Leading Article

Laparoscopic colectomy

Where do we stand?

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ABSTRACT

Laparoscopy has changed our approach to surgery, instrumentation and training. The techniques are evolving for a wide range of surgical procedures outside the biliary tree. Currently available data suggests that laparoscopic colectomy can be completed safely in most cases. It is feasible and offers patient-related benefits similar to those described for other laparoscopic procedures. The advisability of performing laparoscopy for cure of colorectal malignancy has been challenged because the recurrence rates and overall cure rates remain unknown. Until prospective randomized trials resolve these issues neoplastic colon laparoscopic surgery must be the prerogative of selected and specialized centers.

Keywords: Laparoscopy, colectomy, colorectal malignancy, recurrence, cure rates.

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Laparoscopic surgery introduced just over a decade ago has continued to take the general surgical world by storm. Laparoscopic cholecystectomy has already become the gold standard and has actually replaced conventional surgery for the treatment of symptomatic gall stones, not only that, but has also wiped out competing non-surgical alternatives such as dissolution therapy and lithotripsy.[1,2] Laparoscopic techniques have been evaluated for other non-biliary operations including appendicectomy, inguinal hernia repair, variocelectomy, fundoplication and various colorectal procedures.[3-8] The rapidity of spread and the popularity of laparoscopic surgery are attributed to the facts that laparoscopic surgery offers the benefits of less perioperative morbidity, shorter hospital stay, more rapid return to work and better cosmesis.[9] Laparoscopic colectomy is a natural extension of the experience gained from performing other laparoscopic techniques. The literature pendulum on the subjects swings from describing the procedure as being substantially more complex, but has been shown to be efficacious safe and feasible,[9,10] to other reports describing the same procedure as being slower to evolve compared to other laparoscopic techniques and also controversial as a cure of colon cancer.[11,12]

Laparoscopic surgery and benign colonic diseases. Since laparoscopic colectomy was first reported in 1990, numerous reports have been published. The current prevailing and growing consensus is that the procedure is safe, effective and even beneficial for many benign colonic diseases. Reports from the Mayo's clinic showed that laparoscopic assisted bowel resection has become the preferred approach for colonic polyps not amenable to colonoscopic polypectomy.[9,13] Soon afterwards, more reports appeared describing laparoscopic colectomy as the preferred method of bowel resection not only for colonic polyps but also for inflammatory bowel disease (eg complicated and uncomplicated diverticular disease, Crohn's disease, polyposis coli and ulcerative colitis). The bottom line in all these reports was that, such surgery is feasible with similar if not better outcomes as the conventional surgery. It does not only afford the

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patient the advantages of the laparoscopic approach, but also allows the surgeon to gain experience while awaiting the results of ongoing trials for laparoscopic colon surgery in malignant disease.[14-17] Conversely the quoted disadvantages of laparoscopically assisted surgery in the treatment of benign colonic disease compared with open procedures have included longer operative time, shorter specimen, more elaborate and expensive equipment. There is a potential for complications associated with carbon dioxide (CO_2) insufflation like reduction of lung and thoracic compliance and reduction in functional residual capacity as a result of the cephalad shift in the diagram. The net effect is a possible atelectasis especially in the older age groups and in obese patients. There is also possible ventilation perfusion and mismatching that with decreased pulmonary compliance, can lead to hypoxemia. With CO_2 insufflation there is also a rapid initial increase in the partial pressure of arterial carbon dioxide ($PaCO_2$) associated with a decrease in the pH and possible acidosis. Other reported disadvantages include major blood vessel injury, small bowel perforation and injury to the bladder and surrounding structures.[9,18] Much of the increased complication rate associated with laparoscopic procedures has been attributed to a steep learning curve, something which has been well substantiated in previous reports which showed better outcomes for laparoscopic cholecystectomies when surgeons perform more procedures. Similarly, there is a definite learning curve for laparoscopic assisted colectomy with respect to intraoperative and postoperative outcomes. As with other laparoscopic procedures, surgeons who perform higher volumes of laparoscopic assisted colectomy have lower rates of intraoperative and postoperative complications.[19]

Laparoscopic surgery and colorectal malignant diseases. There is approximately 150,000 new cases of colorectal cancer in the United States each year.[9] The level of public awareness regarding colorectal cancer is very high as evidenced by a public awareness article published recently in the Times Magazine[20] describing colon cancer as one of the deadliest and most preventable malignancies. The Times Magazine quoting the London-based Cancer Research Campaign said that colorectal cancer kills 98,500 persons each year in the European Union. The high number of new cases discovered each year, the increased public awareness, the significant morbidity as well as the ongoing trial studies on prevention, namely, the wheat-bran fiber trial by Albert et al[21] and the polyp prevention trial,[22] plus the good results obtained by the laparoscopic assisted resection of benign colorectal diseases, have increased the interest in the use of laparoscopic treatment to minimize the short-term morbidity associated with treating malignant disease. Sufficient research and experience in the laparoscopic treatment of colorectal cancer has shown that these are feasible treatments, and they share the same benefits associated with laparoscopic treatment of benign colonic disease, such as reduction of postoperative pain, length of ileus, length of hospital stay and the decreased surgical trauma.[9,10] The current debate on these treatments is whether it is appropriate to minimize short-term morbidity through minimally invasive techniques given the possibility of as yet unknown changes in the long term morbidity and mortality of essentially curable diseases.[23,24] Many reports have shown that laparoscopic colectomy for colorectal cancer is feasible and compared to open surgery, it is more patient friendly with less pain, quicker return of bowel functions, shortened hospitalization and quicker return to full activity. Although these clinical benefits are important and are thought to reflect less surgical trauma, these clinical parameters can be affected by the patients' psychological background and by the positive attitude of enthusiastic laparoscopic surgeons. This surgeon's bias can be examined only by using an objective marker of tissue trauma.[25-27] The amount of blood loss, and hence transfusion, have been decreased by the laparoscopic techniques. The increased postoperative cell-mediated immunity and neutrophil function indicates a decreased immunosuppression after laparoscopic colectomies and therefore theoretically greater resistance to tumor growth than with laparotomies, this decrease in immunosupression appears primarily to follow decreased trauma during surgery. This can be estimated by measuring the level of the mediators of the immune and acute phase response namely the tumor necrosis factor α (TNF α), interleukin 1ß (1L-1ß) and interleukin 6 (1L-6).[27] In spite of all the advantages mentioned regarding laparoscopic bowel resection for colorectal cancer, retrospective and prospective studies have not proved unequivocally that the laparoscopic technique is superior to open operation particularly in patients with malignant disease especially when the target is cure.[11,28] The questions as to the efficacy of laparoscopic resection of colorectal cancer and the controversies as to its cancer cure have centered on the intraoperative localization of the lesion, the completeness of bowel resection and length of the piece of resected bowel, the completeness of lymph node clearance, the lack of long-term staging and survival and the incidence of the pattern of recurrence especially the port site and extraction site recurrence. The incidence of synchronous malignancy in patients with colorectal carcinoma is between 3 and 8%, while the incidence of synchronous polyps or benign neoplasm is much higher, 40-70%.[29,30] Therefore it becomes essential to thoroughly evaluate the colon before embarking on surgical resection. Preoperative colonoscopy, or less ideally flexible sigmoidoscopy and barium enema

usually suffice in the vast majority of cases. However, for those cases in which preoperative studies were inadequate or could not be performed, intraoperative endoscopy becomes a valuable tool. Likewise, the growing use of laparoscopic resection for colorectal cancer with the inability to palpate the colon for synchronous lesions has increased the importance of intraoperative endoscopy.[31] Other methods used to localize the site of the colonic tumor and the presence of intra-abdominal secondary deposits included endoscopic and laparoscopic ultrasonography, preoperative endoscopic tattooing with India ink, endoscopic metal clipping and intraoperative laparoscopic ultrasound detection and by light induced fluorescence diagnosis (LIFD).[32-35] The application of laparoscopic techniques to malignant colorectal disease has led to concerns regarding the adequacy of excision achieved, however, comparative studies have demonstrated that laparoscopic assisted right hemicolectomy allows lymphovascular clearance indistinguishable from that afforded by open surgery.[36] Thus far, laparoscopic resections have been most successful in the right colon, sigmoid colon, proximal rectum, stoma formation procedures, abdominoperineal resection and ileal pouch anastomosis.[9] Several reports have suggested that the number of lymph nodes harvested from laparoscopic colectomy specimens is less than the number harvested from open colectomy specimens.[37] This may reduce the curability of cancer with a potential for under staging of colon cancer. This may result in the withholding of postoperative systemic adjuvant chemotherapy from patients who might benefit from it.[38] Conversely, other reports have shown that the number of dissected lymph nodes was not significantly different between open and laparoscopic colectomy.[11] The degree and extent of lymph node resection in laparoscopic colorectal cancer shall continue to follow the learning curve for all practical reasons. Local recurrence from the spill of malignant cells during surgery into the abdominal cavity and the venous blood is a prominent concern with the treatment of colon and rectal cancers. Studies have shown that as many as 67% of patients have malignant cells in their blood postoperatively. Other studies have shown that 10-40% of patients have local recurrence from the lymph nodes and primary lesions following surgical treatments.[9,39] Concerns have been raised regarding the effect of laparoscopic techniques on recurrence and long term survival and staging patterns, given the increased manipulation and use of CO_2 insufflation in laparoscopic techniques. In addition, anecdotal reports of port site tumor recurrence have not only fueled discussion in this area but nearly dampened the enthusiasm for laparoscopic colectomy for cancer.[40] Although the etiology and the actual incidence of this problem is unknown, its existence is a threat to the further clinical development of minimally invasive malignant procedures. Some reports have shown that the port site is a potential site for metastases but these port site recurrences are usually associated with wide spread peritoneal dissemination. They reported the development of tumor at port sites in any patient as exceedingly rare with an incidence of 0.8%.[41] Other reports have shown an incidence of 0 to 1.2% which is almost the same as the 0.6 to 1.0% abdominal wound tumor incidence mentioned in several open colectomy series.[42] This has been substantiated by a recent review of a database established by the American Society of Colon and Rectal Surgeons which revealed a comparable wound recurrence rate following laparoscopic colectomy for colon cancer compared with conventional open colectomy, with the benefit of a minimally invasive procedure.[9] Many procedures have been proposed and invented to prevent the alleged causative mechanisms and hence reduce chances of port site secondaries. These procedures included gasless laparoscopically assisted colonic surgery, where the authors claimed that it is technically feasible and it removes the cardiopulmonary and the port site recurrence risks attended with CO_2 insufflation.[43] Animal studies have shown that excision of the port site has significantly, but not completely reduced tumor implantation rate compared to simple wound closure.[44] Irrigation of port site with 5 fluorouracil at the time of laparoscopy was shown to reduce the incidence of port site tumor implantation in a rat colon cancer model.[40] Whether the cause of port site recurrence is due to contamination of the wound, the exfoliation of viable tumor, the size of the tumor or to the aerosol effect of CO_2 pneumoperitoneum, perhaps, it is clear that more research in this area is needed to understand port tumors better and to reconcile the port tumor results with the systemic tumor growth benefits that may be associated with minimally invasive methods.

In conclusion, laparoscopy has become a part of the surgeons armamentarium in benign colonic diseases carrying all the aforementioned advantages. There are also strong indications that laparoscopic treatment for malignant colorectal disease is a viable alternative in selective patients, yet the advisability of performing laparoscopy for the cure of colorectal malignancy has been challenged because it still has limitations, not least, the manual assessment of fixity and extraction of tumors with concern for recurrence rates and overall cure rates which as to now, remain unknown. Therefore, laparoscopy for colorectal cancer should be offered within the confines of a prospective randomized trial in order to resolve these issues. Further studies with substantial follow up to determine the adequacy of resection and the comparability of cure rates are also needed to assess any changes in the long term staging and survival patterns of these treatments.

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