

Original Article

Gasless laparoscopy-assisted surgery for gastric and colorectal cancer in a small rural hospital

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Abstracts

The laparoscopic approach to gastric or colorectal cancer is recognized as an alternative to open surgery, but it is often difficult in small hospitals because of a lack of laparoscopic experience and facilities. Based on 10 years experience of gasless laparoscopic cholecystectomy, we began gasless laparoscopy-assisted surgery via mini-laparotomy for gastric and colorectal cancer in a small rural hospital, Nasu-Minami Hospital, from 1999.

Twelve distal gastrectomies and 2 partial gastrectomies were performed for early gastric cancer. One ileocecal resection, 8 right hemicolectomies, 2 transverse colectomies, one left hemicolectomies, 4 sigmoidectomies, 2 anterior resections, one total colectomy, and one partial resection were performed for colorectal cancer without serous invasion. One case of gastrectomy and 2 cases of colectomy were converted to open surgery because of adhesion and bleeding. The surgeons were beginners in this operation, but had sufficient experience of open surgery and laparoscopic cholecystectomy. The perioperative course was satisfactory with a small amount of blood loss and a short operative time. The postoperative course was fair except for wound infections, which were dramatically improved by wound protector devices. All the patients survived, but two patients recurred in colon cancer group. The gasless laparoscopy-assisted approach is suitable for less experienced surgeons and hospitals because of its similarity to open surgery utilizing mini-laparotomy. It is gentle for patients because of reduced cardiopulmonary and other organs distress by pneumoperitoneum, and is economical because of reusable instruments which are used for open surgery.

In conclusion, gasless laparoscopy-assisted surgery for gastric and colorectal cancer is feasible and useful as a minimally invasive operation.

(Key Words : Gasless, laparoscopy, gastric, colorectal, cancer)

I Introduction

Nowadays, minimally invasive surgery for gastrointestinal disease has spread throughout the world since the establishment of laparoscopic cholecystectomy. Although the laparoscopic or laparoscopy-assisted approach for gastric or colorectal cancer is recognized as an alternative to open surgery, lots of problems such as safety, cost, and long-term results, have not been resolved. Laparoscopy-assisted gastrectomy or colectomy has become popular in Japan, but it is difficult in a small hospital because of a lack of laparoscopic experience and facilities. Gasless laparoscopic surgery using abdominal wall lift is thought to be a safe and feasible method without CO₂ insufflation and special materials¹⁻⁴). This method does not need airtight circumstances and can utilize a direct approach via mini-laparotomy^{1-3,5}). We have been performing gasless laparoscopic cholecystectomy using abdominal wall lift since 1990 in a small rural hospital, Nasu-Minami Hospital⁶). Based on this experience, we began laparoscopy-assisted surgery via mini-laparotomy for gastric and colorectal cancer in 1999.

Herein, we evaluate the short-term and long-term results and verify the usefulness and feasibilities in gasless laparoscopy-assisted approach in a small rural hospital.

II Patients and Methods

A Patients)

We attempted gasless laparoscopy-assisted surgery for gastric cancer in 15 patients and for colorectal cancer in 22 patients from January 1999 to June 2004. Regarding the indication for gastric cancer, the depth of cancer was within the submucosal layer and no lymph node metastasis was recognized on abdominal CT scan according to the therapeutic guideline for gastric cancer⁷). As for colorectal cancer, no exposure to serosa, no infiltration to adjacent organ and no marked lymph node metastasis were recognized on abdominal CT scan. Prior to surgery, all the patients were informed about the complications associated with laparoscopic surgery and accepted the surgery with informed consent.

B Methods)

1 Gasless laparoscopy-assisted gastrectomy (LAG)

In a supine position, we equipped 3 elevating handles (Mizuho Ika, Tokyo, Japan) with right costal arch, left costal arch, and peri-umbilical portion using subcutaneous Kirshner wires. We made an upper median 5–6cm incision and equipped the incision margins with a wound protecting device, Lap Protector[®] (Hakkoh Syouji, Tokyo, Japan) (Fig.1). For a direct approach via the mini-laparotomy, we dissected the greater and lesser omentum, and feeding vessels, in a way similar to open surgery (Fig.2). For laparoscopic procedures, we lifted up the 3 elevating handles by a reversed L-shaped lifting bar (Mizuho Ika, Tokyo, Japan) placed over the patient's right or left shoulder (Fig.3). We placed three reusable trocars on the right and left sides of the upper abdomen and below the umbilicus, sized 5, 5 and 10mm, respectively. Then we inserted a laparoscope via the 10mm umbilicus port. The surgeon performed dissection via the mini-laparotomy observing direct and laparoscopic views. The first assistant exerted

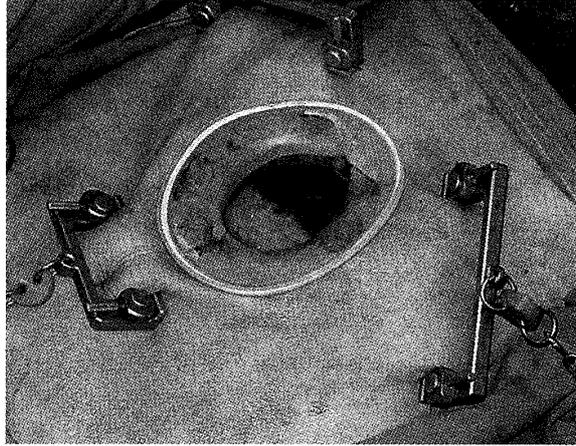


Figure 1 Three elevating handles are placed at right costal arch, left costal arch, and peri-umbilical portion using subcutaneous Kirshner wires. An upper median 5-6cm incision is equipped with a wound protecting device, Lap Protector®.

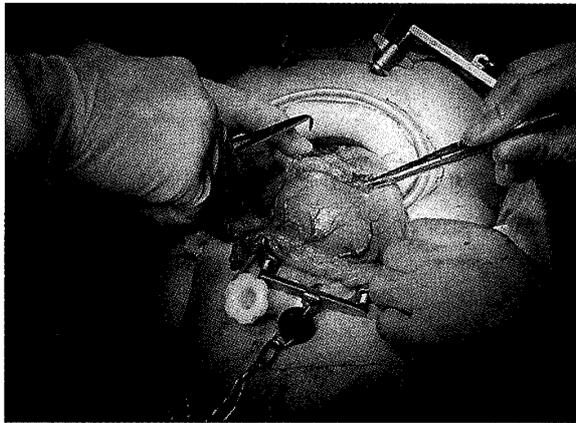


Figure 2 Direct approach via the mini-laparotomy. Surgeons are performing dissection of greater omentum and feeding vessels, like open gastric surgery.

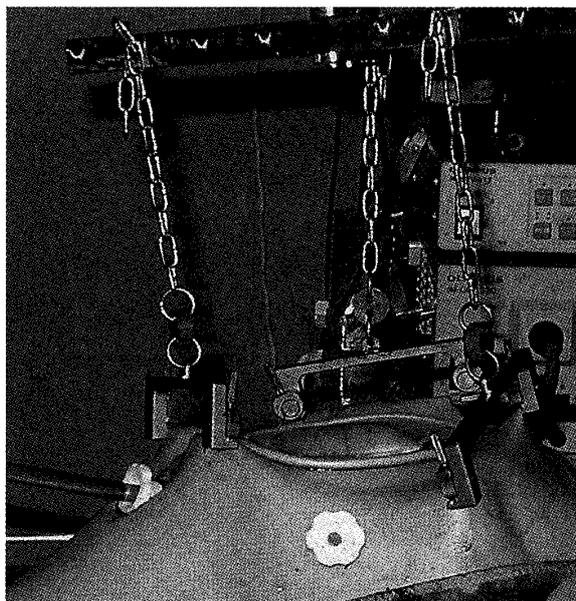


Figure 3 Three elevating handles with abdominal wall are lifted by a reversed L-shaped lifting bar placed over the patient's right or left shoulder for laparoscopic approach.

counter-traction via the 5mm trocars with a laparoscopic view to help the surgeon perform the operation. Lymph nodes and omentum were mainly dissected by an electric cautery and/or an ultrasonic coagulator, Autosonix[®] (US Surgical, Norwalk, Connecticut, USA). In the cases of distal gastrectomy, after an adequate dissection of the distal stomach and perigastric lymph nodes, we resected the stomach and reconstructed the gastrointestinal continuity with a hand-sewn anastomosis or an instrumental anastomosis using a circular stapler, PCEEA[®] (US Surgical, Norwalk, Connecticut, USA). In the cases of partial resection, we resected the lesion with an adequate surgical margin by electric cautery or a liner stapler, EndoGIA[®] (US Surgical, Norwalk, Connecticut, USA) without lymph node dissection.

2 Gasless laparoscopy-assisted colectomy (LAC)

A left semi-lateral position was used for patients with right-sided colon lesions, a right semi-lateral position for those with left-sided colon lesions (Fig.4), a head-down position for those with rectal pathologies, and a variety of positions for one patient with colonic polyposis. A reversed L-shaped lifting bar was set up on the ipsi-lateral side for a localized lesion, either at the shoulder or iliacus of the patient, or at the various sites for the diffuse disease of polyposis. The surgeon stood on the contra-lateral side of the dissected colon with the assistant standing in front of the surgeon. Firstly, we inserted a 10mm valveless trocar at the margin of the umbilicus. Then, an elevating handle with subcutaneous Kirschner wire was placed near the umbilicus and 2 handles either at the costal arch or in the lower abdominal wall according to the localization of the lesions. Then we lifted up the abdominal wall by the lifting bar attached to the elevating handles (Fig.5). After intra-abdominal observation by laparoscopy, a mini-laparotomy was performed near the localized lesion and an additional 2 or 3 valveless trocars were placed for manipulating instruments. Watching the monitor images created by the laparoscopy, or obtaining direct views through the mini-laparotomy, the surgeon mobilized the oral and anal sides of the lesion using an electric cautery or an ultrasonic coagulator. The mesentery of the colon was dissected along with feeding vessels and lymph nodes. After adequate mobilization, the lesion-containing colon was pulled out of the abdominal cavity through the mini-laparotomy, followed by extracorporeal resection and anastomosis (Fig.6). Three patients undergoing anterior resection (AR) and ileorectal anastomosis (IRA) had the anal side of the lesion resected in the abdominal cavity and the specimen removed via the mini-laparotomy.



Figure 4 The patient with left-sided colon lesions is kept a right semi-lateral position.

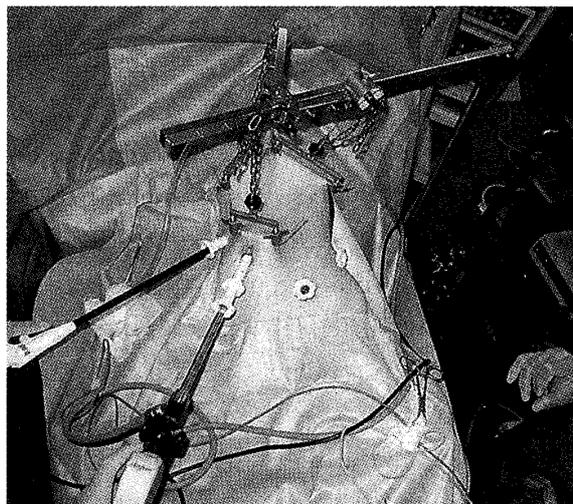


Figure 5 Laparoscopic procedure of left-sided colectomy. Two elevating handle with subcutaneous Kirschner wires are placed near the umbilicus and at the left costal arch and lifted up. Surgeons are performing laparoscopic dissection via the valveless trocars.

Then, intracorporeal reconstruction was performed with a double stapling technique using a

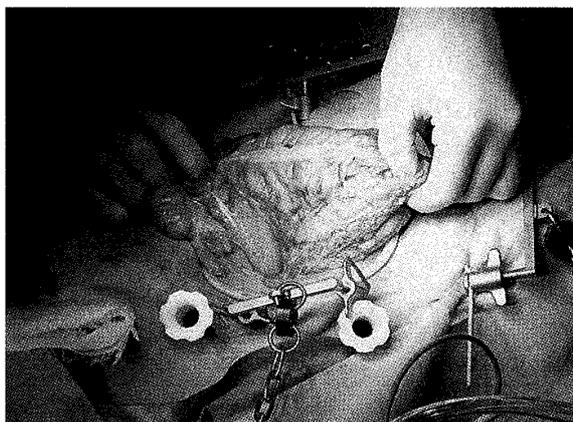


Figure 6 After adequate mobilization, the lesion-containing colon is pulled out through the mini-laparotomy.

circular stapler, PCEEA[®] inserted through the anus.

We reviewed all the cases undergoing gasless LAG and LAC, and all the surgeons performing the operation. All the surgeons except for surgeon A (Table 1, 2) who participated in the present study were beginners for LAG and LAC, but had sufficient experience of open gastric and colorectal surgery, and gasless laparoscopic cholecystectomy. Then, we evaluated operating time, blood loss, time to oral intake, time to discharge, and complications, and estimated long-term results with or without recurrence.

III Results (Table 1, 2)

We converted to open surgery in one case of LAG due to adhesion, and in 2 case of LAC due to adhesion and uncontrollable bleeding. In the LAG group, 12 distal gastrectomies with perigastric lymph node dissection (D1) for the lesion of lower and middle stomach, and 2 partial gastrectomies for the lesion of upper stomach, using mini-laparotomy in one patient, without

mini-laparotomy in one patient were performed. In the LAC group, one ileocecal resection, 8 right hemicolectomies, 2 transverse colectomies, one left hemicolectomy, 4 sigmoidectomies, 2 anterior resections, one total colectomy, and one partial resection were performed. D2 lymph node dissections were carried out except for 3 cases, no lymph node dissection in a total colectomy for a familial adenomatous polyposis and a partial resection for a mucosal cancer of ascending colon, D1 lymph node dissection for a 91-year-old patient. The patients' average age was 67.79 and 71.35 year-old, and the male/female ratio was 6/8 and 7/13 in LAG and LAC, respectively. The surgeons' average experience was 7.64 years among 6 surgeons and 8.45 years among 7 surgeons, in LAG and LAC respectively.

Regarding peri-and post-operative courses, the mean operative time was 179.0 and 181.5 minutes, the mean blood loss was 88.1 and 91.8 ml, the mean starting of diet after surgery was 5.01 and 4.25 days, the discharge time after surgery was 14.3 and 13.8 days, in LAG and LAC, respectively. There was no major complication such as anastomotic leakage and cardiopulmonary disorders, but wound infection was recognized in one case of LAG and 4 cases of LAC before the introduction of the Lap protector, and it also prolonged the time to discharge. All the pathological stages of LAG were I A according to the Japanese classification of gastric carcinoma⁸⁾, and all the patients survived without recurrence. The pathological stages of LAC were 8 cases of Dukes A, 6 cases of Dukes B, and 6 cases of Dukes C, according to Dukes classification. Although all the patients survived, two patients had recurrences. One patient who had lymph node metastases developed lung metastasis, and the other patient who had a serous invasion developed peritoneal dissemination.

Table 1 Profiles and results of gasless laparoscopy-assisted gastrectomy

Age Sex	Location	Operation (LN dissection)	Surgeons' experience	Operating time	Blood loss	Oral intake	Discharge	Wound infection	W.P.D.	Stage	Prognosis
63F	L	DG(D1)	A9	145	37	6	16	-	-	I A	alive
68M	M	DG(D1)	A9	240	200	4	20	+	-	I A	alive
77F	L	DG(D1)	B4	196	134	6	15	-	-	I A	alive
75M	M	DG(D1)	A9	210	140	5	15	-	-	I A	alive
76F	L	DG(D1)	C13	125	39	4	14	-	-	I A	alive
66M	L	DG(D1)	B4	180	120	5	16	-	-	I A	alive
55F	L	DG(D1)	A9	140	30	5	14	-	+	I A	alive
62F	L	DG(D1)	B4	278	120	4	12	-	+	I A	alive
70M	M	DG(D1)	C13	175	132	5	14	-	+	I A	alive
70F	L	DG(D1)	C13	154	62	6	13	-	+	I A	alive
63M	L	DG(D1)	B4	189	80	5	14	-	+	I A	alive
74F	L	DG(D1)	D4	174	120	6	17	-	+	I A	alive
75F	U	RR(D0)	E3	120	10	5	10	-	+	I A	alive
55M	U	PR * (D0)	F9	180	10	5	10	-	+	I A	alive

67.79 (years) 7.64 (years) 179.0 (minutes) 88.1 (ml) 5.01 (days) 14.29 (days)

Age,Sex M: Male, F: Female

Location L: Lower portion, M: Middle portion, U: Upper portion

LN dissection D0: No LN dissection, D1: Perigastric LN dissection (Lymph node dissection)

Operation DG: Distal gastrectomy, PR: Partial resection, PR *: Partial resection without mini-laparotomy

W.P.D.: Wound protecting device (Lap-Protector)

less experienced or beginner surgeons. The learning curve of LAC under pneumoperitoneum was reported not to be steep^{9,10}. If the surgeon had experienced open surgery to some extent and was familiar with gastrointestinal anatomy, we recommended this approach to less experienced surgeons and hospitals. Consequently, a total of 7 surgeons who had low or no experience of LAG and LAC performed the operations, and the blood loss was very small, the mean operative time was short, the postoperative course was fair^{1,2}.

In our experience of the presented cases, we realized 2 disadvantages in gasless surgery. The procedures were difficult and unreliable in obese patients because the intra-abdominal working space made by abdominal wall lifting was narrow. Obese patients were not suitable for laparoscopic surgery^{11,12}, so we considered obese patients were contra-indicated for gasless LAG and LAC. The other disadvantage is concerning with lymph node dissection. Because pneumoperitoneum makes wide working space pressing down other organs for example small intestine, we think that pneumoperitoneum method is more accessible than gasless in a case necessary for extended lymph node dissection.

From the viewpoint of minimally invasive surgery, gasless LAG and LAC resulted in a safe operation because there were no cardio-pulmonary or other major complications, except for the minor complications of wound infection. The pneumoperitoneum method had a risk of cardio-pulmonary and renal disorder, due to 10-15mmHg intra abdominal pressures^{13,14}. With regard to wound infection, we introduced the Lap protector in the latter series for wound protection, and it diminished complications dramatically. The Lap protector seems to be indispensable for gasless LAC and LAG, for the prevention of not only wound infection but also cancer cell scattering¹⁵.

Taking long-term results into account, there was no recurrence in gasless LAG, because we indicated LAG only for early gastric cancer according to the therapeutic guide line for gastric cancer⁷. Unfortunately, two cases of advanced colon cancer resulted in a lung metastasis, and a peritoneal dissemination which is probably due to exfoliated cancer cells from a serous cancer invasion of primary lesion. The pneumoperitoneum method was found to promote cancer cells and recurrence on an experimental basis^{16,17}, and port site recurrences in pneumoperitoneal LAC were reported previously¹⁸. Although gasless LAC and LAG had an advantage in tumor growth inhibition compared with insufflation¹⁹, we must consider the indication of LAC or LAG for advanced cancer patients carefully so that laparoscopic approach does not yielded unfavorable results.

From the point of medical costs, gasless surgery was more economical than pneumoperitoneum in terms of reusable instruments and trocars, utilizing instruments for ordinary open surgery, and there being no need for CO₂ insufflating equipments¹⁻³.

V Conclusions

Gasless laparoscopy-assisted surgery for gastric and colorectal cancer is feasible and useful as a minimally invasive operation.

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胃癌・大腸癌に対する吊り上げ式腹腔鏡補助下手術 —地域病院での経験—

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要 約

那須南病院は、吊り上げ式腹腔鏡下胆嚢摘出術の経験をもとに吊り上げ式腹腔鏡補助下胃癌・大腸癌手術を1999年から開始した。早期胃癌に対し幽門側胃切除12例と胃部分切除2例、大腸癌に対し回盲部切除1例、右半結腸切除8例、横行結腸切除2例、左半結腸切除1例、S状結腸切除4例、前方切除2例、大腸全摘1例、結腸部分切除1例を施行した。癒着や出血による開腹移行は3例であった。術者の腹腔鏡補助下手術経験は少なかったが、出血量は少なく手

術時間も短時間で、重篤な術後合併症も認めなかった。胃癌症例は全例無再発生存、大腸癌症例では2例の再発を認めているが全例生存中である。吊り上げ式補助下胃・大腸切除術は小開腹創が利用でき開腹手術に準じた手術法なので、鏡視下手術の経験の少ない外科医や施設でも可能であり、気腹による心肺合併症の心配もないので高齢者に対しても適していると思われる。また開腹手術用の器具が利用可能で経済的にも優れている。

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