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Hand-Assisted Laparoscopic Colectomy May Be a Second Revolutionary Surgery after Laparoscopic Cholecystectomy

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Abstract: The aim of this prospective study was to determine the benefit of Hand-Assisted Laparoscopic Colectomy (HALC) for the patients compared to conventional open colectomy (OC). Laparoscopic surgery is popular for good cosmetics, less pain, rapid recovery and short hospital stay. However it is still in controversy because of longer operative time, larger expense and higher technical demand. Only laparoscopic cholecystectomy is unconditionally accepted and used worldwide nowadays. It has been outstanding for "Surgery of Revolution" in the past decade. We believe that HALC will be another operation for such a title in the near future. Because it not only maintains the advantages of minimal invasive surgery but regains the fundamental role of open surgery such as tactile sensation, manipulation and hemostasis. The patients with resectable colorectal cancers were randomized into two arms: 19 consecutive patients on Open and 25 patients on HALC arms according to the day of admission. The patient's clinical data, operative time, conversion rate, complications, early and long term results were analyzed prospectively. The characteristics of the patients in both groups were quite similar. The pain scores, number of analgesic injection, time to ambulation, time to oral intake, wound infection and length of stay were favorable of HALC group especially in the elderly. The operative time was 60-90 min longer for HALC group without increasing complication. Local recurrence and survival were also similar or superior to the OC group. We proved that HALC was associated with favorable recovery and adequate oncological clearance. It can be safely performed with superior quality of life outcomes in comparison with OC. We believe that HALC would be a standard procedure or at least a widely used laparoscopic technique for treatment of colorectal cancer.

Key words: Hand-assisted laparoscopic colectomy, open colectomy., colorectal cancer, conventional laparoscopic colectomy

INTRODUCTION

Laparoscopic surgery should be considered one of the most revolutionary surgical achievement among the new surgical techniques that have been developed during the past 15 years. It is exceptionally true for the laparoscopic cholecystectomy in every part of the world. However, apart from this operative procedure, the other different laparoscopic procedures are not yet widely performed for several reasons. The demand of laparoscopic technique especially for major surgery, requirement of expensive facilities and necessity of teamwork co-operation both in professional point of view as well as concepts are the most important factors. The specific features of laparoscopic surgery-the loss of the third dimension and depth perception due to operative control on TV screen-increase the difficulty of performing advanced surgical procedures such as gastrectomy, colectomy and splenectomy. On the contrary, the surgeons have not only good vision provided by the scope but also recover the tactile sense, which facilitates the identification of structures, exposure, retraction, control of bleeding and reducing the operative time by using hand assist technique[1]. The support of National Health Insurance system for the cost of laparoscopic surgery is also another fundamental point for the universal development of the laparoscopic technique. Therefore laparoscopic technique is often developed in individual basis for some particular purposes such as personal interest or advertisement rather than for overall improvement in medical standard of our community. This question is totally answered by the rapid development of laparoscopic cholecystectomy which is the first laparoscopic procedure among the very few endoscopic procedures paid by Health Insurance Program in our country and it was really revolutionized in the past decade. It is also true in other parts of the world. Therefore we have to find another way for development

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of some clinically useful laparoscopic procedures like colectomy, gastrectomy and nephrectomy. The best indications for hand assisted laparoscopic surgery are laparoscopic assisted procedures in which an accessory incision is required for removal of the specimen and/or anastomosis (e.g., colectomy, splenectomy, hepatectomy)[2]. In spite of the evidence of its feasibility and clinical advantages, laparoscopic colectomy has not been widely used as the procedure of choice for the management of the colorectal cancer. For laparoscopic colectomy (LC), not only does it entail a risk for cancer dissemination, it is also technically difficult and requires advanced surgical skills. HALC may have the potential to overcome these problems. Although there were some interesting papers supporting that HALC was preferable to the open method[3,4], to our knowledge, there were veryfew papers in literature discussing the randomized trial of HALC comparing with the traditional Open Colectomy (OC) purely on colorectal cancer at different locations. Here we would like to share our experience in HALC for the colon cancer in the past 3 years 8 months and highlight the possibility of the second revolutionary surgical technique after laparoscopic cholecystectomy in the near future.

MATERIALS AND METHODS

We started to introduce this new technique in the late 2000 and more than 30 cases of conventional laparoscopic colorectal surgery have already been accomplished by a single surgeon (Wen-Yao Yin) in different kinds of diseases including colon cancer with peritoneal or distant metastasis, slow-transit constipation, diverticular disease, iatrogenic colon perforation and some benign colorectal neoplasm before this clinical study. Then the patients with resectable colorectal cancers were randomized to two arms: 19 consecutive patients on Open and 25 patients on HALC arms according to the day of admission. The patient's clinical data, operative time, conversion rate, complications and early outcome measures and long term results were analyzed. Informed consent was obtained from all patients following thorough explanation of risks and potential benefits by the operating surgeon and the protocol was approved by the ethics committee of the hospital

Operative technique: We were doing all the procedures quite similar in the standard procedure described in the literature[3-6]. The only difference is that we did not put our hand at the beginning of the operation and it was introduced only after mobilization of the critical points around the colon and rectum. Therefore, during the dissection of some areas with limited spaces or

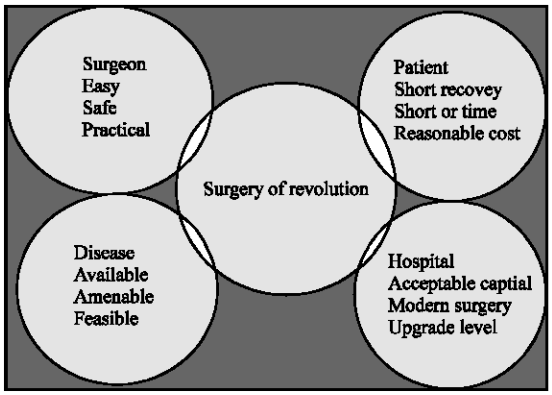

Fig. 1: Nondominant hand inside the abdominal cavity via a HandPort system for help

angle (eg. hepatic and splenic flexures or deep in pelvic cavity), it might be more room for dissection with conventional laparoscopic dissection followed by hand manipulation rather than the HAL dissection from the beginning. It seemed to be more comfortable and relatively quicker for dissection. Otherwise the hand in the abdomen disturb the operative field and only limited space is left for dissection .

A pneumoperitoneal and intracorporeal approach with pure laparoscopic technique was used to explore the abdomen, mobilize the colon, identify the critical structures and ligate the correlated vascular pedicle, if feasible, for different types of colectomy in order to achieve surgical radicality. The hand was inserted for assistance in left low abdomen for left sided colorectal operation (left hemicolectomy, anterior resection, low anterior resection, abdominoperineal resection), in right mid- or upper abdomen for right hemicolectomy and low midline or in left low abdomen for subtotal colectomy. We used Hand-Port assist devise that we have been familiar in the past experience. The wound was about 7 cm in size (same as glove size) and 1-2 cm larger than the conventional laparoscopic colectomy Fig. 1, 2 . Then the hand in the abdomen was used to localize the tumor in the lumen, help in dissection that could be much more difficult to achieve by conventional laparoscopic technique and dissect around the huge tumor and mobilize it out of the pelvic cavity. For the left side coleltomy, ligation of mesenteric vessels was done with laparoscopic technique or via hand port wound Fig. 3a, b. Right sided anastososis was performed extracorporeally with hand sewn or staples; left-sided anastomosis was hand-sewn extracorporeally or transrectal double-stapled intra-abdominally depending on the location of the lesion Fig.4a, b. In addition, the wound was protected with Hand port system or plastic sheet during the retrieval of the specimen.

Fig. 3: Ligation of mesenteric vessels during laparoscopic dissection

Fig. 4: The incision for the Hand Port was slightly larger than that of appendectomy and usually heals well

Fig. 2a: Ligation of mesenteric vessels t b: Delivery of specimen with adequate margin and mesocolon c: extracorporeal bowel anastomosis were done through the HandPort

Different types of colectomy in two groups were carried out in a standard fashion from the oncological point of view. Our study also included patients with extraperitoneal rectal cancer at very low position with very low colorectal anastomosis. We performed LAR with Total Mesorectal Excision (TME) as in open surgery and the preventive colostomy or ileostomy was occassionally used. The colon was reconstructed within one month or one year of the initial operation. Conversion from laparoscopic surgery to open method was allowed at the surgeon's discretion for the patient's safety in terms of technical difficulties, the presence of associated conditions, or inadequate oncologic margins.

Postoperative care, including early feeding and narcotic use was according to the surgeon's standard practice. Most of the patients were given intravenous PCA for postoperative analgesics and refeeding was initiated after the first flatus. But routine oral intake was only allowed on the fourth postoperative day. All the patients were also encouraged for getting out of bed and early ambulation. The patient was discharged when normal feeding was accepted and he or she was safe to leave the hospital

Table 1: Patient's demographics

	Group 1 (HALC) N=25	Group 2 (Open) N=19	p value	Group 3 (HALC) Y > 65 N=11	Group 4 (Open) Y > 65 N=7	p value
Age (year)	62.56	63.53	NS	73.64	71.86	NS
M/F	11/14	8/11	NS	6/5	3/4	NS
ASA	1.8	1.58	NS	2	1.57	NS
BMI	25.39	22.25	NS	25.90	21.56	NS
BMI>28	8/25	2/19	NS	2/11	1/7	NS

NS : Nonsignificant Open-Open colectomy

Table 2: Different locations and procedures

	Halc No.%	Open No.%	Total
Location			
Right colon	5 (20%)	4 (21%)	9
Sigmoid	1 (4%)	1 (5.25%)	2
Rectal	19 (76%)	14 (73.75%)	33
Total	25	19	44
Procedures			
Right hemicolectomy	5 (20%)	4 (21%)	9
Left hemicolectomy	1 (4%)	1 (5.25%)	2
Low Anterior Resection	15 (60%)	9 (47.36%)	24
Abdominoperineal Resection	4 (16%)	5 (26.39%)	9
Total	25	19	44

No difference between two groups by X2 test

Study design: The patients were mainly grouped into 2 groups and the patients over 65 year old in each group were selected for further evaluation. The group 1 composed of HAL patients in all age, the patients in the group 2 were operated by conventional open surgery, the group 3 (subgroup of 1) includes HAL patients with the age more than 65yrs and the group 4 (subgroup of 2) comprised of patients more than 65 years old using open method. All the patients of colon cancer in different locations with correlated operative procedures were included in this study. All the patients admitted on Tuesday and Thursday were assigned for hand assisted laparoscopic colectomy by the author. Other senior surgeons in the same team were responsible for the open colectomy. The patients with acute total obstruction with severe ileus, with acute hemorrahage, with perforation and peritonitis, with unstable vital signs and with previous operation with severe adhesion were excluded from this study. Then the data of four groups were compared and analysed statistically using Fisher's and T test . The P value less than 0.5 was considered as significance.

Follow-up: The follow up period ranges between 30 months to 54 months with the median follow up period of 36 months. The neoadjuvant therapy was given to every patient with Duke C (lymphnode metastasis) for colon cancer and radiation was added for the rectal cancer. CCRT was also administered for the rectal cancer with deep invasion (Duke B2). Patients were evaluated for tumor recurrence as follows: Physical examination, including checking of tumor recurrence at wound sites and carcinoembryonic antigen testing every three months for first two years and then every six months for five years; colon evaluation including colonoscopy and/or colon radiography, one year after initial operation and then every three years; and chest radiography, every six months for two years and then annually.

RESULTS

From January 2002 to December 2004, 25 consecutive patients with colorectal cancer at different sites were operated with HALC technique by a single laparoscopic surgeon and another 19 patients with colorectal cancer with similar locations and staging were treated with traditional method by another four surgeons of the same team in a teaching hospital simultaneously. These two groups were well matched for age, gender and ASA score, but mean BMI was higher in group I Table 1. The different locations of the cancer and procedures in both groups were showed in Table 2. The oncological characteristics of the operation including size of specimen, number of lymph-nodes and cancer staging were described in Table 3. The operative data and immediate outcomes compared between the correlated groups were summarized in Table 4. The surgeon can explore the abdomen with a hand and so obviates the need for tattooing of larger lesions preoperatively or intraoperative colonoscopy. There was no conversion in HALC group. A prophylactic loop ileostomy was created 2 in HALC group and one in open group. The OR time was significantly longer in the HALC group than the control group and the elderly patients of the laparoscopic group took shorter OR time in comparison with the young aged patients operated with the same technique. Regarding the data associated with immediate postoperative pain, there was no definite difference on pain score, number of Demerol injection and the time of getting out of bed between these groups.

Table 3: Cancer characters

	Group I	Group II
Specimen size Mean(range)cm	14.27(3.5-31)	17.13(4.7-36)
LN numbers	8 (3-18)	9.7 (2-22)
Cancer staging		
CIS	2	1
Stage I	11	5
II	6	8
III	6	5
Total	25	19

Table 4: Immediate outcomes

	Group 1 N=25	Group 2 N=19	p value	Group 3 N=11	Group 4 N=7	p value
OR time (mins)	302.60	183.68	S	245.82	172.14	S
Pain score 3 (days)	3.64	4.37	NS	3.27	4.57	S
Pain score 7 (days)	1.44	1.32	NS	1.09	1.43	NS
Out of Bed (days)	2.24	2.32	NS	2.64	2.71	NS
Ambulation, >100M (days)	4.88	7.11	S	5.18	7.14	S
Oral resumption(days)	5.36	7.11	S	5.18	7.14	S
Total Demerol injection	1.08	1.11	NS	0.36	1	NS
WI	1	4	-NS	-	-	-
LOS (days)	8.48	11.11	S	7.55	10.43	S

OR time-Duration for operation, Pain score 3 or 7- Postoperative days before pain score 3 or 7, Out of bed-Time for getting out of bed, LOS-Length of stay,S-Significant, NS-Non-significant S: $p<0.05$

Table 5: Alternative comparison

	Halc Y<65 N =14	Open Y> 65 N =7	p value	Halc Y > 65 N =11	Open Y< 65 N =12	p value
OR time	347.21	172.14	S	245.82	190.42	S
BMI	25	21.6	NS	25.9	22.6	NS
LOS	9.36	10.43	NS	7.55	11.5	S
Ambulation	4.64	7.14	S	5.18	7.08	S
Pain score 3	3.93	4.57	NS	3.27	4.25	S
Pain score 7	1.71	1.43	NS	1.09	1.25	NS
Oral resumption (days0	5.36	7.14	S	5.36	7.17	S

S: $p<0.05$

Table 6: Analysis of Correlations for HALC

Age vs OR time	‡	r < 0
Age vs LOS		
BMI vs OR time	‡	r > 0
BMI vs LOS		
BMI * Flatus		
OR time vs Flatus	‡	r > 0
OR time vs Oral Resumption	‡	r > 0
OR time vs Ambulation		
OR time vs LOS	‡	r > 0
Ambulation vs LOS	‡	r > 0

r-regression, r < 0-reverse relation, r > 0-Linear correlation, F test, A ($p<0.05$)

Table 7: Comparison between the first half and latter half in HALC patients

	First half. N = 12	Remainder, N = 13	P value
OR time (min)	348.83 (132.82)	259.92(58.41)	p<0.05
LOS (day)	9.75(3.79)	7.31(1.03)	p<0.05

However there was statistical significance in ambulation more than 100 meters and recovery of the intestinal function favorable in HALC groups both for the comparison between the two comparing whole groups (group 1 vs group 2) and for the other two groups of elderly patients (group 3 vs group 4). Both these functional recovery was also true even if we compared between the two other different pairs i.e the younger patients in HALC group vs the elderly patients in control group and the elderly patients in HALC vs the younger patients in control group Table 5. It also translated that a profound reduction of LOS in both HALC groups. During the analysis of HALC group itself, it was interesting to find that OR time is the mainstay in relation with flatus passage, initiation of oral feeding and ambulation and it in turn promoted the early discharge for home Table 6. It was also proved to be true when we compared the former 10 patients with the latter 15. The shorter the operative time, the shorter LOS did it take for hospitalization Table 7. At the same time, we could also realize that there was a significant learning curve for the HALC method. Two patients in group I (225, 8%) and three patients in group II (3/19, 16%Y) came up with recurrence. One in each group showed recurrence in colon and the remainder sustained liver metastases. They all are rectal cancers except one case of transverse colon cancer who recurred colon cancer 42 months after operation in contrast to the early recurrence (6-18months) for the rectal cancers. All the patients in both arms were still alive until the last follow-up recently.

DISCUSSION

We all agree that laparoscopic surgery is favorable for its rapid recovery in physical activity, gastrointestinal

function and cosmetic advantage. However, there are several obstacles for the substantial development of the laparoscopic approach for some advanced surgery. These concerns includes not only the cost and technical demanding for the modern surgery but also tumor seeding of the wound from chimney effect by forceful gushing of gas through the wound, tumor recurrence and long term survival if colorectal cancer patients were included. Although laparoscopically assisted colectomy was applied for colon resection as early as 1990, the procedure was has not been widely accepted by surgeons. It is really a wise idea to put a hand into the peritoneal cavity for safer, faster and more feasible technique for solution of these difficulties. HALS is a newly developed technique that was first described in 1994[7]. It is logical to consider that this promising hybrid of laparoscopic and open surgery, HALC, is easier and faster to do than the conventional laparoscopic assisted colectomy. But we have been concerning whether it affects the rapid recovery and more chance of cancer seeding and infection because of the larger wound. But we can clearly see in our experiment that these patients still have significant advantages in recovery both in physical activity and GI function. HALC group revealed a good result in infection rate, GI function, physical activity and length of stay Table 4, 5. We noted that the duration after operation to reach the pain score of 7 by VAS or getting out of bed condition are not much significant among these group. It was clearly understood that the intensity of the pain in the early period may not be much different between large and small wounds. It might be probably due to Patient Controlled Anesthesia (PCA) use in the immediate postoperative period. However, the difference was found more substantial in functional remission by measuring the ambulation for some distance. From these point of view, we can easily understand that why the LOS of patients in HAL group was significantly shorter. Such a meaningful result was magnified in the high BMI (above 28) and the elderly patients. Intraooperative ventilation of obese patients is more often problematic than in normal-weight patients, largely because the static pulmonary compliance of obese patients is 30% lower and their respiratory resistance is 68% higher than normal[8]. The respiratory reserve is thus reduced, with a tendency to hypercarbia and respiratoey acidosis. Pandya *et al.*[9] have shown that the conversion rate is higher in patients with a body mass index BMI) > 29 due to increased technical difficulties. A similar conclusion was reached by Pikarsky *et al.* who reported a higher conversion rate in patients with a BMI > 30[10]. We didn't find such a condition in our study though h igher BMI patients spent more OR time than the non-obese ones. The elderly in the HALC group (group 3) went home earlier than the counterparts in open group (group 4) and such effect was also seen in comparison between the two whole groups (group 1 vs group 2). The longer period of OR time in HALC group did not have a negative affect on recovery when compared with the open group but it is associated with less favorable result if we analyse these factors among the HALC group itself. Surprisingly we noted that the OR time for the elderly in HALC group was significantly lower than that of the younger patients. It might be due to more careful manipulation and better sense of time control in these older high-risked patients by the surgeon as well as anesthesiologist during operation. On analysis of the HALC group, we also realized that the age and obesity factors were correlated reversely and directly with OR time respectively though each factor itself had no effect on LOS . The gastrointestinal recovery and LOS, however, were influenced by the OR time significantly. The shorter OR time was associated with early resumption of GI function and therefore promote early discharge also Table 6. OR time itself however did not change the time of physical recovery. Longer operative time in patients with high BMI did not delay the effective ambulation. But early ambulation really helps in shortening of hospital stay. It proved that minimal invasive surgery with small wounds are the mainstay for early ambulation because of less pain and minor trauma to the abdominal wall. It was also proved that the shorter the OR time in the latter 15 cases came out with the result of shorter hospital stay compared with the former 10 cases Table 7. Therefore shorter OR time with less insult in general condition is still important for rapid and smooth recovery among the patients with HALC though it is not significant if we compare with open colectomy. Most surgeons agree that the LC is a difficult procedure to learn and presents the challenge of a long learning[11-14]. During the surgeon's first 50 LC, for example, the chance of conversion to an open operation averages approximately, 25% (1). Simultaneously, it will explain that learning curve is also very important for the immediate outcomes of the operation. However it must be less steep than that of the LC and it was proved in our study with zero chance of conversion and also in other similar series[3,15,16]. The minimally invasive approach has rarely been proposed for rectal cancer surgery and it is advised to be done only after being familiar with other laparoscopic procedures such as right hemicolectomy due to technical demanding for total mesorectal excision and low colorectal anastomosis close to the pelvic floor . In contrast, we did not feel such a significant difference when accomplishing the procedure with HALC technique though it was slightly more pain-staking.

We proposed that laparoscopic colectomy for colorectal surgery should be energetically developed for more widely use. There are several reasons for this suggestion. We all realize that the laparoscopic technique is not so popular with the exception for the laparoscopic

cholecystectomy and laparoscopic appendectomy in general surgery because of several reasons. Failure of activation of motivation of our colleagues to perform laparoscopic surgery is the most important factor. Hospital may be reluctant for the expense of substantial amount of the cost on the setting of the laparoscopic facility including operative theater and related instruments without much benefit on its budget. Our national insurance policy does not include the payment for such an expensive surgery. At the same time, more manpower and working h are needed for several extra works and the necessity of teamwork to accomplish an advanced laparoscopic surgery is sometimes very frustrating for a surgeon to organize. On the other hand, we can not prove that the laparoscopic technique is preferable in every aspect at least with randomized control study though we will not deny that it is favorable in some aspects than traditional open surgery. Only a few surgeons in some large medical center can do it and usually they present a very small group in each hospital. Most of the surgeon are busy and burden with work load due to shortage of medical graduates enrolled as surgeons and so it is unfeasible for most of the surgeons to use much of their time in doing laparoscopic surgery. As a matter of fact, the laparoscopic technique especially for the advanced surgery were not widely performed and our people ultimately lose the chance of enjoying such a modernized surgery. So we think that it is time for us to find out a way to overcome this obstacle. Takegami *et al*. introduced a minilaparotomy technique which can perform all the operative procedures through incisions measuring 3-7 cm length with earlier recovery, short hospital discharge and good oncological clearance. The size of the wound was very similar to those of the LC and HALC. The drawbacks were that this technique could not be used for colon cancer requiring dissection of the splenic flexure and it may be too difficult to perform in extremely obese patients[17]. Therefore the hand-assisted laparoscopic surgery especially the colectomy for cancer should be one of the problem-solving methods. We have several reasons to support it. As we have introduced more than one and a half decades of laparoscopic application to our clinical practice, most of our general surgeons are now prerequisite with laparoscopic skill at least in some kinds of less advanced laparoscopic surgery such as laparoscopic cholecystectomy, laparoscopic appendectomy, laparoscopic splenectomy and laparoscopic adrenalectomy. A short learning curve given to our enthusiastic laparoscopic surgeons will not be too difficult to combine our traditional skill of open surgery to the laparoscopic manipulation. Although it is considered to be an easier method in comparison to the conventional LC, it still needs a considerable learning period as we have seen in our study. We also agree that cancer lesions are usually free from difficult adhesion and inflammatory change in contrast to some benign inflammatory diseases such as diverticulitis and so increases feasibility of our surgical performance. Cancer seeding, especially around the wound and recurrence are the main factors that we were reluctant to do LC[18-21], was also documented recently that the incidence was not specifically higher for laparoscopic procedure if we pay attention in preventive measure during operation from spreading[22-24]. We also revealed as mentioned above that there was no increase in rate of recurrence or metastasis in laparoscopic group with the median follow-up period of 36 months (range 30-54 months). It was also true in the other similar studies[25-27]. Regarding the adequacy of laparoscopic procedure in terms of oncological points of view, the number of the lymph nodes and size of the specimens were comparable for these two methods[28-30]. In addition to that enough cases of colon cancer cases are available in every level of hospital and well establishment of this HALC technique in practice may be very helpful not only for the patients but also hospital can set up facility for this kind of surgery with a relatively simple and cheaper facility. The next important point for us is that we can do such kind of operation without much tension and only a few min longer OR time is spent for excellent result. In another wards, HALC simplifies difficult intraoperative situations, therefore reducing the OR time and the need for conversion. We also prove that the longer the practice, the shorter is the OR time for the different types of operation. Generally, we can finish HALC with 30-60 min longer than that of open surgery. Therefore this technique is good for the patients, surgeons, hospitals and even for the disease itself. Therefore, we suggest that this procedure should be developed and well established within a next few years for most of the surgeons in every level of hospitals and we hope that it will be the second revolutionary surgery following laparoscopic cholecystectomy within several years in the near future. Fig. 5.

Some experienced surgeons dealing with conventional laparoscopic colorectal surgery might not very comfortable to replace conventional laparoscopic colectomy with this method. The reasons are that they can perform the conventional laparoscopic colectomy comfortably without making a 1 to 2cm larger wound for insertion of hand, HALC makes more injury due to prolonged stretching of wound around the forearm[2,31] and the hand inside abdomen probably makes laparoscopic method less attractive. Most of the authors, however, accept the hand insertion is useful to prevent

Fig. 5: The favorable effect and interrelationship of the HALC with disease, patients, surgeon and hospital may be crucial for universal development of the HALC in the near future

conversion by helping in dissection of some difficult colorectal cases and immediate hemostasis in case of bleeding complication and a bridge stone for training unskilled surgeons. HALS Study Group did not advocate the routine use of hand-assisted devices as a replacement for laparocopic colectomy due to the gas leakage causing loss of pneumoperitoneum[32,33]. But the improvement in hand-assist devices nowadays can achieve the airtight seal during the entire operative procedure[34,28]. Targarona and colleagues tend to reserve the hand-assisted technique for help in difficult operations to minimize their conversion rate because HALC has high inflammatory response such as in C-Reactive Protein (CRP) and interleukin-6 was noted in different time points in the first five postoperative days[2] and concern about the impact on the long term survival and length of free disease free survival[16,35-38]. However the learing curve for LC is deep and the rate of conversion to open surgery is high with the range from 17 to 42%[39,40]. Naar and colleagues, from Madford, MA, on the other hand, suggested at the 10th International Congress of the Society of Laparoscopic Surgeons in 2001 that hand-assisted laparoscopic colectomy should replace standard laparoscopic colectomy[42]. Nakajima and partners emphasized in their paper that the advantages of HALS were still obvious in performing total colectomy though their surgical team has applied laparoscopic surgery to colorectal practice for more than a decade and had already performed > 1000 laparoscopic colorectal operations[28]. Actually, we feel that the difference of length of wound between 6 and 7 cm for LC and HALC respectively are not the point for argument as it is so small that it can be negligible. In addition, using of hand assistance only after the dissection of most part of surgery may reduce the total time of stretching of the wound by Hand port and thus reduces the possible unfavorable biological consequences of HALC.

Although there were multi-center clinical trails randomizing patients with colon cancer to either laparoscopic or open resection were initiated in the mid 1990s to access the oncological safety of laparoscopic surgery, none of these randomized trials has yet accumulated sufficient data that would enable reliable and definitive assessment of laparoscopic colectomy for cancer[29]. A minimum follow-up period of 3 years is required to establish cancer-free survival rates as the recurrence rate in colorectal surgical patients who undergo curative resection is-20-30%; >90% of recurrence are detected within 3 years[43]. The probable higher incidence of cancer seeding on the wound due to gas leakage and larger incision wound was also solved by non-touch technique, gentle manipulation, protection of wound with Hand port or plastic sheath. Our data with the medain follow up period of more than two and a half years also support the proposal that laparoscopic approach possesses the same oncological results compared to the open technique. Very few randomized trials of HALC dealing with colorectal cancer had been reported before[2,3] and our study should be the only randomized controlled trial describing HALC for colorectal cancer at different portions in various stages with the follow up period of three years. We are also happy with the recent favorable oncological clearance including resection margin, lymph nodes yield and wound recurrence and over all survival in laparoscopic patients especially in the stage III patients[44,28,39].

As we all know the total laparoscopic colorectal surgery (intraabdominal vascular ligation as well as bowel anastomosis) was attempted by surgeons at the beginning and it is almost totally replaced by laparoscopic assisted colectomy now. This is because the latter one is more pragmatic than the former one in clinical practice. We believe the HALC will also follow this kind of revolution and more and more surgeons especially the new comers will be willing to accomplish colorectal cancer cases by this method. We also realized that insertion of the hand only after the dissection and mobilization of the colon including the narrow spaces such as flexures and deep pelvic cavity and identification of critical structures (e.g-mesenteric vessels, ureter) is preferable to putting the hand from the beginning. Then the complex portions of dissection such as T colon mobilization and deep pelvic peri-rectal mobilization was helped by hand manupulation. It also avoids crowding of hand among the instruments

doing dissection at the narrow angle and shorter duration of stress due to a stretch of wound by the hand. We should also note that there are several studies proving that hand assisted Laparoscopic Donor Nephrectomy (LDN) is more beneficial for graft survival by reducing warm ischemia time and operative time though an incision wound for retrieve of the donor kidney for conventional LDN is cosmetically superior than the incision for hand assisted surgery[45,46]. For HALC, such a problem does not exist.

We have adequate as well as increasing number of colorectal cancer in our community and LC is encouraged by the recent promising multicenter study report[28-30]. But many cases of colorectal cancer were not operated by this method. Only about 10 % of colorectal cancer cases in our hospital were performed with laparoscopic technique and only 5% of cases are accomplished by laparoscopic method world wide even in the referral medical center because of shortage of time, facility and experienced surgeons. It could be corrected by adding HALC as a routine performance by the inexperienced surgeons as a stepping stone for conventional LC, a tool for training of skill, wider use for the difficult cases, interim technique before conversion from LC and an alternative technique for the busy surgeons in the busy centers. Because of its easier technique, safety, lesser time consumption and less expensive cost, we expect its more common use in different levels of hospitals rather than a very few experts are doing for a limited number of patients in a few referral centers with conventional LC. From the patient's point of view, it is grateful to see more hospitals and surgeons are available for serving such surgical intervention without loosing the advantage of minimal invasive surgery. After all, we believe that HALC should be a standard procedure or at least a widely used laparoscopic technique for treatment of colorectal cancer, it is technically more feasible, safe, less conversion rate, cost effective and no negative affect on oncological results.

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