscopic resection n=435 and open resection n=437). They were from 48 institutions. The study involved the surgeons who had performed 20 laparoscopic colorectal surgeries or more. The median follow up was 4.4 years. There were longer operative times but quicker recoveries and shorter hospital stays in laparoscopic group. There was no significant difference in morbidity and mortality, tumour recurrence or overall survival in both groups. From oncological point of view, the resection margins in both groups, were similar. This group concluded that laparoscopic colorectal surgery was safe if it was performed by expert hands.

The MRC CLASSIC trial [6] compared conventional versus laparoscopic assisted surgeries done for colorectal cancers between 1986 and 2002 at 27 centres of United Kingdom. It randomized 794 patients with colon and rectal cancers into laparoscopic resection (n=526) and open resection (n=268) groups, with a ratio of 2:1. It was the first RCT to include patients with rectal cancer. The study reported a 20% conversion rate. There was a higher incidence of positive circumferential resection margins after laparoscopic resections, but this was not statistically significant. There was no difference in hospital mortality or quality of life at 2 weeks and 3 months post-operatively. The authors concluded that laparoscopic resections done for colon cancer were as effective as open surgeries. However, they were of the opinion that the impaired short term outcomes obtained after laparoscopic resections, especially AR which was done for rectal cancers, didn't justify its routine use.

The COLOR Trial (Colon Cancer Laparoscopic Or Open Resection) [7] was a multicentre study that included 1248 patients with colon cancer, who were randomized into two groups – laparoscopic resection (n=627) and open resection (n=621). The conversion rate was 17%. The laparoscopic resection group had longer operating times but less blood loss, early recovery of bowel functions, fewer analgesia requirements and shorter hospital stays. There was no difference in radicality of resection, mortality and morbidity. The authors concluded that laparoscopic surgery could be done for achieving safe and radical resections in the right, left and sigmoid colon.

Martel G et al., [8], in extensive cumulative meta-analysis which they did for RCTs, randomized 5782 patients into laparoscopic (n=3,031) and open (n=2751) colorectal surgery groups. They reported that laparoscopic surgery done for colon cancer was non-inferior to open surgery in terms of overall survival and that it has been so since 2004. Laparoscopic surgery done for rectal cancer has been increasingly accepted since 2006, but it has remained controversial.

The post-operative (< 30days) morbidity rate and overall recurrence Odds Ratio seen among laparoscopic and open resection groups, as were quoted by P Millo et al., [9], have been reproduced in [Table/Fig-1, 2]. All the trials which have been listed in these tables didn't find any differences in recurrence rates, overall mortality and distance metastasis when laparoscopic and open surgeries were compared.

Indian Perspective: India is a very vast country. The incidence of colorectal cancer is low, as compared to that seen in the west. But the lesion is gradually picking up, especially in the north-eastern part of the country. The overall incidence of rectal cancer amongst young adults is increasing. Westernization of dietary habits and not taking sufficient quantity of diet rich in fibre may partly contribute towards an increased incidence of colorectal malignancies. There is no dearth of highly skilled laparoscopic surgeons in India, who are doing large numbers of laparoscopic colorectal surgeries. But it is surprising to note that we are yet to conduct our own randomized control trials, that will reflect the national database. However, we have done quite a good number of retrospective and prospective studies, individual series, written good review articles and case reports, etc, which have been included in the literature, some of which have been listed in [Table/Fig-3, 4].

Prakash K et al., [10] retrospectively reviewed 62 patients who underwent laparoscopic colorectal surgeries (LACs), with same number of parameter matched patients who underwent open colorectal resections (ORs). The clinical parameters, operative parameters, short-term outcome details were analyzed. LAC was associated with lesser blood loss, shorter ICU stay, early resumption of oral feeds and shorter stay. This first report from India concluded that radical surgery for rectosigmoid colorectal tumours could be performed laparoscopically in selected patients. The same team further reported their own series of 265 patients and concluded that as the unit's experience improved, there was a trend towards selecting difficult cases and performing complex laparoscopic colorectal resections [11].

Palanivelu C et al., [12] reported laparoscopic anterior resections which were done in 170 patients. The average age of the patients

Study ID	Year of last Publication	Number of patients	LAP morbidity rate (%)	Open morbidity rate (%)
Barcelona	2008	219	11	29
Braga	2010	268	12	20
CLASSIC	2010	794	39	42
COLOR	2009	1076	21	20
COST	2007	863	21	20
Curet	2000	73	4	17
Hasegawa	2003	50	4	19
Hewitt	1998	15	0	0
Liang	2006	269	15	22
Milsom	1998	109	15	15
Kaiser	2004	48	18	20

[Table/Fig-1]: Post-operative (<30days) morbidity rate Courtesy Paolo Millo et al., [9]

Study	Odds Ratio	95% CI	Number of patients
Barcelona	0.55	0.29-1.06	219
Braga	0.8	0.42-1.54	268
CLASSIC	1.06	0.62-1.79	794
COLOR	1.2	0.88-1.63	1076
COST	0.86	0.62-1.20	863
Curet	1	0.06-17.33	73
Kaiser	2.28	0.22-23.68	48
Liang	0.74	0.40-1.37	269
Mirza	1.55	0.66-3.64	233

[Table/Fig-2]: Overall recurrence Odds Ratio Courtesy Paolo Millo et al., [9]

Author	Name of study	Number of Patients	Years of Study
Prakash K et al., [10]	Retrospective Analysis	102	Feb2006–April 2008
Prakash K et al., [11]	Prospective Database	265	Dec2005–April 2011
Palanivelu C et al., [12]	Prospective Non-randomised study	170	1993–2005
Palanivelu C et al., [13]	Prospective series	11 (SILCRS)	July 2010–Dec 2011
Puntambekar S et al., [14]	Prospective	37 (MIS by Robotics)	Nov 2009–June 2011
*Moirangthem GS (Present study)	Prospective	25	Jan 2011- Ongoing

[Table/Fig-3]: Data of Laparoscopic Colorectal Surgery for Cancer in India

was 58.4 years (12-90 years), mean operating time was 130 min and mean hospital stay duration was 7 days. The morbidity was 13.5%, with nil mortality. With an average follow up of 49 months (range 9 years and 3 months), nine patients developed local recurrences and 45 patients had distant metastases. The authors concluded that laparoscopic anterior resections could be done for rectal tumours at all levels, which would allow sphincter preservation and maintain oncological safety.

In another series carried out by Palanivelu C et al., [13], eleven patients with colonic and rectal pathologies underwent Single Incision Laparoscopic Rectal resections (SILCRs). Four trocars were placed in a single transumbilical incision. The bowel was mobilized laparoscopically with either intra or extracorporeal anastomosis. There was no conversion to standard multiport laparoscopy or open surgery. The median age was 52 years (range 24-78 years). The average operating time was 130 min (range 90-210 min). The average incision length was 3.2cm (2.5-4.0cm). There were no post-operative complications. The average hospital stay was 4-5days (range 3-8 days). Histopathology showed adequate proximal and distal resection margins with harvesting of an average of 25 lymph nodes (16-30 nodes). The authors thus concluded that single incision multiport laparoscopic surgeries done for malignancies were feasible, without extra costs of specialized ports or instruments. It didn't compromise the oncological radicality of resections. Short term results were encouraging.

Despite the advantages of laparoscopic surgery which was introduced 15 years ago, limitations such as learning curve, the lack of proprioception, spatio-temporal awareness and haptic feedback, the compromise of hand-eye co-ordination, the restricted degree of movement and lack of correct ergonomics among surgeons, prevented its widespread adoption in oncology. In order to maintain the advantages of minimally invasive approach and to avoid the restriction of laparoscopic surgery, robotic surgery is emerging as a reliable surgical option that can achieve the same results as laparoscopic surgery. In this review, Puntambekar S et al., [14] has reported 164 oncological surgeries, which involved thoracic, colorectal, hepatobiliary, gynaecological and urological systems, which were done robotically by using a three arm da Vinchi robot system from Nov 2009 to June 2011. Among these series, they performed surgeries in 37 patients with colorectal malignancies; anterior resections in 33 patients, right hemicolectomies in three patients and abdominoperineal resection (APR) in one patient robotically. All the patients had T2-T3 tumours. None of the patients with rectal cancer underwent pre-operative chemotherapy or radiation therapy. Blood loss was 100ml (50ml-250ml). Mean operating time was 160min (120-240min) for anterior resections and APRs and it was 80mins (60-100min) for right hemicolectomies. There was no conversion to laparoscopy or open surgery. These surgeries were robotic assisted, as stapling and anastomosis were done laparoscopically. The median hospital stay was 6days (5-10 days). Only two cases had minor anastomotic leaks (5.4%), which were managed conservatively. The purpose of introduction of robotics was to broaden the indications of minimal invasive surgeries and to make difficult procedures easier to perform.

Encouraged by these outcomes, we (Moirangthem GS)in the Surgical Gastroenterology and Minimal Access Surgery Unit, Department of Surgery, Regional Institute of Medical Sciences (RIMS), Imphal, Manipur, India (thereafter it was called as RIMS Trial), had also started doing laparoscopic colorectal surgeries for malignant diseases since Jan 2011. Our unit is a large volume centre where all s orts of open colonic procedures such as hemicolectomy, total colectomy, total proctocolectomy with J pouch, anterior resection (high, LAR and ultralow LAR with use of double staple technique) and APR are being performed regularly. Our inclusion

S. No.	Study	Total pts	Laparoscopic group	Open Group	Conclusion
1	Jacob et al., [2]	219	111	108	• Reduced blood loss • Early return of intestinal mortality, • Lower overall morbidity and shorter hospital stay(HS) in comparison with open surgery
2	COST [5]	872	435	437	• Longer operation time(OpT) but quick recovery and shorter HS • No significant difference in morbidity and mortality, tumour recurrence or overall survival • Safe in expert hands
3	MRC CLASSIC Trial [6]	794	526	268	• LCS as effective as open surgery • No difference in hospital mortality or quality of life • Increased incidence of positive circumferential resection margin but not statistically significant
4	COLOR Trial [7]	1248	627	621	• Longer OpT but less blood loss, early recovery of bowel function, fewer analgesic requirement and shorter HS • No difference in radicality of tumour resection.
5	Martel G et al., [8] Meta-analysis	5782	3,031	2,751	• No difference in recurrence rate, overall mortality and distance metastasis when comparing with open surgery
6	Prakash et al., [10]	124	62	62	• Reduced blood loss • Shorter ICU stay • Early resumption of oral feeds, • shorter hospital stay(HS)
7	Prakash et al., [11]	265	265	-	• As experience improved more difficult cases and complex laparoscopic colorectal resection performed
8	Palanivelu et al., [12]	170	170	-	• Laparoscopic anterior resection is possible for all levels of rectal tumours with preserving adequate sphincter function and waiting oncological safety.
9	Palanivelu et al., [13]	11	11	-	• Single incision multiport laparoscopic surgery is feasible without extra cost of specialised ports of instruments.
10	Puntambekar S et al., [14]	37	37	-	• With introduction of Robotic Assisted Laparoscopic Surgery, indication for such operation can be widened and difficult operations can be performed easier.
11	Haas EM et al., [28]	54	54 (SILC)	-	• SILC is feasible with no increase in operative complications or harmful results even in the early phase of learning curve Anastomotic leak
12	Dehni N et al., [29]	258	Not specified	Not specified	• Without faecal diversion-17% • With faecal diversion-6.6%

[Table/Fig-4]: Outcome of relevant studies in favour of LCS

criteria were I) non-emergency colorectal cancer patients II) patients with resectable tumours as were assessed clinically by USG and CECT III) patients who were fit for surgeries from anaesthetic point of view. The exclusion criteria were I) those with colonic obstructions II) those with liver secondaries and ascites III) patients who did not give their consents for the procedure IV) those with co-morbid conditions such as anaemia and cardio-pulmonary compromised patients. Our study was a prospective, non-randomized continuous trial with primary end point at one year, secondary end point at 3 years and final end point on completion of 5 years of surgery, which compared data of patients who underwent open colorectal surgeries, which was already available in the Medical Records Department of the Institute who had near similar ages, stages of the disease and nature of operations.

On completion of primary end point, we performed 25 laparoscopic colorectal procedures for malignant diseases (7 APRs + TMEs, 8 right hemicolectomies, 5 left hemicolectomies, 3 anterior resections and 2 LARs). Initially, we lacked full confidence and took longer time periods for every surgery, about 40-45min more extra time than we took for open surgeries. On reaching the 5th series of our patients, we picked up speed, narrowing down the time gap as compared to that of open surgery, by an average of half an hour. For right and left hemicolectomies, we mobilized the tumour, the desired length of the colon which had to be resected, clipped the vessel to divide it intracorporeally and resection, followed by anastomosis was done extracorporeally. In anterior resection, mobilization, clipping of vessels, resection and anastomosis (by double staple technique), were done completely intracorporeally. However, anvil fashioning to the cut margin of the proximal colon for anastomosis was done extracorporeally. We found that we could do these procedures more easily, without compromising on the principles of minimal invasive surgery. We added faecal diversions in the form of ileostomies, routinely for all left sided hemicolectomies and anterior resections. No post-operative anastomotic leak was reported in our series. The blood loss intra-operatively was definitely less than that which was seen in open surgery. In post-operative period, bowel sounds returned early and diversion stoma (colostomy/ileostomy), if there was any, started functioning earlier in laparoscopic group. Early ambulation was observed in laparoscopy group, with an average hospital stay of 6 days. The post-operative histopathology revealed that free resection margins and harvesting of the lymph nodes were complete. We converted one right hemicolectomy to open surgery, in view of fixity of the tumour of proximal ascending colon densely with posterior peritoneum, oedematous and shortening of mesentery with multiple lymph nodes, which were not detected on USG and CECT scan pre-operatively.

During follow up since the past two years, one young adult of 30yrs who had undergone a laparoscopic APR for a mucin secreting adenocarcinoma of lower rectum, died after 18 months of surgery, due to tumour recurrence. The prognosis of this type of pathology, especially in young adults, is usually poor. The rest of the patients are doing well, without any evidence of tumour recurrence. Based on preliminary outcomes of our series, though they are limited, we found that laparoscopic colorectal resection was feasible with oncological radicality, with survival data being almost similar to that of open surgery and this further confirmed that the procedure was definitely associated with lesser blood loss, a shorter ICU stay, early resumption of oral feeds and a shorter hospital stay.

DISCUSSION

The first concerns of laparoscopic colorectal surgery include skill and steep learning curve required for performing the procedure, but these can be overcome with time.

The next concerns are radicality of tumour resection and harvesting of lymph nodes. The short and long term results of multicentre randomized trials done, like COST [5], CLASSIC [6], COLOR [7], retrospective analysis done of 102 patients, prospective database of 265 patients (Prakash K et al.,) [10,11], prospective non-randomized trial (Palanivelu C et al.,) [12] and Cochrane review, Kuhry E et al., [15] did not reveal any differences in radicality of tumour resection between laparoscopic and open colorectal surgery groups.

The incidences of port site recurrences from multiple case reports and small series ranged from 1.0 to 21% [16]. However, Vukasin et al., [4] were of the view that the incidences of port site recurrences were overstated. Data from a prospective voluntary audit of 1992 to 1995 showed an incidence of 1.1% in laparoscopic surgeries. The reported incidences in wound recurrence rates in open surgeries were about 1.0±1.5% [17]. The port site and tumour recurrence rate seemed to be on the same line between the two groups [18].

Most of the trials reported longer operating times for laparoscopic procedures as compared to those required for open surgeries. The operating time in laparoscopic group was expected to come down with the passage of time and once the duration of steep learning curve of the surgeon was over.

Regarding the intra-operative complications, a meta-analysis [19]. Which pooled all the results together, revealed a total intra-operative complication rate of 7.9% for laparoscopic resections as compared to 5.4% which was seen for open methods. The most frequently reported intra-operative complication was bowel injury, which was also expected to come down with experience in a large volume of surgery.

Tekkis et al., [20] reported that the conversion rates varied with experience, with rates varying from 20.7% in initial 25 cases to 10.7% after 100 cases and to 5.5% after 175 cases. Similarly, as the surgeon or the unit gained more experience in laparoscopic colorectal surgery, it was observed that more difficult resections could be taken up without compromising on the results. Hence, with increasing experience, there is a trend towards including more and more difficult patients who are normally not taken up for laparoscopy. The conversion rate of Prakash K et al., [10], in their series of 102 patients, was 6.4%, which was quite acceptable, while Palanivelu C et al., [12], in their series of 170 patients, who underwent laparoscopic anterior resections and total mesorectal excisions for rectal cancer, did not have any conversion. In our first series of 25 patients who underwent laparoscopic colorectal surgeries, we converted one right hemicolectomy due to dense adhesions of the ascending colon tumour to the posterior peritoneum, in close vicinity of right ureter and as the mesocolon was oedematous and shortened.

Nine RCTs which were quoted by Paolo Millo et al., [9], non-randomized control trials of Palanivelu C et al., [12] which showed 7days of hospital stay and Prakash K et al., [11] who found 8.6±2.4 days of hospital stay, reported a shorter length of stay after laparoscopic resections, with one trial reporting a difference of five days in favour of the laparoscopic technique.

The Cochrane review, Schwenk W et al., [21] demonstrated that the incidence of post-operative complications was lower in patients who underwent laparoscopic resections for colon cancer (18.2% vs 23%, RR 0.72; p=0.02). This review done on short term benefits of laparoscopic colorectal resections, which analyzed 22 trials and 2965 (as quoted by Shukla PJ et al., [22]), concluded that while the results which were available favoured laparoscopic colorectal resections, only seven trials had more than 100 patients. The reviewers were of the opinion that the final verdict could only be given after the outcomes of multicentre trials viz COLOR, MRC CLASSIC Trial and LAPKON II (Germany) were available. The MRC CLASSIC trial concluded that laparoscopic assisted surgery done for colon cancer was as effective as open surgery and that it was likely to produce similar long term outcomes. However, it has got

some reservation regarding routine use of laparoscopy for rectal cancers.

The data which is available [23-26] has shown long term survivals following laparoscopic colorectal surgeries as compared to conventional open surgeries.

As more and more experience is being gained in laparoscopic colorectal surgery, surgeons have started looking for more innovative and newer techniques. The common incisions made for transabdominal specimen retrieval after performances of laparoscopic colorectal surgeries are lower quadrant, midline or transverse suprapubic incisions. Palanivelu C et al., [27] retrospectively studied seven women from 2004 to 2007, where entire specimens were extracted via transvaginal route. Totally laparoscopic proctocolectomies with ileal pouches and anastomosis were successfully performed in all these cases. The authors concluded that transvaginal retrieval of specimens prevented wound related complications by completely eliminating minilaparotomies for specimen retrieval and they suggested that the procedure could be called as 'Natural Orifice Specimen Extraction or "NOSE"'.

Single incision laparoscopic colon resection (SILC) has emerged as a viable minimally invasive surgical approach, with benefits and limitations which have yet to be fully elucidated. In a series of 54 consecutive SILCs which were done, Haas EM et al., [28] concluded that SILCs didn't result in increased complications or harmful results, even in the early phase of the learning curve. A prospective case series of eleven patients (seven men and four women) who underwent single incision multiport laparoscopic colorectal resections for malignancies by using conventional laparoscopic trocars and instruments, has been described by Palanivelu C et al., [13]. This study concluded that single incision multiport laparoscopic colorectal surgery done for malignancy was feasible without extra costs or specialized ports/instruments. It doesn't compromise the oncological radicality of resection. Short term results are encouraging, but long term results are being awaited.

Anastomotic leaks which follow colorectal surgeries contribute to major morbidity and mortality. A temporary proximal diversion in the form of an ileostomy or a colostomy is generally added, to avoid major post-operative leaks following colorectal surgeries.

Dehni N et al., [29] in their retrospective analysis done on 258 consecutive patients with mid-rectal cancers, found that anastomotic leaks which followed low anterior resections without diversions were more (17%) in number than those which followed resections with diversions (6.6%). There is again a controversy regarding the type of diversion; a colostomy or an ileostomy. Guenaga KF et al., [30], in a review of literature which included five randomized trials done to study the types of diversion procedures, showed that except for the stomal prolapse which was higher in colostomy group, none of the outcomes which were reported were statistically or clinically significant between the two procedures. However, in view of simplicity in performing them, especially during laparoscopy and at the time of closure, better odour, ease of appliance change, we are doing more and more of ileostomies as diversion procedures, which we add routinely for all left colorectal resections, including low anterior resections.

CONCLUSION

Based on review data of large multicentre prospective randomized controlled trials and taking into account, outcomes of some of the retrospective analyses, prospective non-randomized study done in Indian series and our own experience on limited series, we would like to draw a preliminary conclusion that laparoscopic colorectal surgery, including APR, is feasible and possible from technical and oncological point of view. This procedure, if it is performed by skilled surgeons in the field, is safe and cost effective, with improved short term outcomes. The review of literature further revealed that laparoscopic surgery done for colon cancer was associated with an earlier resumption of oral intake, shorter duration of hospital stay, less post-operative pain and complications over the short term and that it was also associated with similar long term oncological outcomes as compared to those which are asociated with conventional open surgery. We found the procedure of right laparoscopic hemicolectomy to be easier as compared to left hemicolectomy. We can perform APR with ease, as we can avoid endosuturing steps in the procedure, with better visualization of mesorectum and autonomous pelvic nerve than we can do in open surgery. Routine addition of a faecal diversion is reported to reduce the post-operative anastomotic leaks which follow Laparoscopic left sided colonic and rectal resections. The operating time is expected to come down with the passage of time, once the steep learning curve period is overcome and the surgeons gain enough experience after performing large numbers of laparoscopic colorectal surgeries.

DECLARATION

This paper "Laparoscopic colorectal surgery in India- a recent update." was presented by Professor *Moirangthem GS, In The 7th European Colorectal Congress Complications in Colorectal Surgery;2013 Dec 2-5; St. Galen, Switzerland.

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