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Prospective Evaluation of Laparoscopy-assisted Colectomy versus Laparotomy with Resection for Management of Complex Polyps of the Sigmoid Colon

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Abstract. Laparoscopy-assisted colectomy is technically feasible, but objective evidence of its benefits remains scarce. This study was done to evaluate the outcomes and operative stress of laparoscopy-assisted colectomy versus the traditional open method in the management of sigmoid complex polyps that cannot be safely or adequately removed by colonofibroscopy. Between January 1997 and December 1999, a total of 42 patients were equally randomized to the laparoscopy group and the laparotomy group by the blocked randomization method. Three patients randomized to the laparoscopy group did not complete the trial; therefore 18 patients treated by laparoscopy-assisted sigmoidectomy and the other 21 treated by the open method were prospectively evaluated. These two groups of patients were well matched in age, gender, symptoms, tumor location, localization method, tumor size, morphology, histopathology, and the accuracy of the clinical diagnosis. Two standardized surgical strategies, the lateral-to-medial and medial-to-lateral dissection sequences, were performed in 14 and 4 patients of the laparoscopy group, respectively, according to whether their tumors were located above or below 20 cm above the anal verge. After evaluating the surgical outcomes, we found that the laparoscopy group was significantly better than the laparotomy group in regard to parameters that included severity of postoperative pain, wound size, postoperative complication rate, and the duration of postoperative ileus, hospitalization, and disability. There was no significant difference in the operating times for these two groups. However, the costs of the laparoscopy group were significantly higher. To evaluate the surgical stress, we measured the serum C-reactive protein (CRP) level, erythrocyte sedimentation rate (ESR), total lymphocyte count, and $CD4^+/CD8^+$ ratio 24 hours before and after surgery. We found that the postoperative serum CRP level and the ESR were significantly less elevated and the total lymphocyte counts and $CD4^+/CD8^+$ ratio were significantly less depressed in the laparoscopy group than in the laparotomy group. We thus concluded that laparoscopy-assisted sigmoidectomy can be safely performed with shorter convalescence and less operative stress but at a higher cost. We strongly recommended the use of this technique in the management of sigmoid complex polyps if the patient's economic status permits.

Inspired by the benefits gained from laparoscopic cholecystectomy, colorectal surgeons all over the world are enthusiastically applying the laparoscopic approach for resecting colorectal lesions [1, 2]. The reported benefits of laparoscopic bowel resection included a reduced size of the abdominal wound, less postoperative ileus, less postoperative pain, shorter hospital stay, and lower overall cost [3, 4]. The laparoscopic technique is expected to be further potentiated with refinement of the instrumental technology in the new century. However, the simple fact that a surgical technique can be performed does not justify its use. There are a number of factors that make the laparoscopic or laparoscopy-assisted colectomy quite different from laparoscopic cholecystectomy [5, 6]. First, whereas the gallbladder is a fixed organ, the colon often requires extensive mobilization involving multiple abdominal quadrants to facilitate exteriorization and resection. Second, colonic resection poses several technical challenges, including the need to ligate major blood vessels, perform an anastomosis, and remove a redundant bulky specimen. Third, because of the diversity of the procedures (e.g., right versus sigmoid colectomy) and disease patterns (e.g., polyps versus diverticulitis), most series to date are small, heterogeneous, and uncontrolled, which makes accurate evaluation of the outcome difficult. On the other hand, the appropriateness of the laparoscopic technique for treating colorectal malignancies has become a controversial subject [1, 2, 7, 8]. The major concerns were whether laparoscopic or laparoscopy-assisted colectomy accomplishes proper oncologic resection and staging and if pneumoperitoneum results in the dissemination of cancer cells [9]. Based on these important variables, the exact extent of benefits is therefore not clear at present and needs further investigation.

In Taiwan laparoscopic colectomy was first performed in 1993, and the surgical indications have been strictly limited to benign lesions and early cancers. Because of the unique anatomic structure of the sigmoid colon, sigmoid resection is technically easier than resection of other parts of the colon using the laparoscopic approach. Furthermore, it is well known that many colonic lesions are predominantly located at the sigmoid colon. Therefore, we considered laparoscopy-assisted sigmoidectomy as a fundamental technique for surgeons on the learning curve of laparoscopic colectomy. With these reasons in mind, we initiated a study of laparoscopic colectomy in Taiwan using laparoscopy-assisted sigmoidectomy as a model. In this study, we made a critical appraisal of laparoscopy-assisted colectomy versus the open method for

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managing sigmoid complex polyps, based on the viewpoints of surgical outcome and operative insult. We believed that this study not only could further elucidate the role of laparoscopy-assisted colectomy for the clinical management of sigmoid complex polyps in Taiwan, it also could provide a basis for conducting ongoing clinical trials regarding the application of this technique to benign and even malignant lesions located in the other parts of the colon.

Materials and Methods

Patients

Between January 1997 and December 1999 a total of 42 patients with sigmoid complex polyps diagnosed in the Department of Colorectal Surgery, National Taiwan University Hospital, were recruited for this surgical trial. Complex sigmoid polyps were defined as large sessile or pedunculated benign polyps or malignant polyps that could not be safely or adequately removed by colonofibroscopy and required surgical intervention (Fig. 1). Using the blocked randomization method, we equally randomized these patients to a laparoscopy group and a laparotomy group in which the sigmoid polyps were treated by laparoscopy-assisted sigmoidectomy and traditional laparotomy with segmental bowel resection, respectively. These patients were well informed, and consents were obtained. The randomization of patients was performed preoperatively. The study was approved by our Institutional Review Board because the authors were well trained in both laparoscopic and open procedures.

Three patients randomized to the laparoscopy group withdrew from the trial and sought their preferred open surgery at other hospitals. Therefore 18 patients in the laparoscopy group and 21 in the laparotomy group were prospectively studied. The demographics, clinicopathologic data, surgical outcomes, and degree of surgical stress for these two groups of patients were compared.

For evaluating surgical outcome we used such parameters as the operating time, duration of postoperative ileus and hospitalization, degree of postoperative pain, wound size, overall cost, postoperative complications, and disability. The visual analog scale was used to assess postoperative pain on the first postoperative day. When evaluating surgical complications, we defined postoperative fever as a temperature of $\geq$ 101°F (38.3°C) orally on two consecutive readings 12 hours apart after the first 48 hours. Fever with no identifiable site of infection that occurred within the first 48 hours after surgery was considered to be due to minimal pulmonary atelectasis. Wound infection was defined as the presence of a thin discharge or local abscess in the operative wound, followed by confirmation via Gram stain or bacterial culture. Anastomotic leakage was defined by the presence of both of the related features of peritonitis and bowel contents in the drainage.

A standardized questionnaire was given to patients to assess disability; it included the number of days until return to partial activity, full activity, and work on the basis of their subjective responses. The resumption of partial activity was defined as the patients being able to fulfill basic physiologic needs independently, including eating, bathing, going to the toilet, dressing, and walking. The return to full activity was defined as the patient achieving the preoperative baseline physical or social activities, such as operating a motor vehicle, running, dancing, and sexual activity. All these parameters of functional recovery were evaluated by research assistants blinded to the study groups.

The severity of the surgical insult was evaluated by immunologic parameters, including the serum C-reactive protein (CRP) concentration, erythrocyte sedimentation rate (ESR), blood lymphocyte counts, and the $CD4^+/CD8^+$ ratio. The CRP was quantified by an immunoturbidimetric method, the ESR by the Westergren method, and the $CD4^+/CD8^+$ ratio by flow cytometry. For the quantitative analysis of all these immunologic factors, each patient's peripheral blood was sampled twice, at 24 hours before and after surgery, respectively. The quotient of immunologic alteration was calculated by dividing the postoperative value with the preoperative baseline value. The quotients of alteration in each immunologic parameter for the laparoscopy and laparotomy groups were presented as means $\pm$ standard deviations.

Two-tailed Fisher's exact test was used to analyze the categoric data. The continuous data were compared by Student's *t*-test. The significance level of all tests was set at $p < 0.05$.

Operative Technique

Tumor Localization. If the sigmoid polyp was infiltrating and large enough to be visualized by preoperative barium enema, we did not perform further procedures for tumor localization. This is because the lesion site can usually be directly palpated and localized extracorporeally after retrieving the bowel segment through the incisional wound. In contrast, if the polyp was invisible by barium enema or had been partially removed during the initial colonofibroscopy, further tumor localization was recommended. We preferred the preoperative colonic tattooing method for tumor localization (Fig. 2A). However, intraoperative colonofibroscopy was another good option and was occasionally used. When performing the colonic tattooing, methylene blue was injected into the submucosal layer of bowel wall in the vicinity of the polyps via a sclerotherapy needle inserted through a colonofibroscope. On the other hand, when intraoperative colonofibroscopy was used for tumor localization, the colon proximal to the tumor was first temporarily occluded to prevent distension of the proximal large and small intestine, and then the serosa of the lesion site was identified and marked with electrocautery or a clip.

Surgical Planning and Preparation. We placed the patient in a modified lithotomy position. The surgeon stood on the right side and the assistant on the left side of the patient. The cameraperson stood on the surgeon's left side and viewed the monitor from the best vantage point. A supraumbilical mini-laparotomy was made to allow insertion of a 12 mm cannula and establishment of a pneumoperitoneum up to 14 mmHg intraabdominal pressure. The videoscope was then introduced, and the peritoneal cavity was inspected for evidence of associated disease, and the lesion site was assessed for resectability (Fig. 2B).

If the tumor was located more than 20 cm above the anal verge, we were able to pull the tumor-bearing bowel segment outside the abdomen to perform extracorporeal bowel resection and anastomosis after adequate laparoscopic mobilization of the sigmoid colon. Here we adopted the traditional lateral-to-medial dissection sequence, in which the sigmoid lateral attachments were incised first, and then the sigmoid mesentery was swept medially. In contrast, if the tumor location was 15 to 20 cm above the anal verge, we were unable to retrieve the tumor-bearing bowel segment outside without transecting the upper rectum after adequate mobilization of the sigmoid colon and the upper rectum. There-

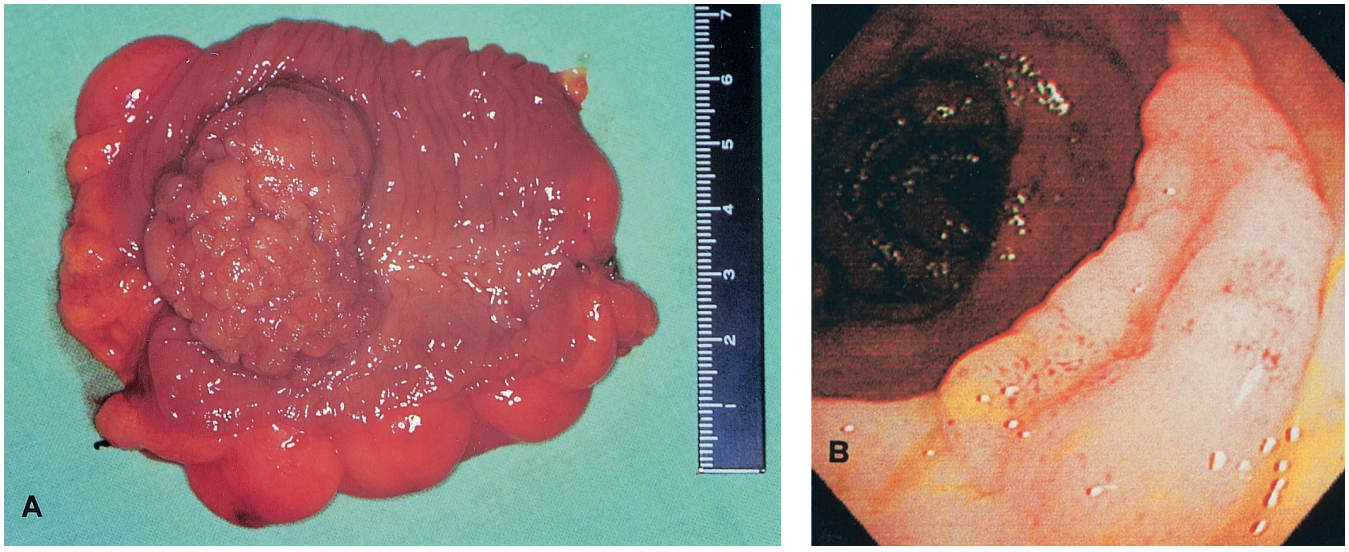

Fig. 1. Typical findings of pedunculated (**A**) and sessile (**B**) complex polyps that cannot be safely or completely removed by colonofibroscopy.

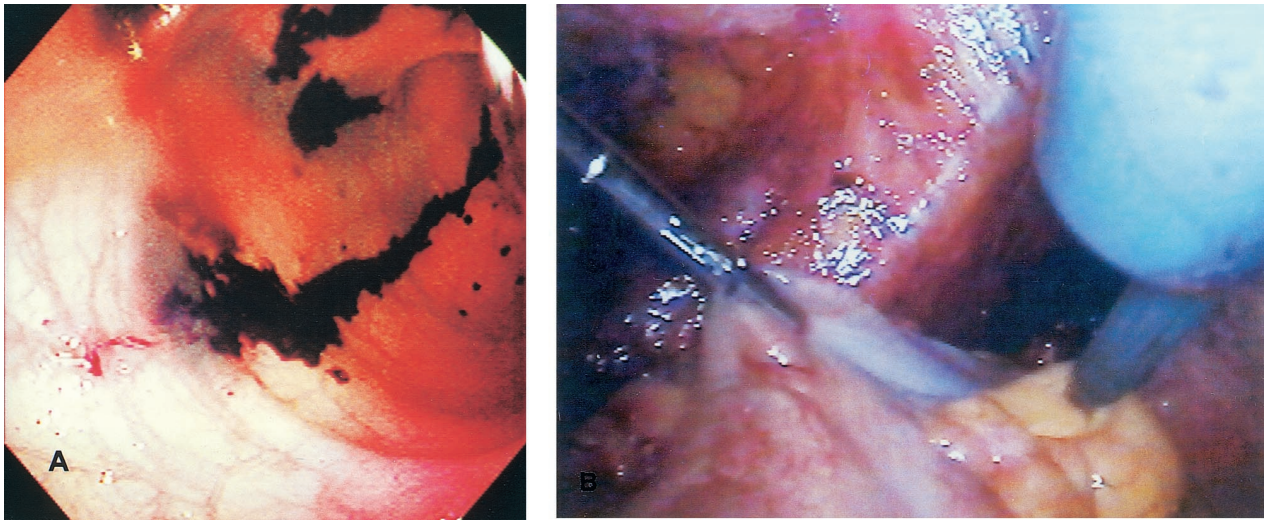

Fig. 2. A. Endoscopic tattooing of the lesion site with methylene blue. **B.** The bluish bowel wall indicates that the tumor location was clearly seen on the monitor.

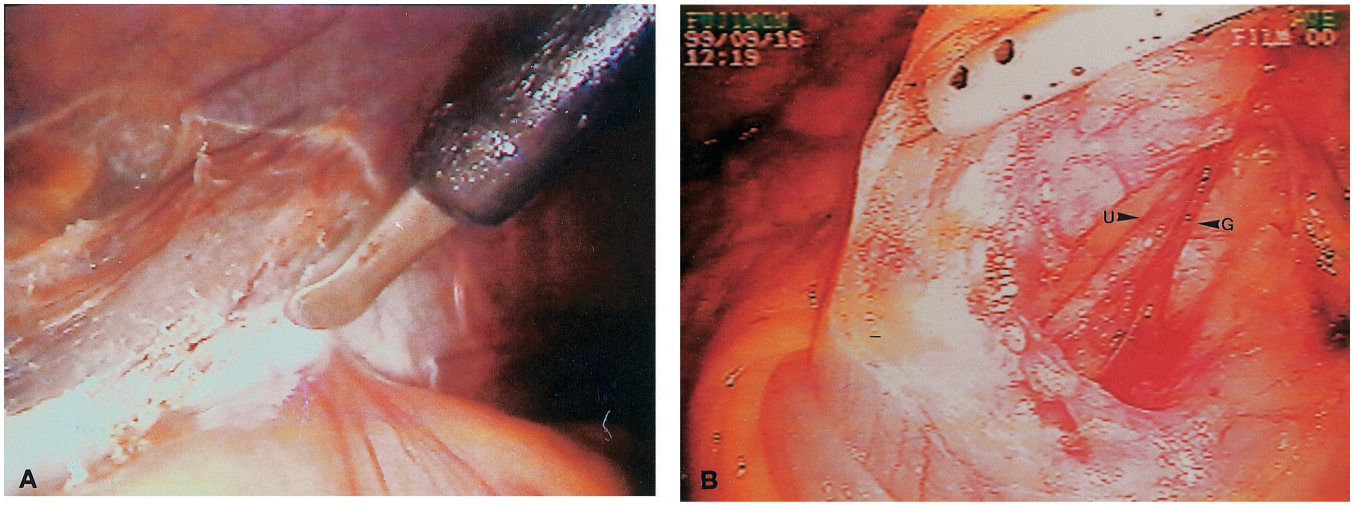

Fig. 3. Lateral-to-medial (**A**) and medial-to-lateral (**B**) dissection sequences, in which the dissection was started from the separation of the lateral peritoneal attachment and medial mesenteric base, respectively. In (**B**), the ureter (U) and gonadal vessels (G) are clearly seen from the mesenteric tunnel.

fore, we preferred to mobilize the sigmoid colon by an alternative method (i.e., the medial-to-lateral dissection sequence) in which the mesenteric base and blood vessels of the sigmoid colon were managed first followed by division of the lateral peritoneal reflections. The surgical details of these two laparoscopic approaches are presented in the following sections.

Lateral-to-medial Dissection Sequence. In addition to the videoscopic port for the lateral-to-medial dissection (Fig. 3A), two working ports were placed under videoscopic control: one at the low abdominal midline about 5 cm above the symphysis pubis and the other at the left flank lateral to the rectus muscle and just above the sigmoid lesion site. Three ports are usually enough in this condition. However, an additional port for countertraction was created, if necessary, at the left hypochondrium. All port sites were 12 mm in diameter, permitting total maneuverability of the laparoscopic instruments. The two monitors were preferably placed near the patient's shoulders. However, we moved the monitors to the patient's knee level for the pelvic dissections.

The patient was further placed in Trendelenburg position (20 degrees head-down) and tilted right side down to keep the small intestine in the right upper quadrant and out of the area of dissection. The location of the tumor was first confirmed by observing the tattoo or by the intraoperative colonofibroscopic localization noted above. The surgeon's left hand then retracted the sigmoid colon ventrally and to the left using Babcock retractors through the left lower quadrant cannula. The endoshear was introduced into the abdominal cavity through the suprapubic port by the surgeon's right hand. Under appropriate traction and fine adjustments of the patient's position, the lateral peritoneal reflection of the sigmoid colon was clearly seen.

We began sharp dissection of the lateral peritoneal reflection at the upper border of the pelvic cavity. Following incision of the peritoneal reflection, the surgeon bluntly pushed the mesocolon medially and off the retroperitoneum with sweeping motions of the lateral surface of the shaft of the endoshear. This dissection was extended as medially as possible. Finally, the colon was mobilized to the level of the splenic flexure.

Thereafter, we switched the procedure to the pelvic dissection. The peritoneal attachment at the left pelvic brim was sharply incised, the areolar tissue was bluntly separated, and the sigmoid mesentery and upper rectum were swept medially. During the retroperitoneal dissection, great care should be taken to identify and avoid any injury to the left gonadal vessels and ureter. When colonic mobilization was subjectively considered sufficient, the surgeon clamped and lifted the bowel segment near the lesion site to make sure that the pathologic bowel segment could reach the suprapubic port without tension. We then released the pneumoperitoneum. The bowel segment was easily retrieved outside the abdomen via the small incision extending from the suprapubic port. The extracorporeal bowel resection and end-to-end anastomosis were then undertaken.

Medial-to-lateral Dissection Sequence. The working ports for the surgeon were placed in the right lower quadrant and the suprapubic area for the medial-to-lateral dissection (Fig. 3B). Two additional ports for the first assistant were created on the left flank lateral to the rectus muscle: one just above the sigmoid lesion site and the other on the left hypochondrium. Under appropriate traction and fine adjustments of the patient's position, the medial side of the sigmoid mesocolon was clearly seen. The origin and tributaries of the inferior mesenteric artery (IMA) were then identified by transillumination of the sigmoid mesentery and observation of the arterial pulsation. We commenced the dissection with an incision in the peritoneum just to the right of the IMA using the endoshear via the suprapubic port. The dissection was continued downward along the preaortic place to the sacral promontory. Thereafter the dissection was extended laterally, and a tunnel was created between the sigmoid mesocolon and retroperitoneal structures. During this dissection the preaortic hypogastric neural plexus, left ureter, and gonadal vessels were identified and swept dorsally to prevent injury to them. Further dissection around the root of the IMA leads to clear exposure of the IMA, inferior mesenteric vein (IMV), and left colonic artery. Taking advantage of the Ultra-cision Harmonic Scalpel (Ethicon Endo-Surgery, Cincinnati, OH, USA) and selective clipping of sigmoid arteries, we efficiently transected the sigmoid mesocolon downward to the colonic edge, taking care to keep an appropriate safety margin for tumor resection. Thereafter, we sequentially incised the peritoneum along the right pelvic brim, Douglas pouch, and left pelvic brim. The areolar tissues between the proper rectal fascia and endopelvic fascia were separated, and the presacral space was opened. Next, with constant traction and sharp dissection, the sigmoid lateral peritoneal attachments were separated in a cephalad manner up to the splenic flexure. The mesocolon was swept medially and ventrally to connect the retroperitoneal tunnel created in the previous medial dissection. Next, the upper mesorectum was transected piece by piece with the aid of the Harmonic Scalpel and selective clipping of big vessels. When the specified transection line in the upper rectum was circumferentially skeletonized, two sets of endo-GIA II 3.5 mm staples (US Surgical Corp., Norwalk, CT, USA) were sequentially applied, and the bowel was transected. Subsequently, the bowel segment was delivered outside the abdomen via a small incision extending from the suprapubic port site. After the extracorporeal transection and removal of the lesion-bearing bowel segment, we introduced an anvil of appropriate size into the cutting end. The proximal bowel segment was then returned to the abdominal cavity. The pneumoperitoneum was reestablished. Finally, the standard double-stapling technique, known as the Knight procedure [10, 11], was used to perform a colorectal anastomosis intracorporeally.

Results

The laparoscopy and laparotomy groups of patients were well matched for age, gender, symptoms, tumor location, localization method, tumor size, morphology, histopathology, and accuracy of the clinical diagnosis (Table 1). Preoperatively, two patients in the laparoscopy group and three in the laparotomy group were misdiagnosed as harboring benign polyps. All these misdiagnosed tumors proved to be adenomas with focal carcinoma ($n = 3$) or invasive carcinoma ($n = 2$) by final histopathologic examinations of the resected specimens. In the laparoscopy group, four patients underwent the medial-to-lateral dissection sequence with intracorporeal anastomosis because their tumors were located 15 to 20 cm above the anal verge; the remaining 14 patients underwent the traditional lateral-to-medial dissection sequence with extracorporeal bowel resection and anastomosis. The comparisons of the various parameters associated with surgical outcomes and opera-

Table 1. Demographics and clinicopathologic data.

Characteristic	Laparoscopy group ($n = 18$)	Laparotomy group ($n = 21$)	p
Age (years, mean ± SD)	63.8 ± 7.1	58.2 ± 10.5	NS
Gender			
Male	10	13	NS
Female	8	8	
Symptoms			
Bleeding	4	5	
Bowel habit change	2	3	NS
Abdominal pain	2	2	
Nil	10	11	
Tumor location (cm above anal verge, mean ± SD)	28.0 ± 10.2	26.0 ± 9.4	NS
Localization method			
Preoperative tattoo	8	9	
Intraoperative palpation	9	10	NS
Intraoperative colonofibroscopy	1	2	
Tumor size (mm, mean± SD)	32 ± 8	35 ± 14	NS
Morphology			
Pedunculated	11	12	NS
Sessile	7	9	
Histopathology			
Benign			
Tubular adenoma	7	8	
Tubulovillous adenoma	3	3	
Villous adenoma	4	5	
Malignant			
Adenoma with focal carcinoma Invasive carcinoma	3 (1^a, 2^b)	4 (2^a, 2^b)	NS
Muscularis mucosa is penetrated	1^a	0	
Muscularis propia is reached	0	1^a	
Accuracy of clinical diagnosis	88.9% (16/18)	85.7% (18/21)	NS

[a]Number of lesions misdiagnosed as "benign" by pre- and intraoperative findings.

[b]Number of lesions first removed by polypectomy but the resection margin was not disease-free.

tive stress between these two groups of patients are shown in Table 2. The laparoscopy group of patients were found to have a significantly lower rate of postoperative complications, smaller length of operative wound, less postoperative pain, and faster functional recovery, as measured by the duration of postoperative ileus, hospitalization, and disability ($p < 0.05$). However, the cost for the laparoscopy group was significantly higher by an average US$266.39 compared to that of the laparotomy group ($p < 0.05$). Remarkably, the surgical stress of the laparoscopy group was significantly lower, as demonstrated by the significantly lower CRP and ESR quotients ($p < 0.05$) and higher lymphocyte count and $CD4^+/CD8^+$ ratio quotients ($p < 0.05$).

Discussion

Although advantages and disadvantages of laparoscopy-assisted colectomy versus open surgery in the management of colonic tumors have already been discussed by various investigators, the objective data remain scarce and need further investigation. The rarity of randomized, controlled trials for laparoscopic surgery reflects the challenging task of conducting surgical trials [12]. The present study disclosed the difficulties we encountered during the surgical trials in the clinical setting of Taiwan. Theoretically, randomization should be performed intraoperatively to decrease the chance of adverse events occurring between the time of randomization and surgery or subjects changing their minds about participating in the trial [13]. However, most patients signed the informed consent of this clinical trial with the prerequisite that they should know the treatment modality before surgery. This was because our patients commonly considered surgery as major psychological and physical trauma. To know the surgical modality preoperatively made them more comfortable and lessened the feeling that they were "guinea pigs." Moreover, the equipment-related costs of laparoscopic surgery were not covered by the Bureau of National Health Insurance in Taiwan. Patients of poor economic status had to raise money before surgery when randomized to the laparoscopy group. The hospital also had to ensure that the patient could afford laparoscopy before surgery. On the other hand, sigmoid complex polyps represent rare surgical indications. Therefore, to accrue adequate patients for this surgical trial, we had no choice but to randomize the patients preoperatively. Three patients left the trial after randomization to the laparoscopy group and underwent open surgery in other hospitals. Although most statisticians agree that an intention-to-treat analysis is the countermeasure for this inevitable condition [14], we excluded these three patients because they were outside the trial situation. Despite the presence of the inevitable defect inherent in this trial, we still believe that the results of this study can have a significant impact, as the patients were allocated and prospectively evaluated in an unbiased fashion.

This study evidently demonstrated that laparoscopy-assisted colectomy can be safely applied to the management of sigmoid complex polyps with less operative stress and quicker convalescence. However, before enthusiastically applying this technique, we recommend that the following aspects be taken into consideration:

First, laparoscopy-assisted colectomy is dependent on technical factors. It can be performed safely and with minimal invasiveness on patients only by an experienced surgeon. This is particularly true when dealing with colorectal malignancies, in which rough dissection could potentially result in intraperitoneal dissemination of cancer cells [9].We thought that it was not only immoral in terms of medical ethics but produced highly unreliable investigative results if a surgeon on the learning curve were to conduct any clinical trial of laparoscopic colectomy. Therefore, before conducting this study we made an effort to learn the knacks and pitfalls of laparoscopy-assisted colectomy from prestigious training centers including the Institut de Recherche Contre les Cancers de L'appareil Digestif-European Institute of Tele-Surgery (IRCAD-EITS), Strasbourg, France; Cleveland Clinic Florida, USA; and Keio University, Tokyo, Japan.

Second, accurate preoperative tumor localization is extremely important for a successful laparoscopy-assisted colectomy. In this study, two laparoscopic approaches were used: (1) the traditional lateral-to-medial dissection sequence with extracorporeal colonic resection and anastomosis; and (2) the medial-to-lateral dissection sequence with intracorporeal colonic transection and colorectal anastomosis. The choice of the surgical strategy was based on tumor location. We found that the advantages of the traditional lateral-to-medial approach were that extensive intraperitoneal mesenteric dissection and intraperitoneal anastomosis could be avoided. However, this approach may be technically difficult for a sigmoid complex polyp located 15 to 20 cm above the anal verge. Under this condition, we thought that the medial-to-lateral dissection sequence was a good alternative.We noted that the

Table 2. Parameters associated with surgical outcome and operative insult.

Parameter	Laparoscopy group	Laparotomy group	*p*
Operating time (minutes)	148.0 ± 51.5	160.0 ± 28.6	NS
Postoperative ileus (hours)	48.0 ± 12.5	96.0 ± 18.4	<0.05
Hospitalization (days)	7.0 ± 1.5	10.5 ± 2.0	<0.05
Postoperative pain (visual analog scale)	4.2 ± 1.0	8.5 ± 1.2	<0.05
Length of operative wound (cm)	4.5 ± 0.5	12.8 ± 2.0	<0.05
Cost ($1US ≈ NT$31)	NT$188,612 ± 8,105	NT$180,354 ± 9,654	<0.05
Postoperative complications			
Total	1	7	
Postoperative fever (< 48 hours) (minimal pulmonary atelectasis)	1	2	
Wound infection	0	2	<0.05
Urinary tract infection	0	1	
Anastomotic leakage	0	1	
Myocardial infarction	0	1	
Disability			
Return to partial activity (weeks)	2.0 ± 0.4 (100%)[a]	3.0 ± 0.4 (66.7%)[a]	
Return to full activity (weeks)	4.0 ± 1.0 (100%)[a]	6.0 ± 0.7 (66.7%)[a]	<0.05
Return to work (weeks)	4.1 ± 0.3 (56%)[a]	6.0 ± 1.0 (47.6%)[a]	
Quotients of immunologic alteration			
CRP	4.95 ± 1.30	14.10 ± 3.50	
ESR	1.61 ± 0.43	2.71 ± 0.54	<0.05
Lymphocyte count	0.86 ± 0.08	0.67 ± 0.10	
$CD4^+/CD8^+$	0.94 ± 0.06	0.78 ± 0.10	

CRP: C-reactive protein; ESR: erythrocyte sedimentation rate.
The value in each category is the mean ± SD.
[a]Percentage of patients responding to questionnaires.

medial-to-lateral dissection could provide the following advantages: (1) So long as the colon is fixed to the lateral wall, countertraction can be applied to the mesentery, which facilitates mesenteric dissection. Early separation of the white line of Toldt results in distortion of colonic anatomic landmarks and an increase in sigmoid redundancy, which evidently hinders the upcoming procedures and may increase manipulation of the tumor-bearing segment. (2) The mesenteric division before bowel mobilization may minimize cancer cell spread through the draining vessels. Therefore, from the oncologic point of view, this approach is particularly appropriate for laparoscopic resection of colorectal malignancies [15].

Third, two malignancies (one focal carcinoma, one invasive carcinoma) in the laparoscopy group and three cancers (two focal carcinomas, one invasive carcinoma) in the laparotomy group were misdiagnosed as benign lesions. This implies that there is always some risk that a complex polyp may harbor a malignancy despite the advent of meticulous diagnostic modalities including the dye method [16] and magnifying endoscopy [17]. To compensate for this diagnostic shortness, Buess advocated use of a surgical full-thickness resection for complex colonic polyps [18]. Remarkably, Nivatvongs and colleagues reported that the incidence of lymph node metastasis was 10% and 6%, respectively, in the resected specimens of sessile and pedunculated polyps harboring invasive carcinoma [19]. Based on these perspectives, laparoscopic segmental colonic resection was therefore better than endoscopic mucosal resection (EMR) for managing complex colonic polyps.

Fourth, colorectal surgeons are increasingly asked to define the cost-effectiveness of the laparoscopic approach. This study demonstrated that laparoscopy-assisted sigmoidectomy was significantly more expensive than the open method, by approximately US$266.39, although the shorter hospital stay partly compensated for the costs of equipment-related variables. However, seeing that the duration of postoperative disability was significantly shorter in the laparoscopy group, this technique was still economically encouraging.

This study provided more sound evidence that laparoscopic procedures induce less proinflammatory response and immunosuppression than the equivalent open procedures. The postsurgical immunosuppression results from a complex sequence of events that is still not understood [20–22]. However, the finding that immune function was better preserved after laparoscopic procedures may provide important clinical implications. Improved postoperative immune function may translate into lower rates of infectious complications and more rapid healing. Remarkably, some authors have pointed out an association between postlaparotomy immunosuppression and increased tumor growth postoperatively [23]. Therefore, it is possible that improved immune function may influence tumor recurrence and survival rates in patients undergoing tumor resection.

In conclusion, this study encourages the use of the laparoscopy-assisted colectomy in the management of complex sigmoid polyps if the patient's economic status permits.

Résumé. La colectomie assistée par laparoscopie est techniquement faisable, mais la preuve de ses avantages n'est pas faite. Cette étude évalue l'évolution et le stress opératoire de la colectomie assistée par laparoscopie comparé à la méthode traditionnelle dans la prise en charge des polypes complexes du sigmoïde qui ne peuvent être traités avec sécurité ni complètement enlevés par colofibroscopie. Entre janvier 1997 et décembre 1999, 42 patients ont été randomisés par blocs de façon égale entre chirurgie traditionnelle par laparotomie ou sigmoïdectomie par laparoscopie. Parce que trois patients randomisés au groupe laparoscopie n'ont pas complété l'essais, on a évalué de façon prospective, 18 patients traités par sigmoïdectomie assistée par laparoscopie et 21 autres par la méthode traditionnelle. Ces deux groupes de patients étaient bien

appariés en ce qui concerne l'âge, le sexe, les symptômes, le site tumoral, la méthode de localisation, la taille tumorale, la morphologie, l'histologie, et la précision du diagnostic clinique. Deux stratégies chirurgicales standardisées, la séquence de dissection latérale vers la ligne médiane, et la dissection médiane vers les flancs, ont été réalisées chez, respectivement, 14 et 4 patients du groupe laparoscopique, selon que ces tumeurs ont été situées au-dessous ou en dessus de 20 cm de la ligne anocutanée. Dans l'évaluation de l'évolution chirurgicale, nous avons trouvé que les résultats du groupe laparoscopique étaient significativement meilleurs que dans le groupe laparotomie en ce qui concernaient la sévérité de la douleur postopératoire, la taille de la plaie opératoire, le taux de complications postopératoire et la durée de l'iléus, de l'hospitalisation et de l'inactivité postopératoires. Il n'y avait aucune différence statistiquement significative entre les deux groupes en ce qui concernait la durée opératoire. Cependant, les coûts de groupe laparoscopique étaient significativement plus élevés. Pour évaluer le stress chirurgical, nous avons measuré le taux de protéine C-réactive (CRP) sérique, la vitesse de sédimentation (VS), le compte lymphocytaire total et le rapport CD4+/CD8+ 24 heures avant et après chirurgie. Nous avons trouvé que les taux de CPR et de la VS postopératoires étaient significativement moins élevés et que le compte lymphocytaire total et le rapport CD4+/CD8+ étaient moins déprimés dans le groupe laparoscopique par rapport au groupe laparotomie. Nous concluons que la sigmoïdectomie assistée par laparoscopie peut être réalisée avec sécurité, avec une convalescence plus courte et moins de stress opératoire, mais avec les coûts plus élevés. Nous recommandons l'utilisation de cette technique pour le traitement des polypes complexes du sigmoïde, si la situation économique du patient le permet.

Resumen. La colonomía asistida laparoscopicamente es técnicamente posible pero no existe evidencia objectiva de que sea más útil o beneficiosa. Este trabajo pretende evaluar los resultados y el estrés operatorio de pacientes, con pólipos complejos del sigma, que no pudiéndose extirpar con seguirdad mediante conolfibroscopia, fueron colectomizados bien por vía laparoscópica o mediante cirugía abierta tradicional. Desde enero de 1997 hasta diciembre de 1999, 42 pacientes con características similares se randomizaron en dos grupos: group laparoscópico, grupo laparotómico. Dado que 3 pacientes randomizados del grupo laparoscópico no completaron el estudio se excluyeron, valorándose prospeectivamente 18 pacientes tratados por vía laparoscópica frente a 21 sometidos a cirugía abierta convencional. Los pacientes de los 2 grupos eran perfectamente compatibles por lo que a la edad, sexo, sintomatología, situaciónd el tumor, método diagnóstico utilzado en la localización del tumor, tamaño de la neoplasia, morfología e histopathología, así como por lo que a la exacitud diagnóstica, se refiere. Dos técnicas quirúrgicas estándar fueron utilizadas: la disección latero-medial y la medio-lateral; se emplearon respectivamente en 14 y 4 pacientes de grupo laparoscópico, dependiedo se sí el tu mor estaba localizado por encima o por debajo de 20 cm. a partir del ano. Los resultados quirúrgicos fueron mejores, en el grupo laparoscópico, que en el laparotómico, por lo que a la intensidad del dolor postoperatorio, tamaño de la herida quirúrgica, complicaciones portoperatorias, duración del íleo paraalítico, tiempo de hospitalización y discapacidad se refiere. La duración de la intervención no fue significativamente diferente entre los dos grupos. Sin embargo, los costos en el grupo laparoscópico fueron mucho mayores. El estrés operatorio se valoró midiando, 24 oras antes y 24 horas después del acto quir-urgico, los niveles séricos le la protein-C-reactiva (CRP), la velocidad de la eritrosedimentación (ESR), el recuento total de linfocitos y el cociente CD4+/CD8+. Constatamos que los miveles séricos postoperatorios de la CRP y la ESR estaban menos elevados y que el recuento total de linfocitos y el cociente CD4+/CD8+ estaban, significativamente, menos deprimidos en el grupo laparoscópico, que en el laparotómico. En conclusión, la sigmoidectomía laparoscópica es una técnica segura, que acorta el periodo de convalecencia y produce un menor estrés operatorio; sin embargo, es mucho más cara. Nosotros recomendamos esta técnica en el tratamiento de pólipos complejos del sigmoide siempre y cuando las condiciones económicas del paciente lo permitan.

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