

Feasibility and Benefits of Laparoscopic Colectomy Versus Open Surgery-A clinical Trial Study

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ABSTRACT

Laparoscopic colectomy has been shown to have significant short- and long-term benefits compared to open approach. The incorporation of laparoscopy in colon surgery is challenging, due to the high costs of equipment and lack of expertise. The aim of this study was to evaluate the safety and feasibility of laparoscopic colorectal surgery for cancer that could be performed in developing countries under different circumstances.

Patients & Methods: This is our initial trials to compare open versus laparoscopic colectomy, twenty patients (12 males and 8 females) with colorectal cancer with mean age of 48 years (35–70) have been enrolled for 10 laparoscopic & 10 open colo-rectal surgery in Beni Suef Faculty Of Medicine, Beni Suef University, Egypt, done by expert laparoscopic surgeons in our surgical department, we tend to reuse some disposable laparoscopic instruments.

Results: Regarding laparoscopic procedure, the mean operative time was 147 min (123–180 min). The mean estimated blood loss was 141 ml (75–260 ml). No major intra-operative complications have been encountered. The mean hospital stay was 7.6 day (5–16 days). Pathologic outcome revealed that the mean number of retrieved lymph nodes was 9 (range 6–18), morbidity in one case with perineal wound infection, peri-operative period passed without major events. While regarding open group the mean operative time was 113 min (90–129 min) The mean estimated blood loss was 350 ml, The mean hospital stay was 13 days (8–30 days) with one mortality case and 3 morbidity cases (leakage & abdominal wound infection), Pathologic outcome revealed that the mean number of retrieved lymph nodes was 16 (range 8–28 lymph node) and all cases had free surgical margin. **Conclusion:** Laparoscopic colorectal surgery for cancer is safe and feasible. Tissue integrity and safety margin are nearly equal between laparoscopic & open colorectal surgery. Major advantages of laparoscopic colectomy are: low rate of wound infection, early mobilization, early administration of chemotherapy.

Keywords: laparoscopic-open-colon cancer

I. INTRODUCTION

Laparoscopic colectomy has been shown to have significant short- and long-term benefits compared with the open approach [1–5].

Despite the evidence from multiple, prospective randomized trials revealed adoption rate of

laparoscopic colectomy has been reported to be low. In a recent study by Robinson et al., of all colorectal surgeries performed in high volume hospitals, only 7.3% have been performed using minimal invasive surgery (MIS). They found a significant socioeconomic disparity in the use of minimal invasive surgery (MIS). [6].

Compared with conventional open resections, laparoscopic colorectal resections are associated with less invasive incision sizes, less postoperative ileus and earlier tolerance of diet which may contribute to less need for analgesic treatment and earlier recovery of the patient with a reduced hospital stay. A faster hospital recovery has been demonstrated to translate significantly lower total costs owing to lower pharmacy, laboratory, and ward nursing costs. Reduced analgesia requirements and lower occurrence of complications may also decrease costs associated with laparoscopic treatment. However, studies reporting differences between the two procedures are equivocal. [7]

Demonstrating oncologic outcomes similar to those achieved in a developed setting will further support and encourage the continued growth of laparoscopy for cancer in developing countries [8-11].

Therefore, the aim of this study was to evaluate the safety and feasibility of laparoscopic colorectal surgery for cancer that could be performed as initial trials in low socioeconomic countries.

II. PATIENTS AND METHODS

This is our initial clinical study to compare laparoscopic versus open colectomy. The study was conducted at BeniSuef Faculty of Medicine, BeniSuef University, Egypt. Twenty patients (12 males and 8 females) have been enrolled for laparoscopic {group A} (10 patients) versus open {group B} (10 patients) colorectal surgery for patients with colorectal cancer in the period of March 2015 to March 2017. The diagnosis of colorectal cancer was confirmed with colonoscopy and biopsy. Preoperative workup has included blood tests, chest X-ray and tumor markers (CEA, CA199). CT pelvic-abdominal scan was a routine. The study was approved by the ethics committee at BeniSuef Faculty Of Medicine. The surgical approach was decided with the consent of the

patients after a thorough discussion on the advantages and risks of the each approach.

Inclusion criteria for laparoscopic group (A) were histopathologically proven carcinoma of the colon or upper half of the rectum, T0 to T2 tumors according to TNM classification, no evidence of extra-colonic or extra-rectal extension or distant metastasis by means of CT, abdominal ultrasound and chest radiograph. Patients with large, fixed tumors with invasion to other organs or patients with distant metastasis, patient with intestinal obstruction, autoimmune and inflammatory colonic lesions were excluded from the study.

The patients were placed in a supine head down position for laparoscopic right hemi-colectomy and lithotomy with head down position for laparoscopic left hemi-colectomy, sigmoidectomy and abdomino-perineal resection.

For economic causes, we use reusable laparoscopic instruments. For disposable instruments, we reuse it several times after proper sterilization, provided that it works efficiently. The only disposable laparoscopic instrument that has been used for several times in this study was the vascular sealing device (ligasure). All other surgical instruments used in this study were reusable.

Regarding laparoscopic procedure at the beginning, the peritoneal cavity was accessed through an insufflations' needle and carbon dioxide was insufflated to maintain the intra-abdominal pressure at 10–12 mmHg. For all cases, peri-umbilical 10 mm port was used for the camera. For right colon cancer another 2 to 3 ports of either 5 or 10 mm size were positioned so that convenient and safe dissection could be done as shown in Figure 1. For left colon and recto-sigmoid cancer, the ports were placed as in Figure 2.

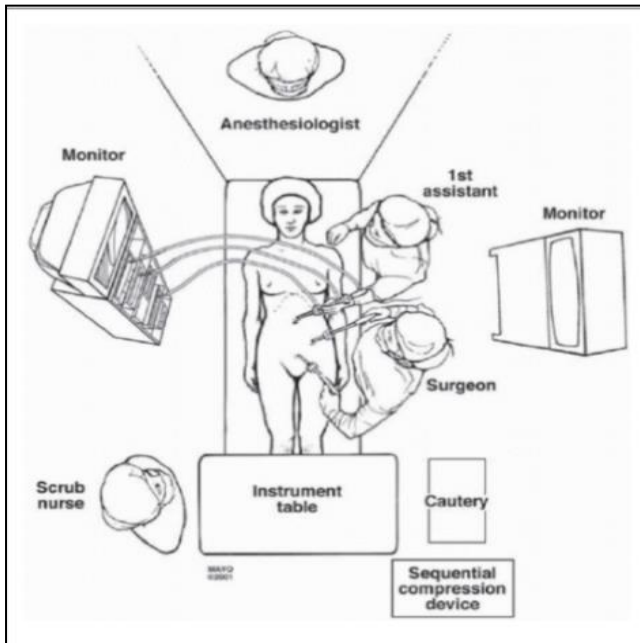


Figure 1. Patient positioning and ports distribution for right hemicolectomy



Figure 3.right lumbar incision for extracorporeal anastomosis of laparoscopic RT hemicolectomy
Regarding left side colon cancer Colorectal mobilization and resection followed the same principles as in open surgery, Colorectal anastomosis was performed by or using a circular stapler which was inserted trans-anally , extraction of specimen through small 4 cm pfannenstiel incision.

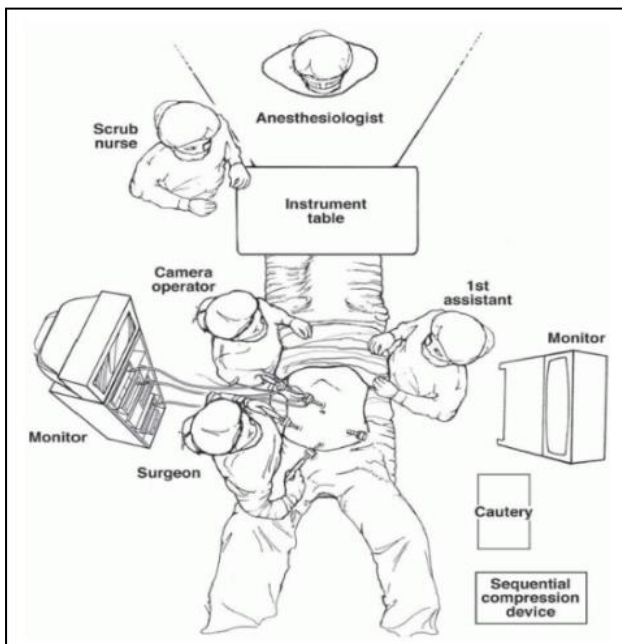


Figure1.Patients' positioning in left cancer colon resection

Dissection was performed in the majority of patients by bipolar vascular sealing devices. (**ligasure device**)Vessels were controlled with bipolar vascular sealing device or metallic clips intra-corporeally in most circumstances.

In case of a laparoscopic right sided colonic lesion, resection from medial to lateral approach and



Figure 4.anastomosis using circular stapler in laparoscopic LT hemicolectomy



Figure 4 Small pfannenstielscion for laparoscopic LT hemicolectomy

Points of comparison were total operative time, total blood loss, post operative hospital stay, integrity of tissues histopathologically, morbidity(wound infection , leaksg e pulmonary complications DVT, ileus, hemorrhage, repeat surgery) and mortality.

III. RESULTS& DISCUSSION

Data on the patient's, medical co-morbidities, location

Table1:operative time difference between 2 groups

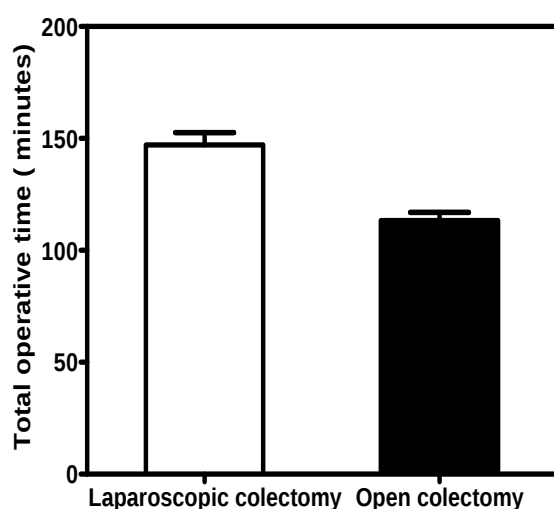
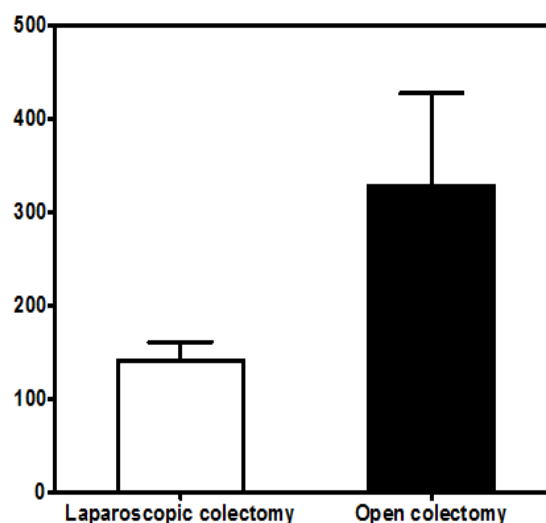


Table2. Blood loss difference between 2 groups(ml)



of the tumors, operative details, postoperative outcomes and follow up status were collected prospectively and entered into a data base. The data were described, minimum, maximum, mean, P value of each point of comparison. Right hemicolectomy was performed for 7 cases (4 lap ,3open). Left hemicolectomy with sigmoidectomy was performed for 6cases(3 lap,3open) cases of , proximal sigmoid cancer and anterior resection was done for 2 cases (1 lap ,1 open) and 5cases of abdominoperineal resection for cancer lower third rectum(2 lap ,3 open). We didn't convert any case of laparoscopic colectomy cases,

Mean operative time for laparoscopic group(147mint),open group(113mint),While open group show significant blood loss mean(330 ml) in comparison to laparoscopic group(mean 140 ml),post operative hospital stay for laparoscopic group (mean 7.5 day) and open group mean (14 days). Regarding number of harvested lymph nodes (-ve infiltrate) mean was 9 while mean +ve infiltrates LNs were 2 in laparoscopic group, while open group show advantage of harvested LNs (mean 18),+veinfiltrate 5 ,all cases were free safety margin .

Table 3. Postoperative hospital stay between 2 groups

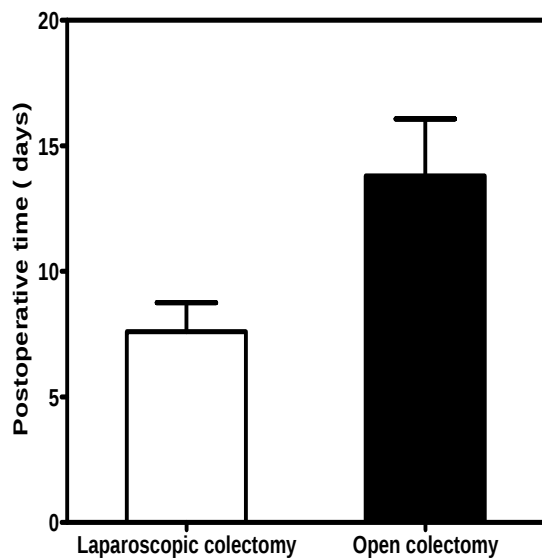
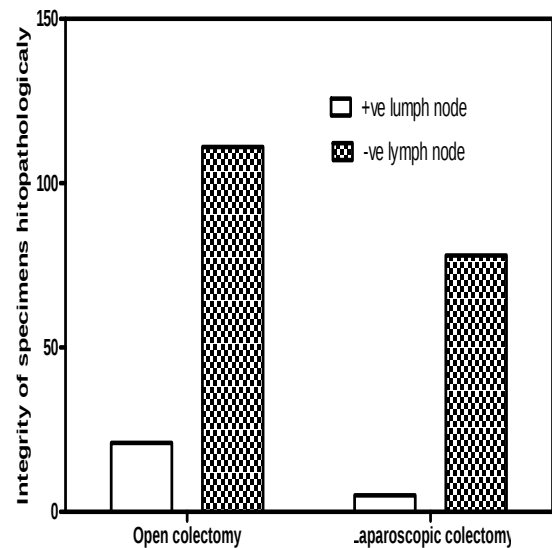


Table4 . difference of total number harvested LNs (+ve,-ve) between 2 groups in all20 patients



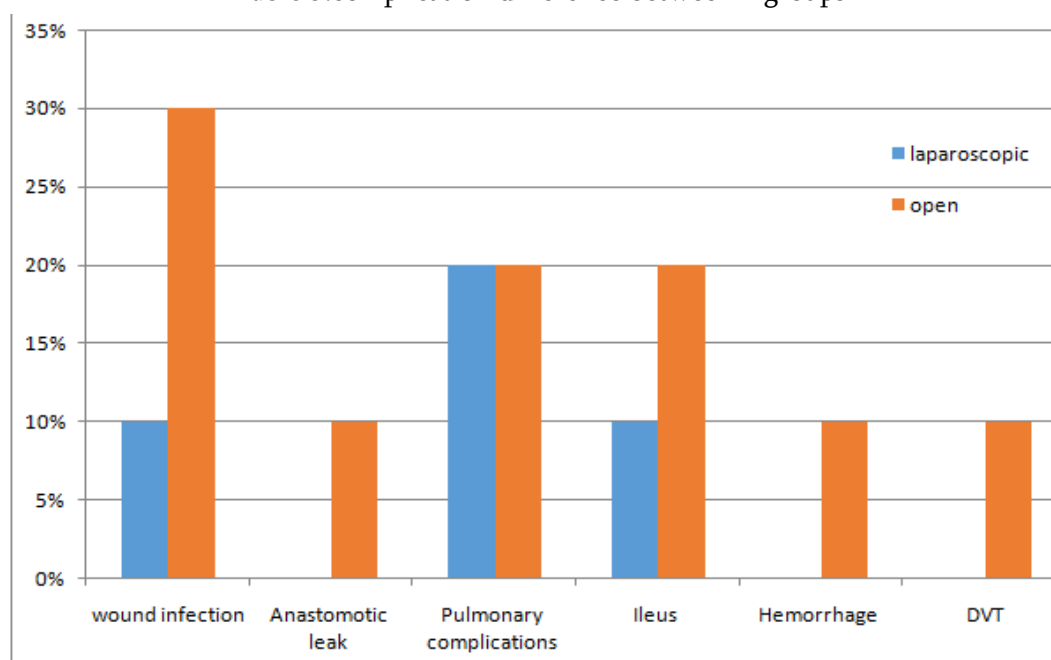
Regarding morbidity laparoscopic group show less rate of wound infection, anastomotic leakage, hemorrhage, while pulmonary complications were equal between 2 groups.

Wound infection was significant in open group 30% of cases ,while laparoscopic group show just 10% due to perineal wound infection We have just one mortality case related to open group developed reaction hemorrhage , died from irreversible septic shock at 10th day postoperative.



Figure 6. wound infection in patient with open LT hemicolectomy after repeated surgery (leakage, colostomy and mucus fistula)

Table 5.complication difference between 2 groups



Discussion

laparoscopic colonic resection for curable cancer is now being performed worldwide. It is now firmly established as a viable, and perhaps, the preferred option for colon cancer resection. [12]

The benefits of laparoscopic surgery are well established and result from the reduced surgical trauma through the use of smaller incisions plus minimal bowel handling which leads to a reduction in the systemic inflammatory response. [13]

The reduced disturbance of the immune function has led to the suggestion that a laparoscopic approach may have an added benefit in cancer patients in reducing tumor recurrence and improving survival.[14]

More acceptable however, is that there is improved pulmonary function, earlier return of bowel function, less post-operative pain, faster return to activity and ultimately, shorter hospital stay. Compared to conventional open surgery, cosmetic results are excellent. This is supported by several large multicentre randomized controlled trials and meta-analyses confirming the benefits and allaying the

oncologic safety concerns of laparoscopic colorectal cancer resection. These include the Barcelona trial ,The Clinical Outcomes of Surgical Therapy (COST) Study Group trial, the Colon Cancer Laparoscopic or Open Resection (COLOR) Study Group trial, and the Conventional versus Laparoscopic assisted Surgery in Patients with Colorectal Cancer (MRC CLASICC) trial. [15]

This study show operative time for laparoscopic group patients (147 mint), while mean for open technique (113 mint), relatively longer operative duration time for laparoscopic group during first trials of introducing laparoscopic procedures and also parallel to learning curve and near to results of COST& COLOR studies., also near similar to Van Ye et al., [16],who quoted that laparoscopic colorectal resection is considered by many papers, in comparison to open control groups,. The average operating room time for laparoscopic colectomy varies from 130 to 261 min and, while the time taken for open resection varies from 77 to 231 min, most series show a significantly longer operation time for the laparoscopic group. The operation times for laparoscopic resection decreased with experience in most series and, as such, future series may show

laparoscopic operation times approximating open times.

Postoperative length of hospitalization also is reported as being decreased after laparoscopic bowel resection, with the average number of days being between 4.1 and 12. Bokey et al summarized, the majority of publications found a statistically significant decrease in length of stay in comparison to open controls, including both of the randomized trials. This finding was not, however, universal. [17] Similarly, Mean operative stay for laparoscopic patients (7.6) day, while open classic technique (13.8) days. The study shows less hospital stay for laparoscopic procedure. Surgical wound infection was the main cause for increase operative stay, one case of laparoscopic abdominoperineal resection shows relative long hospital stay because of perineal wound infection, while open group have 3 cases of wound infection and burst abdomen, so this group shows longer hospital stay.

This study showed overall complication in laparoscopic group is markedly less than open group which shows more than 60% complication rate and that was significant advantage to laparoscopic procedure, and this was in hand with Grailey et al [18], who reported a pooled analysis involving 11 studies as laparoscopic colectomy approach was associated with lower incidence of postoperative cardiac complications, wound complications, earlier return of bowel function and shorter lengths of stay, also met with a randomized control study involving 535 patients by Frasson et al [19], the laparoscopic approach was associated with an overall complication rate of 20% in comparison to 42% in the open group.

Regarding to this study pulmonary complications were equal between 2 groups and were evident in 2 cases of laparoscopic colectomy (2 males, smokers, pulmonary function tests revealed chest tightness), admitted to ICU post operatively. main reason was

hypercapnia from insufflations, the 2 cases discharged after 2 days to our department, while regarding wound infection there was significant advantages of laparoscopic procedure, as regarding open approach, 3 cases developed wound infection in open group, range from superficial wound infection to burst abdomen whom required additional surgery for closure of abdomen, these cases prolong time, cost, morbidity to patients that overcome increased total cost, operative time of laparoscopic procedure; while laparoscopic approach revealed only one case of associated perineal wound infection and this was similar to Mahmoud et al [20] who quoted, The most common complication after colorectal surgery is surgical site infection (SSI). SSI in colorectal surgery is associated with significant economic burden and prolonged recovery, and it affects the quality of life significantly

One of the most significant complications of colorectal resection is anastomotic leak. This complication is reported in several of the available series, being the direct cause of death in at least one case as reported by Tucker et al [21], meanwhile, this complication was reported in this study for one case with sigmoid carcinoma, grade II, done by open technique using hand sewing anastomosis, leakage discovered early at 4th day. (total leucocytic count, 18,000, fever, fecal matter in the drains, US shows mild to moderate collection), reoperation was done, colostomy, mucus fistula also this case developed wound infection, while all laparoscopic cases didn't develop any anastomotic leakage specially cases of LT hemicolectomy

Regarding this study mean totally harvested LNs in open approach were 18 LN, while that of laparoscopic group were 9 LNs, relative low number of this study of harvested LN in laparoscopic colectomy due to loss of tactile sensations for assessment of lymph nodes and this was statistically accepted in comparison to Neugat et al [22], who collect Data from Dutch national trial on rectal cancer revealed

that 12 or more LNs were found in only 18% of resected specimens, also other study by Lacy et al[23], state that Accurate resection and identification of positive LNs is important not only for staging and planning adjuvant therapy, but also for prognosis ,number of retrieved LNs was by itself a prognostic variable in outcome of patients with stage II and III colon cancers

This study also revealed free safety margin for all cases in laparoscopic and open cases, and this results were in favor of laparoscopic approach and parallel to results of Lacy et al who reported very few series addressing the length of the resected bowel as an independent factor that can influence the number of LNs harvested. They concluded that the length of the resected segments of bowel was significantly associated with the number of LNs obtained .

The only mortality case for this study was for 50 years male with cancer sigmoid has done open exploratory approach with LT extended hemicolectomy, with ligation of inferior mesenteric vessels near its origin from aorta, primary anastomosis using hand sewn stitches ,after 24 hours patient develop hypotension, tachypnea, tachycardia, urgent US revealed moderate collection, patient re-operated, , (average blood loss was 1500cc), intra-operatively there was insecure knot over root of inferior mesenteric vessels , hemostasis was done, pt received 2 units of fresh blood, admitted to ICU. at 5th day pt develop wound dehiscence ,TLC 25.000,albumen 1.5 gm L, US revealed moderate collection, patient re-operated under mortality consent ,abdominal lavage, colostomy ,mucus fistula were done, patient died in ICU from irreversible septic shock, end organ failure, while laparoscopic group didn't show mortality at short term follow up.

IV. CONCLUSION

Laparoscopic colectomy is feasible and safe and has many advantages over open approach regarding less wound infection, less blood loss, less hospital stay and can be performed in low socioeconomic status by reuse some disposable instruments ,by using minimal extra corporeal anastomosis cost can be reduced and laparoscopic procedure may replace open approach.

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