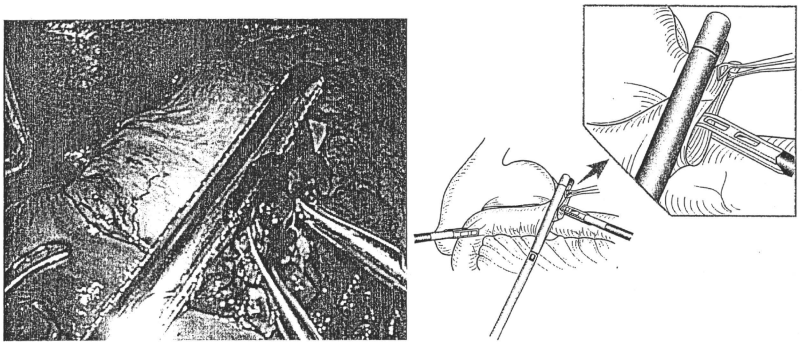

図 13　空腸切離と挿入口の閉鎖

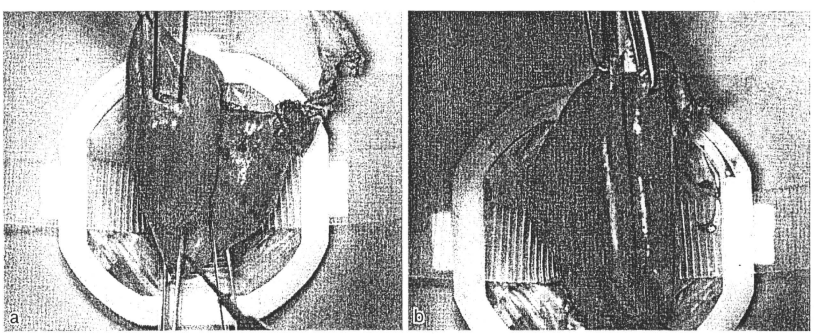

図 14　臍部のポートからの空腸空腸吻合

ば以下の操作は臍部の小切開創から施行可能である。胃空腸吻合部から約 25～30 cm 肛門側の輸出脚にマーキングを行った後，輸出脚と輸入脚を引き出す。輸入脚側はすでに胃空腸吻合の際に大きな孔があいている（図 14a）。輸出脚側の腸間膜対側に小孔をあけ ELS（白）60 mm のカートリッジ側に輸入脚をアンビル側に輸出脚を挿入し，側側吻合する（図 14b）。内腔の止血を確認する。挿入口の閉鎖は ELS（白）60 mm で行うが，この際輸出脚が狭窄を来さないよう，輸出脚と直行する方向に閉鎖しつつ，胃空腸吻合の際の残胃の一部と空腸を切り飛ばす（図 15）。小腸間膜の Gap は 3-0 縫合糸で縫合閉鎖する。肥満症例で創部から輸入脚が出てこない場合は以上の操作を腹腔鏡下に施行する。その完成形から β 吻合と名付けた再建法の完成図を示す（図 16）。

II.　手術のポイント

①いわゆる機能的端端吻合の 1 種であるので，吻合部のステイプラーラインは血流を考え 3 重とならないように留意する。

②空腸の切離と挿入口の閉鎖は同時に行われ

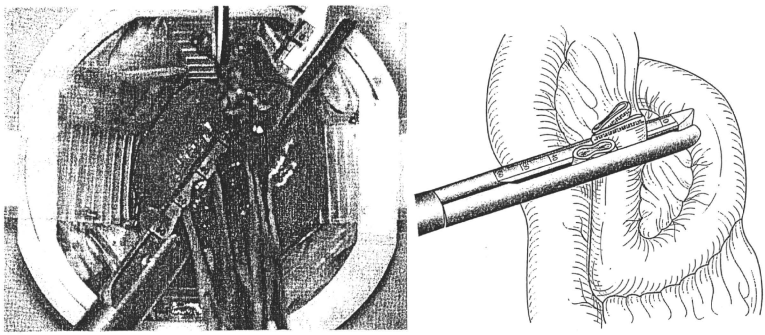

図 15　Y脚の挿入口閉鎖

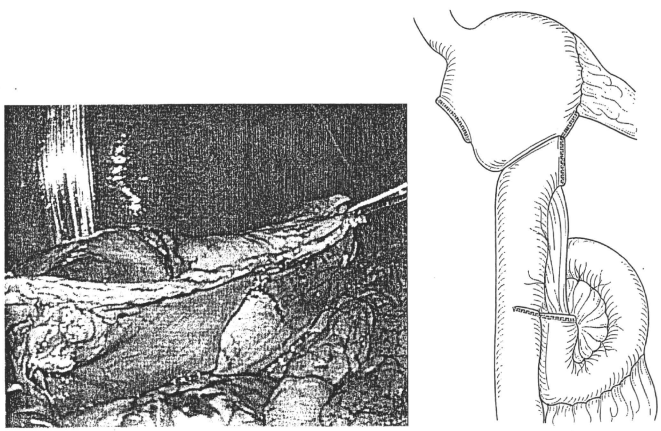

図 16　完成図

るが，後壁側が全層に切除されているかの確認がむずかしいので，後壁側を少し外側に引くことで確実に確認する。

③Y脚吻合は通常腹腔外で吻合可能であるが，出てこない場合は，無理をせず腹腔内で吻合する。

④腔内再建では胃液や腸液が少なからず腹腔内に漏れるので，再建終了後は十分な生理食塩水で洗浄し，腹腔内膿瘍などにならないよう注意する。

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腹腔鏡下胃癌リンパ節郭清
—術野展開とアプローチの秘訣—

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自律神経温存腹腔鏡下胃癌リンパ節郭清
—腹腔鏡下幽門側胃切除術における神経温存手術の工夫—

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円城寺　恩*　河野　辰幸*　杉原　健一*2

はじめに

開腹胃癌幽門側胃切除術における迷走神経温存手術手技は三輪ら[1]により確立され，肝枝温存による術後胆石発生率の低下や腹腔枝温存による下痢の軽減，術後の良好な体重回復，インスリン分泌障害の予防などが報告され[2)3)]，神経温存の意義が明らかにされてきた。

一方，本邦で開発された胃癌に対する腹腔鏡下胃切除術は，技術の向上，器機の開発，外科医の研鑽により，早期胃癌に対する一治療法として確立され[4)5)]，急速に普及している。北野らの多施設共同研究では，早期胃癌に対する腹腔鏡下胃切除術の長期成績は，開腹手術と同等であることが示唆されている[6)]。その適応は進行癌へも拡大され，endoscopic submucosal dissection (ESD)，開腹手術とともに胃癌治療体系の中で重要な位置を占めるようになっている。

当科では，胃癌治療ガイドライン第3版で研究的治療と位置づけされているStage IA, IB症例を対象に腹腔鏡（補助）下胃切除術を行っている。

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key words：早期胃癌，神経温存，腹腔鏡下手術

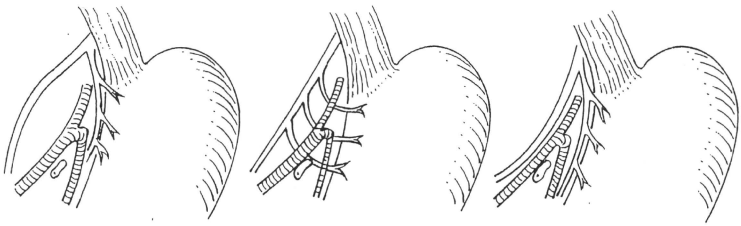
腹腔鏡補助下胃切除術は低侵襲で，術後合併症が少なく，術後の回復が早い[7)8)]など，術後短期QOLがよい。われわれはこれらの周術期の長所に加え，術後長期QOLの向上を目的に，早期胃癌の腹腔鏡（補助）下幽門側胃切除術に自律神経温存手術を併施してきた[3)9)]。

この手術は，腹腔鏡下の臨床解剖の理解は必要であるが，拡大視効果により開腹手術より確実性が高い。本稿では，腹腔鏡下の自律神経系の臨床解剖と，視野展開法の工夫を中心に概説する。

I. 自律神経温存手技の基盤となる臨床解剖

自律神経温存手技は，①前迷走神経幹の肝枝，②後迷走神経幹の腹腔枝，③総肝動脈前面を走行する肝神経叢の温存，からなる。①前迷走神経幹は，噴門の右縁を下行し，噴門直上で肝枝と前胃枝に分枝する。肝枝は数本あり，肝左葉近傍の小網の緻密部内を横走して肝門に至り，肝神経叢の形成に加わる。小網の緻密部は左副肝動脈，副左胃動脈やリンパ管の通路でもあり，臨床上重要である。前胃枝は肝枝と分岐後，小彎に沿って下行し，噴門部から胃体下部まで胃前壁に順次分布していく。

②後迷走神経幹は，腹部食道の背側から胃膵間膜内を走り，後胃枝を分岐し，腹腔枝となり右腹腔神経節を形成するが，一部左胃動脈の後



（A）8例（16%）　（B）23例（47%）　（C）18例（37%）

図1　腹腔枝の走行とその頻度

タイプAは右横隔膜脚前面を，Bは胃膵間膜内を，Cは左胃動脈に伴走する。タイプCでも形態的温存は可能である（日外会誌97：287，文献2から引用）。

面から左腹腔神経節にも入る。腹腔枝の走行にはバリエーションがあり，三輪らは左胃動脈との位置関係から3型に分類している（図1）。タイプBとCでは，腹腔枝が左胃動脈と合流したのちに強く癒合している場合が多い。

③腹腔神経叢の肝枝は左右の腹腔神経節により右枝と左技に区別され，肝十二指腸間膜内を反時計方向にねじれながら肝神経叢を形成し，肝門部に向かう。胃癌リンパ節郭清時に関係が深いのは左枝である。左枝は左腹腔神経節から総肝動脈と固有肝動脈に絡みついて肝門部に達する。これは固有肝動脈近くの総肝動脈では総肝動脈の頭側背側を走行する。これとNo.8リンパ節との間が神経叢を温存する郭清の正しい剝離層となる。

II. 適　　応

当科ではT1N0の中下部早期胃癌に対して，D1＋βのリンパ節郭清を伴う自律神経温存腹腔鏡（補助）下幽門側胃切除術を施行している。

III. 体位，ポート部位，術者の位置

約20°の頭高位，仰臥位かつ開脚で行う。術者は患者の右側，助手は患者の左側，カメラ助手は脚間に位置する。モニターは左右の頭側に計2台配置する。臍部を縦切開し，12 mmポートを挿入し，気腹圧10 mmHgでフレキシブル腹腔鏡を挿入する。気腹下に左右中腹部に12 mm，左右季肋下に5 mmポートを挿入する（図2）。

IV. 視野展開の工夫

腹腔鏡下胃手術において良好な視野を得るために，肝を圧排する方法がいくつか考案されている。われわれはペンローズドレーンを用いた3点支持による肝挙上法を改良して行っている。

1. ペンローズドレーンの準備

幅8 mmのペンローズドレーンを10 cmに切って，両端に2-0直針付きナイロン糸を刺通結紮する。

2. V字の中点縫合

肝外側区域を圧排挙上して食道裂孔部を展開する。ペンローズドレーンを腹腔内に挿入し，肝胃間膜上におく。針付きの3-0バイクリルを10 cmほどに切って末端にラプラタイ®を付けておく。これをペンローズドレーンのほぼ中央に刺入し，食道裂孔部直上の横隔膜腱の中心に縫合し，もう一度ラプラタイ®で固定し，結紮の代わりにする。

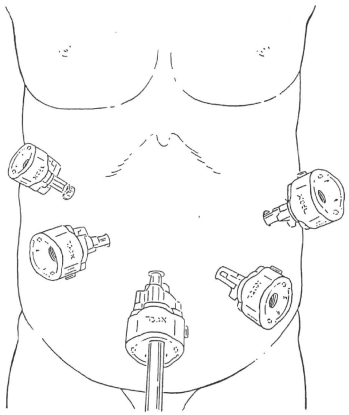


図 2　ポート挿入位置
臍部：12 mm ポート，左右中腹部：12 mm ポート，左右季肋下：5 mm ポート

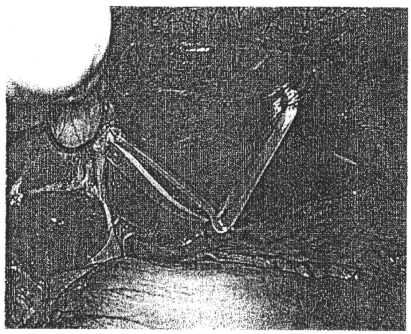


図 3　金谷らが考案したペンローズを用いた肝左葉の挙上の変法
ドレーン右側：肝円索に通し，肝内側区域を挙上するように腹腔外に誘導。
ドレーン左側：肝外側区域を挙上するのに適する位置を確認，腹腔外に誘導。

3. V 字両端固定

ドレーン右側の直針を肝円索に通したのち，肝内側区域を挙上するように腹腔外に誘導する。ドレーン左側の直針は，肝外側区域を挙上するのに適した位置を確認し，腹腔外に誘導する。これにより良好な視野が確保され，助手の右手も自由に使えるようになる（図 3）。

V. 神経温存手技

自律神経温存手術では，前迷走神経幹より分岐する肝枝，後迷走神経幹より分岐する腹腔枝，総肝動脈の前面を走行する肝神経叢を温存する。

1. 肝枝の温存

肝枝を温存するためには，小網繊密部に前迷走神経幹から分岐する肝枝を確認し，最尾側枝を温存するように小網の切開を左側へ進め，腹部食道右壁に至る（図 4）。

2. 後迷走神経幹の確認とテーピング

超音波凝固切開装置で右横隔膜脚を露出する。これは後の No.8a，9 のリンパ節郭清の上縁・右側縁の指標ともなる。右横隔膜脚と腹部食道の間を剝離鉗子で鈍的に剝離すると，斜走行する後迷走神経幹を容易に視認できる。これを長さ約 10 cm の綿テープでテーピングしておく（図 5）。

3. 肝神経叢の温存

肝神経叢は肝枝と協調して，胆石の予防に重要な役割を果たしており[3]，膵，肝，十二指腸の恒常性の役割も果たすと考えられる。超音波凝固切開装置を用いて膵上縁で膵被膜を切開する。切開を可能なかぎり左側へ延長し，脾動脈分岐部を越え，脾動脈が膵の背側に隠れるあたりまで切開する。この際，助手が膵被膜を背側尾側に軽く牽引し，適度な緊張をかける。脾動脈の走行偏位が多く，注意が必要である。また，膵は尾側に向かうにしたがって頭側に位置するので，膵損傷にも注意する。切開した膵被膜を頭側に把持牽引しつつ，尾側から頭側へと電気メスや超音波凝固切開装置などを用いて郭清を

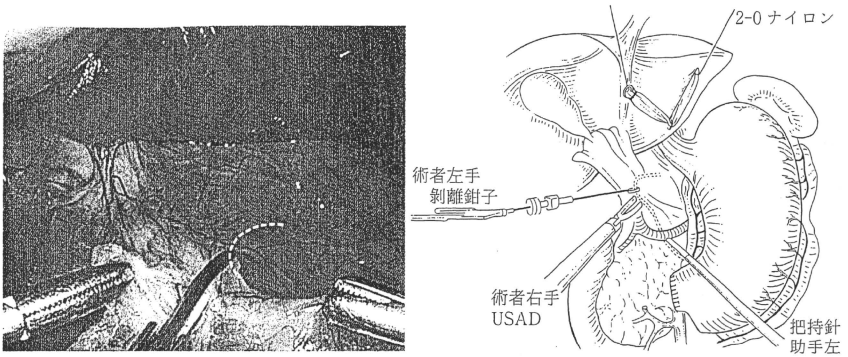


図 4　小網切開

小網切開の目安は，小網の菲薄部と肥厚部の境（破線）で行う。

肝十二指腸間膜の膜だけは切開されているので，神経や血管の確認が容易となる。

術者は左手の剝離鉗子で肝十二指腸間膜の左側から，剝離鉗子で縦方向に少しずつ剝離を行い，できたスペースに術者右手の USAD を挿入し切離する。

助手は右手の無傷鉗子で胃体中部を把持し，尾側に展開し小網を，左手の把持鉗子で小網を把持し，尾側に展開し伸展させる。

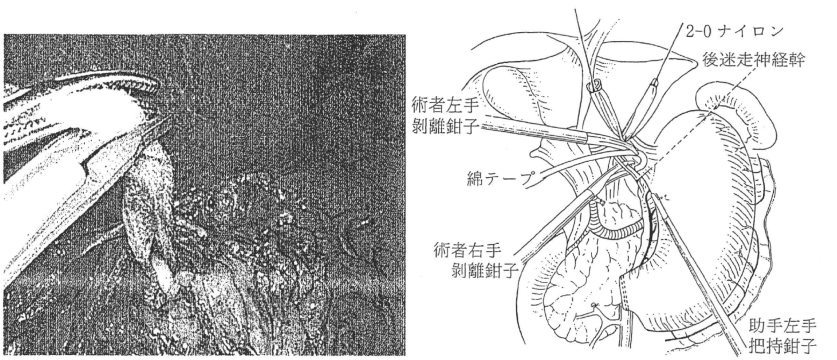


図 5　後迷走神経幹のテーピング

助手：右手の把持鉗子で右胃膵間膜を把持し，左側に牽引する。左手の把持鉗子で胃体上部を把持し，左側に牽引する。

術者：右手は剝離鉗子（弱彎）を後迷走神経幹の背側へ通し，左手で綿テープを誘導し後迷走神経幹のテーピングを行う。

進めていく。途中，左胃静脈が確認できれば，クリッピング後，切離する。No.8a リンパ節は剝離層の指標であり，このリンパ節の背側を剝離すると神経温存の層で総肝動脈は自然に露出されてくる。この層を保持しつつ，No.5，8a リンパ節を把持鉗子で把持し，超音波凝固切開装置を用いて総肝動脈の腹側へと剝離を行う。

ついで，脾動脈周囲の神経叢を温存しながら，脾動脈を明らかにしつつ，No.9 リンパ節左側の郭清を脾動脈から頭側へ向かって行う。No.8a リンパ節郭清に戻り，No.8a リンパ節の郭清の頭側縁を決定する。ここから腹腔動脈右

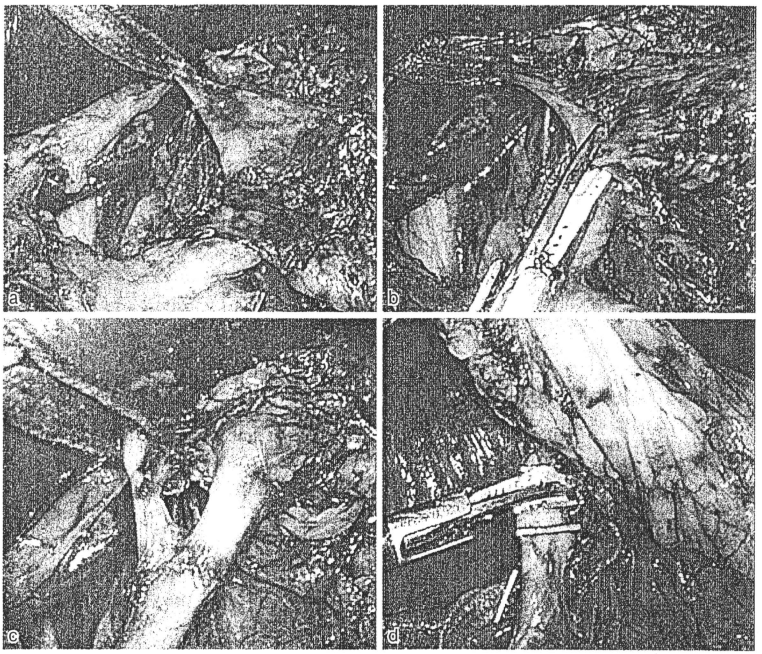


図 6　腹腔枝温存
左胃動脈の走行を確認し（a），術者左手は把持鉗子で後迷走神経幹のテープを把持し，右側へ牽引する。
術者は左胃動脈に沿って No.7 リンパ節を末梢に向かって郭清する（b）。
腹腔枝と左胃動脈の分岐部を明らかにする（c）。
左胃動脈のみにクリップを掛け（d），切離後，後胃枝のみを切離し，腹腔枝を温存する。

側へリンパ節郭清を収束させる。

4. 腹腔枝の温存

助手が胃膵間膜を把持鉗子で腹側に挙上し，圧排鉗子で膵を背側に圧排すると，胃膵間膜を展開できる。術者は腹腔動脈前面を郭清しつつ，左胃動脈を露出する。左胃動脈は動脈を露出するというより，超音波凝固切開装置を用いて，左側，右側から No.9 リンパ節を郭清していくと自然に露出されるイメージである（図 6）。

腹腔枝は左胃動脈に絡みつくように伴走する症例（三輪分類のタイプ B と C）が 84％に認められる。腹腔枝の温存は以下の方法で行っている。まず，左胃動脈とそれに伴走する腹腔枝を温存する層で，動脈根部から末梢に向かって No.7 リンパ節郭清を行う。助手が把持した胃膵間膜を右側に牽引し，左胃動脈を左側から観察すると，腹腔枝と左胃動脈が分離する部位を容易に確認できる。その分岐部で左胃動脈を剝離し，クリッピング後切離する。

5. 後胃枝の切離

先に後迷走神経幹にかけたテープを術者が患者右側腹側に牽引すると腹腔枝の走行を確認できる。この状態で助手が左胃動脈末梢側断端を左側に牽引すると，切離胃後壁に扇状に分岐す

る後胃枝を確認できる（図7）。術者は後胃枝のみを切離し，腹腔枝を温存する。郭清終了時の状態を示す（図8）。

おわりに

当科で施行している早期胃癌に対する自律神経温存腹腔鏡（補助）下幽門側胃切除術においては，臨床解剖の理解と助手による視野展開がもっとも重要である。

文　献

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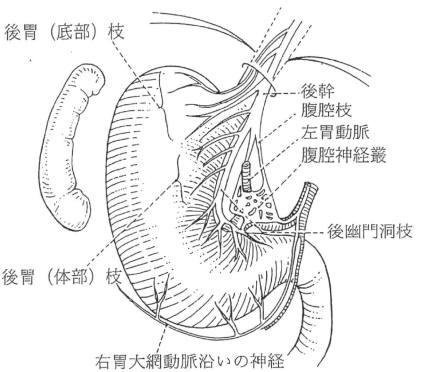

図 7　迷走神経後胃枝の走行

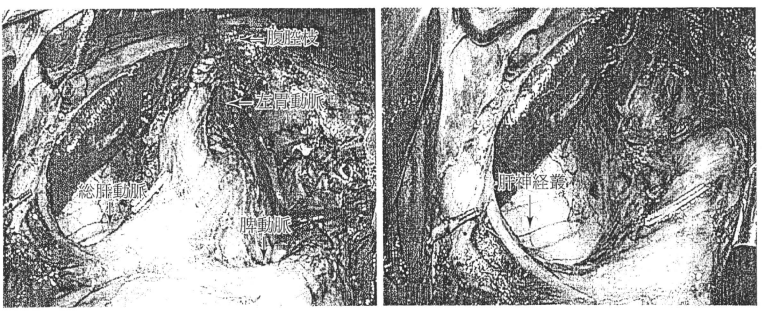

図 8　自律神経温存（D1＋β）完成図

Original article

Laparoscopy-assisted gastrectomy in patients with previous endoscopic resection for early gastric cancer

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Background: Some patients undergoing endoscopic resection for early gastric cancer need further surgical treatment to achieve cure. However, the influence of endoscopic resection on subsequent laparoscopy-assisted gastrectomy (LAG) remains unclear.

Methods: A total of 711 patients who underwent LAG were analysed retrospectively; 111 patients had undergone endoscopic resection previously and the remaining 600 had no history of endoscopic resection. Patient characteristics, operative and postoperative outcomes were compared between the two groups. Risk factors associated with postoperative complications were analysed.

Results: Duration of operation and blood loss were comparable between the two groups. Patients who had undergone endoscopic resection had fewer dissected lymph nodes and a lower rate of preservation of the coeliac branch of the vagus nerve, especially those who had LAG within 2 months after endoscopic resection. Early postoperative outcomes, including complications, gastrointestinal recovery and length of postoperative hospital stay, were not significantly different between the two groups. Previous endoscopic resection was not a risk factor for postoperative complications.

Conclusion: LAG can be performed safely even after endoscopic resection. Endoscopic resection might increase the difficulty of subsequent LAG, including lymph node dissection and preservation of the coeliac branch of the vagus nerve; however, it has little influence on early postoperative outcome.

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Introduction

As a result of advances in diagnostic techniques and the increasing prevalence of screening programmes, early gastric cancer (EGC) accounts for over 50 per cent of gastric cancers in Japan[1,2]. Currently, EGC with a very low or no risk of nodal metastasis is first treated by endoscopic resection, either endoscopic mucosal resection (EMR) or endoscopic submucosal dissection (ESD)[3,4]. Endoscopic resection, however, causes iatrogenic ulcers in the resected area during the healing process, which induce inflammation and subsequent fibrosis and even adhesions in the outer gastric wall[5,6]. Such changes are more obvious in patients experiencing gastric perforation as a result of endoscopic resection[7].

Endoscopic resection is not adequate for EGC if there is a risk of nodal metastasis. Laparoscopy-assisted gastrectomy (LAG) with lymphadenectomy is a good minimally invasive therapeutic option for EGC[8]. Laparoscopy-assisted distal gastrectomy is the most common procedure, and has proven feasibility and safety in the treatment of EGC[9,10]. If the endoscopic resection specimen contains tumour residue or indicates a risk of lymph node metastasis, further operation is needed and in Japan LAG will probably be the first choice[11]. The inflammation and adhesion caused by endoscopic resection might increase the difficulty of the subsequent LAG and the risk of complications, but there are few data available on the influence of previous endoscopic resection on LAG.

This study compared surgical data and postoperative outcomes in patients who had LAG after endoscopic resection with those of patients undergoing LAG without previous endoscopic resection.

Methods

From April 2006 to December 2009, 711 patients with EGC diagnosed before surgery underwent laparoscopy-assisted distal gastrectomy or pylorus-preserving gastrectomy in the Department of Gastroenterological Surgery, Cancer Institute Hospital, Tokyo, Japan. The diagnosis of EGC was based on the preoperative assessment of depth of wall invasion by upper gastrointestinal tract endoscopy, barium radiology and endoscopic ultrasonography, with nodal involvement determined by preoperative computed tomography. Some patients had undergone endoscopic resection previously. The criteria for endoscopic resection were in accordance with gastric cancer treatment guidelines in Japan[12].

Laparoscopy-assisted gastrectomy

LAG was performed by experienced surgeons using standard procedures as described previously[13–15]. Lymph node stations corresponded to specific lymph node tiers according to the Japanese Classification of Gastric Carcinoma[16]. Lymph node dissection of D1 + α indicated dissection of the perigastric lymph nodes and nodes along the left gastric artery (station 7). D1 + β lymph node dissection indicated dissection of the perigastric lymph nodes and stations 7 and 8a (anterosuperior group of the common hepatic artery), and 9 (coeliac artery) nodes. D1 + β + 11p dissection involved stations 7, 8a, 9 and 11p (proximal splenic artery) lymph nodes. D2 lymph node dissection indicated dissection of the perigastric nodes and all second-tier nodes, depending on the tumour location.

Distal gastrectomy was indicated for neoplasms located in the middle or lower part of the stomach. Billroth I anastomosis was performed using a hemi-double stapling technique. If the proximal remnant stomach was too small to perform a Billroth I anastomosis, Roux-en-Y reconstruction was performed. Pylorus-preserving gastrectomy was carried out for tumours located in the middle third of the stomach, with a maximum diameter of 5 cm, and at least 5 cm proximal to the pyloric ring[15].

Clinicopathological and surgical outcome data

Patients were divided into two groups for analysis: those who had endoscopic resection before LAG and those who did not. Clinicopathological and surgical outcome data were compared between the two groups.

Preoperative clinical data obtained included sex, age, body mass index, preoperative co-morbidity, tumour location and clinical stage. Operative data included duration of operation, estimated blood loss, degree of lymph node dissection, whether the coeliac branch of the vagus was preserved, type of surgery and conversion to open surgery. Pathological data included depth of tumour invasion, number of harvested lymph nodes, and presence or absence of lymph node metastasis. Early postoperative outcome data comprised postoperative complications, including bleeding, anastomotic leakage, stasis, ileus, pancreatic leakage, abdominal abscess and wound infection. Time until first passage of flatus, time to resumption of eating and length of postoperative hospital stay were also recorded.

Statistical analysis

Continuous data were expressed as mean(s.d.) and compared using the Student's *t* test. Relationships between categorical variables were analysed using the χ^2 test or Fisher's exact test. Risk factors that might affect postoperative complications were evaluated by univariable analysis; risk factors with $P < 0{\cdot}100$ in univariable analysis were included in multivariable logistic regression analysis. $P < 0{\cdot}050$ was considered significant. Statistical analyses were performed using SPSS® version 13.0 (SPSS, Chicago, Illinois, USA).

Results

Of the 711 patients who had LAG, 111 had undergone endoscopic resection previously, including 13 EMRs and 98 ESDs. Five patients experienced gastric perforation during endoscopic resection and all underwent non-surgical treatment. Reasons for further LAG were: submucosal tumour invasion (84 patients), residual tumour (19), undifferentiated tumour (6) and tumour recurrence (2).

Patient demographics and clinical background of the 111 patients who had endoscopic resection before LAG and the 600 who did not are compared in *Table 1*. There were no significant differences in body mass index, previous upper abdominal surgery, circular location of the lesion or clinical stage between the two groups. The group that had undergone endoscopic resection had a higher percentage of men (71·2 *versus* 61·0 per cent; $P = 0{\cdot}042$) and patients with co-morbidity (43·2 *versus* 30·3 per cent; $P = 0{\cdot}044$), older patients (68·1(8·4) *versus* 60·3(11·8) years; $P < 0{\cdot}001$) and a greater proportion of tumours in the lower third of the stomach (50·5 *versus* 34·2 per cent; $P = 0{\cdot}004$).

Operative and pathological data

There were no significant differences in duration of operation or estimated blood loss between the two groups

Table 1 Characteristics of patients who did or did not undergo endoscopic resection

	Endoscopic resection ($n = 111$)	No endoscopic resection ($n = 600$)	P†
Age (years)*	68·1(8·4)	60·3(11·8)	< 0·001‡
Sex ratio (M : F)	79 : 32	366 : 234	0·042
Body mass index (kg/m^2)*	23·0(3·8)	22·6(3·2)	0·215‡
Co-morbidity	48 (43·2)	182 (30·3)	0·044
Diabetes	17 (15·3)	43 (7·2)	0·005
Hypertension	37 (33·3)	143 (23·8)	0·034
Heart disease	6 (5·4)	19 (3·2)	0·288§
Pulmonary disease	6 (5·4)	27 (4·8)	0·826§
Previous upper abdominal surgery	7 (6·3)	25 (4·5)	0·430§
Location of lesion (third of stomach)			0·004
Upper	2 (1·8)	26 (4·3)	
Middle	53 (47·7)	369 (61·5)	
Lower	56 (50·5)	205 (34·2)	
Location of lesion			0·496
Lesser curvature	35 (31·5)	230 (38·3)	
Greater curvature	26 (23·4)	131 (21·8)	
Anterior wall	20 (18·0)	108 (18·0)	
Posterior wall	30 (27·0)	131 (21·8)	
Clinical stage			0·402
IA	109 (98·2)	573 (95·5)	
IB	2 (1·8)	25 (4·2)	
II	0 (0)	2 (0·3)	

Values in parentheses are percentages unless indicated otherwise; *values are mean(s.d.). †χ^2 test, except ‡Student's t test and §Fisher's exact test.

Table 2 Operative and pathological data

	Endoscopic resection ($n = 111$)	No endoscopic resection ($n = 600$)	P†
Duration of operation (min)*	230·1(60·6)	229·2(52·4)	0·876‡
Blood loss (ml)*	54·7(85·4)	56·3(109·5)	0·881‡
Lymph node dissection			0·048
D1 + α	0 (0)	2 (0·3)	
D1 + β	3 (2·7)	6 (1·0)	
D1 + β + 11p	102 (91·9)	516 (86·0)	
D2	6 (5·4)	76 (12·7)	
Coeliac branch of vagus nerve preserved			0·002
No	65 (58·6)	257 (42·8)	
Yes	46 (41·4)	343 (57·2)	
Type of surgery			< 0·001
LADG (Billroth I)	69 (62·2)	274 (45·7)	
LADG (Roux-en-Y)	11 (9·9)	95 (15·8)	
LAPPG	31 (27·9)	231 (38·5)	
Conversion to open surgery	0 (0)	9 (1·5)	0·368§
No. of harvested lymph nodes*	28·4(11·1)	31·5(10·1)	0·003‡
Depth of cancer invasion			0·096
Mucosa	24 (21·6)	283 (47·2)	
Submucosa	61 (55·0)	228 (38·0)	
Muscle	24 (21·6)	46 (7·7)	
Subserosa	2 (1·8)	34 (5·7)	
Serosa	0 (0)	9 (1·5)	
Lymph node metastasis			0·041
N0	104 (93·7)	519 (86·5)	
N1	6 (5·4)	56 (9·3)	
N2	1 (0·9)	25 (4·2)	

Values in parentheses are percentages unless indicated otherwise; *values are mean(s.d.). LADG, laparoscopy-assisted distal gastrectomy; LAPPG, laparoscopy-assisted pylorus-preserving gastrectomy. †χ^2 test, except ‡Student's t test and §Fisher's exact test.

(*Table 2*). D2 lymph node dissection was less common (5·4 *versus* 12·7 per cent; $P = 0·048$) and the rate of preservation of the coeliac branch of the vagus nerve was lower (41·4 *versus* 57·2 per cent; $P = 0·002$) in the endoscopic resection group. In accordance with the higher percentage of tumours in the lower stomach, distal gastrectomy with Billroth I reconstruction was performed more frequently in this group (62·2 *versus* 45·7 per cent; $P < 0·001$). No conversion to open surgery was needed in the endoscopic resection group, but conversion was necessary in nine patients who had not undergone endoscopic resection ($P = 0·368$). The total number of dissected lymph nodes was smaller in the endoscopic resection group (28·4(11·1) *versus* 31·5(10·1); $P = 0·003$). Depth of tumour invasion was not significantly different between the two groups, whereas the endoscopic resection group had a lower incidence of lymph node metastasis (6·3 *versus* 13·5 per cent; $P = 0·041$).

Early postoperative outcome

The early postoperative complication rate was similar in the groups with and without endoscopic resection (14·4 *versus* 10·8 per cent; $P = 0·275$) (*Table 3*). The most common complication in endoscopic resection group was abdominal infection (4·5 per cent), whereas it was pancreatic leakage (3·0 per cent) in the group that had not undergone endoscopic resection. One patient (0·9 per cent) needed reoperation because of duodenal stump leakage in endoscopic resection group. Five patients (0·8 per cent) had reoperation in the group without endoscopic resection. There were no significant differences in time until start of flatus, time to resumption of oral intake and length of postoperative hospital stay between the groups.

Effect of the interval between endoscopic resection and subsequent surgery on clinical outcome

To evaluate the effect of the interval between endoscopic resection and subsequent surgery on clinical outcome, the 111 patients who had undergone endoscopic resection were divided into two groups: 61 patients who received

Table 3 Early postoperative outcome

	Endoscopic resection ($n = 111$)	No endoscopic resection ($n = 600$)	P†
No. with postoperative complications	16 (14·4)	65 (10·8)	0·275
Intra-abdominal bleeding	0 (0)	1 (0·2)	1·000‡
Anastomotic bleeding	0 (0)	2 (0·3)	1·000‡
Anastomotic or duodenal leakage	2 (1·8)	6 (1·0)	0·359‡
Pancreatic leakage	2 (1·8)	18 (3·0)	0·755‡
Gastric stasis	2 (1·8)	15 (2·5)	1·000‡
Ileus	2 (1·8)	3 (0·5)	0·176‡
Abdominal infection	5 (4·5)	16 (2·7)	0·353‡
Wound infection	2 (1·8)	7 (1·2)	0·637‡
Reoperation	1 (0·9)	5 (0·8)	1·000‡
Time until start of flatus (days)*	2·3(0·9)	2·4(0·8)	0·976§
Time until start of oral intake (days)*	2·3(2·0)	2·2(1·7)	0·570§
Postoperative hospital stay (days)*	13·6(7·3)	13·3(7·3)	0·698§

Values in parentheses are percentages unless indicated otherwise; *values are mean(s.d.). †χ^2 test, except ‡Fisher's exact test and §Student's t test.

Table 4 Effect of interval between endoscopic resection and subsequent surgery on clinical outcome

	≤ 2 months ($n = 61$)	> 2 months ($n = 50$)	P†
Duration of operation (min)*	229·3(61·2)	231·1(60·5)	0·877‡
Blood loss (ml)*	67·3(104·0)	39·5(52·4)	0·072‡
No. of harvested lymph nodes*	27·5(9·4)	29·4(13·0)	0·384‡
Coeliac branch of vagus nerve preserved	20 (33)	26 (52)	0·041
No. with postoperative complications	10 (16)	6 (12)	0·275
Postoperative hospital stay (days)*	14·7(9·0)	12·3(4·3)	0·061‡

Values in parentheses are percentages unless indicated otherwise; *values are mean(s.d.). †χ^2 test, except ‡Student's t test.

LAG within 2 months and 50 patients who underwent LAG more than 2 months after endoscopic resection. There were no significant differences in operative and postoperative outcomes between the two groups, apart from a significantly lower rate of preservation of the coeliac branch of the vagus nerve in patients who received LAG within 2 months after endoscopic resection (33 *versus* 52 per cent; $P = 0·041$) (*Table 4*).

Table 5 Univariable analysis of factors associated postoperative complications

	Without complications ($n = 630$)	With complications ($n = 81$)	P†
Age (years)*	61·3(11·8)	62·9(10·8)	0·261‡
Sex (M : F)	385 : 245	60 : 21	0·165
Body mass index (kg/m^2)*	22·5(3·2)	23·8(3·5)	0·001‡
Co-morbidity	194 (30·8)	36 (44)	0·013
Previous upper abdominal surgery	28 (4·4)	4 (5)	0·777§
Location of lesion (third of stomach)			0·728
Upper	24 (86)	4 (14)	
Middle	377 (89·3)	45 (10·7)	
Lower	229 (87·7)	32 (12·3)	
Location of lesion			0·209
Lesser curvature	236 (89·1)	29 (10·9)	
Greater curvature	132 (84·1)	25 (15·9)	
Anterior wall	115 (89·8)	13 (10·2)	
Posterior wall	147 (91·3)	14 (8·7)	
Previous endoscopic resection	95 (15·1)	16 (20)	0·275
Surgeon's experience of LAG			0·693
< 50	227 (88·0)	31 (12·0)	
≥ 50	403 (89·0)	50 (11·0)	
Duration of operation (min)*	228·6(53·5)	235·1(55·5)	0·305‡
Blood loss (ml)*	54·3(106·6)	69·7(101·4)	0·218‡
Lymph node dissection			0·554
D1 + α	2 (100)	0 (0)	
D1 + β	7 (78)	2 (22)	
D1 + β + 11p	546 (88·3)	72 (11·7)	
D2	75 (91)	7 (9)	
Coeliac branch of vagus nerve preserved			0·207
No	280 (87·0)	42 (13·0)	
Yes	350 (90·0)	39 (10·0)	
Type of surgery			0·788
LADG (Billroth I)	304 (88·6)	39 (11·4)	
LADG (Roux-en-Y)	92 (86·8)	14 (13·2)	
LAPPG	234 (89·3)	28 (10·7)	
No. of harvested lymph nodes*	31·1(10·5)	30·5(8·8)	0·615‡

Values in parentheses are percentages unless indicated otherwise; *values are mean(s.d.). LAG, laparoscopy-assisted gastrectomy; LADG, laparoscopy-assisted distal gastrectomy; LAPPG, laparoscopy-assisted pylorus-preserving gastrectomy. †χ^2 test, except ‡Student's t test and §Fisher's exact test.

Risk factors associated with postoperative complications

Univariable analyses showed that body mass index and preoperative co-morbidity affected postoperative complications (*Table 5*). Multivariable analysis identified

body mass index (at least 24 kg/m^2) as an independent risk factor for postoperative complications (odds ratio 1·90, 95 per cent confidence interval 1·17 to 3·07; $P = 0·009$).

Discussion

EGC is considered a good indication for a minimally invasive approach such as endoscopic resection or LAG. When there is no risk of lymph node metastasis, endoscopic resection is similar to surgery in terms of curability but less invasive and more cost effective[17]. EMR, the so-called strip biopsy method, is widely accepted as a standard treatment for EGC in Japan[17,18]. ESD increases *en bloc* and histologically complete resection rates[19]. In the present study, 111 patients needed further surgery after endoscopic resection to achieve cure, of whom 98 had undergone ESD.

LAG has advantages over conventional open gastrectomy, including less intraoperative blood loss, less postoperative pain, faster recovery and shorter hospital stay[10,20]. When LAG is carried out after endoscopic resection, the influence of the endoscopic procedure on the stomach and surrounding tissue has to be taken into account. Endoscopic resection-induced inflammation causes oedema, fibrosis, and adhesions of both the stomach and surrounding tissue. In the present study, these changes were observed in almost all patients who had undergone endoscopic resection, being most apparent in the five patients who experienced gastric perforation. Although the mean duration of operation and estimated blood loss were comparable between groups of patients who had or had not undergone endoscopic resection, several surgical aspects differed. D1 + β + 11p was the most common type of lymph node dissection in both groups, whereas D2 dissection, which probably retrieves more lymph nodes[21], was performed less frequently in the endoscopic resection group. Among patients who had a non-D2 lymph node dissection, the mean number of dissected lymph nodes was smaller in the endoscopic resection group (data not shown). Inflammation caused by endoscopic resection probably influenced the subsequent lymph node dissection. However, the extent of lymph node dissection and number of harvested lymph nodes were sufficient to achieve cure and for determining pathological lymph node metastasis in both groups[12]. The rate of preservation of the coeliac branch of the vagus nerve was lower in the endoscopic resection group, especially in patients who had LAG within 2 months after the endoscopic procedure. To preserve the coeliac branch of the vagus nerve, it is very important to have clear surgical anatomy in the vicinity of the nerve. When endoscopic resection is carried out for EGC in the lesser curvature or posterior wall of the stomach, inflammation surrounding the vagus nerve might increase the difficulty of nerve preservation.

In spite of differences in surgical procedures, the postoperative complication rate, recovery and hospital stay were similar in the two groups, indicating that endoscopic resection had little influence on early postoperative outcomes. A previous study documented that abdominal adhesions caused by previous laparotomy did not affect the surgical outcome of LAG[22].

There were several clinical differences between the two groups in this study. The endoscopic group had a higher proportion of men and elderly patients, and preoperative co-morbidities including diabetes and hypertension were more common, which might indicate a higher risk of postoperative complications. Nevertheless, a previous study showed that postoperative complications of LAG did not increase significantly in elderly patients with more preoperative co-morbidities[21], consistent with the present results. Multivariable analysis revealed body mass index as the only independent risk factor for postoperative complications. Thus, endoscopic resection had little influence on early postoperative outcome of LAG.

The present study had some limitations. It included all patients who had undergone endoscopic resection previously, but the influence of type of endoscopic procedure was not analysed. Detailed information on the endoscopic procedure used in each patient could not be obtained because some patients underwent endoscopic resection in other hospitals. Complications caused by endoscopic resection, such as perforation, might lead to more adhesions and will probably increase the difficulty of LAG. This study included only five patients who experienced perforation during endoscopic resection, which was not sufficient for analysis. Further studies are warranted to clarify the effect of the endoscopic procedure on subsequent LAG.

The long-term outcome of the group who had endoscopic resection is unknown because of the short follow-up. However, other studies have reported satisfactory long-term survival after LAG for EGC[23,24]. In the present study, most patients in the endoscopic resection group underwent modified D2 lymphadenectomy (D1 + β with or without 11p), with an adequate number of dissected lymph nodes, and the rate of lymph node metastasis was very low at 6·3 per cent, all of which predict good long-term outcome.

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Long-term outcome and survival with laparoscopy-assisted pylorus-preserving gastrectomy for early gastric cancer

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Abstract
Background Laparoscopically assisted pylorus-preserving gastrectomy (LAPPG) is introduced as a function-preserving operation with minimal invasion for early gastric cancer (EGC). This study aimed to investigate the long-term outcome and survival with LAPPG.
Methods From January 2005 to July 2008, 188 patients with EGC underwent LAPPG. The surgical and long-term outcomes and survival were assessed retrospectively.
Results The accuracy of the preoperative EGC diagnosis was 92.6%. The median follow-up period was 38 months (range, 2–63 months). Two patients experienced gallstones, and three patients experienced a second primary EGC. One patient with T3N0 gastric cancer died of peritoneal metastasis, and four patients died of other causes. The overall 3-year survival rate was 97.8%, and the disease-specific 3-year survival rate was 99.3%.
Conclusions The LAPPG procedure is safe in terms of satisfactory long-term outcome and survival for patients with EGC in the middle third of the stomach.

Keywords Early gastric cancer · Laparoscopy-assisted pylorus-preserving gastrectomy · Long-term outcome

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In recent years, the number of early gastric cancer (EGC) cases has been increasing due to the development of mass screening and diagnostic procedures. In Japan, EGC represents more than 50% of all gastric cancers [1, 2]. Early gastric cancer has a low incidence of lymph node metastasis and excellent survival rates after surgical treatment, which has led to the frequent application of limited and less invasive operations such as endoscopic mucosal resection, segmental resection, and laparoscopically assisted gastrectomy [3].

Pylorus-preserving gastrectomy (PPG) with radical lymph node dissection has been applied as a limited surgical therapy for EGC [4]. Compared with conventional distal gastrectomy (CDG), PPG retains the pyloric ring and gastric function, which results in a lower incidence of postgastrectomy syndrome including dumping syndrome, bile reflux gastroesophagitis, weight loss, and nutritional deficit [5–7].

Laparoscopically assisted surgery is increasingly used for EGC because it is less invasive and offers a better postoperative outcome [8]. Laparoscopically assisted distal gastrectomy (LADG) has resulted in less pain, earlier postoperative recovery, shorter hospital stay, and better quality of life, whereas the curability and long-term survival have not differed between LADG and CDG [8, 9]. However, as an operation without preservation of the pyloric ring, postgastrectomy syndrome still remains a problem after LADG [10].

Laparoscopically assisted pylorus-preserving gastrectomy (LAPPG), as both a function-preserving and minimally invasive surgical technique, combines the merits of PPG and laparoscopic surgery. We have reported the feasibility and techniques of LAPPG previously [11–13]. Compared with conventional PPG, LAPPG had less intraoperative blood loss, shorter bowel function recovery, and shorter hospital stay [11–13].

We have previously reported the survival benefit of PPG shown in 94 LAPPG procedures for 305 patients with EGC [14]. However, little is known about the long-term outcome of LAPPG such as the occurrence of postoperative intestinal obstruction, gallstone, and remnant stomach cancer. The survival benefit of LAPPG itself also is unknown. In this study, we investigated the long-term outcome and survival benefit of PPG using only the laparoscopic approach for 188 patients with EGC.

Patients and methods

From January 2005 to July 2008, 188 patients with EGC diagnosed before surgery underwent LAPPG in the Department of Gastroenterological Surgery at The Cancer Institute Hospital, Tokyo, Japan. All the patients had a clinical diagnosis of mucosal or submucosal gastric cancer without lymph node metastasis (cT1, cN0) based on the results of gastric endoscopy, barium radiography, computed tomography, or endoscopic ultrasonography.

The indication for LAPPG was cT1, cN0 gastric cancer located in the middle one-third of the stomach more than 5 cm proximal to the pyloric ring and with a maximum diameter less than 5 cm. Patients who were candidates for endoscopic resection were excluded from the study. Nodal involvements were rechecked by routine intraoperative frozen-section diagnosis of lymph nodes from the dissected stomach specimen.

Surgical procedures

The LAPPG technique was performed according to procedures we have described previously [11, 12]. Lymph node stations corresponded to specific lymph node tiers named by the Japanese Classification of Gastric Carcinoma (JCGC) [15]. Dissection of the first-tier nodes (stations 1, 3, 4sb, 4d, and 6) was performed by D1 lymphadenectomy, whereas D1 + α lymphadenectomy involved station 7; D1 + β involved stations 7, 8a, and 9; and D1 + β + 11p involved stations 7, 8a, 9, and 11p. The lymph nodes at station 5 (suprapyloric) were routinely left intact. The infrapyloric vessels and the first branch of the right gastric artery were routinely preserved to maintain sufficient blood supply to the pyloric cuff. The hepatic and pyloric branches of the vagus nerve were routinely preserved, and the celiac branch of the vagus nerve was preserved when possible. The remaining procedures were the same as described previously [12].

The resected specimens were examined, and gross form, degree of N, and stage classification were scored according to JCGC [15]. Operation data and early postoperative outcome including complications were recorded. Early postoperative complications were defined as conditions occurring during the first 30 postoperative days that required reoperation, an additional procedure, or a prolonged hospital stay compared with routine practice [16].

Postoperative surveillance

All the patients were followed according to the established protocol at our hospital including medical history, physical examination, and laboratory studies such as tumor markers 1 and 3 months after operation, then every 6 months. At each visit, symptoms were recorded. Abdominal ultrasonography and computed tomography were performed every 6 months, and gastroscopy was performed each year. Vital statistics of all the patients were confirmed using data from follow-up charts. Occurrence of gallstone or remnant stomach cancer was recorded. Information about patients free of tumor recurrence and, when appropriate, the cause of death, also were recorded.

Statistical analysis

All data were analyzed on an intention-to-treat basis. Overall survival was calculated by the Kaplan–Meier method. Statistical analyses were performed using SPSS version 13.0 (SPSS Inc., Chicago, IL, USA).

Results

The 188 patients (109 men and 79 women) receiving LAPPG had a mean age of 58.2 years (range, 34–80 years)

Table 1 Clinical and pathologic characteristics of 188 patients undergoing laparoscopy-assisted pylorus-preserving gastrectomy (LAPPG)

Characteristic	Value
Age (years)[a]	58.0 ± 10.3 (34–80)
Sex (male/female)	109/79
Body mass index (kg/m^2)[a]	22.5 ± 3.1 (16.8–30.8)
Tumor location (U/M/L)[b]	2/170/16
Tumor size (cm)[a]	2.8 ± 1.4 (0.6–9)
Differentiation (differentiated/undifferentiated)	65/123
Depth of tumor invasion[c]	
Mucosa/submucosa	100/74
Muscle/subserosa/serosa	4/7/3
Nodal status (pN0/pN1/pN2)[c]	174/12/2
Pathologic staging (IA/IB/II/IIIA)[c]	164/15/8/1

[a] Values are mean ± standard deviation (range)

[b] U: Upper third of the stomach; M: Middle third; L: Lower third

[c] According to the Japanese Classification of Gastric Carcinoma

(Table 1). Their mean body mass index (BMI) was 22.5 kg/m^2 (range, 16.8–30.8 kg/m^2). The tumors were in the middle third of the stomach for 170 of the patients (90.4%). Six patients had a history of cholecystectomy, and 13 patients underwent laparoscopic cholecystectomy during LAPPG. Postoperative pathologic data confirmed T1 (mucosal or submucosal) tumors in 174 patients (92.6%). Although the preoperative diagnosis was stage IA (T1, N0) for all the patients, the pathologic diagnosis was lymph node metastasis for 14 patients (7.4%), and the final diagnosis was stage IB for 15 patients, stage II for 8 patients, and stage IIIA for 1 patient. The mean tumor size was 2.8 cm (range, 0.6–9 cm). Differentiated tumors were found in 65 patients and undifferentiated tumors in 123 patients.

The mean operation time was 234.4 min (range, 140–407 min), and the mean blood loss was 53.6 ml (range, 2–420 ml) (Table 2). There was no conversion to open surgery. Modified D2 lymph node dissection (D1 + β or D1 + β + 11p) was performed for 185 patients (98.4%), and the mean number of resected lymph nodes was 35.7 (range, 14–70).

Early postoperative complications developed in 29 patients (15.4%). The complications for most patients were not severe and could be managed by nonoperative therapy. Only two patients underwent reoperation because of pancreatic leakage and postoperative ileus, respectively. Gastric stasis was the most frequent complication, occurring in 14 patients (7.4%) who had severe symptoms requiring fasting and intravenous fluid. The mean postoperative hospital stay was 13.4 days (range, 7–106 days).

Table 3 summarizes the long-term follow-up outcome and survival data. The follow-up rate was 100%, and the median follow-up time was 38 months (range, 2–63 months). One patient underwent partial small bowel resection because of adhesive intestinal obstruction 8 months after LAPPG. Gallstones developed in two patients (1.1%). The one patient received laparoscopic cholecystectomy 38 months after LAPPG, and the other patient with asymptotic gallstone was still under observation. There was no evidence of bile duct stones in the 19 patients who had undergone cholecystectomy. Three patients experienced a second primary EGC, and all were treated by endoscopic submucosal dissection.

Overall, the 3-year cumulative survival rate was 97.8%. Five patients died. One of these patients with T3N0 gastric cancer died of peritoneal metastasis 27 months after surgery. Three patients died of cancers other than gastric cancer. The cause of death was unclear for the remaining patient. The disease-specific 3-year survival rate was 99.3%. No patients with a final diagnosis of EGC died.

Table 2 Surgical and early postoperative outcomes

Variable	Value
Operation time (min)[a]	234.4 ± 47.0 (140–407)
Blood loss (ml)[a]	53.6 ± 68.0 (2–420)
Lymph node dissection (D1 + α/D1 + β/ D1 + β + 11p)	3/8/177
Total number of resected lymph nodes[a]	35.7 ± 10.3 (14–70)
Early postoperative complication: *n* (%)	29 (15.4)
Stasis	14 (7.4)
Ileus	1 (0.5)
Pancreatic leak	8 (4.3)
Abdominal abscess	9 (4.8)
Wound infection	2 (1.1)
Postoperative stay (days)[a]	13.4 ± 9.5 (7–106)

[a] Values are mean ± standard deviation (range)

Table 3 Long-term outcome and survival

Variable	Value
Median follow-up period: months (range)	38 (2–63)
Intestinal obstruction: *n* (%)	1 (0.5)
Gallstone: *n* (%)	2 (1.1)
Remnant stomach cancer: *n* (%)	3 (1.6)
Cause of death: *n* (%)	
Gastric cancer metastasis	1 (0.5)
Other cause	4 (2.1)
Overall 3-year survival rate (%)	97.8
Disease-specific 3-year survival rate (%)	99.3

Discussion

Currently, PPG is indicated as a function-preserving operation for EGC in the middle third of stomach. The early and long-term outcome has proved its safety, better postoperative quality of life, and excellent long-term survival compared with CDG [5, 6, 17].

Recently, PPG was performed laparoscopically (LAPPG) as a minimally invasive technique. We and other groups have reported the safety and feasibility of LAPPG in terms of intraoperative and early postoperative outcomes [11, 17, 18]. The demonstrated benefits of LAPPG are less intraoperative blood loss, less postoperative pain, faster recovery of bowel function, and shorter hospital stay than patients experience with conventional PPG.

The intraoperative and early postoperative outcomes in the current study were in accordance with previous reports. However, as a new therapeutic method, LAPPG should meet the basic surgico-oncologic principles for maintaining curability. To this end, LAPPG should be proved safe in terms of long-term outcome. In this study, we report 188

consecutive cases of LAPPG with long-term surgical and oncologic outcomes.

Adhesive intestinal obstruction is a major concern after abdominal surgery. Studies have shown that laparoscopic surgery may reduce the incidence of intestinal obstruction. A study comparing the outcomes between laparoscopic and open surgery for patients with right-sided colon cancer showed less postoperative intestinal obstruction with laparoscopic surgery [19].

We previously performed a retrospective analysis comparing 72 patients who underwent LAPPG and 37 patients who had conventional PPG for EGC and found that the incidence of early postoperative ileus in the LAPPG group was significantly lower than in the conventional PPG group (1 vs. 14%) [11]. In the current study, only two patients (1.1%) experienced intestinal obstruction. The one patient had early positive ileus, and the other patient had adhesive intestinal obstruction 8 months after the operation. Although this was not a case–controlled study, the low incidence of intestinal adhesion showed the benefit of PPG performed by laparoscopy.

Gallstone formation is a common complication after gastrectomy for patients with gastric cancer. Fukagawa et al. [20] reported gallstones in 25.7% (173/672) of patients who had undergone gastrectomy with lymph node dissection for gastric cancer. Nunobe et al. [7] reported that gallstone incidence after conventional PPG was 10.8% (21/194). In the current study, the overall incidence of gallstone after LAPPG was 1.1%, and only one patient underwent laparoscopic cholecystectomy because of cholecystolithiasis. We performed LAPPG by routinely preserving the hepatic branch of the vagus nerve.

Denervation of the hepatic branch of the vagus nerve may play an important role in the formation of gallstone after gastrectomy. Kojima et al. [21] compared the effect of vagus nerve preservation on the incidence of gallstone after LADG and found that vagus nerve-sparing LADG had a lower incidence of gallstone than LADG. Findings have proved that PPG is less likely to cause stasis of the bile flow associated with disturbance of biliary motility [22] and that gallbladder function in patients who had PPG is better than in patients who had CDG [6].

The long-term outcome and survival after PPG is excellent. Morita et al. [23] reported their results from conventional PPG for 611 patients with EGC. The 5-year survival rate was 96.3%. Five patients experienced a second primary gastric carcinoma in the remnant stomach, and six patients experienced recurrence.

Our previous study retrospectively summarized the results of PPG for 305 patients with EGC. The overall 5-year survival probability was 98%, and the gastric cancer-related death rate was 0% during a median follow-up period of 60 months [14]. Although that study included 94 patients who underwent LAPPG, the long-term outcome for the pure LAPPG group was not estimated.

The current study is the first to report the long-term survival outcome of LAPPG itself. The median follow-up period was 38 months (range, 2–63 months). The overall 3-year survival rate was 97.8%, and the disease-specific 3-year survival rate was 99.3%. Only one patient with T3N0 gastric cancer died of peritoneal metastasis. No patients with pathologically confirmed EGC experienced death. The results of this study indicated that LAPPG may be performed safely with excellent long-term outcome for patients with EGC, and a preoperative accurate diagnosis of EGC may ensure the safety of this procedure.

Although Shimoyama et al. [24] thought PPG was optimal for serosal negative gastric tumors less than or equal to cT2 cN0 and less than or equal to 2 cm in maximum diameter, we do not suggest expanding the indication of LAPPG to advanced gastric cancer. Because EGC may recur even 5 years after treatment [25], the follow-up evaluation of these patients is continued, and the longer follow-up outcome is worth expecting.

In summary, we report the long-term outcome and survival with LAPPG for 188 consecutive patients. The satisfactory long-term surgical and oncologic outcomes showed LAPPG to be a safe surgical procedure for patients with EGC in the middle third of the stomach.

Disclosures

Drs. Xiaohua Jiang, Naoki Hiki, Souya Nunobe, Tetsu Fukunaga, Koshi Kumagai, Kyoko Nohara, Hiroshi Katayama, Shigekazu Ohyama, Takeshi Sano, and Toshiharu Yamaguchi have no conflicts of interest or financial ties to disclose.

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