

Laparoscopic Gastrectomy

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Introduction

The advantages of laparoscopic surgery for the treatment of gastrointestinal benign disease have been well demonstrated [1]. Although the operative time for laparoscopic procedures is generally longer than that for conventional open gastrectomy, laparoscopic gastrectomy is superior to open surgery by virtue of its reduced surgical invasiveness, less postoperative pain, earlier hospital discharge, lower hospital cost, better cosmesis, and a better quality of life as a result of smaller skin incisions and minimized trauma to the abdominal wall [2–6]. Since our first experience with laparoscopy-assisted distal gastrectomy (LADG) using the Billroth I reconstruction in a patient with early gastric carcinoma in 1991 [7], the use of laparoscopic gastrectomy for gastric carcinoma has increased worldwide. The application of laparoscopic surgery to cure gastric carcinoma, however, remains controversial. Thus far, several case-controlled studies have investigated different aspects of the laparoscopic technique for the treatment of gastric carcinoma, mainly in Japan [8–11]. While waiting for a large randomized trial to be conducted, a review of the literature can inform us of the status of laparoscopic gastrectomy.

Laparoscopic Treatment of Gastric Carcinoma

Current Status of Laparoscopic Gastric Resection

The goal of any curative surgical approach to gastric carcinoma should be a complete resection, leaving no residual neoplasm after the operation.

For the management of patients with early lesions, wide agreement exists about therapy by laparoscopic surgery. There are three options for the management of early gastric carcinoma: (1) laparoscopic wedge resection (LWR), (2) intragastric mucosal resection (IGMR), and (3) laparoscopic gastrectomy (totally laparoscopic, laparoscopy-assisted, and hand-assisted). Regional lymph nodes may be involved in

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early gastric carcinoma, but this is much less common in lesions limited to the mucosa only (2%–3%) than in submucosal lesions (15–20%) [12,13]. Lymphatic vessel invasion, histological tumor ulceration, and tumor diameter (>30 mm) are independent factors predicting regional lymph node metastasis [14]. These data suggest that most early carcinomas are located only in the gastric wall and that local resection of the gastric wall is adequate for complete clearance. Theoretically, laparoscopic local resection, such as LWR or IGMR, can be applied to treat early gastric carcinoma without risk factors for lymph node metastasis. On the other hand, laparoscopic gastrectomy, such as LADG, was developed to treat early gastric carcinoma in which there is some risk of lymph node metastasis at the perigastric portion (n1). The Guidelines for Gastric Cancer Treatment of the Japanese Gastric Cancer Association present two indications for LADG: (1) mucosal carcinoma without preoperatively diagnosed lymph node metastasis, and (2) carcinoma with submucosal invasion and without preoperatively diagnosed lymph node metastasis [15]. However, it is sometimes difficult to diagnose lymph node metastasis preoperatively, and the diagnostic accuracy rate is very low. Therefore, indications of LWR, IGMR, and LADG are generally determined by tumor size, depth of cancer invasion, the presence of ulceration, and histological type.

To treat advanced gastric carcinoma, D1 dissection of only perigastric lymph nodes is considered inadequate by most Japanese and some Western surgeons. In Japan, D2 lymph node dissection is routine practice. Japanese surgeons established the techniques of D2 lymphadenectomy in which the lymph nodes in the first (perigastric) and second (along the celiac artery and its branches) tier are systematically dissected. By this surgical therapy, 30%–40% of patients with metastasis in even second-tier lymph nodes have survived more than 5 years [16]. However, surgeons in the United States and other Western countries rarely perform extensive prophylactic lymphadenectomy. Based on two European randomized trials (RCT) that in comparing D1 and D2 showed high operative mortality, exceeding 10% in the D2 group, the British NHS Cancer Guidance officially discourages the use of D2 in clinical practice [17,18].

D1 gastrectomy is eminently feasible through the laparoscopic or laparoscopy-assisted approach. Because laparoscopic gastrectomy has improved the outcome of D1 lymph node dissection for early gastric carcinoma, laparoscopic procedures with D2 lymph node dissection have been recently tried for advanced gastric carcinoma in Japan. Some investigators reported low mortality and morbidity in laparoscopic gastrectomy with D2 lymph node dissection [8,19,20]. However, it seems technically difficult to dissect extragastric lymph nodes (group 2 nodes, based on the 13th Japanese edition of the Japanese Classification of Gastric Carcinoma) using the laparoscopic approach [21]. D2 lymphadenectomy using the laparoscopic approach requires a learning curve, as does conventional open surgery. So far, it is difficult to draw any conclusions from these limited early reports. To establish the acceptability of laparoscopic gastrectomy with D2 lymph node dissection against advanced gastric carcinoma, a safe technique and a new instrument must be developed.

Technical Aspects of Laparoscopic Gastric Resection

The techniques of laparoscopic gastric resection, including laparoscopic wedge resection (LWR), intragastric mucosal resection (IGMR), and laparoscopy-assisted distal gastrectomy (LADG), are described next.

Laparoscopic Wedge Resection (LWR)

LWR is performed by the lesion-lifting method developed by Ohgami et al. [22] as shown in Fig. 1.

1. The cancerous lesion and the gastric wall around it are exposed endoscopically and laparoscopically.
2. The abdominal wall and gastric wall near the lesions are pierced with a 12-G sheathed needle.
3. A small metal rod with a fine wire is inserted into the stomach through the outer sheath, and the sheath is removed.
4. The lesion is lifted by retracting the metal rod and resected with a wedge-shaped part of the stomach with the use of an endoscopic stapler.
5. After the resected specimen is removed, the abdomen is closed.

The lesion must be removed with an adequately clear margin. To resect the lesion successfully, Altorjay et al. modified the lesion-lifting technique to create a “double-lifting” method [23].

Intragastric Mucosal Resection (IGMR)

IGMR is performed by techniques developed by Ohashi et al. [24] as shown in Fig. 2.

1. Three trocars are placed in the gastric lumen, penetrating both the abdomen and the stomach walls, under endoscopic and laparoscopic observation.
2. These trocars fix the gastric wall to the abdominal wall with a balloon.
3. After the laparoscope and two forceps are inserted into the stomach through the trocars, dots are placed around the lesion to indicate the removal margin, and a mucosal resection is performed.
4. Hemostasis is achieved by electrocautery and laser.
5. The resected specimen is extracted by endoscope.
6. Each balloon is then deflated, and the trocars are pulled out.
7. Each port in the stomach is sutured laparoscopically, and the abdomen is closed.

For IGMR, it is important to access the gastric lumen easily and to obtain an optimal operative field. Several new devices, such as the expandable sleeve, can be used instead of forceps with a balloon to provide the necessary easy access.

Laparoscopy-Assisted Distal Gastrectomy (LADG)

The essentials for LADG with D1 lymph node dissection for gastric carcinoma are listed here.

1. Under general anesthesia with tracheal intubation, a 10mmHg pneumoperitoneum is created and a laparoscope is inserted through the subumbilical incision.
2. Four cannulas for grasping and dissecting instruments are placed in the upper abdomen (Fig. 3).
3. The greater omentum and gastrocolic ligament are dissected laparoscopically outside the epigastric arcade (Fig. 4).
4. The right gastroepiploic vessels are cut to facilitate dissection of lymph nodes at the subpyloric portion (Fig. 5).

5. The lesser omentum is opened and the suprapyloric lymph nodes are dissected after the right gastric artery and vein are divided between clips.
6. The stomach is fully mobilized, and the left gastric artery and vein are divided using clips and ligatures (Fig. 6).
7. The left cardiac and superior gastric lymph nodes are dissected down to the distal portion of the stomach (Fig. 7).
8. A 5-cm-long upper midskin incision is made just below the xiphoid, and the mobilized stomach is pulled out through this minilaparotomy wound. The distal two-thirds of the stomach is resected using staplers (Fig. 8).
9. The perigastric lymph nodes are completely dissected along with the distal portion of the stomach.
10. Billroth I gastroduodenostomy is carried out through the minilaparotomy wound, with the same handsewn technique as used for conventional open surgery (Fig. 9).

Other Types of Laparoscopic Gastrectomy

Given the tools available today, laparoscopic proximal and total gastrectomies are still challenging [25–28]. In both these procedures, esophageal anastomosis is performed laparoscopically [26]. Even with the use of a circular stapler, however, this part of the surgery is technically complicated. The totally laparoscopic approach may become easier with the development of improved staplers for transoral application. Hand-assisted laparoscopy, using one of the currently available devices, may simplify the performance of these highly complex procedures. More recently, to preserve the function of the gastric remnant after gastrectomy, some surgeons have performed a laparoscopic pylorus-preserving gastrectomy without injuring vagal nerves such as the pyloric or hepatic branch [10].

Short-Term Outcome

Several case-controlled studies have evaluated the short-term outcome of laparoscopic surgery for early gastric carcinoma. The advantages of laparoscopic gastric resection compared with open gastric resection are summarized in Table 1. Prospective and retrospective analyses by a single institution showed bowel function recovery between 1 and 3 days after laparoscopic gastric resection. In several case-controlled studies, bowel function recovered significantly faster after laparoscopic gastrectomy than after open gastrectomy. In addition, patient quality of life has been assessed by several studies, focusing mainly on postoperative pain and analgesic requirements. In several studies, pain after laparoscopic surgery was also significantly less than that after open surgery [2,5,6].

Other short-term advantages of the laparoscopic procedures were demonstrated by a randomized trial at a single institution, which revealed better postoperative pulmonary function in 14 patients who underwent LADG compared to 14 patients who underwent open distal gastrectomy [29]. Patients after laparoscopic surgery had a significantly faster recovery in forced respiratory volume per second and in forced vital capacity.

Regarding the cost, a case-controlled study showed that LADG is less expensive than conventional open gastrectomy (total hospital charge, ¥1336 × 10³ vs. ¥1411 × 10³)

TABLE 1. Short-term benefits of laparoscopic gastrectomy compared with open gastrectomy

Clinical course after operation:
Less blood loss
Reduced analgesic request
Earlier first eating
Earlier first flatus
Earlier first walking
Earlier hospital discharge
Lower hospital cost
Better cosmesis
Pulmonary function
Better forced capacity at post operative day (POD) 3
Better forced expiratory volume in 1 at POD 3
Inflammation
Lower peak of number of white blood cells (WBC)
Lower peak of C-reactive protein (CRP)
Lower peak of inter leukin (IL-6)

because both the postoperative recovery period and the hospital stay are shorter (16.1 vs. 20.5 days) [30]. However, Rosin et al. noted problems with LADG, including the complexity of the procedure and long operating time [31].

Follow-Up Evaluation

With regard to operative curability, the surgical margins and the number of dissected lymph nodes in laparoscopic gastrectomy are equivalent to those in conventional open gastrectomy. Table 2 lists several noncomparative or comparative studies of short-term follow-up evaluation of laparoscopic gastrectomy [4,27,29,32–35]. However, the issues regarding the recurrence rates and the long-term survival rate remain unclear. Most retrospective published studies were composed of a small number of patients and showed short-term follow-up. In addition, no long-term results have been recorded after laparoscopic gastrectomy. In the near future, a multicenter randomized controlled trial is needed to confirm the advantages in the long-term outcome of laparoscopic gastric resection for early gastric carcinoma.

Morbidity Related to Laparoscopic Gastric Resection

A survey conducted by the Japan Society for Endoscopic Surgery showed the incidences of intraoperative and postoperative complications to be 2.1% and 4.6% after LWR and 4.2% and 6.5% after IGWR, respectively [36]. The major intraoperative and postoperative complications are bleeding and gastric dysempting, respectively, for both LWR and IGMR. After LADG, the incidences of intraoperative and postoperative complications are 1.4% and 9.7%, respectively. The major intraoperative complication after LADG is bleeding and the major postoperative complications are gastric dysempting, anastomotic leakage, and wound infection. Recently, a randomized controlled trial of a small number of cases demonstrated no significant difference in the incidence of complications, such as anastomotic leakage, anastomotic

TABLE 2. Follow-up evaluation of laparoscopic gastrectomy

Authors	Year	Study design	N	Candidate	Lymph node dissection	Follow-up (months)	Recurrence (cases)
Azagra et al. [1]	1999	RNC	Lap 13	T2-T3	D1 or D2	Mean, 27.5	2
Hüscher et al. [33]	2000	RNC	Lap 45	T2-T4	D1 or D2 or D3	Mean, 43	1
Ballesta-Lopez et al. [34]	2002	RNC	Lap 25	T1-T2	D1	7-63	0
Kitano et al. [29]	2002	RNC	Lap 116	T1	D1	Mean, 45	0
Tanimura et al. [27]	2003	RNC	Lap 28	T1	D1 or D2	1-36	0
Reyes et al. [4]	2001	RC	Lap 9 Open 12	Stage I-IV	Not described	1-36	0
Kitano et al. [35]	2002	PR	Lap 14 Open 14	T1	D1	Mean, 21.5	0

RNC, retrospective noncomparative study; RC, retrospective comparative study; PR, prospective randomized controlled study; Lap, laparoscopic gastrectomy; Open, open gastrectomy

stenosis, bleeding, and wound infection, between an LADG group and a conventional open gastrectomy group [29]. However, laparoscopic gastric resection for gastric carcinoma is still under development. Under laparoscopic surgery, some adverse events occur that are technically associated with laparoscopic gastrectomy.

Bleeding

Bleeding related to lymph node dissection is the most frequent complication during laparoscopic gastrectomy. It is important to recognize the anatomy as seen in a limited, two-dimensional monitor and to maintain a perspective that allows the prevention of accidental bleeding.

Injury of the Gastrointestinal Tract

When the walls of the stomach, transverse colon, or duodenum are strongly grasped by forceps to extend them, they can be accidentally injured. If these injuries happen, they should be repaired carefully by an intraabdominal suturing technique or automatic suturing.

Injury of Solid Organs

When the lymph node is dissected superior to the pancreas, parenchyma of the pancreas can be injured accidentally by forceps or by an ultrasonically activated device. The liver and spleen also can be injured when they are strongly retracted. All procedures should be done gently and carefully under laparoscopic surgery because of the limited operative view and the mobility of each instrument.

Port Site Metastasis

The issues of port site metastasis are still unresolved. Therefore, a understanding of physiology and the development of correct measures are needed to prevent it. Although recent papers in a clinical setting have demonstrated that laparoscopic colectomy in patients with advanced colorectal cancer has a long-term survival rate equivalent to that of open surgery and does not increase port site metastases [37–39], it is dangerous to apply these results for colorectal cancer to advanced gastric carcinoma. The few reported cases regarding port site metastasis in gastric carcinoma were all related to advanced tumors or diffuse carcinomatosis [33]. The presence of serosal penetration may be associated with this phenomenon.

Conclusion

Laparoscopic surgery for gastric carcinoma has been shown to be potentially superior to traditional laparotomy with regard to short-term benefits. The technique seems safe and capable of fulfilling oncological criteria for cancer surgery. However, questions regarding recurrence rates and long-term survival have not yet been satisfactorily answered. Further follow-up and a review of large, multicenter randomized trials are needed before widespread acceptance of the technique can be recommended. Finally, surgeons with sufficient expertise and ongoing peer-reviewed data collection may currently offer this therapy to appropriately selected patients.

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Color Plates

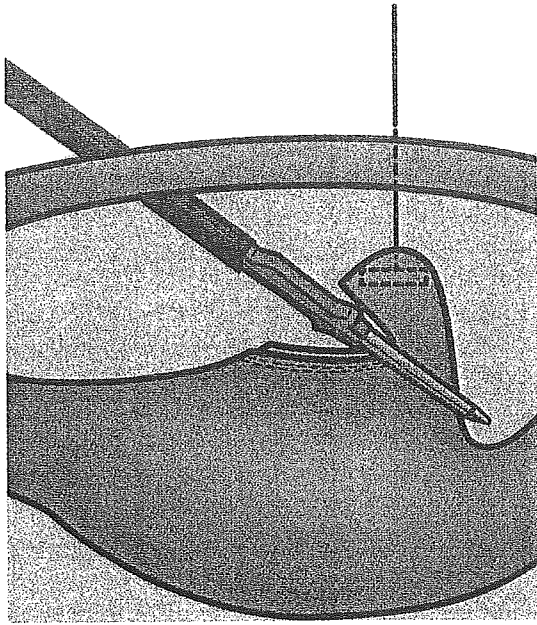


FIG. 1. Local wedge resection (LWR) by the lesion-lifting method

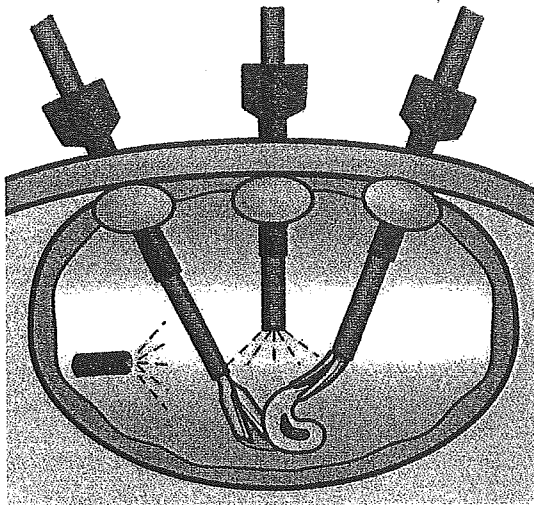


FIG. 2. Intragastric mucosal resection (IGMR)

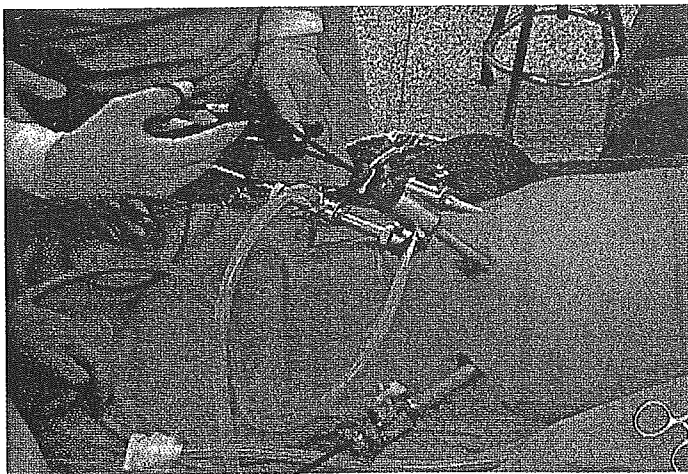


FIG. 3. Placement of four cannulas

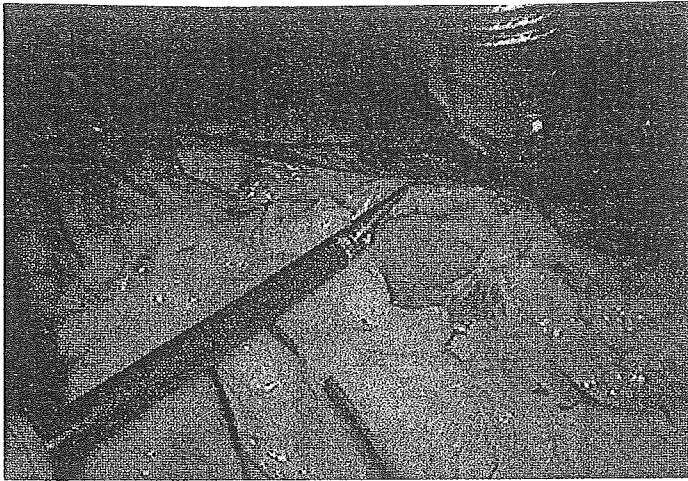


FIG. 4. Dissection of the greater omentum and gastrocolic ligament outside the epigastric arcade

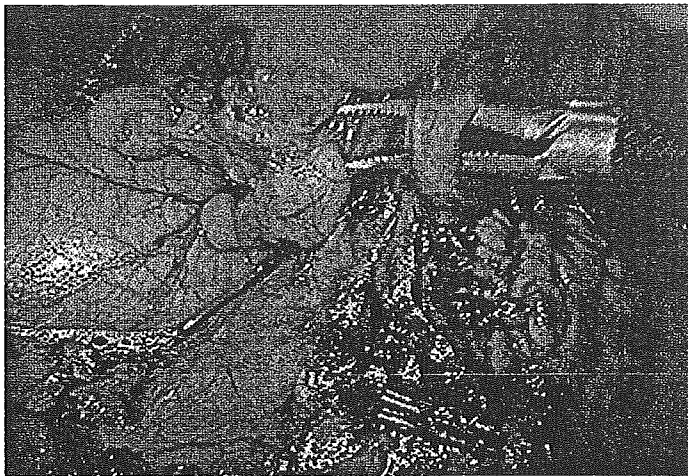


FIG. 5. Cutting the right gastroepiploic vessels

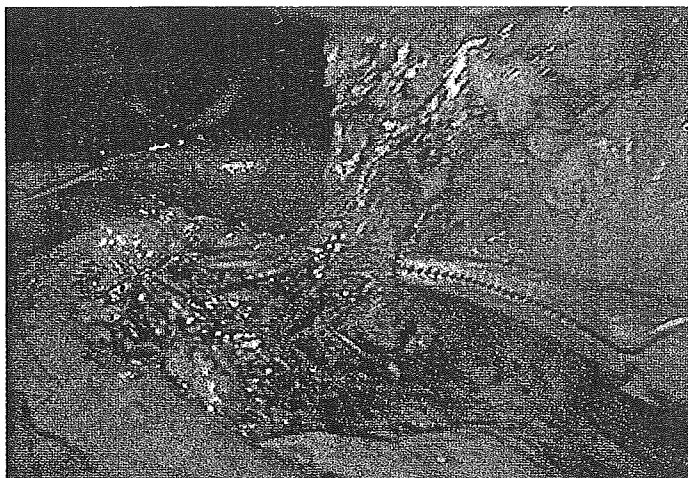


FIG. 6. Cutting the left gastric vessels

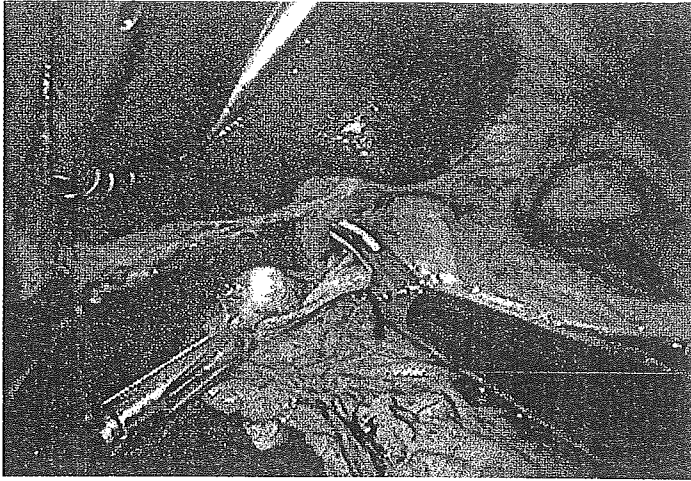


FIG. 7. Dissection of the left cardiac and superior gastric lymph nodes

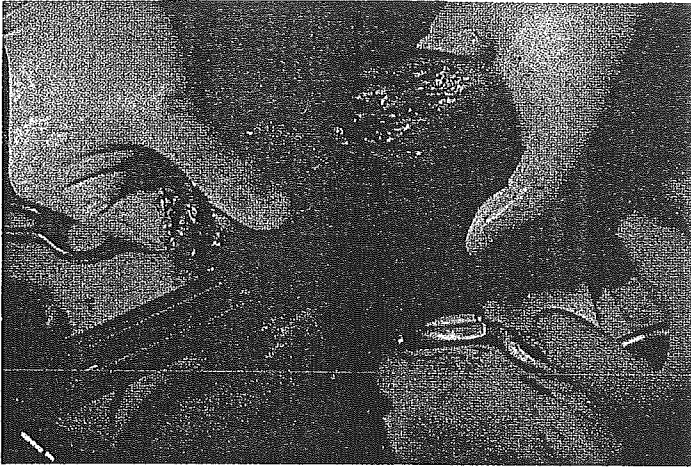


FIG. 8. Resection of the distal two-thirds of the stomach through a minilaparotomy wound

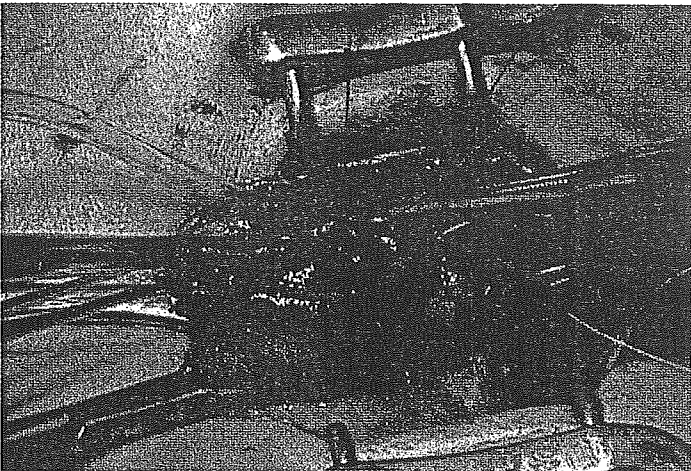


FIG. 9. Anastomosis by Billroth I method

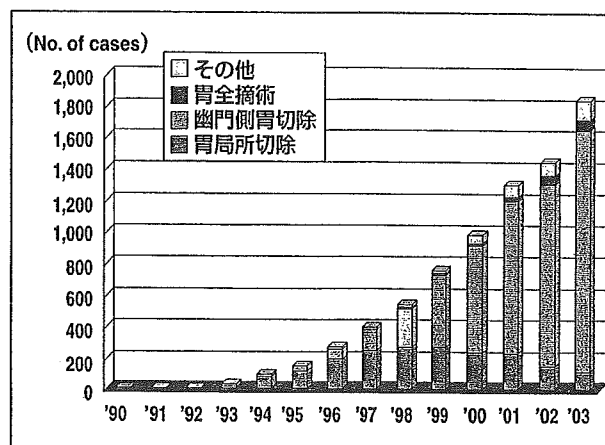
1-1 腹腔鏡下胃切除術の現状

要点

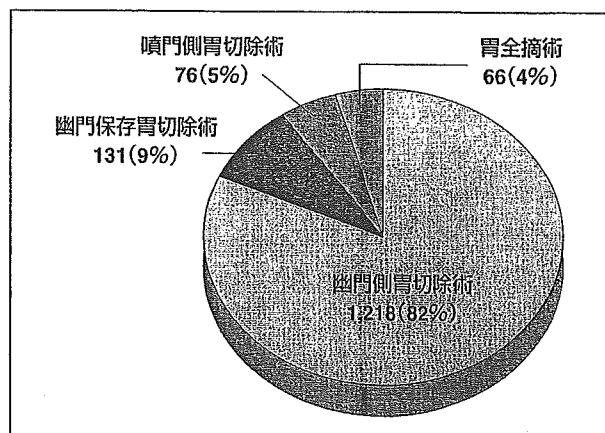
1. 胃癌に対する腹腔鏡下胃切除術の中で特に幽門側胃切除術の増加が目覚ましく、腹腔鏡下胃切除術の4/5を占めている。
2. その主な適応は、EMRの適応とならない早期胃癌を対象としており、その際のリンパ節郭清はD1+ α とD1+ β が選択されている。
3. 早期胃癌を対象として開発された腹腔鏡下胃切除術は、T2N0、T2N1の進行癌にまで適応拡大が試みられている。
4. 本術式の術中偶発症と術後合併症の発生頻度は2%と12%であり、術中偶発症としては出血と他臓器損傷が、術後合併症としては吻合部に関するものが多い。
5. 早期胃癌に対する本術式の術後無再発生存率は、従来の開腹手術と同等であった。進行胃癌に対する本術式の検討が今後の課題である。

腹腔鏡下胃切除術の動向(図1-1, 2)

1991年、早期胃癌に対する腹腔鏡補助下幽門側胃切除術(LADG)が最初に行われて以来¹⁾、腹腔鏡下手術の特徴である低侵襲性と術後患者QOLの向上を目的として新しい手技上の工夫と症例数の大幅な増加がみられている。図1-1に日本内視鏡外科学会の第7回アンケート調査結果を示す²⁾。LADGは、年々増加し、これまでに総計5,200例が行われてきた。2003年の1年間には1,800例(腹腔鏡下胃切除術の83%を占める)が施行されている。厚生労働省北野班によるアンケート調査結果³⁾によると、図1-2のように、幽門側胃切除術の他、幽門保存胃切除術(9%)、噴門側胃切除術(5%)、胃全摘術(4%)などの腹腔鏡下手術が行われている。



【図1-1】 胃癌に対する腹腔鏡下手術
(第7回アンケート調査, 2004, JSES, 文献2)

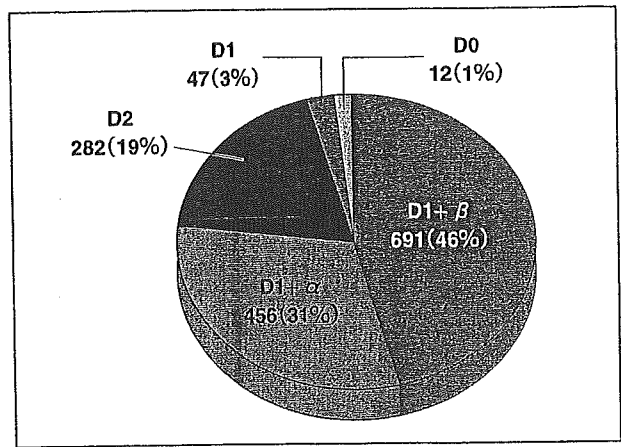


【図1-2】 早期胃癌に対する腹腔鏡下胃切除術(局所切除を除く)
局所切除を除いた1,491例の術式別内訳である。幽門側胃切除術82%の他、幽門保存胃切除術、噴門側胃切除術、胃全摘術が行われた。(厚生労働省北野班第4回アンケート調査)

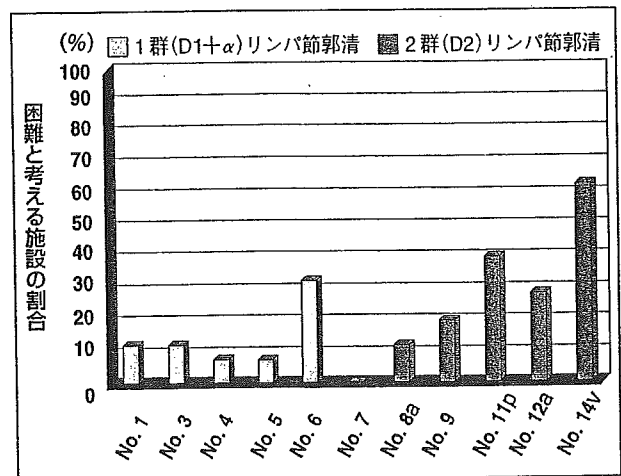
腹腔鏡下リンパ節郭清(図1-3, 4)

本手術は、内視鏡的粘膜切除(EMR)の適応を越える早期胃癌に対して、D1+ α のリンパ節郭清を行う手術として誕生した。近年、手術手技の向上と新しい機器の開発により腹腔鏡下手術によるリンパ節郭清範囲が広がっている。図1-3は、厚生労働省北野班によるアンケート調査結果である。早期胃癌に対して最も多く施行されている腹腔鏡下リンパ節郭清範囲は、D1+ β であった。さらに現在、T2N0、T2N1の進行胃癌に対しても腹腔鏡下胃切除術を試みている施設もあり、リンパ節郭清範囲がD2へと拡大されてきた。

一方、開腹手術においてリンパ節郭清範囲の拡大とともに術中偶発症や術後合併症の増加が報告されている。腹腔鏡下手術においても同様なことが懸念されている。厚生労働省北野班では、安全な腹腔鏡下リンパ節郭清を心がけるため、どのリンパ節郭清が手技的に難しいかをアンケート調査した。その結果、図1-4のように、D1+ α のリンパ節郭清ではNo.6リンパ節郭清が、またD2ではNo.11p、12a、14vリンパ節郭清が難しいと考えている施設が多く、これらのリンパ節郭清の際には、十分注意し安全な手技を行う必要がある。



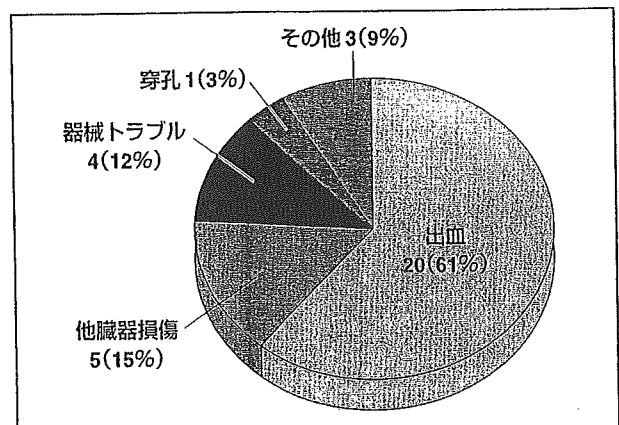
【図1-3】リンパ節郭清
約60%がm癌で、77%にD1+ α 、 β が施行されている。(厚生労働省北野班第4回アンケート調査)



【図1-4】腹腔鏡下リンパ節郭清手技の難易度
2群リンパ節郭清に関して、No.6、11p、14v、12aなどの郭清手技が難しいと考えている施設が多く、このような手技を確立する必要があると思われる。(厚生労働省北野班第4回アンケート調査)

術中偶発症と術後合併症(図1-5, 6)

術中偶発症は、手技に起因するものがその大半を占めている。それゆえ、術中偶発症の発生頻度とその内訳を十分に理解しておく必要がある。図1-5に厚生労働省北野班によるアンケート調査結果を示す。早期胃癌に対する腹腔鏡下胃切除術における術中偶発症の発生頻度は2%であり、出血と他臓器損傷によるものが多かった。出血は、左胃動静脈と短胃静脈、さらには脾損傷による出血が多いことが示された。鉗子操作や超音波凝固切開装置の使用に十分習熟して、安全な操作を心がけたいものである。



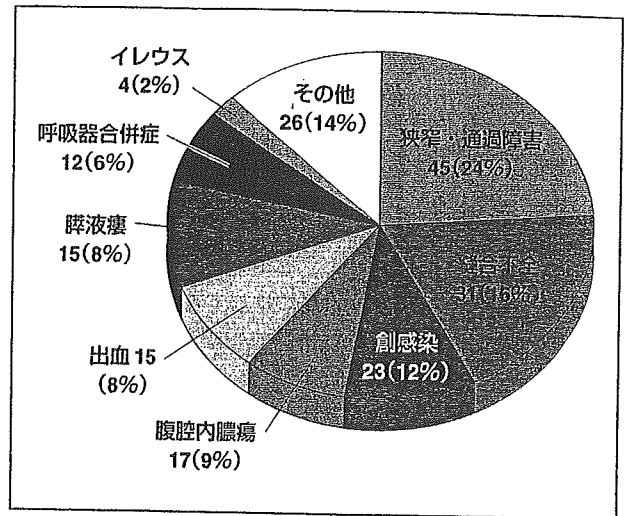
【図1-5】術中偶発症
発生率は2%で出血が多い。(厚生労働省北野班第4回アンケート調査)

一方、図1-6に術後合併症に関するアンケート調査結果を示した。術後合併症の発生率は12%であり、その約40%が吻合部に関するものであった。縫合不全と吻合部狭窄を生じた症例の約半数が手縫いであり、残り半数が器械吻合であった。縫合不全を生じた器械吻合の大半は、自動吻合器(circular stapler)を用いたものであり、使用に際しては十分な注意が必要である。また創感染は、本術式の特徴である低侵襲性を損なうこととなるため、創部の保護や感染予防に十分気をつける必要がある。

無再発生存率

厚生労働省北野班によるアンケート調査結果において早期胃癌に対する腹腔鏡下胃切除術の5年無再発生存率は約99%であり、開腹手術と同等であると思われる。一方、進行胃癌に対するその評価は、今後の症例の蓄積を待ちたい。

[北野正剛]



【図1-6】 術後合併症
発生率は12%で吻合部のトラブルが多い。(厚生労働省北野班第4回アンケート調査)



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腹腔鏡下大腸切除術に必要な解剖学の知識*

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* Surgical anatomy for laparoscopic colectomy

キーワード：腹腔鏡下大腸切除術，外科解剖，アプローチ法，後腹膜下筋膜

要旨：腹腔鏡下大腸切除術を安全に施行し，その長所である低侵襲性を十分に引き出すためには従来の開腹手術における解剖を理解するだけでなく，腹腔鏡下の外科解剖と腹腔鏡下手術の視野や手技の特殊性を熟知しておく必要がある。また各アプローチ法の正確な剝離層を理解し，各術式における剝離や切離のランドマークを決め，視野展開の工夫をすることにより腹腔鏡下大腸切除術は開腹手術以上の良好な視野で安全に施行可能となりえる。

はじめに

大腸疾患に対する腹腔鏡下手術は患者のQOLを重視する近年の医療と合致し，低侵襲手術(minimally invasive surgery)というひとつのカテゴリーを確立し，この10年間で驚くばかりの急速な発展をとげてきた¹⁾。日本内視鏡外科学会第6回アンケート調査²⁾によると，腹腔鏡下大腸切除術は胆嚢摘出術に次いで数多く施行されており，早期癌はもちろん進行癌に対しても著しい増加が示されている。しかし，術中，術後合併症を生じてその低侵襲性を損なったり，予期せぬ再発をきたしてはそのメリットが十分発揮されないことになる。そのためには従来の開腹手術における解剖を理解するだけでなく，腹腔鏡下手術の特殊性と腹腔鏡下の外科解剖に熟知する必要がある。

本稿では腹腔鏡下大腸切除術を安全に遂行するために必要な外科解剖のポイントと視野展開のコツについて述べる。

腹腔鏡下手術の特殊性

腹腔鏡下手術の術野は開腹手術のように真上か

ら腹腔内を観察する視野とは異なり，腹腔内を比較的低い位置から横に観察する視野で手術が行われている。このため術野の奥に存在する臓器や構造物が開腹手術の時と異なることを認識する必要がある。また，2次元画像のため遠近感の把握が難しいことがある。操作部位の奥にどのような構造物が存在するか常に念頭に置き，操作の際には奥に十分なスペースを確保し，できるだけ別な角度から確認することが安全に手術を行うコツである。特に外側あるいは内側アプローチに際して，後腹膜剝離を先行する場合は腹腔鏡下手術特有の視野となる。この層は基本的には血管がなく比較的容易に広範な剝離操作が可能であり，肥満など患者の体型にも影響を受けにくく，腹腔鏡下手術の特徴が特に生かされる操作手技である。さらに，術野の拡大視効果も腹腔鏡下手術の特徴の1つであり，繊細な手術操作が可能である一方で，腹腔内全体像の把握や広い視野を得ることが難しいため，周囲臓器との関係を常に注意しておくことが必要である。

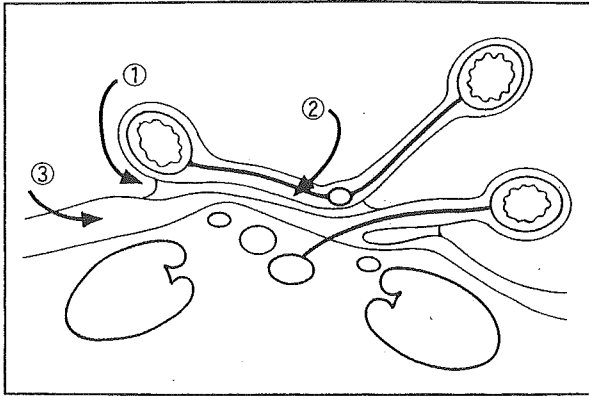


図1 アプローチ法と外科解剖

3つのアプローチ法における剥離層および方向を示す。①外側アプローチ、②内側アプローチ、③後腹膜アプローチ。

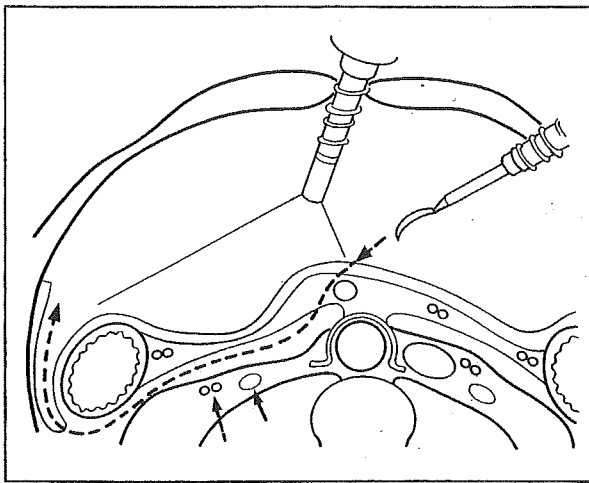


図3 右側結腸の外科解剖

後腹膜の剥離ラインを示す。右尿管(→)と右精巣(卵巣)動静脈(⇄)を後腹膜下筋膜の背側に透見し、剥離する。



アプローチ法における外科解剖

腹腔鏡下大腸切除術のアプローチ法は現時点で外側アプローチおよび内側アプローチ、後腹膜アプローチの3つに大きく分けられている³⁾。これらのアプローチ法の剥離層を図1に示した。各アプローチの剥離層をよく理解して、そのメリットを生かした選択と確実に安全な腹腔鏡操作を行うことが大切である。



切除術式における外科解剖

1. 大腸と周囲臓器との関係

大腸は図2に示すようにすべての腹部臓器と隣接している。腸管切除の際には隣接臓器との位

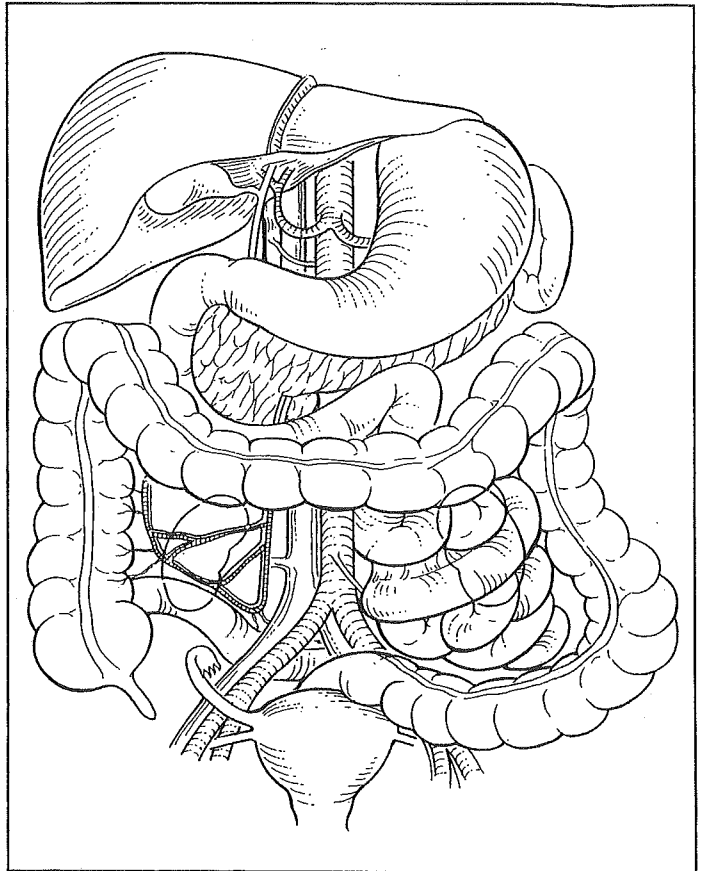


図2 大腸と周囲臓器との関係

大腸はすべての腹部臓器と隣接しているためその位置関係を十分に把握し、正しい層で無血管野で剥離を行うことが重要である。

置関係を十分に把握し、正しい層で無血管野で剥離を行うことが重要である。

2. 右側結腸

上行結腸はその背側で後腹膜に固定されているが、回盲部および横行結腸は free である。まず小腸を頭側に移動させた後、回盲部を後腹膜下筋膜前面の層で頭側に剥離を進めると十二指腸水平脚前面に到達する。この層でさらに剥離を外側に進めると回盲部の広範な剥離が行うことができ、右尿管と右精巣(卵巣)動静脈を損傷することなくこれらを後腹膜下筋膜の背側に透見することができる(図3)。肝彎曲部の授動は腎前筋膜前面の層で剥離を進め十二指腸下行脚前面に達し、さらに肝結腸靭帯を切離し、右側結腸を授動する。十二指腸下行脚内側から臍頭部前面を不用意に剥離すると Henle の胃結腸静脈幹へ流入する静脈を損傷する危険性があるので注意が必要である。リンパ節郭清を安全に行うために、右結腸動静脈の有

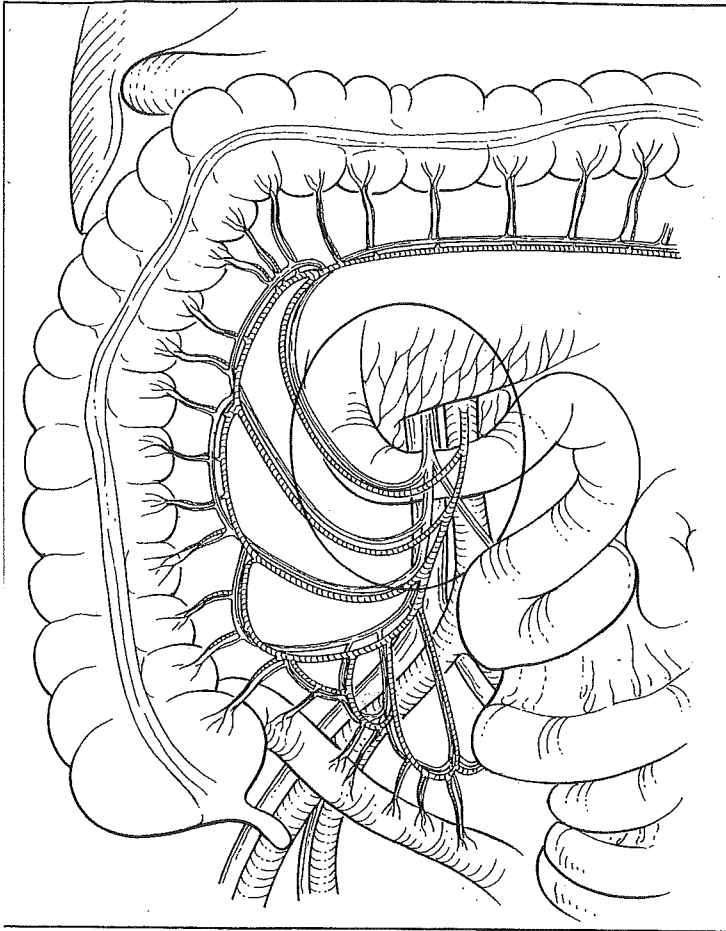


図4 右側結腸と surgical trunk との関係

リンパ節郭清を安全に行うために右結腸動静脈の有無や surgical trunk のパターンなど血管走行や分岐のバリエーションを把握する。

無や surgical trunk のパターンなど血管走行や分岐のバリエーション⁴⁾を早めに把握することも重要である(図4)。

3. 横行結腸

横行結腸間膜は中央から右側では胃結腸間膜と癒合し、中結腸動静脈や Henle の胃結腸静脈幹を含む厚い間膜として臍頭部に付着している。中央から左側では胃との間に網嚢腔を形成し、薄い間膜として臍体尾部下縁に付着している。脾彎曲部は脾結腸靭帯で脾下極に固定されている。横行結腸は上腸間膜動静脈から分岐する中結腸動静脈にて支配されている。Surgical trunk から臍下縁までの間に中結腸静脈が存在する。また上腸間膜動脈は後腹膜下筋膜を貫いて大動脈に合流する一方、静脈は後腹膜下筋膜の前面を走って門脈へ流入する。上腸間膜動脈の分岐はバリエーションが多い

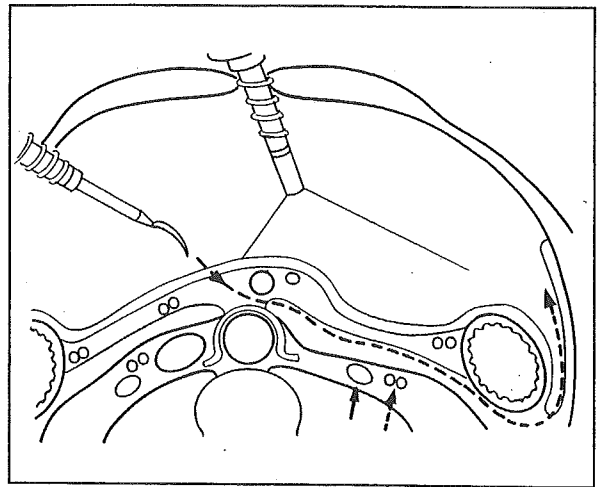


図5 左側結腸の外科解剖

後腹膜の剥離ラインを示す。左尿管(→)と左精巣(卵巢)動静脈(↔)を後腹膜下筋膜の背側に透見し、剥離を進める。

ためその把握に注意が必要である。

4. 左側結腸

下腸間膜動脈から左側結腸間膜背側で後腹膜下筋膜前面の層で剥離を進めると左の尿管と左の精巣(卵巢)動静脈は温存される(図5)。また下腸間膜動脈の背側で大動脈前面に存在する上下腹神経叢は温存しながら剥離を進める。

5. 直腸

腹腔鏡下手術の拡大視効果は骨盤内操作で特にその威力が発揮される。後腹膜下筋膜から尿管下腹神経筋膜の前面で直腸の剥離を進めると、下腹神経から骨盤神経叢を温存して直腸が授動できる。後壁層では直腸固有筋膜を破らないように剥離を進め、直腸仙骨靭帯を切離して肛門挙筋に到達する。側方では骨盤神経叢の直腸枝と中直腸動脈からなる側方靭帯に到達する(図6)。前壁では

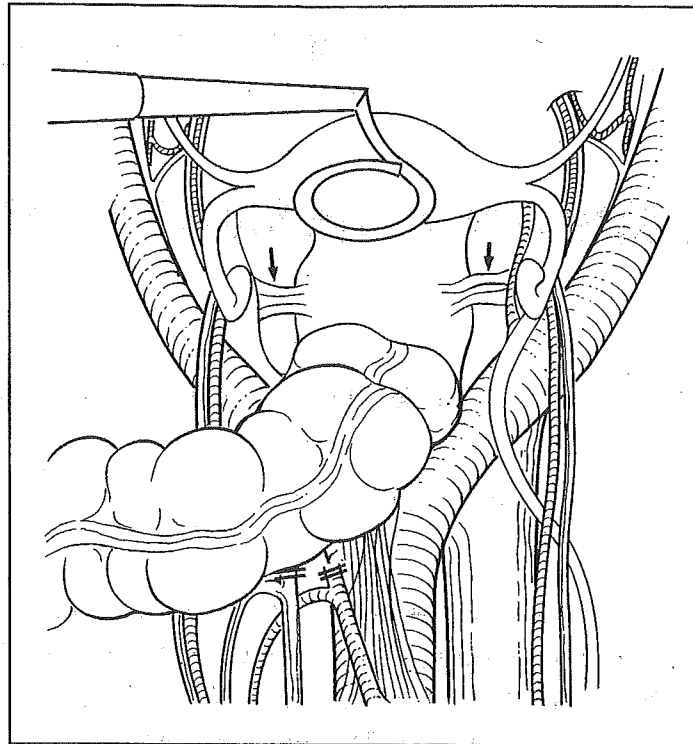


図6 直腸の外科解剖

TME (total mesorectal excision) の層での剥離・授動が基本である。矢印 (→) は側方靭帯。

腹膜反転で腹膜を切離し、精嚢あるいは子宮を損傷しないように Denonvilliers 筋膜を切除側につけ肛門側へ剥離を進める。TME (total mesorectal excision) の層での剥離・授動が基本である。



おわりに

腹腔鏡下大腸切除術を安全に施行し、その長所である低侵襲性を十分に引き出すために、腹腔鏡下の外科解剖を熟知することが必要である。本稿で述べた外科解剖と腹腔鏡操作の特殊性をふまえて視野展開の工夫をすることにより、腹腔鏡下大腸切除術は開腹手術以上の良好な視野で安全に施

行可能となりえる。

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(KITANO Seigo, et al 大分医科大学第 1 外科: ☎ 879-5593 大分県大分郡挾間町医大ヶ丘 1-1)

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内視鏡下手術の低侵襲性と開腹手術の操作性という両者のメリットを備えた画期的な泌尿器手術アトラス。2~5cmの切開創から、直視と内視鏡視で術野を確認し、指という最も優れたセンサー、かつ手術器具を用いる新世紀の手術。特殊なスキルも器具も要らず、コストも患者の負担も軽い。その全貌とテクニックのすべてを本書で紹介する。

Quality of Life after Laparoscopic or Open Colonic Resection for Cancer

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KEY WORDS:

Colon cancer;
Colonic resection;
Laparoscopy;
Laparoscopic
colectomy;
Quality of life

ABBREVIATIONS:

C-Reactive
Protein (CRP)

ABSTRACT

Background/Aims: Although laparoscopic colectomy has been widely accepted, little is known about the subjective clinical results of this less invasive surgery. The aim of this study was to evaluate the quality of life of patients who had undergone laparoscopic or open colonic resection for cancer.

Methodology: The study included 26 patients with laparoscopic colectomy and 87 with conventional open colectomy for cure of colon cancer. Body temperature, serum C-reactive protein and albumin levels, lymphocyte count, and weight loss during hospital stay were compared between the two groups. Quality of life was estimated by the 9-item questionnaire with scoring system of 1 (high), 2 (fair), and 3 (low).

Results: Laparoscopic colectomy was significantly different from open colectomy with regard to the body temperature (37.8°C vs. 38.0°C, $p < 0.01$) and C-reactive protein level (6.34mg/dL vs. 11.15mg/dL,

$p < 0.01$) on postoperative day 1, albumin level (3.54g/dL vs. 3.36g/dL, $p < 0.05$) and lymphocyte count (1354/mm³ vs. 995/mm³, $p < 0.01$) on postoperative day 7, and weight loss on postoperative day 14 (3.95% vs. 5.45%, $p < 0.01$). Although all patients with laparoscopic colectomy were satisfied with their surgical results, total score of the quality-of-life questionnaire was not significantly different between the two groups (10.95 vs. 11.81). Both laparoscopic and open colonic resections were similarly accepted by the patients as a good operation that they would recommend to others (1.105 vs. 1.206).

Conclusions: These results indicate that although laparoscopic colonic resection for cancer was less invasive than conventional open colectomy, both laparoscopic and open colonic resections were favorably accepted by the patients, and quality of life after operation was not significantly different between the two procedures.

INTRODUCTION

With rapid advances in instruments and techniques, laparoscopic surgery has been widely applied to the patients with colorectal disease, and the usefulness of laparoscopic colectomy have been demonstrated by many clinical studies (1,2). Several authors report that when compared with conventional open colectomies, laparoscopic approaches provide a faster recovery, less pain, shorter hospital stay, and a quicker return to normal activities (3,4). Thus, it is generally accepted that laparoscopic colectomy is less invasive and more beneficial compared with open colectomy.

However, laparoscopic colonic resection for cancer requires advanced surgical skills and is associated with an increased incidence of port-site metastasis (5,6). Until now, only short-term surgical results are demonstrated, and a long-term follow-up study is needed to confirm the advantage of this less invasive surgery (7,8). Furthermore, little is known about the quality of life after laparoscopic operations for colon cancer, and few data are available concerning subjective clinical results of patients who underwent laparoscopic resection of colon cancer (9,10).

In our institute, all patients who had undergone

laparoscopic colonic resection for cancer were alive without port-site metastasis during a median follow-up period over 3 years (11). In this retrospective study, postoperative physical condition, mental condition, and performance status were compared between the patients with laparoscopic resection and those with conventional open resection of colon cancer. Quality of life after colectomy was assessed in a questionnaire fashion using scoring system and quantitative analysis.

METHODOLOGY

We studied 113 patients who had undergone resection of colon cancer in the First Department of Surgery, Oita Medical University, from April 1990 to October 1998, and had been alive without recurrence. Twenty-six patients underwent laparoscopic colectomy, whereas 87 underwent conventional open colectomy. The patients were assigned to one of the two procedures based on the presence or absence of serosal invasion estimated before surgery: laparoscopic resection for tumors without serosal invasion (11) and conventional open resection for those with serosal invasion. Patients with rectal cancer and those with mechanical anastomosis were excluded.