

Endoscopic Treatment of Upper Gastrointestinal Tumors

Si Young Song

Abstract

The art and science of gastrointestinal endoscopy will continue to evolve at an amazing pace, with both endoscopists and industry providing new techniques and technologies for us to learn, investigate and apply to the benefit of our patients. It is not difficult to imagine that the next decade may see the maturation of a distinct specialty of gastrointestinal endoscopic surgery, currently in its adolescence, which crosses traditional boundaries. Practitioners will originate from a variety of backgrounds - gastroenterological, surgical or radiological - but must be trained specifically to perform the wide range of endoscopic procedures already in existence and those continually being introduced. Such 'endotherapists' will be an integral part of multidisciplinary units where optimal management strategies are planned based on available scientific evaluation of techniques irrespective of who performs them. Currently, numerous gastrointestinal diseases including both benign and malignant conditions have been managed using only endoscopic measurements. Control of gastrointestinal bleeding (variceal and non-variceal), dilation of benign and malignant strictures, antireflux management for esophagogastric reflux, endoscopic curative resection of premalignant and malignant lesions, treatment of submucosal tumors, percutaneous endoscopic gastrostomy or jejunostomy, stenting for malignant stricture of hollow viscus or pancreaticobiliary diseases, tumor ablation, and removal of biliary or pancreatic duct stones, etc. have been widely performed and various fascinating techniques and instruments have been continuously developed. It would be difficult to handle all of these various treatment modalities in a limited space. In this review we would like to discuss the fields of gastrointestinal tumors.

Key Words: Upper gastrointestinal tumor, endoscopic therapy

INTRODUCTION

Gastroenterologists have long been pioneers in employing new technologies for diagnosis and therapy. From bougies in the 16th century to the elegant string-guided dilation balloon of Plummer and Vinson in 1919. And since the introduction of flexible endoscopy in the early 1960s and endoscopic retrograde cholangiopancreatography (ERCP) in the late 1960s, there has been a remarkable evolution in the endoscopic diagnosis and therapy of a variety of gastrointestinal disorders with clear influences on clinical decision-making.

Various modalities of therapy on GI tumors expand the range of therapeutic endoscopic procedures in a relatively safe and readily repeatable manner which achieves high patient tolerance. By reducing morbidity, mortality and time spent in hospital, it offers

significant advantages in the palliative treatment of conditions previously managed by conventional chemotherapy, radiation therapy, or surgery, and also offers opportunities for the treatment of previously inoperable disorders. Endoscopic therapy also has an important role not only for the palliative treatment of far advanced cancer but also for the radical therapy of early cancer or premalignant tumors.

ENDOSCOPIC MANAGEMENT OF ESOPHAGOGASTRIC TUMORS

A. Recent trends in the management of esophagogastric cancer

Recent trends in the management of esophageal cancer include: the poor prognosis of surgery in advanced cases, with a high rate of early recurrence; the confirmed potentiation of chemotherapy with radiotherapy; the progressive acceptance of the non-surgical chemoradiation protocol as potentially equivalent to surgery; the tendency to abandon neoadjuvant combined protocols preoperatively; and the association of intraluminal high dose brachytherapy with

Received October 18, 1999

Division of Gastroenterology, Department of Internal Medicine, Yonsei University College of Medicine, Seoul, Korea.

Address reprint request to Dr. S. Y. Song, Department of Internal Medicine, Yonsei University College of Medicine, C.P.O. Box 8044, Seoul 120-752, Korea. Tel: 82-2-361-5422, Fax: 82-2-393-6884, E-mail: sysong@yumc.yonsei.ac.kr

external radiation despite the increased risk of complications.

For gastric cancer, recent trends have focused on the role of endoscopic ultrasonography (EUS) for staging. The screening policy conducted in Japan explains the increased rate of detection of early gastric cancer up to 40–66.4% of total gastric cancer and this is comparable to around 30% of early cases in Korea.^{1,2} Our approach combining complete staging, the use of endoscopic curative procedures, a more systematic lymphadenectomy, and complementary chemotherapy protocols achieves better results than the Western approach. Advanced gastric cancer is now considered to be a relatively chemosensitive tumor and chemotherapy is gaining popularity as a non-surgical regimen for metastatic cancer.

In this review we shall consider esophageal and gastric tumors as a single group with respect to interventional endoscopy procedures.

B. Endoscopy in the management of advanced cancer

The sophistication of the non-surgical management of esophageal and gastric cancer, with radiation or chemotherapy or both, modifies the role of endoscopic procedures in the management of advanced cancer: they are often done to potentiate, or to complete the action of chemotherapy or radiation. However, side effects or complications may also be potentiated. Palliation requires two major procedures - stenting and tumor debulking. Dilation techniques are also helpful, and have recently been reviewed, including the management of strictures after radiation.

(1) Stenting for the palliation

Until recently, rigid non-metallic non-expandable prostheses had been widely used. However, these prostheses are suboptimal: stent diameters are limited by scope channel size or anatomic constraints; prostheses occlude frequently by ingested foodstuffs. In addition, prostheses have a variable instance of erosion and migration. For all of these reasons, as well as defined difficulties when inserting these stents, self-expandable metallic prostheses have been developed and are likely to be increasingly used. These prostheses are theoretically advantageous because large diameter stents can be placed through small-

diameter and flexible or semiflexible insertion tubes, allowing not only prolonged patency but also placement across previously inaccessible stenoses. Moreover, improved delivery systems have the potential to pinpoint endoprosthesis placement, precluding inadvertent proximal or distal delivery. There are currently four types of expandable prostheses, including Z (Gianturco) stents, wallstents, nitinol mesh stent, and endocoil. All are likely to be expensive, ranging from several hundred to several thousand dollars each. These metallic stents were initially developed in an uncoated form. However, because of frequent failure due to tumor ingrowth through the wire mesh, the silicone or polyurethane-coated stents over variable metallic backbone has been developed and is undergoing study to preclude such ingrowth. The focus is on metal expandable stents, and the radial force of expansion of the different models, in decreasing order, is as follows: the spiral Esophagocoil nitinol stent, the thin mesh Wallstent type, the Gianturco Z type, and the knitted Ultraflex nitinol stent. Covered models have less expansive force than uncovered models.

Esophageal stenting can achieve prompt and better relief of malignant dysphagia. The respective figures from a recent study were 81% for stenting, 63% for chemotherapy, and 56% for radiotherapy.³ This applies to squamous cell cancer, adenocarcinoma in the esophagus, and cardia cancer. To date, very few data from controlled trials dealing with the comparison of efficacies among these stents have been published.

We conducted a study to compare the efficacy prospectively between a self-expandable metallic coil stent (EsophaCoilTM, In stent Inc., Prairie, MN, USA) and a silicone-covered modified Z-type metal stent (Song's stentTM, Suho Meditech, Seoul, Korea) between 1993 and 1996.⁴ A total of 42 patients (19 females, 23 males, mean age 60.6 years) with malignant esophageal obstruction due to esophageal cancer (29 cases [4 cases had tracheoesophageal fistula]), gastric cardiac cancer (8 cases), recurrent gastric cancer after total or subtotal gastrectomy (3 cases), pancreatic cancer with subcarinal LN enlargement (2 cases) were treated. In all cases the stents were placed successfully without any serious complication. Patients were prospectively followed up to assess dysphagia (graded from 0 [normal] to 4 [inability to swallow saliva], foreign body sensation, heartburn, and stent dysfunction. The results are shown in Table 1. These findings suggest that both stents offer safe and ef-

Table 1. Characteristics and Outcomes in Patients with Esophagogastric Malignant Obstruction Who Underwent Metallic Stenting

	EsophaCoil	Song's stent
Number of patients	21	21
Mean age (yr)	63.7	62.2
Presence of TE fistula	2	2
Prior dilation (No. of sessions)	1.4	1.1
Success rate	21/21 (100%)	21/21 (100%)
Initial dysphagia grade	3.2	3.2
Dysphagia grade after stenting	0.8	1.2
Complications		
Tumor overgrowth		2
Tumor ingrowth		0
Migration		1
Bleeding		

TE, Tracheoesophageal.

fective palliation for malignant dysphagia. EsophaCoil seems to have less stent dysfunction than Song's stent. However, the patients with EsophaCoil have experienced more discomfort than Song's stent which was thought to be because of its strong expansile force. Covered stents can be employed systematically when there is a tracheal or bronchial fistula. We observed successful obstruction of tracheoesophageal fistula in 3 of 4 cases.

Recently, more advanced kinds of stents have been developed and we have experienced better responses than with the above stents. Currently, our team is developing a radioisotope tagging membrane-coated metal stent. We eagerly anticipate the development of further-improved stents with prolonged patency, survival benefits, and less iatrogenic duct or gut injury in the near future.

Unusual anatomic stenoses

Contingent on the delivery system, expandable prostheses have the potential to be placed across previously inaccessible stenoses. For instance, we have implanted metallic prostheses in patients with duodenal obstruction because of cancer, and malignant afferent loop obstruction following radical duodenopancreatectomy for bile duct cancers. Expandable stents have also been used across the gastric outlet in patients with inoperable gastric carcinoma, thereby

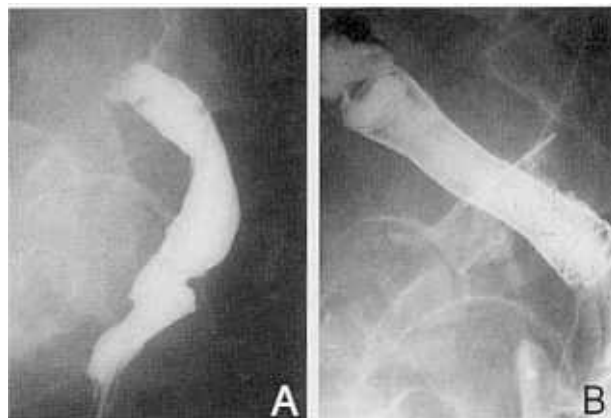


Fig. 1. A: Radiographic image of complete obstruction of rectosigmoid colon due to malignant tumor. B: The stent is completely expanded and the patent lumen is confirmed by infusion of radio-opaque dye.

allowing ingestion of a soft or pureed diet. We are currently developing more effective stents for gastric emptying with a larger diameter like a flask. Finally, expandable prostheses have been used in malignant rectal or colonic stenoses to reestablish luminal continuity. While perhaps providing a reasonable temporizing method to allow bowel preparation and subsequent colon resection or bypass, long-term stent placement is likely to be associated with recurrent obstruction from stool, and its widespread application appears to be unwarranted at this time. We have also conducted study to clarify the efficacy of the insertion of self-expandable metallic stents in malignant obstruction due to rectosigmoid cancers (Fig. 1). In all cases the stents were placed successfully without any complications, and dramatic symptomatic improvement was observed.

(2) Palliative tumor ablation for tumors of esophagogastric tract

Unfortunately even though there has been much improvement in the early diagnosis of gastrointestinal cancers, cases with far-advanced esophagogastric cancer are frequently encountered.

In the past, laser treatment for gastrointestinal tract malignancies under endoscopic guidance has been evaluated as a palliative treatment. The depth of penetration of the argon plasma coagulator or the multipolar gold probe is limited; the procedures may prove helpful in unblocking the stent. The Nd:YAG laser is the most commonly used energy source for

this purpose. The Nd:YAG lasers were used initially in the mid 1970s to produce hemostasis in acutely bleeding peptic ulcers. With the evolution of treatment techniques, the main area of use of the Nd:YAG laser has now become the palliation of upper and lower GI malignancies. Thermal ablation of tumors may be achieved endoscopically by non-contact laser application at high power, or in the contact mode using artificial sapphire probes at much lower energy levels. In a series of 62 patients undergoing 150 sessions, relief of dysphagia was obtained in 93% with a median interval between sessions of 100 days and a low rate of complications.⁵ Laser sessions should be entered in a multimodal non-surgical protocol; the association with radiation is beneficial, as was shown in a series of 67 patients.⁶ High-dose intraluminal brachytherapy has also been used and resulted in longer dysphagia-free intervals, but with a risk of increased morbidity.

Non-thermal photodynamic therapy designed for the destruction of early neoplasia has also been suggested as palliation for dysphagia in advanced cancer. In a large series of patients treated with Photofrin for esophageal malignancy, 70 of 77 were at an advanced stage and the median survival was 6.3 months.⁷ However, there is generally no place for photodynamic therapy in palliation.

In summary, the Nd:YAG laser is still the instrument of choice for luminal debulking in the palliation of dysphagia or in the reduction of tumor volume, and for the treatment of chronic tumor hemorrhage. Good results are obtained only in polypoid, obstructing, and non-circumferential tumors; in such conditions the morbidity is less than that of stenting. Stenting and tumor debulking have their own specific indications and may be considered as complementary. There is no place for photodynamic therapy in palliation. New thermal energy sources such as microwave or non-thermal therapy such as injection of immunomodulating or chemotherapeutic agents or gene therapy have already been tried or will be applicable in the near future.

C. Endoscopy in the management of early or premalignant cancer

Recently, the possibility of endoscopic curative therapy for gastrointestinal tract malignancies has been more actively investigated. Endoscopic treat-

ments for early esophagogastric cancer such as mucosal resection technique, laser photocoagulation, and photodynamic therapy are the most promising methods for the curative treatment of early-stage malignancies. With the increasing detection rate of early cancers of gastrointestinal tracts, these modalities will be promising, confirmative treatment methods in the near future. In Japan, endoscopic treatments have been recognized as a possible curative treatment for early cancer and have increasingly taken the place of surgical treatment. However, patient selection for curative endoscopic treatment of early stage esophagogastric carcinoma can still be problematic. The correct diagnosis of depth of invasion and the confirmation of absent lymph node metastasis are indispensable factors in accomplishing curative endoscopic treatment. In this regard, it is anticipated that EUS will greatly resolve this problem. And the development of EUS-guided needle aspiration cytology should also be promising in determining whether the enlarged lymph node is malignant or benign.

(1) Endoscopic mucosal resection and polypectomy

The rationale for curative endotherapy

The rationale for endoscopic curative treatment for esophageal and gastric cancer are listed. Principles are largely based on the Japanese classifications with the established association between depth of invasion and the rate of lymph node extension. The following points should be considered.

1) The extension of the surface and the morphology: elective indications are only for small lesions with an upper limit of 2 cm.

2) The extension in depth, as predicted from endoscopic morphology of the surface, controlled at EUS, and later confirmed by pathological examination of the resected specimen, should not be further than the mucosa. This is why resection, when possible, is preferable to tumor destruction.

3) The histology: high-grade dysplasia is the earliest stage of malignancy, as shown by the p53 mutation, and should be treated as a confirmed cancer.⁸ A high degree of differentiation favors local treatment, while poorly-differentiated tumors are at higher risk of distant spread and should not be treated by a local procedure.

4) The endoscopic detection of intramural meta-

stases is a poor prognostic sign and suggests palliative management.⁹ There is a contraindication to curative procedures, either esophagectomy or endoscopic treatment. The large spreading type of early cancer should not be treated by endotherapy.¹⁰ Finally, multiple early cancer, which is found in about 10% of cases, may be treated at endoscopy if the entire morphology is compatible with intramucosal cancer.

5) The ease of the resection technique depends on the topography. Some areas are more difficult to treat with curative intent at endoscopy; access to the posterior wall and lesser curvature is more difficult in the stomach.

6) The endotherapy (resection or tumor destruc-

tion) procedure is understood to be curative, so it should not be associated with chemotherapy or radiation. The success or failure is assessed by examination of the endoscopic control biopsy specimen after a few weeks. The combined protocol may induce unnecessary delay in evaluation of healing or tumor recurrence.

7) The assessment of the results is based on the rates of complete destruction, recurrence, and survival. The data are abundant for gastric cancer, but still limited for esophageal cancer.

The morphological variables that govern the decision to treat by endotherapy are related to the surface of the small lesion. A size of 2 cm is the general upper limit when complete resection is the goal. In

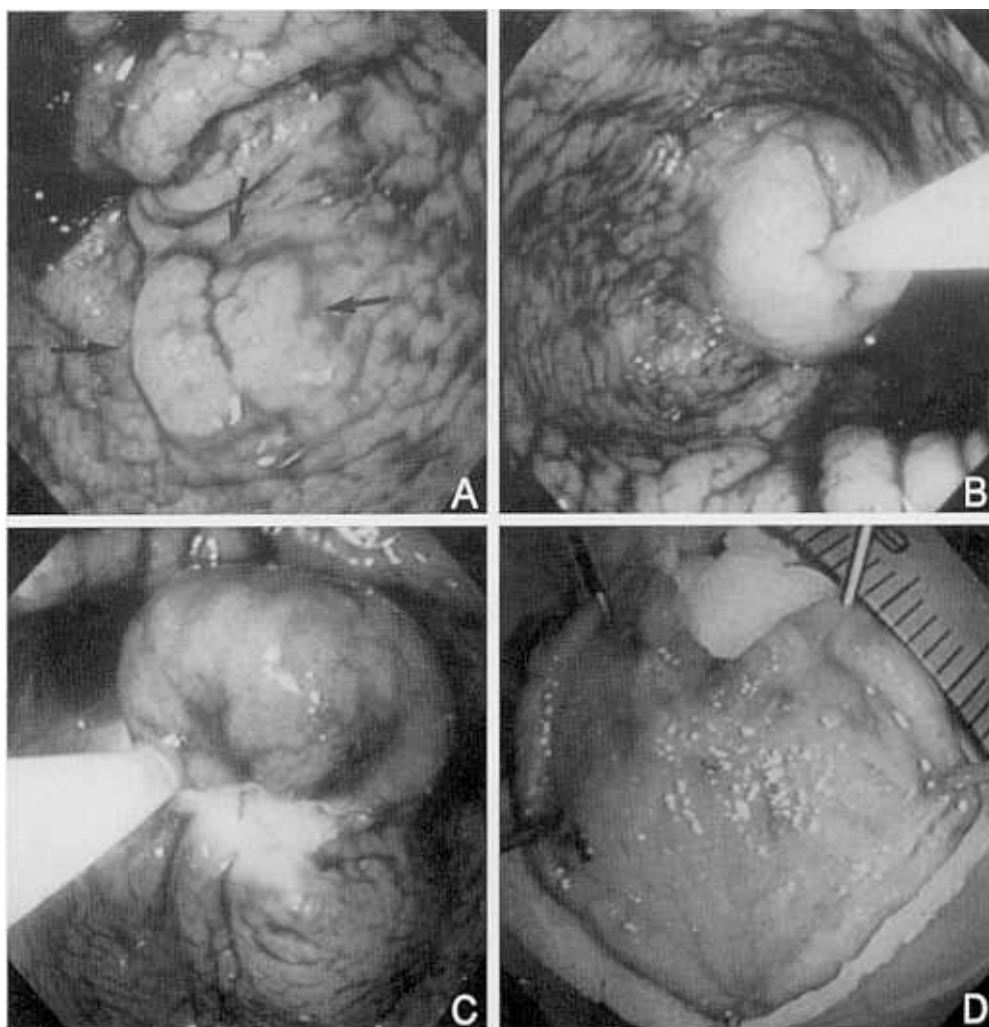


Fig. 2. Endoscopic mucosal resection of early gastric cancer. A: A 1.0 cm bilobulated elevated nodular lesion is noted (arrows). B: The neoplastic lesion is lifted with injection of saline. C: The target mucosal area is resected with snare polypectomy device. D: The resected specimen is stretched and fixed to cardboard with pins.

type 0 endoscopic classification, the polypoid subtype (I) should be treated with caution, and the ulcerated subtype (III) should not be treated by endoscopy. Most indications therefore concern the flat subtype II with the three variants: elevated (IIa), flat (IIb), and depressed (IIc). Concerning the depressed type, safe resection requires a still smaller dimension, the upper limit in size being 1 cm. Finally, while the IIc or the mixed IIc+IIa subtypes are compatible with endotherapy cure, the mixed IIa+IIc pattern suggests deeper infiltration in the submucosa and will probably not be completely eradicated.

Another important factor for the selection of cases will be the depth of tumor invasion and lymph node metastasis. The accuracy of conventional EUS in staging the depth of invasion and lymph node extension is well known. New techniques using high frequency US miniprobe are gaining in efficiency and popularity; the miniprobe passing across the instrument channel of the scope is placed under direct vision onto the lesion. The acoustic contact is ensured by a transparent plastic bag filled with water. At high frequency, a 9-layer diagram is obtained, with identification of the muscularis as the fourth layer. In a recent series, 84% accuracy in the detection of intraepithelial cancer was reported.¹¹ The curative effect of endoscopic mucosal resection is acknowledged for intramucosal cancer (m1, m2, and probably m3), but not for submucosal cancer (sm1 to sm3)¹²; this is why the EUS distinction between m3 cancer and sm1 cancer is of primary importance.

The techniques for Endoscopic Mucosal Resection (EMR)

There has been considerable progress in the technique of EMR during the last 10 years, including successive adaptation to the stomach and then the esophagus.

The progressive simplification has resulted in three variations: EMR with a double-channel endoscope (alligator forceps and snare); EMR with a single-channel endoscope (alligator forceps) and an overtube with a channel (snare); and EMR with a single-channel cap-fitted endoscope (rubber band ligator or detachable snare). In all three procedures lifting, the lesion with a submucosal injection of saline helps snaring. Furthermore it has a major prognostic value; the invasion of the submucosa is suspected if the lesion does not lift. The easiest method is derived

from the ligator kit in which a transparent cap is fixed to the tip of the scope; resection is assisted by the combined effect of aspiration and saline injection. This procedure is adaptable for esophagus, stomach, duodenum, or colon. Fig. 2 is an illustrated example for EMR.

Results of curative endotherapy in cancer

Results depend on the tolerance and side effects of the procedure, the rate of complications, the rate of complete response in the short term, the rate of recurrence in the long term, and the five-year survival. The data collected in this recent period are limited and are not comparable to the large surgical series. According to Japanese data; the five-year survival rate after EMR varies between 95–100% with a recurrence rate of 3–7%.¹³ Concerning esophageal cancer, the five-year survival rate was found to be similar in EMR (86%) and conventional surgery (83.2%), in patients treated by the same team; the rate of EMR complications was 12.9% in the early period and 7.2% later.¹⁴ Severe early complications included bleeding, perforation, and later stenosis. More recently, in the review of a questionnaire of the Japan Society for Esophageal Diseases, the figure for the global rate of complications was lower (6.8%).¹⁵ In another series, EMR in 56 cases of esophageal cancer resulted in good epithelialization without complications, all patients being alive.¹⁶

In gastric cancer, strictly parallel survival curves after EMR or surgery have been shown.¹⁷ The safety of the procedure has been confirmed with a rate of complete resection reaching 89% for the elevated type up to 2 cm in size, and 83% for the depressed type up to 1 cm in size. These indications have been confirmed further.^{18,19}

Currently-available EMR results are mostly based on the Japanese data. However, large scale, international studies are required because there are definite discrepancies in the histologic grading system from adenoma to overt carcinoma among different countries.

We conducted EMR in 86 cases with dysplasia or gastric carcinoma from 1991 to 1996. Their ages ranged from 28 to 82 years, and 47 patients were male and 39 female. Thirteen cases were adenocarcinoma and 73 cases varying grades of dysplasia. The mean diameter of lesions was 15.4 (5–35) mm. Eighty-one cases had single lesion and the remaining

Table 2. Endoscopic Mucosal Resection of Early Gastric Cancer or Dysplasia

Number of patients	86 cases
Number of lesions	95 lesions
Sex (Male : Female)	47 : 39
Diagnosis	
Cancer	13 cases
Dysplasia	73 cases
Size	15.4 (5 - 35) mm
Success rate	
Complete resection	92 lesions
Incomplete resection	3 lesions
Recurrence	2 cases

5 patients had more than two lesions. A total of 95 lesions were resected endoscopically using double-channel endoscope (alligator forceps and snare), or a single-channel endoscope and a snare, or a single-channel cap-fitted endoscope (rubber band ligator). Ninety-two of 95 lesions were successfully resected (Table 2). One case of moderate dysplasia (35 mm in the largest diameter) and 2 cases of well-differentiated adenocarcinoma (18 mm IIc and 22 mm IIb+IIc, respectively) were resected incompletely. Two cases with adenocarcinoma (15 mm IIc+IIb and 18 mm IIa+IIc, respectively) who underwent complete resection were recurred. These findings suggest that lesions combining a IIc component should be carefully considered when performing EMR.

Neoplastic lesions at an early stage are usually found in either asymptomatic patients or in patients with symptoms unrelated to the disease. Such lesions can be detected by a 'case finding' endoscopic examination in patients found to be at risk after completing a questionnaire, but mass screening programs are still questionable in cost-benefit terms.

D. Endoscopic submucosal tumor resection

Submucosal tumors of the gastrointestinal tract are broadly classified into three groups; Inflammatory, tumorous and aberration tissue. The tumorous conditions are generally benign lesions with some potential for malignant change. Leiomyomas, lymphomas, lipomas and neurinomas are common benign gastric submucosal tumors, while leiomyosarcomas, leiomyoblastomas, plasmacytomas and some malignant lymphomas are malignant in nature. These submucosal tumors of the gastrointestinal tracts are not infre-

quent, and before endoscopy became available, surgical resection was the only method for treatment. With the beginning of the endoscopic era, there have been lots of advances in the diagnosis and treatment of these submucosal tumors. However, no matter how advanced several endoscopic methods have been developed for the diagnosis of submucosal tumor, it is still not easy to diagnosis these tumor histologically. Recently, EUS has been widely used and considered as an important diagnostic tool for gastrointestinal submucosal tumors. However, when considering that histologic diagnosis is the only confirmative way of diagnosis, the accurate histologic diagnosis of submucosal lesions by conventional biopsy and needle aspiration cytology is particularly difficult. In most cases, submucosal tumors of the GI tracts are followed conservatively by periodic endoscopic observation to check the changes of size and surface morphology, but a conclusion has yet to be reached. No clear-cut advice can be found in the literature on the clinical management of these patients since most studies are concerned with the management of an established clinical entity.

There have been several publications on various endoscopic therapies in various types of submucosal tumors; resection is achieved as a strip mucosal resection, either using a double-channel scope with traction, or a cap fitted endoscope with aspiration (called lumpectomy).²⁰⁻²² Recent data of 62 patients with submucosal esophageal tumors²⁰ and a comparative study of resection, with and without the aspiration cap, in 77 cases have been published.²² The so-called lumpectomy procedure resulted in more accurate histological diagnosis and in larger resected specimens. For large submucosal tumors or when malignancy is suspected, surgery is preferred; then the laparoscopic or thoracoscopic approach may be an alternative to a conventional operation.

We conducted a prospective study to evaluate the effectiveness and safety of endoscopic resection of submucosal tumor in upper and lower GI tracts for diagnostic and therapeutic purposes from 1992 to 1996.^{23,24} A total of 52 cases with submucosal tumor of the esophagus and stomach were included (Table 3). For the lower GI tract, 11 cases were treated endoscopically. Three were located in the rectum, two in hepatic flexure of the colon, two in the transverse colon, one in the ascending colon, one in the descending colon, and one in the terminal ileum. One

Table 3. Endoscopic Resection of Submucosal Tumors of the Upper Gastrointestinal Tracts

Treatment	Size (mm)	Treatment location				
		E	F	UB	LB	A
Simple polypectomy	13.8 (6.7-30)	12	6	7	3	
Polypectomy after SMI	16.6 (10-30)	1		2	1	2
Enucleation	27.7 (10-70)		2	3		

SMI, submucosal injection of fibrin glue or saline; E, esophagus; F, fundus; UB, upper body; LB, lower body; A, antrum.

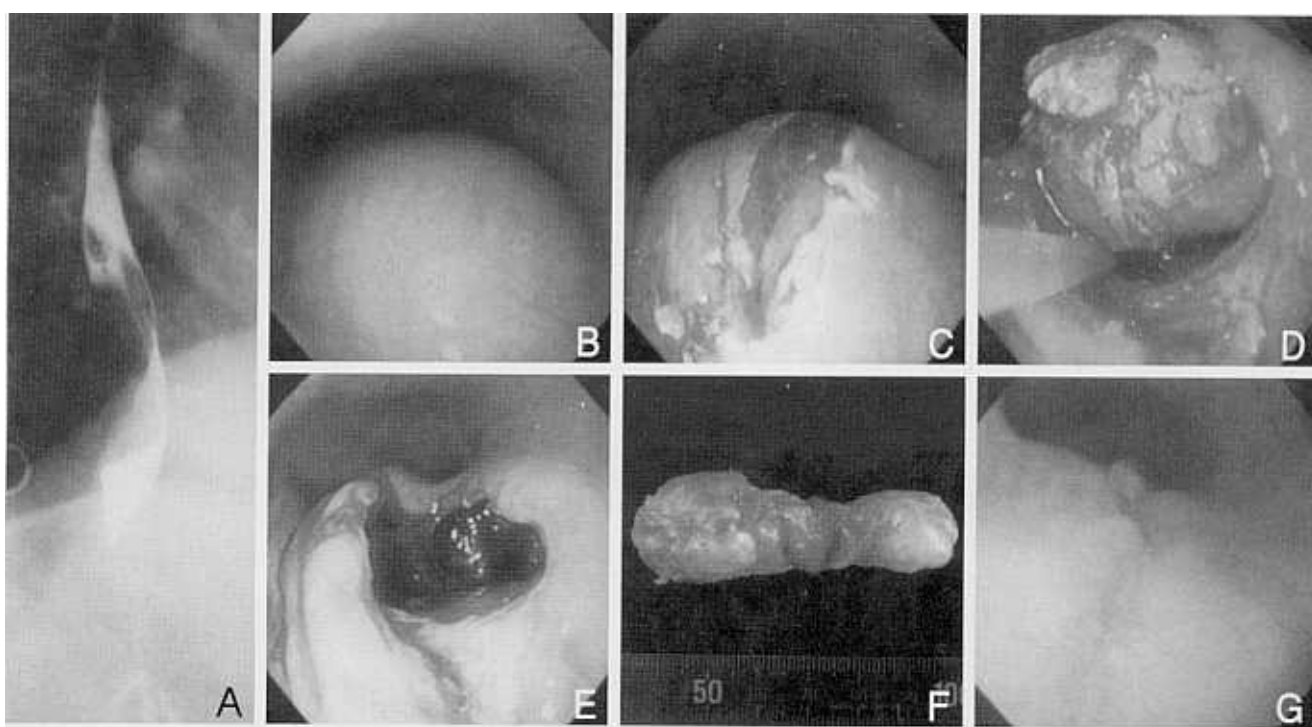


Fig. 3. Endoscopic enucleation in a case with huge esophageal stromal tumor. A: Esophagogram demonstrates a huge filling defect with smooth surface. B-F: Endoscopic view shows a broad elevated mass with normal epithelial covering suggesting submucosal tumor. After making an incision using needle papillotome, the tumor is dissected with alligator forceps and snare. A large deep empty space is noted after removal of tumor, and the length of removed tumor is 6.4 cm. G: Follow-up endoscopy performed a week after resection reveals almost complete healing of previous incision site.

case of rectal tumor suffered from Blue Rubber Bleb Nevus Syndrome, having numerous hemangiomas in the entire GI tract. The mean diameter of tumors in the upper GI tract was 19.3 (5.3-70) mm and in the tumors of lower GI tract it was 21 (5-30) mm.

Simple polypectomy was performed in pedun-

culated type cases. Polypectomy after submucosal saline or fibrin glue injection was undertaken in cases with broad-base nature of lesions. In large tumors located at the easily approachable area or proper muscle originating tumors, endoscopic enucleation after incision of the mucosal layer was performed. The lesions located in the cervical esophagus or the

posterior wall of the duodenal bulb were excluded. And the lesion covered with ulcerated mucosa was also excluded.

All the tumors in a total 63 cases, except one with a 5-cm tumor located in the gastric lower body, were successfully and completely removed endoscopically. No acute or late complications, such as perforation or massive bleeding requiring transfusion were encountered, except in one case showed transient pneumomediastinum spontaneously healed who had a 6.4-cm stromal tumor in the distal esophagus which was successfully enucleated after mucosal incision (Fig. 3). Our study demonstrated that endoscopic resection for submucosal tumors of the lower and upper GI tracts is safe and effective, and may be a feasible alternative to surgery, and useful for the histologic confirmation. However, further investigations for definite indications and methods of endoscopic resection are necessary.

CONCLUSIONS

Laparoscopists and therapeutic endoscopists now have a great deal in common. All of these developments together demand better collaboration between the various medical disciplines. Patients with complex gastrointestinal diseases can be managed effectively only if the appropriate specialists work closely together. Although this can be done informally, increasingly it is obvious that organizational restructuring can facilitate the process. The opportunity to develop a multidisciplinary Endoscopy Center may be what persuaded us to move to Yonsei University Medical Center, where we have an integrated clinical environment, joint clinics, therapeutic facilities, and development. This infrastructure provides the environment for streamlined patient-friendly care and a springboard for technical and clinical research.

REFERENCES

1. Mitsunaga N, Tsubouchi H. Detection of early esophageal and gastric cancers by mass screening (Jap). *Nippon Rinsho* 1996;54:1415-20.
2. Kura T, Kumaki T, Matsuhisa T, Tanaka S. Investigation of gastric cancers detected at a medical check up center (Jap). *Nippon Ika Daigaku Zasshi* 1996;63:202-14.
3. Cwikiel M, Cwikiel W, Albertsson M. Palliation of dysphagia in patients with malignant esophageal strictures. Comparison of results of radiotherapy, chemotherapy and esophageal stent treatment. *Acta Oncol* 1996;35:75-9.
4. Lee SJ, Song SY, Kang JK, Park IS. Comparison between EsophacoilTM and silicone-covered self-expandable metallic stent in malignant esophageal stenosis. *Gastroenterology* 1996;A1812.
5. Mitty RD, Cave DR, Birkett DH. One stage retrograde approach to Nd:YAG laser palliation of esophageal carcinoma. *Endoscopy* 1996;43:29-32.
6. Sargeant IR, Tobias JS, Blackmann G, Thorpe S, Glover JR, Bowl SG. Radiotherapy enhances laser palliation of malignant dysphagia: a randomised study. *Gut* 1997;40:362-9.
7. McCaughan JS, Ellison EC, Guy JT, Hicks WJ, Jones JJ, Laufman LR, et al. Photodynamic therapy for esophageal malignancy: a prospective twelve-year study. *Ann Thorac Surg* 1996;62:1005-9.
8. Kitamura K, Kuwano H, Yasuda M. What is the earliest malignant lesion, in the esophagus? *Cancer* 1966;77:1614-9.
9. Nishimaki T, Suzuki T, Tanaka Y. Intramural metastases from thoracic esophageal cancer: local indicators of advanced disease. *World J Surg* 1996;20:32-7.
10. Kitamura K, Yamaguchi T, Okamoto K, Nishida T, Takahashi T. Superficial spreading type of early gastric cancer. *Br J Cancer* 1996;74:1834-7.
11. Murata Y, Suzuki S, Ohta M, Mitsunaga A, Hayashi K, Yoshida K, et al. Small ultrasonic probes for determination of the depth of superficial esophageal cancer. *Gastrointest Endosc* 1996;44:23-8.
12. Kodama M, Kakegawa T. Treatment of superficial carcinoma of the esophagus. A review of responses to questionnaire on superficial carcinoma of the esophagus, collected at the 49th conference of JSED. *Nippon Gekka Gakkai Zasshi* 1996;97:683-90.
13. Yoshida M, Hanashi T, Momma K. Endoscopic mucosal resection for radical treatment of esophageal cancer. *Gan To Kagaku Ryoho* 1995;22:847-54.
14. Lambert R. Endoscopic treatment of esophagogastric tumors. *Endoscopy* 1998;30:80-93.
15. Kodama M, Kakegawa T. Treatment of superficial carcinoma of the esophagus. A review of responses to questionnaire on superficial carcinoma of the esophagus, collected at the 49th conference of JSED. *Nippon Gekka Gakkai Zasshi* 1996;97:683-90.
16. Takeshita K, Tani M, Inoue H, Hayashi S, Honda T, Kando F, et al. Endoscopic treatment of early esophageal or gastric cancer. *Gut* 1997;40:123-7.
17. Tada M, Murakami A, Karita M, Yanai H, Okita K. Endoscopic resection of early gastric cancer. *Endoscopy* 1993;25:445-50.
18. Takekoshi T, Baba Y, Ota H, Kato Y, Yanagisawa A, Takagi K, et al. Endoscopic resection of early gastric carcinoma: results of a retrospective analysis of 308 cases. *Endoscopy* 1994;25:352-8.
19. Hiki Y. Endoscopic mucosal resection (EMR) for early

- gastric cancer. *Nippon Geka Gakkai Zasshi* 1996;97:273-8.
20. Kajiyama T, Hajiro K, Sakai M, Inoue K, Konishi Y, Takakuwa H, et al. Endoscopic resection of gastrointestinal submucosal lesions: a comparison between strip biopsy and aspiration lumpectomy. *Gastrointest Endosc* 1996;44:404-10.
21. Kojima T, Takahashi H, Parra Blanco A. Endoscopic resection of submucosal tumors (SMT) of the upper gastrointestinal tract. *Endoscopy* 1997;29:E58.
22. Hyun JH, Jeon YT, Chun HJ, Lee HS, Lee SW, Song CW, et al. Endoscopic resection of submucosal tumor of the esophagus: results of 62 patients. *Endoscopy* 1997;29:165-70.
23. Song SY, Kim BS, Lee YC, Kim TI, Kang JK, Park IS. Endoscopic treatment of submucosal tumors of the lower gastrointestinal tracts [abstract]. *Gastroenterology* 1996;A1809.
24. YC Lee, Song SY, Kang JK, Park IS. Endoscopic treatment of submucosal tumors of the upper gastrointestinal tracts [abstract]. *Gastroenterology* 1995;A3062.
-